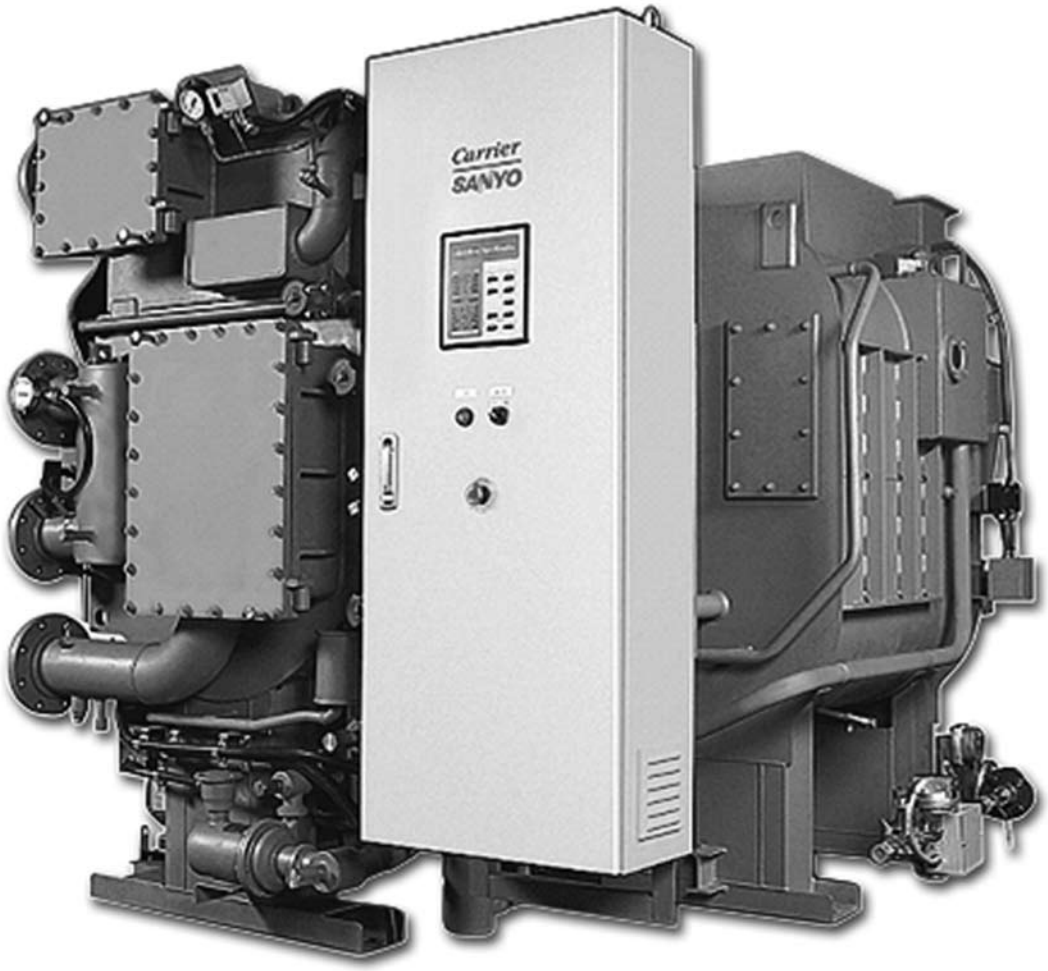
Carrier
SANYO

16DJ
Double-Effect Direct-Fired Absorption Chillers/Heaters

Nominal cooling capacity 352-5274 kW

50 Hz



Installation instructions

GB/T-19001-2000 to ISO9001/2000

NOTES TO USERS

Thank you for purchasing a Carrier/Sanyo absorption chiller/heater.

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

Please utilize the chiller/heater 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.

CONTENTS

1 - INSTALLATION

1.1 - Environmental requirements and safety precautions

1.1.1 - Installation considerations

The 16DJ absorption chiller/heater is designed for indoor installation in a machine room. The protection rating of the chiller/heater is IP40. Room temperature should be maintained between 5°C and 40°C to protect against solution crystallization during chiller/heater 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/heater 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/heater, 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/heater. 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.

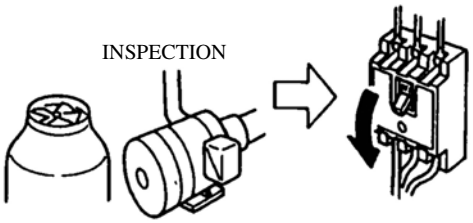
- After reading this manual, it should be kept in a safe place to be available for any user at any time.

1.1.4.1 Safety considerations

WARNINGS

TURN OFF THE BREAKER BEFORE CLEANING AND CHECKING

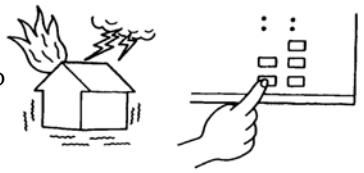
Always turn off the circuit breaker before cleaning and checking the cooling tower fan, chilled water pump, or other components linked to the chiller/heater, to provide protection from electric shock or possible injury by the rotating fan.



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.

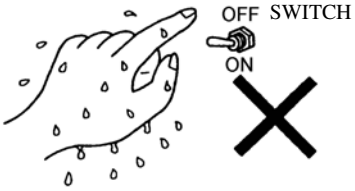
MUST BE OBSERVED



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.

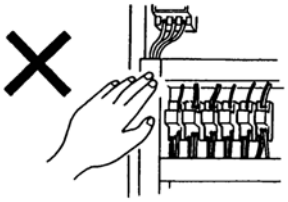
DO NOT TOUCH



DO NOT TOUCH THE WIRING INSIDE THE CONTROL PANEL

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

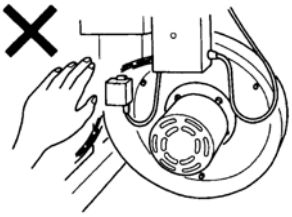
DO NOT TOUCH



DO NOT TOUCH HIGH-VOLTAGE CABLES

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

DO NOT TOUCH

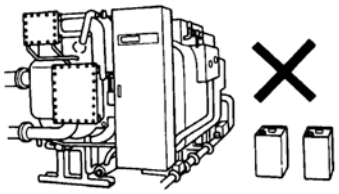


WARNINGS

KEEP FLAMMABLE SUBSTANCES AWAY FROM THE CHILLER/HEATER

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

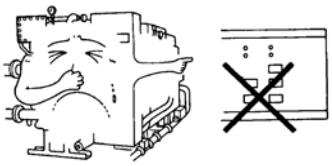
PROHIBITED



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

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

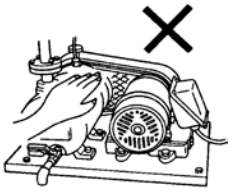
PROHIBITED



DO NOT TOUCH ROTATING PARTS OF FANS

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

PROHIBITED

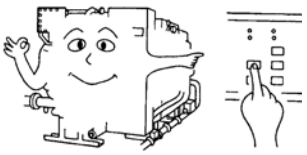


CAUTIONS

SOLVE ALL PROBLEMS BEFORE RESTARTING THE CHILLER/HEATER

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

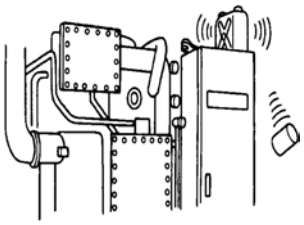
MUST BE OBSERVED



DO NOT PLACE HEAVY OBJECTS ON THE CHILLER/HEATER OR CONTROL PANEL

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

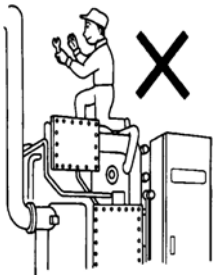
PROHIBITED



DO NOT CLIMB ON THE CHILLER/HEATER

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

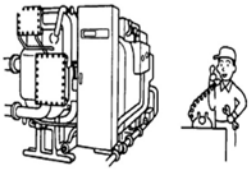
PROHIBITED



CALL SPECIALISTS FOR SERVICE OR MAINTENANCE

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

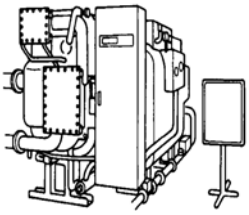
MUST BE OBSERVED



AUTHORIZED PERSONNEL ONLY

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

PROHIBITED

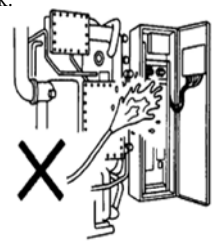


CAUTIONS

DO NOT POUR WATER ON THE CHILLER/HEATER OR CONTROL PANEL

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

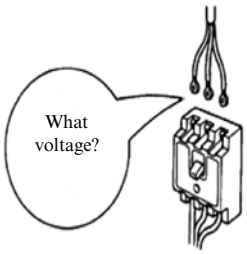
PROHIBITED



USE THE CORRECT POWER SUPPLY

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

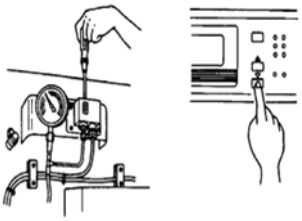
PROHIBITED



NEVER CHANGE THE SET VALUES

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

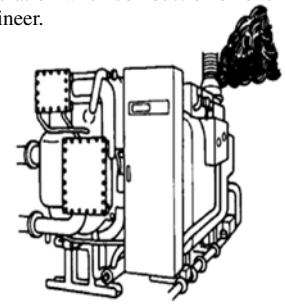
PROHIBITED



STOP THE OPERATION WHEN COMBUSTION SMOKE IS BLACK

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

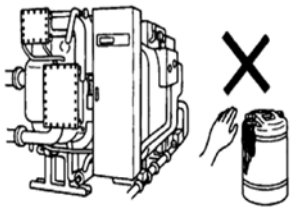
MUST BE OBSERVED



DO NOT TOUCH THE ABSORBENT

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

PROHIBITED

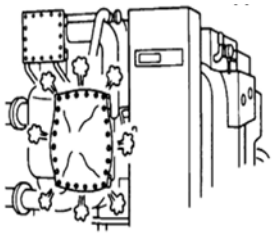


OBSERVE THE SPECIFIED WATER PRESSURE

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

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

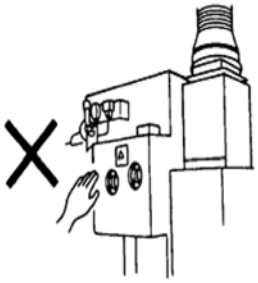
MUST BE OBSERVED



DO NOT TOUCH HIGH-TEMPERATURE AREAS

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

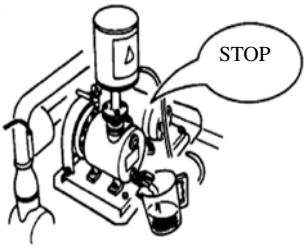
PROHIBITED



STOP THE PURGE PUMP TO REPLACE OIL

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

MUST BE OBSERVED



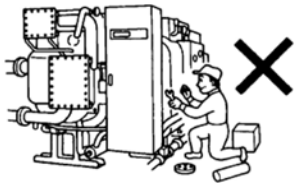
1.1.4.2 - Safety precautions for repair, moving or disposal

WARNINGS

ONLY AUTHORIZED PERSONNEL SHOULD SERVICE THE CHILLER/HEATER

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

PROHIBITED

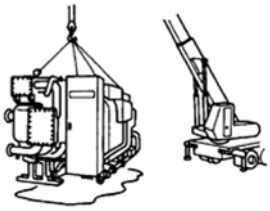


CAUTIONS

ONLY AUTHORIZED PERSONNEL SHOULD REMOVE OR REPAIR THE CHILLER/HEATER

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

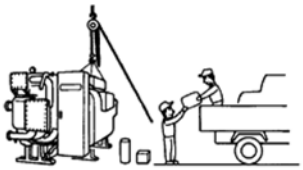
MUST BE OBSERVED



ONLY AUTHORIZED PERSONNEL SHOULD DISPOSE OF THE CHILLER/HEATER

To dispose of the chiller/heater, 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/heater to the job site, the owner or his designated representative should carefully inspect the chiller/heater:

- Ensure that the chiller/heater is factory-charged with nitrogen gas to a pressure of 20 kPa.
- Open SV7 and check the pressure of the high generator pressure gauge. If the pressure is 0 kPa, the chiller/heater has a leak. In this case, check the leaking point with pressurized nitrogen gas at 50 kPa. Close the cap of SV7 with sealant.
- Refer to paragraph 1.9.2 (Fig. 5), exhibit A and the specification drawings.
- Check for physical damage to the chiller/heater
  - Main shell
  - High temperature generator
  - Burner
  - Valves
  - Control panel
  - Wiring and connections
  - Accessories
  - Solution: in case of multiple-piece shipment
- Check the shipping or packing slip sent with the chiller/heater and note all missing items.
- Check all boxes or crates shipped with the chiller/heater 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

16DJ	Absorbent kg	Refrigerant kg	Alcohol l	Inhibitor l
11	700	70	0.710	0.410
12	850	50	0.830	0.480
13	1000	110	1.010	0.580
14	1100	90	1.150	0.670
21	1300	120	1.310	0.760
22	1500	110	1.460	0.840
23	1600	190	1.640	0.950
24	1800	160	1.820	1.050
31	2100	210	2.120	1.230
32	2300	170	2.290	1.330
41	2700	260	2.730	1.580
42	3000	230	2.960	1.720
51	3300	280	3.350	1.940
52	3700	340	3.680	2.130
53	4000	400	4.010	2.320
61	4900	500	4.940	2.860
62	5500	600	5.490	3.180
63	6200	600	6.160	3.570
71	7500	700	7.530	4.360
72	8200	800	8.190	4.740
73	8800	900	8.800	5.090
81	9900	900	9.880	5.720
82	10500	1100	10.440	6.040

Legend

Absorbent	LiBr	50 wt %
Inhibitor	Li_2MoO_4	20 wt % 300 ppm (total concentration)
Alcohol	Octyle alcohol	$CH_3(CH_2)_5CH(OH)CH_3$

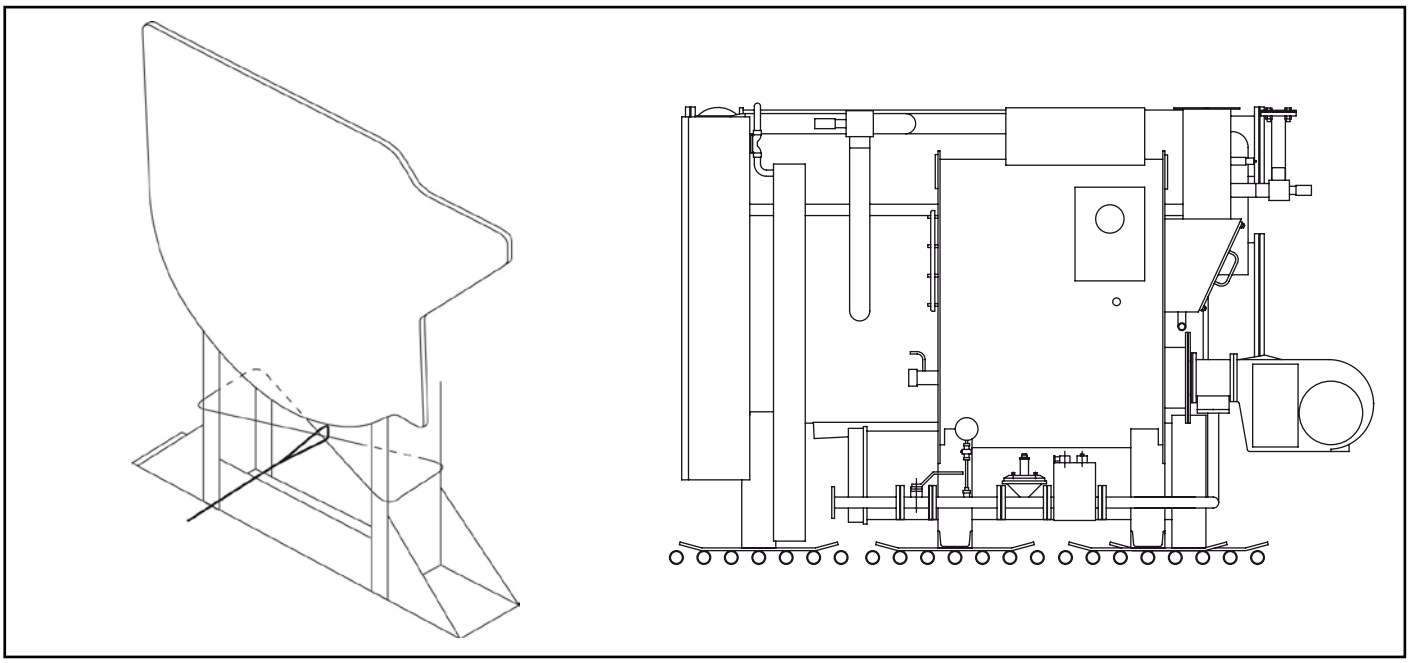
1.4 - Rigging

Check the weight of the chiller/heater by referring to the contract specifications and then choose and use suitable wires and shackles. To lift the chiller/heater use the two holes provided at the corners of the lower tube sheet and the two holes provided at the corners of the high temperature generator in case of one-piece shipment. Note that the angle of the wires should be 60° maximum. Refer to the specification drawings and exhibit B.

1.5 - Moving the chiller/heater

If the chiller/heater needs to be moved, use of roller skids is recommended. The wire should be connected as shown in the figure below.

Fig. 1



1.6 - Placing chiller/heater on the foundation

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

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

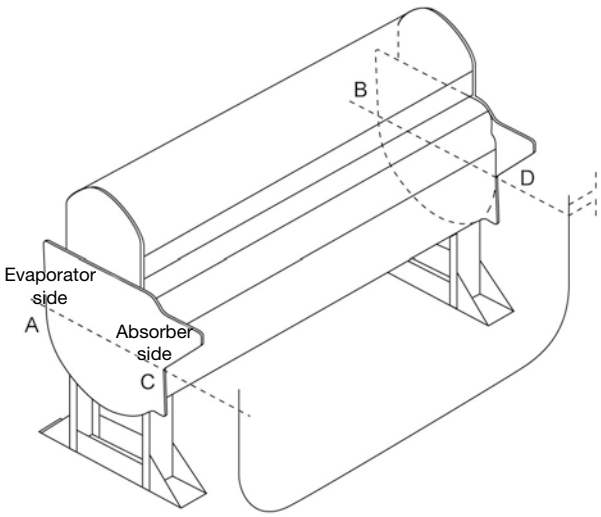
- The levelling calculation is as shown below:

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

Tolerance $\leq \frac{2}{1000}$ L: Chiller/heater length

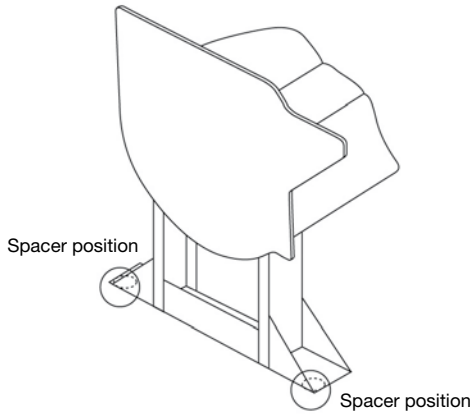
- Note that in the figure below there are four levelling check points on the chiller/heater, labeled A, B, C and D. These check points are designated by three punch markers on the tube sheet or shell of the lower shell.

Fig. 2



- 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).

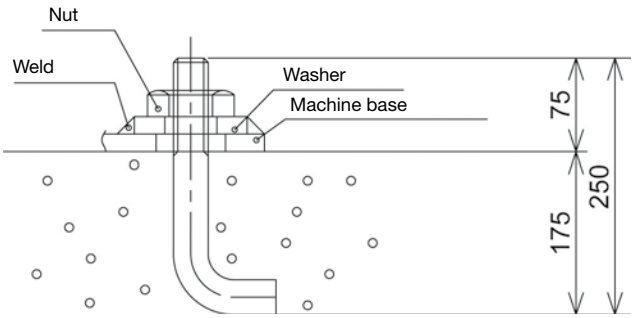
Fig. 3



Fixing of the anchor bolts

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

Fig. 4



1.8 - Field assembly

- Chiller/heater models 16DJ-61 to 16DJ-82 are shipped in two sections. Set each shell on the foundation bolt positions (refer to the specification drawings and exhibit C - foundation.)
- Weld each pipe according to welding procedure in exhibit D
- Leak test should be conducted after welding (refer to Section1.9.1).
- Selection of welding materials.
  - Be sure to keep the electrodes dry.
  - Use electrodes equivalent with LB-52U. Refer to the specification of the electrode LB-52U in exhibit D

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

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

1.9.1 - Leak test

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

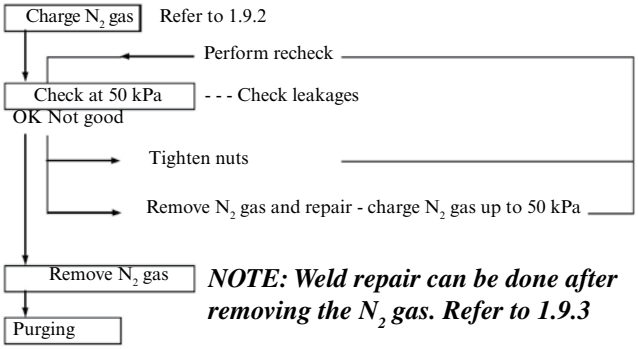
Equipment to use

- Nitrogen gas cylinder
- Pressure regulator
- Pressure-proof hose
- Flashlight
- Soapy water
- Adjustable wrench
- Hose band

Requirement to meet

Pressurize the chiller/heater 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 1.9.3

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. Charge N_2 gas (refer to 1.9.2)
   - Pressurize the chiller/heater up to 50 kPa with N_2 gas. The pressure inside the chiller/heater can be checked with the high temperature generator pressure 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.
   - High temperature generator solution level bar.
   - 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/heater pressurized to 50 kPa for 24 hours, and then check the pressure again.
8. After completion of the test, remove the N_2 gas (refer to chapter 1.9.3)

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

1.9.2 - Method of charging nitrogen gas

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

Equipment use

- The required amount of N_2 gas

Volume

16DJ	Volume l	16DJ	Volume l
11	2080	51	10550
12	2100	52	11770
13	3110	53	12940
14	3120	61	15190
21	3980	62	16760
22	3980	63	18390
23	5220	71	22280
24	5220	72	24360
31	6400	73	26370
32	6410	81	28930
41	8100	82	31120
42	8100		

- Pressure regulator
- Pressure-proof hose
- Adjustable wrench

The pressure in the chiller/heater is charged to 50 kPa at the high temperature 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 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/heater.
- Using the pressure regulator, charge a small amount of N_2 gas into the chiller/heater.
- Watch the vacuum gauge while N_2 gas is charged. When the pressure inside the chiller/heater 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

1.9.3 - Removing nitrogen gas (see Fig. 5)

Follow this procedure to remove N_2 gas from the chiller/heater.

Equipment to use

Adjustable wrench

Requirement to meet

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

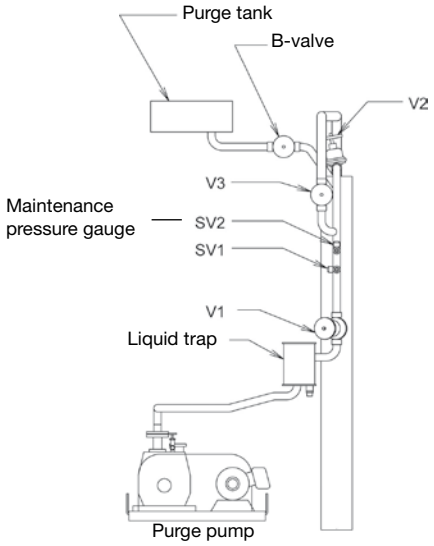
Precautions

- 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



1.10 - Piping

1.10.1 - Connect each pipe according to exhibit E and the specification drawings.

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

1.10.2 - Flushing

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

1.11 - 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 F and the specification drawings for wiring connections.
- Refer to chapter 2.3 - Electrical check.
- A properly qualified electrician should carry out the electrical wiring.

1.12 - Purging (see Fig. 5)

- Ensure that the power supply is continuous.
- Remove nitrogen gas (refer to chapter 1.9.3.)
- 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/heater.
  Then change any two of the wires of main power supply source. The chiller/heater 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/heater.
  - After one hour open V2.
- Operate the purge pump until the vacuum gauge shows 0.5 kPa. Refer to the following table.

16DJ	Time
11-14	5 hours
21-24	12 hours
31-42	24 hours
51-63	2-3 days
71-82	4-5 days

1.12.1 - 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

16DJ	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
61	< 60
62	< 65
63	< 75
71	< 80
72	< 85
73	< 100
81	< 105
82	< 110

Procedure
- Purge the air from the chiller/heater until the internal pressure in the chiller/heater 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. 6.
- 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.

1.13 - Insulation

- After the chiller/heater has been installed, it must be insulated.
- Before fitting the insulation, the chiller/heater 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 G.
- 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:

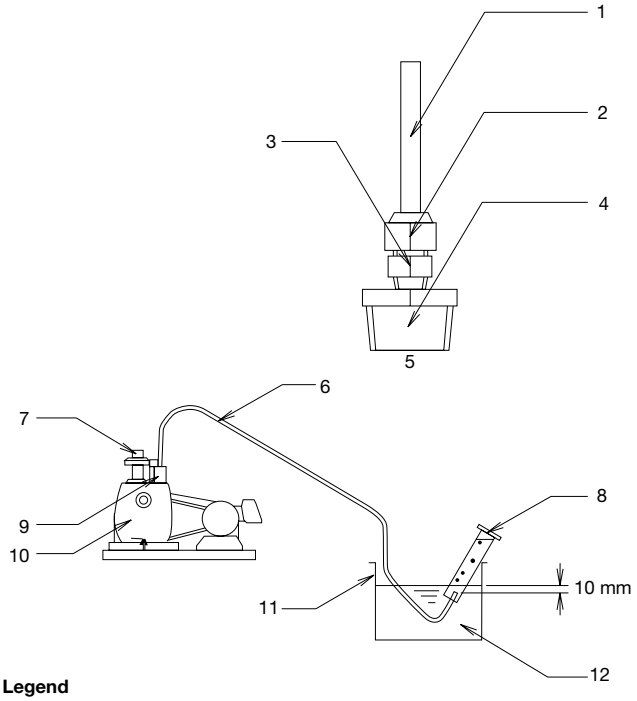
- Changeover valves, dampers, service valves and sight glasses.
- Temperature sensors and pressure gauges should be replaceable.
- Bar-thermometers need to be inserted into the wells provided on water headers and solution pipes.
- Evaporator headers should be removable.
- Inspection window for the high temperature generator should be removable.

2.1.1 - Chiller insulation must be correctly fitted.

The following positions should not be insulated.

- The motor section of the refrigerant pump
- The rupture disk
- The rupture disk on the high temperature generator.

Fig. 6



Legend

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

2.1.2 - Installation checks

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

2.2 - Solution charge

2.2.1 - Precautions

- Solution shall be charged at the site for multiple-piece shipment unit.
- Make sure that the vacuum of the Chiller/heater is sufficient.
- The refrigerant must be charged just before running the chiller/heater.

2.2.2 - Procedure

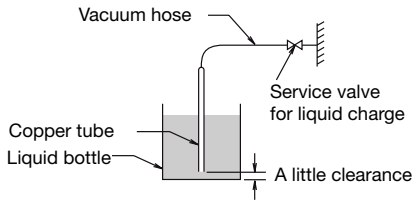
Refer to figure 5 and 7 and to exhibit A.

1. Prepare solution containers.
2. Operate the vacuum pump.
3. Open V1 and V3.
4. Charge the absorbent first and then charge the refrigerant.
5. Charge one-third each of the absorbent from SV3, SV4 and SV8.
6. Connect a vacuum hose to the service valve and attach a copper tube at the other end of the hose, and put the copper tube into the container. Be sure that the copper tube does not touch the bottom of the container)
7. Open the service valve.
8. When the solution starts to be drawn into the chiller/heater, make sure not to let air leak into the chiller/heater.
9. Before the container is empty, tilt it so that no air enters the tube.
10. When the container is almost empty, bend the rubber vacuum hose with both hands to ensure that no air enters, and quickly insert it into the next container.
11. Repeat steps 8. to 10. until all containers have been emptied.
12. Close SV3, SV4 and SV8.
13. After that, to charge the refrigerant from SV3.
14. Once the required amount of solution has been charged, make sure SV3, SV4 and SV8 have been closed tightly.
15. Remove the rubber vacuum hose from SV3, SV4 and SV8, and put the caps on the service valves.
16. Close V1 and V3.
17. Stop the purge pump.

NOTES:

1. ***Wear rubber gloves. (Do not handle equipment or solution with bare hands.)***
2. ***Thoroughly wash off any absorbent that gets on hands, skin or clothes. Take care to prevent absorbent from getting into the eyes or mouth.***
3. ***If absorbent spills on the machine or auxiliary equipment, thoroughly rinse it off with water.***
4. ***Refer to the material safety data sheet for lithium bromide solution (exhibit H).***

Fig. 7



2.3 - Electrical check (see Fig. 8)

The electrical specifications must comply with the control panel nameplate data. Check the field wiring and the palladium cell heater wiring. Refer to exhibit F 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 No.1, No. 2 and the blower motor 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).
- Disconnect the three wires (U1, V1, W1) connected to the inverter of absorbent pump No. 1.
- 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. 8 :
  - Absorbent pump (terminals): U1/V1/W1
  - Absorbent pump (terminals): U2/V2/W2
  - Refrigerant pump (terminals): U3/V3/W3
  - Purge pump (terminals) : U4/V4/W4
- Record the measured values.
- Remove the earth wire.

2.4 - Initial control board and inverter settings

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 J.

2.4.4 - Check the inverter parameters

Refer to section 2.7.1 and Inverter manual.

2.5 - Damper setting and valve position

2.5.1 - Damper setting

Refer to exhibit J.

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

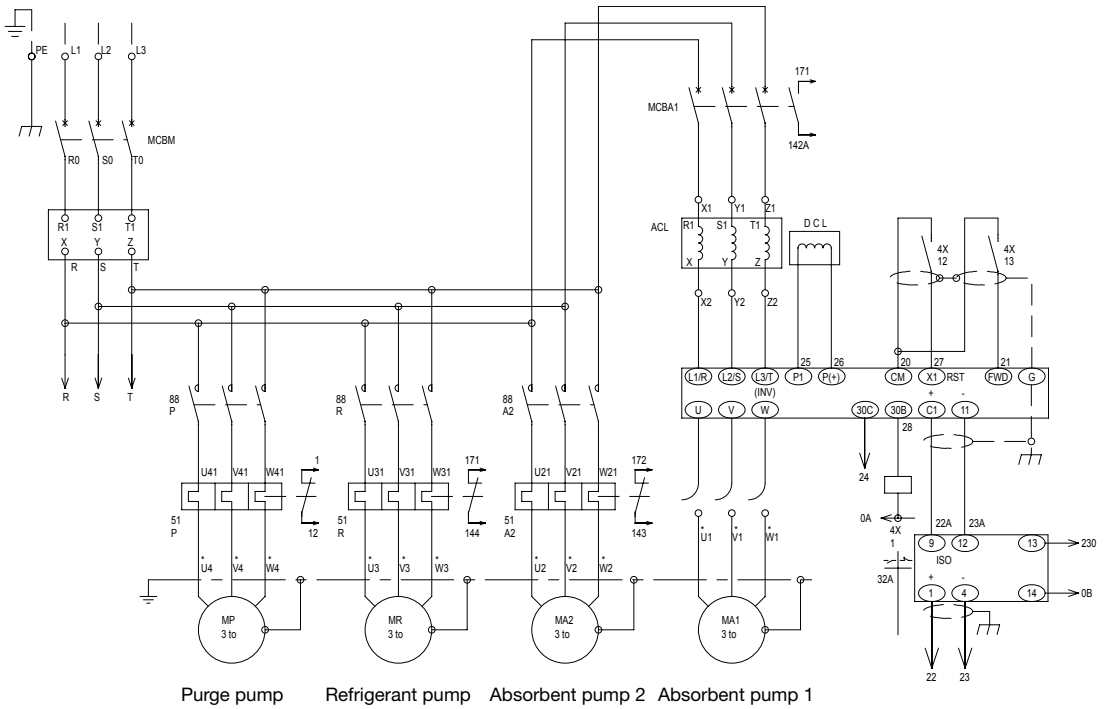
2.6.1 - Ensure the gas ballast valve is closed before starting the purge pump.

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/heater for at least one hour. The gas ballast valve should be closed during the bubble test. Please refer to the table in the chapter 1.12.1 "Bubble test".

Fig. 8



2.7 - Function test

1. Check the inverter parameters

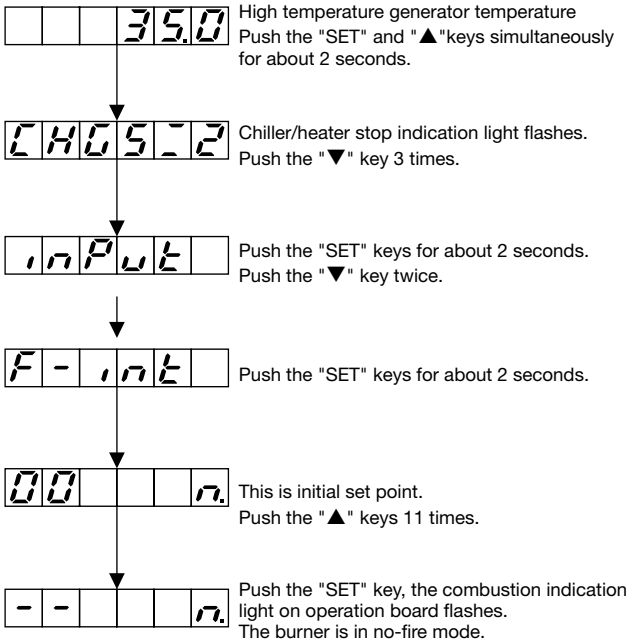
Inverter setpoint

Function code	Function name	Model:	FRN-C1 Set value	FVR-P11 Set value	Unit
F00	Data protection		1 → 0 → 1	1 → 0 → 1	
F01	Frequency setting		3	2	
F02	Operation		1	1	
F03	Highest frequency		60	60	Hz
F04	Base frequency		60	60	Hz
F05	Base frequency voltage		Spec.	Spec.	V
F06	Highest output voltage		-	Spec.	V
F07	Acceleration time 1		33.0	33.0	s
F08	Deceleration time 1		33.0	33.0	s
F09	Torque boost 1		5.5	1.5	
F10	Electron thermal (moving level)		2	1	
F11	Electron thermal1 (moving)		Spec.	Spec.	A
F12	Electron thermal1 (time constants)		5.0	5.0	min.
F14	Power shutdown characteristics		4	4	
F15	Frequency limiter (upper limit)		60	60	Hz
F16	Frequency limiter (lower limit)		24	24	Hz
F17	Gain		-	200	%
F18	Bias frequency		0.00	0.0	Hz
F20	DC deceleration (start frequency)		0.0	0.0	Hz
F21	DC deceleration (running level)		0	0	%
F22	DC deceleration (time)		0.0	0.0	s
F23	Start frequency		1.0	0.5	Hz
F24	Start frequency			0.0	s
F25	Stop frequency		0.2	0.2	Hz
F26	Motor running sounds		2	2	kHz
F27	Motor running sounds		0	0	
F30	FMA terminal (output gain)		100	100	%
F31	FMA terminal (monitor)		0	0	
F33	FMP terminal (pulse)			1440	p/s
F34	FMP terminal (voltage)			0	
F35	FMA terminal			0	
F36	30Ry mode			0	
F37	Load selection		2		
F40	Torque control			999	%
F41	Torque control			999	%
F42	Dynamic torque control			0	
F43	Current limits (selection)		0		
F44	Current limits		200		%
F50	Electron thermal 1 (radiation)		999		kWs
F51	Electron thermal 1 (average loss)		0.000		kWs
C32	Analogue input adjustment terminal 12 (gain)		200		%
E01	X1 terminal		8	8	
E20	Y1 (terminal)		30		
			200		%
P01	X1 terminal (function)			2	
P02	Motor 1 (capacity)		Spec.		kW
P03	Motor 1 (rated current)		Spec.		A
P99	Motor selection		4		
H06	On/off control of cooling fan		1	1	
H09				1	
H10				0	
H70	Overload prevention control		0.00		
H98	Automatic energy efficient operation		7		Hz/s
U48	Overload prevention control			1	

2. Close main fuel valve.

3. Switch the burner to no-fire mode. Refer to Fig. 9.

Fig. 9 - Display example



4. High temperature generator solution level relay

- Press the "RUN" key on the interface panel.
- Jumper Nos. 30 and 31.
- Jumper Nos. 30 and 32. Check that absorbent pump 1 stops.
- Remove the jumper wiring on Nos. 30 and 32. Check that absorbent pump 1 runs.
- Remove jumper Nos. 30 and 31. Check that the data display on the control board shows J-15 "High temperature generator solution level alarm".

5. 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 approxi-mately 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 entering 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".

6. Motor alarm

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

- Refrigerant pump: The data display shows J-10 "Refrigerant pump alarm".
- absorbent pump 1: The data display shows J-04 "Absorbent pump 1 alarm".
- absorbent pump 2: The data display shows J-05 "Absorbent pump 2 alarm".

7. 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

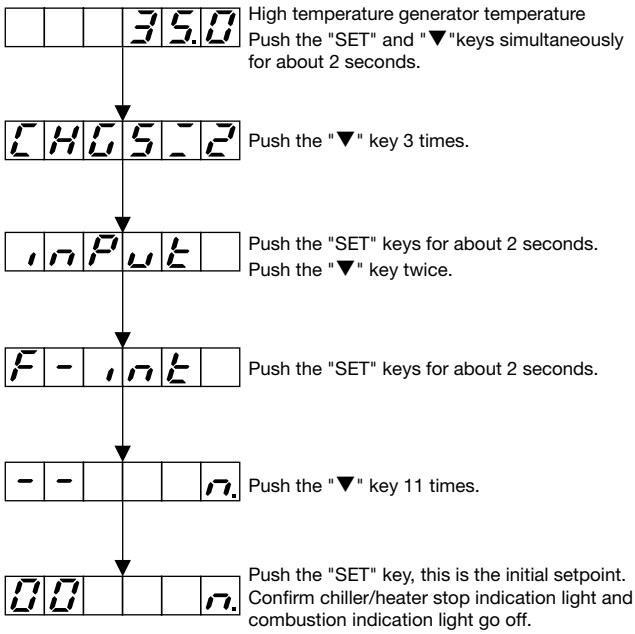
a. Press the "RUN" key.
b. Stop the cooling water pump.
c. Confirm that the data display on the control board shows J-06 "Cooling water pump interlock alarm".

Ventilation fan

a. Press the "RUN" key.
b. Stop the ventilation fan.
c. Check that the data display on the control board shows J-11 "Ventilation fan interlock alarm".

8. Return the burner to normal mode

Fig. 10 - Display example



9. Combustion alarm

This item shall be checked at startup of the burner.

- Press the "RUN" key on the control board.
- The burner starts.
- Check the blower direction. If the direction is wrong, turn off the main breaker of the chiller/heater.
  Then change the wire of burner blower.
- The burner stops due to an alarm, because the main valve has closed.
- Confirm that the data display on the control board shows J-18 "Burner alarm".

2.8 - Burner and fuel piping

2.8.1 - Leak test for gas piping and adjustment of burner

1. For gas pipe leaks and leaks at the seat of each valve refer to the burner operation and maintenance manual.
2. To prepare for burner adjustment refer to the burner operation and maintenance manual.
3. To adjust the main burner refer to exhibit K or exhibit L.

2.9 - Operation

2.9.1 - Gas-fired

- Check that the smoke pipe, draught regulator, chimney top and chimney are all in good condition.
- Turn on the main power and the main gas valve.
  Adjust the burner link in accordance with the burner installation and operation instructions to keep the exhaust gas within the standard combustion value.
- Change to automatic normal operation.

2.9.2 - Oil-fired

- Check that the smoke pipe, draught regulator, chimney and chimney top are all in good condition.
- Turn on the main power and the main oil valve. Adjust the burner link to keep the exhaust gas within the standard combustion value.
- Change to automatic normal operation.

2.9.3 - Test operation, cooling

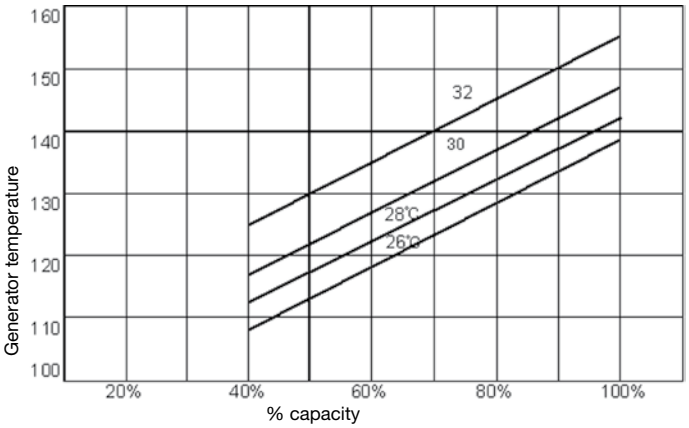
Before starting the chiller/heater, check the valve opening and the damper position. Refer to exhibit J. Usually the units are factory adjusted, but for on-site assemby or first operation the following adjustments should be made. These are only possible, if the cooling load is more than 50% of the rated capacity.

NOTES

1. ***Change the burner control mode to manual.***
2. ***Adjust the control valve to keep the chilled water leaving temperature within ± 1.5 K of the specification.***
3. ***The chilled water and cooling water temperature shall be steady during this adjustment.***

Mark	Problem	Correct mode	Action
A1	Frequent ON/OFF of absorbent pump	Continuous running without ON/OFF, and continuous inverter frequency whithout abnormal change	Open the intermediate damper little by little (about 2° at a time).
B1	Hammer sound (heat exchanger)	No hammer sound	Close the intermediate damper little by little (about 2° at a time).
C1	High temperature generator solution level	Liquid level visible in the sight glass	When the solution level is low, close the intermediate solution damper (about 2° at a time).
D1	High temperature generator temperature	Measure input rate and cooling water entering temperature. Refer to Fig. 11 and generator temperature should be within about ±2 K of the rate shown in the figure	Generator temp. > value from Fig.11 Open the diluted solution damper little by little (about 2° at a time). Generator temp. < value from Fig.11 Close the diluted solution damper little by little (about 2° at a time).

Fig. 11 - Input rate and generator temperature



2.9.4 - Operation and data record

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

Tools required to record operation data

- Thermometer
- Pressure gauge
- Stop watch
- Exhaust gas analyzer
- Smoke tester
- Solution sampling tool
- Gravimeter
- Concentration table as attached

2.9.5 - Absorbent sampling

Sampling should be carried out as follows:

- Sampling of diluted solution
- Sampling from SV4, located on absorbent pump 1 outlet
- Solution should be sampled twice. The sample quantity is 100 ml. The second sample should be used for analysis.

Fig. 12 - Concentration versus temperature and relative density

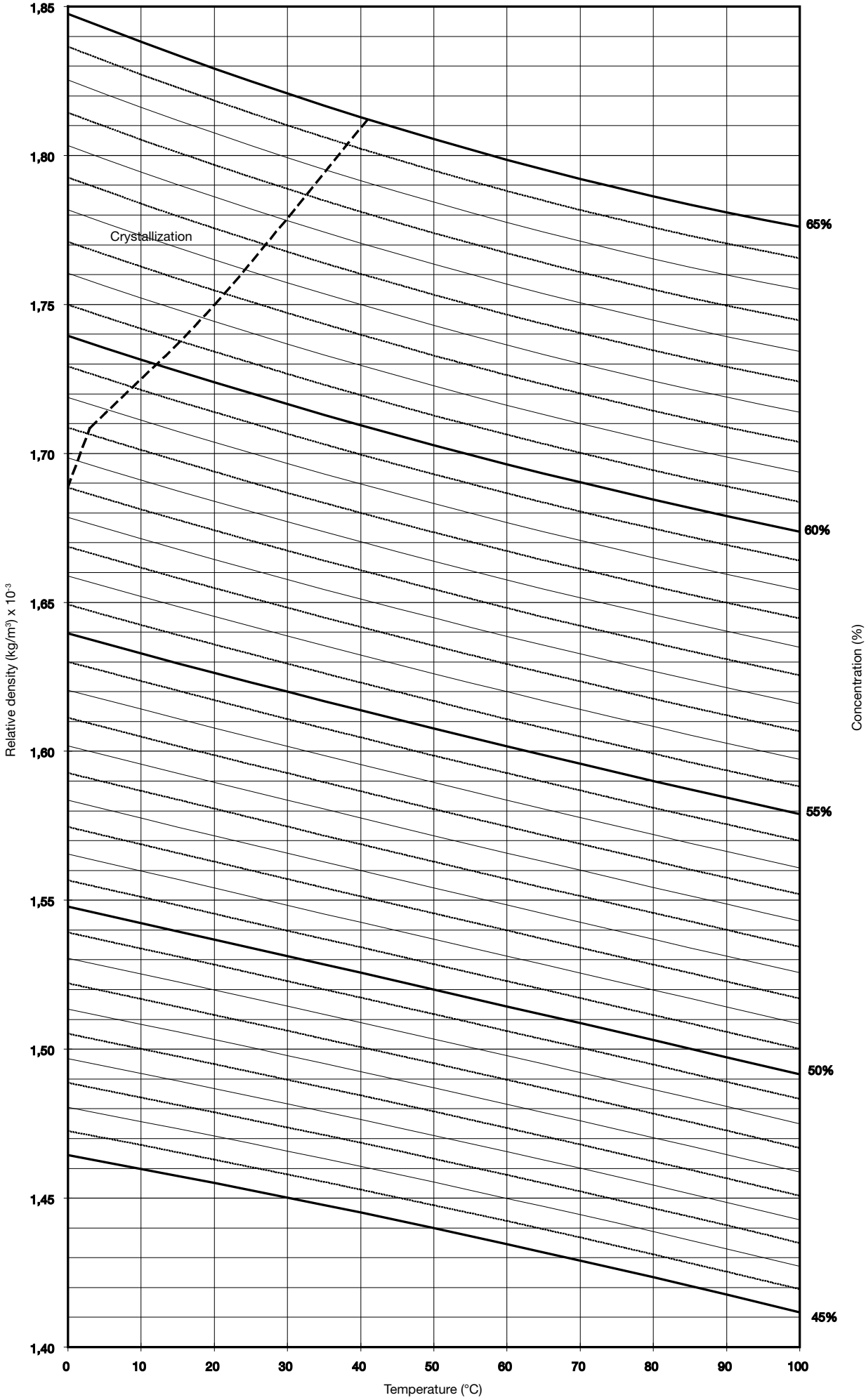
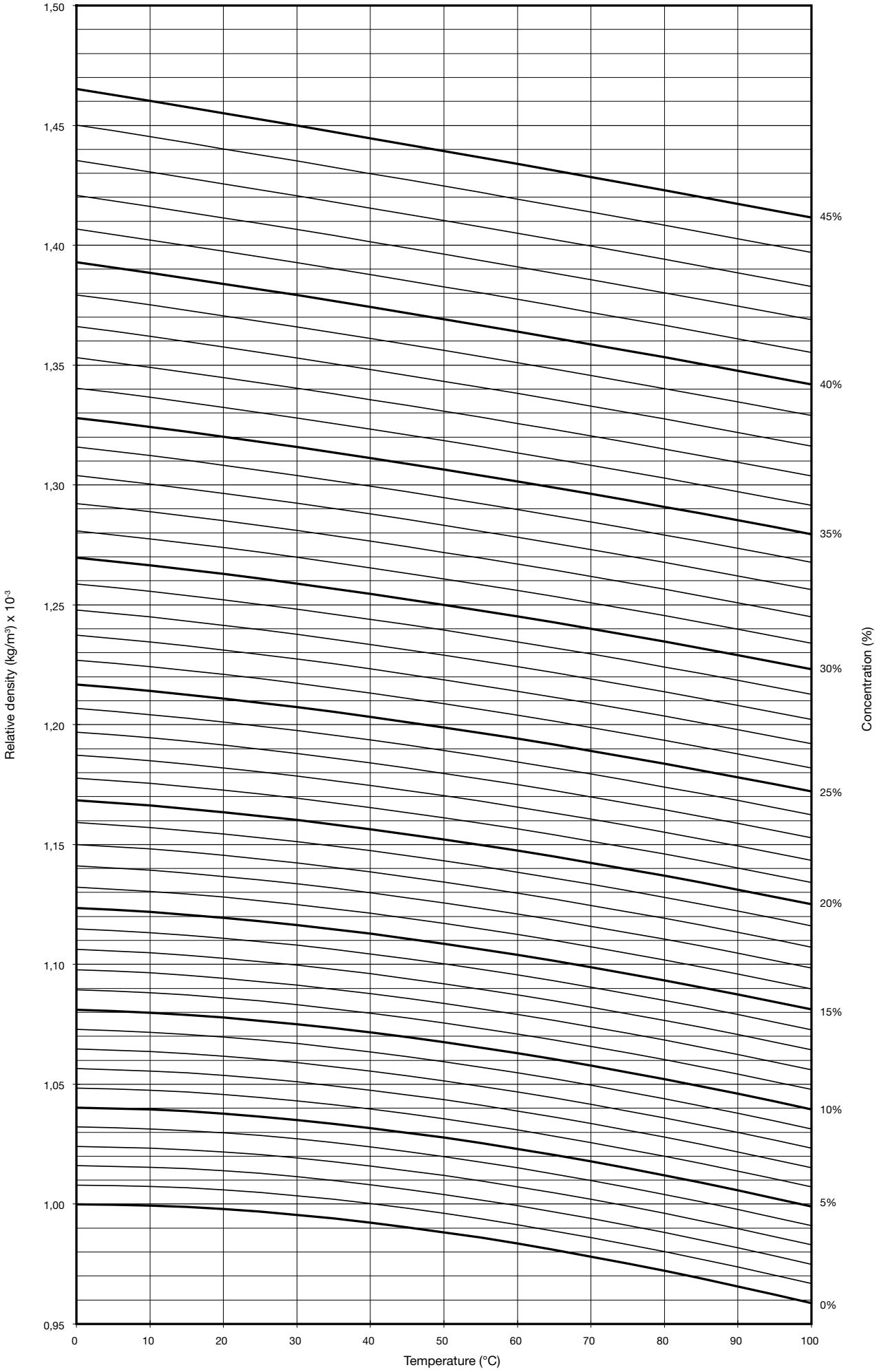


Fig. 13 - Concentration versus temperature and relative density



3 - CHECK LIST

Test operation shall be conducted 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 - Parameter checks
3.10 - Leak test for gas
3.11 - Pre-operation checks
3.12 - Operation and data record

Project name : _____
Chiller/heater 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 ☐
- High-temperature generator ..... Not damaged ☐ Damaged ☐
- Heat exchangers ..... Not damaged ☐ Damaged ☐
- Burner ..... Not damaged ☐ Damaged ☐
- Fuel piping ..... Not damaged ☐ Damaged ☐
- Evaporator headers ..... Not damaged ☐ Damaged ☐
- Absorber headers ..... Not damaged ☐ Damaged ☐
- Condenser headers ..... Not damaged ☐ Damaged ☐
- Control panel ..... Not damaged ☐ Damaged ☐
- Absorbent pump 1 and isolation valves ..... Not damaged ☐ Damaged ☐
- Absorbent pump 2 and isolation valves ..... Not damaged ☐ Damaged ☐
- Refrigerant pump and isolation valves ..... Not damaged ☐ Damaged ☐
- Strainer of absorbent pump 1 outlet ..... Not damaged ☐ Damaged ☐
- Temperature sensors (11 sensors) ..... Not damaged ☐ Damaged ☐
- High temperature generator solution level electrodes ..... Not damaged ☐ Damaged ☐
- Generator pressure switches ..... Not damaged ☐ Damaged ☐
- Generator pressure gauge ..... 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 ☐
- Ventilation fan interlock (#124-#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 ☐
- Ventilation fan (#370-#371) ..... Not damaged ☐ Damaged ☐
- Cooling mode indication (#378-#379) ..... Not damaged ☐ Damaged ☐
- Heating mode indication (#380-#381) ..... Not damaged ☐ Damaged ☐
- Feedback indication (#362-#363) ..... Not damaged ☐ Damaged ☐
- Earth connection (#G/P) ..... Not damaged ☐ Damaged ☐
- Wiring of palladium cell heater ..... Not damaged ☐ Damaged ☐
  For 460 V and 400 V: #232 and #0B in the control panel.
  For 208 V: #232 and #202 in the control panel

3.3 - Check of motor insulation resistance

Standard: more than 10 MΩ

- Absorbent pump 1 : _____MΩ ..... Good ☐ Not good → Repaired ☐ Replaced ☐
- Absorbent pump 2 : _____MΩ ..... Good ☐ Not good → Repaired ☐ Replaced ☐
- Refrigerant pump : _____MΩ ..... Good ☐ Not good → Repaired ☐ Replaced ☐
- Purge pump : _____MΩ ..... Good ☐ Not good → Repaired ☐ Replaced ☐
- Burner blower motor : _____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 switch (63GHH) : _____kPa/MPa
- Generator pressure switch (63GHL) : _____kPa/MPa
- Purge tank pressure sensor (69PR) : _____kPa
- Absorption pump 2 thermal relay (51A2) : _____A
- Refrigerant pump thermal relay (51R) : _____A
- Purge pump thermal relay (51P) : _____A
- Gas pressure switch : _____mbar

3.5 - Check of purge pump

- No water in liquid trap : Yes ☐ No ☐
- Oil quality : Clean ☐ Not clean ☐ (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 ☐ → Replace two power supply wires.

3.6 - Verify auxiliary equipment

(For confirmation purpose only)

Water piping

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

Air vent valve, drain valve, pressure gauge, thermometer

Water circuit	Air vent valve		Drain valve		Press. gauge		Thermometer	
Chilled/hot water	Yes	No	Yes	No	Yes	No	Yes	No
Cooling water	Yes	No	Yes	No	Yes	No	Yes	No

Water pump duty

- Chilled/hot water pump : _____kW *
- Cooling water pump : _____kW *
- Cooling tower : _____kW *

Cooling water temperature control:

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

Water charge into the chilled/hot water circuit:

Yes ☐ No ☐

Water charge into the cooling 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/hot water	Cooling water
Suction pressure (kPa/MPa)		
Delivery pressure ((kPa/MPa)		
Current (A)		

Capacity of 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 positions

Change-over valves, cooling mode

A-valve - refrigerant vapour pipe (closed): Open ☐ Closed ☐
B-valve - purge pipe (open): Open ☐ Closed ☐
C-valve - intermediate solution pipe (closed): Open ☐ Closed ☐
D-valve - cooling water pipe between evaporator and condenser (closed): Open ☐ Closed ☐

Change-over valves, heating mode

A-valve - refrigerant vapour pipe (open): Open ☐ Closed ☐
B-valve - purge pipe (closed): Open ☐ Closed ☐
C-valve - intermediate solution pipe (open) Open ☐ Closed ☐
D-valve - cooling water pipe between evaporator and condenser (open): Open ☐ Closed ☐

Isolation valves

- Absorbent pump 1 (open): Open ☐ Closed ☐
- Absorbent pump 2 (open): Open ☐ Closed ☐
- Refrigerant pump (open): Open ☐ Closed ☐

Diaphragm valves

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

Service valves

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 ☐
Intermediate solution: SV5 (closed) Open ☐ Closed ☐
Concentrated solution: SV6 (closed) Open ☐ Closed ☐
Generator pressure gauge: SV7 (open) Open ☐ Closed ☐
Generator maintenance: SV8 (closed) Open ☐ Closed ☐

Switch

- Mode select switch: Cool ☐ Heat ☐
- Purge (off): On ☐ Off ☐

3.9 - Parameter checks

3.9.1. Check that the inverter parameters are as follows.

Function code	Function name	Model:	FRN-C1 Set value	FVR-P11 Set value	Unit
F00	Data protection		1 → 0 → 1	1 → 0 → 1	
F01	Frequency setting		3	2	
F02	Operation		1	1	
F03	Highest frequency		60	60	Hz
F04	Base frequency		60	60	Hz
F05	Base frequency voltage		Spec.	Spec.	V
F06	Highest output voltage		-	Spec.	V
F07	Acceleration time 1		33.0	33.0	s
F08	Deceleration time 1		33.0	33.0	s
F09	Torque boost 1		5.5	1.5	
F10	Electron thermal (moving level)		2	1	
F11	Electron thermal1 (moving)		Spec.	Spec.	A
F12	Electron thermal1 (time constants)		5.0	5.0	min.
F14	Power shutdown characteristics		4	4	
F15	Frequency limiter (upper limit)		60	60	Hz
F16	Frequency limiter (lower limit)		24	24	Hz
F17	Gain		-	200	%
F18	Bias frequency		0.00	0.0	Hz
F20	DC deceleration (start frequency)		0.0	0.0	Hz
F21	DC deceleration (running level)		0	0	%
F22	DC deceleration (time)		0.0	0.0	s
F23	Start frequency		1.0	0.5	Hz
F24	Start frequency			0.0	s
F25	Stop frequency		0.2	0.2	Hz
F26	Motor running sounds		2	2	kHz
F27	Motor running sounds		0	0	
F30	FMA terminal (output gain)		100	100	%
F31	FMA terminal (monitor)		0	0	
F33	FMP terminal (pulse)			1440	p/s
F34	FMP terminal (voltage)			0	
F35	FMA terminal			0	
F36	30Ry mode			0	
F37	Load selection		2		
F40	Torque control			999	%
F41	Torque control			999	%
F42	Dynamic torque control			0	
F43	Current limits (selection)		0		
F44	Current limits		200		%
F50	Electron thermal 1 (radiation)		999		kWs
F51	Electron thermal 1 (average loss)		0.000		kWs
C32	Analogue input adjustment terminal 12 (gain)		200		%
E01	X1 terminal		8	8	
E20	Y1 (terminal)		30		
			200		%
P01	X1 terminal (function)			2	
P02	Motor 1 (capacity)		Spec.		kW
P03	Motor 1 (rated current)		Spec.		A
P99	Motor selection		4		
H06	On/off control of cooling fan		1	1	
H09				1	
H10				0	
H70	Overload prevention control		0.00		
H98	Automatic energy efficient operation		7		Hz/s
U48	Overload prevention control			1	

3.9.2. Check that the control board parameters are as follows (refer to exhibit H)

Item	Data display	Set point	Confirm
Specification setting	SPEC		
1. Chilled water temperature setting	C-tEMP	7.0°C	
2. Hot water temperature setting	H-tEMP	55.0°C	
3. Chilled water temperature difference setting	C-dt	5.0°C	
4. Hot water temperature difference setting	H-dt	5.0°C	
5. Rank-up/down	rAnkUP	100.0	
6. Purge pump light on	AP-St	10.0kPA	
7. Purge pump light off	AP-SP	7.0kPA	
8. Exhaust gas condensate prevention temperature	EMCont	65°C	
9. Crystallisation	LEC-YS	3.0°C	
Input setting	inPUt		
10. Burner control type	bntYPE	Pid	
11. Input correction	iPtCor	50	
12. Combustion interval setting	F-int	00	n.
Inverter setting	inUSEt		
13. Level control forecast time	33AL	15	
14. Level control forecast decrease factor	33AL-1	1.00	
15. Inverter parameter: a1	inU-A1	148	
16. Inverter parameter: a2	inU-A2	0.042	
17. Inverter parameter: a3	inU-A3	0.060	
18. Inverter parameter: a4	inU-A4	3.6	
19. Inverter parameter: a5	inU-A5	50	
20. Inverter parameter: a6	inU-A6	2.3	
PID setting	PibSEt		
21. Proportional setting in cooling	CooL-P	2.0	
22. Integral setting in cooling	CooL-i	200	
23. Derivative setting in cooling	CooL-d	5	
24. Proportional setting in heating	HEAt-P	5.0	
25. Integral setting in heating	HEAt-i	50	
26. Derivative setting in heating	HEAt-d	30	
27. Sampling setting	SAnPLE	10	
Field setting	FiELd		
28. Cooling water temperature at maximum input	Co-inP	32.0°C	
29. Slow input time	inP-tn.	0000	S
30. Slow input temperature	inPtnP	000°C	
31. Dilution cycle time	diLU-t	04	n.
32. Remote signal	r-SiGn	StArt iC	
33. Remote off pulse signal	oF-PLS	Pos iti	

3.10. - Leak test for gas

Gas pipe leakage (no leakage)	Good ☐	Not good ☐
Oil pipe leakage (no leakage)	Good ☐	Not good ☐
Fuel select valve	Gas ☐	Oil ☐
Completion of air purge in fuel piping	Good ☐	Not good ☐

3.11 - Pre-operation checks

Start (incl. combustion sequence) + stop	Good ☐	Not good ☐
High-temp. generator solution level	Good ☐	Not good ☐
Interlock alarm		
Chilled/hot water	Good ☐	Not good ☐
Cooling water	Good ☐	Not good ☐
Air vent	Good ☐	Not good ☐
Motor alarm	Good ☐	Not good ☐
Generator alarm	Good ☐	Not good ☐
System alarm	Good ☐	Not good ☐
Combustion alarm	Good ☐	Not good ☐

Check for rotation direction of pump

a	Absorbent pump 1	Good ☐	Not good ☐
b	Absorbent pump 2	Good ☐	Not good ☐
c	Refrigerant pump	Good ☐	Not good ☐
d	Burner blower	Good ☐	Not good ☐
e	Burner adjustment	Good ☐	Not good ☐

3.12 - Operation and data record

Run the chiller. Perform refrigerant blow-down	Yes ☐	No ☐
Record operating data	Yes ☐	No ☐

TEST OPERATION DATA SHEET

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/hot-water entering temperature	°C/°F				
4	Chilled/hot-water leaving temperature	°C/°F				
5	Chilled/hot-water entering pressure	kPa/psi				
6	Chilled/hot-water leaving pressure	kPa/psi				
7	Evaporator pressure drop	kPa/psi				
8	Chilled/hot-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	High-temperature generator temperature	°C/°F				
16	High-tempersture generator pressure	kPa/psi				
17	Evaporator solution level	n/60 mm n/2-3/8”				
18	High-temperature generator solution level	n/60 mm n/2-3/8”				
19	Solution level in bottom of absorber	n/60 mm n/2-3/8”				
20	Purge tank pressure	kPa				
21	Concentration of concentrated solution	%				
	Relative density of concentrated solution	-				
	Temperature of concentrated solution	°C/°F				
22	Concentration of diluted solution	%				
	Relative density of diluted solution	-				
	Temperature of diluted solution	°C/°F				
23	Concentration of refrigerant	%				
	Relative density of refrigerant	-				
	Temperature of refrigerant	°C/°F				
24	Condensed refrigerant temperature	°C/°F				
25	LTD *	°C/°F				
26	Absorbent pump 1 current	A				
27	Absorbent pump 2 current	A				
28	Refrigerant pump current	A				
29	Purge pump current	A				

* LTD = Condensed refrigerant temperature minus cooling water leaving temperature

Notes

4 - EXHIBITS

4.1 - Exhibit A

4.1.1 - Precautions for use

Installation and operation
Before installing and operating this chiller/heater, 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/heater.

Machine room
- Keep the machine room temperature between 5°C and 40°C to protect against solution crystallisation during chiller/heater shut-down.
- Keep the humidity in the machine room below 90%.
- Ensure that the machine room is sufficiently ventilated. The required fresh air rate is approximately 0.28 l/s per kW fuel consumed.
- Leave the service and maintenance clearances shown in the dimensional drawing.

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

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

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/heater shut-down. If the cooling water pump(s) operate to provide frost protection of the cooling water, operate the chilled-water pump(s) simultaneously.

For multiple unit installations ensure that the chiller/heater hot water entering temperature does not exceed 60°C.

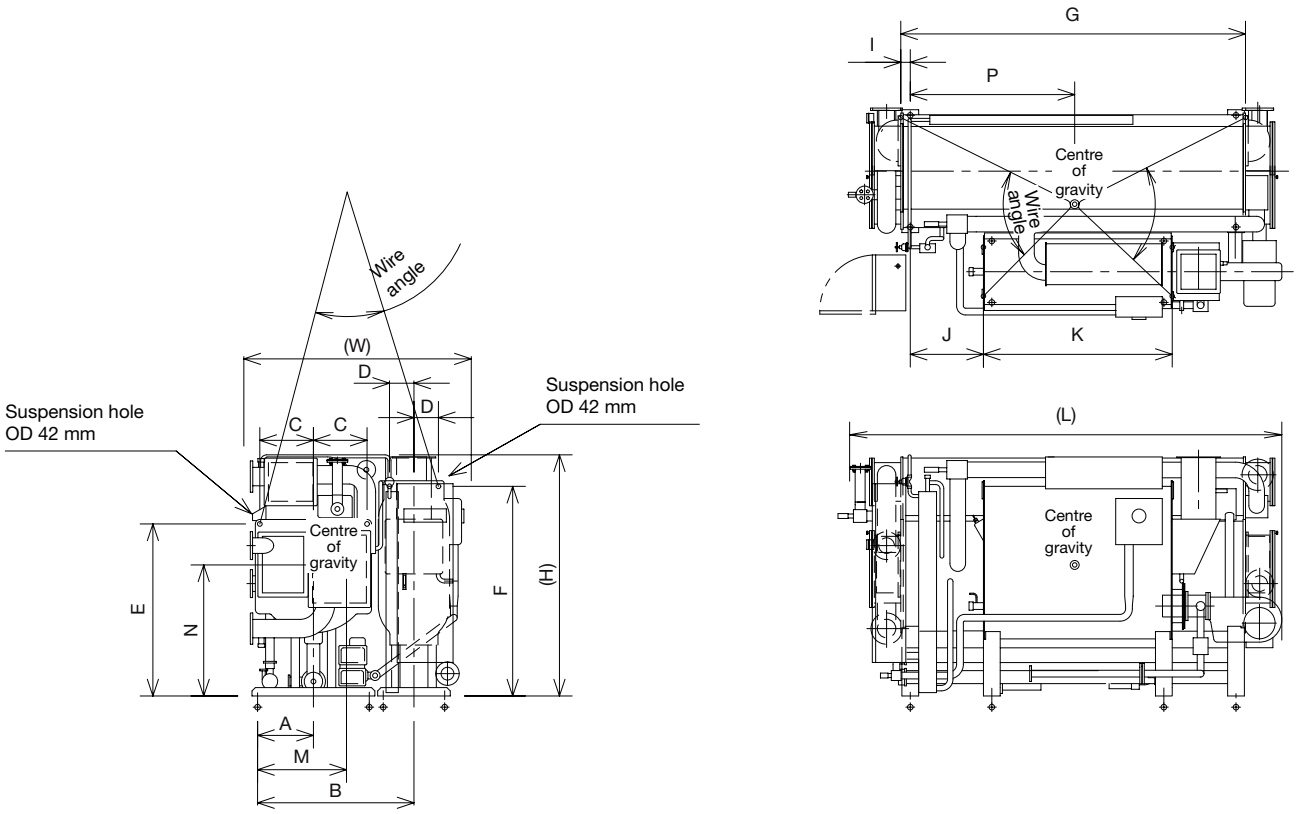
Service and maintenance
The chiller/heater should be checked periodically. Please contact the service agent.

4.1.2 - Precautions for installation
- Always make sure that the installation complies with local regulations.
- The chiller/heater is designed for indoor installation.
- Install the chiller/heater 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/heater 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/heater control panel.
- Connect the operation signal wires from the chiller/heater to the chilled water pump and cooling water pump. Each pump is automatically operated by the chiller/heater signal.
- Connect the interlock wire of each pump to the chiller/heater.
- 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 B

4.2.1 - Shipping dimensions - location of suspension hole

Fig. 14 - One-piece shipping



NOTES:

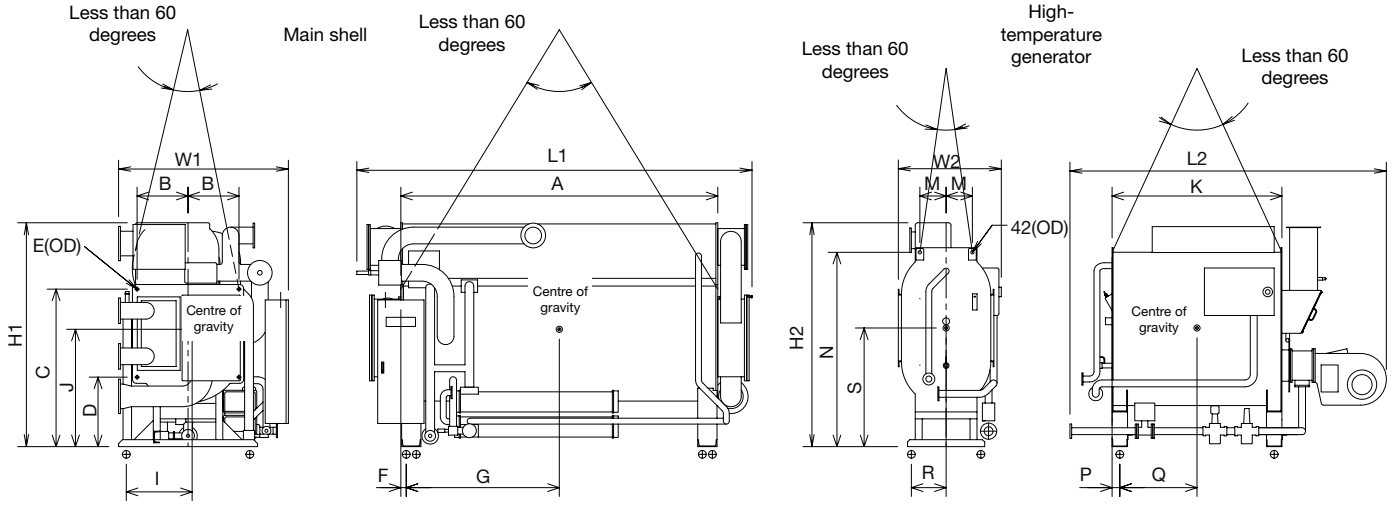
1. *The diagram indicates suspension hole positions.*
2. *Length (L), width (W) and height (H) differ according to the specific installation and should always be verified.*

16DJ	Shipping dimensions				Suspension hole location										Centre of gravity		
	L	W	H	Weight	A	B	C	D	E	F	G	I	J	K	M	N	P
	mm	mm	mm	kg	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
11	3080	1810	1960	4800	400	1280	400	180	1440	1698	2070	85	790	1000	706	1095	1070
12	3080	1810	1960	5100	400	1280	400	180	1440	1698	2070	85	590	1200	718	1094	1040
13	3810	1910	1960	6100	400	1330	400	180	1440	1698	3090	85	925	1250	702	1075	1490
14	3810	1910	1960	6500	400	1330	400	180	1440	1698	3090	85	725	1450	720	1072	1450
21	3980	2090	2160	7600	500	1510	470	200	1530	1897	3090	110	900	1500	842	1172	1550
22	3980	2090	2160	8000	500	1510	470	200	1530	1897	3090	110	700	1700	850	1175	1520
23	4980	2130	2160	9200	500	1530	470	200	1530	1880	4110	110	1300	2000	844	1180	2090
24	4980	2130	2160	9700	500	1530	470	200	1530	1880	4110	110	1100	2200	849	1177	2060
31	5000	2290	2390	12000	550	1650	500	250	1690	2068	4110	135	1275	1950	922	1263	2070
32	5000	2290	2390	12600	550	1650	500	250	1690	2068	4110	135	1075	2150	931	1262	2020
41	5010	2490	2600	14700	575	1795	540	300	1877	2261	4110	135	905	2250	985	1391	1980
42	5040	2490	2600	15400	575	1795	540	300	1877	2261	4110	135	705	2450	994	1388	1950
51	5310	2990	2900	20100	800	2170	660	340	2068	2517	4110	70	1030	2200	1237	1525	2030
52	5850	2990	2900	21700	800	2170	660	340	2068	2517	4650	70	1030	2400	1233	1527	2250
53	6350	2990	2900	23300	800	2170	660	340	2068	2517	5150	70	1030	2600	1290	1612	2440

4.2 - Exhibit B (cont.)

4.2.2 - Shipping dimensions - location of suspension hole

Fig. 14 - One-piece shipping (cont.)

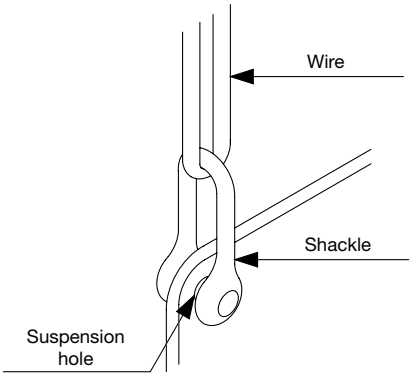


16DJ	Main shell													High-temperature generator										Solutions				Others
	LI	W1	H1	Weight	A	B	C	D	E	F	G	I	J	L2	W2	H2	Weight	K	M	N	P	Q	R	S	LiBr		Refrigerant		
	mm	mm	min	kg	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg	mm	mm	mm	mm	mm	mm	mm	kg	bottles	kg	bottles	kg
61	6110	2450	3330	17600	4648	715	2353	977	50	90	2234	850	1687	4570	1510	3330	5800	2700	390	2910	160	1200	500	1795	4900	17	500	5	200
62	6600	2450	3330	18800	5146	715	2353	977	50	90	2483	950	1689	4870	1510	3330	6100	3000	390	2910	160	1350	500	1795	5500	19	600	5	200
63	7130	2450	3330	19900	5671	715	2353	977	50	90	2746	950	1690	5220	1510	3330	6800	3300	390	2910	160	1500	500	1795	6200	21	600	5	200
71	6490	2840	3450	23100	5146	890	2310	930	60	290	2283	1177	1732	5320	1740	3450	9600	3400	458	3058	160	1550	600	1752	7500	25	700	6	200
72	7020	2840	3450	24700	5671	890	2310	930	60	290	2546	1174	1736	5840	1740	3450	10200	3700	458	3058	160	1700	600	1752	8200	28	800	7	200
73	7520	2840	3450	25900	6171	890	2310	930	60	290	2796	1172	1737	6140	1740	3450	10900	4000	458	3058	160	1850	600	1752	8800	30	900	8	300
81	7010	3040	3650	27800	5671	970	2410	970	70	290	2546	1272	1843	6530	1900	3650	12000	4000	500	3218	160	1850	700	1818	9900	33	900	8	300
82	7510	3040	3650	29200	6171	970	2410	970	70	290	2796	1269	1846	6730	1900	3650	12400	4200	500	3218	160	1950	700	1818	10500	35	1100	10	300

4.2.3 - 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.
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.

Fig. 15



4.3 - Exhibit C

4.3.1 - Foundation dimensions, mm

Fig. 16 - Details of weld

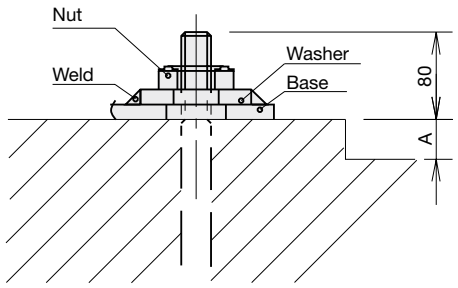


Fig. 17 - 16DJ-11 to 16DJ-12

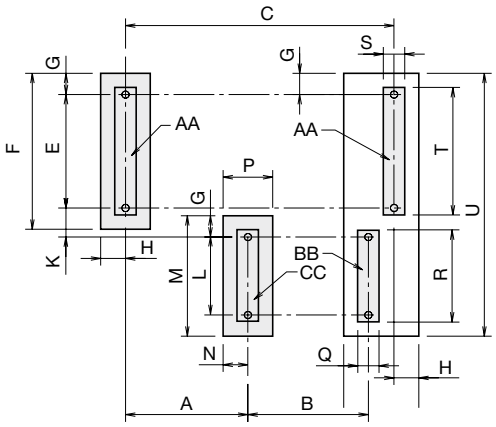


Fig. 18 - 16DJ-13 to 16DJ-63

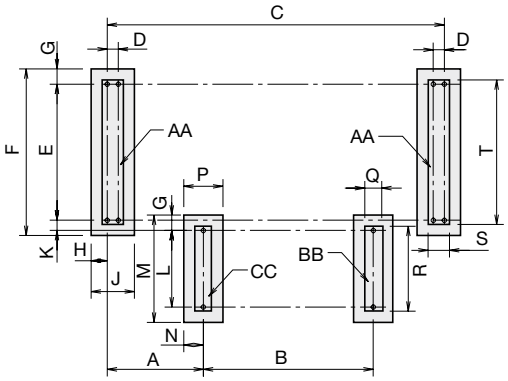
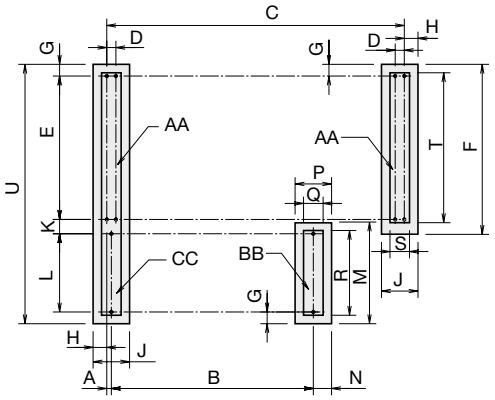


Fig. 19 - 16DJ-71 to 16DJ-82



NOTES

1. *The machine base has a ø50-mm hole for the anchor bolt.*
2. *Fix the anchor bolt as shown in the detail drawing and weld the washer to the base (see Fig. 16).*
3. *Provide a drain channel around the foundation.*
4. *Waterproof the floor surface to facilitate maintenance work.*
5. *The foundation surface should be 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

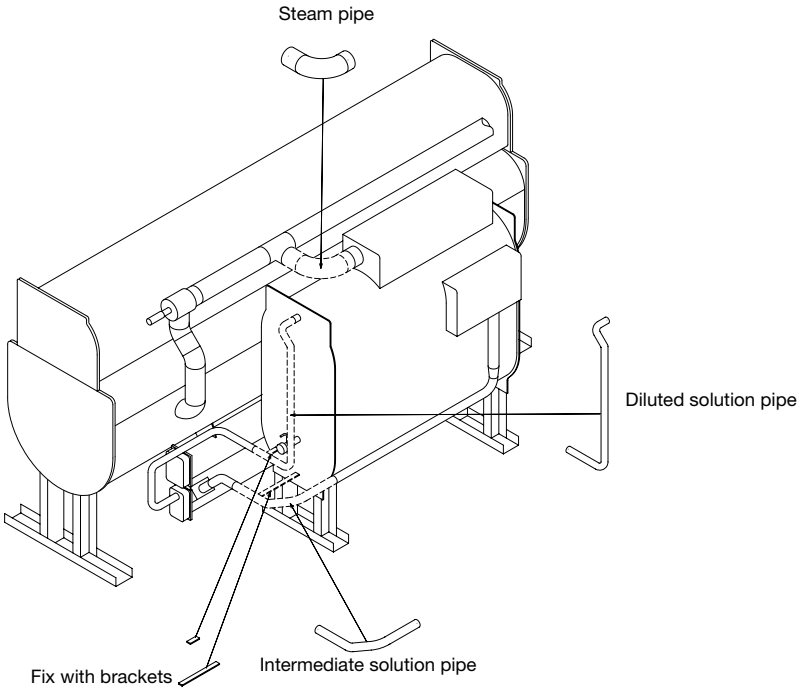
16DJ	Foundation weights, kg				Dimensions, mm																		
	Operating	AA	BB	CC	A	B	C	D	E	F	G	H	1	K	L	M	N	P	Q	R	S	T	U
11	5200	1750	900	800	865	850	1896	—	800	1100	150	175	350	150	550	850	175	350	150	650	150	900	1855
12	5500	1850	1000	800	—	800	1100	150	175	350	—	—	—	150	550	850	175	350	150	650	150	900	1855
13	6600	2250	1200	900	1000	1100	2916	—	800	1100	150	175	350	150	600	900	175	350	150	700	150	900	—
14	7100	2450	1300	900	800	1300	2916	—	800	1100	150	175	350	300	600	900	175	350	150	700	150	900	—
21	8300	2850	1400	1200	1000	1350	2916	—	1000	1300	150	175	350	185	650	950	175	350	150	750	150		—
22	8800	2950	1600	1300	800	1550	2916	—	1000	1300	150	175	350	185	650	950	175	350	150	750	150		—
23	10100	3450	1700	1500	1400	1850	3936	—	1000	1300	150	175	350	255	650	950	175	350	150	750	150		—
24	10700	3650	1900	1500	1200	2050	3936	—	1000	1300	150	175	350	255	650	950	175	350	150	750	150		—
31	13200	4600	2200	1800	1400	1750	3886	—	1100	1400	150	200	400	200	700	1000	200	400	200	800	200		—
32	13900	4700	2400	2100	1200	1950	3886	—	1100	1400	150	200	400	200	700	1000	200	400	200	800	200		—
41	16300	5650	2700	2300	1030	2050	3886	—	1150	1450	150	200	400	245	800	1100	200	400	200	900	200		—
42	17100	5750	3000	2600	830	2250	3886	—	1150	1450	150	200	400	245	800	1100	200	400	200	900	200		—
51	22800	8300	3300	2900	1130	2000	3966	130	1600	1960	180	190	510	120	900	1260	230	460	200	1000	250		—
52	24600	8900	3600	3200	1130	2200	4508	130	1600	1960	180	190	510	120	900	1260	230	460	200	1000	250		—
53	26300	9500	3900	3400	1130	2400	5006	130	1600	1960	180	190	510	120	900	1260	230	460	200	1000	250		—
61	32700	11700	4900	4400	1398	2400	4468	140	1800	2160	180	310	560	120	1000	1360	280	560	300	1100	300		—
62	35200	12500	5400	4800	1398	2700	4966	140	1800	2160	180	210	560	120	1000	1360	280	560	300	1100	300		—
63	37900	13400	5800	5300	1398	3000	5490	140	1800	2160	180	210	560	120	1000	1360	280	560	300	1100	300		—
71	46100	16400	6900	6400	70	3100	4566	140	2200	2560	180	210	560	220	1200	1560	280	560	300	1300	300		—
72	49500	17500	7600	6900	70	3400	5091	140	2200	2560	180	210	560	220	1200	1560	280	560	300	1300	300		—
73	52500	18500	8100	7400	70	3700	5594	140	2200	2560	180	210	560	220	1200	1560	280	560	300	1300	300		—
81	57200	20050	8900	8200	70	3700	5091	140	2400	2760	180	210	560	200	1400	1760	280	560	300	1500	300		—
82	60200	21150	9300	8600	70	3900	5591	140	2400	2760	180	210	560	200	1400	1760	280	560	300	1500	300		—

4.4 - Exhibit D

4.4.1 - Welding of connecting pipes for the high temperature generator and main shell

1. Weld the steam pipe in place.
2. Weld the diluted and intermediate solution pipes in place and then fix the pipes by welding on the brackets. The shape of the connecting pipe depends on the model.
3. During the welding operation cover electrical wiring, burner and sensor with a heat-resistant sheet to prevent sparks.
4. When working on the unit ensure that you have a sufficient area as foothold. Do not stand on the pipes or other parts of the equipment.

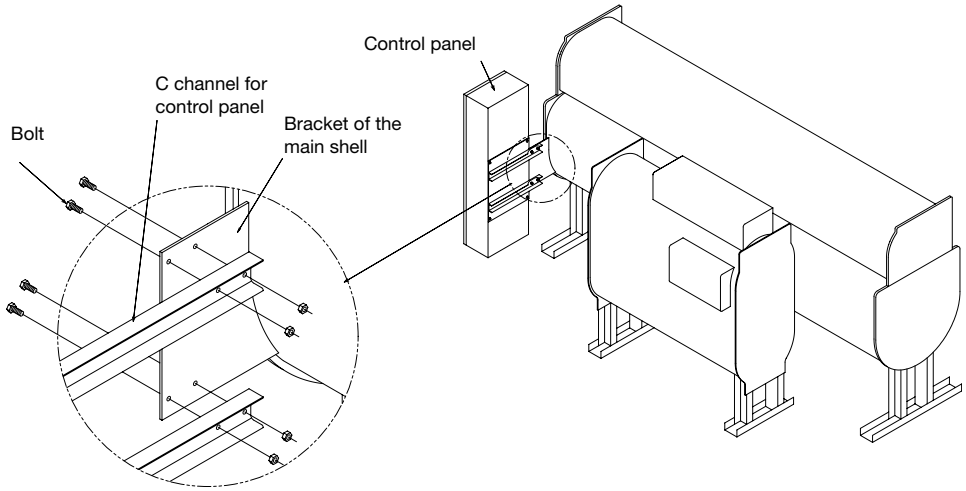
Fig. 20



4.4.2 - Connection of the control panel

Fix the C channels for the control board and the bracket of the main shell with four bolts. Since the control board contains precision instruments, please handle it with care. Do not drop it and avoid sudden shocks during transportation and installation of the equipment.

Fig. 21



4.4.3 - Sample specification for welding electrodes

Model number: LB-52U
For one-side welding.

JIS D4316 AWS E7016
BS E5143B24 (H) DIN E5143B (R) 10
ISO E514B24 (H)

Applications

One-side welding of pipes and general butt joints of mild steel and 490 N/mm^2 (50 kgf/mm^2) class high tensile steel.

Characteristics on usage

LB-52U is a low hydrogen type electrode for exclusive use for one-side welding of pipes and general structures. Its arc stability is extremely good for one-side welding with relatively low currents.
LB-52U provides good slag removal and smooth weld beads.

Notes on usage

1. Reverse welds of good appearance are obtained with proper currents and optimum root gaps (about 3 mm).
2. Stop the arc after moving the crater to the side wall of the groove.
3. Dry the electrodes at 300~350°C for 30~60 minutes before use.
4. Strike the arc on a small steel plate prepared for this purpose or on the side wall of the groove.
5. Keep the arc as short as possible.

Typical chemical composition of weld metal (%)

C	Mn	Si	P	S
0.08	0.86	0.64	0.012	0.010

Typical mechanical properties of weld metal

YP	TS	EL	IV
N/mm^2 (kgf/mm^2)	N/mm^2 (kgf/mm^2)	%	J (kgf-m)
460 (47)	550 (56)	31	110 (11)

YP - Yield point
TS - Tensile strength
EL - Elongation
IV - Energy absorbed

Sizes available and recommended currents (AC or DC*)

Diameter	mm	2.6	3.2	4.0	5.0
Length	**mm**	**350**	**350/400**	**400**	**400**
OSW	A	30~80	60~110	90~140	130~180
F	A	60~90	90~130	130~180	180~240
V & O	A	50~80	80~120	110~170	150-200

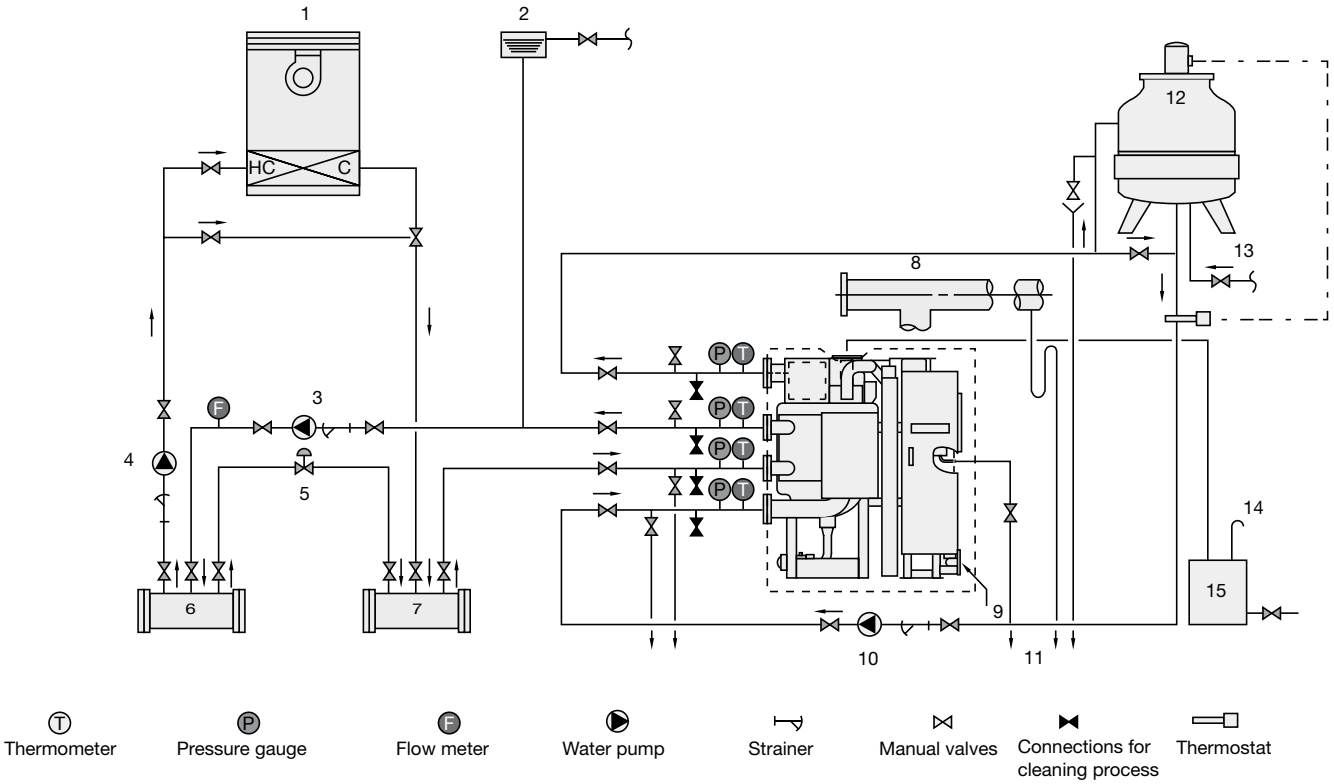
OSW - One-side welding
F - Flat welding position
V - Vertical welding position
O - Overhead welding position

* DC(-) for only root pass

4.5 - Exhibit E

4.5.1 - Typical piping diagram

Fig. 22



Legend

1. Air conditioner
2. Expansion tank
3. Chilled/hot water pump (primary)
4. Chilled/hot water pump (secondary)
5. Bypass valve
6. Supply header
7. Return header
8. Flue pipe
9. Fuel
10. Cooling water pump
11. To drain channel
12. Cooling tower
13. Water supply
14. Vent pipe
15. Minimum tank capacity 1 m³

NOTE: In order to prevent freezing of the chilled water when the chiller/heater switches off, continue the operation of the primary and secondary chilled-water pumps and air conditioner during the chiller/heater dilution cycle for about 15 minutes.

General remarks on piping

1. Equipment and parts outside the area surrounded by the broken line are not supplied by Carrier.
2. For pipe connections and diameters refer to the dimensional drawings.
3. Determine the location of the chilled/hot water pumps, cooling water pump and expansion tank with due consideration of the pump's hydrostatic head. The chillers/heaters should not, as standard, be subjected to a pressure above 1034 kPa at any water headers.
4. For the minimum cooling water entering temperature refer to the section of "Cooling water temperature control".
5. It is recommended to have separate chilled/hot and cooling water pumps for each chiller/heater.
6. During heating operation, cooling water must be discharged.
7. Provide a thermometer and pressure gauge at the chilled/hot water and cooling water inlet and outlet pipe connections.
8. Provide an air vent valve in each of the chilled/hot and cooling water lines at a point higher than each header.
9. Drain pipes from the evaporator, absorber and smoke chamber to the drain channel.
10. Provide an expansion tank in the chilled/hot water line.
11. Provide a blow-down valve in the cooling water line for water quality control.
12. There should be a sufficiently large clearances for easy access to the evaporator, absorber and condenser, to facilitate inspection and cleaning.
13. Provide heat insulation to the flue, which should be equipped with a damper and condensate drain.
14. Do not connect the flue to the smoke stack of an incinerator.
15. If one flue is used for two or more chillers/heaters, a device should be provided to prevent the flow of exhaust gas into the inoperative unit.
16. The exhaust discharge end of the flue should be kept at a sufficiently large distance from the cooling tower.
17. If the static pressure inside the flue is subject to fluctuations, provide a draught regulator.
18. If necessary, fit the rupture disk on the chillers/heaters according to the rupture disk manual.
19. All external water piping with ANSI 150 LB welding flanges is to be provided by the customer.

4.5.2 - Water treatment

Absorption chillers/heaters 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/heater and tank, or contact a water treatment specialist.

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

If the chiller/heater 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.

4.5.3 - Standard water quality values

Ref: JRA-GL-02-1994

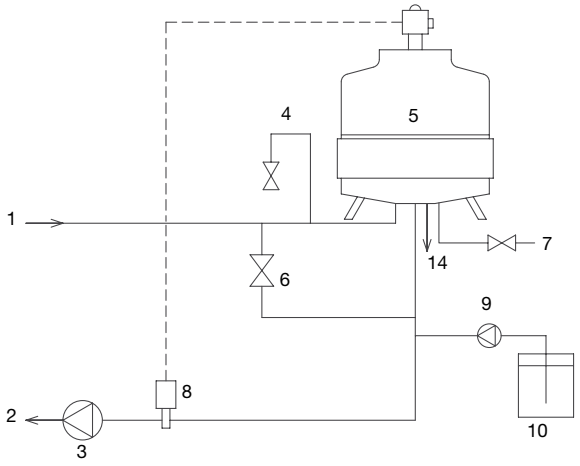
			Cooling water systems			Chilled water systems		Tendency	
			Recirculating water	Make-up water	Once-through water	Recirculating water < 20°C	Make-up water	Corrosive	Scale-forming
Standard	pH (25°C)		6.5 - 8.2	6.0 - 8.0	6.8 - 8.0	6.8 - 8.0	6.8 - 8.0	X	X
	Electrical conductivity 25°C	(mS/m)	below 80	below 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)		Corrosive	Scale-forming
			Recirculating water	Make-up water	Recirculating water	Make-up water		
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

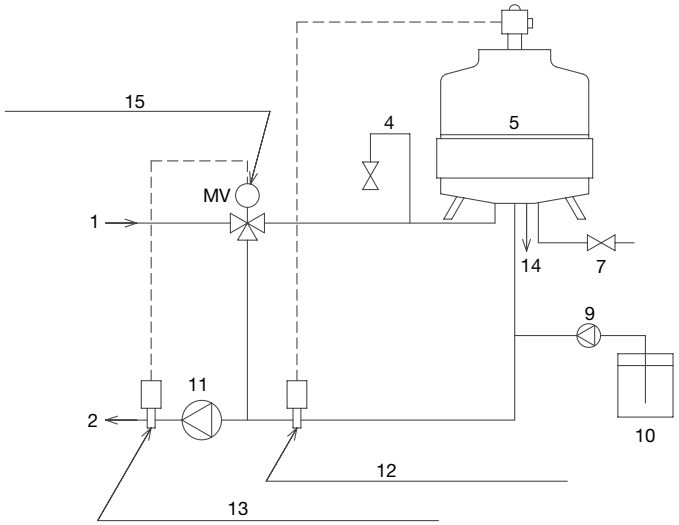
4.5.4 - Cooling water temperature control

Fig. 23 - 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/heaters are designed to operate with a cooling water entering temperature above 18°C. In typical applications the chiller/heater 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/heater operates during an intermediate season or in winter, provide an automatic three-way control valve shown as above.

4.5 - Exhibit E (cont.)

4.5.5 - 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 1.85 (exhaust heat factor) divided by 575 (latent heat of water at 40°C) = 2.77 l/h/kW

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

B: Blow-down volume

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

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

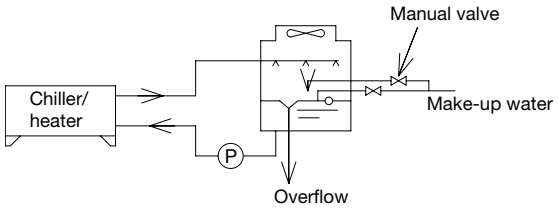
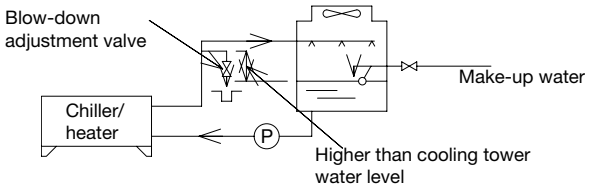
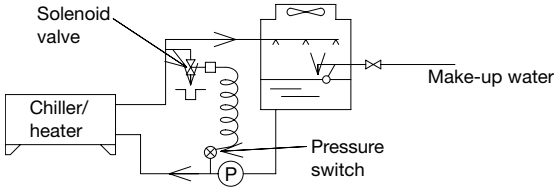
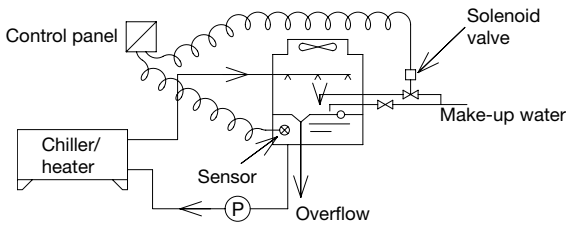
Example

Cooling water flow rate = 284 l/h/kW
(chiller/heater cooling capacity)

E = 2.77 l/h/kW
N = 3
W = 0.57 l/h

$$B = \frac{1}{3 - 1} \times 2.77 - 0.57$$

B = 0.82 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)	

4.5 - Exhibit E (cont.)

4.5.6 - Flue and stack connection

- The flue and stack must be heat-insulated and provided with a damper and a condensate drain.
- The flue should never be connected to an incinerator stack.
- Locate the top end of the smoke stack a sufficient distance away from the cooling tower.
- If the same stack is used for discharging exhaust from two systems, the back flow of the exhaust gas should be prevented from going into the inoperative unit.
- Provide a draught regulator if fluctuations in static pressure are expected inside the flue.

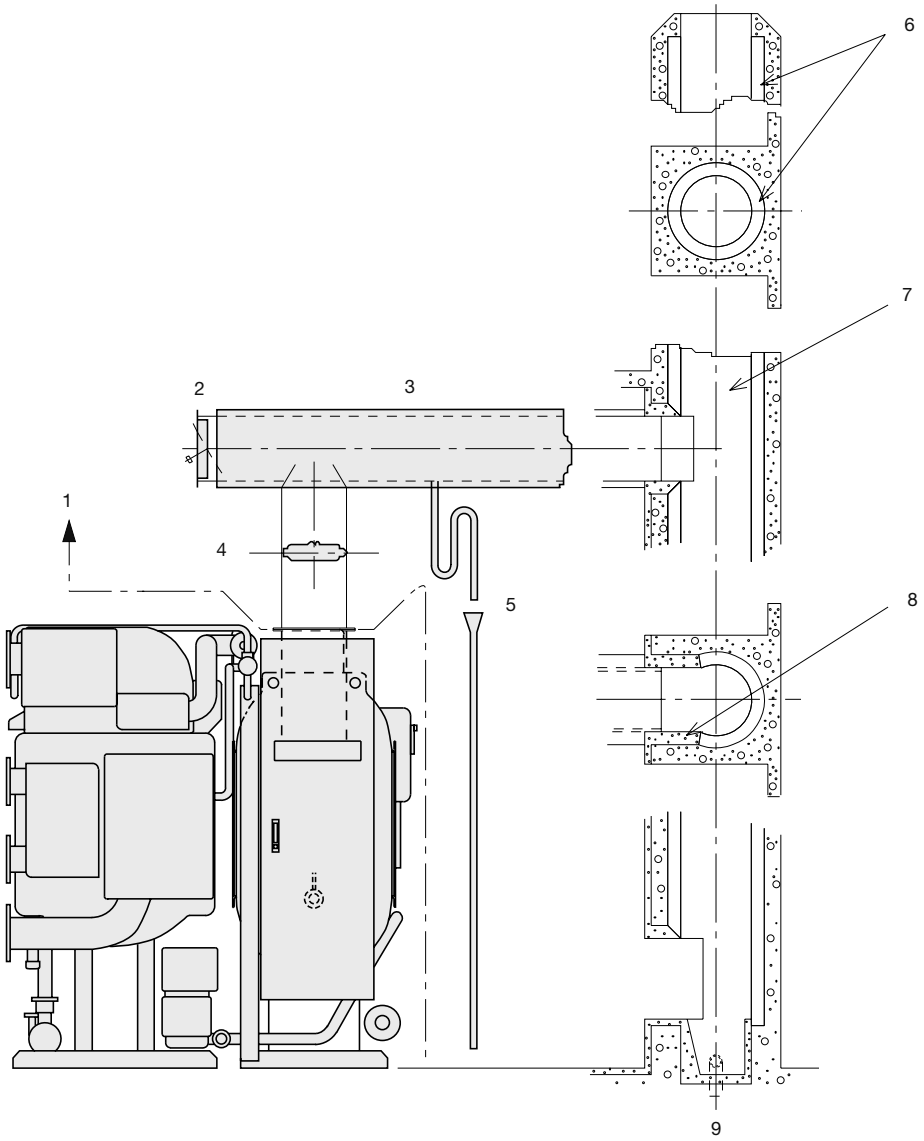
4.5.7 - Typical steel stack

As illustrated, the steel stack should be lined on the interior surface as a protection against corrosion due to exhaust gas.

4.5.8 - Compliance with local regulations

- In many areas local codes may regulate large capacity chillers consuming oil or gas as fuel.
- Such regulations should be strictly followed.

Fig. 24 - Typical flue and stack installation

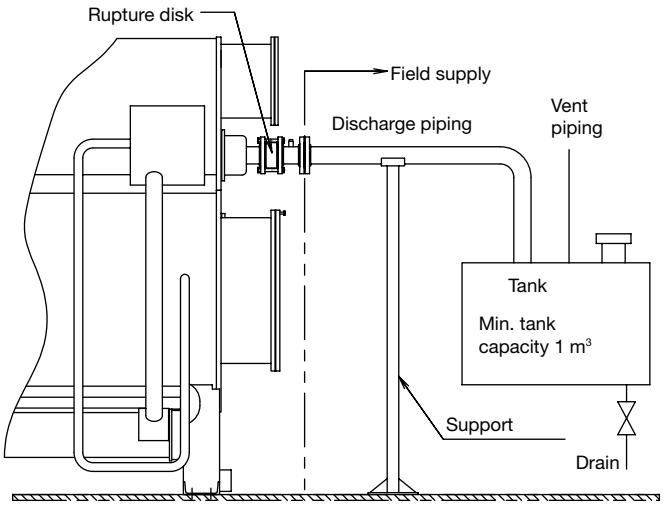


Legend
1. Field supply
2. Draught regulator
3. Flue (insulated)
4. Damper
5. Condensate drain
6. Internal lining
7. Stack
8. Fire-proof mortar
9. Condensate drain

NOTE: Design the chiller/heater draught pressure at the flue flange for a negative pressure of 0 to -29.4 Pa (0 to -3 mmH_2O).

4.5.9 - Rupture disk connection

Fig. 25



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. 27.
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. 27.

   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. 26

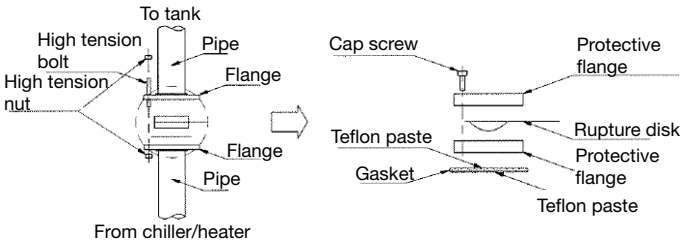
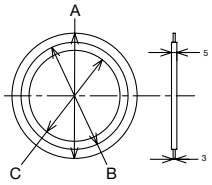


Fig. 27

		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

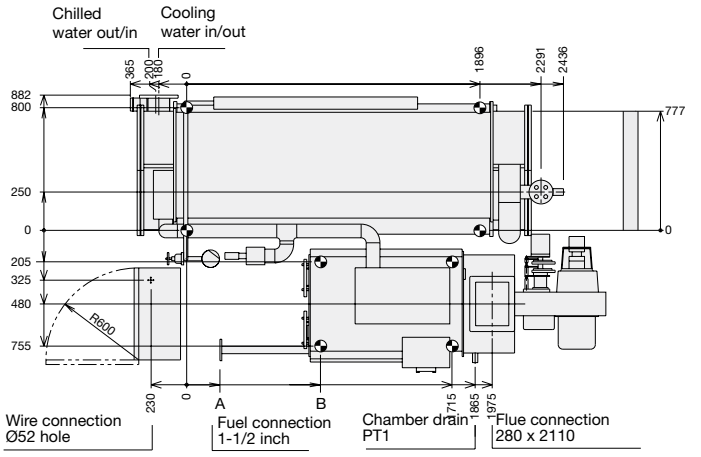
4.5 - Exhibit E (cont.)

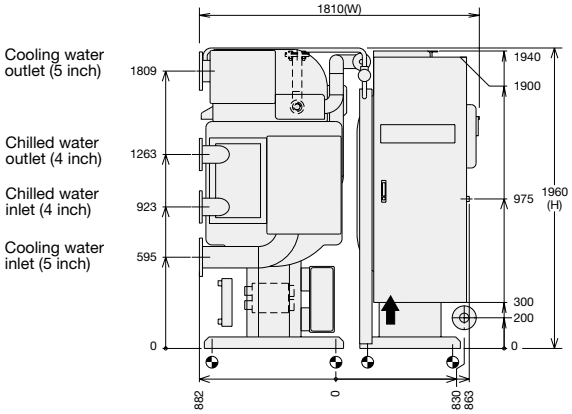
4.5.10 - Dimensional drawings

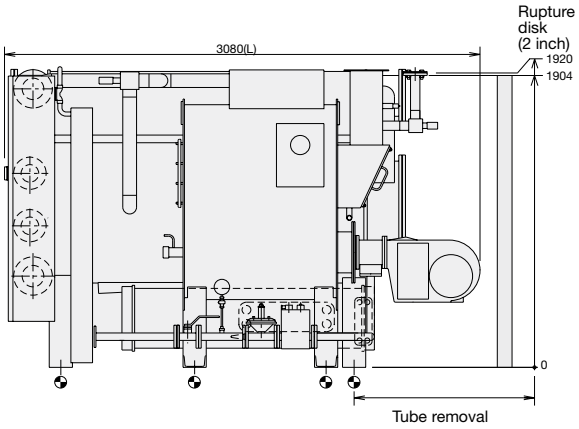
16DJ-11 through 16DJ-12 (mm)

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. All external water pipes must be provided with welded ANSI 150 LB flanges by the customer.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 52 mm)
5. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm
6. For the fuel connection diameter and position, refer to specifications.

16DJ	A	B
11	215	865
12	15	665

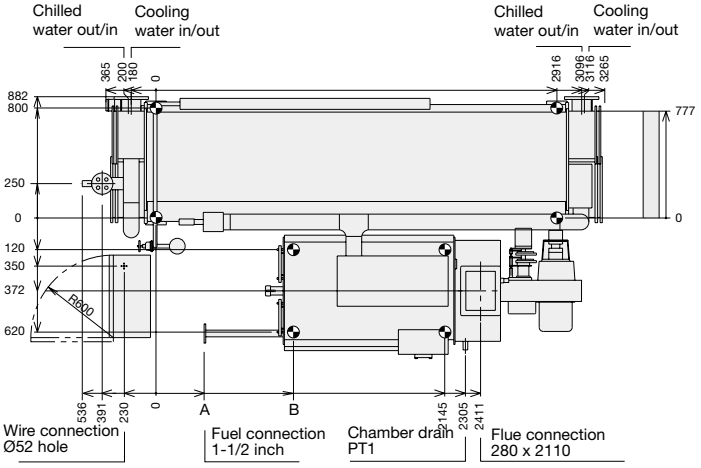


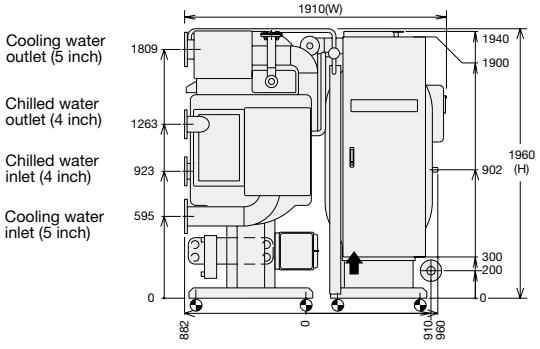


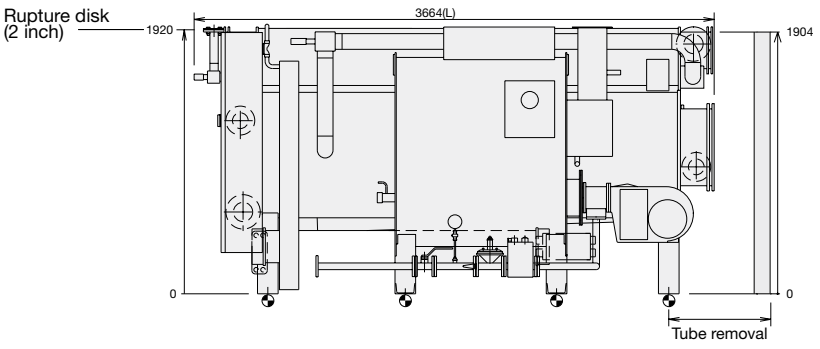


16DJ-13 through 16DJ-14 (mm)

16DJ	A	B
13	350	1000
14	150	800





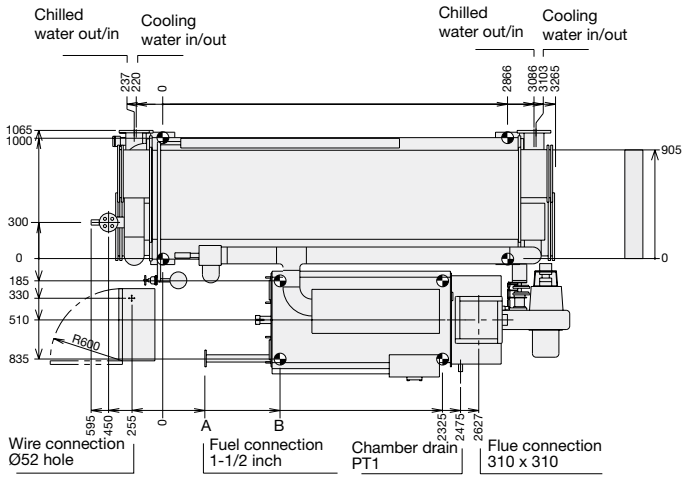


NOTE: Dimensions are for guidance only. Refer to the certified drawings supplied upon request when designing an installation.

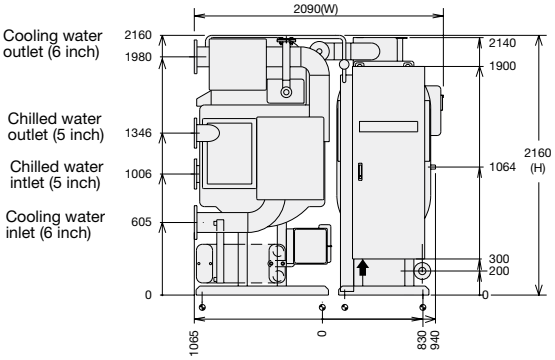
4.5 - Exhibit E (cont.)

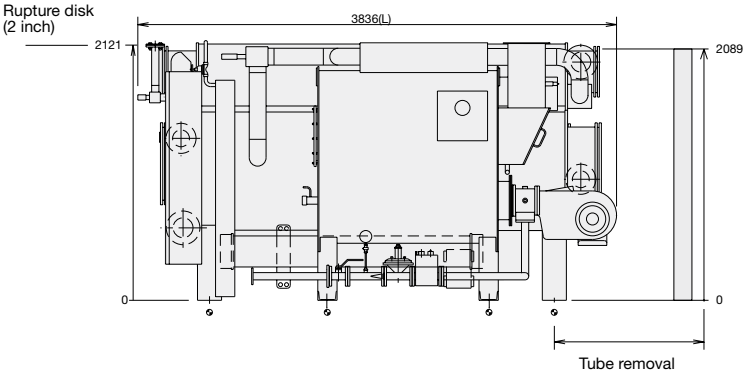
16DJ-21 through 16DJ-22 (mm)

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. All external water pipes must be provided with welded ANSI 150 LB flanges by the customer.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 52 mm)
5. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm
6. For the fuel connection diameter and position, refer to specifications.



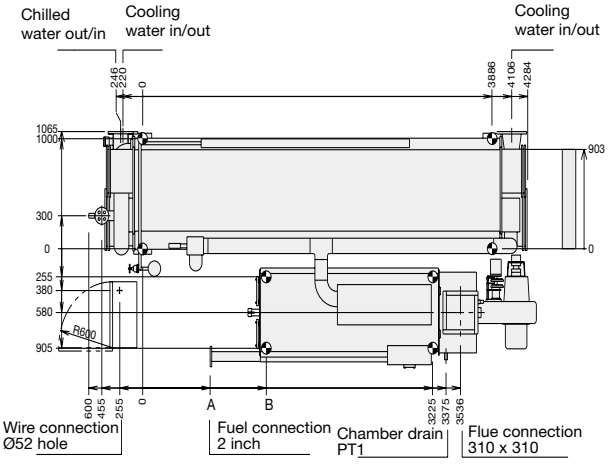
16DJ	A	B
21	350	975
22	150	775

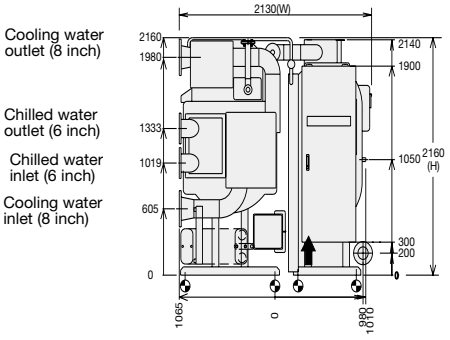


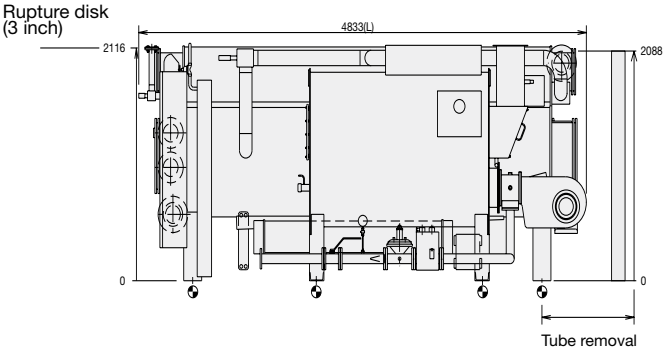


16DJ-23 through 16DJ-24 (mm)

16DJ	A	B
23	750	1375
24	550	1775







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

4.5 - Exhibit E (cont.)

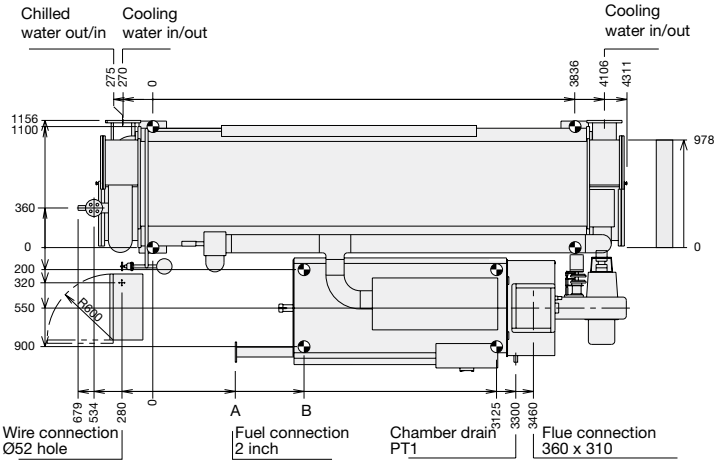
16DJ-31 through 16DJ-32 (mm)

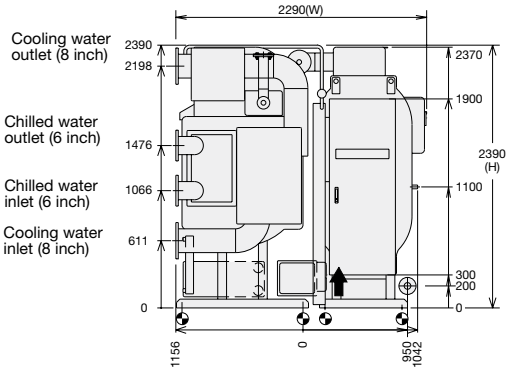
NOTES :
1. Dimensions (L), (W), (H) are for a standard machine. The dimensions are changed by parts added.
2. ◔ indicates the position of anchor bolts.
3. All external water pipes must be provided with welded ANSI 150 LB flanges by the customer.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 52 mm)
5. Installation clearance:

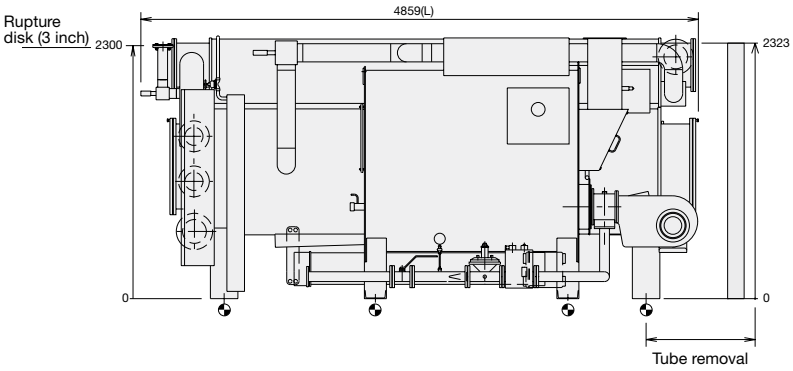
Ends	1000 mm
Top	200 mm
Others	500 mm

6. For the fuel connection diameter and position, refer to specifications.

16DJ	A	B
31	750	1375
32	550	1775

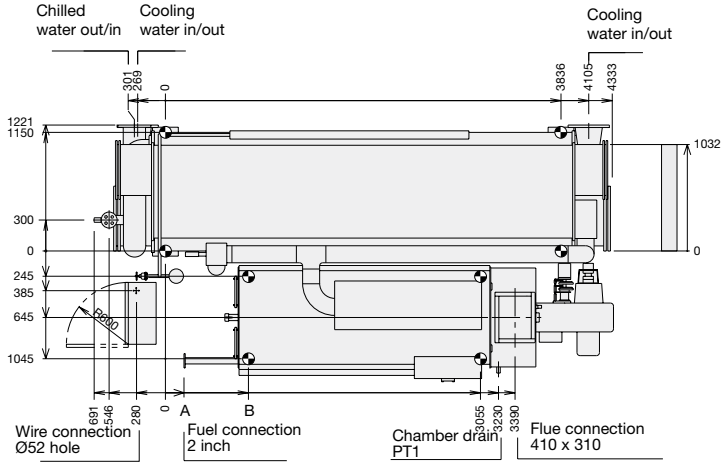


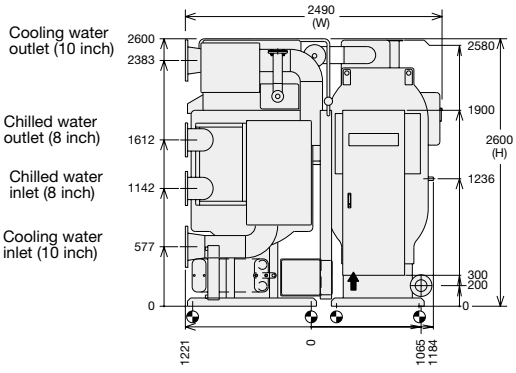


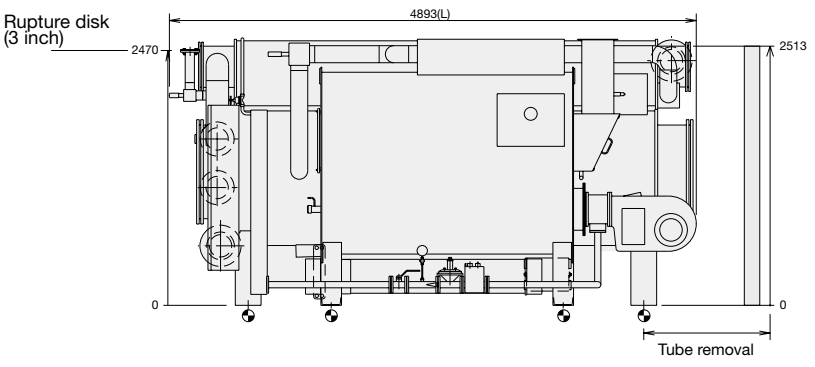


16DJ-41 through 16DJ-42 (mm)

16DJ	A	B
41	380	1005
42	180	805







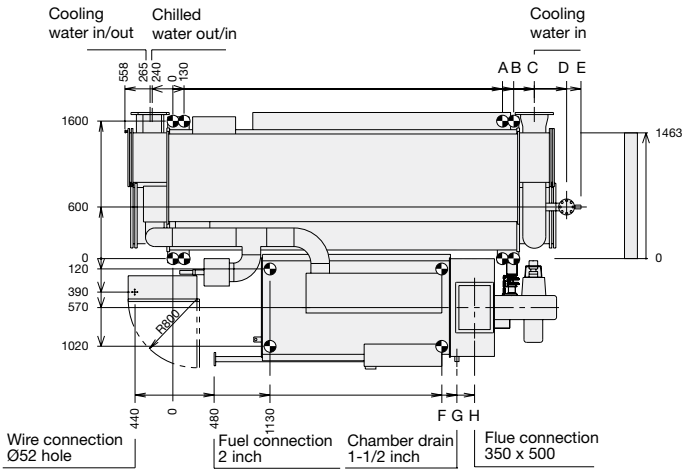
NOTE: Dimensions are for guidance only. Refer to the certified drawings supplied upon request when designing an installation.

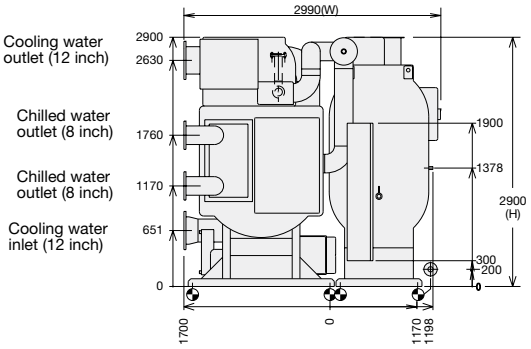
4.5 - Exhibit E (cont.)

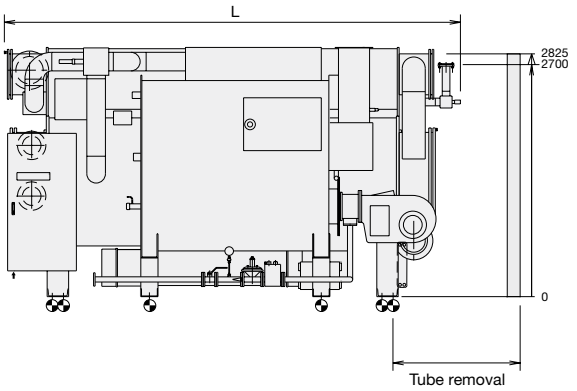
16DJ-51through 16DJ-53 (mm)

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. All external water pipes must be provided with welded ANSI 150 LB flanges by the customer.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 52 mm)
5. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm
6. For the fuel connection diameter and position, refer to specifications.

16DJ	A	B	C	D	E	F	G	H	K	L
51	3836	3966	4206	4582	4749	3130	3305	3511	4600	5036
52	4378	4508	4748	5124	5291	3330	3505	3711	5200	5578
53	4876	5006	5246	5622	5789	3530	3705	3911	5700	6076

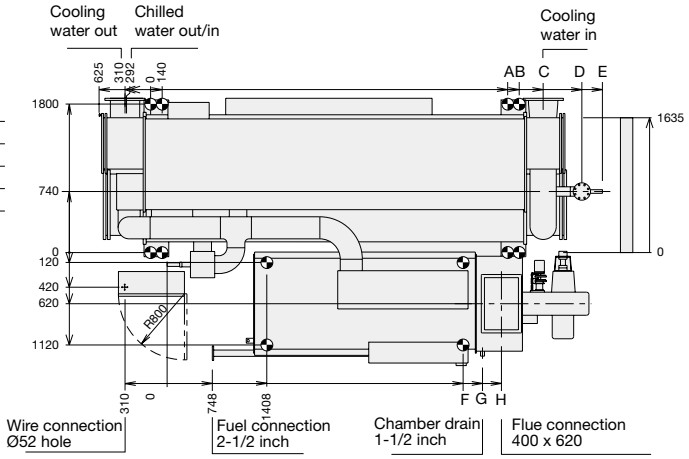


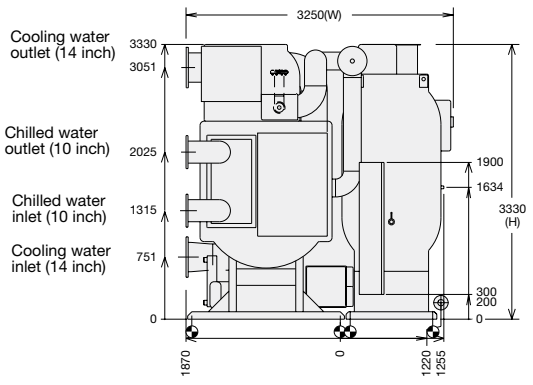


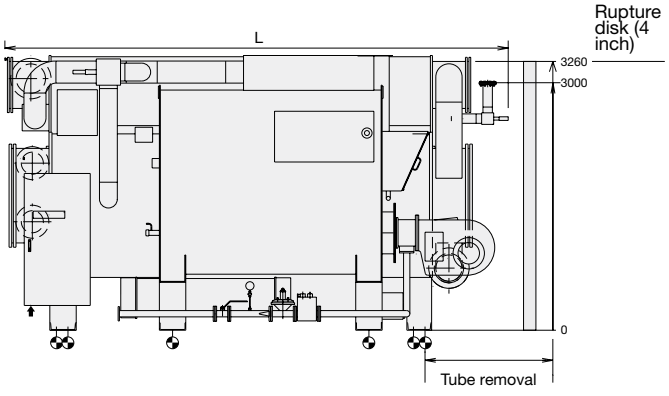


16DJ-61 through 16DJ-63 (mm)

16DJ	A	B	C	D	E	F	G	H	K	L
61	4328	4468	4758	5227	5476	3788	4023	4252	5200	5938
62	4828	4966	5256	5725	5974	4088	4323	4552	5700	6238
63	5351	5491	5781	6250	6499	4388	4623	4852	6200	6690







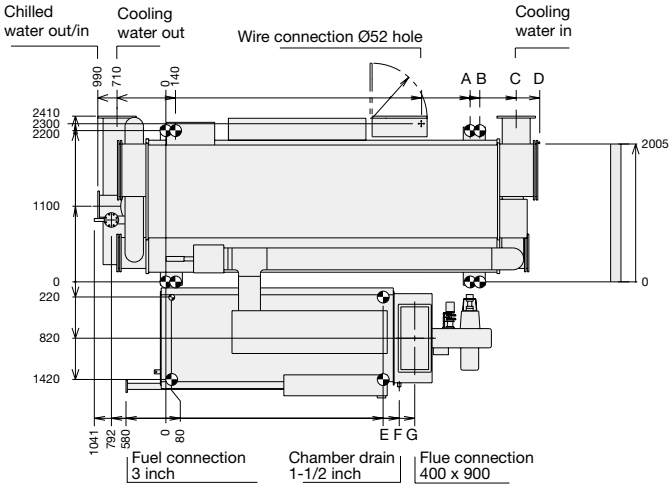
NOTE: Dimensions are for guidance only. Refer to the certified drawings supplied upon request when designing an installation.

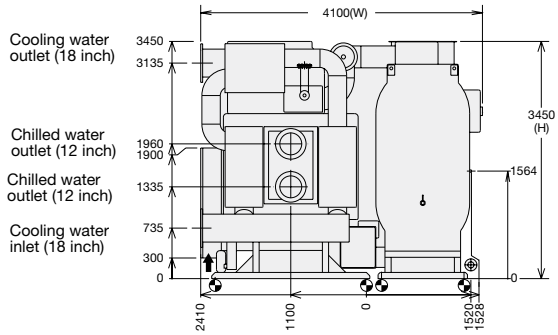
4.5 - Exhibit E (cont.)

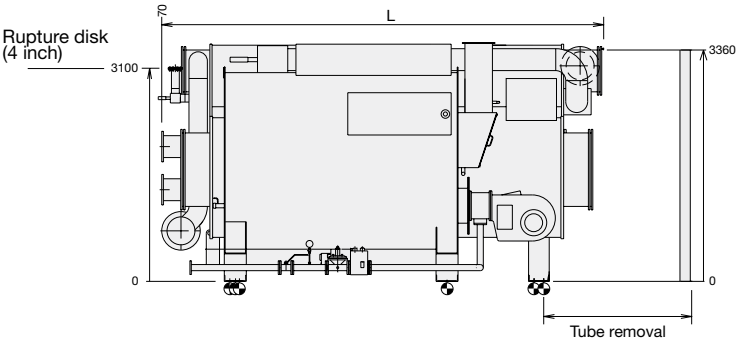
16DJ-71through 16DJ-73 (mm)

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. All external water pipes must be provided with welded ANSI 150 LB flanges by the customer.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 52 mm)
5. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm
6. For the fuel connection diameter and position, refer to specifications.

16DJ	A	B	C	D	E	F	G	K	L
71	4426	4566	5096	5440	3160	3395	3620	5700	6428
72	4951	5091	5621	5970	3480	3695	3920	6200	6953
73	5451	5591	6121	6470	3760	3995	4220	6700	7453

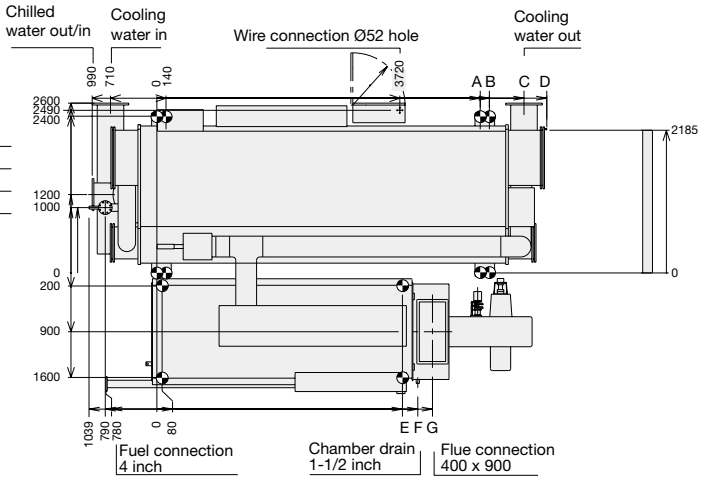


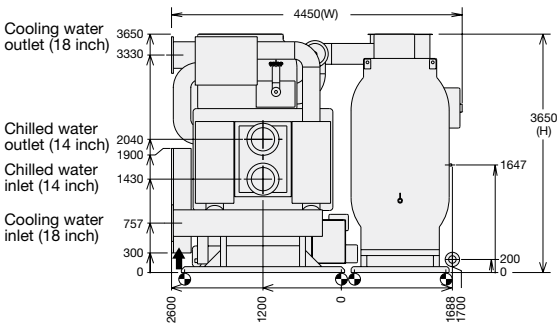


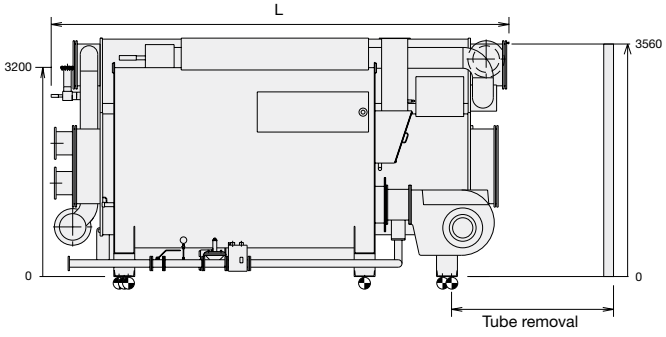


16DJ-81 through 16DJ-82 (mm)

16DJ	A	B	C	D	E	F	G	K	L
81	4951	5091	5621	5970	3780	3995	4220	6200	6960
82	5451	5591	6121	6470	3960	4195	4420	6700	7460







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

4.6 - Exhibit F

4.6.1 - Wire sizes

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

16DJ	208 V				460 V				400 V			
	Current	Wire section, mm²	Screw size	Tightening torque, Nm	Current	Wire section, mm²	Screw size	Tightening torque, Nm	Current	Wire section, mm²	Screw size	Tightening torque, Nm
11	21	4	M5	2.2-2.8	10.1	2.5	M5	2.2-2.8	10.8	2.5	M5	2.2-2.8
12	21	4	M5	2.2-2.8	10.1	2.5	M5	2.2-2.8	10.8	2.5	M5	2.2-2.8
13	21	4	M5	2.2-2.8	10.1	2.5	M5	2.2-2.8	10.8	2.5	M5	2.2-2.8
14	31.5	10	M6	4-5	15.1	2.5	M5	2.2-2.8	16.3	2.5	M5	2.2-2.8
21	31.5	10	M6	4-5	15.1	2.5	M5	2.2-2.8	16.3	2.5	M5	2.2-2.8
22	31.5	10	M6	4-5	15.1	2.5	M5	2.2-2.8	16.3	2.5	M5	2.2-2.8
23	37.3	10	M6	4-5	17.5	2.5	M5	2.2-2.8	19.2	4	M5	2.2-2.8
24	37.3	10	M6	4-5	17.5	2.5	M5	2.2-2.8	19.2	4	M5	2.2-2.8
31	37.3	10	M6	4-5	17.5	2.5	M5	2.2-2.8	19.2	4	M5	2.2-2.8
32	37.3	10	M6	4-5	17.5	2.5	M5	2.2-2.8	19.2	4	M5	2.2-2.8
41	51.3	16	M6	4-5	24.3	4	M6	4-5	26.0	6	M6	4-5
42	64.5	25	M6	4-5	30.1	10	M6	4-5	32.9	10	M6	4-5
51	68.3	25	M6	4-5	31.8	10	M6	4-5	34.9	10	M6	4-5
52	68.3	25	M6	4-5	31.8	10	M6	4-5	34.9	10	M6	4-5
53	68.3	25	M6	4-5	31.8	10	M6	4-5	34.9	10	M6	4-5
61	80.8	35	M8	8-10	37.5	10	M6	4-5	41.4	16	M6	4-5
62	91.6	35	M8	8-10	43.5	16	M6	4-5	48.7	16	M6	4-5
63	107	50	M8	8-10	50.4	16	M6	4-5	56.7	25	M6	4-5
71	110	50	M8	8-10	51.9	16	M6	4-5	58.7	25	M6	4-5
72	110	50	M8	8-10	51.9	16	M6	4-5	58.7	25	M6	4-5
73	124.0	70	M8	8-10	59.4	25	M6	4-5	66.8	25	M6	4-5
81	127.9	70	M8	8-10	61.2	25	M6	4-5	68.8	25	M6	4-5
82	127.9	70	M8	8-10	61.2	25	M6	4-5	68.8	25	M6	4-5

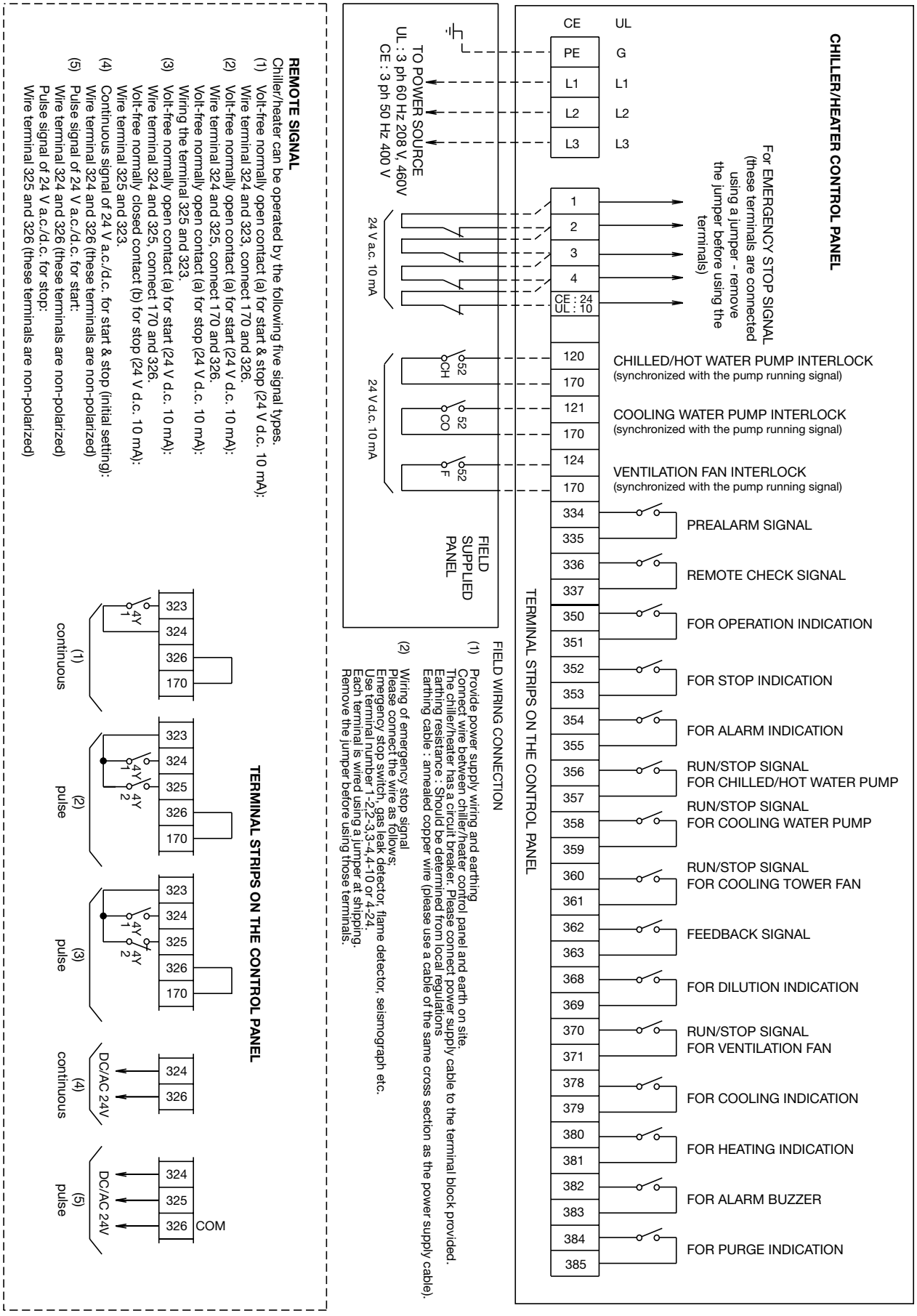
Other signals (copper only, over-voltage category II - IEC 60664)

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

4.6 - Exhibit F (cont.)

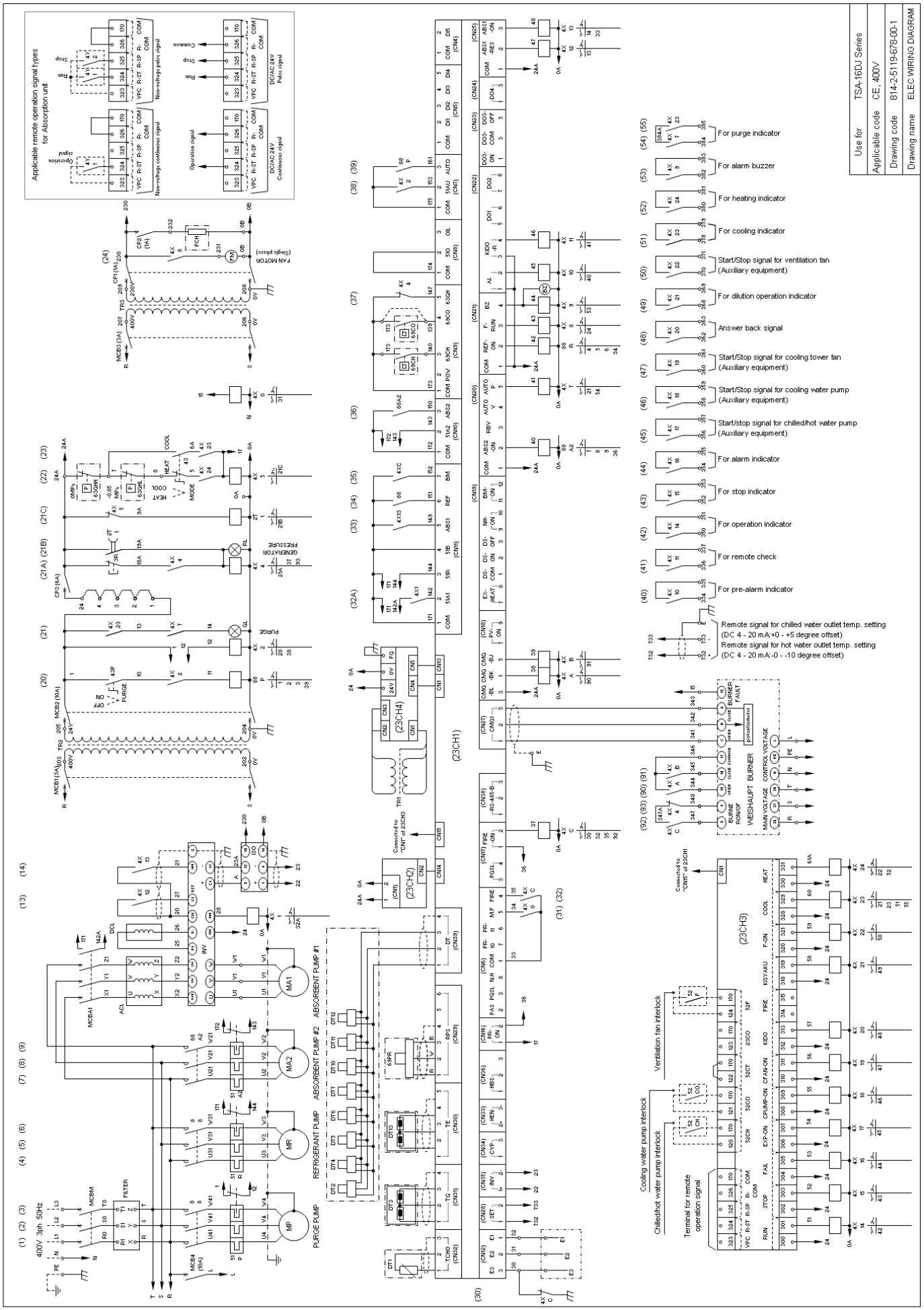
4.6.2 - Field wiring

Fig. 28 - Typical electric field connection diagram



4.6 - Exhibit F (cont.)

4.6.3 - Wiring diagram



4.6 - Exhibit F (cont.)

4.6.3 - Legend for wiring diagram

Symbol	Name	Remarks
ACL	AC reactor	
BURNER	Weishaupt burner	
BZ	Alarm buzzer	
CP1 - 3	Circuit protector	
DCL	DC reactor	
DT1	Leaving chilled/hot water temperature sensor	
DT2	Leaving cooling water temperature sensor	
DT3	High-temperature generator temp. sensor	
DT4	Low-temperature generator temp. sensor	
DT5	Condenser temperature sensor	
DT6	Entering chilled/hot water temperature sensor	
DT7	Entering cooling water temperature sensor	
DT10	Absorber temperature sensor	
DT11	Evaporator temperature sensor	
DT12	Intermediate cooling water temp. sensor	
DT13	Exhaust gas temperature sensor	
E1-3	High-temp.generator solution level electrode	
FILTER	EMI Filter	
FM	Fan motor	
GL	Purge indication light	
INV	Inverter	
ISO	Isolator	
MA1	Absorbent pump 1	
MA2	Absorbent pump 2	
MP	Purge pump	
MR	Refrigerant pump	
MCBM	Main circuit breaker	
MCBA1	Absorbent pump 1 circuit breaker	
MCB1 - 3	Circuit breaker	
PCH	Palladium cell heater	
RL	Generator pressure indication light	
TR1 - 3	Transformer	
23CH1	CPU board	
23CH2	Indication board	
23CH3	I/O board	
23CH4	Power board	
3R	Generator pressure reset button	
4Xn	Control relay	
43P	Purge pump ON-OFF switch	
43T	Mode select switch	
51A2	Absorbent pump 2 overcurrent relay	
51P	Purge pump overcurrent relay	
51R	Refrigerant pump overcurrent relay	
63GHH	High-temperature generator pressure switch	Cooling (0 MPa)
63GHL	High-temperature generator pressure switch	Heating (-0.05 MPa)
69CH	Chilled/hot water flow switch	
69PR	Pressure sensor for purge tank	
88A2	Absorbent pump 2 solenoid switch	
88P	Purge pump solenoid switch	
88R	Refrigerant pump solenoid switch	
4Y1 & 2	Remote signal	
52CH	Chilled/hot water pump interlock	Field-supplied
52CO	Cooling water pump interlock	Field-supplied
52F	Ventilation fan interlock	Field-supplied

CPU board output

PR-ON	Combustion ready
FIRE-ON	Combustion on
PGSL	Not used
CMG-BK	Control valve open
CMG-BL	Common control valve
CMG-BJ	Control valve closed
PV-ON	Not used
DS-COM	Not used
DS-ON	Not used
DS-OFF	Not used
EX-HEAT	Not used
NH-ON	Not used
BM-ON	Not used
ABS2-ON	Absorbent pump 2 on
RBV	Not used
AUTOV	Not used
AUTOP	Purge signal on
REF-ON	Refrigerant pump on
F-RUN	Cooling fan on
BZ	Alarm buzzer
AL	Pre-alarm
KIDO-R	Remote check
DO1	Not used
DO2	Not used
DO3-ON	Not used
DO3-COM	Not used
DO3-OFF	Not used
DO4	Not used
ABS1-RES	Absorbent pump 1 inverter reset
ABS1-ON	Absorbent pump 1 on

I/O board output

RUN	Run
STOP	Stop
FAIL	Fail
EXP-ON	Chilled/hot water pump on
CPUMP-ON	Cooling water pump on
CFAN-ON	Cooling tower fan on
KIDO	Feedback signal
FIRE	Not used
KISYAKU	Dilution
F-ON	Ventilation fan on
COOL	Cooling
HEAT	Heating

CPU board input

E1	Generator solution level electrode high
E2	Generator solution level electrode low
E3	Generator solution level electrode ground
51A1	Absorbent pump 1 over-current
51R	Refrigerant pump over-current
51B	Burner blower over-current
ABS1	Absorbent pump 1 on
REF	Refrigerant pump on
BM	Burner blower on
51A2	Absorbent pump 2 over current
ABS2	Absorbent pump 2 on
POW	Not used
69CH	Chilled/hot water flow switch
69CO	Cooling water flow switch
63GH	Generator pressure switch
51O	Not used
OIL	Not used
51AU	Purge pump over-current
AUTO	Purge pump on
PAS	Not used
PGSL	Not used
FIRE	Combustion
M.F	Conbustion error
PR-11	Not used
PR-10	Not used
N.H	Not used
DI1	Not used
DI2	Not used
DI3	Not used
DI4	Not used
DI5	Not used

I/O board input

R-COM	Common remote signal
R-SP	Remote stop signal
R-ST	Remote start signal
VPC	Remote signal power supply
COM	Input signal common
52CH	Chilled/hot water pump interlock signal
52CO	Cooling water pump interlock signal
52CT	Not used
23CO	Not used
52F	Ventilation fan interlock signal

CPU board analogue output

INV	Inverter frequency
CVP	Control valve
HEN	Not used

CPU board analogue input

SET	Remote temperature setting
CMG1	Control valve feedback

CPU board sensor input

TCHO	Chilled/hot water outlet
TG	Generator
TE	Exhaust gas
PRS	Purge tank pressure
DT	Digital temperature sensor

Communication

RS-485-A	Not used
RS-485-B	Not used
RS-232C	RS-232C
HBS	Not used

4.6 - Exhibit F (cont.)

4.6.4 - Wiring for burner control

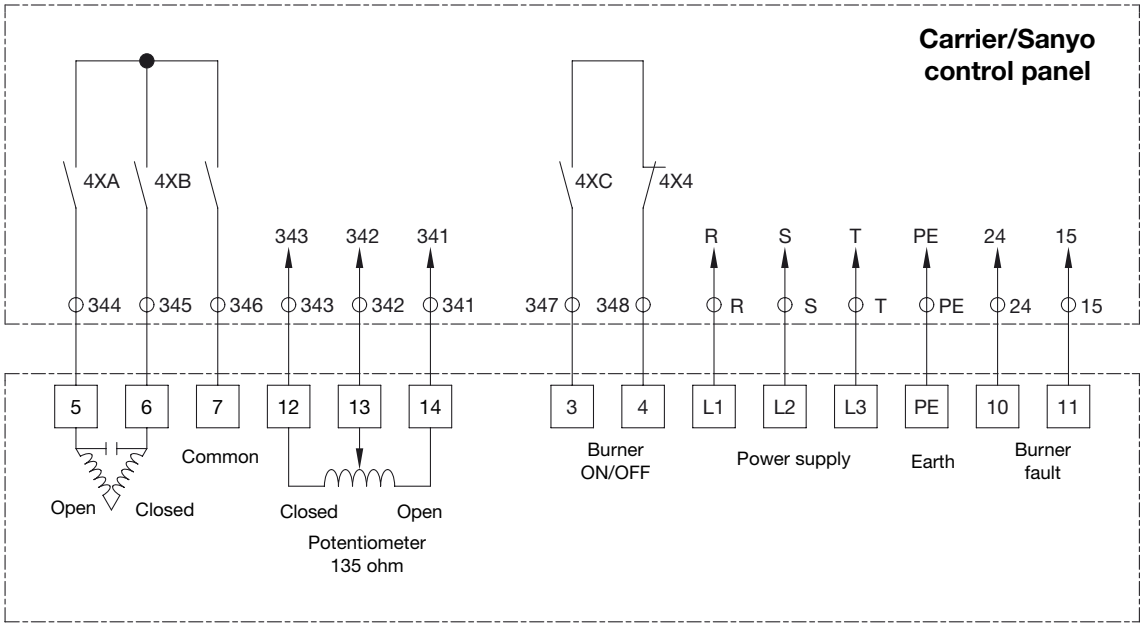
Electrical signal from chiller to burner

1. Power supply: 3 phase R, S T (3 wires)
   Do not use N line (neutral).
2. On/Off signal from 4X4 and 4XC chiller relays
   No voltage and normally open signal:
   ON for operation
   OFF for stop.
3. Fuel control valve open signal from 4XA chiller relay
   No voltage and normally open signal:
   ON for valve open
4. Fuel control valve closed signal from 4XB chiller relay
   No voltage and normally open signal:
   ON for closed valve

Electrical signal from burner to chiller

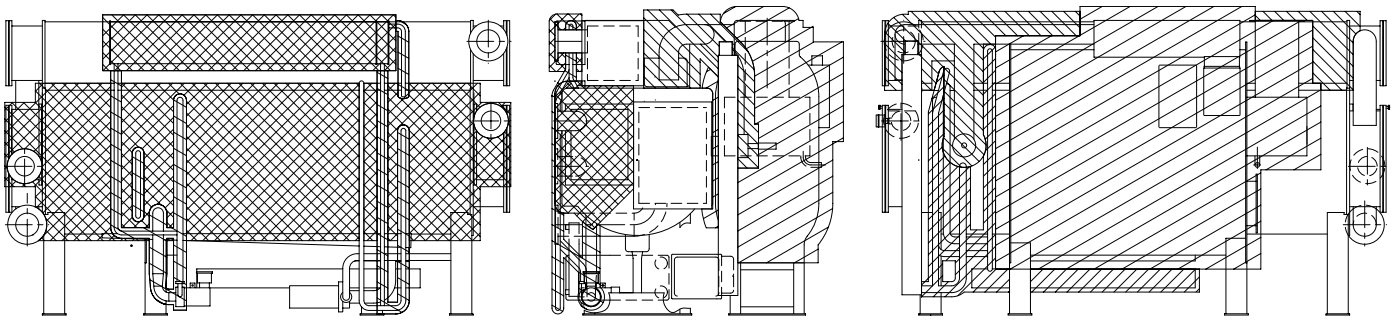
1. Fuel control valve opening signal 0 - 135 ohm (feedback signal)
2. Burner fault signal
   No voltage and normally open signal:
   Closed on fault.
3. Earth line (PE)

Fig. 29 - Weishaupt burner panel



4.7 - Exhibit G

Fig. 30 - Insulation area



100 mm thick insulation for hot surfaces
75 mm thick insulation for hot surfaces
30 mm thick insulation for hot surfaces
50 mm thick insulation for cold surfaces
30 mm thick insulation for cold surfaces

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 motor of the refrigerant pump.***
6. ***Evaporator header covers and high temperature generator chamber covers shall be removable.***
7. ***The face of the high temperature generator to the burner is mounted shall be insulated by 50 mm thickness insulator.***

16DJ	Hot surface insulation m^2			Cold surface insulation m^2	
	100 mm	75 mm	30 mm	50 mm	30 mm
11	5.8	2.2	2.9	4.0	0.4
12	6.2	2.2	3.0	4.0	0.4
13	7.8	3.2	4.2	5.5	0.4
14	8.0	3.2	4.3	5.5	0.4
21	10.1	3.8	4.9	5.1	0.5
22	10.4	3.8	5.0	5.1	0.5
23	11.8	4.8	5.5	7.6	0.5
24	12.5	4.8	5.6	7.6	0.5
31	14.5	5.5	6.2	8.5	0.7
32	15.2	5.5	6.4	8.5	0.7
41	17.5	5.7	6.8	9.9	0.7
42	18.1	5.7	7.0	9.9	0.7
51	19.6	5.4	7.6	13.8	1.1
52	20.7	5.9	7.9	15.0	1.1
53	21.7	6.2	8.2	16.1	1.1
61	25.4	7.2	9.7	17.5	1.2
62	27.2	7.7	10.1	18.7	1.2
63	28.9	8.2	10.5	20.0	1.2
71	35.4	10.4	12.1	10.9	1.4
72	37.4	10.7	12.4	11.4	1.4
73	39.4	11.0	12.7	11.8	1.4
81	42.5	11.0	13.0	13.1	1.5
82	44.0	11.3	13.5	13.6	1.5

4.8 - Exhibit H

Material safety data sheet for LiBr
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

4.8.1 - 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

4.8.2 - Composition/information on ingredients

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

4.8.3 - Hazards identification

Adverse human health effects
Risk of serious damage to eyes

4.8.4 - 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.

4.8.5 - 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

4.8.6 - 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.

4.8.7 - 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").

4.8.8 - Exposure controls/personal protection

Exposure limits

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

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.

4.8.9 - 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

4.8.10 - 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

4.8.11 - 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.

4.8.12 - 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

4.8.13 - Disposal considerations

Waste disposal

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

4.8.14 - Transportation information

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

4.8.15 - 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

4.8.16 - Other information

This data sheet contains changes from the previous version in section(s) 4.8.12 and 4.8.15.

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

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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.

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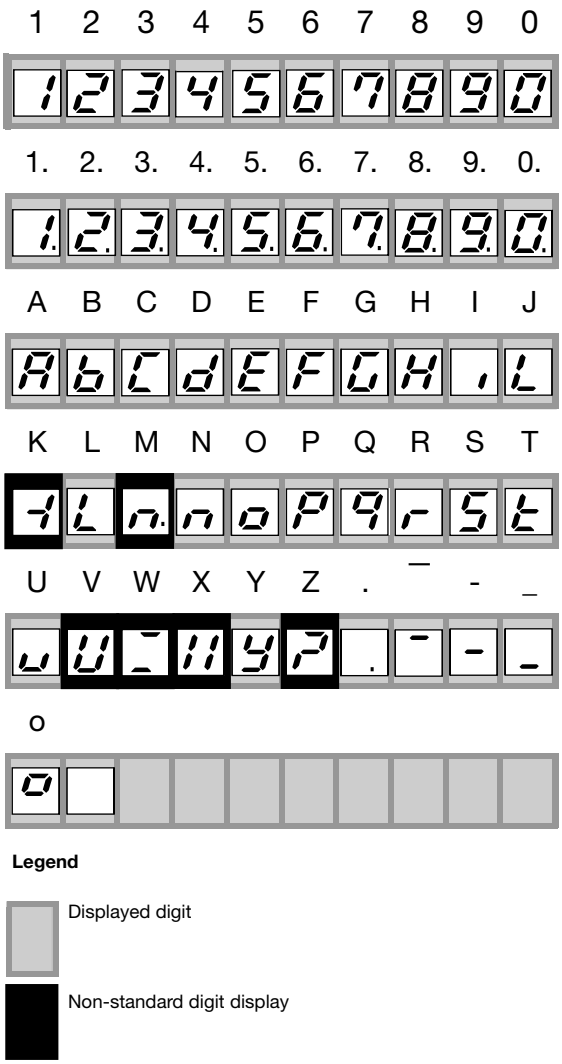
End of safety data sheet

4.9 - Exhibit I

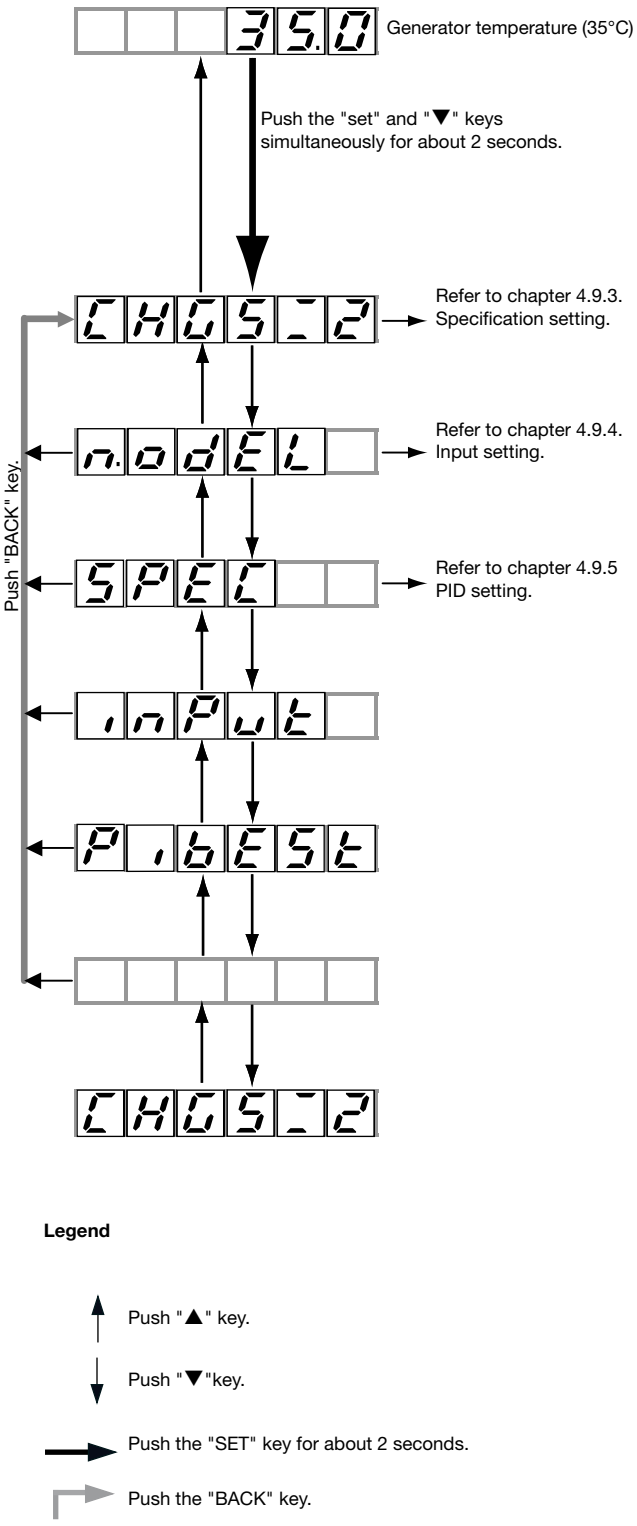
4.9.1 - Character recognition table for digital display

Fig. 31



4.9.2 - Instructions to verify operation board parameters

Fig. 32



4.9 - Exhibit I (cont.)

4.9.3 - Specification setting

Fig. 33

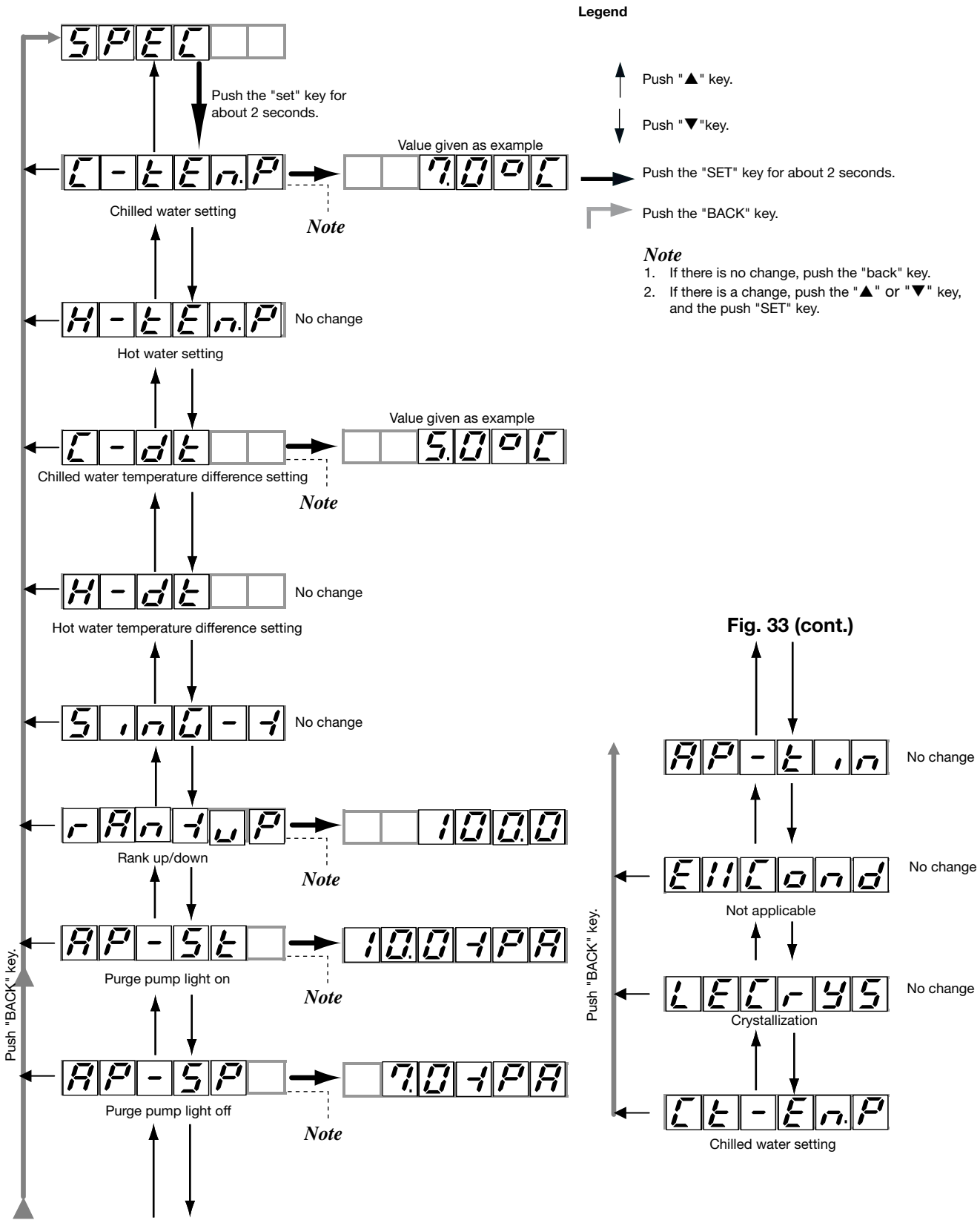


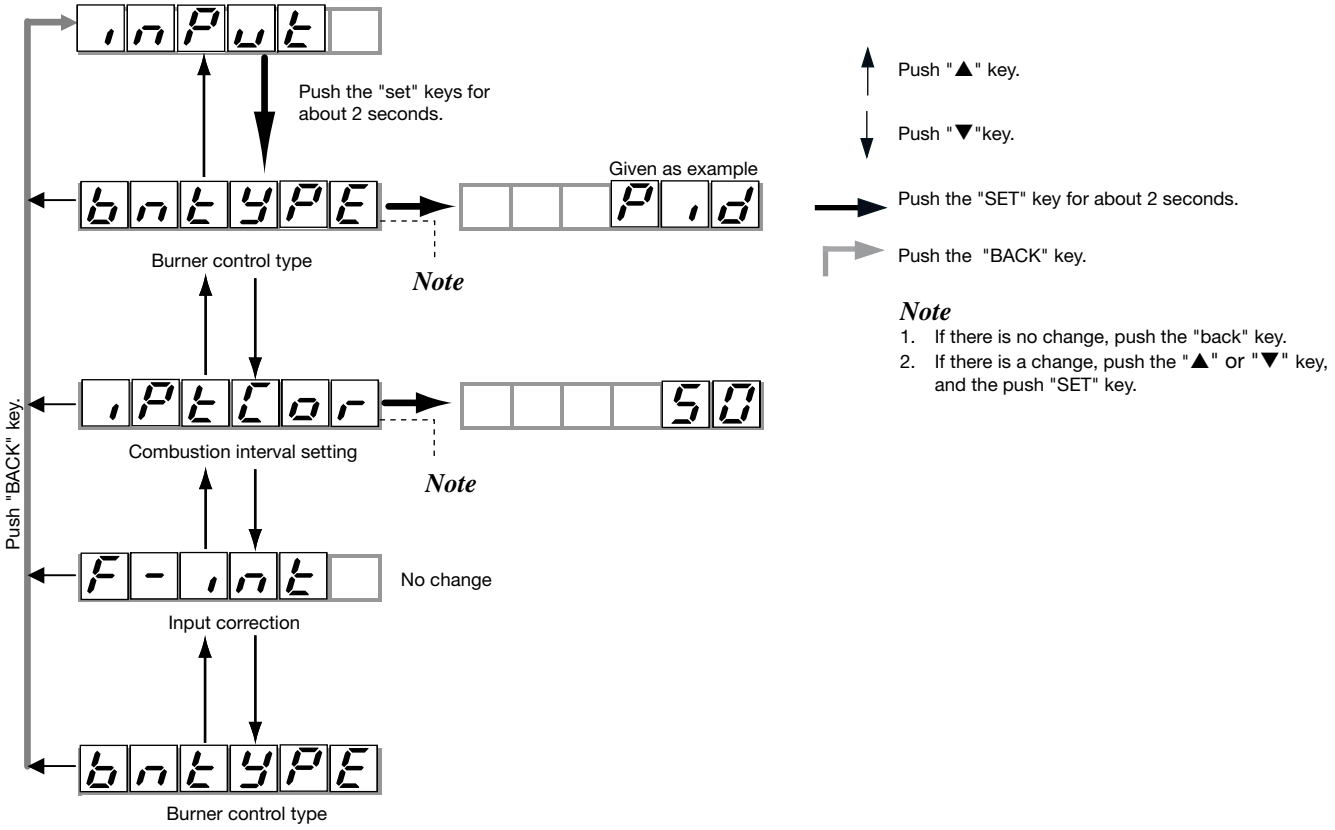
Fig. 33 (cont.)

Fig. 33 (cont.)

4.9 - Exhibit I (cont.)

4.9.4 - Input setting

Fig. 34



4.9.5 - Inverter setting

Fig. 35

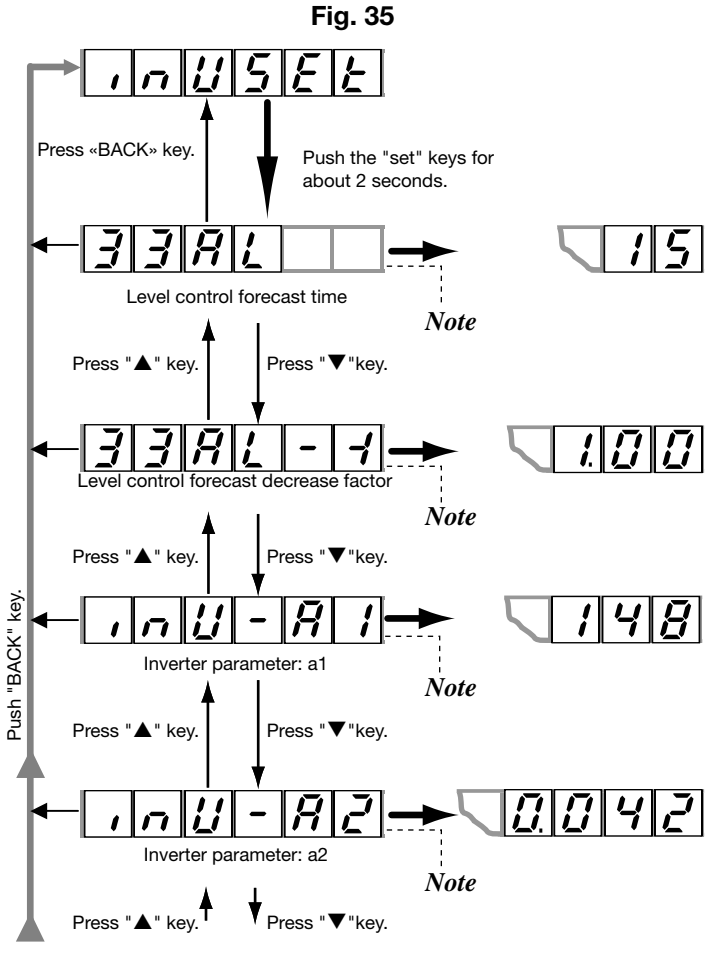


Fig. 35 (cont.)

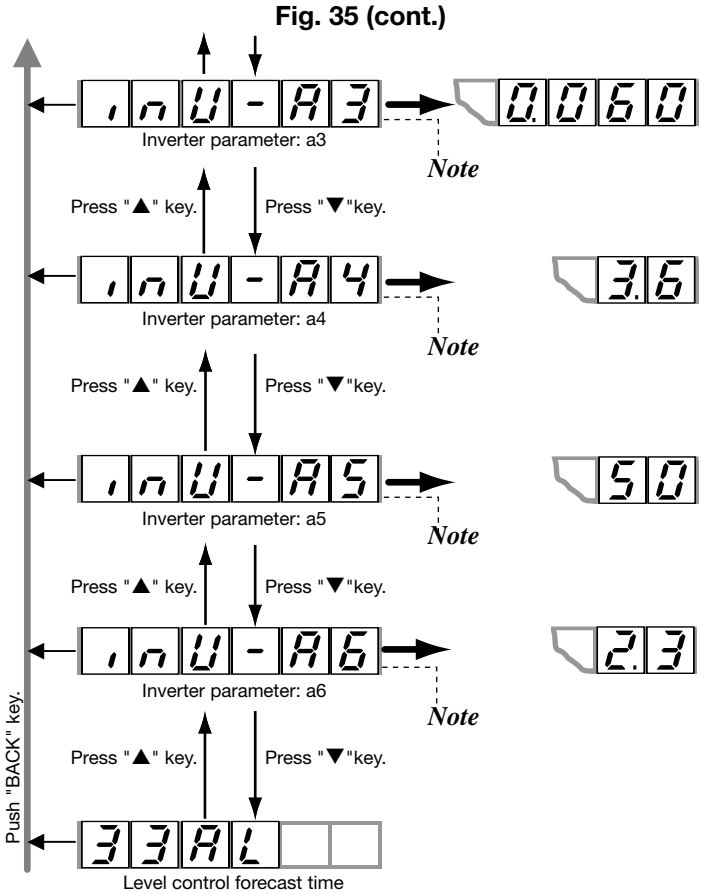
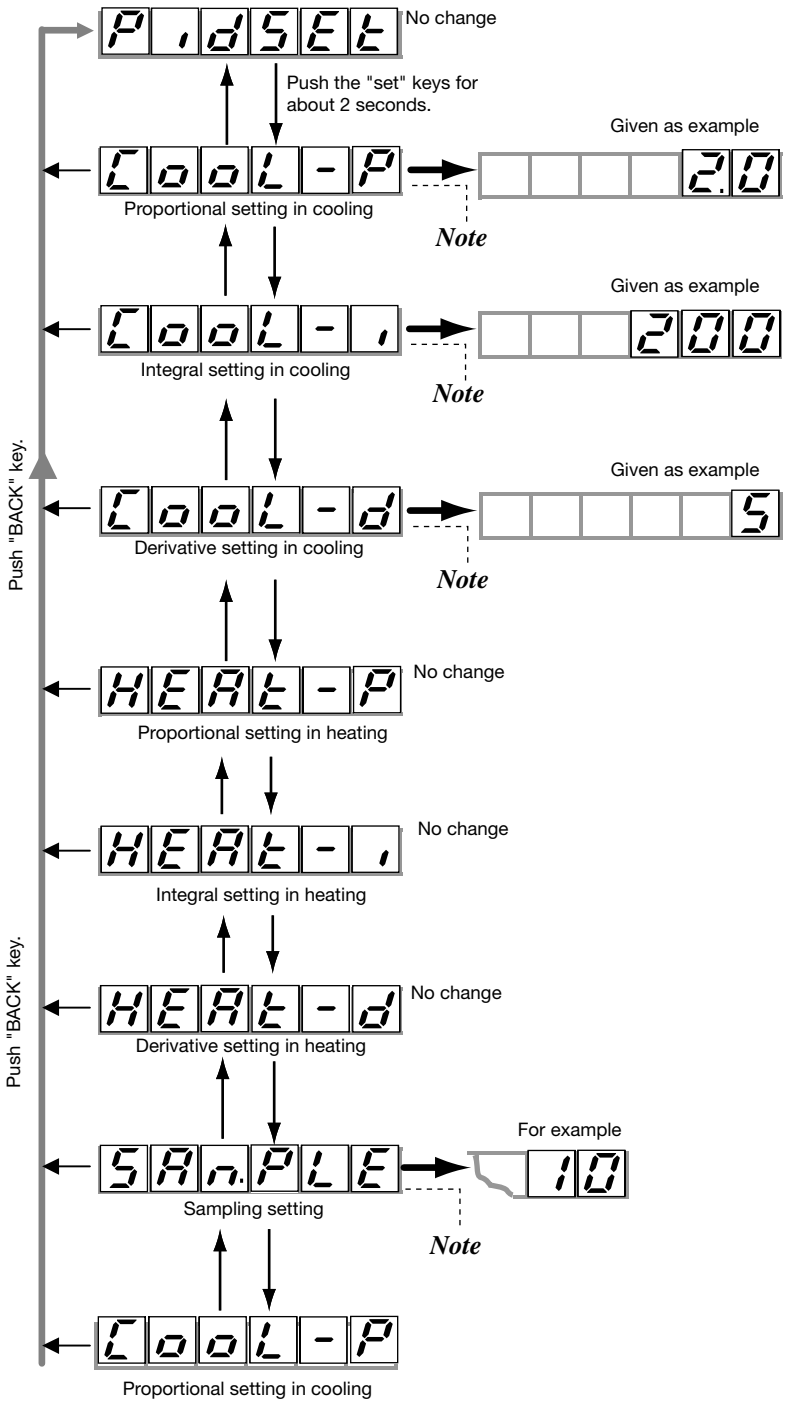


Fig. 35 (cont.)

4.9 - Exhibit I (cont.)

4.9.6 - PID setting

Fig. 36



Legend

Push "▲" key.

Push "▼"key.

Push the "SET" key for about 2 seconds.

Push the "BACK" key.

Note

1. If there is no change, push the "back" key.
2. If there is a change, push the "▲" or "▼" key, and the push "SET" key.

4.9 - Exhibit I (cont.)

4.9.7 - Field setting

Fig. 37

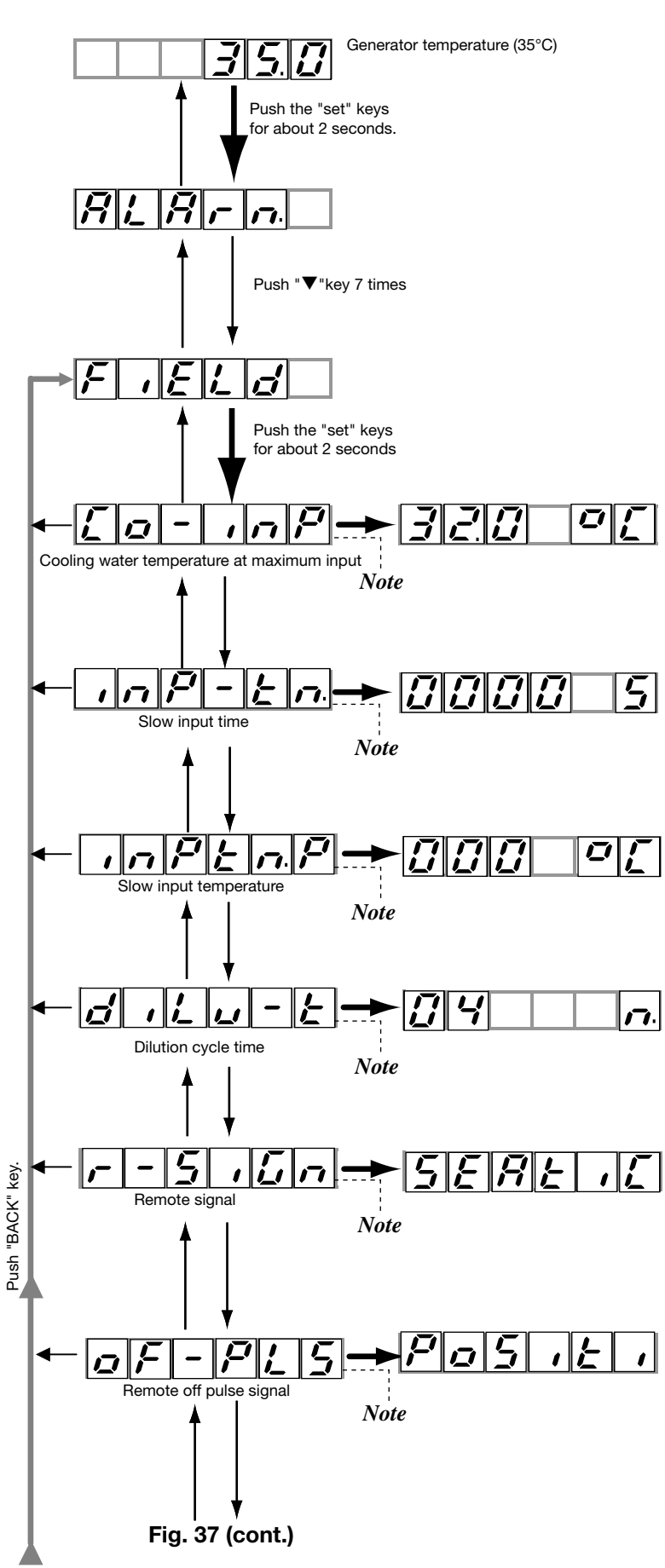


Fig. 37 (cont.)

Legend

Push "▲" key.

Push "▼"key.

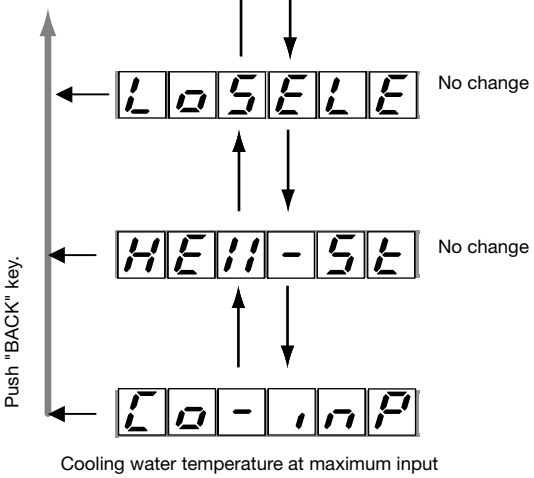
Push the "SET" key for about 2 seconds.

Push the "BACK" key.

Note

1. If there is no change, push the "back" key.
2. If there is a change, push the "▲" or "▼" key, and the push "SET" key.

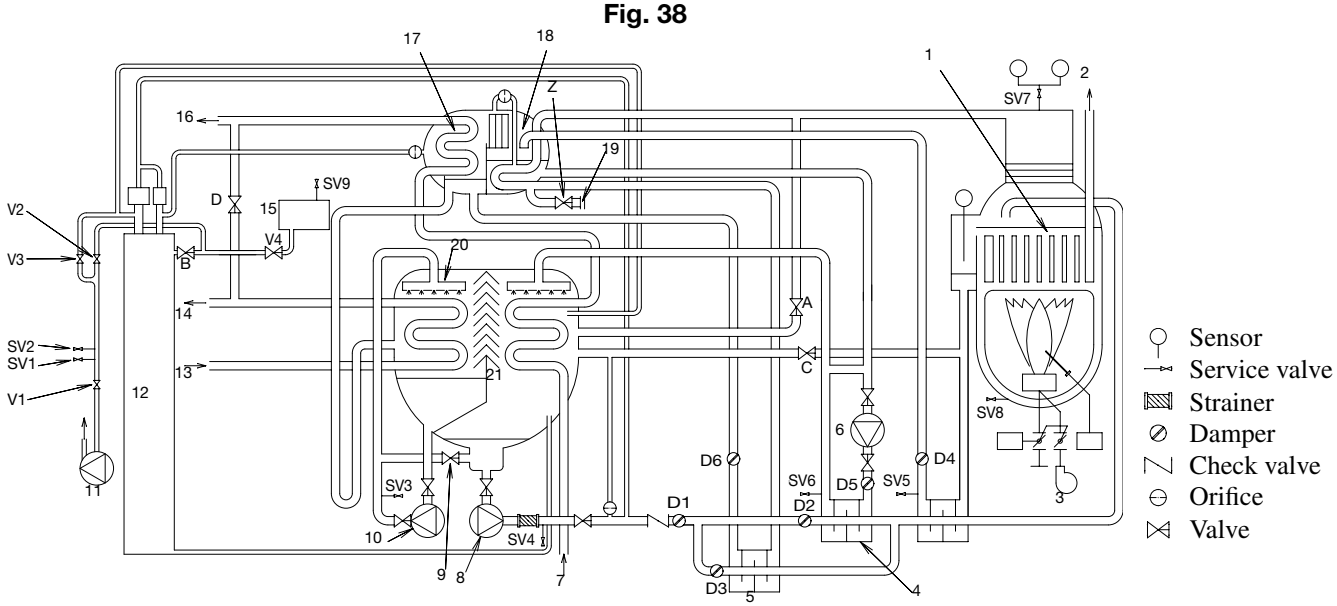
Fig. 37 (cont.)



4.10 - Exhibit J (cont.)

4.10.2 - Flow diagram and damper and valve position

Fig. 38



Legend

1	High-temperature generator
2	Exhaust gas
3	Burner
4	Low-temperature heat exchanger
5	Refrigerant drain heat reclaimer
6	Absorbent pump 2
7	Cooling water inlet
8	Absorbent pump 1
9	Refrigerant blow valve
10	Refrigerant pump
11	Purge pump
12	Purge unit
13	Chilled/hot water inlet
14	Chilled/hot water outlet
15	Purge tank
16	Cooling water outlet
17	Condenser
18	Low-temperature generator
19	Rupture disk
20	Evaporator
21	Absorber

D1	Diluted solution, main damper
D2	Diluted solution, low temperature heat exchanger damper
D3	Diluted solution, refrigerant drain heat reclaimer damper
D4	Internediate solution damper
D5	Concentrated solution damper
D6	Refrigerant solution damper
SV1	Charge/discharge N_2 gas service valve
SV2	Purge unit service valve
SV3	Refrigerant service valve
SV4	Diluted solution service valve
SV5	Intermediate solution service valve
SV6	Concentrated solution service valve
SV7	Generator pressure gauge service valve
SV8	Generator maintenance service valve
SV9	Purge tank service valve
V1	Manual purge valve
V2	Manual purge valve
V3	Manual purge valve
V4	Manual purge valve
A valve	Cooling/heating changeover valve
B valve	Cooling/heating changeover valve
C valve	Cooling/heating changeover valve
D valve	Cooling/heating changeover valve
Z valve	Rupture disk isolation valve

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

16DJ	D1	D2	D3	D4	D5	D6
11	35	22	22	25	5	45
12	35	40	40	42	40	30
13	40	38	19	60	20	42
14	35	48	38	50	45	30
21	40	90	20	60	60	50
22	40	90	20	60	60	50
23	45	90	45	40	45	30
24	45	90	45	40	45	30
31	45	55	36	37	26	35
32	50	32	28	42	42	25
41	50	45	43	54	23	44
42	46	35	31	43	22	28
51	40	60	35	60	30	30
52	40	65	35	65	30	30
53	45	70	30	70	30	30
61	45	70	35	75	30	30
62	35	90	35	90	20	28
63	35	75	32	88	28	27
71	40	80	30	90	28	27
72	40	82	28	90	28	26
73	45	90	28	90	28	26
81	45	90	25	90	27	25
82	45	90	25	90	27	25

Valve position

Cooling		Heating	
Valve name	**Position**	**Valve name**	**Position**
A	closed	A	open
B	open	B	closed
C	closed	C	open
D	closed	D	open
SV1	closed	SV1	closed
SV2	closed	SV2	closed
SV3	closed	SV3	closed
SV4	closed	SV4	closed
SV5	closed	SV5	closed
SV6	closed	SV6	closed
SV7	open	SV7	open
SV8	closed	SV8	closed
V1	closed	V1	closed
V2	closed	V2	closed
V3	closed	V3	closed
V4	open	V4	closed

GB/T-24001 to ISO14001:1996

Carrier

SANYO

Order No.: 11612-76, 07.2006. Supersedes order No.: New
Manufacturer reserves the right to change any product specifications without notice.

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