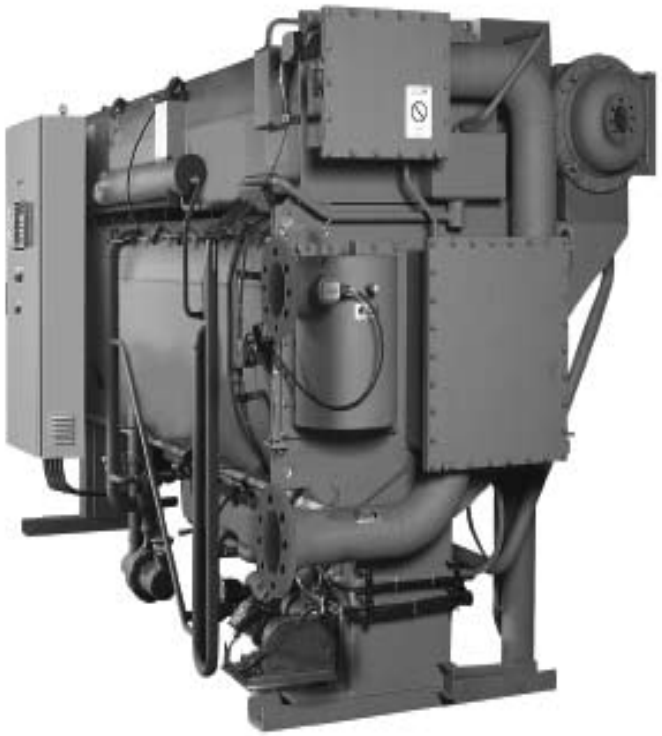
Carrier
SANYO

16NK
Double-Effect Steam-Fired Absorption Chillers

Nominal cooling capacity 345-4652 kW

50 Hz



Installation instructions

GB/T-19001-2000 to ISO9001/2000

NOTES TO USERS

Thank you for purchasing a Carrier/Sanyo absorption chiller.

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

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

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

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

Contents

* NKI - Not used

1 - INSTALLATION

1.1 - Environmental requirements and safety precautions

1.1.1 - Installation considerations

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

1.1.2 - Field wiring

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

1.1.3 - Altitude

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

1.1.4 - Safety precautions

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

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

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

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

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

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

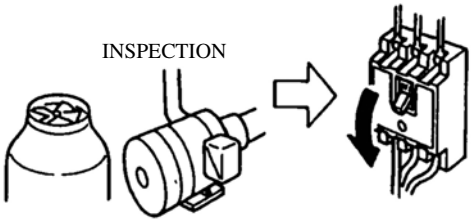
- After reading this manual, it should be kept in a safe place to be available for any user at any time.

1.1.4.1 Safety considerations

WARNINGS

TURN OFF THE BREAKER BEFORE CLEANING AND CHECKING

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



STOP OPERATION IN CASE OF FIRE, EARTHQUAKE OR ELECTRICAL STORMS

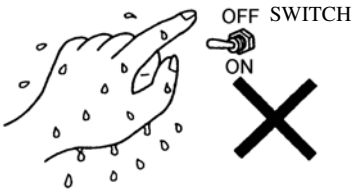
Stop operation in case of fire, earthquake or an electrical storm, to prevent fire or electric shock.

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.

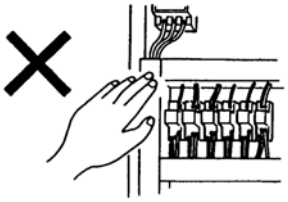
DO NOT TOUCH



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

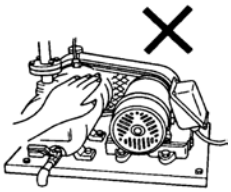


WARNINGS

DO NOT TOUCH ROTATING MOTOR PARTS

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

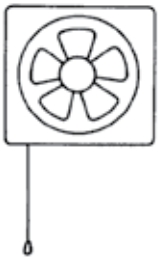
PROHIBITED



VENTILATE THE MACHINE ROOM

Ventilate the machine room while nitrogen gas is discharged to avoid anoxia.

MUST BE OPERATED

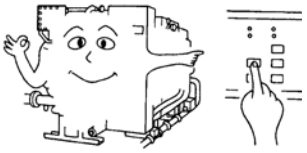


CAUTIONS

SOLVE ALL PROBLEMS BEFORE RESTARTING THE CHILLER

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

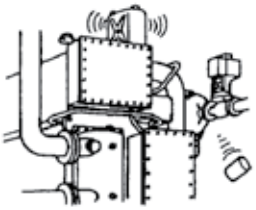
MUST BE OBSERVED



DO NOT PLACE HEAVY OBJECTS ON THE CHILLER OR CONTROL PANEL

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

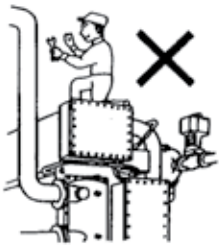
PROHIBITED



DO NOT CLIMB ON THE CHILLER

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

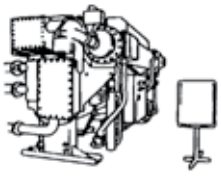
PROHIBITED



AUTHORIZED PERSONNEL ONLY

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

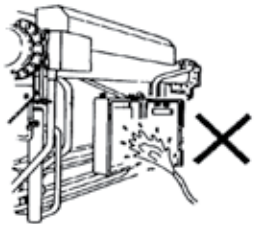
PROHIBITED



DO NOT POUR WATER ON THE CHILLER OR CONTROL PANEL

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

PROHIBITED

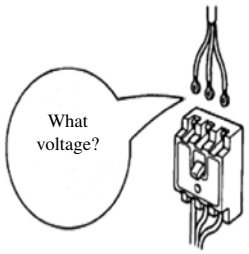


CAUTIONS

USE THE CORRECT POWER SUPPLY

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

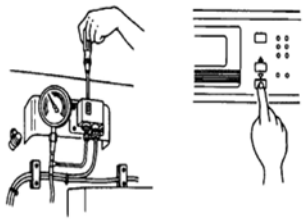
PROHIBITED



NEVER CHANGE THE SET VALUES

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

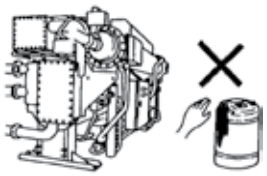
PROHIBITED



DO NOT TOUCH THE ABSORBENT

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

PROHIBITED

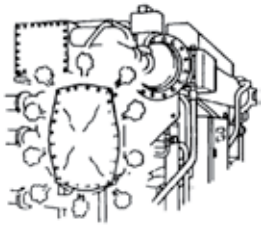


OBSERVE THE SPECIFIED WATER/STEAM PRESSURE

The specified chilled water, cooling water and steam pressure must be strictly observed.

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

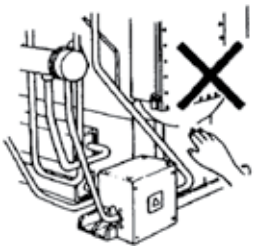
MUST BE OBSERVED



DO NOT TOUCH HIGH-TEMPERATURE AREAS

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

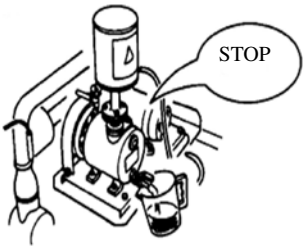
PROHIBITED



STOP THE PURGE PUMP TO REPLACE OIL

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

MUST BE OBSERVED



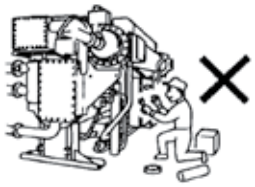
1.1.4.2 - Safety precautions for repair, moving or disposal

WARNINGS

ONLY AUTHORIZED PERSONNEL SHOULD SERVICE THE CHILLER

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

PROHIBITED

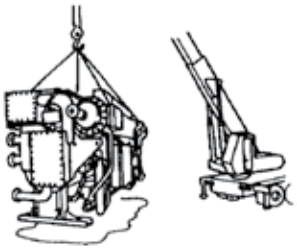


CAUTIONS

ONLY AUTHORIZED PERSONNEL SHOULD REMOVE OR REPAIR THE CHILLER

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

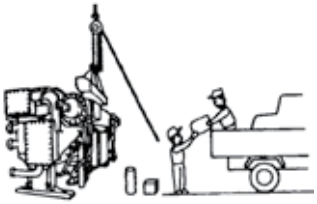
MUST BE OBSERVED



ONLY AUTHORIZED PERSONNEL SHOULD DISPOSE OF THE CHILLER

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

MUST BE OBSERVED



1.2 - Safe installation

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

1.3 - Delivery inspection

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

The chiller is factory-filled with nitrogen gas at a pressure of 20 kPa to prevent air from entering the chiller during transport. If the pressure inside the chiller is kept at approximately 20 kPa, there will not be any leakage in the vacuum sections. If the pressure inside the chiller is 0 kPa, there are leakages in the vacuum sections.

The pressure can be measured by opening SV7. Opening SV7, the pressure is shown on the generator pressure gauge. If the pressure is 0 kPa, leakage points can be detected with pressurised nitrogen gas of 50 kPa. (Refer to 1.9.1 - Leak test). After confirming the pressure, seal the cap of SV7 with sealant.

- Check for physical damage to the chiller
  - Main shell (lower shell and upper shell)
  - High-temperature generator
  - High and low-temperature heat exchangers
  - Heat reclaimer
  - Valves
  - Control panel
  - Wiring and electric piping
  - Accessories
- Check the shipping or packing slip sent with the chiller and note all missing items.
- Check all boxes or crates shipped with the chiller for missing items.

NOTES:

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

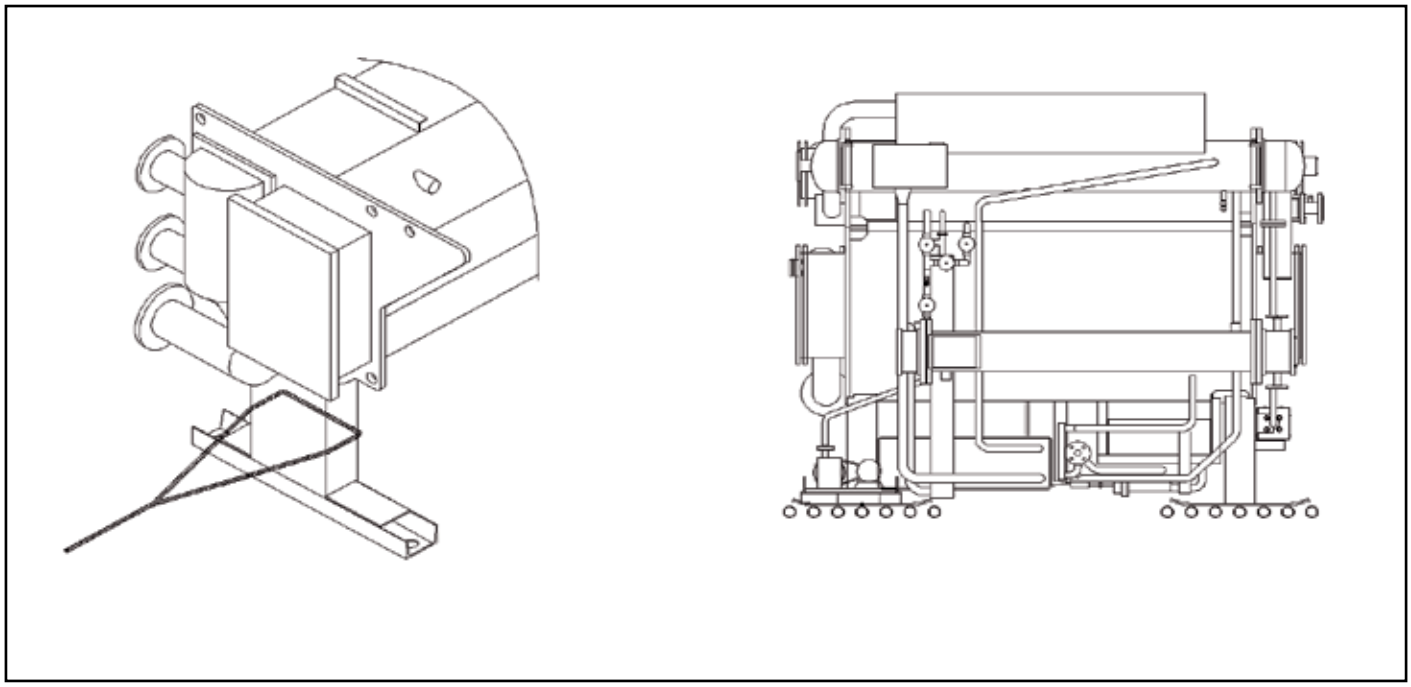
1.4 - Rigging

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

1.5 - Moving the chiller

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

Fig. 1



1.6 - Placing chiller on the foundation

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

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

1.7 - Levelling

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

A B

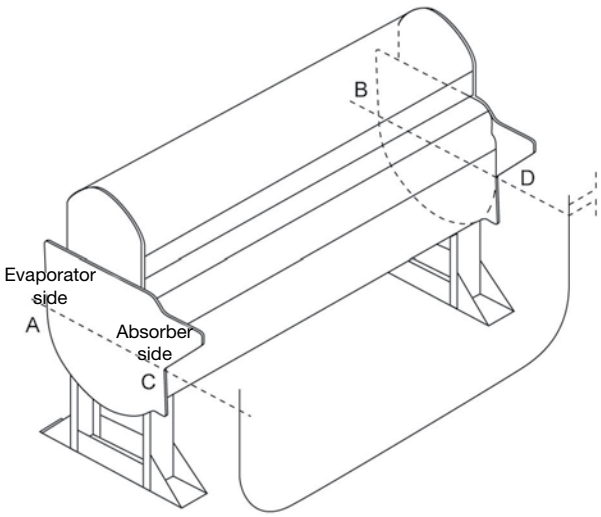
(Evaporator side)

(Absorber side)

C D

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

Fig. 2



- The levelling calculation is as shown below:

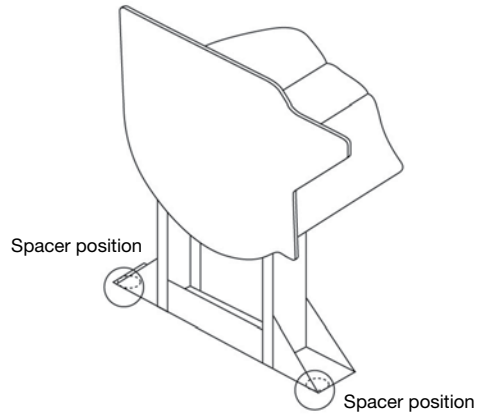
$$\frac{A\text{-}B}{L} \quad \frac{C\text{-}D}{L} \quad \frac{A\text{-}D}{L} \quad \frac{B\text{-}C}{L} \quad \frac{A\text{-}C}{W} \quad \frac{B\text{-}D}{W}$$

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

L: Chiller length
W: Chiller width

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

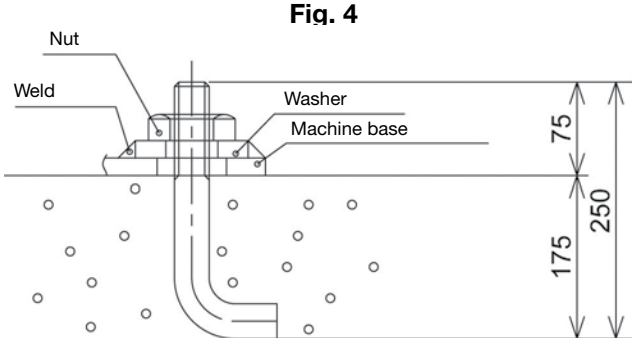
Fig. 3



Fixing of the anchor bolts

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

Fig. 4



1.8 - Field assembly (for three-piece shipment chillers only)

This paragraph explains the field-assembly method for chillers shipped in three parts. The sections of these chillers are as follows:

- Lower shell with high and low-temperature heat exchangers, heat reclaimer, purge unit and control panel (LOWER SHELL)
- Upper shell with non-condensable gas tank (UPPER SHELL)
- High-temperature generator (HT GENE)

1.8.1 - Sequence for assembling

- Install the LOWER SHELL on the foundation of the chiller. Refer to exhibit NKC.
- Put the UPPER SHELL on the LOWER SHELL. Refer to exhibit NKD.
- Weld the pipes connecting the UPPER SHELL and the LOWER SHELL. Refer to exhibit NKD.
- Put the HT GENE on the LOWER SHELL and fix the two sections with bolts. Refer to exhibit NKD
- Weld the pipes connecting the HT GENE and the UPPER/ LOWER SHELLS. Refer to exhibit NKD.
- Conduct a leak test at the welding points. Refer to 1.9.
- Paint rust-preventing paint on the welding points.

1.8.2 - Welding process

Method: Ark welding
Type: Refer to exhibit NKD.

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

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

1.9.1 - Leak test

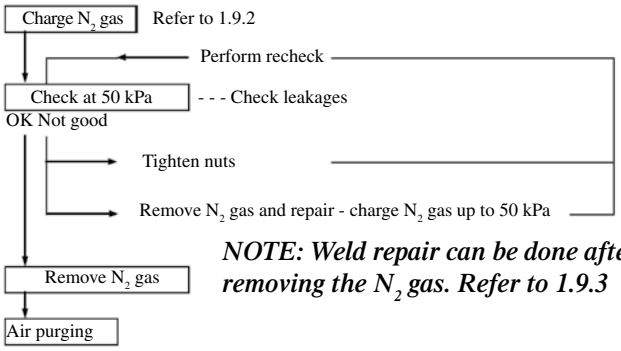
This describes the chiller leak test procedure, using pressurized nitrogen gas (N_2 gas).

Equipment to use

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

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

Test sequence



NOTE: Weld repair can be done after removing the N_2 gas. Refer to 1.9.3

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. Connect the vacuum gauge to SV2 and open SV2
   - Charge N_2 gas (refer to 1.9.2).
   - Pressurize the chiller up to 50 kPa with N_2 gas. The pressure inside the chiller can be checked with the vacuum gauge.
   - When the pressure reaches 50 kPa, close the service valve and the valve of the N_2 gas cylinder.
4. Check the following positions with the soapy water:
   - All field-welded parts (not needed for one-piece machine)
   - Sight glass: If any leakage is observed in the sight glass, tighten the fittings and ensure that there is no N_2 gas leak.
   - Flare nut joints of service valves.
   - Flange connections (absorbent pumps, refrigerant pump, etc.)
   - Diaphragm valves.

5. If any leakage is observed at the welded parts, remove the N_2 gas and then repair the leaks.
6. Repeat steps 3 and 4.
7. If there is no leakage at 50 kPa, keep the chiller pressurised to 50 kPa for 24 hours, and then check the pressure again.
8. After completion of the test, remove the N_2 gas, and the vacuum gauge (refer to chapter 1.9.3)
9. Close SV2.

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.

Equipment to use
- The required amount of N_2 gas:

Internal volume

16NK	Volume litres	16NK	Volume litres
11	1850	51	9420
12	2840	52	10790
13	2780	53	11970
21	3470	61	13450
22	4840	62	15290
31	5710	63	16860
32	5740	71	18960
41	7340	72	22700
42	7360	81	26460

- Pressure regulator
- Pressure-proof hose
- Adjustable wrench
- Valve key for N_2 gas cylinder

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

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

Procedure (see Fig. 5)
- Attach a pressure regulator to the N_2 gas cylinder.
- Connect the vacuum gauge to SV2. Open SV2.
- Connect a pressure-proof hose to the outlet of the pressure regulator, then slightly open the valve at the top of the cylinder in order to purge the air from the hose. After purging, close the valve.
- Connect the other end of the hose to SV1 and fix it with a hose band.
- Check that V1, V2, V3, B, SV1 are fully closed.
- Open the V3 and B-valve and then open SV1.
- Using the pressure regulator, charge a small amount of N_2 gas into the chiller.
- Watch the vacuum gauge while N_2 gas is charged. When the pressure inside the chiller reaches the required pressure, close SV1, V3, and B-valve. Then close the valve of the cylinder.
- Remove the hose from SV1 and attach the service valve cap to the service valve with sealant.
- Remove the pressure regulator and the vacuum gauge.
- Close SV2.

1.9.3 - Removing nitrogen gas (see Fig. 5)
Follow this procedure to remove N_2 gas from the chiller.

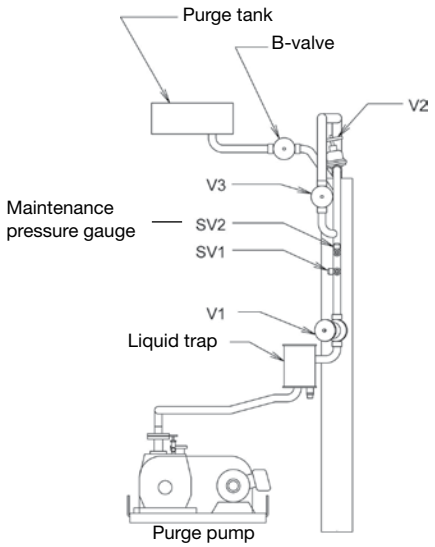
Equipment to use
Adjustable wrench

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

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

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

Fig. 5



Legend
V Valve
SV Service Valve

1.10 - Piping

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

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

1.10.2 - Flushing

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

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 NKF and the specification drawings for wiring connections.
- Supply power to the steam control valve and steam shut-off valve.
- 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 pump oil to the centre of the red mark of purge pump level gauge.
- Turn on the control panel main breaker and the purge pump switch. Check the direction of rotation. If the direction is wrong, turn off the power supply to the chiller. Then change any two of the wires of main power supply source. The chiller was connected with all wires meeting the same phase. Run the purge pump continuously.
- Connect the vacuum gauge (1 kPa) to SV2.
  - Open SV2.
  - Open V1, V3, and B-valve to purge the chiller.
  - After one hour open V2.
- Operate the purge pump until the vacuum gauge shows 0.5 kPa.

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

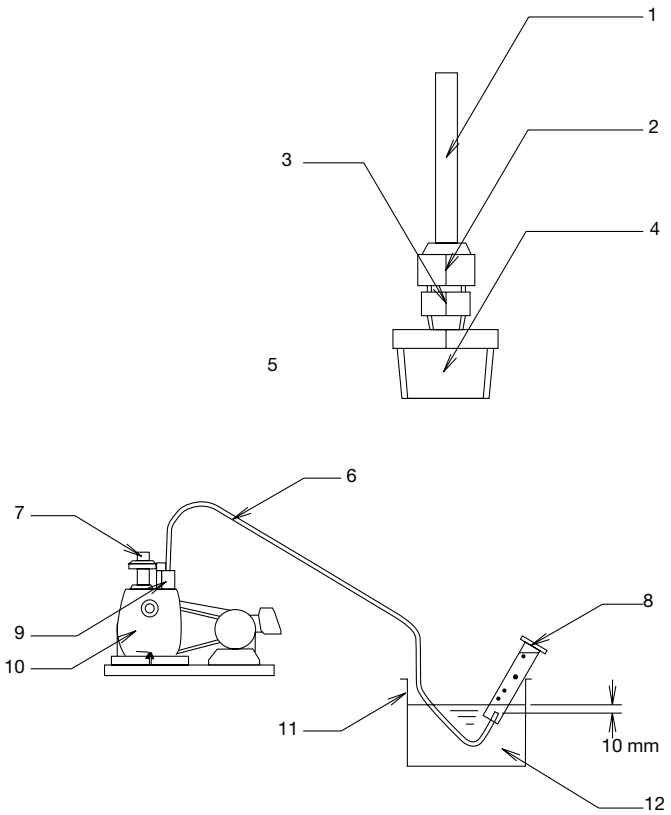
16NK	Standard value ml per 10 min
11	8
12	10
13	12
21	15
22	19
31	23
32	27
41	30
42	34
51	38
52	42
53	47
61	53
62	60
63	68
71	75
72	86
81	101

Procedure

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

- B ml - A ml is the result of the bubble test.
- After the bubble test, the gas ballast valve should be opened. The oil delivery valve should be opened to check if any water is contained in the purge pump oil. If water is observed, drain the water and charge with new oil.

Fig. 6



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

1.13 - Insulation

- After the chiller has been installed, it must be insulated.
- Before fitting the insulation, the chiller should be placed in its permanent position.
- To fit insulating materials, use appropriate fixtures and fittings.
- Insulation on piping connections, access covers and flange sections should be easily removable.
- The drawings show the areas to be insulated and the recommended insulating materials and procedures. Please refer to exhibit NKG.

2 - TEST OPERATION

2.1 - External visual inspection

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

2.1.1 - Chiller insulation must be correctly fitted.

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

2.1.2 - Installation checks

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

2.2 - Solution charge (for three-piece shipment chillers only)

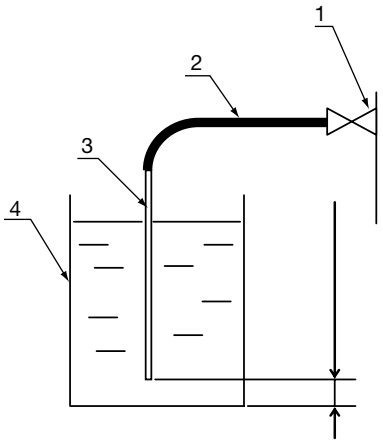
2.2.1 - Precautions

- Make sure that the chiller vacuum condition is sufficient.
- LiBr solution and refrigerant solution should be charged just before trial operation. If it is impossible to start trial operation within three days, do not charge solution to prevent accidents.

2.2.2 - Procedure (refer to exhibit NKA)

1. Prepare the solution containers.
2. Operate the vacuum pump.
3. Open V1 and V3.
4. Charge the absorbent solution first, and then charge the refrigerant. The absorbent solution is charged at the following three service valves into the chiller.
   - SV3: Service valve provided on the refrigerant pump discharge pipe
   - SV4: Service valve provided on the absorbent pump 1 discharge pipe
   - SV8: Service valve provided at the bottom of the high-temperature generator
5. Insert the copper tube connected to the vacuum rubber hose into the container.
6. Open the service valve.
7. When the absorbent solution begins to enter the chiller, watch carefully to ensure that no air can leak in.
8. Before the container is empty, tilt it so that no air enters the tube.
9. When the absorbent container is almost empty, bend the rubber vacuum hose with both hands to ensure that no air enters, and quickly insert it in the next container.
10. Repeat steps 7 to 9 until all absorbent has been emptied.
11. Close SV3, SV4 and SV8.
12 Charge refrigerant from SV3 only.

Fig. 7



Legend
1 Service valve
2 Vacuum hose
3 Copper tube
4 Container

13. Remove the rubber vacuum hoses from SV3, SV4 and SV8, and put the caps on the service valves.
14. Start the chiller and continue operation for one hour if possible. The purpose of this operation is to remove dissolved oxygen from the refrigerant and absorbent.
15. Stop the chiller.
16. Close V1 and V3.
17. Stop the purge pump.

NOTES:

1. ***Wear rubber gloves. Do not handle the solution with bare hands.***
2. ***Thoroughly wash off any absorbent which gets on the hands, skin and/or clothes. Take care to prevent absorbent from entering eyes or mouth.***
3. ***If absorbent spills on metal plates etc. thoroughly wash it off with water.***
4. ***Refer to the lithium bromide solution material safety data sheet in exhibit NKH.***

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 NKF and the specification drawings.

2.3.1 - Check the motor insulation resistance

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

2.3.2 - Measuring the insulation resistance

Measure the insulation resistance of absorbent pumps, refrigerant pump and purge pump using the following equipment:

- 500 V d.c. megger
- Screwdriver

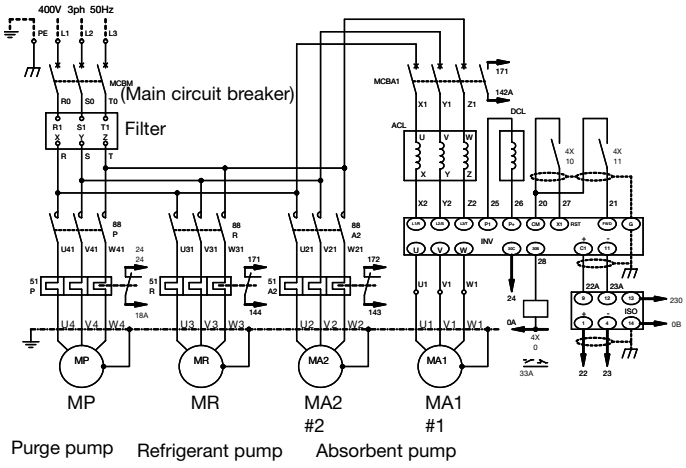
2.3.3 - Precautions

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

2.3.4 - Procedure

- Switch off the power supply during the work. Make sure to turn off the circuit breaker (MCBM).
- Connect the earth wire of the megger to the earth terminal in the control panel.
- Measure the insulation resistance of each motor at the following terminals on the control panel and at the wires disconnected in chapter 2.3.1.
- For positions measured with the megger see Fig. 8:
  - Absorbent pump 1 (wires) : U1/V1/W1
  - Absorbent pump 2 (terminals) : U2/V2/W2
  - Refrigerant pump (terminals) : U3/V3/W3
  - Purge pump (terminals) : U4/V4/W4
- Record the measured values.

Fig. 8



2.4 - Initial control board and inverter setting

2.4.1 - Time setting

Refer to the operation and maintenance manual.

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

Refer to the operation and maintenance manual.

2.4.3 - Check the control board parameters

Refer to the checklist, specification drawings.

2.4.4 - Check the inverter parameters

Refer to Section 2.7.1 and the inverter manual.

2.5 - Damper setting and valve position

2.5.1 - Damper setting

Refer to the specification drawings and exhibit NKJ.

2.5.2 - Check valve opening status and switch positions

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.

2.7 - Function test

2.7.1 - Inverter parameters

16NK Function code	Function name	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 thermal 1 (moving)	Spec.	Spec.	A
F12	Electron thermal 1 (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 sound (carrier frequency)	2	2	kHz
F27	Motor sound (sound tone)	0	0	
F30	FMA terminal (output gain)	100	100	%
F31	FMA terminal (monitor)	0	0	
F33	FMA terminal (pulse)		1440	p/s
F34	FMA terminal		0	
F35	FMA terminal (voltage)		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		%
E0	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	
H10			1	
H70	Overload prevention control	0.00		Hz/s
H98	Automatic energy efficient operation	7		
U48	Overload prevention control		1	

2.7.2 - Generator solution level relay

a. Push the "Run" key on the control board.
b. Jumper #31 and #32. Check that absorbent pump 1 stops.
c. Remove #31 and #32. Check that absorbent pump 1 runs.

2.7.3 - Water alarm

Chilled-water temperature (setpoint: 2.5°C)

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

Chilled-water flow rate

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

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

Cooling water temperature

(setpoint 19°C for 30 minutes during operation)

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

2.7.4 - Motor alarm

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

Refrigerant pump

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

Absorbent pump

a. Absorbent pump 1: The data display shows J-04 "#1 Absorbent pump has overload".
b. Absorbent pump 2: The data display shows J-05 "#2 Absorbent pump has overload".

2.7.5 - System alarm

Chilled water pump

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

Cooling water pump

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

2.8 - Operation

2.8.1 - Test operation

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

2.8.2 - Operation and data record

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

3 - CHECKLIST

Test operation in accordance with this check list.

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

Project name : _____
Chiller model : 16NK _____
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 ☐
• High and low-temperature heat exchangers	Not damaged ☐	Damaged ☐
• Heat reclaimer	Not damaged ☐	Damaged ☐
• Evaporator headers	Not damaged ☐	Damaged ☐
• Absorber headers	Not damaged ☐	Damaged ☐
• Condenser headers	Not damaged ☐	Damaged ☐
• High-temperature generator 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 gauge	Not damaged ☐	Damaged ☐
• Generator pressure switches	Not damaged ☐	Damaged ☐
• Purge unit (diaphragm valves, liquid trap)	Not damaged ☐	Damaged ☐
• Chilled-water flow switch	Not damaged ☐	Damaged ☐
• Cooling water flow switch (option)	Not damaged ☐	Damaged ☐
• Refrigerant blow-down valve	Not damaged ☐	Damaged ☐
• Purge tank pressure sensors	Not damaged ☐	Damaged ☐
• Steam trap	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 ☐
• Remote operation signal (#323, #324, #325, #326)	Not damaged ☐	Damaged ☐
• Pre-alarm indication (#334, #335)	Not damaged ☐	Damaged ☐
• Remote check (#336, #337)	Not damaged ☐	Damaged ☐
• Steam shut-off valve signal (#347, #348)	Not damaged ☐	Damaged ☐
• Operation indication (#350, #351)	Not damaged ☐	Damaged ☐
• Stop indication (#352, #353)	Not damaged ☐	Damaged ☐
• Alarm indication (#354, #355)	Not damaged ☐	Damaged ☐
• Start/Stop signal for chilled water pump (#356, #357)	Not damaged ☐	Damaged ☐
• Start/Stop signal for cooling water pump (#358, #359)	Not damaged ☐	Damaged ☐
• Start/Stop signal for cooling tower fan pump (#360, #361)	Not damaged ☐	Damaged ☐
• Feedback signal (#362, #363)	Not damaged ☐	Damaged ☐
• Dilution cycle operation indication (#368, #369)	Not damaged ☐	Damaged ☐
• Alarm buzzer signal (#382, 383)	Not damaged ☐	Damaged ☐
• Purge indication (#384, 385)	Not damaged ☐	Damaged ☐
• Grounding/earth (#G/P)	Not damaged ☐	Damaged ☐
• Wiring of palladium cell heater	Not damaged ☐	Damaged ☐
• For 460 V and 400 V: #232 and #0B on the control panel	Not damaged ☐	Damaged ☐
• For 208 V: #232 and #202 on the control panel	Not damaged ☐	Damaged ☐

3.3 - Check of motor insulation resistance

Standard: 10 MΩ mimum

- 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 ☐

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

3.4 - Check of control board safety and switch settings

- Generator pressure gauge (63GH) : _____kPa/MPa
- Purge tank pressure sensor (69PR) : _____kPa/MPa
- Absorbent pump 2 thermal relay (51A2) : _____A
- Refrigerant pump thermal relay (51R) : _____A
- Purge pump thermal relay (51P) : _____A

3.5 - Check of purge pump

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

3.6 - Verify auxiliary equipment

(For confirmation purpose only)

Water piping

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

Air vent valve, drain valve, pressure gauge, thermometer

Water circuit	Air vent valve		Drain valve		Pressure gauge		Thermometer	
Chilled water	Yes	No	Yes	No	Yes	No	Yes	No
Cooling water	Yes	No	Yes	No	Yes	No	Yes	No

Water pump duty

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

Cooling tower : _____kW*

* For information only

Cooling water temperature control: Fan on-off ☐ 2-way valve ☐ 3-way valve ☐

Water charge into the chilled-water circuit: Yes ☐ No ☐

Water charge into the cooling water circuit: Yes ☐ No ☐

Automatic cooling water blow-down device: Yes ☐ No ☐

Chemical cooling water feeding device: Yes ☐ No ☐

Check cooling water temperature control: Good ☐ Not good ☐

Water circulating conditions:

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

Capacity of a main breaker: _____A

3.7 - Bubble test (when the unit is charged)

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

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

3.8 - Verify valve opening status and switch position

Change-over valves

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

Isolation valves

Valve open/close status should be as follows.

• Absorbent pump 1 (open)	Open ☐	Closed ☐
• Absorbent pump 2 (open)	Open ☐	Closed ☐
• Refrigerant pump (open)	Open ☐	Closed ☐

Diaphragm valves

Valve open/close status should be as follows.

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

Service valves

Valve open/close status should be as follows.

• Charge/remove N_2 gas: SV1 (closed)	Open ☐	Closed ☐
• Purge unit: SV2 (closed)	Open ☐	Closed ☐
• Refrigerant: SV3 (closed)	Open ☐	Closed ☐
• Diluted solution: SV4 (closed)	Open ☐	Closed ☐
• Concentrated solution: SV6 (closed)	Open ☐	Closed ☐
• Generator pressure gauge: SV7 (open)	Open ☐	Closed ☐
• Generator maintenance: SV8 (closed)	Open ☐	Closed ☐

Switch - purge (off)	On ☐	Off ☐

3.9 - Verify control board parameters

INVERTER PARAMETERS (refer to exhibit NKH)

16NK				
Function code	**Function name**	**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 thermal 1 (moving)	Spec.	Spec.	A
F12	Electron thermal 1 (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 sound (carrier frequency)	2	2	kHz
F27	Motor sound (sound tone)	0	0	
F30	FMA terminal (output gain)	100	100	%
F31	FMA terminal (monitor)	0	0	
F33	FMA terminal (pulse)		1440	p/s
F34	FMA terminal		0	
F35	FMA terminal (voltage)		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		%
E0	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	
H10			1	
H70	Overload prevention control	0.00		Hz/s
H98	Automatic energy efficient operation	7		
U48	Overload prevention control		1	

Item	Data display	Setpoint example	Verify
Specification setting	SPEC		
1. Chilled-water setting	C-tEn.P	7.0 °C	
2. Chilled-water temperature difference setting	C-dt	5.0 °C	
3. Rank-up/down	rAn4uP	100.0	
4. Purge pump light on	AP-St	10.04PA	
5. Purge pump light off	AP-SP	7.04PA	
Input setting	inPut		
6. Control type	bntYPE	Pid	
7. Input correction	iPtCor	50	
Inverter setting	inUSEt		
8. Level control forecast time	33AL	15	
9. Level control forecast decrease factor	33AL-1	1.00	
10. Inverter parameter: a1	inU-A1	148	
11. Inverter parameter: a2	inU-A2	0.024	
12. Inverter parameter: a3	inU-A3	0.060	
13. Inverter parameter: a4	inU-A4	3.6	
14. Inverter parameter: a5	inU-A5	50	
15. Inverter parameter: a6	inU-A6	23	
PID setting	PibSEt		
16. Proportional setting in cooling	CooL-P	2.0	
17. Integral setting in cooling	CooL-i	200	
18. Derivative setting in cooling	CooL-d	5	
19. Sampling setting	SAn.PLE	10	
Field setting	FiELd		
20. Cooling water temperature at maximum input	Co-inP	32.0 °C	
21. Slow input time	inP-tn.	0000 S	
22. Slow input temperature	inPtn.P	000 °C	
23. Dilution cycle time	diLu-t	04 n.	
24. Remote signal	r-SiGn	StAtiC	
17. Remote off pulse signal	oF-PLS	PoSitiv	

3.10 - Pre-operation checks

Start and stop: Good ☐ Not good ☐
High temperature generator solution level: Good ☐ Not good ☐
Interlock alarm
- Chilled water: Good ☐ Not good ☐
- Cooling water: Good ☐ Not good ☐

Motor alarm: Good ☐ Not good ☐
Generator alarm: Good ☐ Not good ☐
System alarm: Good ☐ Not good ☐

Check direction of pump rotation
- Absorbent pump 1: Good ☐ Not good ☐
- Absorbent pump 2: Good ☐ Not good ☐
- Refrigerant pump: Good ☐ Not good ☐

3.11 - Operation and data record

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

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

TEST OPERATION DATA SHEET

Trial run data sheet 1/2

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

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

No.	Data items	Unit	Spec.	DATA-1 Time:	DATA-2 Time:	DATA-3 Time:
1	Ambient temperature	°C/°F				
2	Room temperature	°C/°F				
3	Chilled-water entering temperature	°C/°F				
4	Chilled-water leaving temperature	°C/°F				
5	Chilled-water entering pressure	kPa/psi				
6	Chilled-water leaving pressure	kPa/psi				
7	Evaporator pressure drop	kPa/psi				
8	Chilled water flow rate	l/s/gpm				
9	Cooling capacity	kW				
10		USRT				
11	Cooling water entering temperature	°C/°F				
12	Cooling water leaving temperature	°C/°F				
13	Cooling water entering pressure	kPa/psi				
14	Cooling water leaving pressure	kPa/psi				
15	Pressure drop in absorber & condenser	kPa/psi				
16	Cooling water flow rate	l/s/gpm				
17	High-temperature generator pressure	MPa/psi				
18	High-temperature generator temperature	°C/°F				
19	Solution level in high-temperature generator	n/60 mm				
20	Inverter frequency	Hz				
21	Operating current of absorbent pump 1	A				
22	Operating current of absorbent pump 2	A				
23	Operating current of refrigerant pump	A				
24	Operating current of purge pump	A				
25	Evaporator solution level	n/60 mm n/2-3/8"				
26	Purge tank pressure	kPa				
27	Opening degree of dilution solution damper	n/90				
28	Opening degree of intermediate solution damper	n/90				
29	Opening degree of concentrated solution damper	n/90				
30	Steam consumption	kg/h / lb/h				
31	Supply steam pressure	kPa/psi				
32	Supply steam temperature	°C/°F				

Trial run data sheet 2/2

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

Unit model/serial No.		Operator:			Date: / /	
No.	Data items	Unit	Spec.	DATA-1 Time:	DATA-2 Time:	DATA-3 Time:
33	Concentration of concentrated solution	%				
	Relative density of concentrated solution	-				
	Temperature of concentrated solution	°C/°F				
34	Concentration of diluted solution	%				
	Relative density of diluted solution	-				
	Temperature of diluted solution	°C/°F				
35	Concentration of refrigerant	%				
	Relative density of refrigerant	-				
	Temperature of refrigerant	°C/°F				
36	Condensed refrigerant temperature	°C/°F				
37	*LTD (See below)	K				

* LTD (Leaving Temperature Difference) = Condensed refrigerant temperature minus cooling water leaving temperature

NOTES

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

3.12 - Sample of absorbent taken (for analysis)

Yes ☐ No ☐

4 - EXHIBITS

4.1 - Exhibit NKA - Precautions for use/precautions for installation

4.1.1 - Precautions for use

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

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

Machine room

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

Purging

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

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

Pumps and air handling units

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

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

Winter season

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

Service and maintenance

The chiller should be checked periodically. Please contact your Carrier service agent.

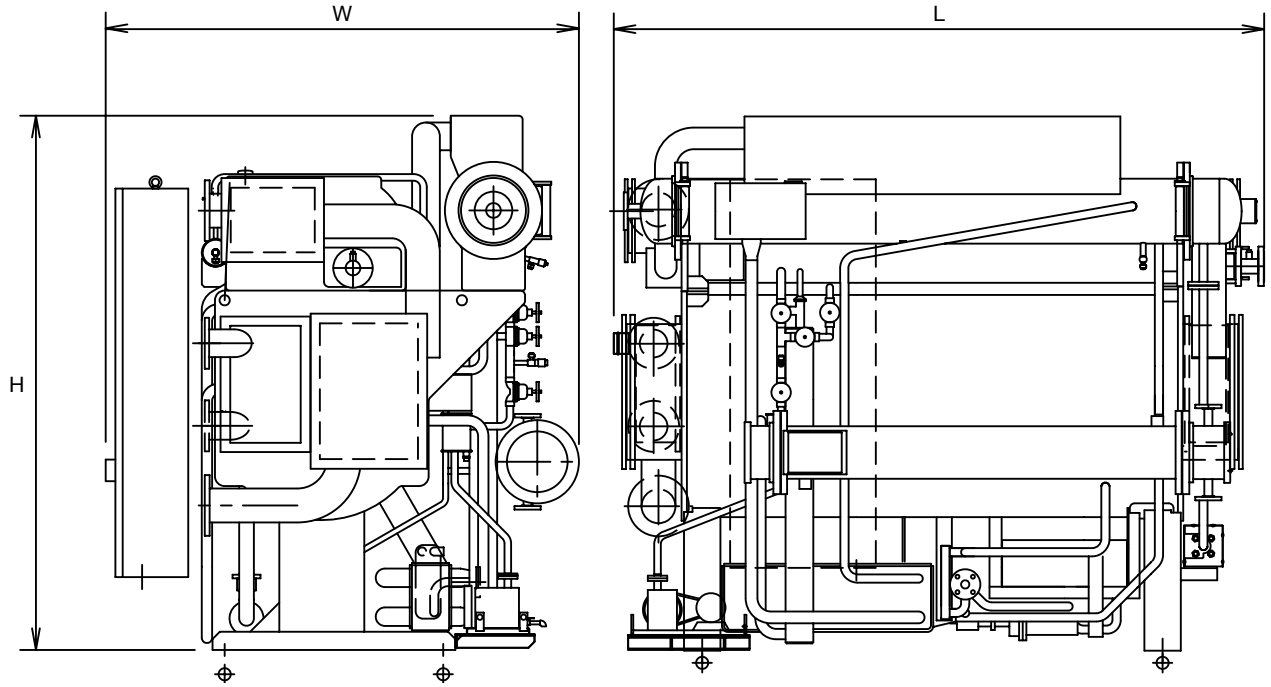
4.1.2 - Precautions for installation

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

4.2 - Exhibit NKB - Shipping dimensions/centre of gravity location

4.2.1 - Shipping dimensions

Fig. 9 - One-piece shipping



NOTES:

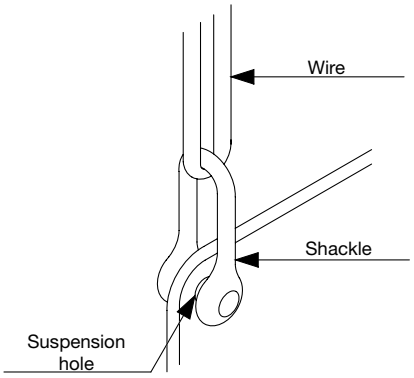
1. *The dimensions do not include the packaging.*
2. *The weight values include the solution for the initial charge. The solution for NK-71 and NK-72 is shipped separately.*
3. *The solution bottle size is 600 x 600 x 950 mm. The solution weight is included in the bottle weight.*

	Shipping dimensions				Solution	
16 NK	L	W	H	Weight	Weight	Bottle
	mm	mm	mm	kg	kg	
11	2850	2010	2250	4200	-	-
12	3800	2050	2250	5400	-	-
13	3800	2050	2250	5600	-	-
21	3810	2200	2300	6700	-	-
22	4910	2070	2300	7900	-	-
31	4980	2180	2490	10200	-	-
32	4980	2200	2490	10600	-	-
41	4980	2390	2690	12400	-	-
42	4990	2420	2690	12800	-	-
51	5070	2770	2970	16300	-	-
52	5650	2750	2970	18100	-	-
53	6150	2750	2970	19400	-	-
61	5750	2920	3410	22700	-	-
62	6280	2980	3410	26000	-	-
63	6800	2980	3410	27800	-	-
71	6520	3300	3520	27600	5600	20
72	7540	3300	3520	30400	6400	22

4.2.2 - Detail of the suspension hole location

1. Insert the shackle bar into the suspension hole and attach the shackle with the wire to the shackle bar. The wire angle should be less than 90°. Be sure to lift at all four machine points and never just at 2 points.
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. 10



4.2.3 - Centre of gravity location, mm

16NK	Suspension hole location						Centre of gravity "G"		
	A	B	E	F	J	H	X	Y	Z
11	85	1980	850	127	1440	1440	915	340	1160
12	85	1980	850	127	1440	1440	1475	340	1160
13	85	3000	850	127	1440	1440	1475	350	1160
21	85	3000	1020	115	1480	1440	1475	420	1230
22	85	4020	1020	115	1480	1530	2065	430	1240
31	110	3995	1100	113	1495	1530	1950	480	1300
32	110	3995	1100	113	1495	1530	1950	470	1310
41	110	3995	1165	205	1620	1850	2000	480	1420
42	110	3995	1165	205	1620	1850	2000	470	1430
51	70	4035	1510	-18	1870	2040	2040	720	1570
52	70	4575	1510	-18	1870	2040	2250	700	1600
53	70	5075	1510	-18	1870	2040	2505	700	1600
61	90	4560	1625	30	2145	2325	2235	720	1750
62	90	5055	1625	30	2145	2325	2370	660	1780
63	90	5580	1625	30	2145	2325	2515	660	1780
71	290	4855	1995	-20	2180	2315	2285	840	1800
72	290	5880	1995	-20	2180	2315	2760	830	1820

Fig. 11

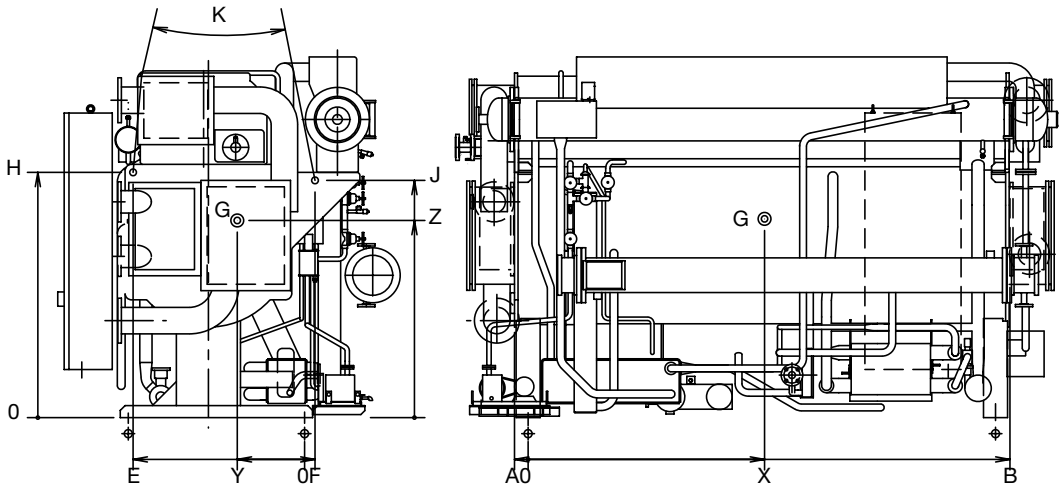
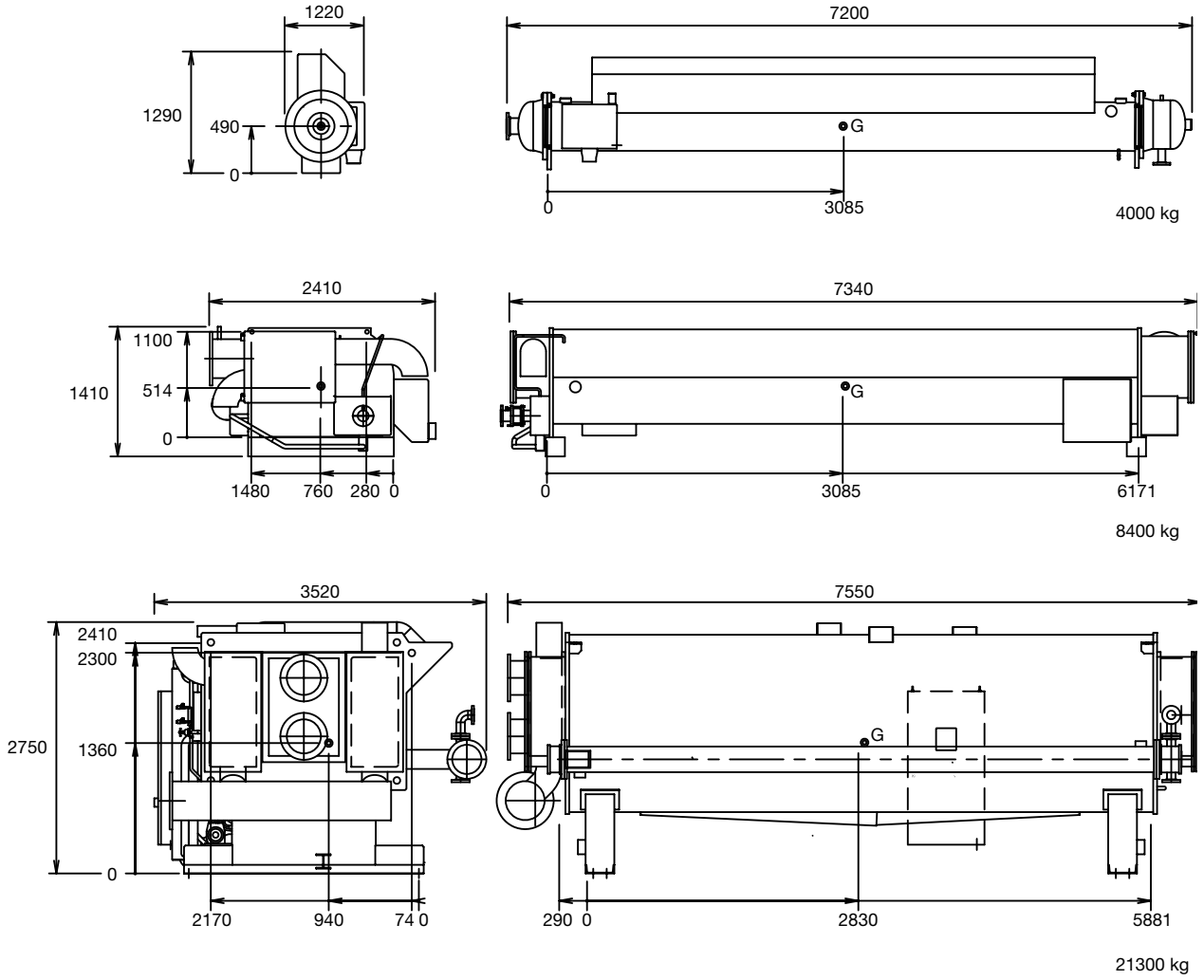


Fig. 12 - Three-piece shipment for 16NK-81



Solution weight: 7200 kg
Solution bottles: 25

NOTE: All dimensions are in mm.

4.3 - Exhibit NKC - Foundation dimensions

Fig. 13 - 16NK-11 to 16NK-42

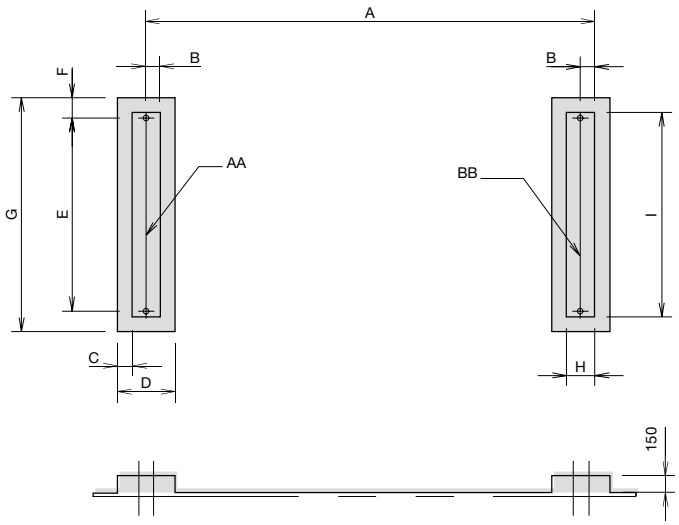


Fig. 14 - 16NK-51 to 16NK-61

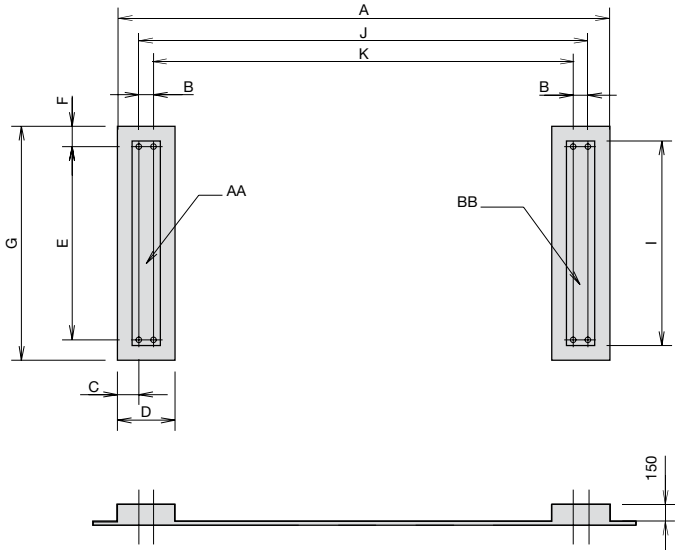


Fig. 15 - 16NK-62 to 16NK-81

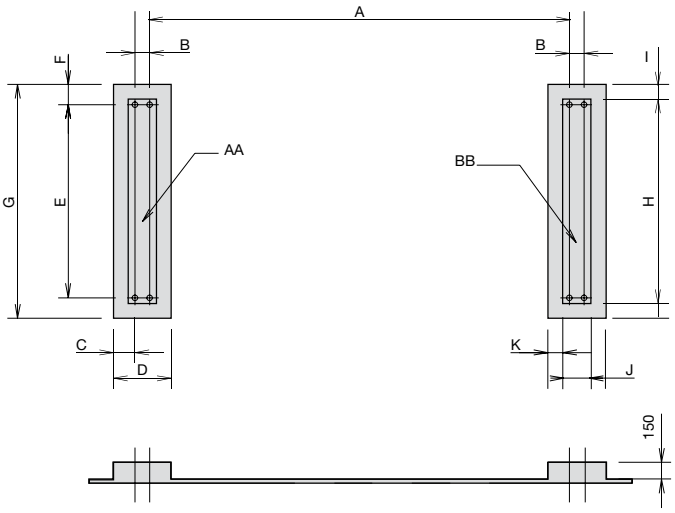
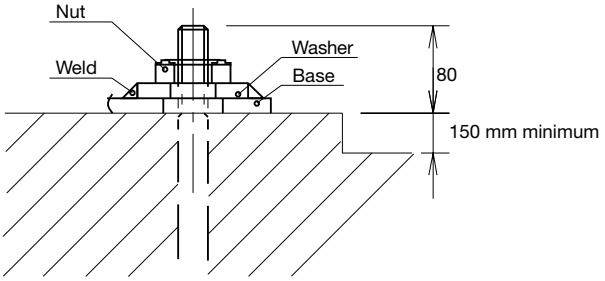


Fig. 16 - Details of weld



NOTES

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

Table 2 - Dimensional data

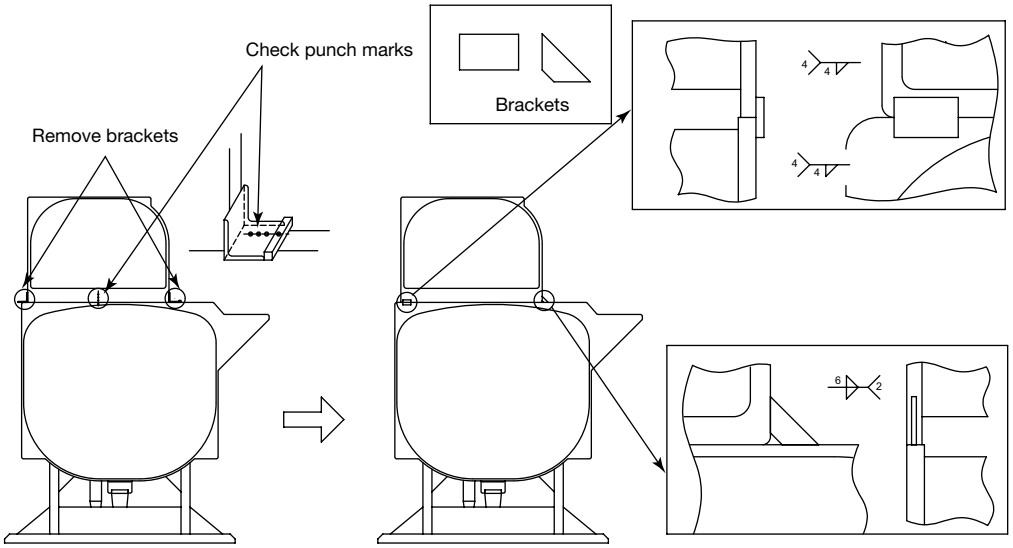
16 NK	Weight, kg			Dimensions, mm										
	Operating	AA	BB	A	B	C	D	E	F	G	H	I	J	K
11	4600	2300	2300	1896	175	90	350	900	150	1200	160	1000	100	--
12	5800	2900	2900	2916	175	90	350	900	150	1200	160	1000	100	--
13	6100	3050	3050	2916	175	90	350	900	150	1200	160	1000	100	--
21	7500	3750	3750	2916	175	90	350	1100	150	1400	160	1200	100	--
22	8800	4400	4400	3936	175	90	350	1100	150	1400	160	1200	100	--
31	11200	5600	5600	3886	200	100	400	1200	150	1500	200	1300	100	--
32	11800	5900	5900	3886	200	100	400	1200	150	1500	200	1300	100	--
41	13900	6950	6950	3886	200	100	400	1250	150	1550	200	1350	100	--
42	14500	7250	7250	3886	200	100	400	1250	150	1550	200	1350	100	--
51	18800	9400	9400	4346	130	190	510	1700	180	2060	250	1800	3966	3836
52	20800	10400	10400	4888	130	190	510	1700	180	2060	250	1800	4508	4378
53	22300	11150	11150	5386	130	190	510	1700	180	2060	250	1800	5006	4876
61	26500	13250	13250	4888	140	210	560	1800	180	2160	320	1900	4468	4328
62	30000	15000	15000	4686	140	210	560	1800	180	2160	1900	130	300	130
63	32100	16050	16050	5211	140	210	560	1800	180	2160	1900	130	300	130
71	38000	19000	19000	4286	140	210	560	2200	180	2560	2300	130	300	130
72	42300	21150	21150	5311	140	210	560	2200	180	2560	2300	130	300	130
81	47300	23650	23650	5311	140	210	560	2400	180	2760	2500	130	300	130

4.4 - Exhibit NKD - Typical field assembly method

4.4.1 - Assembly with upper shell and lower shell

- Put the upper shell on the lower shell. At this time, refer to the punch marks on the tube sheet.
- Remove the brackets attached to the upper shell and lower shell. Use a grinder.
- Weld brackets supplied with the chiller.

Fig. 17



4.4.2 - Welding of connection pipes

Fig. 18 - Weld pipes

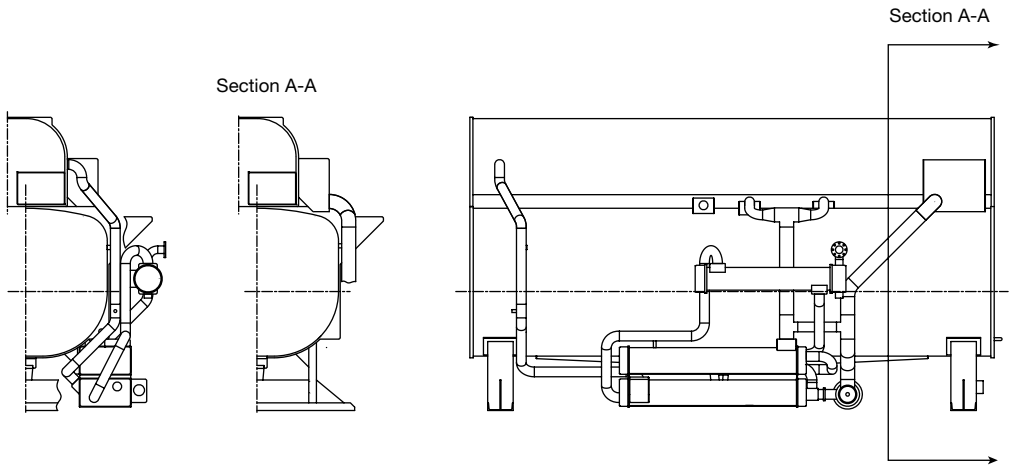


Fig. 19

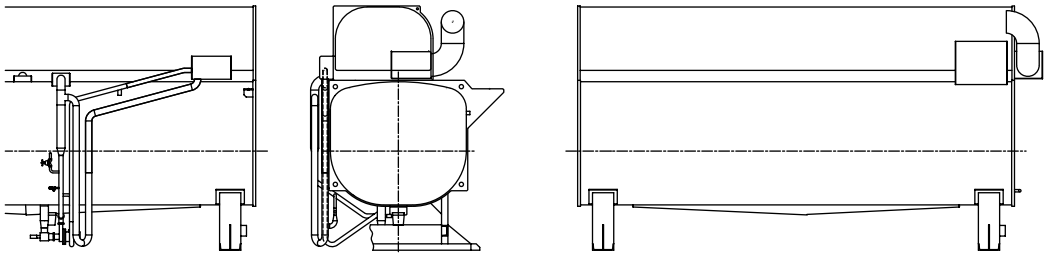
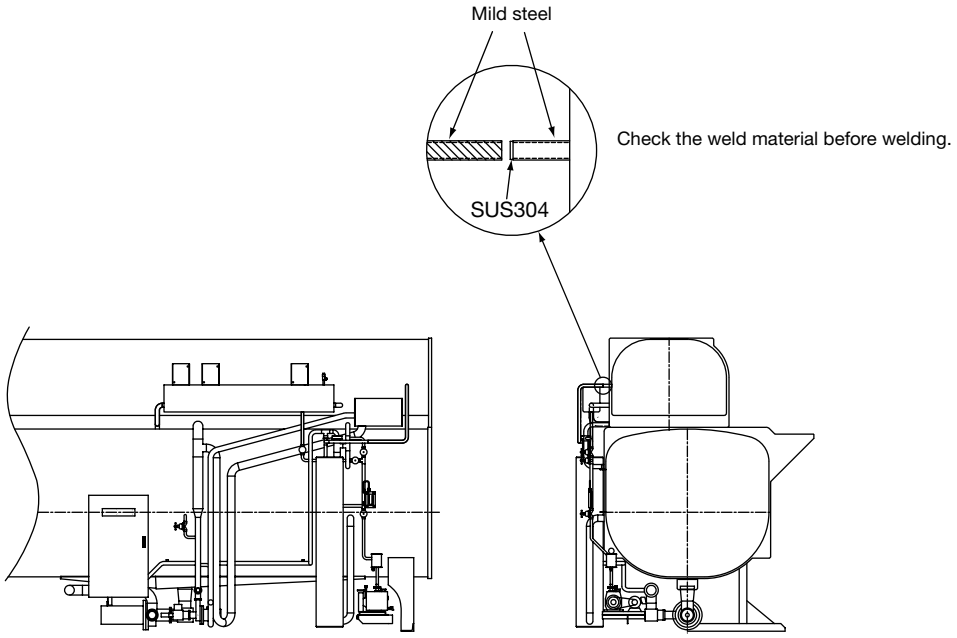


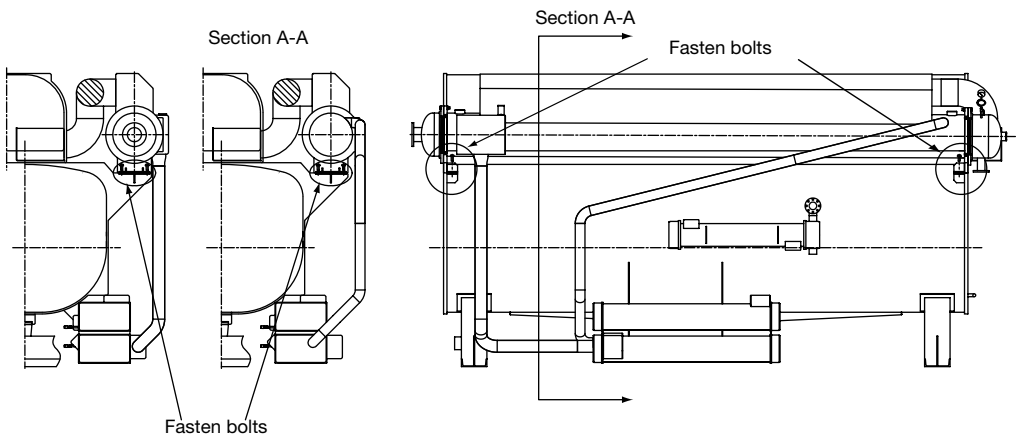
Fig. 20



4.4.3 - Assembly of the lower shell and the high-temperature generator

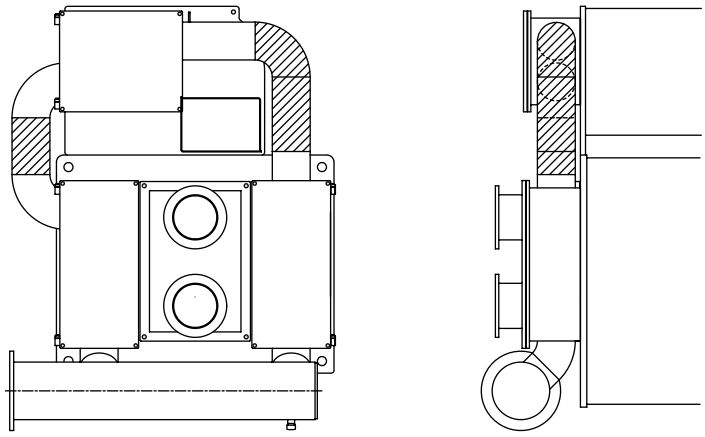
- Put the high-temperature generator on the lower shell.
- Fix the high-temperature generator with bolts to the lower shell.

Fig. 21 - Weld hatched pipes



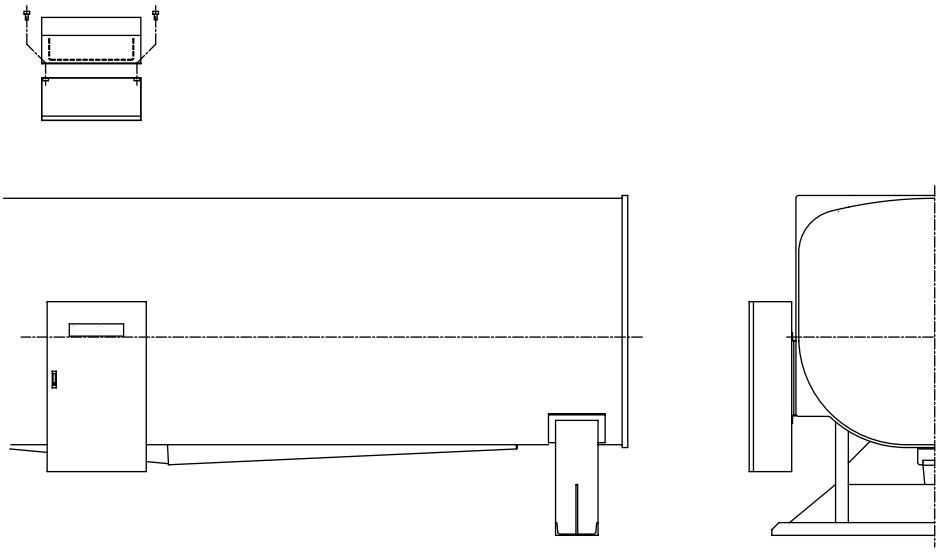
4.4.4 - Welding of connection pipes

Fig. 22 - Weld pipes



4.4.5 - Assembly of the control panel

Fig. 23 - Mount the control panel with bolts



LB-52U
JIS D4316 AWS E7016
BS E5143B24 (H) DIN E5143B (R) 10 ISO E514B24 (H)

For one-side welding.

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.

Usage characteristics
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 to perform one-side welding with relatively low currents.
LB-52U provides good slag removal and smooth weld beads.

Notes on usage
- Reverse welds of good appearance are obtained with proper currents and optimum root gaps (about 3 mm).
- Stop the arc after moving the crater to the side-wall of the groove.
- Dry the electrodes at 300~350°C for 30-60 minutes before use.
- Strike the arc on a small steel plate prepared for this purpose or on the side wall of the groove.
- 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
A	OSW	30~80	60~110	90~140	130~180
	F	60~90	90~130	130~180	180~240
	V&O	50~80	80~120	110~170	150~200

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

* DC(-) for only root pass

NC-39, NCA-309, HIMELT-309
JIS D309-16 AWS E309-I6 BS 23.12R
DIN (E2212R26) (NC-39, NCA-309) (E2212MPR26) (HIMELT-309)
ISO E23, 12R26(NC-39, NCA-309) E23, 12R13026 (HIMELT-309)

For welding 22%Cr-12%Ni steel (SUS 309S etc.) and welding stainless steel to mild steel or low-alloy steel.

Applications
Welding of SUS 309S or SCS 17.
Welding of dissimilar metals such as stainless steel to mild steel or low-alloy steel.

Usage characteristics
NC-39, NCA-309 or HIMELT-309 is of a lime-titanium type for all-position welding and has good usability. As weld metal contains ferrite in an austenitic structure, its weldability is good and it provides good corrosion resistance and good heat resistance. As weld metal contains a high number of alloying elements and has a stable austenitic structure, it is suitable for welding of the part that is affected by the dilution of the mother plate.

Notes on usage
- Keep the arc as short as possible.
- Weaving width should be within two and a half times of the electrode diameter.
- If the electrodes have absorbed moisture, dry them at 150~200°C for 30-60 minutes before use.
- Ensure that the dilution of the mother plate is not excessive.
- Usually preheat is not necessary.

Typical chemical composition of weld metal (%)

Type	C	Mn	Si	P	S	Ni	Cr
NC-39	0.08	1.61	0.45	0.021	0.003	12.51	23.87
NCA-309	0.06	1.45	0.23	0.023	0.004	13.09	24.01
HIMELT-309	0.07	1.09	0.26	0.018	0.004	12.41	23.91

Typical mechanical properties of weld metal

Type	As welded			Solution heat treatment (1050°C x 30 min W.Q)			IV (as welded) J (kgf m)
	0.2% OS N/mm^2 (kgf/mm^2)	TS N/mm^2 (kgf/mm^2)	EL	0.2%OS N/mm^2 (kgf/mm^2)	TS N/mm^2 (kg/mm^2)	EL %	
NC-39	410 (42)	580 (59)	36	310 (32)	530 (54)	47	62 (6.3)
NCA-309	420 (43)	560 (57)	41	310 (32)	530 (54)	51	60 (6.1)
HIMELT-309	400 (41)	570 (58)	38	290 (30)	520 (53)	46	56 (5.7)

Typical corrosion resistance of welded metal

Type	65% nitric acid test (Heuy test)	
	Heat treatment	Corrosion rates, mm/y
NC-39	As welded	0.113
NCA-309	650°C x 2 hour AC	0.140
HIMELT-309	1050°C x 30 min. W.Q	0.104

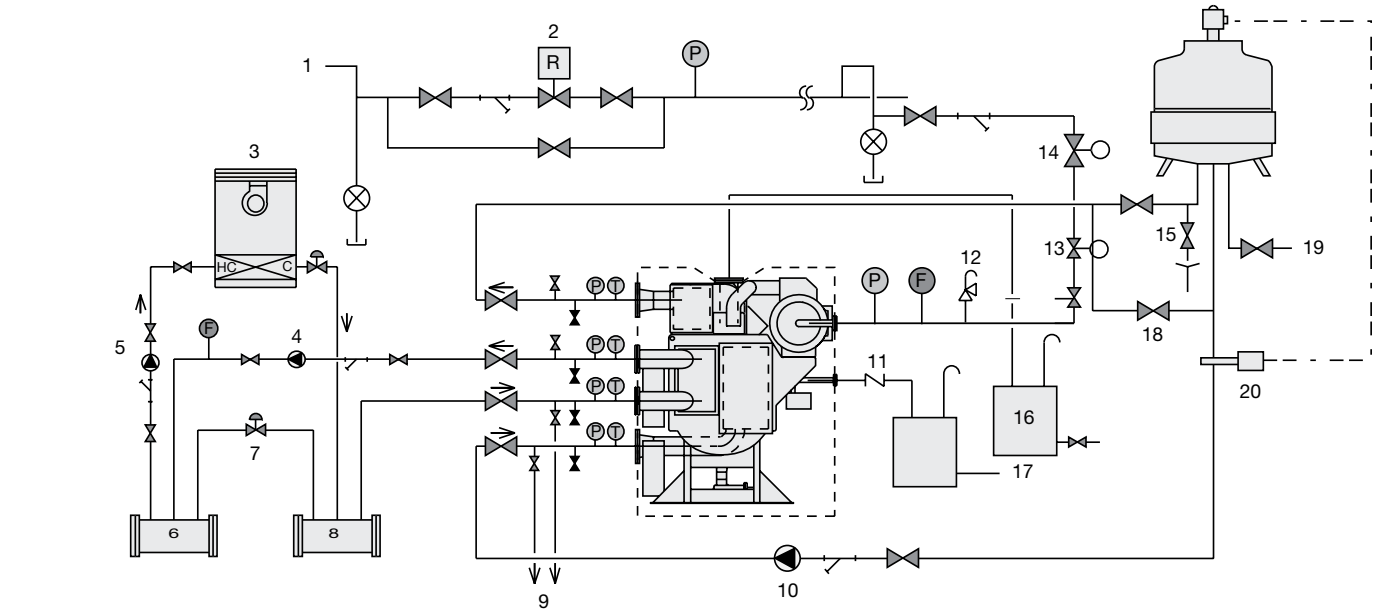
Sizes available

	Diameter, mm					
L (mm)	2.0	2.6	3.2	4.0	5.0	6.0
NC-39	250	300	350	350	350	350
NCA-309	-	300	350	350	350	350
HIMELT-309	-	300	350	350	400	450

4.5 - Exhibit NKE - Typical piping diagram/water treatment/dimensional drawings

4.5.1 - Typical piping diagram

Fig. 24



Thermometer | Pressure gauge | Flow meter | Water pump | Strainer | Manual valves | Connections for cleaning process | Thermostat

Legend

1	Main steam piping	6	Supply header	11	Check valve	16	Tank (minimum capacity 1 m³)
2	Reducing valve	7	Bypass valve	12	Relief valve	17	To boiler
3	Cooling load	8	Return header	13	Steam control valve	18	Bypass valve
4	Chilled water pump (primary)	9	To drain channel	14	Steam shutoff valve	19	Water supply
5	Chilled water pump (secondary)	10	Cooling water pump	15	Blown-down valve	20	Cooling water thermostat

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

General remarks on piping

1. Equipment and parts outside the area surrounded by the broken line are not supplied by Carrier. A steam control valve and a steam shut-off valve shall be provided, if specified in the scope of supply.
2. For pipe connections and diameters refer to the dimensional drawings and specification tables.
3. Ensure that the chilled water flow rate and cooling water flow rate are in conformity with the standard value. If the chilled water flow rate sinks to under 50% of the standard value, the chiller will stop.
4. Position the chilled water pump, cooling water pump and expansion water tank correctly so that the chiller pressure does not exceed the set value.
5. For cooling water temperature control refer to the chapter "Cooling water temperature control method".
6. Separate chilled and cooling water pumps should be provided for each chiller.
7. Provide a cooling water blow-down valve in the cooling tower inlet for water quality control.
8. Install a filter in the chilled water and cooling water pipes (10 mesh).
9. Install stop valves on the chilled and cooling water inlet/ outlet.
10. Provide a thermometer and pressure gauge at the chilled and cooling water inlet and outlet.
11. Provide an air vent valve in each of the chilled and cooling water lines at a point higher than the header.
12. Install drain valves at the lowest positions between absorption chiller and the stop valves of the chilled water and cooling water, and pipe them to the drain channel.
13. Install stop valves between the absorption chiller and stop valves of all inlets and outlets for chemical cleaning of the water circuit system.
14. The maximum allowable steam pressure is 900 kPa. Please refer to this diagram to install a relief valve to ensure that the maximum pressure is not exceeded. The exhaust pipe of the relief valve should be connected to the outside.
15. If the steam superheat exceeds 10 K, chiller performance would deteriorate.
16. Install a filter (100 mesh), drain water pipe and pressure gauge near the chiller steam inlet location.
17. The back pressure of the steam drain outlet pipe should be controlled below 49 kPa.
18. If there is a possibility of backward flow of the steam, when the absorption chiller does not operate, please install a check valve.
19. A steam trap has been installed in the absorption chiller and does not need to be installed by the customer.
20. Install a cooling tower away from any exhaust gas outlet.
21. The maximum steam drain temperature is 90°C.

4.5.2 - Water treatment

Absorption chillers use copper tubes 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 tubes. Please contact a water treatment specialist.

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

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

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

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

4.5.3 - Standard water quality values
Ref: JRA-GL-02-1994

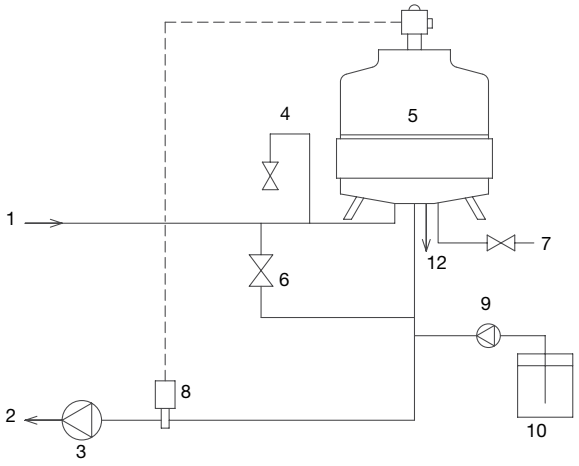
			Cooling water systems			Chilled water systems		Tendency	
			Recirculating water	Make-up water	Once-through water	Recirculating water < 20°C	Make-up water	Corrosive	Scale-forming
Standard	pH (25°C)		6.5 - 8.2	6.0 - 8.0	6.8 - 8.0	6.8 - 8.0	6.8 - 8.0	X	X
	Electrical conductivity 25°C	(mS/m)	below 80	below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

			Hot-water systems				Tendency	
			Lower level (20-60°C)		Higher level (60-90°C)			
			Recirculating water	Make-up water	Recirculating water	Make-up water	Corrosive	Scale-forming
Standard	pH (25°C)		7.0 - 8.0	7.0 - 8.0	7.0 - 8.0	7.0 - 8.0	X	X
	Electrical conductivity 25°C	(mS/m)	below 30	below 30	below 30	below 30	X	X
	Chloride 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

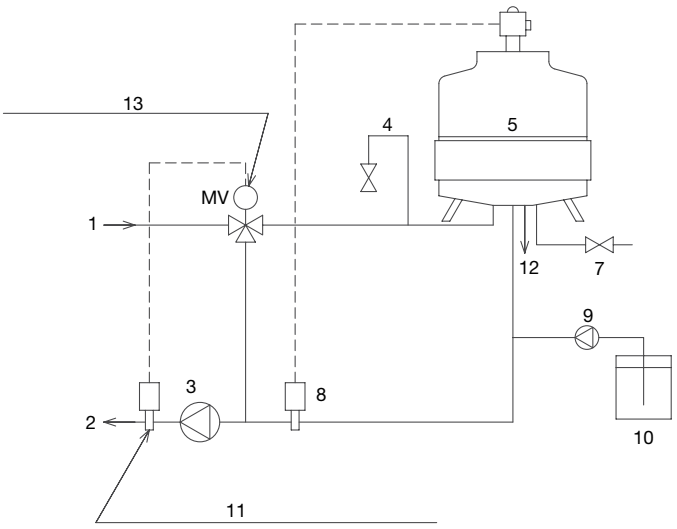
4.5.4 - Cooling water temperature control

Fig. 25 - Example for cooling water entering temperature of 29.4°C

A



B



Legend

1 From chiller
2 To chiller
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 thermostat for three-way control valve
12 Blow-down
13 Automatic three-way control valve

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 A

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

During operation of the chiller 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.

Case B

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

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 1.80 (exhaust heat factor) divided by 576 (latent heat of water at 40°C) = 2.69 l/h/kW

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

B: Blow-down volume

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

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

Example

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

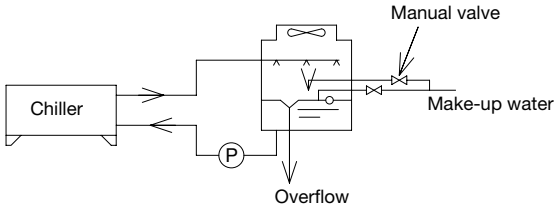
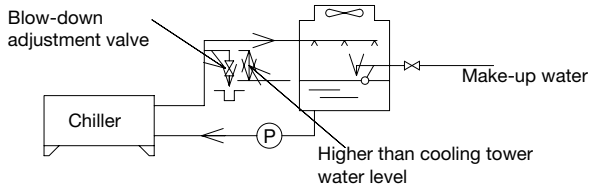
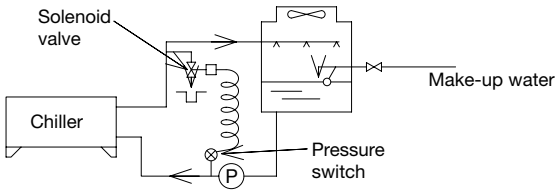
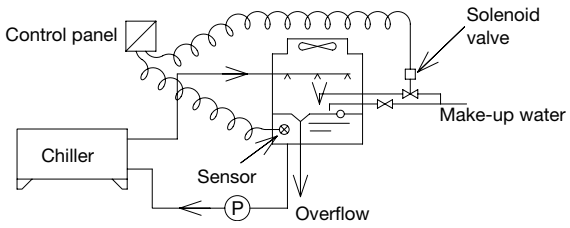
E = 2.69 l/h/kW

N = 3

W = 0.52 l/h

$$B = \frac{1}{3 - 1} \times 2.69 - 0.52$$

B = 0.825 l/h/kW

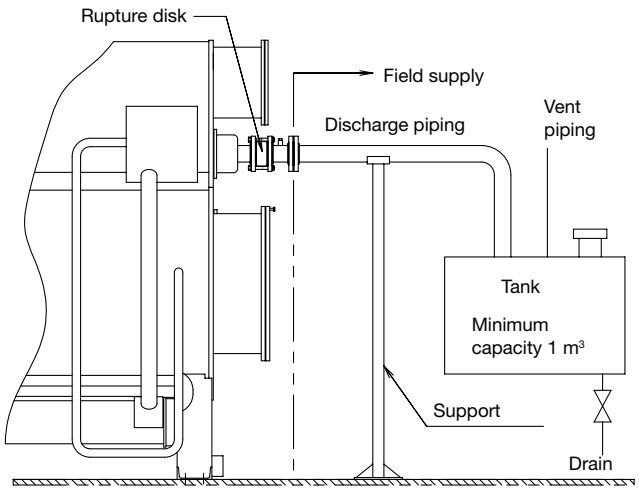
1	**Overflow** (Overflow at cooling tower via manual valve)	
2	**Constant blow-down** (Constant blow-down via solenoid valve)	
3	**Pressure switch and solenoid valve** (Blow-down via solenoid valve at pressure switch)	
4	**Conductivity meter and/or pH meter** (Blow-down by conductivity or pH)	

4.5.6 - Boiler water quality
Ref: JIS-B-8223-1989

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

4.5.7 - Rupture disk connection

Fig. 26



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.***

4.5.8 - 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. 27 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. 28.
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. 28.**

   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. 27

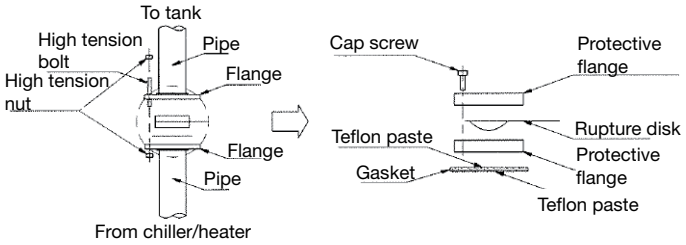
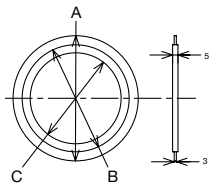


Fig. 28

	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)*	26	41

* Cap screw hexagon socket head

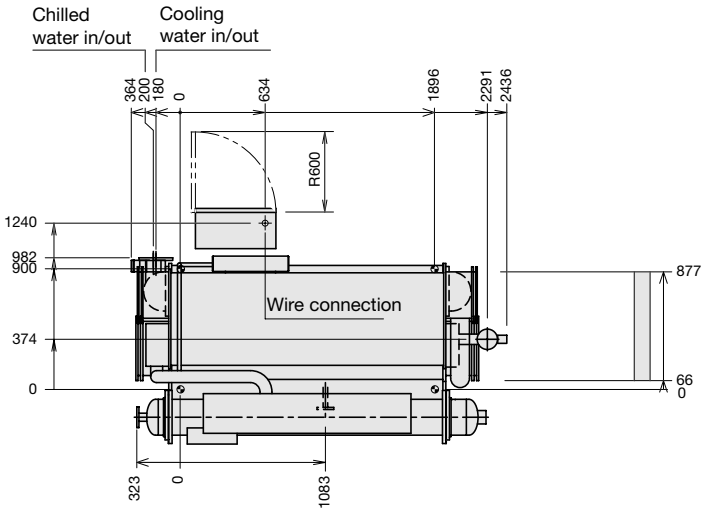


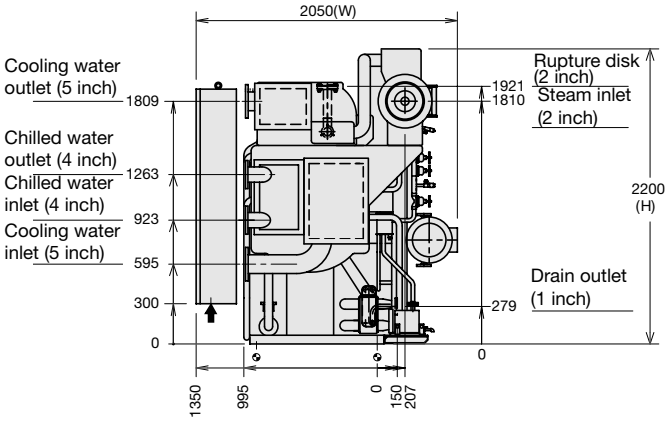
Material: T/#9090-OR
ANSI class: 150 lbs
Part No.: 814-2-2101-675-00-0: 2 inch
814-2-2101-677-00-0: 3 inch

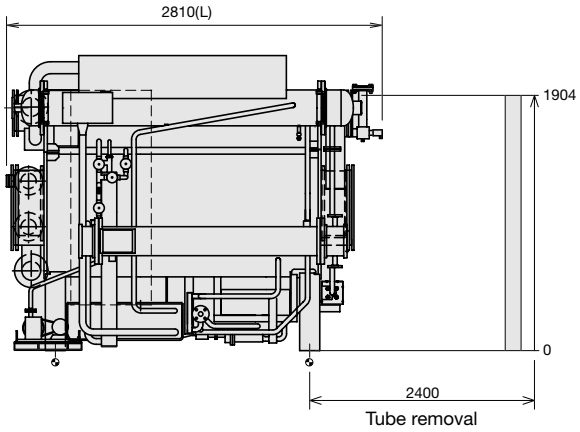
4.5.9 - Dimensional drawings

16NK-11 (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. Mating flanges all external water piping are provided welded ANSI 150LB flange with chiller.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 35 mm).
5. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm

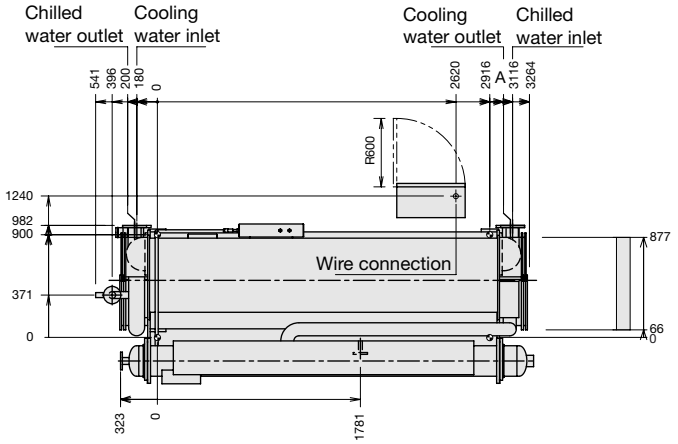


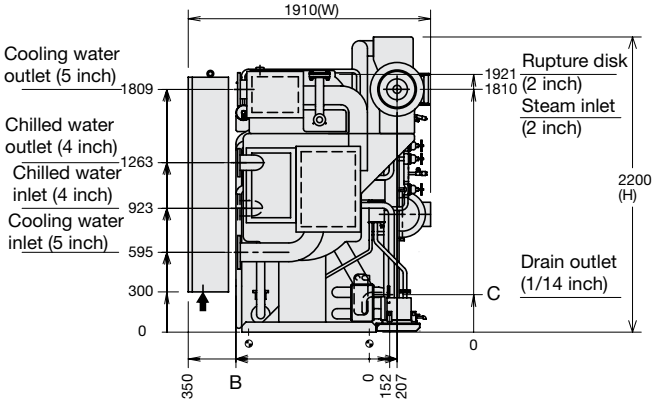


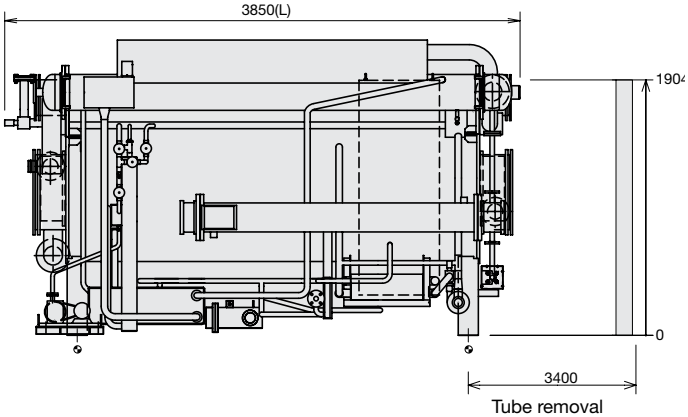


16NK-12 through 16NK-13 (mm)

16NK	A	B	C
12	3097	994	280
13	3096	995	279



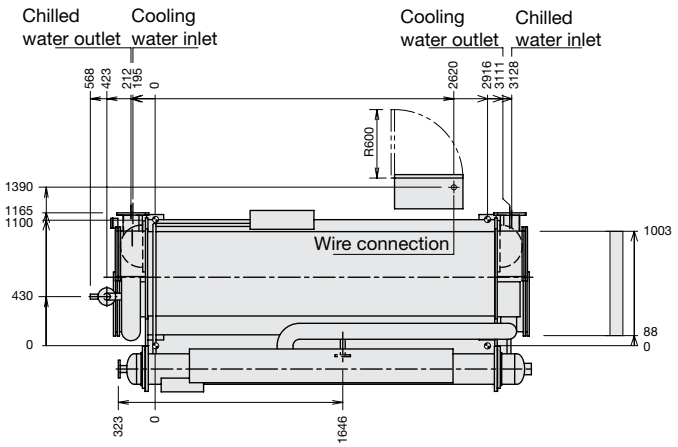


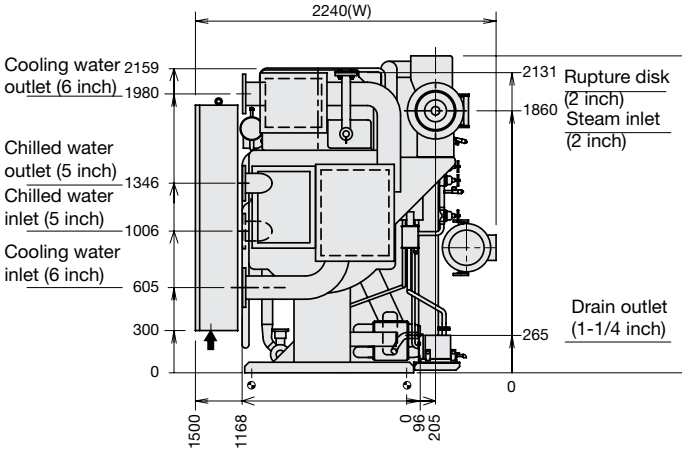


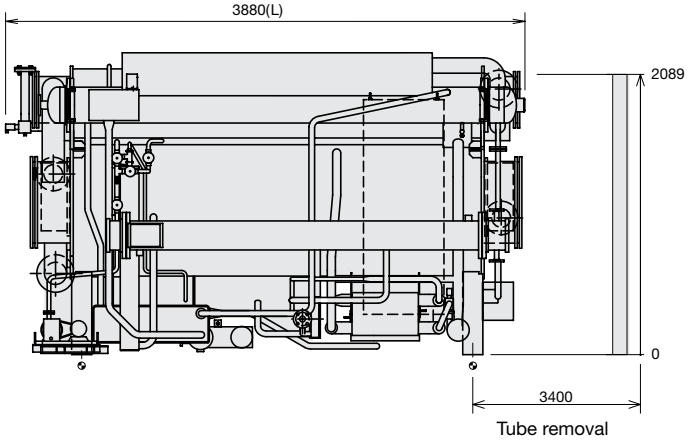
NOTE: Dimensions are for guidance only. Refer to the certified drawings supplied upon request when designing an installation.

16NK-21 (mm)

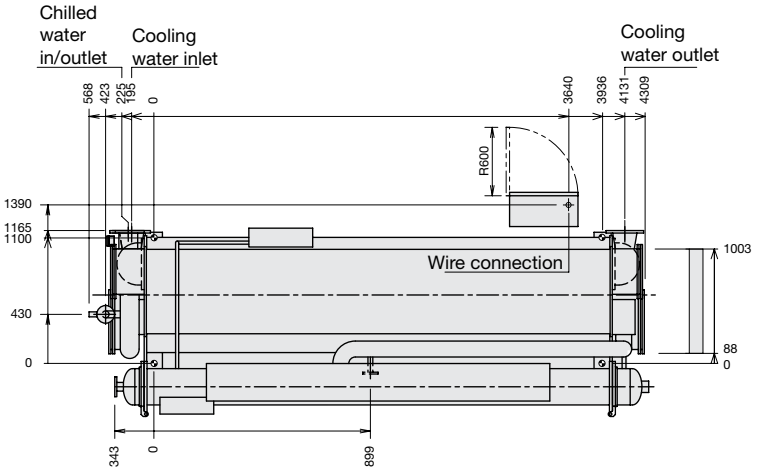
NOTES:
1. Dimensions (L), (W), (H) are for a standard machine. The dimensions are changed by parts added.
2. ◔ indicates the position of anchor bolts.
3. Mating flanges all external water piping are provided welded ANSI 150LB flange with chiller.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 35 mm).
5. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm

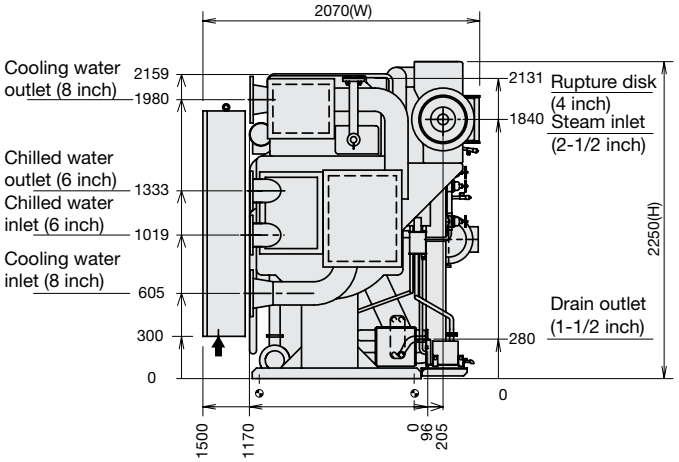


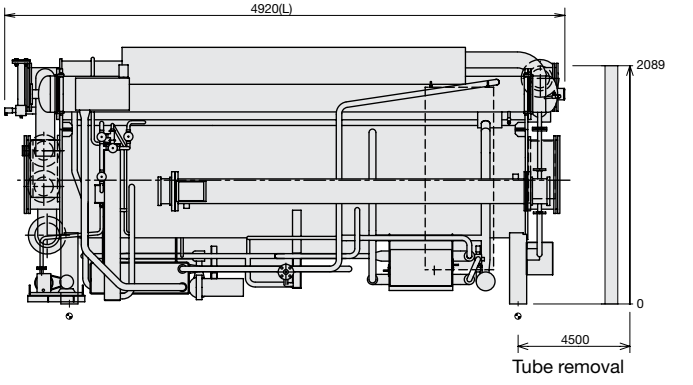




16NK-22 (mm)





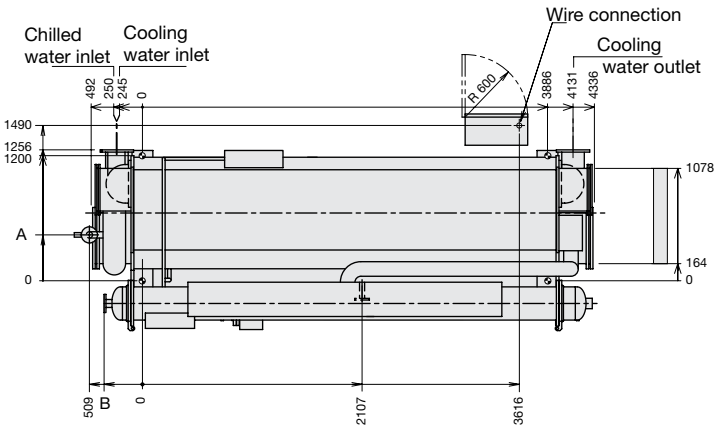


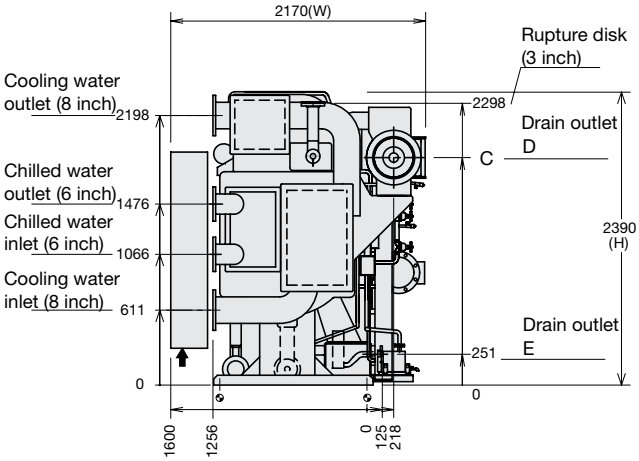
NOTE: Dimensions are for guidance only. Refer to the certified drawings supplied upon request when designing an installation.

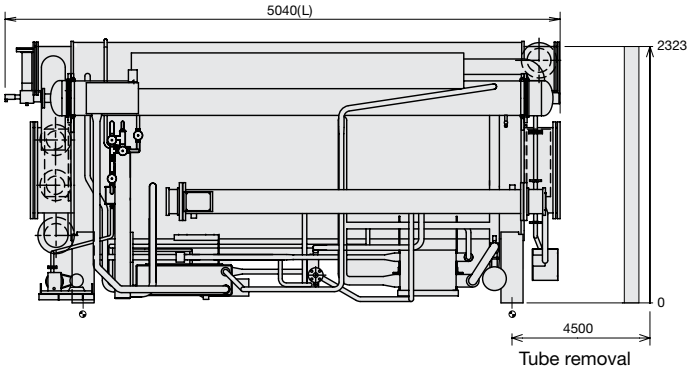
16NK-31 through 16NK-32 (mm)

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. Mating flanges all external water piping are provided welded ANSI 150LB flange with chiller.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 35 mm).
5. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm

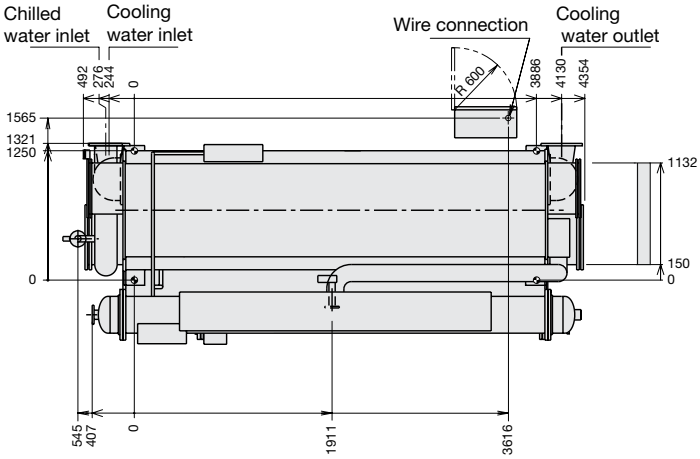
16NK	A (mm)	B (mm)	C (mm)	D (in)	E (in)
31	440	368	1855	2-1/2	1-1/4
32	460	370	1910	3	1-1/2

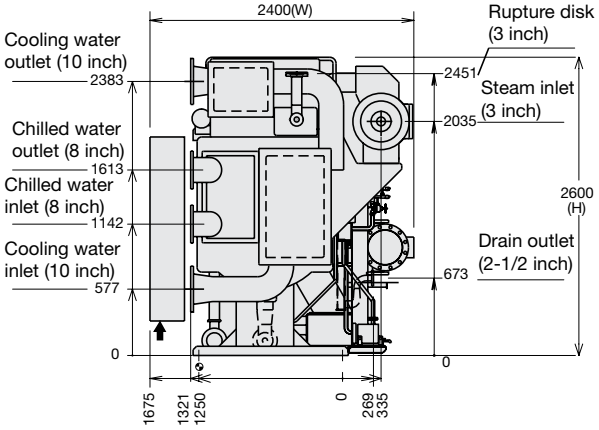


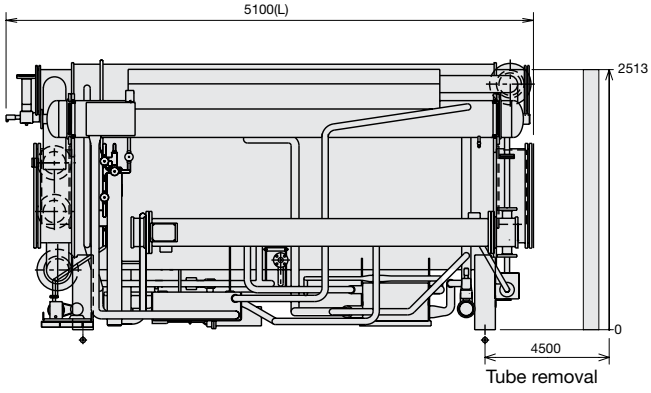




16NK-41 (mm)



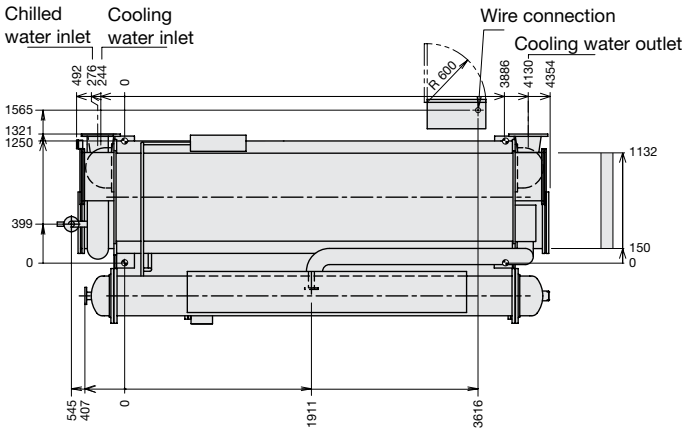


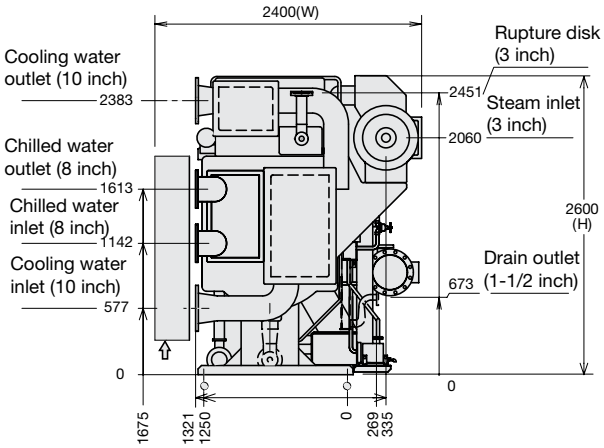


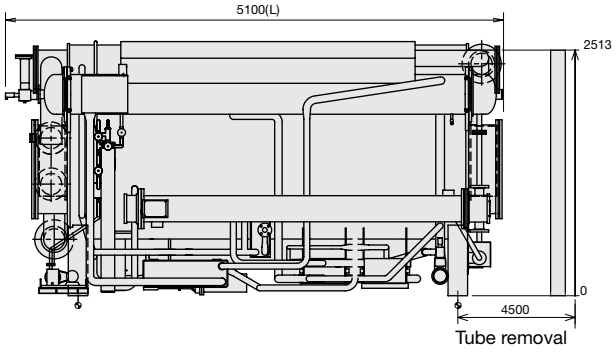
NOTE: Dimensions are for guidance only. Refer to the certified drawings supplied upon request when designing an installation.

16NK-42 (mm)

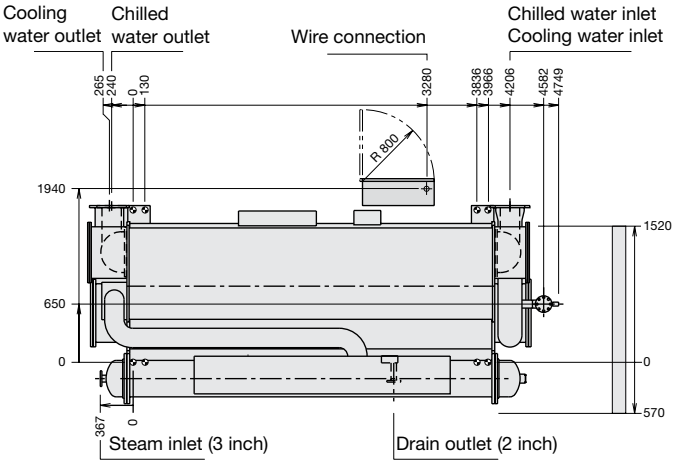
NOTES:
1. Dimensions (L), (W), (H) are for a standard machine. The dimensions are changed by parts added.
2. ◔ indicates the position of anchor bolts.
3. Mating flanges all external water piping are provided welded ANSI 150LB flange with chiller.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 35 mm).
5. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm

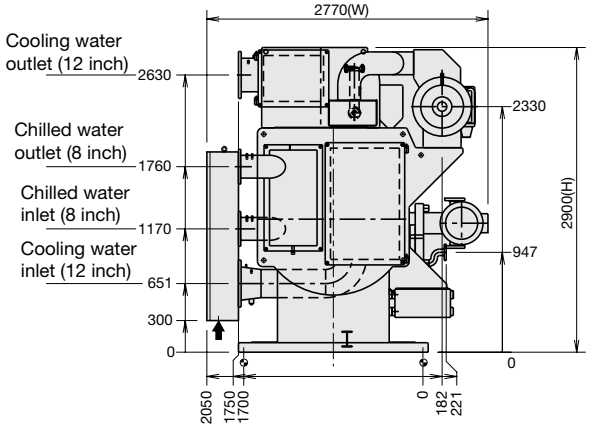


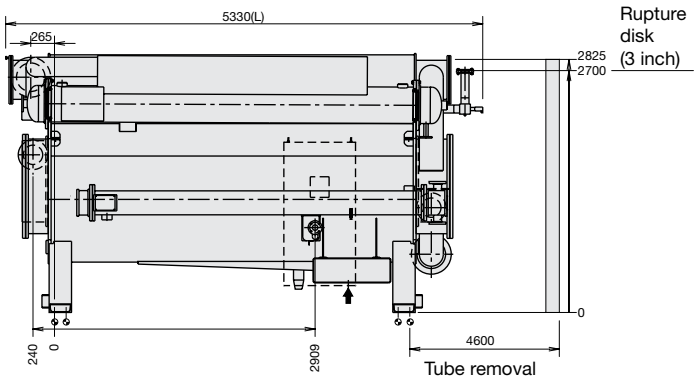




16NK-51 (mm)





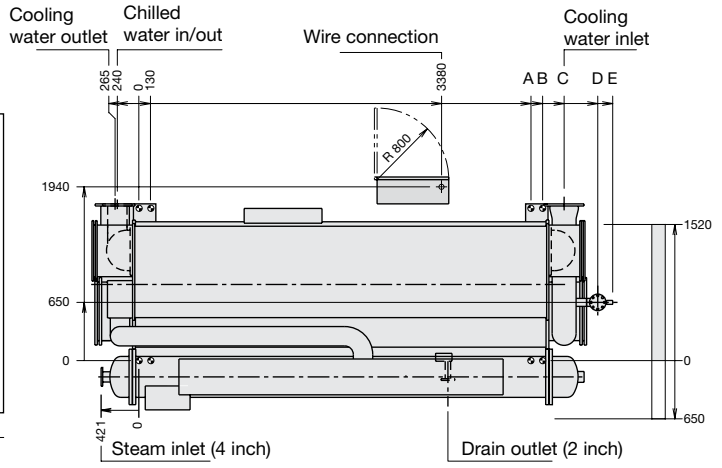


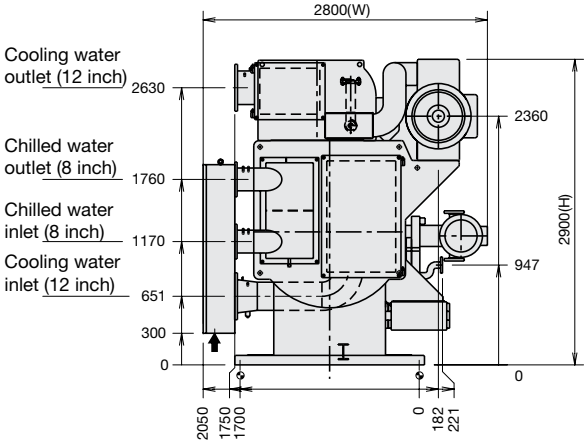
NOTE: Dimensions are for guidance only. Refer to the certified drawings supplied upon request when designing an installation.

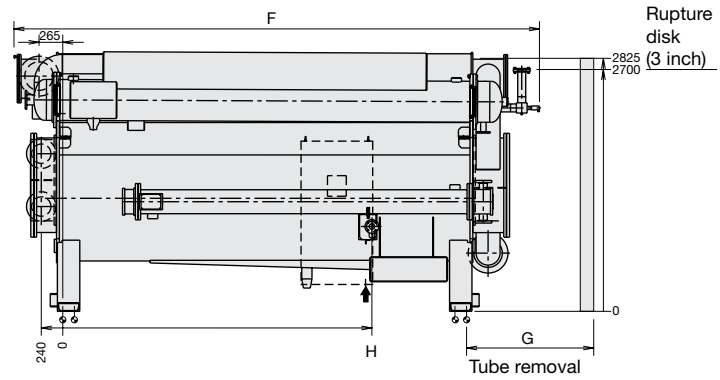
16NK-52 through 16NK-53 (mm)

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. Mating flanges all external water piping are provided welded ANSI 150LB flange with chiller.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 35 mm).
5. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm

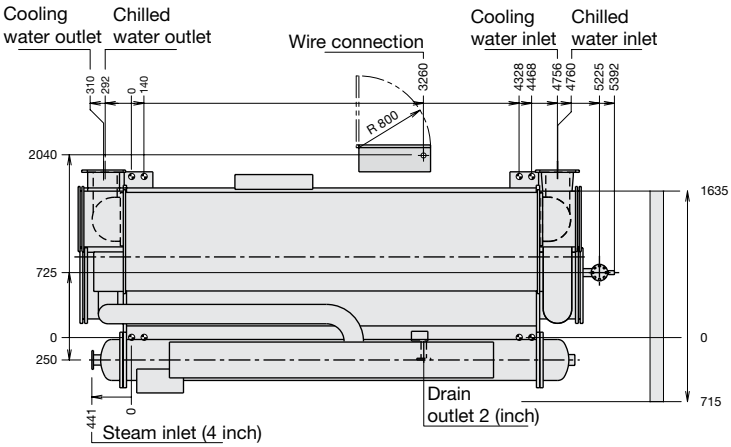
16NK	A	B	C	D	E	F	G	H
51	4378	4508	4748	5123	5290	5870	5100	3451
52	4876	5006	5246	5622	5789	6370	5600	3949

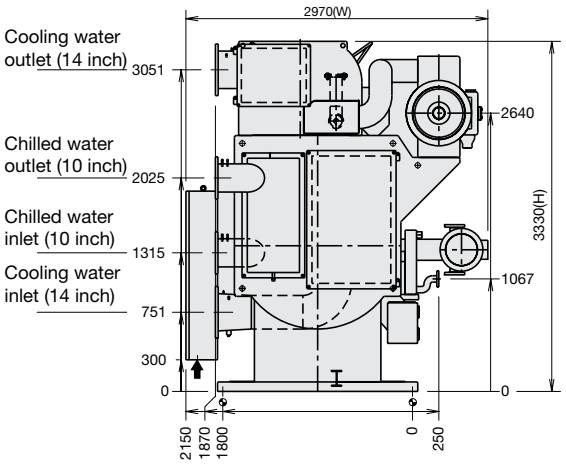


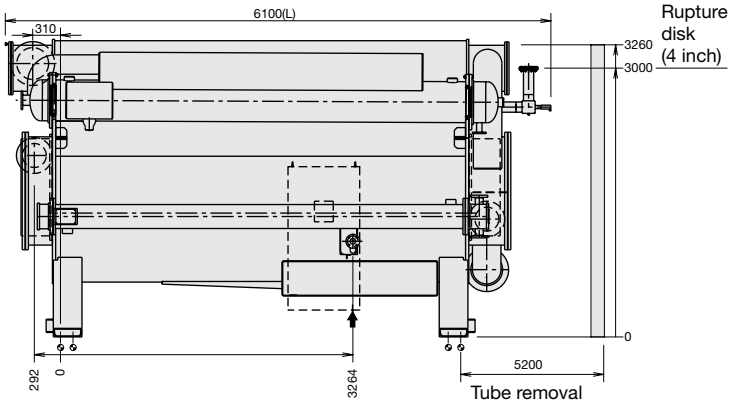




16NK-61 (mm)



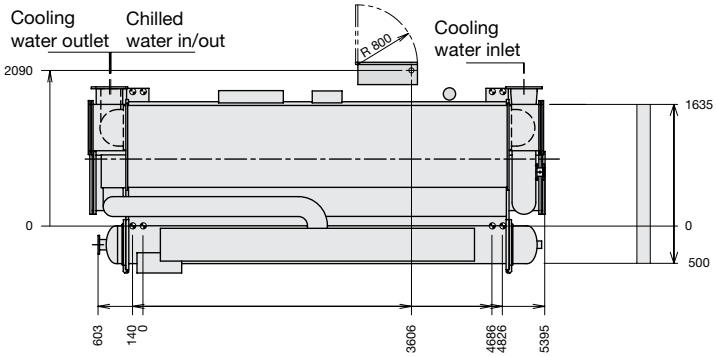


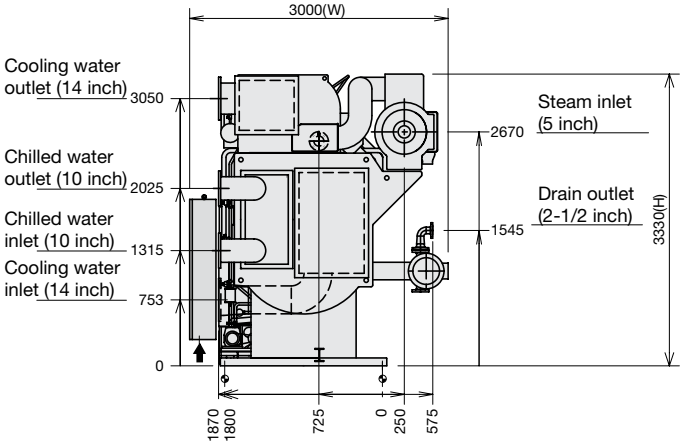


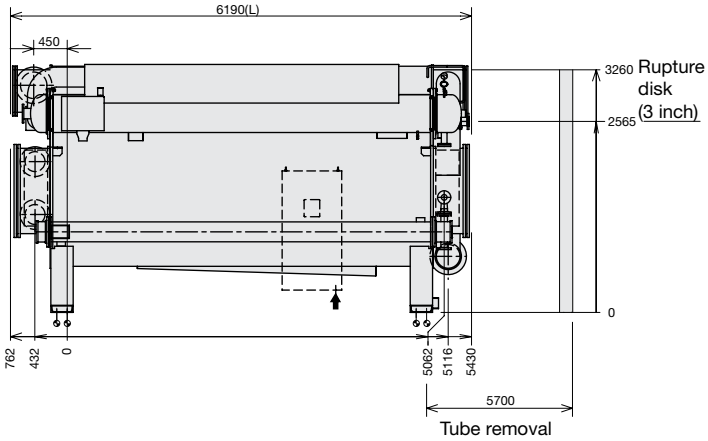
NOTE: Dimensions are for guidance only. Refer to the certified drawings supplied upon request when designing an installation.

16NK-62 (mm)

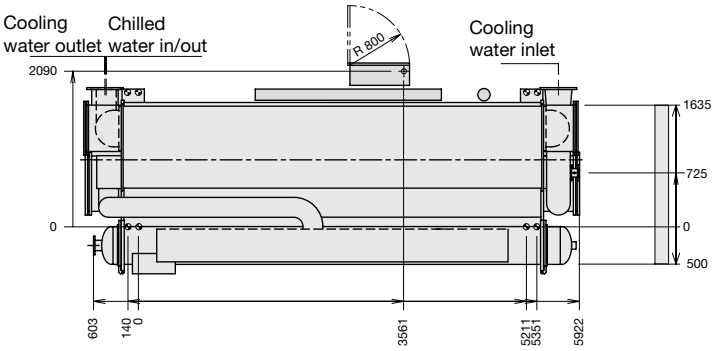
NOTES:
1. Dimensions (L), (W), (H) are for a standard machine. The dimensions are changed by parts added.
2. ◔ indicates the position of anchor bolts.
3. Mating flanges all external water piping are provided welded ANSI 150LB flange with chiller.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 35 mm).
5. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm

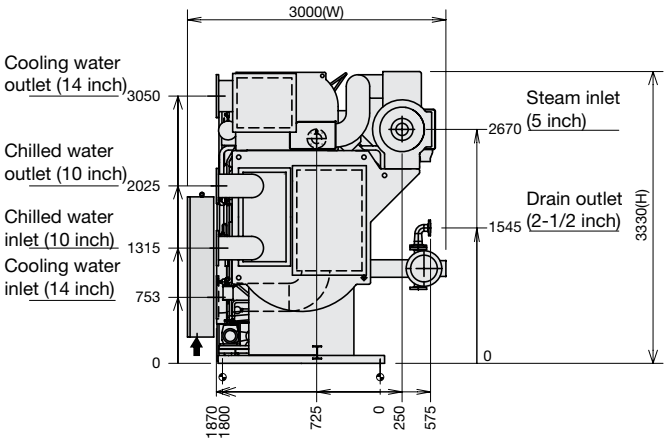


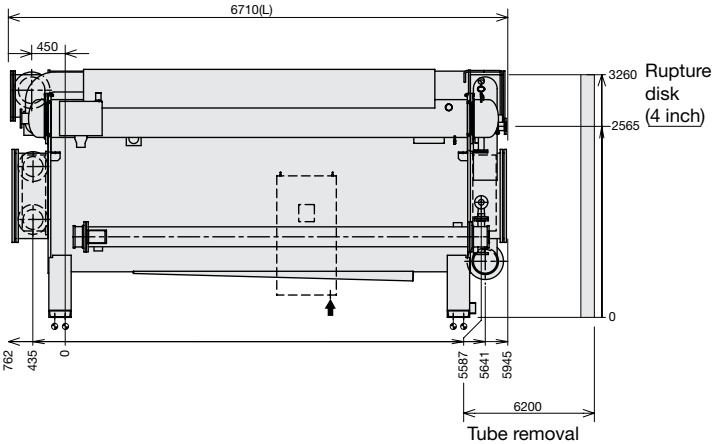




16NK-63 (mm)



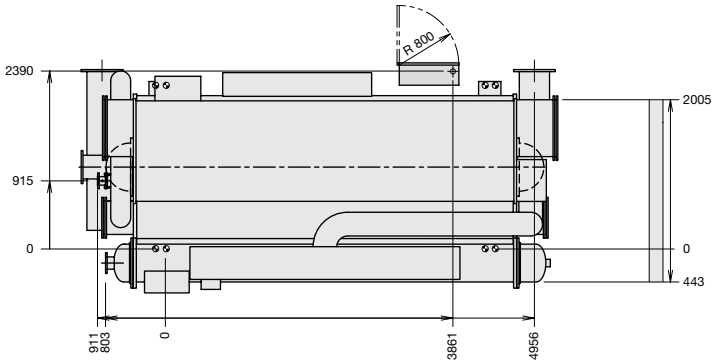


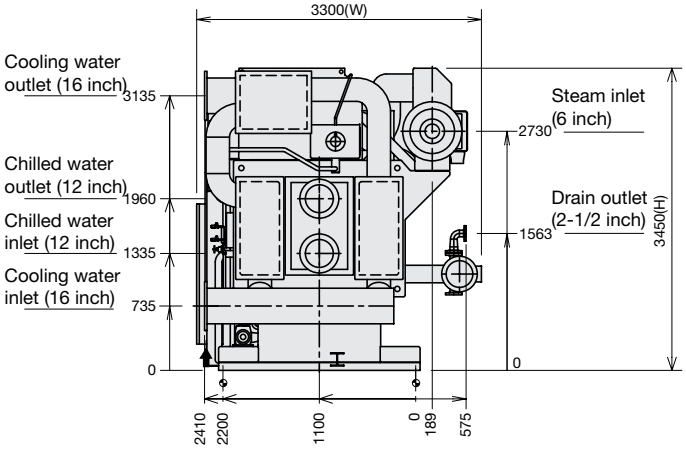


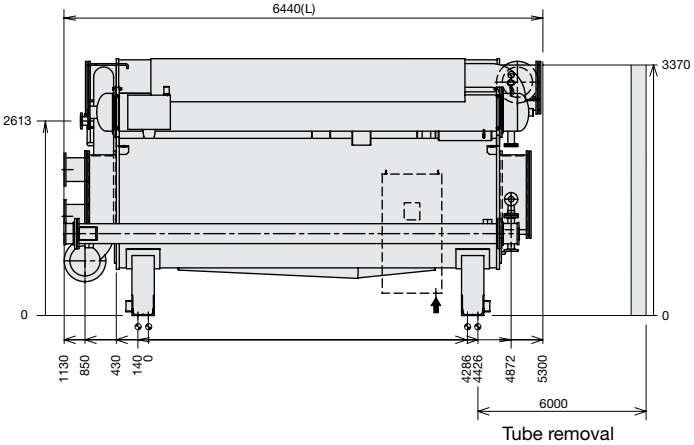
NOTE: Dimensions are for guidance only. Refer to the certified drawings supplied upon request when designing an installation.

16NK-71 (mm)

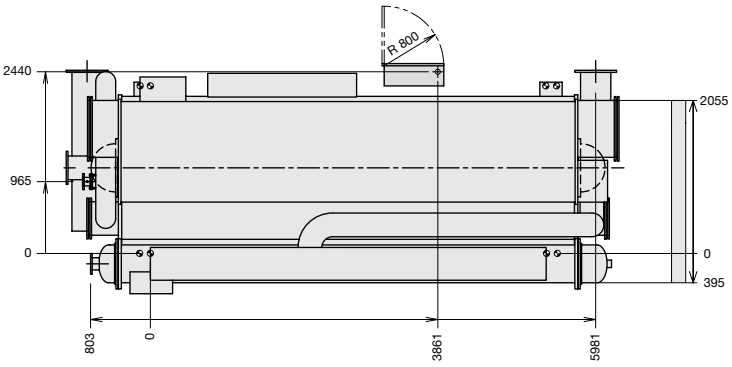
NOTES:
1. Dimensions (L), (W), (H) are for a standard machine. The dimensions are changed by parts added.
2. ◔ indicates the position of anchor bolts.
3. Mating flanges all external water piping are provided welded ANSI 150LB flange with chiller.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 35 mm).
5. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm

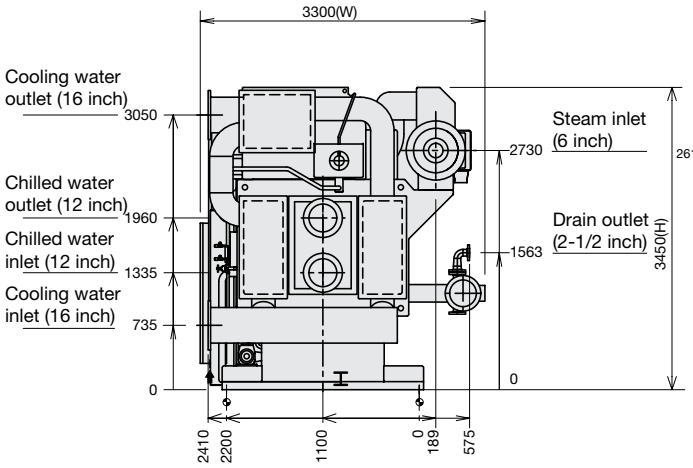


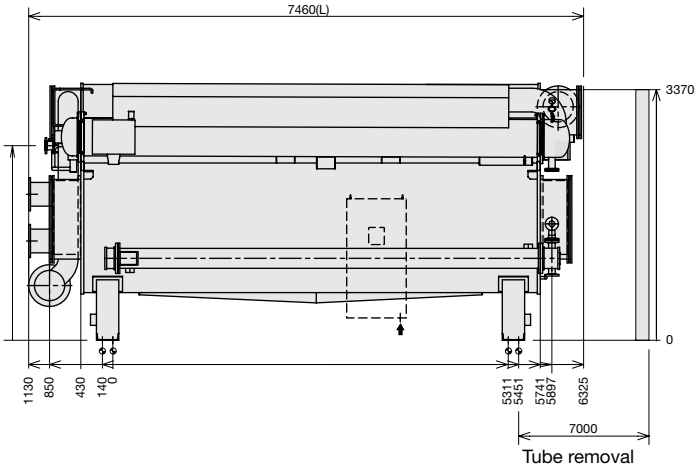




16NK-72 (mm)



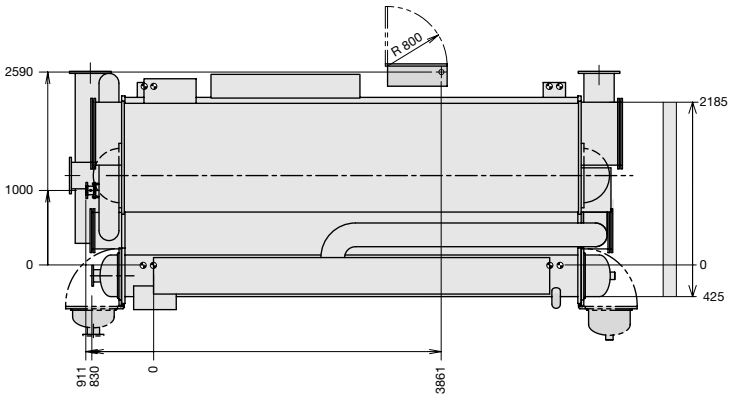


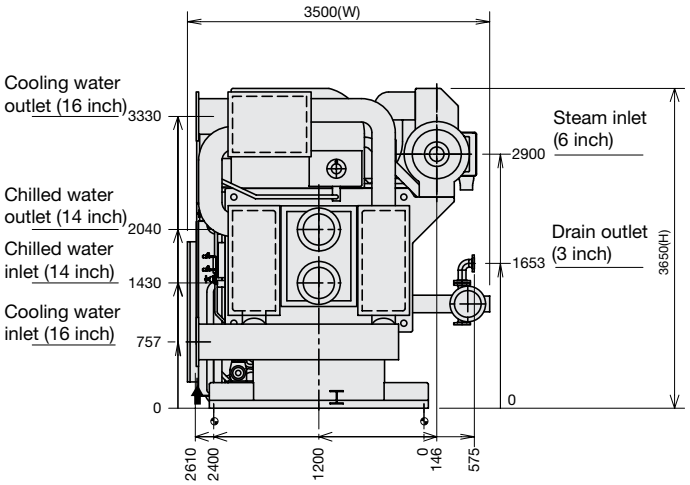


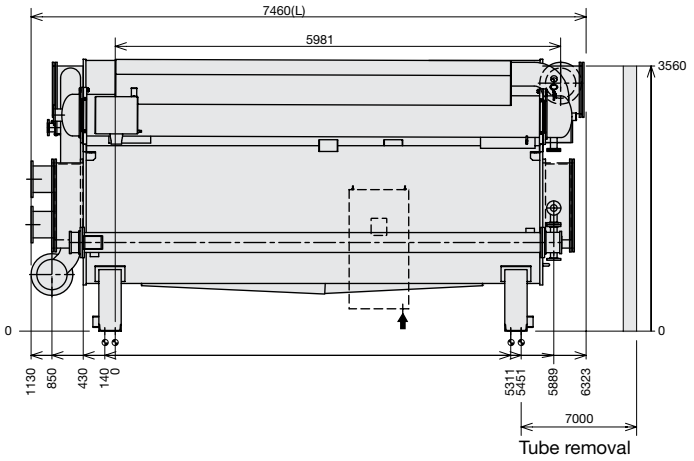
NOTE: Dimensions are for guidance only. Refer to the certified drawings supplied upon request when designing an installation.

16NK-81 (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. Mating flanges all external water piping are provided welded ANSI 150LB flange with chiller.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 35 mm).
5. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm







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

4.6 - Exhibit NKF - Wire sizes/field wiring/wiring diagram

4.6.1 - Wire sizes

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

16NK	208 V				460 V				400 V			
	Current drawn, A	Wire section, mm^2	Screw size	Tightening torque, Nm	Current drawn, A	Wire section, mm^2	Screw size	Tightening torque, Nm	Current drawn, A	Wire section, mm^2	Screw size	Tightening torque, Nm
11	21.9	4	M5	2.2-2.8	9.9	2.5	M5	2.2-2.8	10.8	2.5	M5	2.2-2.8
12	21.9	4	M5	2.2-2.8	9.9	2.5	M5	2.2-2.8	10.8	2.5	M5	2.2-2.8
13	21.9	4	M5	2.2-2.8	9.9	2.5	M5	2.2-2.8	10.8	2.5	M5	2.2-2.8
21	26.7	6	M6	4.0-5.0	12.1	2.5	M5	2.2-2.8	13.3	2.5	M5	2.2-2.8
22	26.7	6	M6	4.0-5.0	12.1	2.5	M5	2.2-2.8	13.3	2.5	M5	2.2-2.8
31	27.3	6	M6	4.0-5.0	12.3	2.5	M5	2.2-2.8	13.6	2.5	M5	2.2-2.8
32	27.3	6	M6	4.0-5.0	12.3	2.5	M5	2.2-2.8	13.6	2.5	M5	2.2-2.8
41	40.9	16	M6	4.0-5.0	18.5	4	M5	2.2-2.8	20.7	4	M5	2.2-2.8
42	40.9	16	M6	4.0-5.0	18.5	4	M5	2.2-2.8	20.7	4	M5	2.2-2.8
51	44.8	16	M6	4.0-5.0	20.2	4	M5	2.2-2.8	22.7	4	M5	2.2-2.8
52	48.2	16	M6	4.0-5.0	21.8	4	M5	2.2-2.8	24.5	4	M5	2.2-2.8
53	48.2	16	M6	4.0-5.0	21.8	4	M5	2.2-2.8	24.5	4	M5	2.2-2.8
61	50.1	16	M6	4.0-5.0	22.7	4	M5	2.2-2.8	25.5	6	M6	4.0-5.0
62	49.2	16	M6	4.0-5.0	18.5	4	M5	2.2-2.8	25.0	4	M5	2.2-2.8
63	49.2	16	M6	4.0-5.0	18.5	4	M5	2.2-2.8	25.0	4	M5	2.2-2.8
71	63.9	25	M6	4.0-5.0	20.2	4	M5	2.2-2.8	33.5	10	M6	4.0-5.0
72	63.9	25	M6	4.0-5.0	21.8	4	M5	2.2-2.8	33.5	10	M6	4.0-5.0
81	63.9	25	M6	4.0-5.0	22.7	4	M5	2.2-2.8	33.5	10	M6	4.0-5.0

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

Wire size	Screw size	Tightening torque
1 mm^2	M3.5	1.4-1.8 Nm

4.6.2 - Field wiring

Fig. 29 - Typical electric field connection diagram

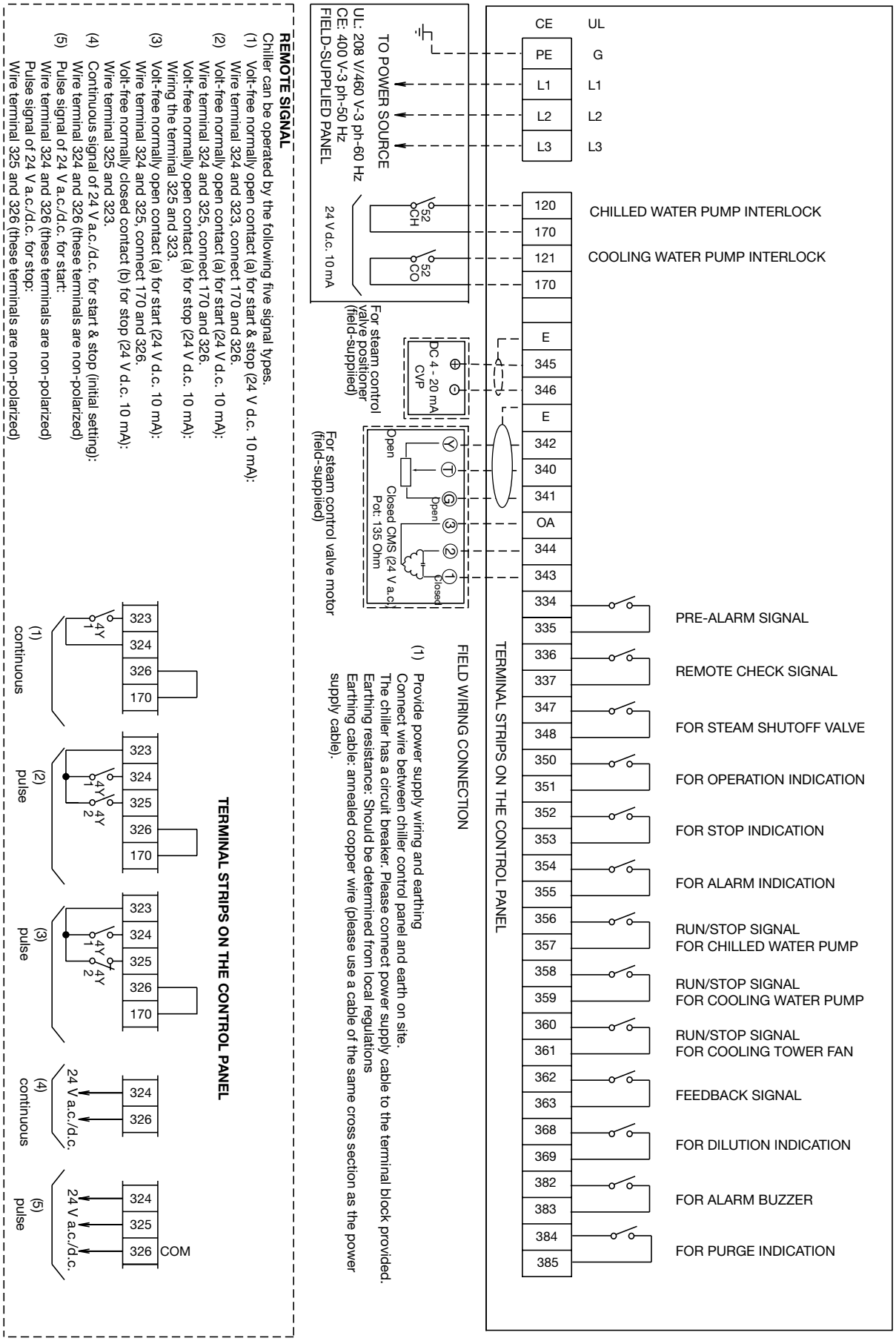
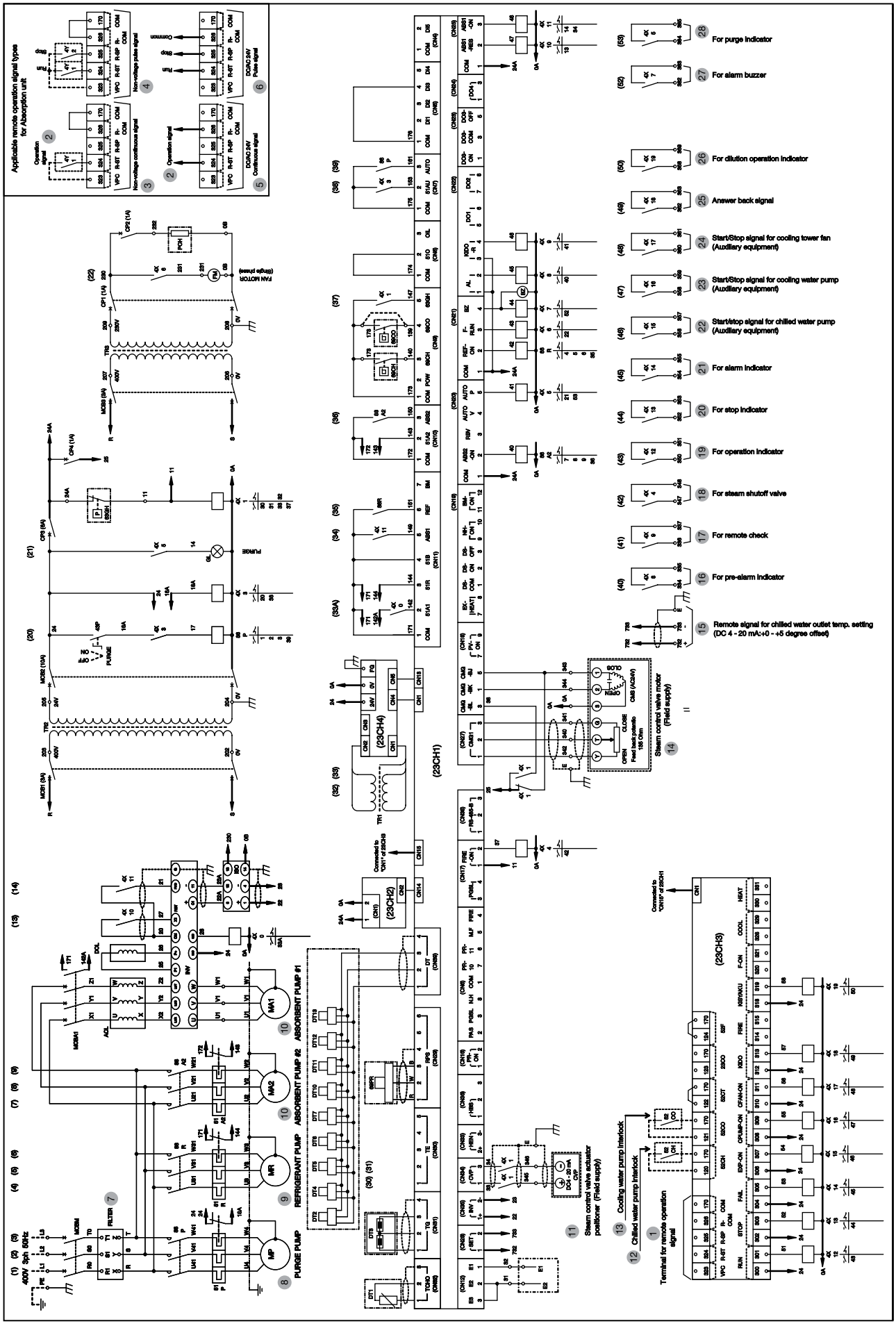


Fig. 30 - Wiring diagram



4.6.3 - Parts list for Fig. 30

SYMBOL	NAME	REMARKS
ACL	AC reactor	
BZ	Alarm buzzer	
DCL	Circuit protector	
CP1-3	Circuit protector Nos. 1 to 3	There are also CP1 (..) CP3 (..)
DT1	Chilled water leaving temperature sensor	
DT2	Cooling water leaving temperature sensor	
DT3	Generator temperature sensor	
DT5	Condenser temperature sensor	
DT6	Chilled water entering temperature sensor	
DT7	Cooling water entering temperature sensor	
DT10	Absorber temperature sensor	
DT11	Evaporator temperature sensor	
DT12	Intermediate cooling water temperature sensor	
DT13	Steam drain temperature sensor	
FILTER	EMI filter	
FM	Fan motor	
GL	Purge indication lamp	
MA1	Absorbent pump 1	
MA2	Absorbent pump 2	
MP	Purge pump	
MR	Refrigerant pump	
MCBA1	Absorbent pump 1 circuit breaker	
MCBM	Main circuit breaker	
MCB1-3	Circuit breaker Nos. 1 to 3	
PCH	Palladium cell heater	
TR1-3	Transformer Nos. 1 to 3	
23CH1	CPU board	
23CH2	Indicator board	
23CH3	In/out board	
23CH4	Power board	
4Xn	Control relay	
43P	Purge pump on-off switch	
51A2	Absorbent pump 2 overcurrent relay	
51P	Purge pump overcurrent relay	
51R	Refrigerant pump overcurrent relay	
63GH	Generator pressure switch	
69CH	Chilled water flow switch	
69CO	Cooling 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	Field-supplied
52CH	Chilled water pump interlock	Field-supplied
52CO	Cooling water pump interlock	Field-supplied

Other codes	DESCRIPTION	REMARKS
CMS	Steam control valve motor	Field-supplied
CVP	Steam control valve positioner	Field-supplied
RUN - STOP - OPEN - CLOSE	Run - Stop - Open - Close	
COM	Common input signal	
HEAT	Heat	
COOL	Cool	
F-ON	Ventilation fan on	
KISYAKU	Dilution	
FIRE	Not used	
KIDO	Feedback signal	
CFAN-ON	Cooling tower fan on	
CPUMP-ON	Cooling water pump on	
EXT-ON	Chilled/hot water pump on	
FAIL	Fail	
ABS1-RES	No. 1 Absorbent pump inverter reset	Option
ABS1-ON	No. 1 Absorbent pump on	
POTI	Valve position feedback	
63GH	Generator pressure switch	
VPC	Remote signal power supply	
R-ST	Remote start signal	
R-SP	Remote stop signal	
R-COM	Common remote signal	
E1, 2	HT generator soution level electrode	
E3	Not used	
SET	Remote temperature setting - CPU board analogue input	
INV	Inverter	
HEN	Not used - CPU board analogue output	
HBS	Not used	
PR-ON	Not used	
PAS	Not used	
PGSL	Not used	
N.H	Not used	
PR-10 ; PR-11	Not used	
M.F	Not used	
FIRE	Not used	
FIRE-ON	Not used	
RS-485-B	Not used	
DI1- DI2 - DI4 - DI5	Not used	
DI3	Cooling only	
CN1….CN39	Connector No 1 to 39	
CMG1	Control valve feed back - CPU board analogue input	
TCHO	Chilled/hot water outlet - CPU board sensor input	
52CO	Cooling water pump interlock signal	
52CT	Not used	
23CO	Not used	
Purge	Purge	

Legend for Fig. 30

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

4.7 - Exhibit NKG - Insulation area

Fig. 31 - Insulation area 16NK-11 to 16NK-63

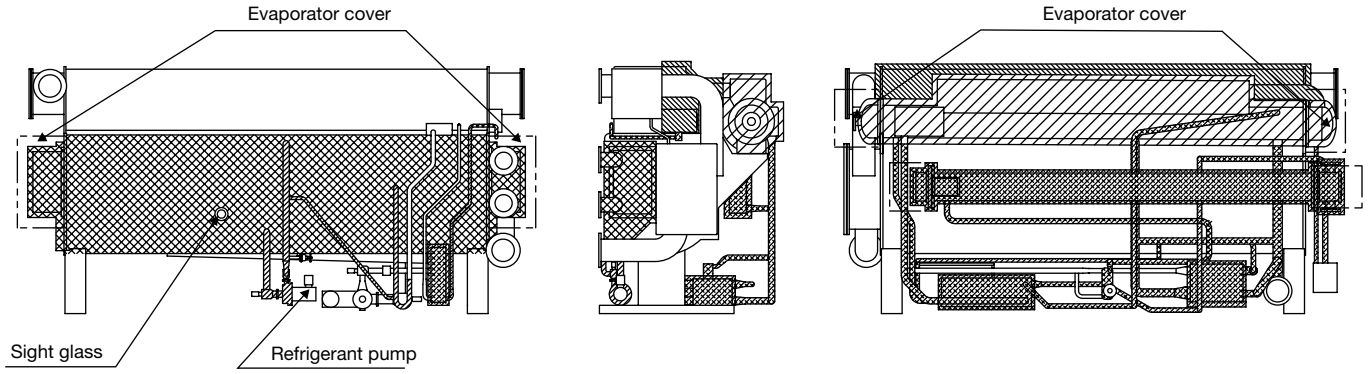
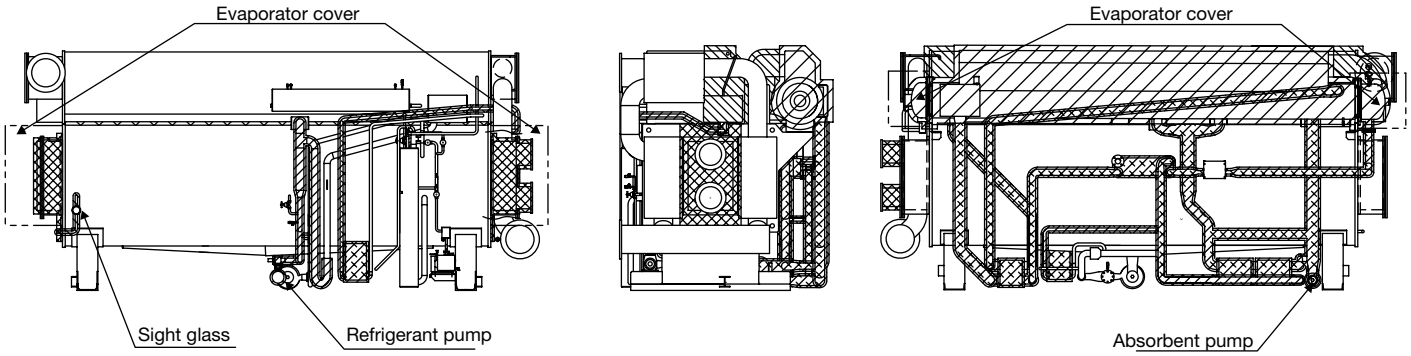


Fig. 32 - Insulation area 16NK-71 to 16NK-81



NOTES

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

16NK	Hot surface insulation, m²			Cold surface insulation, m²	
	75 mm	50 mm	30 mm	50 mm	30 mm
11	3.3	1.9	3.1	4.0	0.4
12	4.6	2.7	3.8	5.5	0.4
13	4.6	2.7	4.1	5.5	0.4
21	4.6	3.1	4.9	6.1	0.5
22	6.6	3.9	5.3	7.6	0.5
31	6.6	4.4	6.6	8.5	0.7
32	7.2	4.4	6.9	8.5	0.7
41	7.2	4.6	7.6	9.9	0.7
42	8.4	4.6	8.0	9.9	0.7
51	8.4	4.4	9.5	13.8	1.1
52	10.5	4.9	10.0	15.0	1.1
53	11.7	5.3	10.6	16.1	1.1
61	10.5	5.9	12.6	17.5	1.2
62	12.5	6.3	15.2	18.7	1.2
63	15.2	6.8	16.3	20.0	1.2
71	13.8	7.1	19.4	10.9	1.4
72	16.4	8.2	21.2	11.8	1.4
81	16.4	8.5	23.8	13.6	1.5

4.8 - Exhibit NKH - LiBr solution material safety data sheet

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

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

4.8.1 - 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 7550-35-8	Not determined	Not determined

Ventilation requirements

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

Personal protective equipment

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

Hygiene measures

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

4.8.9 - 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) 4.7.12 et 4.7.15.

The HSE Policy of Dead Sea Bromine Group

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

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

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

Within this framework DSBG is committed to:

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

DSBG Disclaimer

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

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

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

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

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

End of safety data sheet

4.9 - Exhibit NKJ - Flow diagram and damper and valve position

Fig. 33 - 16NK-11 to 16NK-61

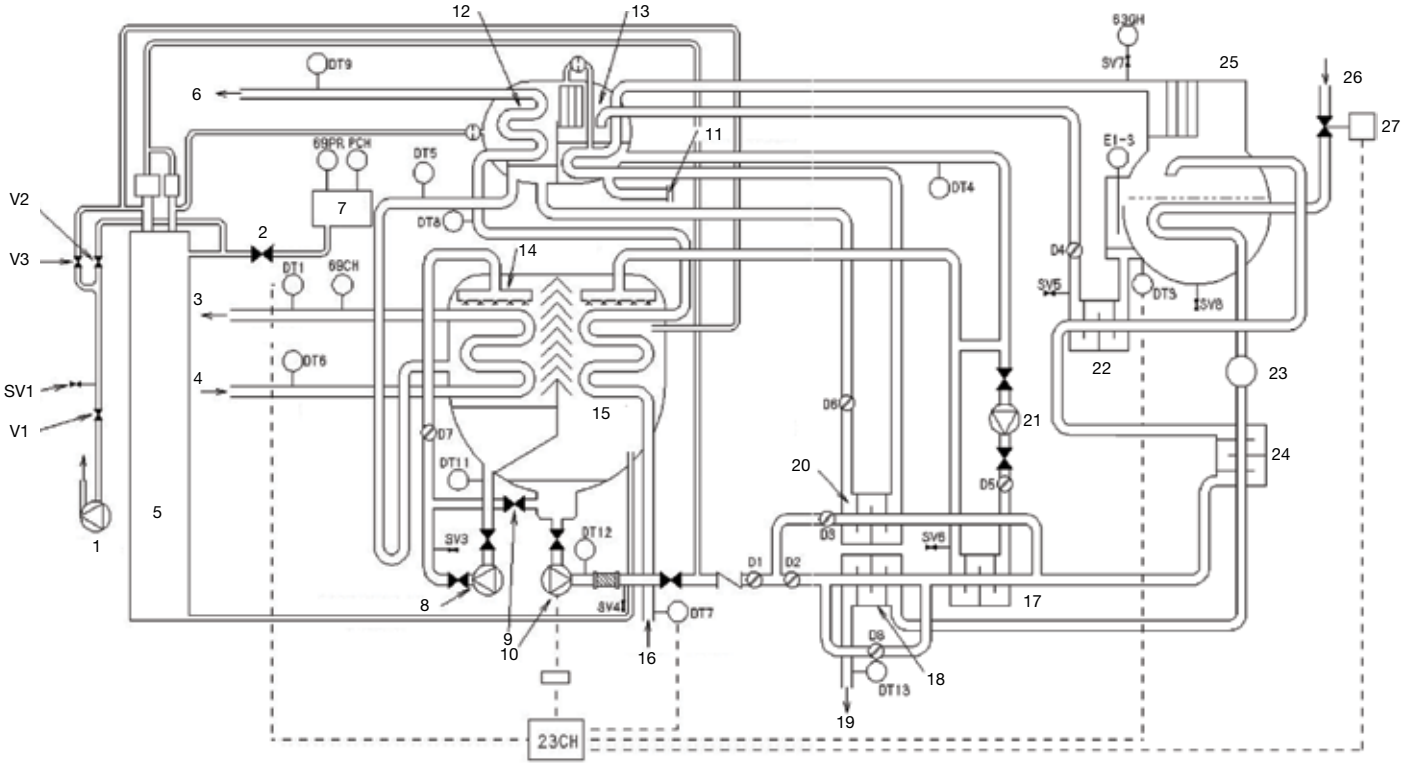
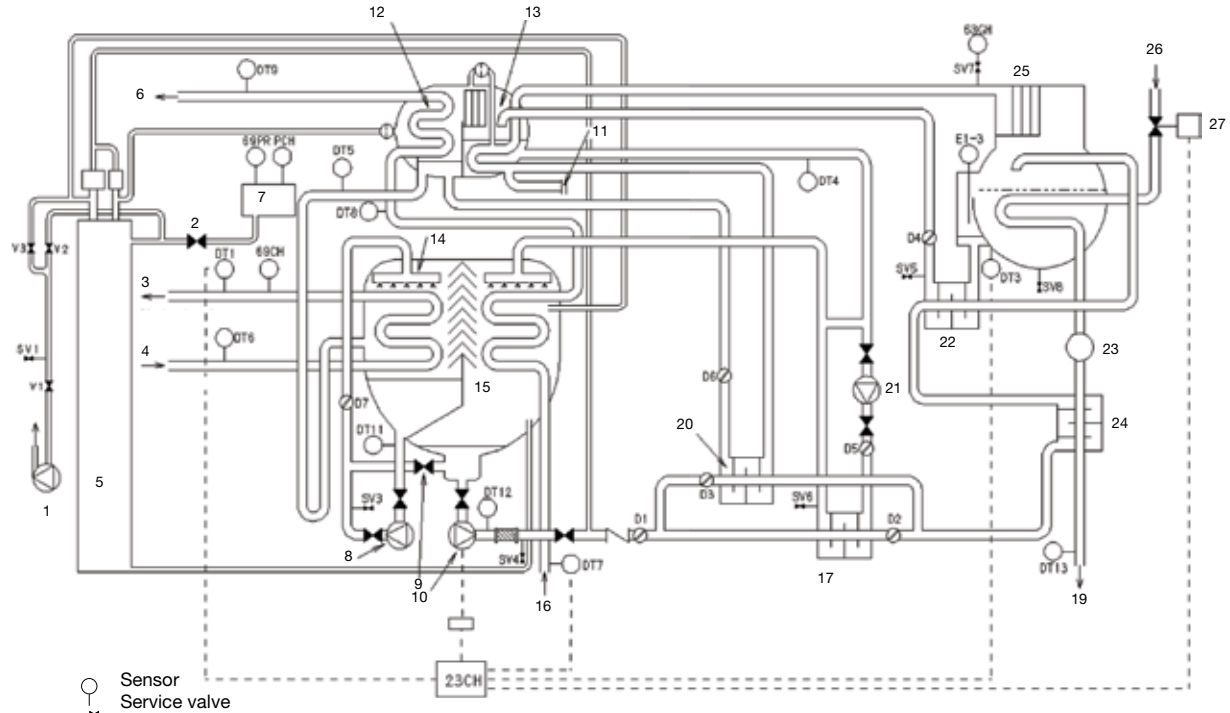


Fig. 34 - 16NK-62 to 16NK-81



Legend for Figs. 33 and 34

1 Purge pump
2 B-valve
3 Chilled water outlet
4 Chilled water inlet
5 Purge unit
6 Cooling water outlet
7 Purge tank
8 Refrigerant pump
9 Refrigerant blow valve
10 Absorbent pump 1
11 Rupture disk
12 Condenser
13 Low-temperature generator
14 Evaporator
15 Absorber
16 Cooling water inlet
17 Low-temperature heat exchanger
18 Low-temperature heat reclaimer
19 Steam drain outlet
20 Refrigerant drain heat reclaimer
21 Absorbent pump 2
22 High-temperature heat exchanger
23 Steam trap
24 High-temperature heat reclaimer
25 High-temperature generator
26 Steam inlet
27 Steam control valve

D1 Diluted solution main damper
D2 Diluted solution low-temperature heat exchanger damper
D3 Diluted solution refrigerant drain heat reclaimer damper
D4 Intermediate solution damper
D5 Concentrated solution damper
D6 Refrigerant drain damper
D7 Refrigerant recycling damper
D8 Diluted solution bypass damper
V1 Manual purge valve
V2 Manual purge valve
V3 Manual purge valve
SV1 Charge/discharge N_2 gas and pressure gauge installation service valve
SV3 Refrigerant service valve
SV4 Diluted solution service valve
SV5 Intermediate solution service valve
SV6 Concentrated solution service valve
SV7 Generator maintenance service valve
SV8 Generator maintenance service valve
B valve Manual purge valve

Damper opening (0: closed 90: full open)

16NK	D1	D2	D3	D4	D5	D6	D7	D8
11	25	45	22	68	18	35	52	31
12	35	45	22	68	18	35	52	31
13	62	50	15	65	15	45	40	52
21	38	57	33	90	49	32	48	63
22	17	60	30	44	50	32	35	65
31	60	60	45	45	52	45	32	60
32	60	60	45	45	52	45	32	60
41	90	90	90	90	53	90	30	88
42	90	90	90	90	53	90	30	88
51	42	75	65	90	40	65	45	60
52	80	75	65	50	40	60	45	65
53	84	79	68	45	41	61	45	75
61	90	80	70	45	40	60	45	60
62	41	65	65	35	37	37	90	-
63	45	65	65	35	40	40	90	-
71	50	65	65	35	40	40	90	-
72	55	65	65	35	40	40	90	-
81	60	65	65	35	40	40	90	-

Valve position

Valve name	Position
B	Open
SV1	Closed
SV2	Closed
SV3	Closed
SV4	Closed
SV5	Closed
SV6	Closed
SV7	Open
SV8	Closed
V1	Closed
V2	Closed
V3	Closed

GB/T-24001 to ISO14001:1996

Carrier

SANYO

Order No.: 11633-76, 08.2007. Supersedes order No.: New

Manufactured by: Sanyo Electric Co. Ltd. Dalian, PR China
Printed in the Netherlands.