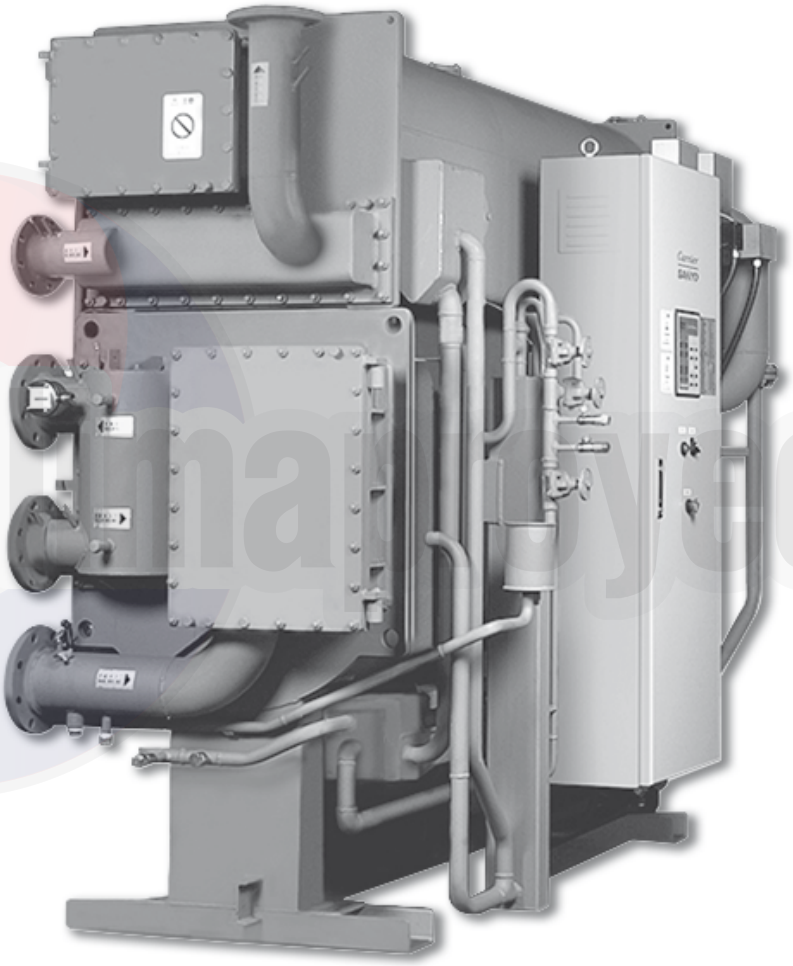
Carrier
SANYO

16LJ
Single-Effect Hot Water-Fired Absorption Chillers

Nominal cooling capacity 264-1846 kW

50 Hz



Installation instructions

GB/T-19001-2000 to ISO9001/2000

NOTES TO USERS

Thank you for purchasing a Sanyo/Carrier absorption chiller.

Refer to this manual and the specification drawings before installing the absorption chiller and read this manual carefully before operating the unit. It contains instructions for the installation of the chiller.

Please utilize the chiller to its optimum performance by carrying out the recommended daily maintenance and handling instructions as well as the periodic service.

If you need any information about maintenance contracts or have any other enquiries, please contact your Carrier service agent.

The cover photograph is for illustrative purposes only, and are not contractually binding.

CONTENTS

1 - INSTALLATION

1.1 - Environmental requirements and safety precautions

1.1.1 - Installation considerations

The 16LJ absorption chiller is designed for indoor installation in a machine room. The protection rating of the chiller is IP40. Room temperature should be maintained between 5°C and 40°C to protect against solution crystallization during chiller shutdown. The humidity in the machine room must be kept below 90%.

1.1.2 - Field wiring

CE machines should be connected to a power source that complies with overvoltage category III (IEC 60664). All other wiring should comply with overvoltage category II.

1.1.3 - Altitude

Please install the absorption chiller at a maximum height of 1000 m above sea level. If the location is higher than 1000 m above sea level, please contact your local Carrier office.

1.1.4 - Safety precautions

- Before operating this chiller, first carefully read the following instructions.
- All precautions are classified as either WARNING or CAUTION.

WARNING: Failure to observe this instruction may result in serious injury or death.

CAUTION : Failure to observe this instruction may cause an injury or failure of chiller. Depending on circumstances, this may result in serious injury or death.

This symbol denotes danger, a warning or a caution. The illustration in this symbol shows the specific description of the item.

This symbol prohibits an action. The illustration next to this symbol shows the specific description of the item.

This symbol instructs an action to be done. The illustration in this symbol shows the specific description of the item.

- After reading this manual, it should be kept in a safe place to be available for any user at any time.

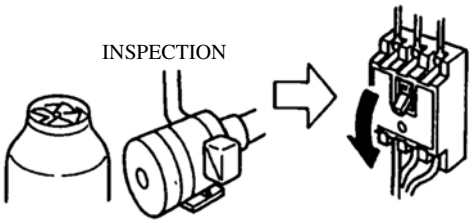
1.1.4.1 Safety considerations

WARNINGS

TURN OFF THE BREAKER BEFORE CLEANING AND CHECKING

Always turn off the circuit breaker before cleaning and checking the cooling tower fan, chilled water pump, or other components linked to the chiller, to provide protection from electric shock or or possible injury by the rotating fan.

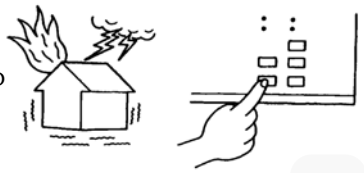
INSPECTION



STOP OPERATION IN CASE OF FIRE, EARTHQUAKE OR ELECTRICAL STORMS

Stop operation in case of fire, earthquake or an electrical storm, to prevent fire or electric shock.

MUST BE OBSERVED



DO NOT TOUCH THE CONTROL PANEL SWITCH WITH WET HANDS

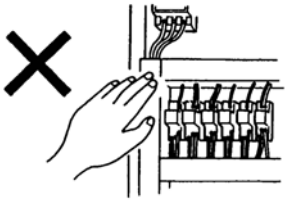
Do not touch the switch inside the control panel with wet hands to avoid electric shock.

DO NOT TOUCH

DO NOT TOUCH THE WIRING INSIDE THE CONTROL PANEL

Do not touch the wiring inside the control panel to avoid electric shock.

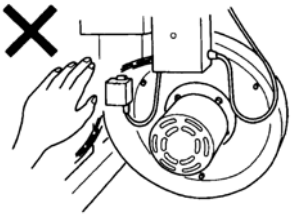
DO NOT TOUCH



DO NOT TOUCH HIGH-VOLTAGE CABLES

Do not touch high-voltage cables to avoid electric shock.

DO NOT TOUCH

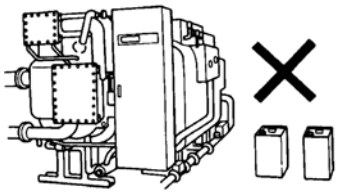


WARNINGS

KEEP FLAMMABLE SUBSTANCES AWAY FROM THE CHILLER

Do not place any flammable substances (e.g. gasoline, thinner) close to chiller, flue, chimney or oil tank to prevent fire.

PROHIBITED



DO NOT OPERATE THE CHILLER IF THERE IS A SMELL OF GAS

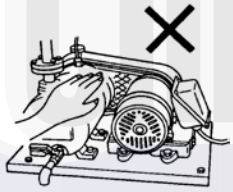
Do not operate the chiller if there is a smell of gas. Do not turn on/off any switch, as this could cause a fire.

PROHIBITED

DO NOT TOUCH ROTATING PARTS OF FANS

Keep away from rotating parts of fans or pumps to avoid possible injury.

PROHIBITED

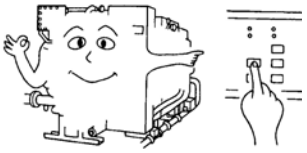


CAUTIONS

SOLVE ALL PROBLEMS BEFORE RESTARTING THE CHILLER

Solve all the problems before restarting the chiller after a safety or security device is activated, to prevent fire.

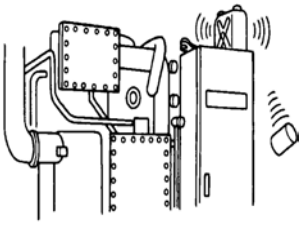
MUST BE OBSERVED



DO NOT PLACE HEAVY OBJECTS ON THE CHILLER OR CONTROL PANEL

Do not place heavy objects on the chiller or control panel as these may fall off and cause injuries.

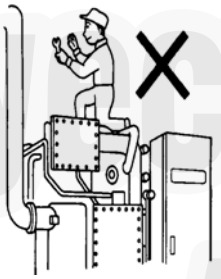
PROHIBITED



DO NOT CLIMB ON THE CHILLER

Do not climb on the chiller as you may fall off.

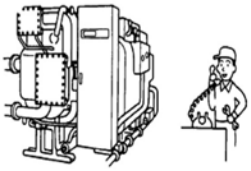
PROHIBITED



CALL SPECIALISTS FOR SERVICE OR MAINTENANCE

Call specialists for service or maintenance. Incorrect service/ maintenance may cause electric shock, fire or burns.

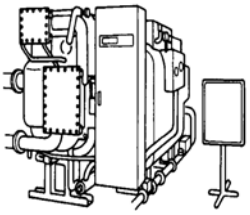
MUST BE OBSERVED



AUTHORIZED PERSONNEL ONLY

A notice, "For Authorized Personnel Only" must be affixed to the chiller to stop unauthorized personnel from touching it. If necessary surround the chiller by a protective fence. Misuse of the chiller may cause injury.

PROHIBITED

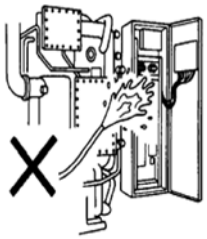


CAUTIONS

DO NOT POUR WATER ON THE CHILLER OR CONTROL PANEL

Do not pour water on the chiller or control panel to avoid electric shock.

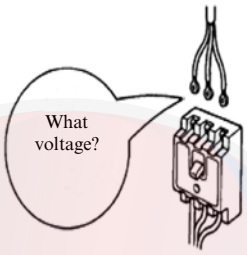
PROHIBITED



USE THE CORRECT POWER SUPPLY

This is indicated on the chiller name plate. Use of an incorrect power supply may cause fire or electric shock.

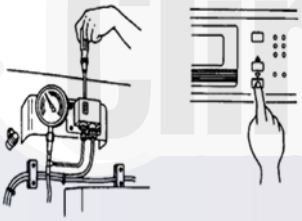
PROHIBITED



NEVER CHANGE THE SET VALUES

Never change the set values of the safety and/or protective devices. Wrong settings may damage the chiller or cause fire.

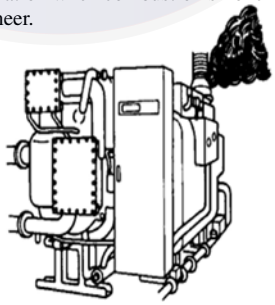
PROHIBITED



STOP THE OPERATION WHEN COMBUSTION SMOKE IS BLACK

Stop the operation when combustion smoke is black and call a service engineer.

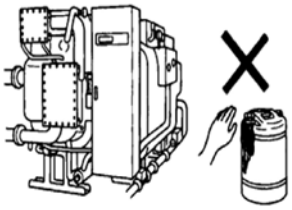
MUST BE OBSERVED



DO NOT TOUCH THE ABSORBENT

Do not touch spare or leaked absorbent, as this can cause metal corrosion or skin disease.

PROHIBITED

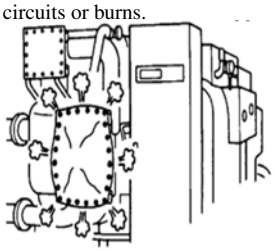


OBSERVE THE SPECIFIED WATER PRESSURE

The specified chilled/hot water and cooling water pressure must be strictly observed.

Incorrect pressure may cause the water to leak/spray which can lead to short circuits or burns.

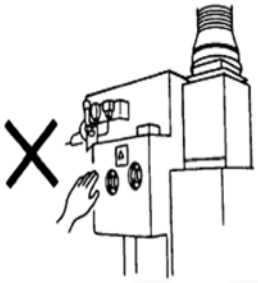
MUST BE OBSERVED



DO NOT TOUCH HIGH-TEMPERATURE AREAS

Do not touch high-temperature areas, as they may cause burns. These areas are indicated by caution label.

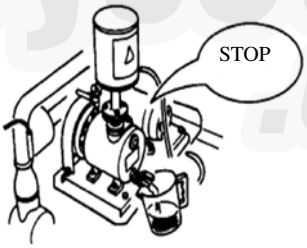
PROHIBITED



STOP THE PURGE PUMP TO REPLACE OIL

Stop the purge pump when replacing oil to avoid possible injury by fuel spillage.

MUST BE OBSERVED



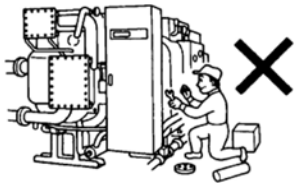
1.1.4.2 - Safety precautions for repair, moving or disposal

WARNINGS

ONLY AUTHORIZED PERSONNEL SHOULD SERVICE THE CHILLER

Only authorized personnel should service the chiller. Incorrect service could result in electric shock or fire.

PROHIBITED

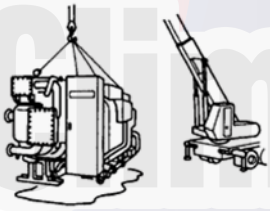


CAUTIONS

ONLY AUTHORIZED PERSONNEL SHOULD REMOVE OR REPAIR THE CHILLER

Any relocation or moving of the chiller should only be done by authorized personnel. Incorrect work could result in water leaks, electric shock or fire.

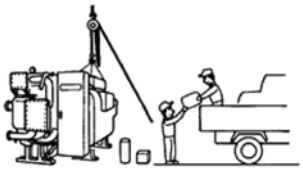
MUST BE OBSERVED



ONLY AUTHORIZED PERSONNEL SHOULD DISPOSE OF THE CHILLER

To dispose of the chiller, contact local specialists. Incorrect disposal may result in absorbent leaks and cause metal corrosion or skin disease, electric shock or fire.

MUST BE OBSERVED



1.2 - Safe installation

Equipment installation must be carried out by a qualified installer, taking the appropriate safety measures.
Ensure that unauthorized people cannot enter the installation site during installation.

1.3 - Delivery inspection

Upon delivery of the Carrier-Sanyo chiller to the job site, the owner or his designated representative should carefully inspect the chiller:

- Ensure that the chiller is factory-charged with nitrogen gas to a pressure of 20 kPa.
- Open SV7 and connect a pressure gauge to SV2. Open V2, V3 and B-valve, and check the pressure at the pressure gauge. If the pressure is 0 kPa, the chiller has a leak. In this case, check the leaking point with pressurized nitrogen gas at 50 kPa. Close the cap of SV2 and SV7 with sealant.
- Refer to paragraph 1.8.2 (Fig. 5), exhibit LA and the specification drawings.
- Check for physical damage to the chiller
  - Main shell and piping
  - Valves
  - Control panel
  - Wiring and connections
  - Accessories
  - Solution
- Check the shipping or packing slip sent with the chiller and note all missing items.
- Check all boxes or crates shipped with the chiller for missing items.

NOTES:

1. ***Isolation pads are not required for most installations.***
2. ***Inform Carrier immediately if items are damaged or missing.***

Solution volume

16LJ	Absorbent kg	Refrigerant kg	Alcohol l	Inhibitor l
11	430	60	0.78	0.25
12	430	60	0.78	0.25
13	560	100	1.02	0.33
14	620	90	1.12	0.36
21	750	110	1.36	0.44
22	810	120	1.48	0.48
23	980	150	1.78	0.57
24	1070	140	1.94	0.62
31	1230	190	2.24	0.72
32	1340	170	2.44	0.78
41	1560	250	2.84	0.91
42	1680	230	3.06	0.98
51	1950	260	3.54	1.13
52	2170	290	3.94	1.26
53	2420	310	4.40	1.40

Legend

Absorbent	LiBr	50 wt %
Inhibitor	Li_2MoO_4	20 wt % 300 ppm (total concentration)
Alcohol	Octyle alcohol	$CH_3(CH_2)^5CH(OH)CH_3$

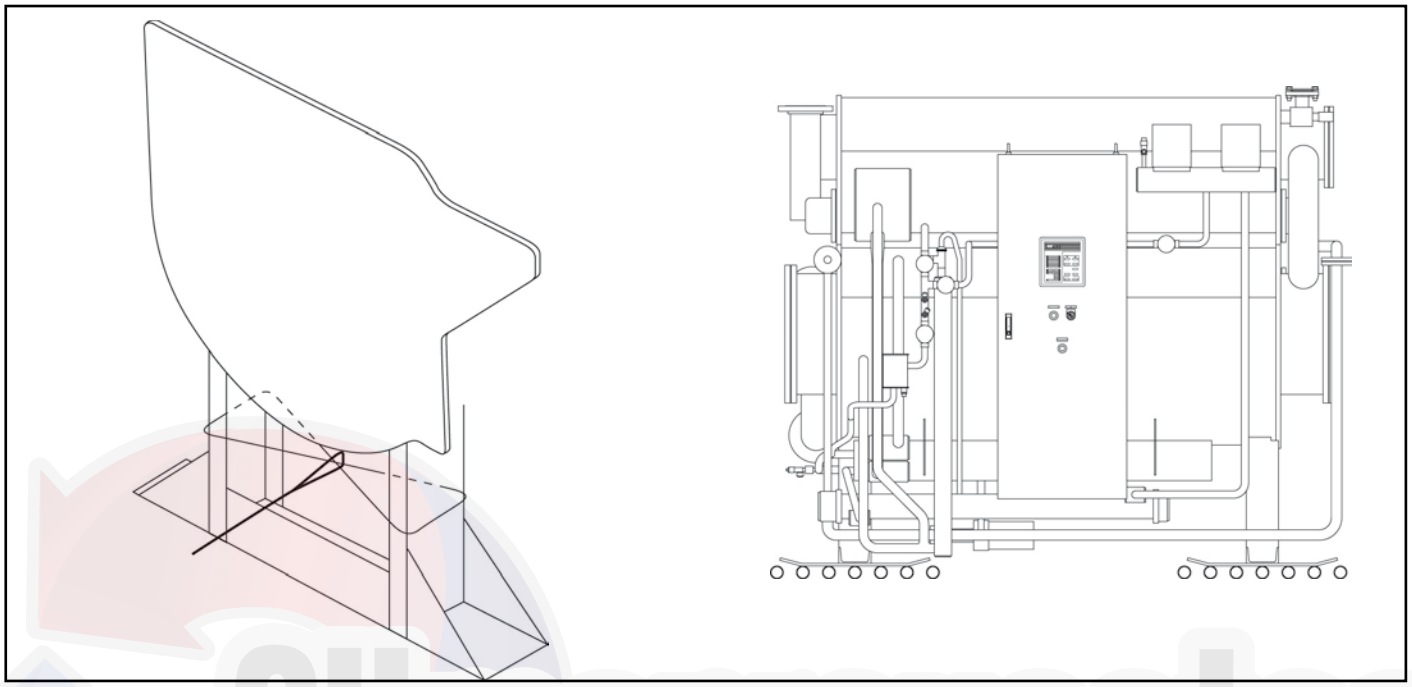
1.4 - Rigging

Check the weight of the chiller by referring to the contract specifications and then choose and use suitable wires and shackles. To lift the chiller use the four holes provided at the corners of the lower tube sheet. Note that the angle of the wires should be 60° maximum, as shown in the figure below. Refer to the specification drawings and exhibit LB.

1.5 - Moving the chiller

If the chiller needs to be moved, use of a fork-lift truck is recommended. The wire should be connected as shown in the figure below.

Fig. 1



1.6 - Placing chiller on the foundation

Refer to the specification drawings and exhibit LC - Foundation. Set the chiller on the foundation bolt positions.

- Note that in the figure below there are four levelling check points on the chiller, labeled A, B, C and D. These check points are designated by three punch markers on the tube sheet or shell of the lower shell.

1.7 - Levelling

- Fill a clear vinyl hose with water and check there are no air bubbles in the hose.
- Using point A as reference point, measure the difference in the water level at the other points (B, C and D).

A B

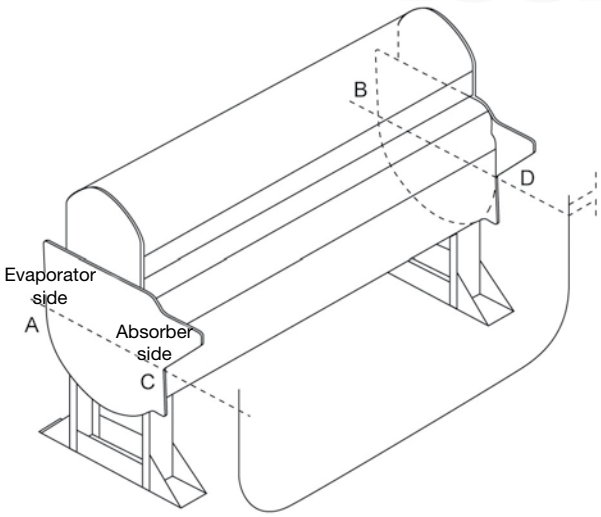
(Evaporator side)

(Absorber side)

C D

A	B	C	D
0 mm	___ mm	___ mm	___ mm

Fig. 2



- The levelling calculation is as shown below:

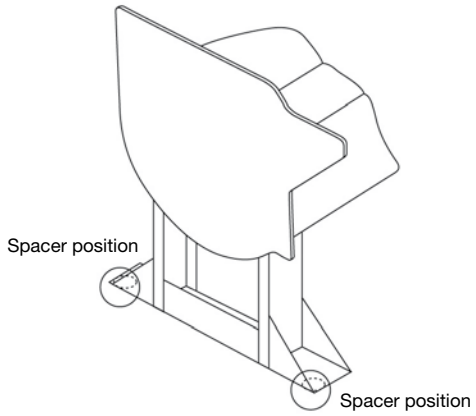
$$\frac{A-B}{L} \quad \frac{C-D}{L} \quad \frac{A-D}{L} \quad \frac{B-C}{L} \quad \frac{A-C}{W} \quad \frac{B-D}{W}$$

Tolerance $\leq \frac{2}{1000}$

L: Chiller length
W: Chiller width

- If tolerances are not met, shim the appropriate points by inserting a metal spacer between the machine base and the foundation. The metal spacer size is approximately 50 mm wide by 80 mm long. Prepare spacers with different thicknesses (0.6 mm to 9 mm).

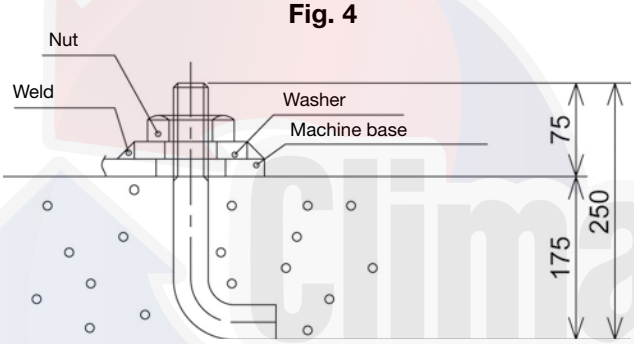
Fig. 3



Fixing of the anchor bolts

a. Weld the washers to the 16LJ unit base.
b. Tighten the nuts.

Fig. 4



1.8 - Leak test and method of charging/removing nitrogen gas

If the chiller is leaking, please refer to the following items and Fig. 5.

1.8.1 - Leak test

This describes the chiller leak test procedure, using pressurized nitrogen gas (N_2 gas).

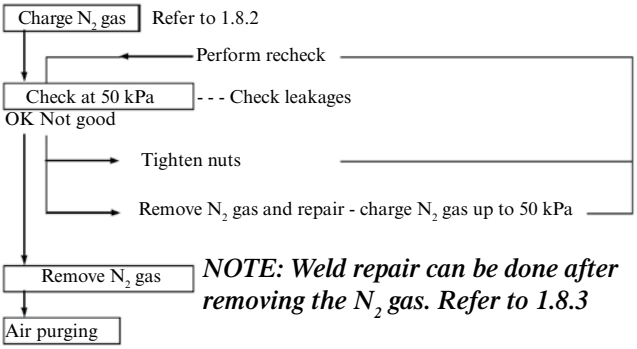
Equipment to use

- Nitrogen gas cylinder
- Pressure regulator
- Pressure-proof hose
- Flashlight
- Soapy water
- Adjustable wrench
- Hose band
- Vacuum gauge (0-1 kPa)
- Pressure gauge (0-100 kPa)

Requirement to meet

Pressurize the chiller up to 50 kPa with the nitrogen gas. Use a soapy water solution and check that there are no bubbles at any of the joints.

Test sequence



NOTE: Weld repair can be done after removing the N_2 gas. Refer to 1.8.3

Procedure (see Fig. 5)

1. Confirm that V1, V2, V3, B-valve, SV1, SV2 are fully closed.
2. Confirm that all absorbent and refrigerant pump isolation valves are fully open.
3. Connect the vacuum gauge to SV2 and open SV2
   - Charge N_2 gas (refer to 1.8.2).
   - Pressurize the chiller up to 50 kPa with N_2 gas. The pressure inside the chiller can be checked with the vacuum gauge.
   - When the pressure reaches 50 kPa, close the service valve and the valve of the N_2 gas cylinder.
4. Check the following positions with the soapy water:
   - All field-welded parts (not needed for one-piece machine)
   - Sight glass: If any leakage is observed in the sight glass, tighten the fittings and ensure that there is no N_2 gas leak.
   - Flare nut joints of service valves.
   - Flange connections (absorbent pumps, refrigerant pump, etc.)
   - Diaphragm valves.
5. If any leakage is observed at the welded parts, remove the N_2 gas and then repair the leaks.
6. Repeat steps 3 and 4.
7. If there is no leakage at 50 kPa pressure, keep the chiller pressurized to 50 kPa for 24 hours, and then check the pressure again.
8. After completion of the test, remove the N_2 gas, and the vacuum gauge (refer to chapter 1.8.3)
9. Close SV2.

NOTE: If N_2 gas is removed, ensure that the room is sufficiently ventilated.

1.8.2 - Method of charging nitrogen gas

This is the procedure for charging nitrogen gas (N_2 gas) to the chiller.

Equipment to use

- The required amount of N_2 gas:

16LJ	Volume litres	16LJ	Volume litres
11	1640	31	5030
12	1580	32	4830
13	2510	41	6150
14	2380	42	5910
21	3150	51	8240
22	3010	52	9350
23	4210	53	10350
24	4020		

- Pressure regulator
- Pressure-proof hose
- Adjustable wrench
- Valve key for N_2 gas cylinder
- Pressure gauge (0-100 kPa)

The pressure in the chiller is charged to 50 kPa at the generator pressure gauge.

Precautions

- Since the N_2 gas cylinders are pressurized up to 15 MPa be careful when handling them.
- Do not suddenly raise the primary or secondary pressure of the pressure regulator.
- Fix the N_2 gas cylinder so that it cannot fall down.
- Be sure not to open V1, V2 during this work.

Procedure (see Fig. 5)

- Attach a pressure regulator to the N_2 gas cylinder.
- Connect the vacuum gauge to SV2. Open SV2.
- Connect a pressure-proof hose to the outlet of the pressure regulator, then slightly open the valve at the top of the cylinder in order to purge the air from the hose. After purging, close the valve.
- Connect the other end of the hose to SV1 and fix it with a hose band.
- Check that V1, V2, V3, B, SV1 are fully closed.
- Open the V3 and B-valve and then open SV1.

NOTE: B-valve should be closed after the solution is charged to the chiller.

- Using the pressure regulator, charge a small amount of N_2 gas into the chiller.
- Watch the vacuum gauge while N_2 gas is charged. When the pressure inside the chiller reaches the required pressure, close SV1, V3, and B-valve. Then close the valve of the cylinder.
- Remove the hose from SV1 and attach the service valve cap to the service valve with sealant.
- Remove the pressure regulator and the vacuum gauge.
- Close SV2.

1.8.3 - Removing nitrogen gas (see Fig. 5)

Follow this procedure to remove N_2 gas from the chiller.

Equipment to use

Adjustable wrench

Requirement to meet

The pressure in the chiller is reduced down to atmospheric pressure.

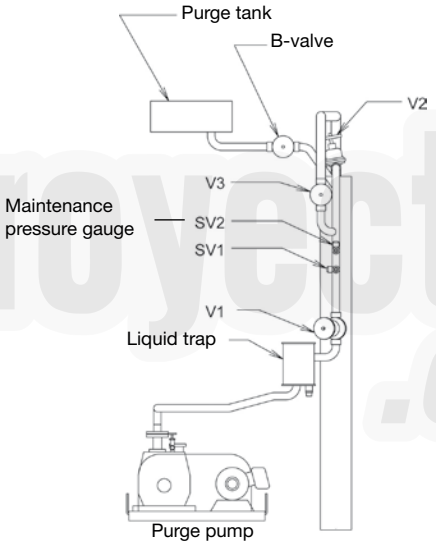
Precautions

- Be sure not to open V1, V2 during this work.
- Adequately ventilate the machine room.

Procedure

- Check that the V1, V2, V3, SV1, SV2 are fully closed.
- Open V3.
- Remove the cap and the flare nut of SV1, and open the valve.
- When the generator pressure gauge shows atmospheric pressure, close SV1 and V3.

Fig. 5



1.9 - Piping

1.9.1 - Connect each pipe according to exhibit LE and the specification drawings.

- Make all necessary connections to the building chilled and cooling water systems. Ensure that all piping is adequately supported and that no strain is placed on the chiller nozzles and connecting flanges.
- Provide adequate temperature and pressure sockets or taps on all supply and return piping.

1.9.2 - Flushing

All water system pipes must be flushed before the water is circulated in the chiller.

1.10 - Field wiring

CE marking

Power supply connections should be in accordance with CE and comply with overvoltage category III (IEC 60664). All other connections should be in accordance with overvoltage category II. All wiring must be in accordance with CE requirements.

- Refer to exhibit LF and the specification drawings for wiring connections.
- Supply power to the hot water control valve and hot water shut-off valve.
- Refer to chapter 2.3 - Electrical check.
- A properly qualified electrician should carry out the electrical wiring.

1.11 - Purging (see Fig. 5)

- Ensure that the power supply is continuous.
- Remove nitrogen gas (refer to chapter 1.8.3.)
- Fill the purge oil pump to the centre of the red mark of purge pump level gauge.
- Turn on the control panel main breaker and the purge pump switch. Check the direction of rotation. If the direction is wrong, turn off the power supply to the chiller.
- Then change any two of the wires of main power supply source. The chiller was connected with all wires meeting the same phase. Run the purge pump continuously.
- Connect the vacuum gauge (1 kPa) to SV2.
  - Open SV2.
  - Open V1, V3, and B-valve to purge the chiller.
  - After one hour open V2.
- Operate the purge pump until the vacuum gauge shows 0.5 kPa. Refer to the following table.

16LJ	Time
11-14	5 hours
21-32	12 hours
41-53	24 hours

1.11.1 - Carry out a bubble test (refer to Fig. 6)

Equipment to use

- Purge pump exhaust attachment
- Graduated cylinder
- Vinyl hose (ø 6 mm)
- Bucket
- Putty
- Stop watch
- Vacuum gauge (0 to 1 kPa)

Required purge rate

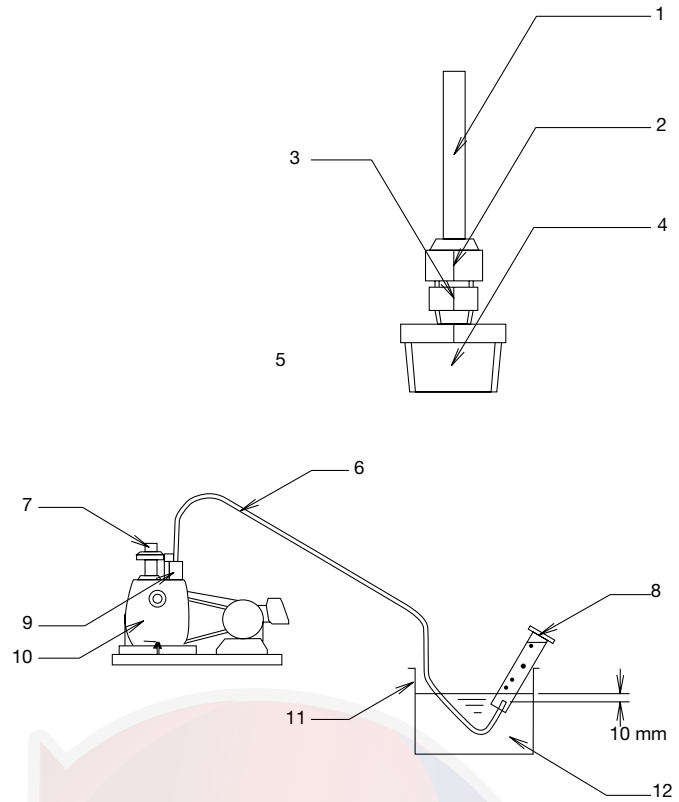
16LJ	Standard value ml per 10 min
11	< 15
12	< 15
13	< 15
14	< 15
21	< 25
22	< 25
23	< 25
24	< 30
31	< 30
32	< 30
41	< 40
42	< 40
51	< 45
52	< 45
53	< 50

Note: 1 ml is 1 cm^3

Procedure

- Purge the air from the chiller until the internal pressure in the chiller reaches required degree of vacuum, then continue purging for at least one hour.
- Connect the vacuum gauge to SV2, and open SV2.
- Make sure that the attained purge pump vacuum is below 0.5 kPa.
- Remove the exhaust port cap of the purge pump, and install the attachment to the exhaust port. Fit a vinyl hose to the attachment as shown in Fig. 5 and Fig. 7.
- Open V1, close V2 and V3.
- Continue operating the purge pump for one minute under the conditions above. Then measure the volume of bubbles (the measured volume is called A ml). Do not submerge the vinyl hose more than 10 mm during this measurement. If bubbles collect, inspect and tighten the connections downstream of V2 and V3. If bubbles still appear after tightening, measure the volume collected for 10 minutes.
- Open V1 and V3. Close V2. The gas ballast valve and the oil delivery valve should be closed.
- Continue operating the purge pump under the conditions above. Measure the volume of bubbles for 10 minutes (the measured volume is called B ml). The measurement should be repeated at least three times. During these measurements the attained purge pump vacuum should be kept below 0.5 kPa.
- B ml - A ml is the result of the bubble test.
- After the bubble test, the gas ballast valve should be opened. The oil delivery valve should be opened to check if any water is contained in the purge pump oil. If water is observed, drain the water and charge with new oil.

Fig. 6



Legend
1 3/8" copper tube
2 Flare nut
3 Nipple (3/8")
4 Bushing (1-1/4")
5 Attachment
6 Vinyl hose
7 Suction port
8 Graduated cylinder
9 Discharge port
10 Purge pump
11 Tank
12 Water

1.12 - Insulation

- After the chiller has been installed, it must be insulated.
- Before fitting the insulation, the chiller should be placed in its permanent position.
- To fit insulating materials, use appropriate fixtures and fittings.
- Insulation on piping connections, access covers and flange sections should be easily removable.
- The drawings show the areas to be insulated and the recommended insulating materials and procedures. Please refer to exhibit LG.
- The insulating material should be fibre glass.
- The coeffcient of thermal conductivity is ≤ 0.04 W/(mK)

2 - TEST OPERATION

2.1 - External visual inspection

The items below must be accessible after fitting the insulation:
- Dampers, service valves and sight glass.
- Temperature sensors and pressure gauges should be replaceable.
- Bar-thermometers need to be inserted into the wells provided on water headers and solution pipes.
- Evaporator headers should be removable.

2.1.1 - Chiller insulation must be correctly fitted.

The following position should not be insulated.
- The motor section of the refrigerant pump
- The rupture disk

2.1.2 - Installation checks

- There should not be any rust on the chiller.
- Flange and bolted connections should not be loose.
- There should not be any liquid leakage from the chiller.
- Ensure that the chiller components are not damaged.
- Ensure that no chiller components are missing.
- Ensure that wiring and piping are not damaged.

2.2 - Solution charge

Standard units are shipped fully charged with solution, inhibitor and alcohol.

2.3 - Electrical check (see Fig. 7)

The electrical specifications must comply with the control panel nameplate data. Check the field wiring and the palladium cell heater wiring. Refer to exhibit LF and the specification drawings.

2.3.1 - Check the motor insulation resistance

Always ensure that the motors are disconnected from the wiring before carrying out this check. The standard value is 10 MΩ minimum. The insulation resistance of the absorbent pump, solution pump and purge pump should be measured at the secondary terminals of each magnetic contactor.

2.3.2 - Measuring the insulation resistance

Measure the insulation resistance of absorbent pumps, refrigerant pump and purge pump using the following equipment:
- 500 V d.c. megger
- Screwdriver

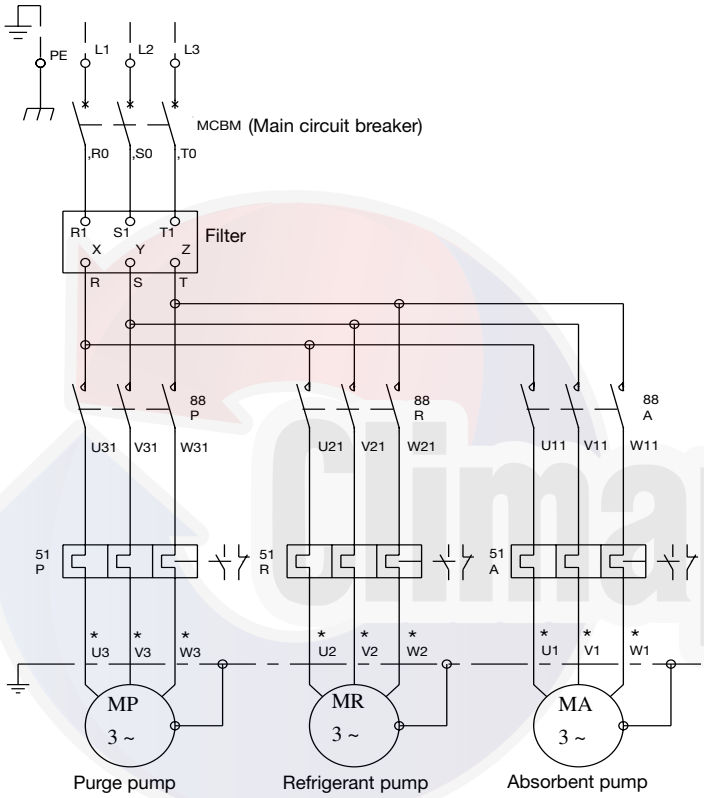
2.3.3 - Precautions

The insulation resistance should be 10 MΩ minimum. Be sure to perform this measurement at the seasonal maintenance and after pump replacement.

2.3.4 - Procedure

- Switch off the power supply during the work. Make sure to turn off the circuit breaker (MCBM).
- Connect the earth wire of the megger to the earth terminal in the control panel.
- Measure the insulation resistance of each motor at the following terminals on the control panel and at the wires disconnected in chapter 2.3.1.
- For positions measured with the megger see Fig. 7:
  - Absorbent pump (terminals) : U1/V1/W1
  - Refrigerant pump (terminals) : U3/V3/W3
  - Purge pump (terminals) : U4/V4/W4
- Record the measured values.

Fig. 7



2.4 - Initial control board setting

2.4.1 - Time setting

Refer to the operation and maintenance manual.

2.4.2 - Turn on the backup battery on the control board.

Refer to the operation and maintenance manual.

2.4.3 - Check the control board parameters.

Refer to the checklist, specification drawings and exhibit LI.

2.5 - Damper setting and valve position

2.5.1 - Damper setting

Refer to the specification drawings and exhibit LJ.

2.5.2 - Check valve opening status and switch positions

The position of each valve and switch is different for each operation mode. Refer to the operation and maintenance manual.

2.6 - Purging

2.6.1 - Ensure the gas ballast valve is closed before starting the purge pump.

During operation of the purge pump, the gas ballast valve should be opened. However if the valve is opened too far, purge pump oil may spill from the oil charge port.

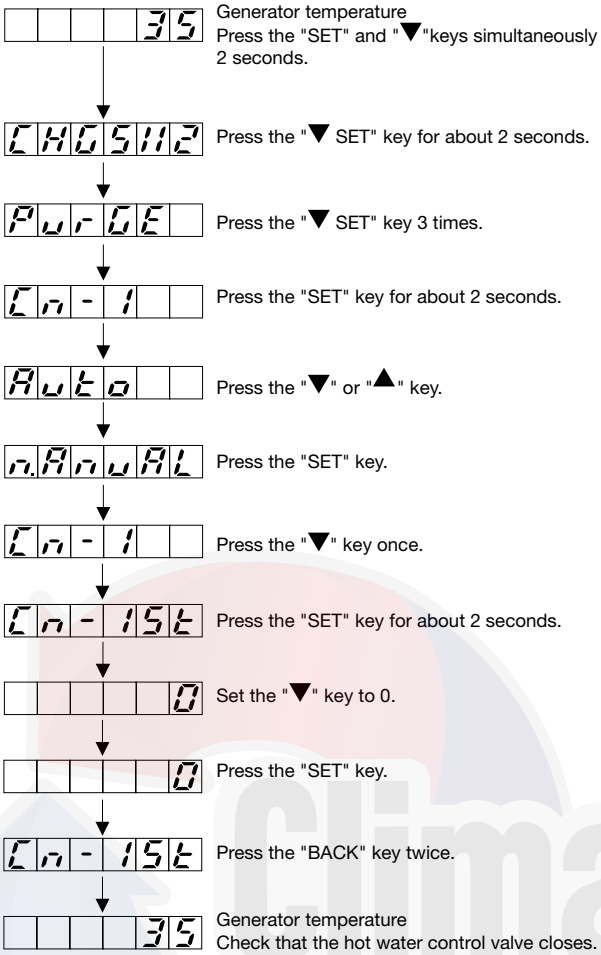
2.6.2 - Bubble test

Before conducting the bubble test, purge the chiller for at least one hour. The gas ballast valve should be closed during the bubble test. Please refer to the table in the chapter 1.11.1 "Bubble test".

2.7 - Function test

2.7.1 - Calibrating hot water control valves

Fig. 8 - Display example



2.7.2 - Water alarm

Chilled-water temperature (setpoint: 2.5°C)

a. Provide 1-2 litres of ice water.
b. Press the "RUN" key on the control board.
c. Dip the chilled-water temperature sensor (DT1) removed from the sensor holder into the water.
d. Confirm that the data display on the control board shows J-01 "Chilled water temperature alarm".

Chilled-water flow rate

(setpoint: less than approximately 50% of rated flow)

a. Press the "RUN" key
b. Reduce the chilled-water flow rate by gradually closing the evaporator outlet side valve.
c. Confirm that the data display on the control board shows J-03 "Chilled water flow rate alarm".

Cooling water temperature

(setpoint 19°C for 30 minutes during operation)

a. Dip the cooling water inlet temperature sensor into the water.
b. Press the "RUN" key
c. After about 30 minutes confirm that the data display on the control board shows J-20 "Cooling water temperature alarm".

2.7.3 - Motor alarm

After starting the chiller press the test levers of each thermal relay.

Refrigerant pump

The data display shows J-10 "Refrigerant pump alarm".

Absorbent pump

The data display shows J-04 "Absorbent pump alarm".

2.7.4 - System alarm

Chilled water pump

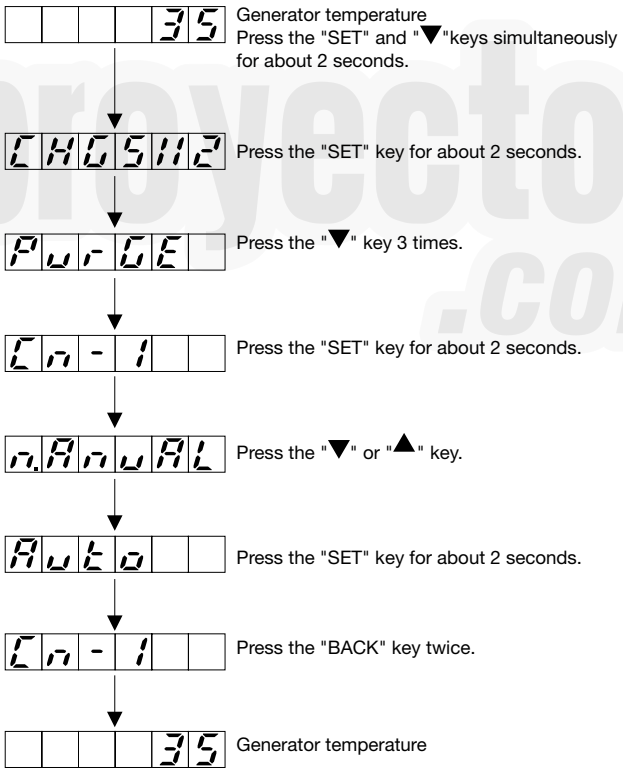
a. Press the "RUN" key.
b. Stop the chilled-water pump.
c. Confirm that the data display on the control board shows J-02 "Chilled-water pump interlock alarm" and the cooling water pump stops immediately.

Cooling water pump

a. Press the "RUN" key.
b. Stop the cooling water pump.
c. Confirm that the data display on the control board shows J-06 "Cooling water pump interlock alarm".

2.7.5 - Hot-water control valve operation

Fig. 9 - Display example



2.8 - Operation

2.8.1 - Test operation

Before starting the chiller, check the opening of the valves and the damper position. Refer to exhibit LJ.

Usually the units are factory-adjusted, but when assembling them on site or operating them for the first time, the following adjusting procedure should be taken.

Mark	Item	Criteria	Action
B1*	Hammer sound (heat exchanger)	No hammer sound	Close the diluted solution damper little by little (angle ± 2°)

* During the adjustment, service engineers must stay near the chiller, because it is running with the hot water control valve forced open.

2.8.2 - Operation and data record

Record data three times at 10 to 15-minute intervals during stable operating conditions.

Tools required to record operation data

- Thermometer
- Pressure gauge
- Stop watch
- Solution sampling tool
- Gravimeter
- Concentration table as attached

2.8.3 - Absorbent sampling

Sampling should be carried out as follows:

- Sampling of diluted solution
- Sampling from SV4, located on the absorbent pump outlet
- Solution should be sampled twice. The sample quantity is 100 ml. The second sample should be used for analysis.

Fig. 10 - Concentration versus temperature and relative density

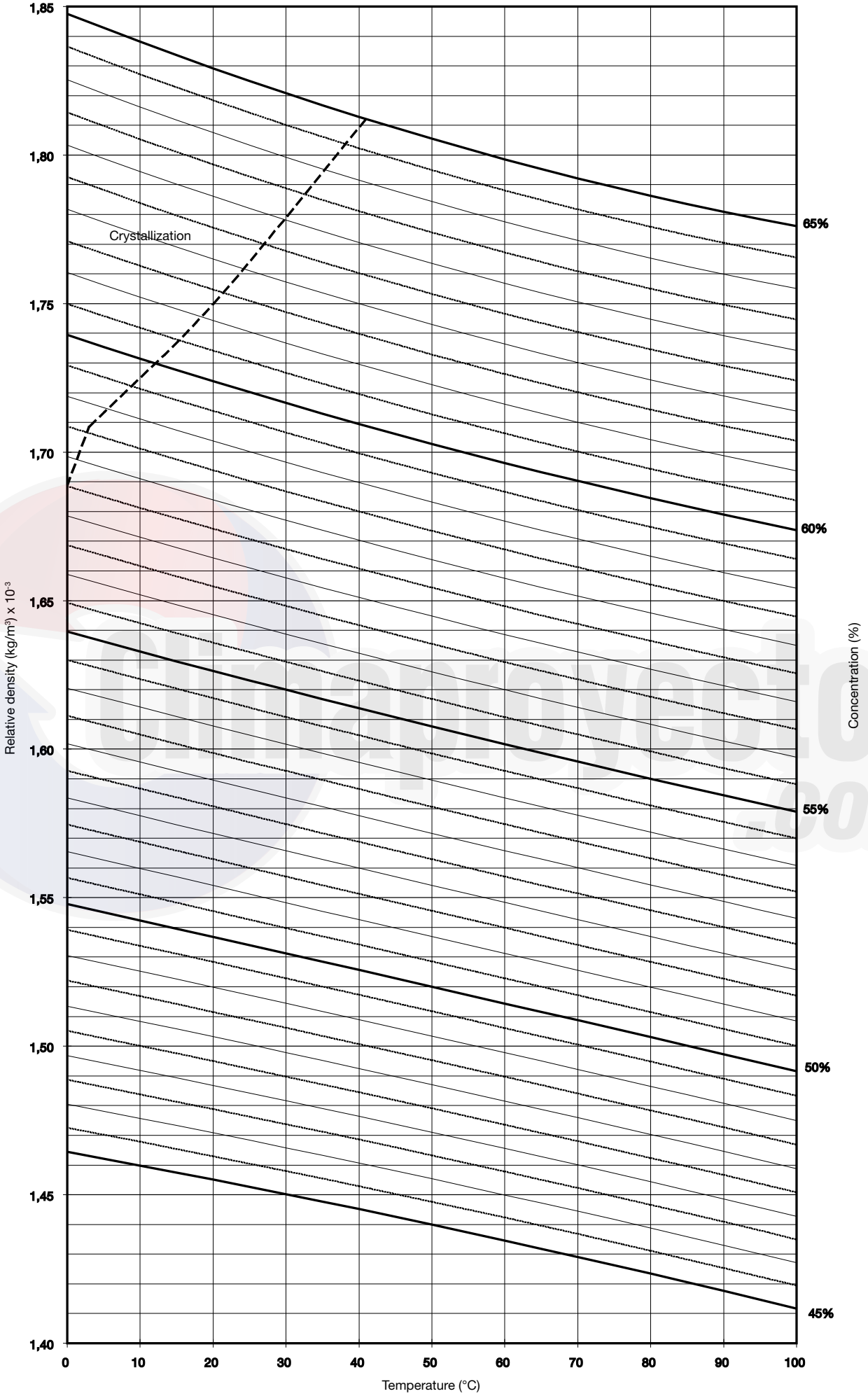
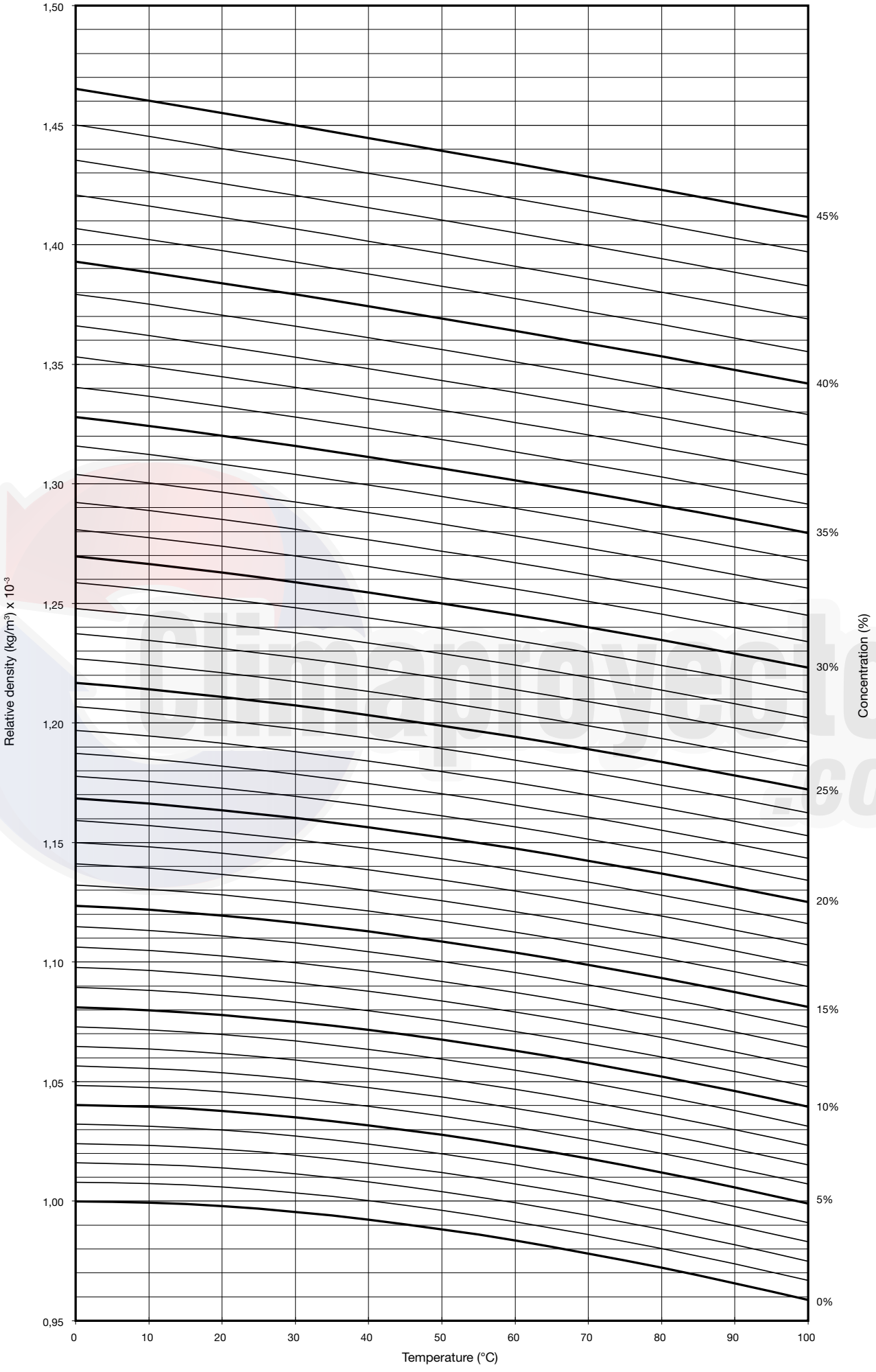


Fig. 11 - Concentration versus temperature and relative density



3 - CHECKLIST

Test operation in accordance with this check list.

3.1 - External visual inspection
3.2 - Verify field wiring and wiring of palladium cell heater
3.3 - Check of motor insulation resistance
3.4 - Check of control board safety and switch settings
3.5 - Check of purge pump
3.6 - Verify auxiliary equipment
3.7 - Bubble test
3.8 - Verify valve opening status and switch positions
3.9 - Verify control board parameters
3.10 - Pre-operation checks
3.11 - Operation and data record
3.12 - Sample of absorbent taken (for analysis)

Project name : _____
Chiller model : TSA-_____
Serial number : _____
Commissioned by : _____ Date _____
Accepted by : _____ Date _____

3.1 - External visual inspection

- Lower shell ..... Not damaged ☐ Damaged ☐
- Upper shell ..... Not damaged ☐ Damaged ☐
- Heat exchangers ..... Not damaged ☐ Damaged ☐
- Evaporator headers ..... Not damaged ☐ Damaged ☐
- Absorber headers ..... Not damaged ☐ Damaged ☐
- Condenser headers ..... Not damaged ☐ Damaged ☐
- Control panel ..... Not damaged ☐ Damaged ☐
- Absorption pump and isolation valves : ..... Not damaged ☐ Damaged ☐
- Refrigerant pump and isolation valves ..... Not damaged ☐ Damaged ☐
- Temperature sensors (11 sensors) ..... Not damaged ☐ Damaged ☐
- Generator pressure switches ..... Not damaged ☐ Damaged ☐
- Purge unit (diaphragm valves, liquid trap) ..... Not damaged ☐ Damaged ☐
- Chilled-water flow switch ..... Not damaged ☐ Damaged ☐
- Cooling water flow switch (option) ..... Not damaged ☐ Damaged ☐
- Refrigerant blow-down valve ..... Not damaged ☐ Damaged ☐
- Purge tank pressure sensors ..... Not damaged ☐ Damaged ☐
- Palladium cells and heater ..... Not damaged ☐ Damaged ☐

3.2 - Verify field wiring and wiring of palladium cell heater

- Cooling water pump interlock (#121-#170) ..... Not damaged ☐ Damaged ☐
- Chilled-water pump interlock (#120-#170) ..... Not damaged ☐ Damaged ☐
- Run/stop remote signal (#323-#326) ..... Not damaged ☐ Damaged ☐
- Stop indication (#352-#353) ..... Not damaged ☐ Damaged ☐
- Operation indication (#350-#351) ..... Not damaged ☐ Damaged ☐
- Alarm indication (#354-#355) ..... Not damaged ☐ Damaged ☐
- Chilled-water pump (#356-#357) ..... Not damaged ☐ Damaged ☐
- Cooling water pump (#358-#359) ..... Not damaged ☐ Damaged ☐
- Feedback indication (#362-#363) ..... Not damaged ☐ Damaged ☐
- Earth connection (#G/PE) ..... Not damaged ☐ Damaged ☐
- Wiring of palladium cell heater ..... Not damaged ☐ Damaged ☐
  For 460 V and 400 V: #232 and #0B on the control panel.
  For 208 V: #232 and #202 on the control panel.
- Hot-water control valve (4 to 20 mA: #345-#346) ..... Not damaged ☐ Damaged ☐
  (24 V a.c.: #340-#344,#0)
- Hot-water shut-off valve (#347-#348) ..... Not damaged ☐ Damaged ☐

3.3 - Check of motor insulation resistance

Standard: 10 MΩ mimum

- Absorbent pump : _____MΩ..... Good ☐ Not good → Repaired ☐ Replaced ☐
- Refrigerant pump : _____MΩ..... Good ☐ Not good → Repaired ☐ Replaced ☐
- Purge pump : _____MΩ..... Good ☐ Not good → Repaired ☐ Replaced ☐

NOTE: Do not use this test for an electronic controller.

3.4 - Check of control board safety and switch settings

- Generator pressure gauge (63GH) : _____kPa/MPa
- Purge tank pressure sensor (69PR) : _____kPa/MPa
- Absorbent pump thermal relay (51A) : _____A
- Refrigerant pump thermal relay (51R) : _____A
- Purge pump thermal relay (51P) : _____A

3.5 - Check of purge pump

- No water in liquid trap : Yes ☐ No ☐
- Oil quality : Clean ☐ Not cleaned ☐ (or contains water) → Replace oil
- Oil quantity : Good ☐ Not good ☐ → Add new oil up to the centre of sight glass or remove oil.
- Direction of rotation : Good ☐ (as arrow on V-belt cover) Not good ☐ → Transpose two power supply wires

3.6 - Verify auxiliary equipment

(For confirmation purpose only)

Water piping

- Chilled-water flow direction (inlet/outlet): Good ☐ Not good ☐
- Cooling water flow direction (inlet/outlet): Good ☐ Not good ☐
- Hot water flow direction (inlet/outlet): Good ☐ Not good ☐
- Chilled-water inlet/outlet valves: Open ☐ Closed ☐
- Cooling water inlet/outlet valves: Open ☐ Closed ☐
- Hot water inlet/outlet valves: Open ☐ Closed ☐

Air vent valve, drain valve, pressure gauge, thermometer

Water circuit	Air vent valve		Drain valve		Pressure gauge		Thermo-meter	
Chilled water	Yes	No	Yes	No	Yes	No	Yes	No
Cooling water	Yes	No	Yes	No	Yes	No	Yes	No

Water pump duty

- Chilled water pump : _____kW*
- Cooling water pump : _____kW*
- Hot water pump : _____kW*

Cooling tower : _____kW*

* For information only

Cooling water temperature control:

Fan on-off ☐ 2-way valve ☐ 3-way valve☐

Water charge into the chilled-water circuit:

Yes ☐ No ☐

Water charge into the cooling water circuit:

Yes ☐ No ☐

Water charge into the hot water circuit:

Yes ☐ No ☐

Automatic cooling water blow-down device:

Yes ☐ No ☐

Chemical cooling water feeding device:

Yes ☐ No ☐

Check cooling water temperature control:

Good ☐ Not good ☐

Water circulating conditions:

Item	Chilled water	Cooling water
Suction pressure (kPa/MPa)	_____	_____
Delivery pressure (kPa/MPa)	_____	_____
Current (A)	_____	_____

Capacity of a main breaker: _____A

3.7 - Bubble test (when the unit is charged)

- _____ml (cm^3)/10 min
- _____ml (cm^3)/10 min
- _____ml (cm^3)/10 min

Refer to the table in the chapter "Bubble test". Take measurements several times to obtain the value given in the table.

3.8 - Verify valve opening status and switch position

Change-over valves

B-valve - in purge pipe (open): ..... Open ☐ Closed ☐

Isolation valves

Valve open/close status should be as follows.

- Absorption pump (open): ..... Open ☐ Closed ☐
- Refrigerant pump (open): ..... Open ☐ Closed ☐

Diaphragm valves

Valve open/close status should be as follows.

- Manual purge Valve V1, V2, V3 (closed): Open ☐ Closed ☐
- Refrigerant blow-down valve (closed): Open ☐ Closed ☐

Service valves

Valve open/close status should be as follows.

- Charge/remove N_2 gas:.....SV1 (closed) Open ☐ Closed ☐
- Purge unit: .....SV2 (closed) Open ☐ Closed ☐
- Refrigerant: .....SV3 (closed) Open ☐ Closed ☐
- Diluted solution:.....SV4 (closed) Open ☐ Closed ☐
- Concentrated solution: .....SV6 (closed) Open ☐ Closed ☐
- Generator pressure gauge:.....SV7 (open) Open ☐ Closed ☐

Switch - purge (off): ..... On ☐ Off ☐

3.9 - Verify control board parameters

Parameters should be as follows (please refer to exhibit LH).

Item	Data display	Setpoint example	Verify
Specification setting	SPEC		
1. Chilled-water setting	C-tEn.P	7.0 °C	
2. Chilled-water temperature difference setting	C-dt	5.0 °C	
3. Rank-up/down	rAn-uP	100.0	
4. Purge pump light on	AP-St	10.0-PA	
5. Purge pump light off	AP-SP	7.0-PA	
Input setting	inPut		
6. Control type	bnt YPE	P.d	
7. Input correction	.PtCor	50	
PID setting	P.bSEt		
8. Proportional setting in cooling	CooL-P	2.0	
9. Integral setting in cooling	CooL-.	200	
10. Derivative setting in cooling	CooL-d	5	
11. Sampling setting	SAn.PLE	10	
Field setting	F.ELd		
12. Cooling water temperature at maximum input	Co-.inP	32.0 °C	
13. Slow input time	.inP-tn.	0000 S	
14. Slow input temperature	.inPtn.P	000 °C	
15. Dilution cycle time	d.Luu-t	04 n.	
16. Remote signal	r-S.Cn	StAt.C	
17. Remote off pulse signal	oF-PLS	Pos.t.	

3.10 - Pre-operation checks

Start and stop: Good ☐ Not good ☐

Interlock alarm

- Chilled water: Good ☐ Not good ☐
- Cooling water: Good ☐ Not good ☐

Motor alarm: Good ☐ Not good ☐

System alarm: Good ☐ Not good ☐

Check direction of pump rotation

- Absorbent pump: Good ☐ Not good ☐
- Refrigerant pump: Good ☐ Not good ☐
- Purge pump: Good ☐ Not good ☐

3.11 - Operation and data record

Run the chiller. Perform refrigerant blow-down: ..... Yes ☐ No ☐

Record operating data: ..... Yes ☐ No ☐

TEST OPERATION DATA SHEET

Trial run data sheet 1/2

Project name : _____
Chiller model : TSA-16LJ- _____
Serial number : _____
Accepted by : _____ Date _____
Reviewed by : _____ Date _____
Recorded by : _____ Date _____

Unit model/serial No. Operator: Date: / /

No.	Data items	Unit	Spec.	DATA-1 Time:	DATA-2 Time:	DATA-3 Time:
1	Ambient temperature	°C/°F				
2	Room temperature	°C/°F				
3	Chilled-water entering temperature	°C/°F				
4	Chilled-water leaving temperature	°C/°F				
5	Chilled-water entering pressure	kPa/psi				
6	Chilled-water leaving pressure	kPa/psi				
7	Evaporator pressure drop	kPa/psi				
8	Chilled water flow rate	l/s/gpm				
9	Cooling water entering temperature	°C/°F				
10	Cooling water leaving temperature	°C/°F				
11	Cooling water entering pressure	kPa/psi				
12	Cooling water leaving pressure	kPa/psi				
13	Pressure drop in absorber & condenser	kPa/psi				
14	Cooling water flow rate	l/s/gpm				
15	Hot-water entering temperature	°C/°F				
16	Hot-water leaving temperature	°C/°F				
17	Hot-water entering pressure	kPa/psi				
18	Hot-water leaving pressure	kPa/psi				
19	Generator pressure drop	kPa/psi				
20	Hot-water flow rate	l/s/gpm				
21	Generator temperature	°C/°F				
22	Evaporator solution level	n/60 mm n/2-3/8"				
23	Purge tank pressure	kPa				

Trial run data sheet 2/2

Project name : _____
Chiller model : TSA-16LJ- _____
Serial number : _____
Accepted by : _____ Date _____
Reviewed by : _____ Date _____
Recorded by : _____ Date _____

Unit model/serial No. Operator: Date: / /

No.	Data items	Unit	Spec.	DATA-1 Time:	DATA-2 Time:	DATA-3 Time:
24	Concentration of concentrated solution	%				
	Relative density of concentrated solution	-				
	Temperature of concentrated solution	°C/°F				
25	Concentration of diluted solution	%				
	Relative density of diluted solution	-				
	Temperature of diluted solution	°C/°F				
26	Concentration of refrigerant	%				
	Relative density of refrigerant	-				
	Temperature of refrigerant	°C/°F				
27	Condensed refrigerant temperature	°C/°F				
28	*LTD (See below)	°C/°F				
29	Absorbent pump current	A				
30	Refrigerant pump current	A				
31	Purge pump current	A				

* LTD = Condensed refrigerant temperature minus cooling water leaving temperature

Notes

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

3.12 - Sample of absorbent taken (for analysis)

Yes ☐ No ☐

4 - EXHIBITS

4.1 - Exhibit LA

4.1.1 - Precautions for use

Installation and operation
Before installing and operating this chiller, read all applicable manual(s).

WARNING: Do not store or use gasoline, thinner or other flammable vapours, liquids and materials in the vicinity of the chiller.

Machine room
- Keep the machine room temperature between 5°C and 40°C to protect against solution crystallisation during chiller shut-down.
- Keep the humidity in the machine room below 90%.
- Leave the service and maintenance clearances shown in the dimensional drawing.

Purging
Ensure that air cannot leak into the chiller (refer to the relevant manuals).

The chiller has a palladium cell as an auto-purge system; do not turn off the main power supply to the chiller during chiller shut-down.

Pumps and air handling units
Operate the chilled-water pump(s) and air handling unit(s) during the dilution cycle of the chiller.

During the operation of the chilled water pump(s), never manually stop the cooling water pump(s).

Winter season
In winter, ensure that the chilled and cooling water in the pipes does not freeze during chiller shut-down. If the cooling water pump(s) operate to provide frost protection of the cooling water, operate the chilled-water pump(s) simultaneously.

Service and maintenance
The chiller should be checked periodically. Please contact the service agent.

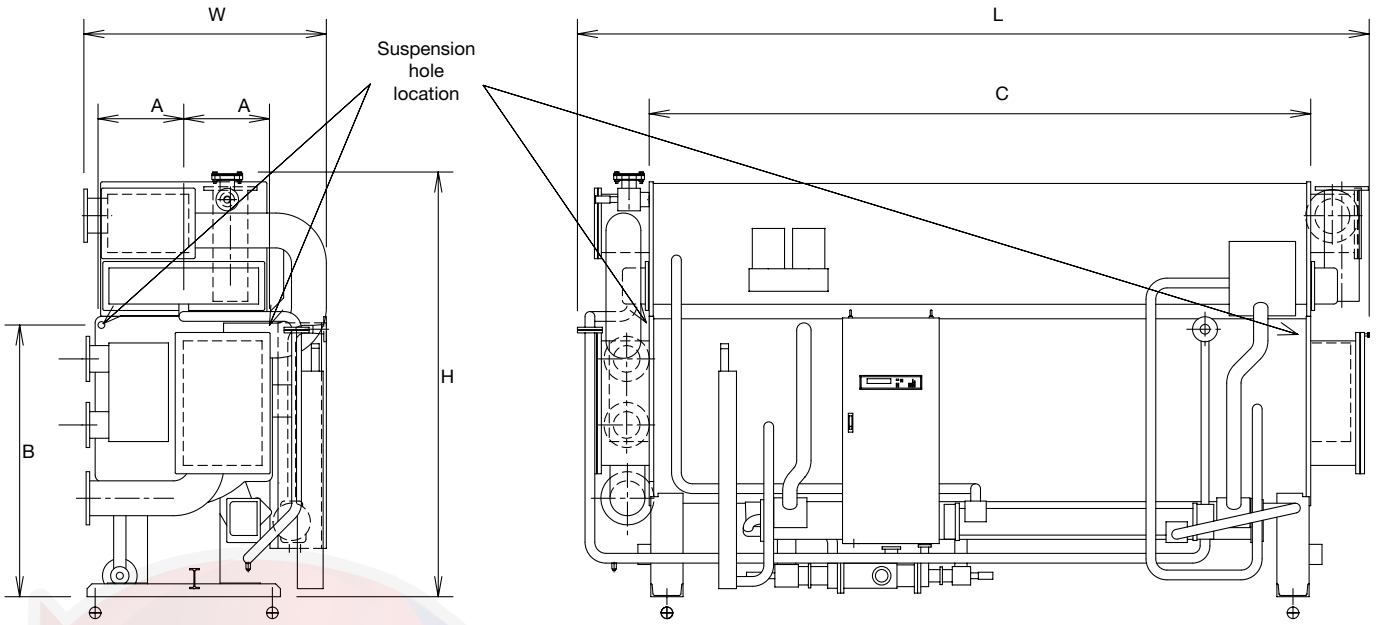
4.1.2 - Precautions for installation

- Always make sure that the installation complies with local regulations.
- The chiller is designed for indoor installation.
- Install the chiller on a floor that is suitable to carry the weight.
- Leave the service and maintenance clearances shown in the dimensional drawing.
- Do not install the unit in a dusty environment.
- If necessary, install anti-vibration mountings.
- Install the control panel so that it is not exposed to direct sunshine to ensure that the display is legible.
- Do not install the unit near an exhaust gas outlet or ventilation port.
- Use a shackle, when lifting the chiller with lifting cables. Insert the shackle into the hole on the lower shell.
- Ensure that the unit does not fall sideways.
- Keep sufficient space for a smooth installation.
- Avoid shocks and sudden movements.
- For units shipped as separate parts, assembly and welding must be done by a qualified technician. Please refer to the relevant manuals.
- The wiring connection must be done by a qualified technician.
- Use steel conduits for the wiring between the field power supply and the chiller control panel.
- Connect the operation signal wires from the chiller to the chilled water pump, cooling water pump and hot water pump. Each pump is automatically operated by the chiller signal.
- Connect the interlock wire of each pump to the chiller.
- If a remote signal is used, do not install this in parallel with the power line.
- Always connect an earth wire, but do not connect it to gas pipes or water pipes, etc.

4.2 - Exhibit LB

4.2.1 - Shipping dimensions - location of suspension hole

Fig. 12 - One-piece shipping



NOTES:

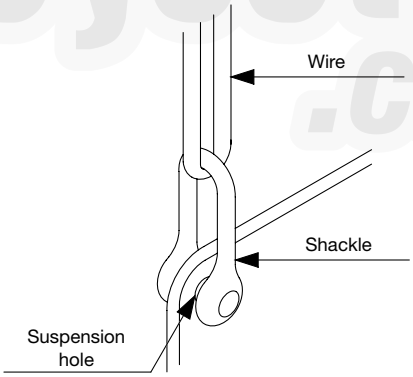
1. ***The diagram indicates suspension hole positions.***
2. ***Length (L), width (W) and height (H) differ according to the specific installation and should always be verified.***

16LJ	Shipping dimensions				Suspension hole location		
	L	W	H	Weight	A	B	C
	mm	mm	mm	kg	mm	mm	mm
11	2720	1295	2215	3500	400	1440	2066
12	2720	1295	2215	3600	400	1440	2066
13	3740	1295	2215	4500	400	1440	3086
14	3740	1295	2215	4700	400	1440	3086
21	3830	1455	2350	5700	470	1530	3086
22	3830	1455	2350	6000	470	1530	3086
23	4860	1455	2350	7000	470	1530	4106
24	4860	1455	2350	7300	470	1530	4106
31	4990	1515	2620	9000	500	1690	4106
32	4990	1515	2620	9400	500	1690	4106
41	5070	1615	2870	10800	540	1877	4106
42	5070	1615	2870	11200	540	1877	4106
51	5200	1950	3200	15100	660	2068	4106
52	5740	1950	3200	16400	660	2068	4648
53	6240	1950	3200	17600	660	2068	5146

4.2.2 - Detail of the suspension hole location

1. Insert the shackle bar into the suspension hole and attach the shackle with the wire to the shackle bar. The wire angle should be less than 90°. Be sure to lift at all four machine points and never just at 2 points.

Fig. 13



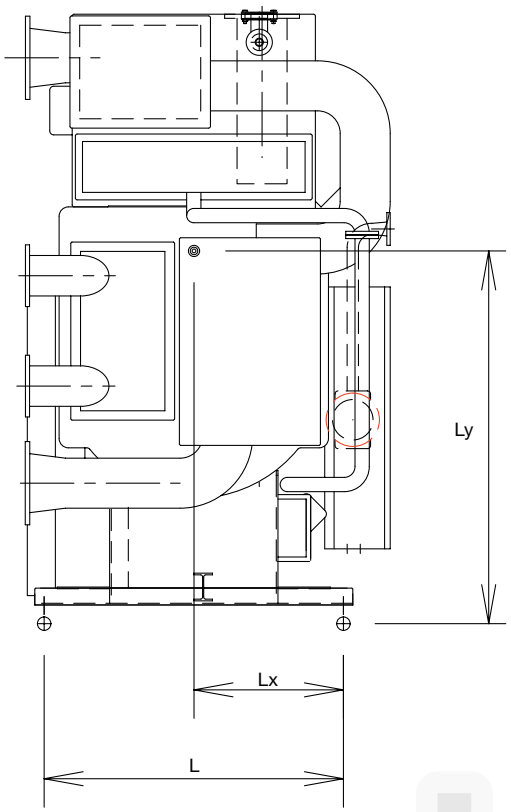
2. Move the hook of the crane to the machine, and hang the two wires on the hook
3. Move the machine carefully.
   Avoid shocks and do not drop the machine.
4. The machine is a vacuum vessel and includes solutions.
   Any damage caused may be irreparable.

4.2 - Exhibit LB (cont.)

4.2.3 - Centre of gravity location

16LJ	Centre of gravity location		Foundation width
	Ly (mm)	Lx (mm)	L (mm)
11	1270	390	800
12	1270	390	800
13	1270	390	800
14	1270	390	800
21	1380	490	1000
22	1380	490	1000
23	1380	490	1000
24	1380	490	1000
31	1530	530	1100
32	1530	530	1100
41	1610	560	1150
42	1610	560	1150
51	1710	780	1600
52	1710	780	1600
53	1710	780	1600

Fig. 14



4.3 - Exhibit LC

4.3.1 - Foundation dimensions, mm

Fig. 15 - 16LJ-11 to 16LJ-42

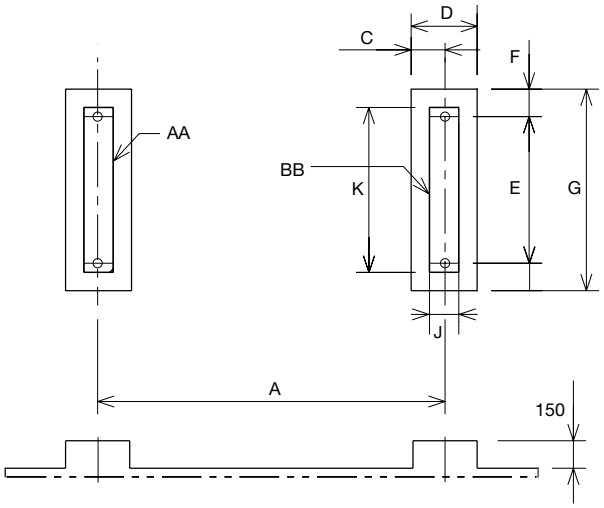


Fig. 17 - 16LJ-51 to 16LJ-53

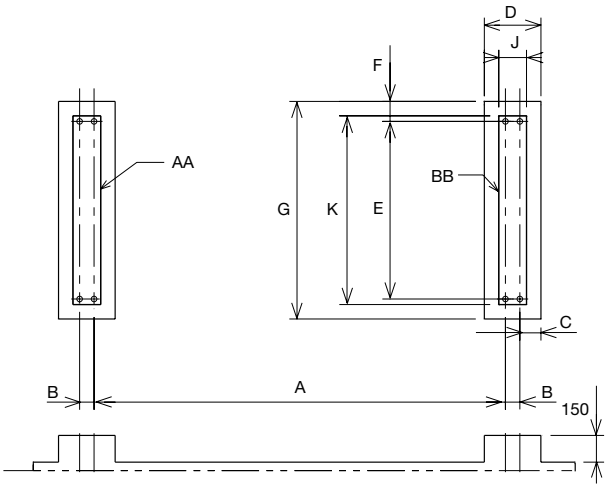
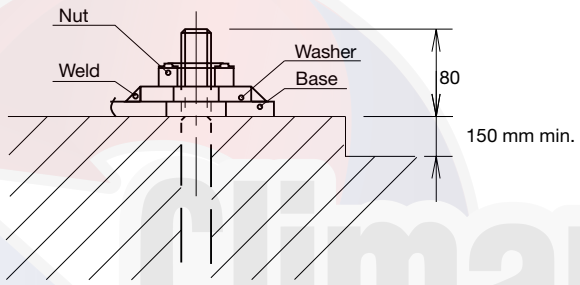


Fig. 16 - Details of weld



NOTES

1. *The machine base has a ø50-mm hole for the anchor bolt.*
2. *The anchor bolt should be fixed as shown in the detail drawing. The washer should be welded to the base (see Fig. 16).*
3. *There should be a drain channel around the foundation.*
4. *The floor surface should be made waterproof to facilitate maintenance work.*
5. *The surface of the foundation should be made flat (levelling tolerance is 1 mm for 1000 mm).*
6. *Anchor bolts and nuts are to be supplied by the customer.*

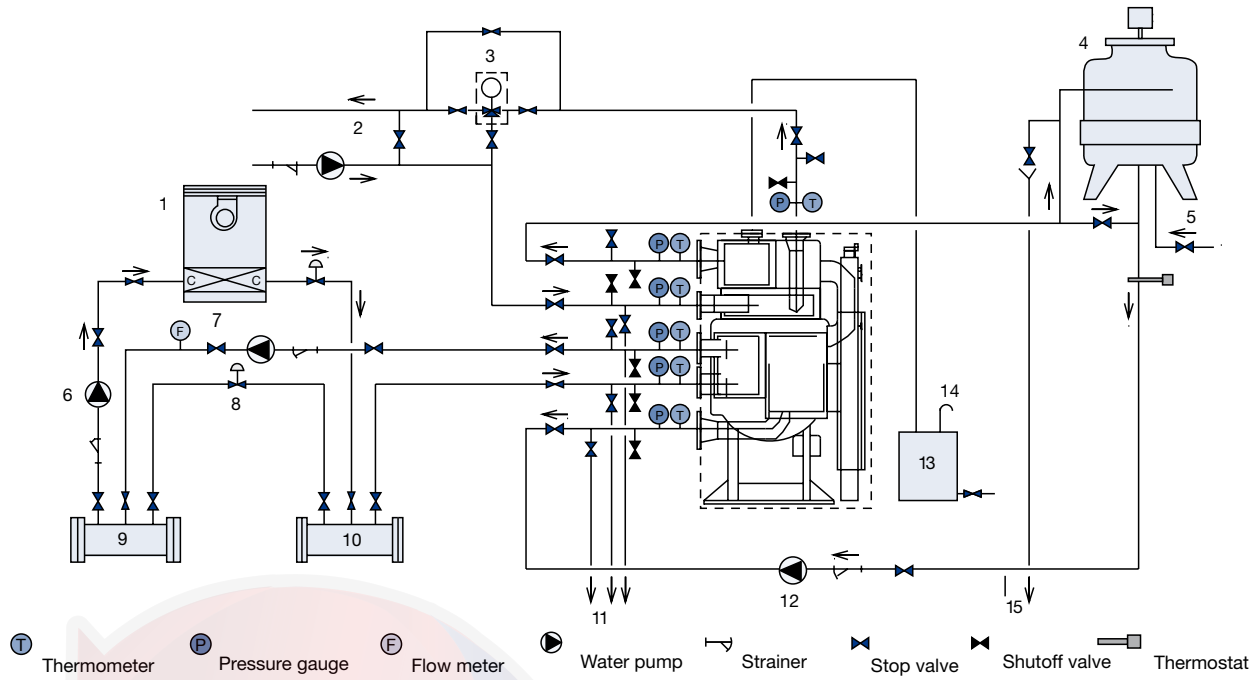
Table 2 - Dimensional data

16LJ	Weight, kg			Dimensions, mm								
	AA + BB	AA	BB	A	B	C	D	E	F	G	J	K
11	4000	2000	2000	1896	--	185	360	800	150	1100	160	900
12	4200	2100	2100	1896	--	185	360	800	150	1100	160	900
13	5200	2600	2600	2916	--	185	360	800	150	1100	160	900
14	5500	2750	2750	2916	--	185	360	800	150	1100	160	900
21	6700	3350	3350	2866	--	200	400	1000	150	1300	200	1100
22	7100	3550	3550	2866	--	200	400	1000	150	1300	200	1100
23	8200	4100	4100	3886	--	200	400	1000	150	1300	200	1100
24	8700	4350	4350	3886	--	200	400	1000	150	1300	200	1100
31	10600	5300	5300	3836	--	225	450	1100	150	1400	250	1200
32	11100	5550	5550	3836	--	225	450	1100	150	1400	250	1200
41	12900	6450	6450	3836	--	225	450	1150	150	1450	250	1250
42	13400	6700	6700	3836	--	225	450	1150	150	1450	250	1250
51	18200	9100	9100	3706	130	190	510	1600	180	1960	250	1700
52	19700	9850	9850	4248	130	190	510	1600	180	1960	250	1700
53	21100	10550	10550	4746	130	190	510	1600	180	1960	250	1700

4.4 - Exhibit LE

4.4.1 - Typical piping diagram

Fig. 18



Legend

1	Cooling load	6	Chilled-water pump (secondary)	11	To drain
2	Hot-water pump	7	Chilled-water pump (primary)	12	Cooling water pump
3	Hot water three-way valve	8	Bypass valve	13	Minimum tank capacity 1 m^3
4	Cooling tower	9	Supply header	14	Air vent
5	Make-up water	10	Return header	15	To drain

NOTE: In order to prevent freezing of the chilled water during the chiller dilution cycle, ensure continued operation of the chilled water pumps and cooling load until the dilution symbol on the control panel goes off. For the same reason the chilled water volume must be higher than 10.5 litres/kW.

General remarks on piping

1. Equipment and parts outside the area surrounded by the broken line are not supplied by Carrier. A hot water control valve and a hot water shut-off valve shall be provided, if specified in the scope of supply.
2. For pipe connections and diameters refer to the dimensional drawings and specification tables.
3. Ensure that the chilled water flow rate and cooling water flow rate are in conformity with the standard value. If the chilled water flow rate sinks to under 50% of the standard value, the chiller will stop.
4. Position the chilled water pump, cooling water pump, hot water pump and expansion water tank correctly so that the chiller pressure does not exceed the set value.
5. For cooling water temperature control refer to the chapter "Cooling water temperature control method".
6. Separate chilled and cooling and hot water pumps should be provided for each chiller.
7. Provide a cooling water blow-down valve in the cooling tower inlet for water quality control.
8. Install a filter in the chilled water, cooling water and hot water pipes (10 mesh).
9. Install stop valves on the chilled, cooling and hot water inlet/outlet.
10. Provide a thermometer and pressure gauge at the chilled, cooling and hot water inlet and outlet.
11. Provide an air vent valve in each of the chilled and cooling water lines at a point higher than the header.
12. Install drain valves at the lowest positions between absorption chiller and the stop valves of the chilled water, cooling water and hot water, and pipe them to the drain channel.
13. Install stop valves between the absorption chiller and stop valves of all inlets and outlets for chemical cleaning of the water circuit system.
14. Install a cooling tower away from any exhaust gas outlet.

4.4.2 - Water treatment

Absorption chillers use copper pipes to prevent corrosion due to the use of fresh water (pipe material: JIS H 3300 C1201TS) But there is a possibility of corrosion due to water pollution or poor water quality.

Please follow the points below to prevent problems:

- For chilled and cooling water refer to water quality standard JRA GL-02-1994 (see below). If the water does not comply with this standard, please contact a water treatment specialist.
- If coated steel pipe is used in the chilled and cooling water lines, add corrosion inhibitor to the steel pipes and make sure that the rust does not adhere to the copper pipes. Please contact a water treatment specialist.

If corrosive gas exists near the cooling tower, the corrosive components can dissolve into the cooling water. Please ensure that it is not located near a source of corrosive gas.

If a heat storage tank is used in the chilled water line, pipe corrosion may occasionally occur due to dissolved oxygen or rust in the tank. In this case install a heat exchanger between chiller and tank, or contact a water treatment specialist.

If the pipes are flushed before commissioning ensure that no foreign materials get into the chiller. Always flush the pipes using the bypass piping for the chiller.

If the chiller is installed in an existing system, rust in the existing pipes may prevent the formation of the corrosion-inhibiting film in the pipe. Contact a water treatment specialist.

4.4.3 - Standard water quality values

Ref: JRA-GL-02-1994

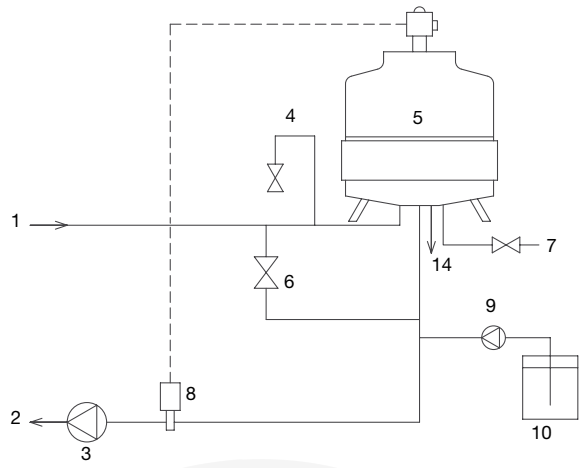
			Cooling water systems			Chilled water systems		Tendency	
			Recirculating water	Make-up water	Once-through water	Recirculating water < 20°C	Make-up water	Corrosive	Scale-forming
Standard	pH (25°C)		6.5 - 8.2	6.0 - 8.0	6.8 - 8.0	6.8 - 8.0	6.8 - 8.0	X	X
	Electrical conductivity 25°C	(mS/m)	below 80	below 30	below 40	below 40	below 30	X	X
	Chroride ion	($mgCl^-$/l)	below 200	below 50	below 50	below 50	below 50	X	
	Sulphuric acid ion	($mgSO_4^{2-}$/l)	below 200	below 50	below 50	below 50	below 50	X	
	Acid consumption (pH 4.8)	($mgCaCO_3$/l)	below 100	below 50	below 50	below 50	below 50		X
	Total hardness	($mgCaCO_3$/l)	below 200	below 70	below 70	below 70	below 70		X
	Calcium hardness	($mgCaCO_3$/l)	below 150	below 50	below 50	below 50	below 50		X
	Ion silica	($mgSiO_2$/l)	below 50	below 30	below 30	below 30	below 30		X
Reference	Iron	(mgFe/l)	below 1.0	below 0.3	below 1.0	below 1.0	below 0.3	X	X
	Copper	(mgCu/l)	below 0.3	below 0.1	below 1.0	below 1.0	below 0.1	X	
	Sulphide ion	(mgS^{2-}/l)	Not detected	Not detected	Not detected	Not detected	Not detected	X	
	Ammonium ion	($mgNH_4^+$/l)	below 1.0	below 0.1	below 1.0	below 1.0	below 0.1	X	
	Residual chlorine	(mgCl/l)	below 0.3	below 0.3	below 0.3	below 0.3	below 0.3	X	
	Free carbon dioxide	($mgCO_2$/l)	below 4.0	below 4.0	below 4.0	below 4.0	below 4.0	X	
	Ryzner stability index (RSI)		6.0 - 7.0	***	***	***	***	X	X

			Hot-water systems				Tendency	
			Lower level (20-60°C)		Higher level (60-90°C)			
			Recirculating water	Make-up water	Recirculating water	Make-up water	Corrosive	Scale-forming
Standard	pH (25°C)		7.0 - 8.0	7.0 - 8.0	7.0 - 8.0	7.0 - 8.0	X	X
	Electrical conductivity 25°C	(mS/m)	below 30	below 30	below 30	below 30	X	X
	Chroride ion	($mgCl^-$/l)	below 50	below 50	below 30	below 30	X	
	Sulphuric acid ion	($mgSO_4^{2-}$/l)	below 50	below 50	below 30	below 30	X	
	Acid consumption (pH 4.8)	($mgCaCO_3$/l)	below 50	below 50	below 50	below 50		X
	Total hardness	($mgCaCO_3$/l)	below 70	below 70	below 70	below 70		X
	Calcium hardness	($mgCaCO_3$/l)	below 50	below 50	below 50	below 50		X
	Ion silica	($mgSiO_2$/l)	below 30	below 30	below 30	below 30		X
Reference	Iron	(mgFe/l)	below 1.0	below 0.3	below 1.0	below 0.3	X	X
	Copper	(mgCu/l)	below 1.0	below 0.1	below 1.0	below 0.1	X	
	Sulphide ion	(mgS^{2-}/l)	Not detected	Not detected	Not detected	Not detected	X	
	Ammonium ion	($mgNH_4^+$/l)	below 0.3	below 0.1	below 0.1	below 0.1	X	
	Residual chlorine	(mgCl/l)	below 0.25	below 0.3	below 0.1	below 0.3	X	
	Free carbon dioxide	($mgCO_2$/l)	below 0.4	below 4.0	below 0.4	below 1.0	X	
	Ryzner stability index (RSI)		6.0 - 7.0	***	***	***	X	X

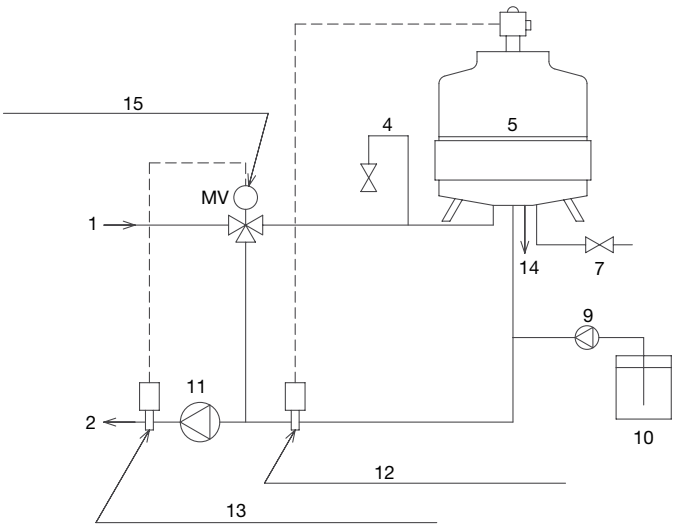
4.4.4 - Cooling water temperature control

Fig. 19 - Example for cooling water entering temperature of 29.4°C

A



B



Legend
1 From chiller/heater
2 To chiller/heater
3 Cooling water pump
4 Constant flow blow-down valve
5 Cooling tower
6 Bypass valve
7 Water supply
8 Cooling water thermostat
9 Dosing pump
10 Chemical tank
11 Cooling water pump
12 Cooling water thermostat for cooling tower fan
13 Cooling water thermostat for three-way control valve
14 Blow-down
15 Automatic three-way control valve

Case A

Absorption chillers are designed to operate with a cooling water entering temperature above 18°C. In typical applications the chiller is selected on the basis of the cooling water temperature available at full load. This is 29.4°C.

During operation of the chiller/heater keep the cooling water entering temperature between 29.4°C and 18°C.

During start-up however, a lower temperature is allowable until the operating conditions are reached.

NOTES

1. ***Be sure to start and stop the fan by means of the cooling water thermostat.***
2. ***Provide a bypass valve in order to control the cooling water entering temperature properly.***

Case B

If the chiller operates during an intermediate season or in winter, provide an automatic three-way control valve shown as above.

4.4.5 - Cooling water blow-down method

Prevent concentration and replace cooling water by blow-down.

Calculate the blow-down volume as follows.

N: Concentration factor (N = 3 is normal condition)

M: Volume of make-up water

E: Evaporation loss = 860 x 2.43 (exhaust heat factor) divided by 575 (latent heat of water at 40°C) = 3.63 l/h/kW

W: Splash loss (0.2% of circulation water volume)

B: Blow-down volume

$$M = E + W + B \qquad N = \frac{E + W + B}{W + B}$$

$$B = \frac{1}{N - 1} \times E - W \qquad M = \frac{N}{N - 1} \times E$$

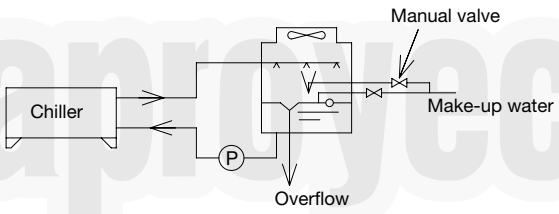
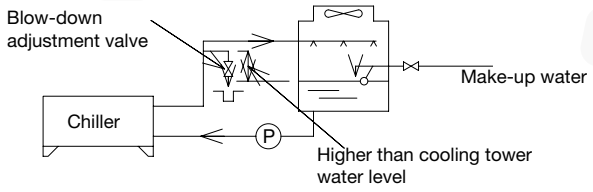
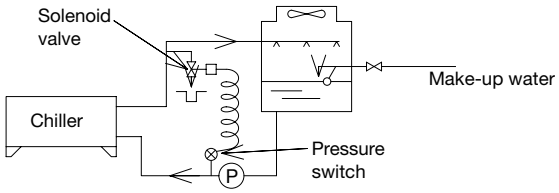
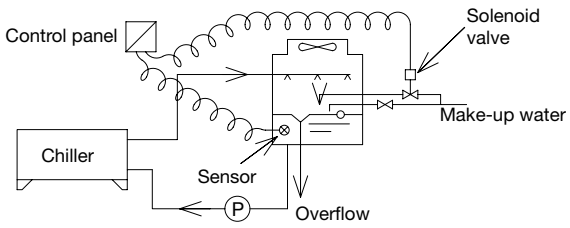
Example

Cooling water flow rate = 230 l/h/kW (chiller cooling capacity)

E = 3.63 l/h/kW
N = 3
W = 0.46 l/h

$$B = \frac{1}{3 - 1} \times 3.63 - 0.46$$

B = 1.36 l/h/kW

1	**Overflow** (Overflow at cooling tower via manual valve)	
2	**Constant blow-down** (Constant blow-down via solenoid valve)	
3	**Pressure switch and solenoid valve** (Blow-down via solenoid valve at pressure switch)	
4	**Conductivity meter and/or pH meter** (Blow-down by conductivity or pH)	

4.4 - Exhibit LE (cont.)

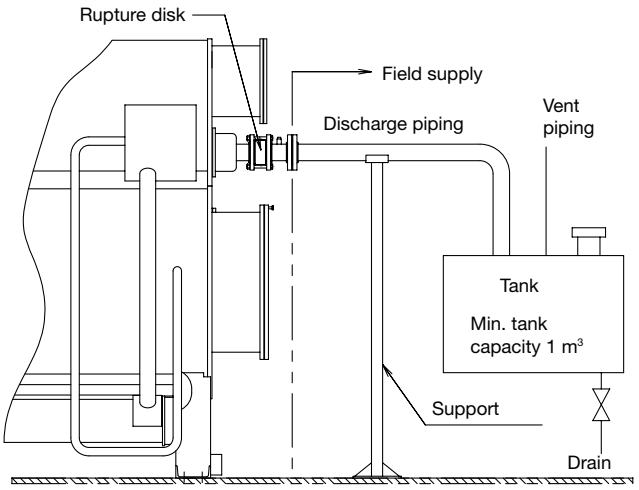
4.4.6 - Boiler water quality

Ref: JIS-B-8223-1989

Kind of boiler			Cylindrical boiler	Water tube boiler	Multibubular boiler
Maximum operating pressure		(MPa)	1	1	1
Kind of make-up water			Softening water	Softening water	Softening water
Feed water	pH (at 25°C)		7 - 9	7 - 9	7 - 9
	Calcium hardness	($mgCaCO_3$/l)	below 1	below 1	below 1
	Fat and oils	(mg/l)	keep low	keep low	keep low
	Dissolved oxygen	(mg O/l)	keep low	keep low	keep low
	Iron	(mg Fe/l)	-----	below 0.3	below 0.3
	Residue on evaporation	(mg/l)	-----	-----	-----
	Conductivity (at 25°C)	(µS/cm)	-----	-----	-----
	Acid consumption (pH 4.8) (M-alkalinity)	($mgCaCO_3$/l)	-----	-----	-----
	Acid consumption (pH 8.3) (P-alkalinity)	($mgCaCO_3$/l)	-----	-----	-----
	Hydrazine	(mgN_2H_4/l)	-----	-----	-----
	Chloride ion	($mgCl^-$/l)	-----	-----	-----
	Phosphoric acid ion	($mgPO_4^{3-}$/l)	-----	-----	-----
Boiler water	Processing		Alkali treatment	Alkali treatment	Alkali treatment
	pH (at 25°C)		11.0-11.8	11.0-11.8	11.0-11.8
	Acid consumption (pH 4.8) (M-alkalinity)	($mgCaCO_3$/l)	100 - 800	100 - 800	100 - 800
	Acid consumption (pH 8.3) (P-alkalinity)	($mgCaCO_3$/l)	80 - 600	80 - 600	80 - 600
	Residue on evaporation	(mg/l)	below 2500	below 2500	below 2500
	Conductivity (at 25°C)	(µS/cm)	below 4000	below 4000	below 4000
	Chloride ion	($mgCl^-$/lit)	below 400	below 400	below 400
	Phosphoric acid ion	($mgPO_4^{3-}$/l)	20 - 40	20 - 40	20 - 40
	Sulphurous acid ion	($mgSO_3^{2-}$/l)	10 - 50	10 - 50	10 - 50
	Hydrazine	(mgN_2H_4/l)	0.1- 1.0	0.1- 1.0	0.1- 1.0

4.4.7 - Rupture disk connection

Fig. 20



NOTES

1. ***The rupture disk is factory-mounted on the chiller.***
2. ***Install a receiver tank for the solution. The tank volume is approx. 1 m³.***
3. ***Install piping support near the rupture disc connection.***

4.4.8 - Rupture disk replacement

1. Apply a small amount of Teflon paste (part No. 814-2-3701-002-00) to both sides of the gasket, as shown in Fig. 21 to avoid leakage, Do not apply too much Teflon paste.
2. The gasket (part No. 814-2-2101-675-00-0 or -677-00-0) should be used as indicated in Fig. 22.
3. Attach the upper flange exactly parallel to the lower flange.
4. Read the manufacturer's installation instructions before assembly. A torque wrench should be used for tightening the bolts equally, and **the correct torque is shown in Fig. 22.**

   NOTE: Disregard the torque table in the installation instructions from the manufacturer.
5. Tighten the bolts with a torque wrench during the routine maintenance.
6. A used gasket should not be used again.
7. Leak test the system using the bubble test method.

Fig. 21

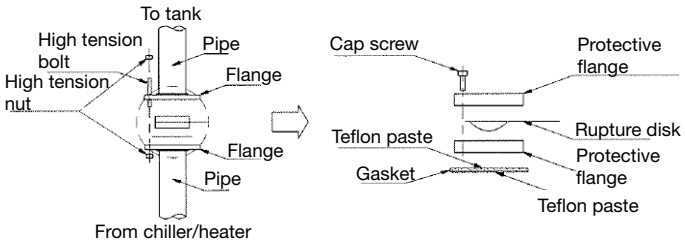
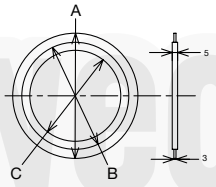


Fig. 22

		2 inch disk	3 inch disk
A (mm)		104.9	136.7
B (mm)		85.9	120.7
C (mm)		69.9	101.6
Tightening torque (N m)	Cap screw hexagon socket head	26	41



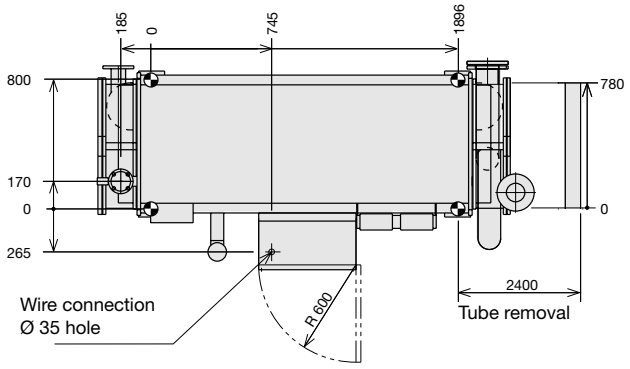
Material: T/#9090-OR
ANSI class: 150 lbs
Part name: packing, gasket for rupture disk
Part No.: 814-2-2101-675-00-0: 2 inch
814-2-2101-677-00-0: 3 inch

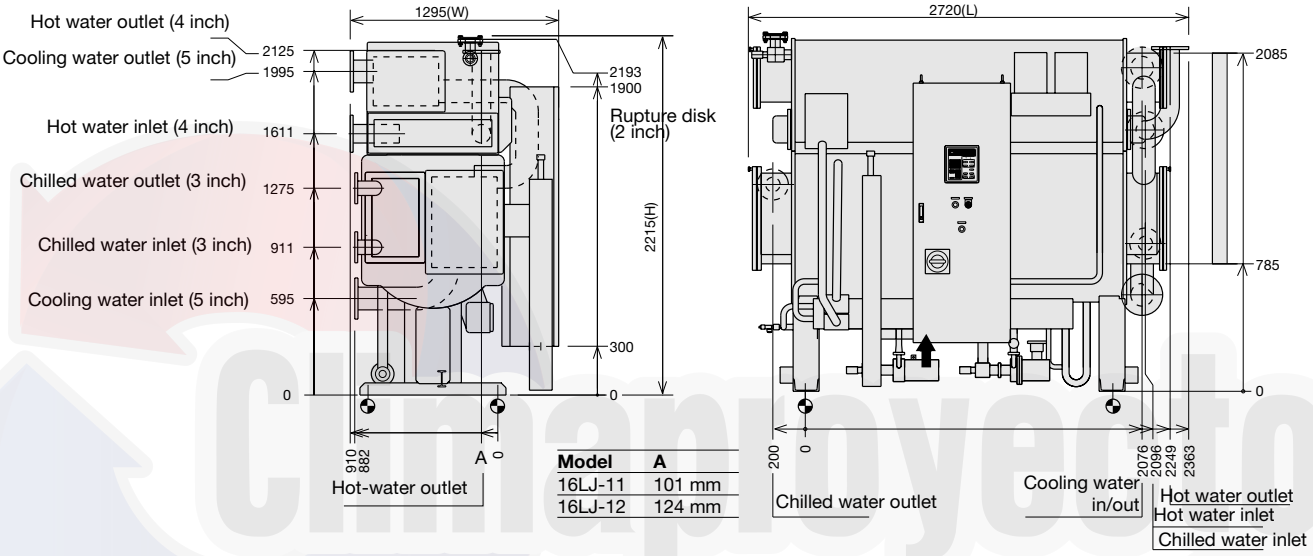
4.4 - Exhibit LE (cont.)

4.4.9 - Dimensional drawings

16LJ-11 through 16LJ-12 (mm)

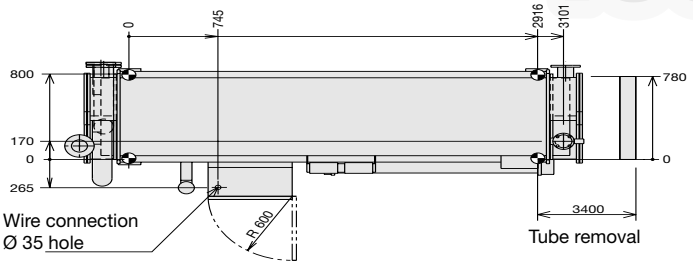
NOTES:
1. Dimensions (L), (W), (H) are for a standard machine. The dimensions are changed by parts added.
2. ⊕ indicates the position of anchor bolts.
3. Clearance space must be available at the front and rear of the chiller.
4. All external water piping are to be provided with welded ANSI 150 LB flanges by the customer.
5. ⬆ indicates the position of the power supply connection on the control panel (diameter 35 mm).
6. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm
   Space for tube removall

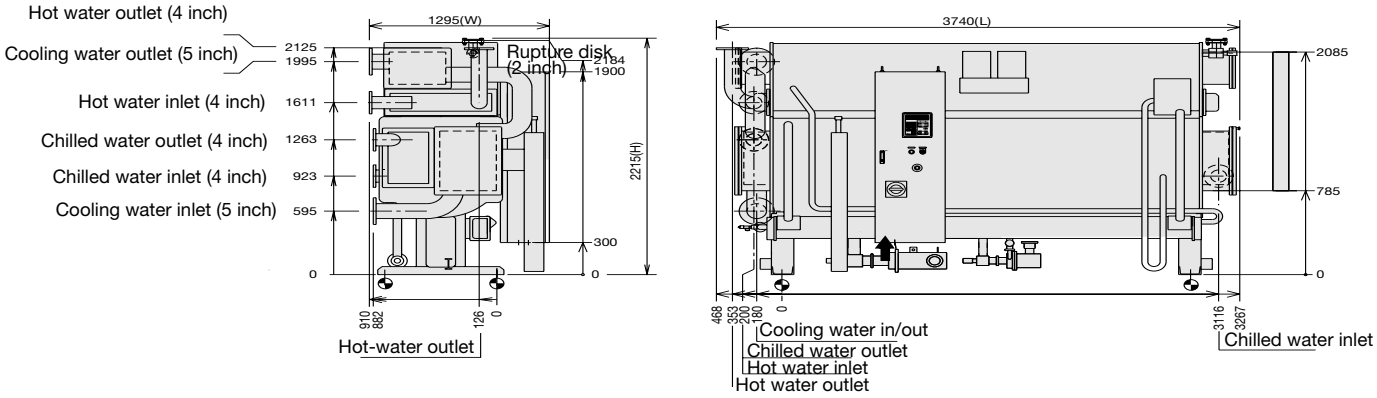




Model	A
16LJ-11	101 mm
16LJ-12	124 mm

16LJ-13 through 16LJ-14 (mm)



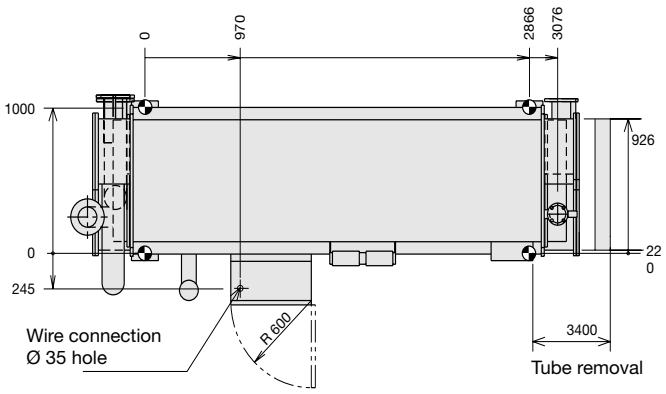


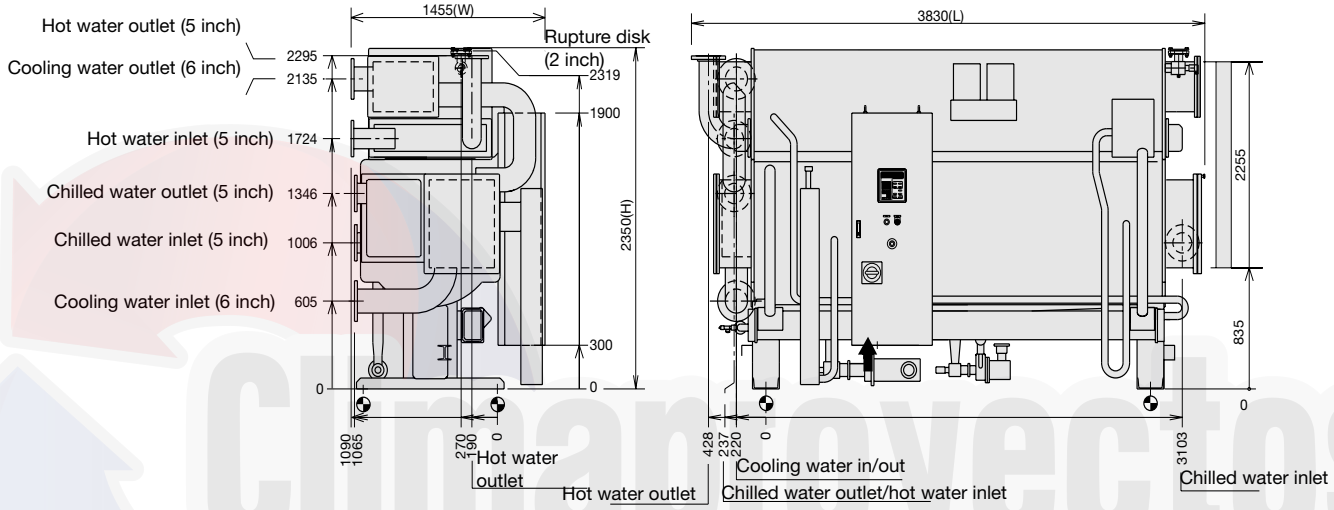
NOTE: Dimensions are for guidance only. Refer to the certified drawings supplied upon request when designing an installation.

4.4 - Exhibit LE (cont.)

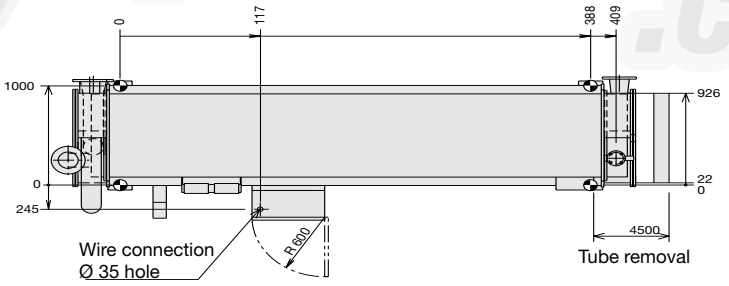
16LJ-21 through 16LJ-22 (mm)

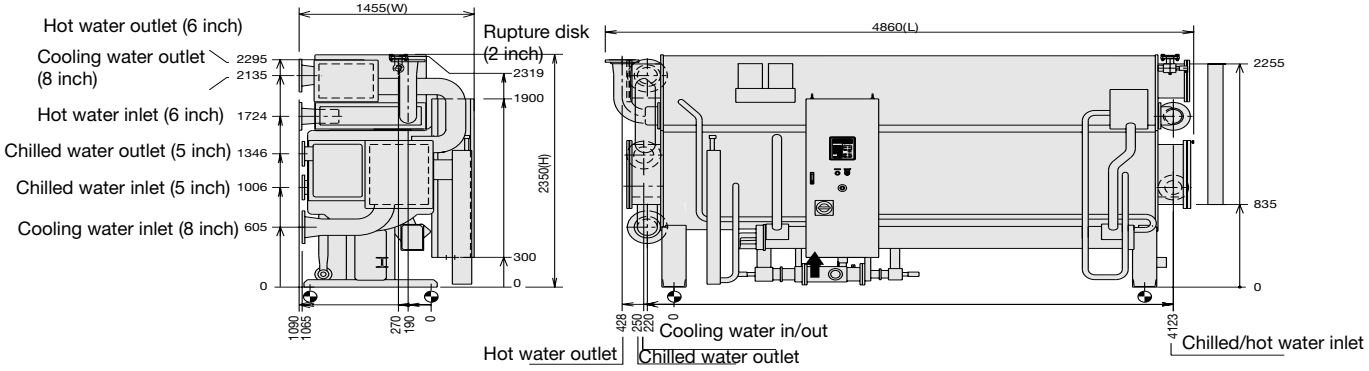
NOTES:
1. Dimensions (L), (W), (H) are for a standard machine. The dimensions are changed by parts added.
2. ⊕ indicates the position of anchor bolts.
3. Clearance space must be available at the front and rear of the chiller.
4. All external water piping are to be provided with welded ANSI 150 LB flanges by the customer.
5. ⬆ indicates the position of the power supply connection on the control panel (diameter 35 mm).
6. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm
   ▨ Space for tube removal





16LJ-23 through 16LJ-24 (mm)





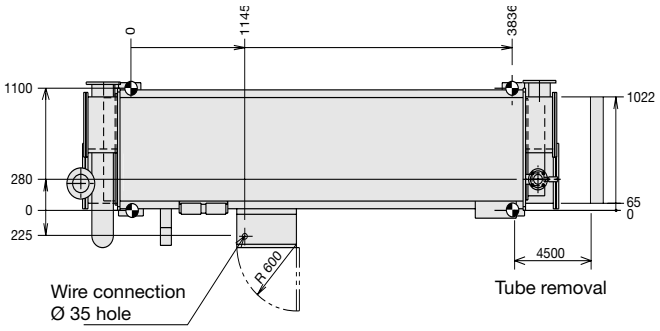
NOTE: Dimensions are for guidance only. Refer to the certified drawings supplied upon request when designing an installation.

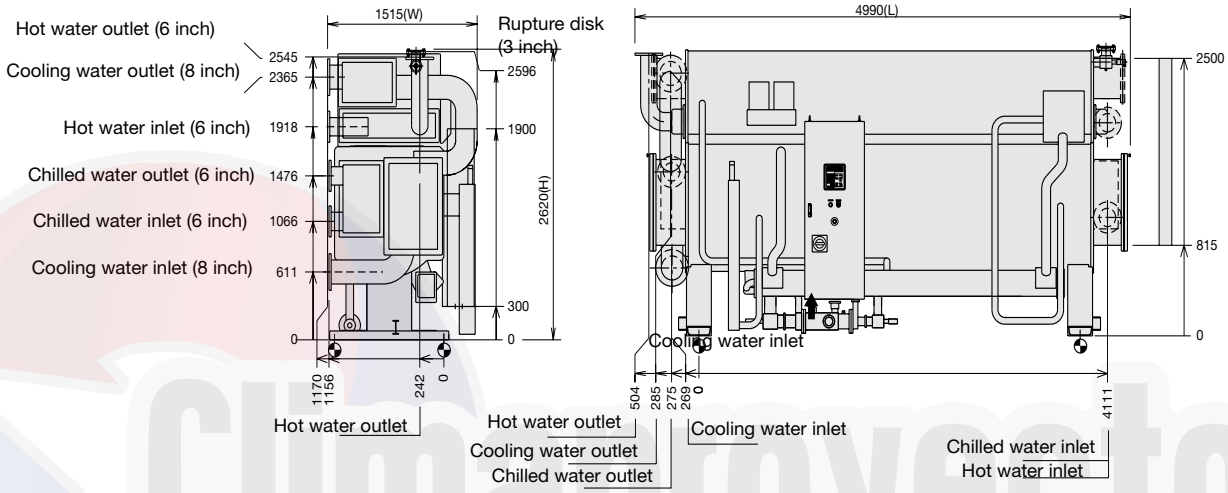
4.4 - Exhibit LE (cont.)

16LJ-31 through 16LJ-32 (mm)

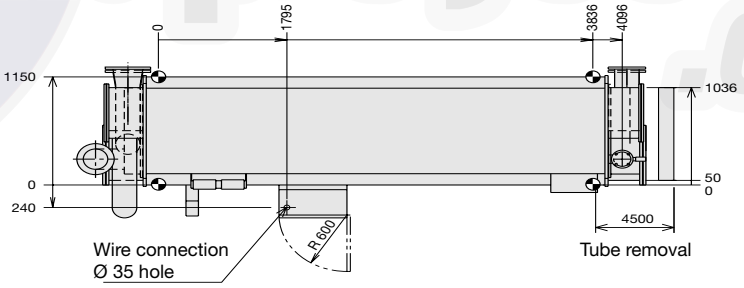
NOTES:
1. Dimensions (L), (W), (H) are for a standard machine. The dimensions are changed by parts added.
2. ⊕ indicates the position of anchor bolts.
3. Clearance space must be available at the front and rear of the chiller.
4. All external water piping are to be provided with welded ANSI 150 LB flanges by the customer.
5. ⬆ indicates the position of the power supply connection on the control panel (diameter 35 mm).
6. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm

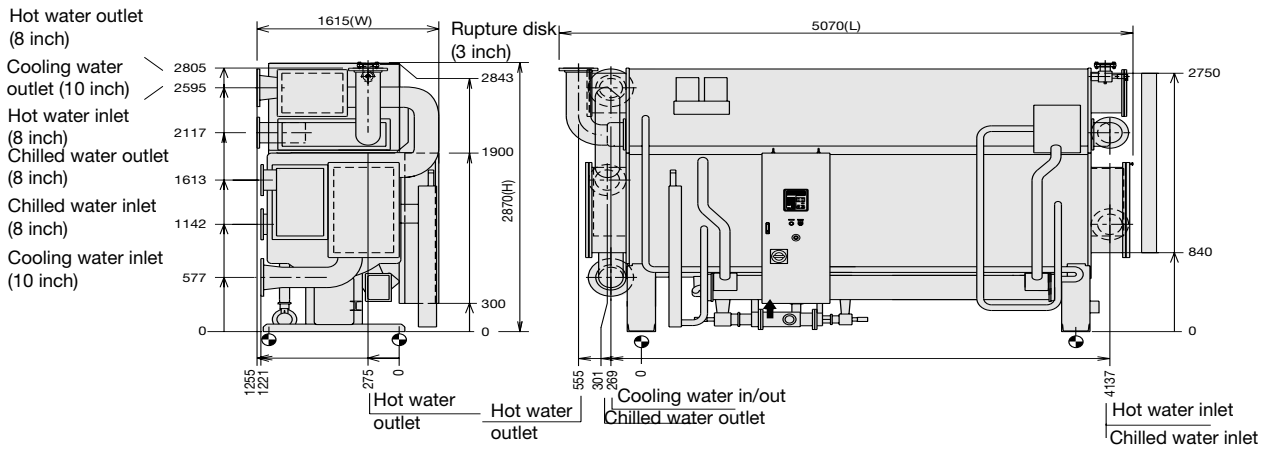
▨ Space for tube removal





16LJ-41 through 16LJ-42 (mm)



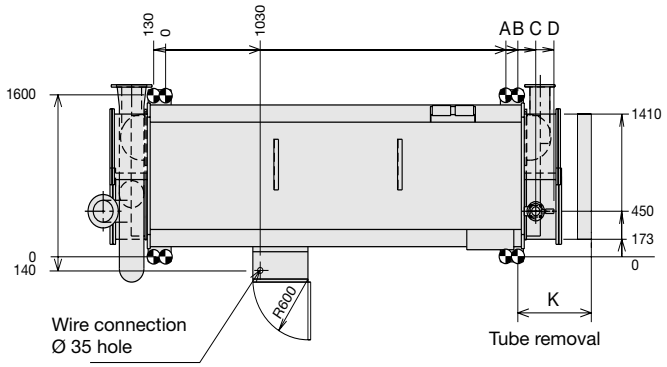


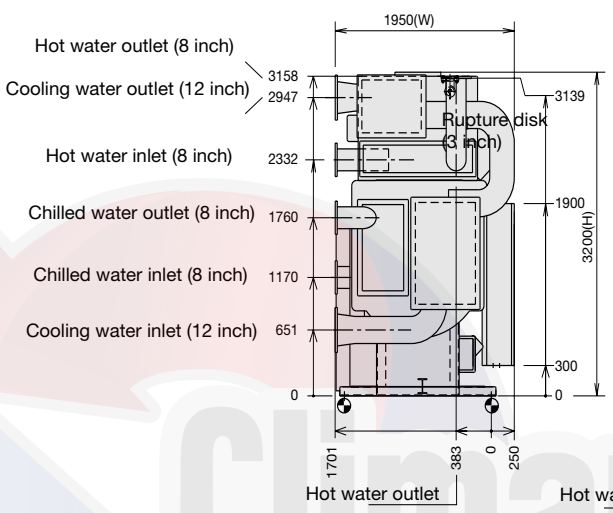
NOTE: Dimensions are for guidance only. Refer to the certified drawings supplied upon request when designing an installation.

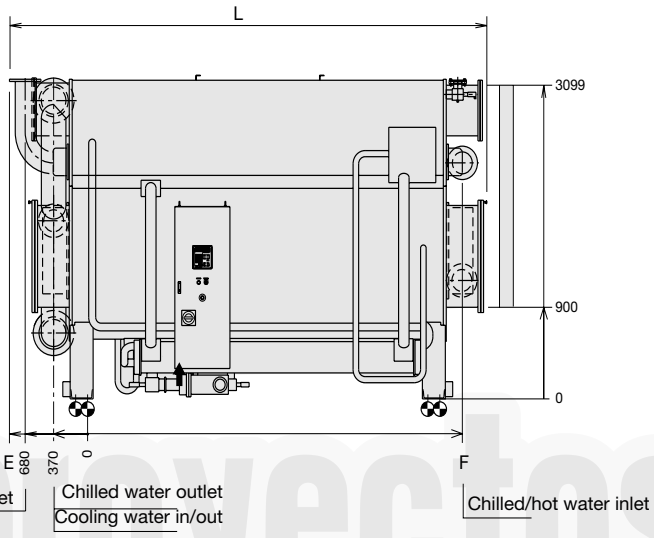
4.4 - Exhibit LE (cont.)

16LJ-51 through 16LJ-53 (mm)

NOTES:
1. Dimensions (L), (W), (H) are for a standard machine. The dimensions are changed by parts added.
2. ◔ indicates the position of anchor bolts.
3. Clearance space must be available at the front and rear of the chiller.
4. All external water piping are to be provided with welded ANSI 150 LB flanges by the customer.
5. ⬆ indicates the position of the power supply connection on the control panel (diameter 35 mm).
6. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm
   ▨ Space for tube removal







16LJ	A	B	C	D	E	F	K	L
51	3706	3836	4031	4229	851	4081	4600	5200
52	4248	4378	4573	4771	845	4623	5200	5740
53	4746	4876	5071	5269	845	5121	5700	6240

NOTE: Dimensions are for guidance only. Refer to the certified drawings supplied upon request when designing an installation.

4.5 - Exhibit LF

4.5.1 - Wire sizes

Power supply (copper only, over-voltage category III - IEC 60664)

16LJ	208 V				460 V				400 V			
	Current drawn, A	Wire section, mm²	Screw size	Tightening torque, Nm	Current drawn, A	Wire section, mm²	Screw size	Tightening torque, Nm	Current drawn, A	Wire section, mm²	Screw size	Tightening torque, Nm
11	13.9	2.5	M5	2.2-2.8	6.7	2.5	M5	2.2-2.8	6.7	2.5	M5	2.2-2.8
12	13.9	2.5	M5	2.2-2.8	6.7	2.5	M5	2.2-2.8	6.7	2.5	M5	2.2-2.8
13	13.9	2.5	M5	2.2-2.8	6.7	2.5	M5	2.2-2.8	6.7	2.5	M5	2.2-2.8
14	13.9	2.5	M5	2.2-2.8	6.7	2.5	M5	2.2-2.8	6.7	2.5	M5	2.2-2.8
21	18.8	4	M5	2.2-2.8	9.0	2.5	M5	2.2-2.8	9.2	2.5	M5	2.2-2.8
22	18.8	4	M5	2.2-2.8	9.0	2.5	M5	2.2-2.8	9.2	2.5	M5	2.2-2.8
23	19.0	4	M5	2.2-2.8	9.1	2.5	M5	2.2-2.8	9.3	2.5	M5	2.2-2.8
24	19.0	4	M5	2.2-2.8	9.1	2.5	M5	2.2-2.8	9.3	2.5	M5	2.2-2.8
31	23.5	4	M5	2.2-2.8	11.1	2.5	M5	2.2-2.8	11.5	2.5	M5	2.2-2.8
32	23.5	4	M5	2.2-2.8	11.1	2.5	M5	2.2-2.8	11.5	2.5	M5	2.2-2.8
41	23.5	4	M5	2.2-2.8	11.1	2.5	M5	2.2-2.8	11.5	2.5	M5	2.2-2.8
42	23.5	4	M5	2.2-2.8	11.1	2.5	M5	2.2-2.8	11.5	2.5	M5	2.2-2.8
51	23.5	4	M5	2.2-2.8	11.1	2.5	M5	2.2-2.8	11.5	2.5	M5	2.2-2.8
52	23.5	4	M5	2.2-2.8	11.1	2.5	M5	2.2-2.8	11.5	2.5	M5	2.2-2.8
53	23.5	4	M5	2.2-2.8	11.1	2.5	M5	2.2-2.8	11.5	2.5	M5	2.2-2.8

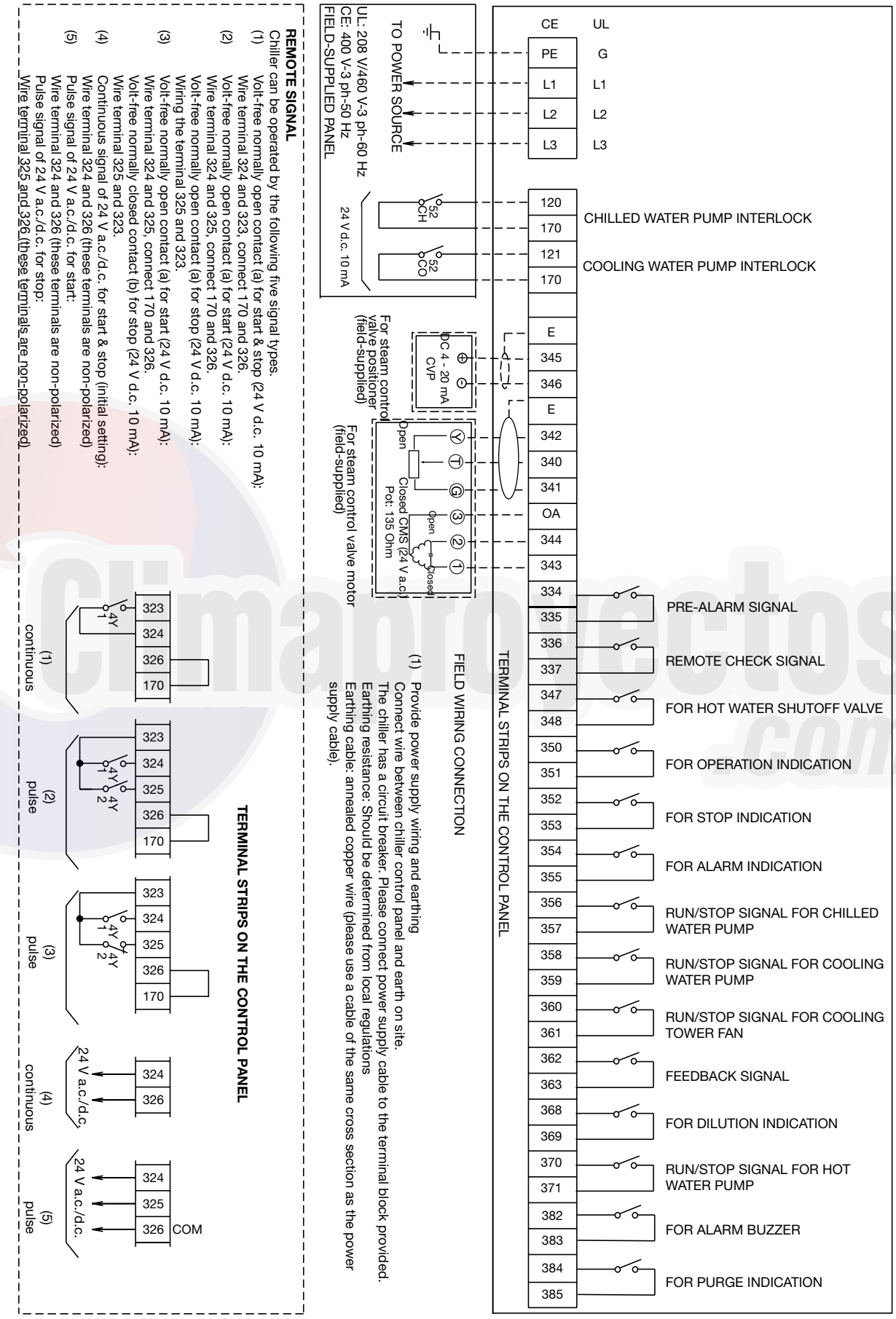
Other signals (copper only, over-voltage category II - IEC 60664)

Wire size	Screw size	Tightening torque
1 mm²	M3.5	1.4-1.8 Nm

4.5 - Exhibit LF (cont.)

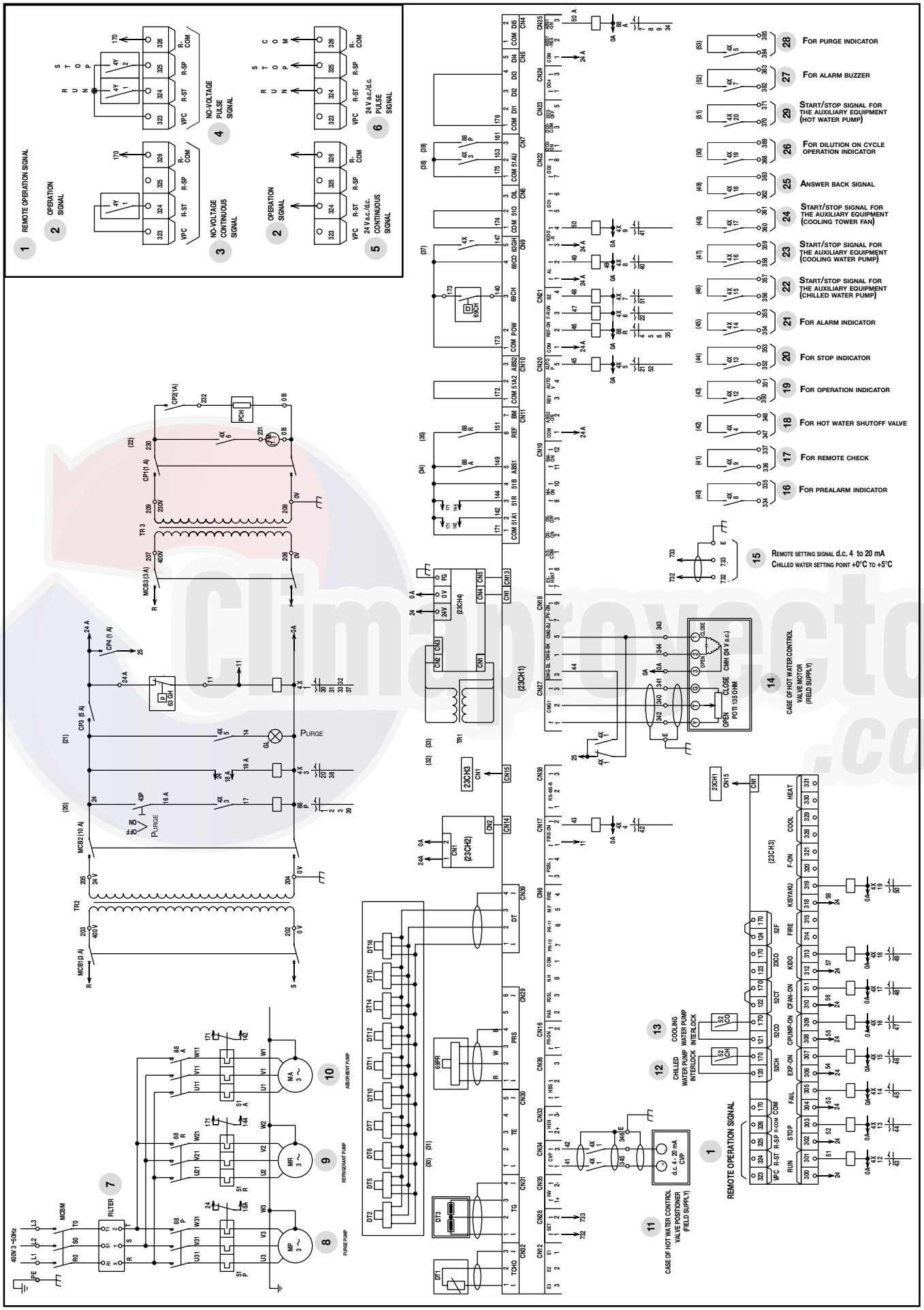
4.5.2 - Field wiring

Fig. 23 - Typical electric field connection diagram



4.5 - Exhibit LF (cont.)

Fig. 24 - Wiring diagram



4.5 - Exhibit LF (cont.)

4.5.3 - Parts list for Fig. 24

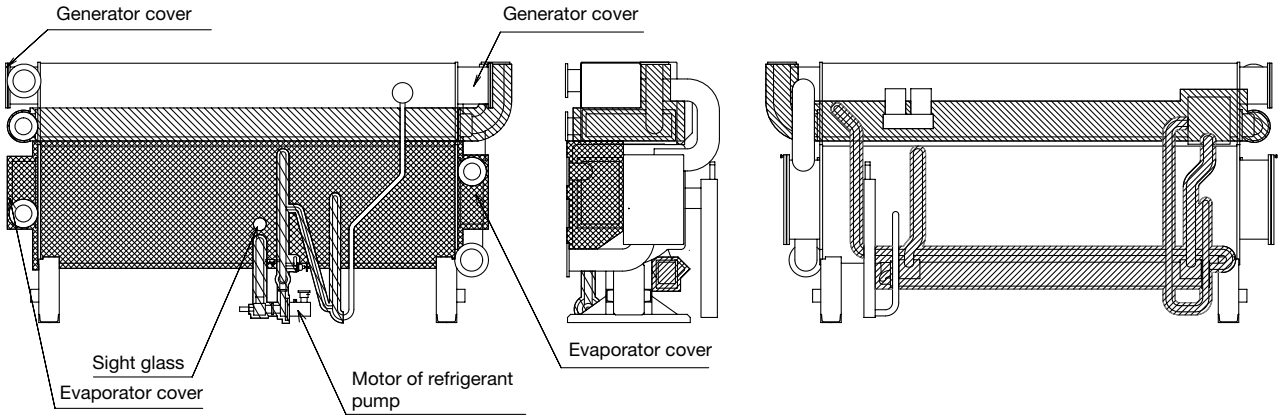
SYMBOL	NAME	REMARKS
CP1-4	Circuit protector Nos. 1 to 4	There are also CP1(..) CP3(..)
DT1	Chilled water leaving temperature sensor	
DT2	Cooling water leaving temperature sensor	
DT3	Generator temperature sensor	
DT5	Condenser temperature sensor	
DT6	Chilled water entering temperature sensor	
DT7	Cooling water entering temperature sensor	
DT10	Absorber temperature sensor	
DT11	Evaporator temperature sensor	
DT12	Intermediate cooling water temperature sensor	
DT14	Temperature sensor for hot water 3-way valve return	
DT15	Temperature sensor for hot water inlet	
DT16	Temperature sensor for hot water outlet	
FILTER	EMI filter	
FM	Fan motor	
GL	Purge indication lamp	
MA	Absorbent pump	
MP	Purge pump	
MR	Refrigerant pump	
MCBM	Main circuit breaker	
MCB1-3	Circuit breaker Nos. 1 to 3	
PCH	Palladium cell heater	
TR1-3	Transformer Nos. 1 to 3	
23CH1	CPU board	
23CH2	Indicator board	
23CH3	In/out board	
23CH4	Power board	
4Xn	Control relay	
43P	Purge pump on-off switch	
51A	Absorbent pump overcurrent relay	
51P	Purge pump overcurrent relay	
51R	Refrigerant pump overcurrent relay	
63GH	Generator pressure switch	
69CH	Chilled water flow switch	
69PR	Pressure sensor for purge tank	
88A	Absorbent pump solenoid switch	
88P	Purge pump solenoid switch	
88R	Refrigerant pump solenoid switch	
4Y1, 2	Remote signal	Field-supplied
52CH	Chilled water pump interlock	Field-supplied
52CO	Cooling water pump interlock	Field-supplied
CMH	Hot water control valve motor	Field-supplied
CVP	Hot water control valve positioner	Field-supplied

Other codes	DESCRIPTION	REMARKS
RUN - STOP - OPEN - CLOSE	Run - Stop - Open - Close	
COM	Common input signal	
HEAT	Heat	
COOL	Cool	
F-ON	Ventilation fan on	
KISYAKU	Dilution	
FIRE	Not used	
KIDO	Feedback signal	
CFAN-ON	Cooling tower fan on	
CPUMP-ON	Cooling water pump on	
EXT-ON	Chilled/hot water pump on	
FAIL	Fail	
ABS1-RES	No. 1 Absorbent pump inverter reset	Option
ABS1-ON	No. 1 Absorbent pump on	
POTI	Valve position feedback	
63GH	Generator pressure switch	
VPC	Remote signal power supply	
R-ST	Remote start signal	
R-SP	Remote stop signal	
R-COM	Common remote signal	
E1	Not used	
E2	Not used	
E3	Not used	
SET	Remote temperature setting - CPU board analogue input	
INV	Inverter frequency - CPU board analogue output	Option
HEN	Not used - CPU board analogue output	
HBS	Not used	
PR-ON	Not used	
PAS	Not used	
PGSL	Not used	
N.H	Not used	
PR-10 ; PR-11	Not used	
M.F	Not used	
FIRE	Not used	
FIRE-ON	Not used	
RS-485-B	Not used	
DI1- DI2 - DI4 - DI5	Not used	
DI3	Cooling only	
CN1….CN39	Connector No 1 to 39	
CMG1	Control valve feed back - CPU board analogue input	
TCHO	Chilled/hot water outlet - CPU board sensor input	
52CO	Cooling water pump interlock signal	
52CT	Not used	
23CO	Not used	
Purge	Purge	

Legend for Fig. 24

1 Remote operation signal
2 Operation signal
3 Volt-free continuous signal
4 Volt-free pulse signal
5 24 V a.c./d.c. continuous signal
6 24 V a.c./d.c. pulse signal
7 Filter
8 Purge pump
9 Refrigerant pump
10 Absorbent pump
11 Located on hot water control valve positioner (field-suppiied)
12 Chilled water pump interlock
13 Cooling water pump interlock
14 Located on hot water control valve motor (field-supplied)
15 Remote setting signal d.c. 4-20 mA - chilled water set point +0 to +5°C
16 For pre-alarm indicator
17 For remote check
18 For hot water shutoff valve
19 For operation indicator
20 For stop indicator
21 For alarm indicator
22 Start/stop signal for the auxiliary equipment (chilled water pump)
23 Start/stop signal for the auxiliary equipment (cooling water pump)
24 Start/stop signal for the auxiliary equipment (cooling tower fan)
25 Feedback signal
26 For dilution on cycle operation indicator
27 For alarm buzzer
28 For purge indicator

Fig. 25 - Insulation area



75 mm heat insulation: generator, generator cover

30 mm heat insulation: heat exchanger connecting pipes, etc.

50 mm cooling insulation: evaporator, evaporator cover

30 mm cooling insulation: upper part of refrigerant pump, connecting pipes, etc.

NOTES

1. ***Heat insulation material: fibre glass, non-asbestos or similar material.***
2. ***Total heating/cooling insulation area includes the machine pipe area.***
3. ***The machine has a primary coat of corrosion-inhibiting paint ex-works (does not include finish coat).***
4. ***Always use non-combustible insulating material.***
5. ***Do not insulate the refrigerant pump motor and sight glass.***
6. ***The evaporator and generator covers need to be opened for maintenance. This should be taken into account when completing the insulation work.***

16LJ	Hot surface insulation, m²		Cold surface insulation, m²	
	75 mm	30 mm	50 mm	30 mm
11	2.8	1.6	4.0	0.3
12	2.8	1.8	4.0	0.3
13	3.8	1.9	5.5	0.3
14	3.8	2.2	5.5	0.3
21	4.0	2.5	6.1	0.4
22	4.0	2.5	6.1	0.4
23	5.2	3.1	7.6	0.5
24	5.2	3.3	7.6	0.5
31	6.0	3.5	8.5	0.5
32	6.0	3.6	8.5	0.5
41	6.6	3.7	9.9	0.5
42	6.6	3.9	9.9	0.5
51	7.6	4.8	13.8	0.7
52	8.4	5.1	15.0	0.7
53	9.2	5.3	16.1	0.7

4.7 - Exhibit LH - Material safety data sheet

The following chapters are a material safety data sheet, issued by DSBG (Dead Sea Bromine Group) on **April 30, 2002**.
For more information refer to the supplier.

Product name	Lithium bromide solution
Product identification	1910S
Revision date	30/05/2002
Supersedes	15/09/1998
Revision	3

4.7.1 - Identification of the substance and the company

Chemical name	Lithium bromide water solution
Chemical formula	LiBr
Chemical family	Inorganic bromide
Molecular weight	86.85
Type of product and use	Inorganic solution used as desiccant medium in air conditioning and cooling systems
Company	Bromine Compounds Ltd. P.O.B 180, Beer Sheva 84101, Israel Tel +972-8-6297830

Emergency telephone numbers:

For mainland Europe	(+31) 115 689000
For the UK and Ireland	(01865)407333
For the USA	Chemtrec (800) 424-9300

4.7.2 - Composition/information on ingredients

Components	Weight %	Annex No.	EINECS No.	Classification	Notes
Lithium bromide 7550-35-8	47-58		Listed	Xi: R41	

4.7.3 - Hazards identification

Adverse human health effects
Risk of serious damage to eyes

4.7.4 - First-aid measures

Eye contact
Holding the eyelids apart, flush eyes promptly with copious flowing water for at least 20 minutes. Get medical attention immediately.

Skin contact
Remove contaminated clothing. Wash skin thoroughly with mild soap and plenty of water for at least 15 minutes. Wash clothing before re-use. Get medical attention if irritation persists.

Inhalation
In case of mist inhalation or breathing fumes released from heated material, remove person to fresh air.

Keep the patient quiet and warm. Apply artificial respiration if necessary and get medical attention immediately.

Ingestion
If swallowed, wash mouth thoroughly with plenty of water and give water to drink. Get medical attention immediately.

NOTE: Never give an unconscious person anything to drink.

Notes to the physician
Irritant - No specific antidote. Treat symptomatically and supportively. In case of ingestion induce vomiting in alert patient.

4.7.5 - Fire - fighting measures

Flash point	None
Flammable/Explosion limits	Not flammable
Auto-ignition temperature	Not available
Suitable extinguishing media	Material is not combustible. Use extinguishing media appropriate to surrounding fire conditions.
Fire fighting procedure	Cool containers with water spray. In closed stores, provide fire-fighters with self-contained breathing apparatus in positive pressure mode.
Unusual fire and explosion hazards	None known

4.7.6 - Accidental release measures

Personal precautions
Wear respirator, chemical safety goggles, rubber gloves and boots.

Methods for cleaning up
Absorb on sand or vermiculite and place in closed container for disposal. Avoid access to streams, lakes or ponds. Ventilate area and wash spill site after material pickup is complete.

4.7.7 - Handling and storage

Handling
Avoid bodily contact. Keep containers tightly closed.

Storage
Store in a dry, cool, well-ventilated area away from incompatible materials (see "Materials to avoid").

4.7.8 - Exposure controls/personal protection

Exposure limits

Components	ACGIH-TLV Data	OSHA (PEL) Data
Lithium bromide 7550-35-8	Not determined	Not determined

Ventilation requirements
Provide adequate ventilation. Use local exhaust as necessary, especially under misting conditions.

Personal protective equipment

Respiratory protection	Approved respirator
Hand protection	Rubber gloves
Eye protection	Chemical safety goggles
Skin and body protection	Body covering clothes and boots

Hygiene measures
Safety shower and eye bath should be provided. Do not eat, drink or smoke until after-work showering and changing clothes.

4.7 - Exhibit LH (cont.)

4.7.9 - Physical and chemical properties

Appearance	Clear, colourless to yellow liquid, odourless
Melting point/range	10°C (58%)
Boiling point/range	146°C (55%)
Vapour pressure	2.1 mm Hg at 20°C (55%)
Vapor density	Not available
Evaporation rate (ether=1)	Not available
Solubility	
Solubility in water	70 g/100 ml at 101°C
Solubility in other solvents	Miscible with methanol, ethanol (absolute), n-propanol
Specific gravity	1.627 (55%)
Decomposition temperature	Not available

4.7.10 - Stability and reactivity

Stability	Stable under normal conditions
Materials to avoid	Strong acids
Conditions to avoid	None known
Hazardous decomposition products	None known
Hazardous polymerization	Will not occur

4.7.11 - Toxicological information

Note: The following data refers to LiBr 55%

Acute toxicity

1. Rat oral LD50	>2000 mg/kg
2. Rabbit dermal LD50	>2000 mg/kg
3. Rat inhalation LC50	>5.1 mg/l/4 hour
4. Eye irritation (rabbit)	Severe irritant
5. Dermal irritation (rabbit)	Mild irritant
6. Dermal sensitization (guinea pig)	Not a sensitizer

Effects of overexposure

1. Ocular	Severe irritant
2. Dermal	Mild irritant to intact skin
3. Inhalation	May irritate the upper respiratory tract
4. Ingestion	May cause vomiting, nausea, diarrhea and ataxia. Slurred speech, blurred vision, dizziness, sensory loss, convulsions and stupor may occur in cases of large intake.

Chronic toxicity

Repeated skin contact may cause dermatitis. Repeated oral intake of bromides (> 9 mg/kg body weight/day) may affect the central nervous system. Warning symptoms include mental dullness, slurred speech, weakened memory, apathy, anorexia, constipation, drowsiness and loss of sensitivity to touch and pain.

Mutagenicity

Not mutagenic by the Ames Test

Carcinogenicity

- Not known to be a carcinogen.
- Not classified by IARC.
- Not included in NTP 9th Report on Carcinogens.

4.7.12 - Ecological information

Aquatic toxicity

96 hour - LC50, Fish	>1000 mg/l
72 hour - EC50, Marine alga	751.9 mg/l
48 hour - EC50, Marine invertebrate	1527.7 mg/l

4.7.13 - Disposal considerations

Waste disposal

Avoid access to streams, lakes or ponds. Observe all federal, state and local environmental regulations when disposing of this material.

4.7.14 - Transportation information

IMO	Not regulated
ADR/RID	Not regulated
ICAO/IATA	Not regulated
DOT	Not regulated

4.7.15 - Regulatory information

EEC	Reported in EINECS (No. 2314398)
Indication of danger	Irritant, symbol required (Xi)
Risk Phrases	R 41: Risk of serious damage to eyes.
Safety Phrases	S 26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S 39 : Wear eye/face protection.
Australia	Listed in AICS
USA	Reported in the EPA TSCA Inventory
Canada	Listed in DSL
Japan	Listed in MITI (ENCS No.1-110)
China inventory	Listed
South Korea	Listed in ECL (KE-22549)
Philippines	Listed in PICCS

4.7.16 - Other information

This data sheet contains changes from the previous version in section(s) 4.7.12 et 4.7.15.

The HSE Policy of Dead Sea Bromine Group

Dead Sea Bromine Group (DSBG) is the world's largest producer of elemental bromine and a recognized leader in the development and supply of bromine compounds.

DSBG is committed to responsibly manage its products at all stages of their life cycle in order to protect human health and the environment.

This responsibility applies throughout development, manufacture, transportation, use, recycle and disposal of DSBG products.

Within this framework DSBG is committed to:

1. Comply with national and international regulatory requirements
2. Conform to the ISO 14001 and OHSAS 18001 requirements for environmental and occupational health & safety management systems and periodically evaluate performance as part of the company's existing quality audits system
3. Design products and processes which prevent risk to health and the environment at production sites and along the supply chain
4. Improve efficiency in use of energy & natural resources, promote recycling and waste management through safe & environmentally sound end of life programs
5. Work for continual improvement in HSE performance
6. Regularly assess and responsibly manage health, safety and environmental risks associated with products and processes
7. Educate and train all managers and employees to improve their HSE performance
8. Distribute updated information concerning its policy and products to its workers, customers and other interested parties through Material Safety Data Sheet (MSDS), workers' safety sheets and through the DSBG Internet Site
9. Develop business relationships with responsible suppliers, transporters and distributors and provide them with HSE support, information and training
10. Support Product Stewardship programs in cooperation with customers, distributors and transporters
11. Allocate the necessary resources for implementation of this policy

DSBG Disclaimer

Although the information and recommendations set forth herein (herinafter "information") are presented in good faith and believed to be correct as of the date hereof, Bromine Compounds Ltd. makes no representations as to the completeness or accuracy thereof.

Information is supplied upon the condition that the persons receiving same will make their own determination as to its safety and suitability for their purposes prior to use.

In no event will Bromine Compounds Ltd. be responsible for damages of any nature whatsoever resulting from the use of or reliance upon information.

No representations or warranties, either expressed or implied, of merchantability, fitness for a particular purpose or of any other nature, are made hereunder with respect to information or the product to which the information refers.

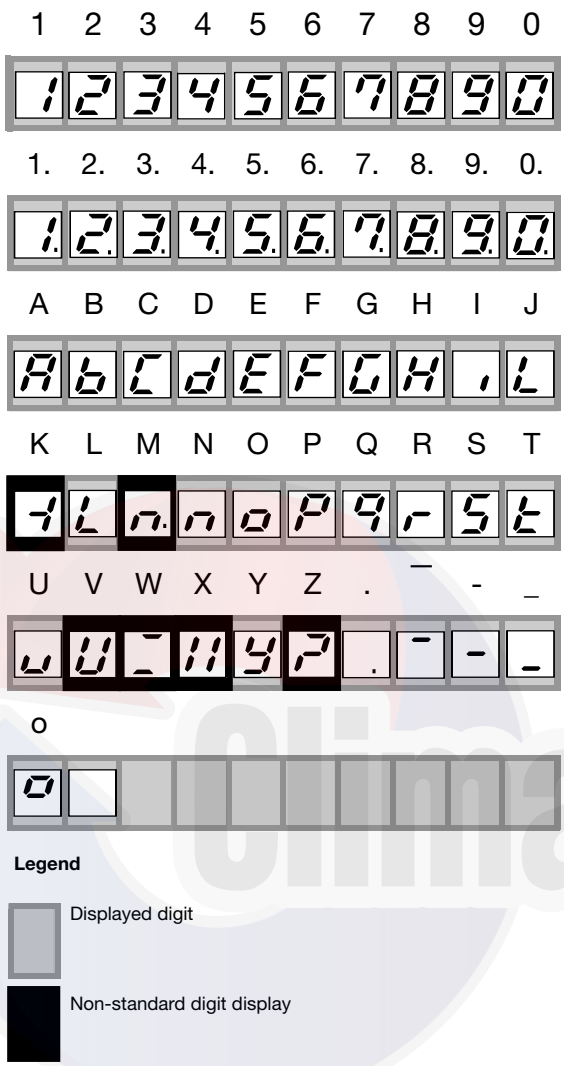
Prepared by:
HSE Division in ISRAEL
telephone: +/972-8-6297830
telefax: +/972-8-6297832
www.dsbg.com

End of safety data sheet

4.8 - Exhibit LI

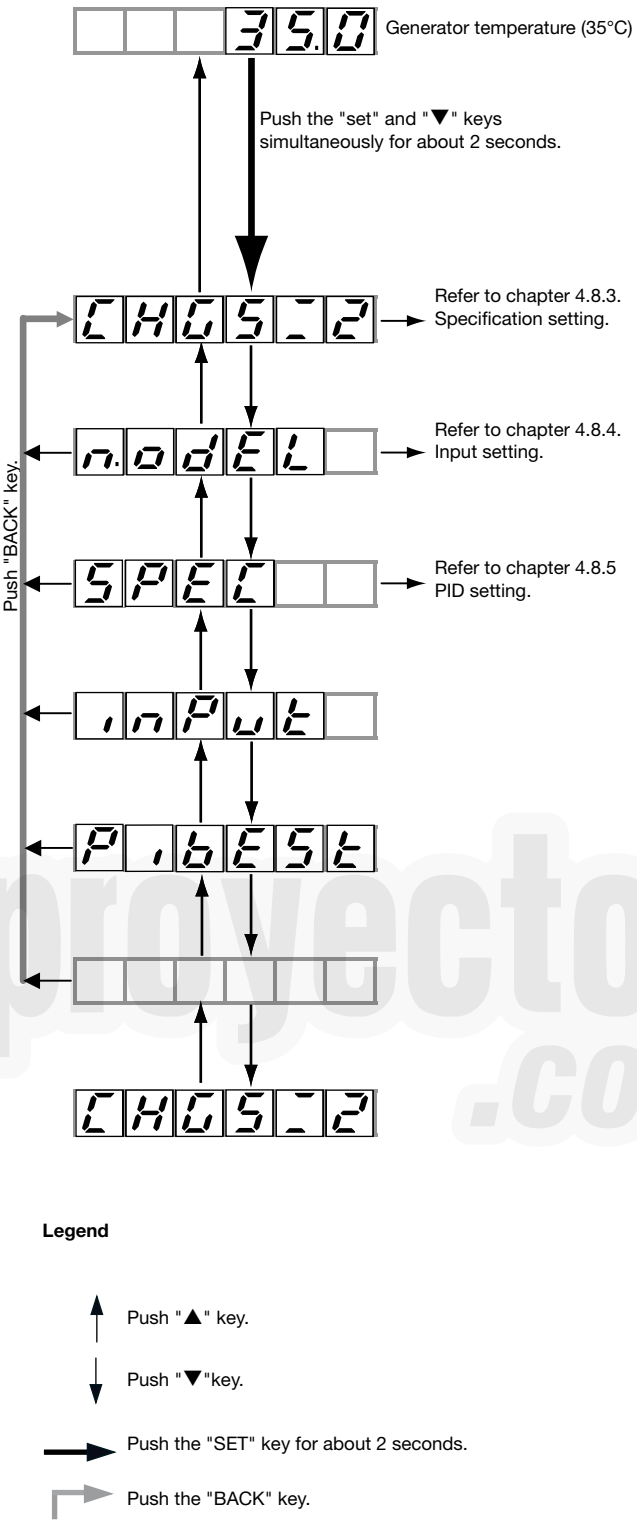
4.8.1 - Character recognition table for digital display

Fig. 26



4.8.2 - Instructions to verify operation board parameters

Fig. 27



4.8 - Exhibit LI (cont.)

4.8.3 - Specification setting

Fig. 28

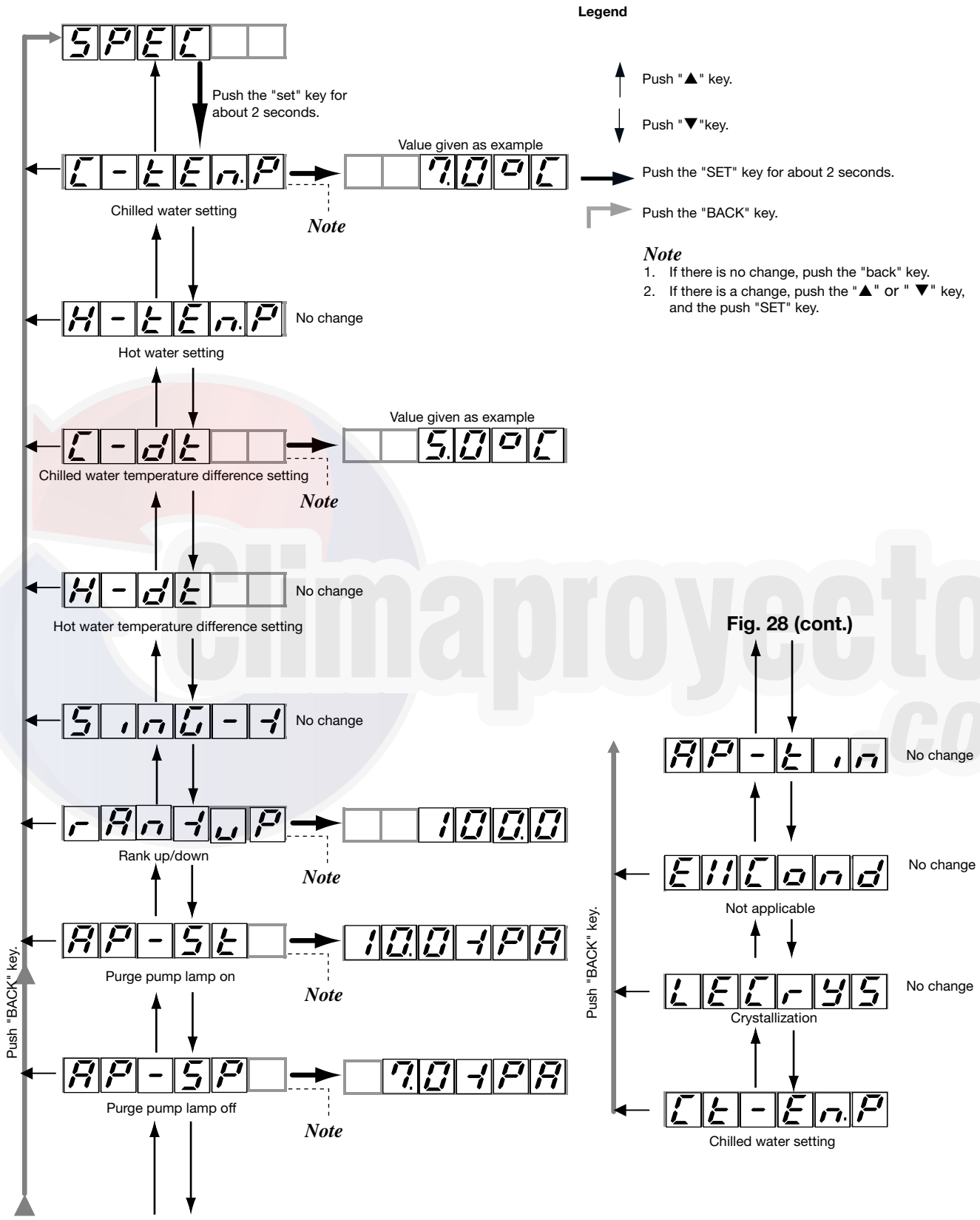


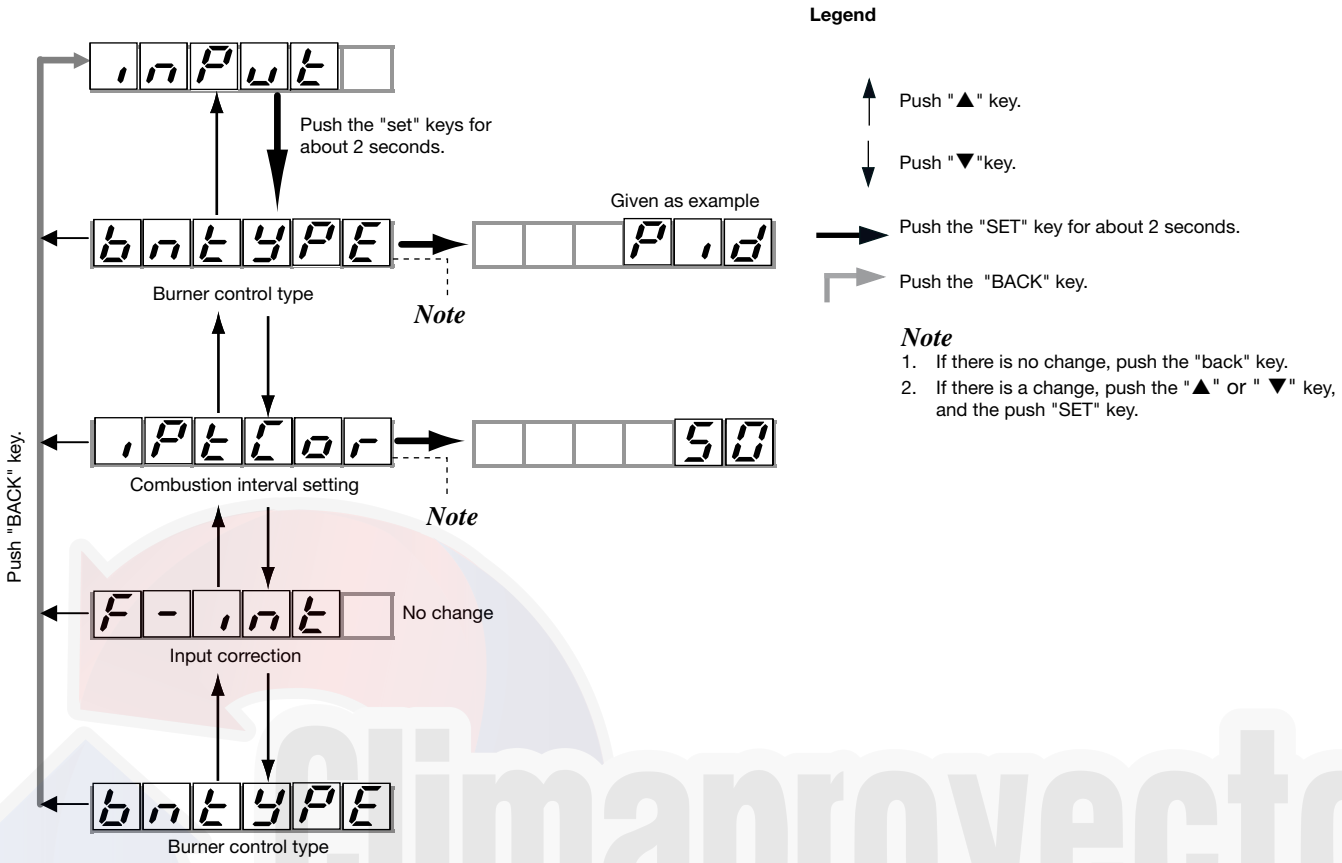
Fig. 28 (cont.)

Fig. 28 (cont.)

4.8 - Exhibit LI (cont.)

4.8.4 - Input setting

Fig. 29



4.8.5 - PID setting

Fig. 30

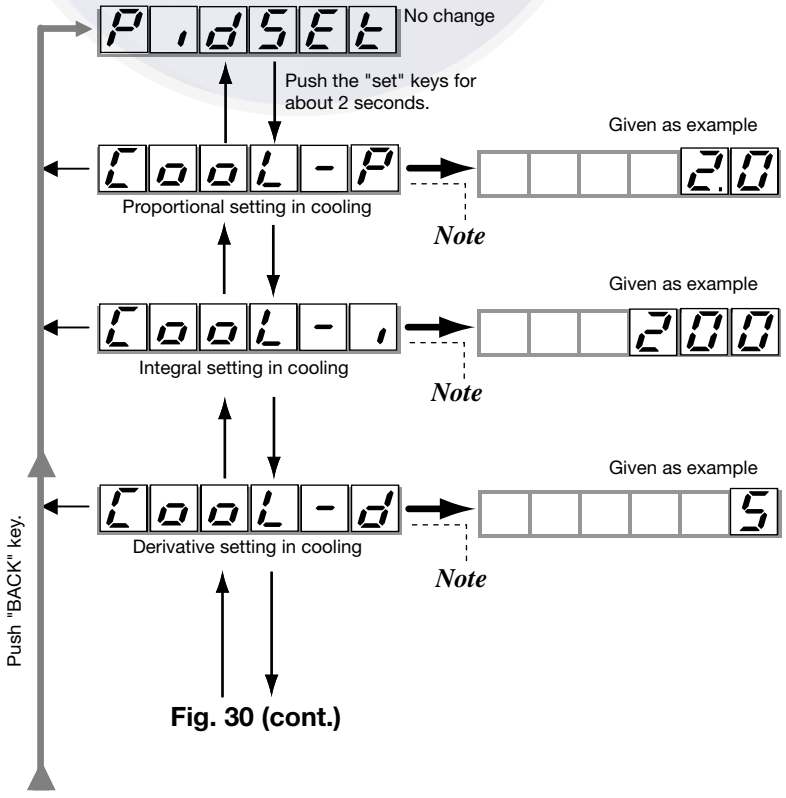
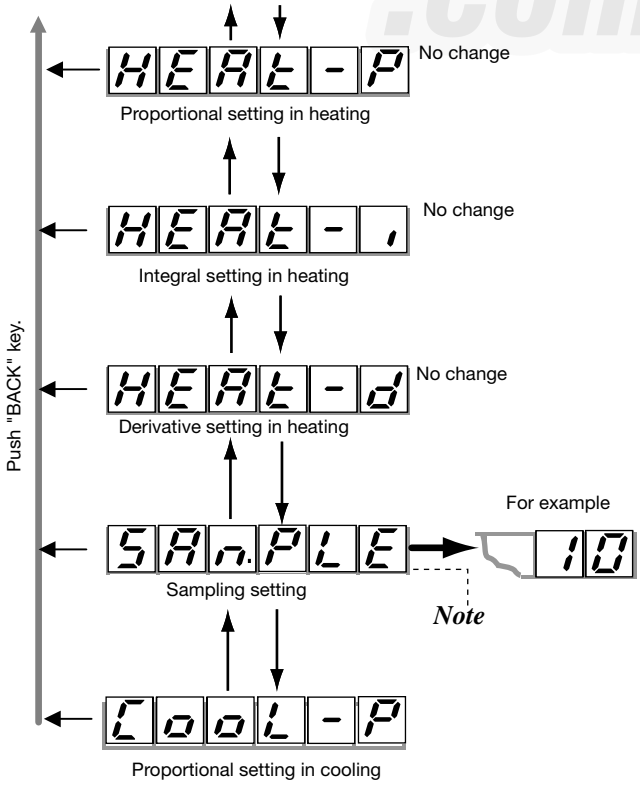


Fig. 30 (cont.)

Fig. 30 (cont)



4.8 - Exhibit LI (cont.)

4.8.6 - Field setting

Fig. 30

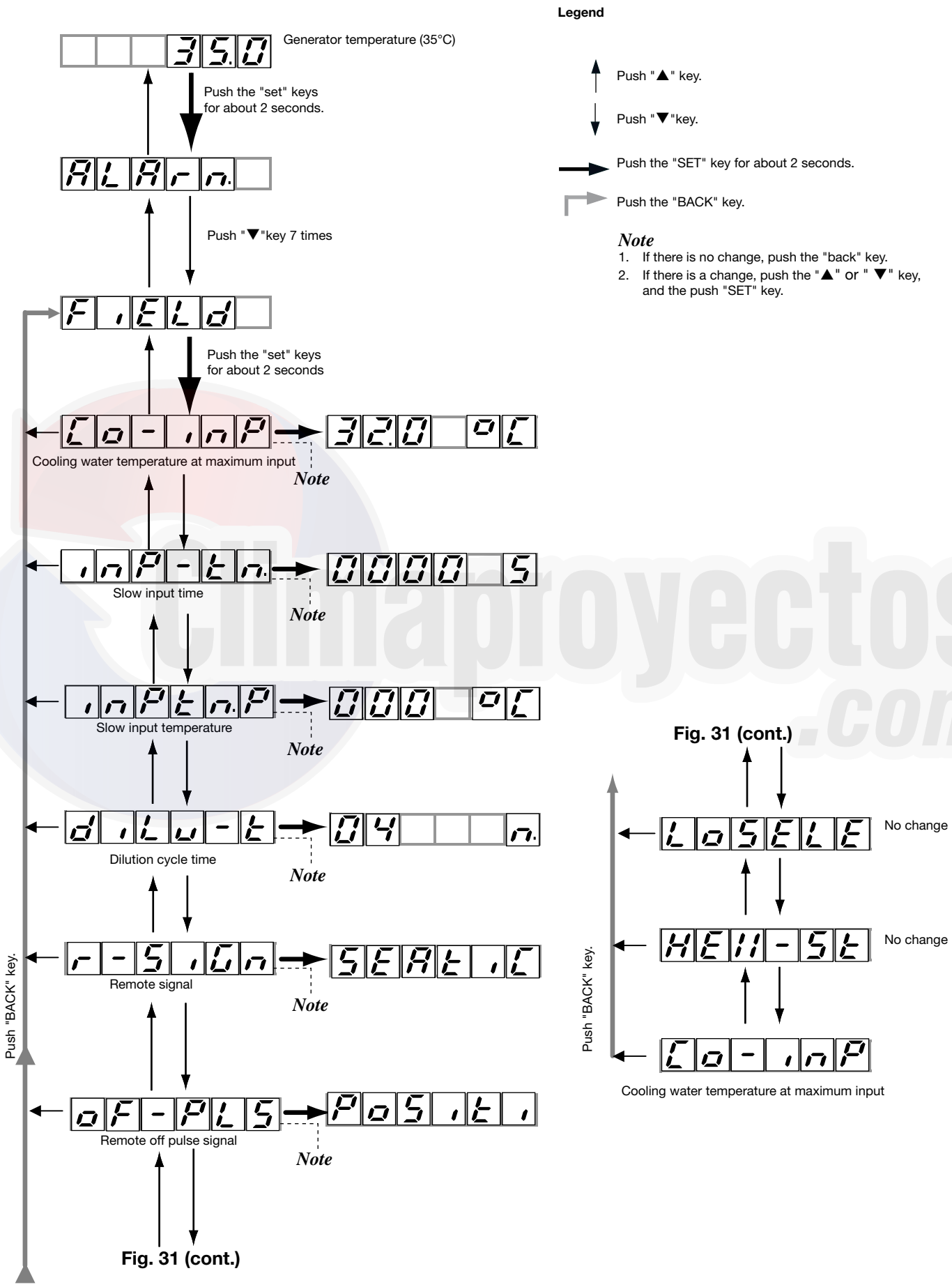
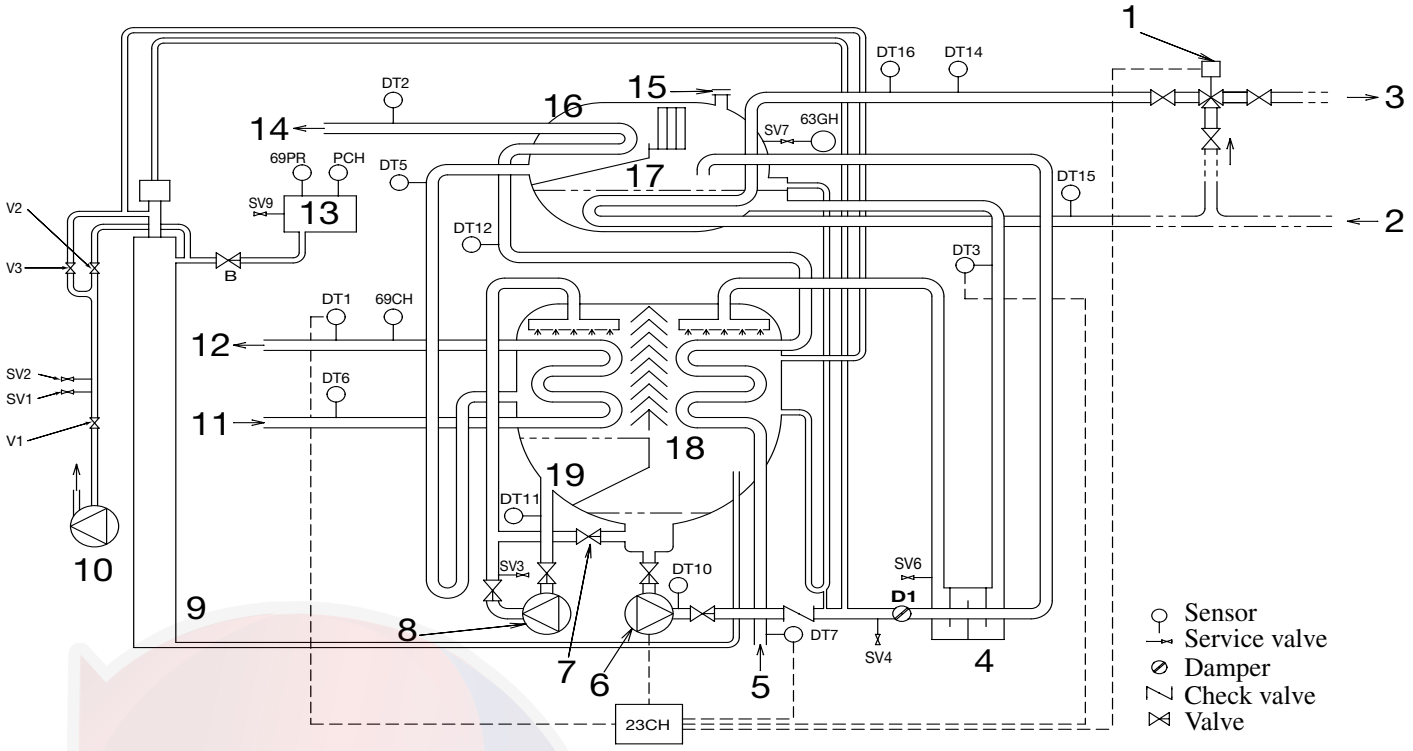


Fig. 31 (cont.)

4.9 - Exhibit LJ

4.9.1 - Flow diagram and damper and valve position



Legend

1 Hot water control valve
2 Hot water inlet
3 Hot water outlet
4 Heat exchanger
5 Cooling water inlet
6 Absorbent pump
7 Refrigerant blow-down valve
8 Refrigerant pump
9 Purge unit
10 Purge pump
11 Chilled water inlet
12 Chilled water outlet
13 Purge tank
14 Cooling water outlet
15 Rupture disk
16 Condenser
17 Generator
18 Absorber
19 Evaporator

D1 Diluted solution, main damper
SV1 Charge/discharge N_2 gas service valve
SV2 Purge unit service valve
SV3 Refrigerant service valve
SV4 Service valve, diluted solution
SV6 Service valve, concentrated solution
SV7 Generator pressure gauge service valve
SV9 Purge tank service valve
V1 Manual purge valve
V2 Manual purge valve
V3 Manual purge valve
B Manual purge valve

Damper opening
(0°: closed 90°: fully open)

16LJ	D1	D7
11	45	90
12	45	90
13	45	90
14	45	90
21	45	90
22	45	90
23	45	90
24	45	90
31	45	90
32	45	90
41	45	90
42	45	90
51	45	90
52	45	90
53	45	90

Valve position

Valve name	Position
B	Open
SV1	Closed
SV2	Closed
SV3	Closed
SV4	Closed
SV6	Closed
SV7	Open
SV9	Closed
V1	Closed
V2	Closed
V3	Closed

GB/T-24001 to ISO14001:1996

Carrier

SANYO

Order No.: 11619-76, 03.2006. Supersedes order No.: New

Manufactured by: Sanyo Electric Co. Ltd. Dalian, PR China
Printed in the Netherlands on totally chlorine-free paper.