The Samurai Range

HITACHI
Inspire the Next

Technical Catalog

Installation, Operation and Maintenance Instructions.
Design Information

CONDENSER LESS WATER CHILLERS -SCREW TYPE-

RCUE40CLG-120CLG (R407C)
Capacity 120 kW-360 kW

TABLE OF CONTENTS

1. IMPORTANT NOTICE

HITACHI pursues a policy of continuing improvement in design and performance of Products. The right is therefore reserved to vary specifications without notice.
HITACHI cannot anticipate every possible circumstance that might involve a potential hazard.
No part of this manual may be reproduced without written permission.
Signal words (DANGER, WARNING and CAUTION) are used to identify levels of hazard seriousness. Definitions for identifying hazard levels are provided below with their respective signal words.

DANGER:
Immediate hazards which WILL result in severe personal injury or death.

WARNING:
Hazards or unsafe practices which COULD result in severe personal injury or death.

CAUTION:
Hazards or unsafe practices which COULD result in minor personal injury or product or property damage.

NOTE:
Useful information for operation and/or maintenance.

If you have any questions, contact your contractor or dealer of HITACHI.
This instruction gives a common description and information for this condenser less water Chiller which you operate as well as for other models.
This condenser less water Chiller has been designed for the following temperatures. Operate the condenser less water Chiller within this range.

°C

Working Range	Maximum	Minimum
Condensing Temperature	55	30
Chilled Water Outlet Temperature	15	5

These instructions should be considered as a permanent part of the condenser less water Chiller equipment and should remain with the condenser less water Chiller equipment.

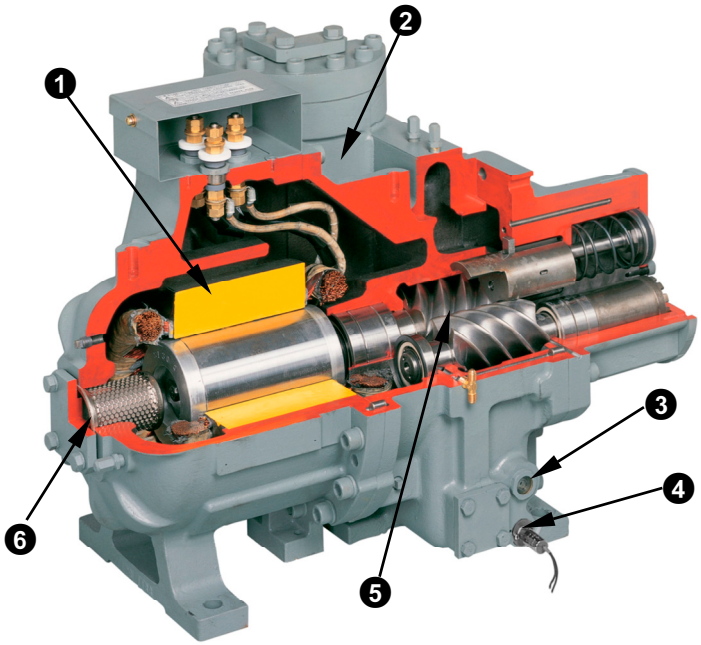
2. FEATURES AND BENEFIT

2.1. NEW CHILLER PICTURE

HITACHI is a world leader in technology and with continual research and product development, now offers a screw type **Condenser less Chillers**.

A range of capacity are available from 120 KW to 360KW.

2.2. COMPRESSOR



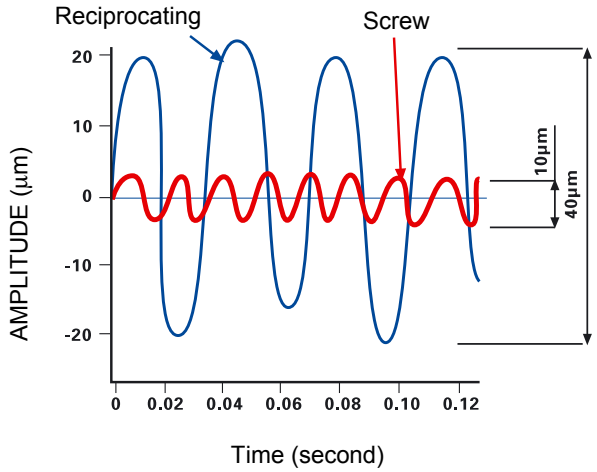
■ **THE SAMURAI RANGE INCORPORATES THE LATEST DEVELOPMENT OF HITACHI´S SCREW COMPRESSOR TECHNOLOGY FOR THE NEW MILLENNIUM.**

1. Highly Reliable HITACHI Two-Pole Motor
2. Built-in Oil Separator (Cyclone oil separator)
3. Oil Sight Glass
4. Oil Heater
5. High precision Twin Screw Rotors
6. Suction Filter

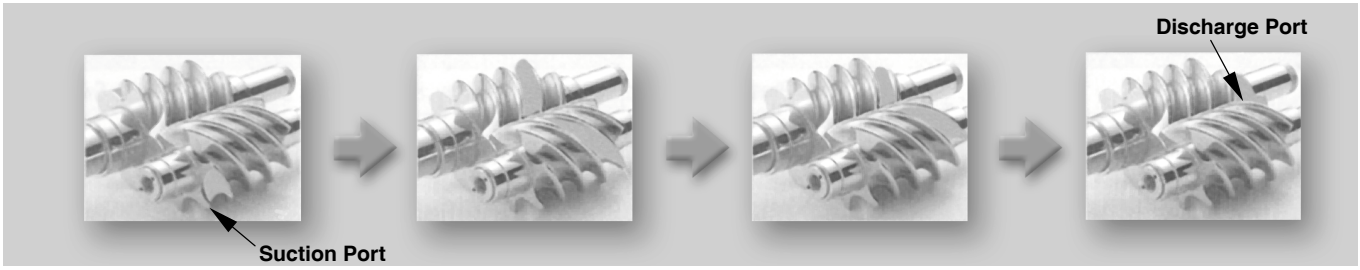
■ TWIN SCREW COMPRESSOR

By having so few moving parts, it has become highly reliable with very low noise level and low vibration

-LOW VIBRATION-

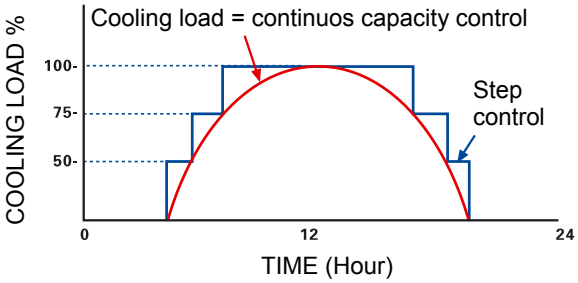


■ PRINCIPLE OF COMPRESSION



■ CONTINUOUS CAPACITY CONTROL

HITACHI´s Continuous Capacity Control system uses advanced electronic controls to position the infinitely variable slide valve within each compressor.
This modulation allows exact load control and accurate chilled water temperature without the need for expensive inverters.

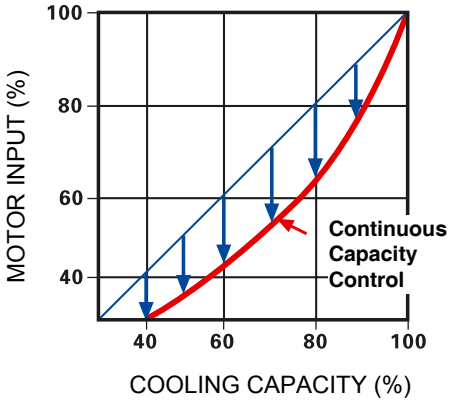


■ ENERGY SAVING

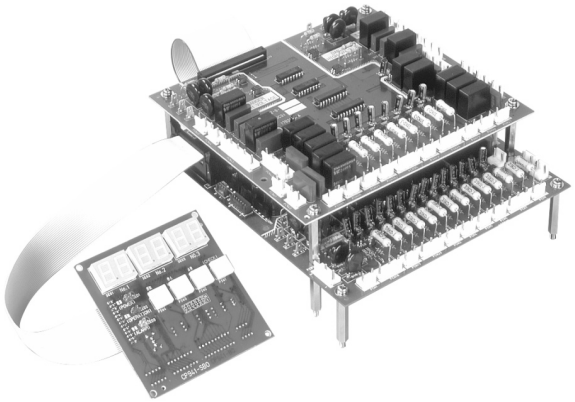
Thanks to Continuous Capacity Control, 15~20% energy saving is possible compared with current step control systems due to the following:

- The cooling load can be more closely matched
- Continuous Capacity Control takes advantage of high efficiency part load performance.
- Frequent compressor starts and stops are eliminated.

-PART LOAD PERFORMANCE-



2.3. CONTROL



■ MANY FUNCTIONS

Newly developed Control Board has many functions shown below as standard.

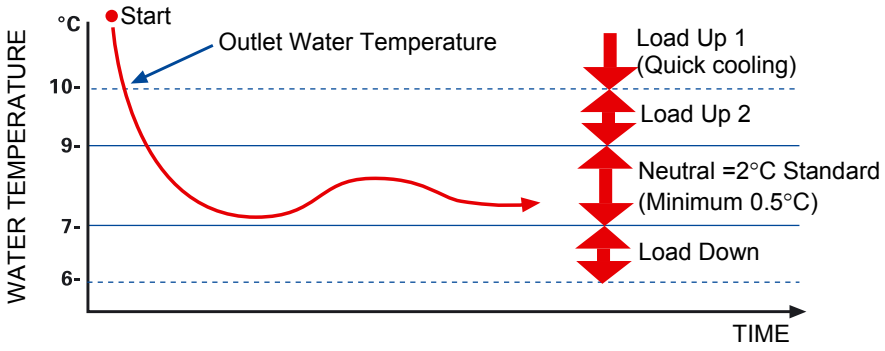
- REMOTE/LOCAL changeover switch
- Individual Alarm
- Pump operation circuit
- Pump Freeze Protection Control
- Reverse Phase Protection
- Time Guard
- Star Delta starting Circuit
- Easy Interface

etc...

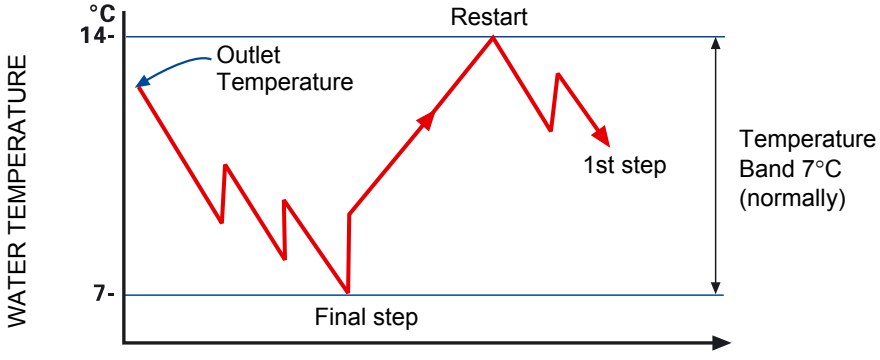
■ PRECISE TEMPERATURE CONTROL

Combination of "Continuous Capacity Control Compressor" and "HITACHI´s unique electronic controls" enable the Chiller to control outlet water temperature precisely, independent of cooling load. This control benefits not only air-conditioning but also industrial process use.

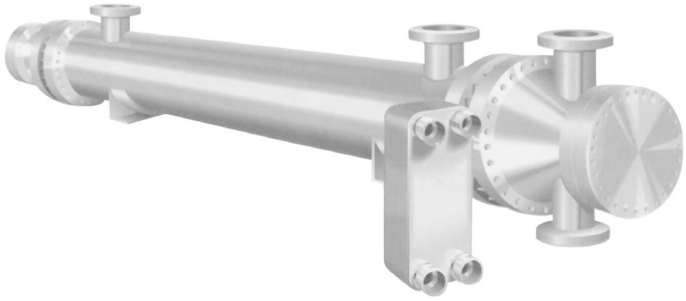
-CONTINUOUS CAPACITY CONTROL-



-CONVENTIONAL STEP CONTROL-



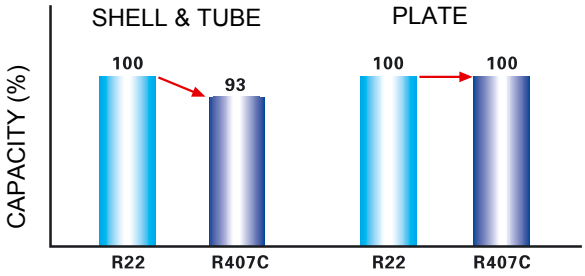
2.4. HEAT EXCHANGER



■ PLATE TYPE HEAT EXCHANGER

The new Condenser less Chillers are equipped with plate type Heat Exchangers, which have many advantages when compared with conventional Shell & Tube heat exchanger as described below:

- Less Refrigerant (Small Internal Volume)
- Clean (Stainless Steel)
- High efficiency (closer approach temperature)
- Plate type heat exchanger can provide improved cooling capacity for R407C



3. OPERATION INSTRUCTIONS

3.1. HITACHI CONDENSER LESS WATER CHILLER MODELS: RCUE 40-120 CLG

■ To Start the Unit.

1. Open the water inlet and outlet valves.
2. After assuring that all control switches have been cut OFF, and the "LOCAL/REMOTE" switch on the printed circuit board is in the "LOCAL" position, turn ON the power switch.
3. Confirm that phases R, S and T are correctly connected. The correct phase connection can be checked by a phase sequence indicator. If not correctly connected, the compressor does not start due to activation of a reversal phase protection device. Cut the main switch and interchange two of three terminals, R, S and T at the main power source terminals.
4. Fully open the discharge and liquid line stop valves.
5. Operate the chilled water pump.
6. Set the Dip SW at the desired temperature
7. Depress the "ON" push button of the operation Switch

■ To Stop the Unit

1. Depress the "OFF" push button of the operation switch.
2. Switch OFF the main power source when the unit is shut down for a long period of time.

■ Pilot Lamp

The red LED indicates the normal operation.

When the orange LED is activated, any one of the safety devices may be functioning.
Please contact your service shop, if this condition is detected.

■ Daily Checking

1. Check the power supply to ensure that it is proper.
2. Check for abnormal sounds and vibration.
3. Check the unit amperage.
4. Check the operating pressure.

■ Troubleshooting

▪ Unit Does Not Start

1. Is the main switch ON?
2. Is the main fuse OK?
3. Is the chilled water running?
4. Are the setting temperature calling for the cooling operation?

■ Poor Cooling Operation

1. Is sufficient water supplied to the cooler?
2. Are the setting temperature correct?
3. Are the operating pressures normal?

■ Maintenance

1. Replace the oil, if it has been deteriorated
2. Clean the unit with a cleaner.
3. Clean the condenser and the water cooler . (It is recommended that a specialist will be contacted for this type of work.)

DANGER:
Switch OFF main interruptor (M.I.) for any work inside electrical box.

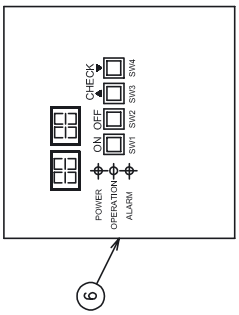
4. COMPONENTS OF CHILLER

4.1. STRUCTURE DRAWING

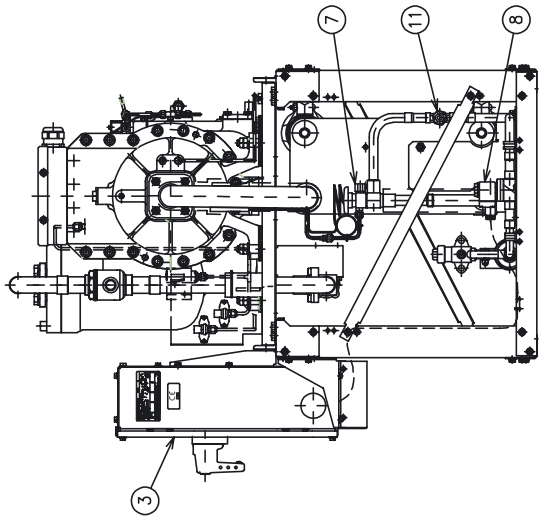
■ **HITACHI Condenser less Water Chiller (Example of 1 Compressor Chiller)**

STRUCTURE DRAWING OF HITACHI CONDENSER LESS CHILLER (MODEL: RCUE40CLG, 50CLG, 60 CLG)

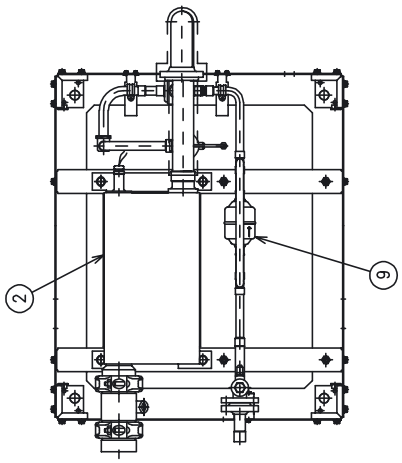
N°	Name
①	Compressor
②	Water Cooler
③	Electrical Box
④	Stop Valve
⑤	Check Valve
⑥	Operation Switch
⑦	Expansion Valve
⑧	Solenoid Valve
⑨	Drier
⑩	Stop Valve (with Check Joint)
⑪	Liquid Sight Glass

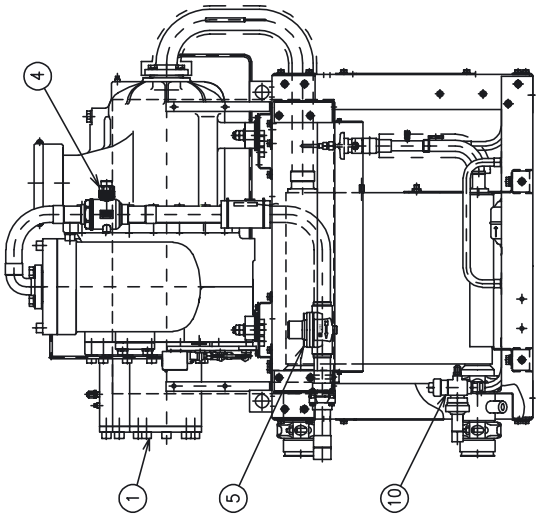


Remote/Local Changeover Switch is Rear Side.



Detail of LPIPE structure





5. PREPARATION INITIAL CHECK

5.1. INITIAL CHECK

■ **Required Materials**

Measure and Architectural Information Regarding Installation Location

■ **Remote Condenser**

Check the capacity of the selected remote condenser.

■ **Installation Location**

Confirm that the final installation location is provided with convenient piping and wiring work. Strong water runoff should be avoided.

■ **Installation Space**

Check for obstacles which hamper maintenance work in the space specified in Fig.1.

■ **Foundation**

Check to ensure that the foundation is flat, level and sufficiently strong, taking into account the maximum foundation gradient (Fig. 2) and the unit weight balance. Confirm elevation provision for the unit on a solid base with an iron frame or concrete curbs shown in chap. 5.4.
In order to obtain proper clearance beneath the unit for on-the-ground installation, where foundation bolts should be sunk into concrete.

■ **Unit**

Check to ensure that the unit has been transported without damage. File a damage claim with the transportation companies if mishandling due to transportation company negligence is suspected.

■ **Transportation**

Secure the route to the final installation location by confirming the dimensions, (Refer to the “Unit General Data”).

5.2. PLACING THE UNIT

DANGER:

- *Do not install the unit outdoors. If installed outdoor, an electrical leakage will occur, since the unit has not been designed for dew protection*
- *If leakage is detected, stop the unit and contact the installer or a service shop. Do not use a naked fire near the refrigerant gas. If a naked fire is utilised near the refrigerant gas, refrigerant is turned into a harmful phosgene compound.*

WARNING:

This unit is operated with refrigerant R407C, which is non-flammable and non-poisonous. However, refrigerant itself is heavier than the atmosphere so that a floor is covered with refrigerant gas if refrigerant is leaked. Therefore, keep good ventilation to avoid choke during servicing.

CAUTION:

- *Check to ensure that valves are correctly opened. If not opened, serious damage will occur to the compressor due to an abnormally high pressure.*
- *Install the unit in a restricted area not accessible by the general public.*

■ **Tools And Instruments**

Pincers, Wrenches, Facilities to Transport and Place The Unit.

■ **Transportation**

Transportation the unit as close to the final installation location as practical before unpacking is accomplished. Provide adequate facilities to place the unit on the foundation, with sufficient consideration given to those individuals performing the installation.

■ **Unpacking**

Follow the instructions marked on the packing.

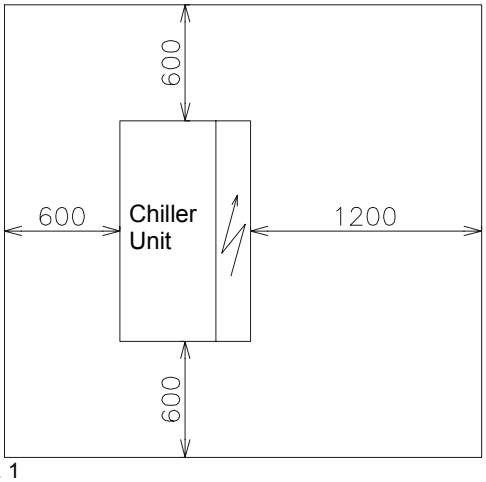


Fig. 1

■ **Maximum Foundation Gradient**

The unit should be installed in an upright position within the gradient shown in below Fig.

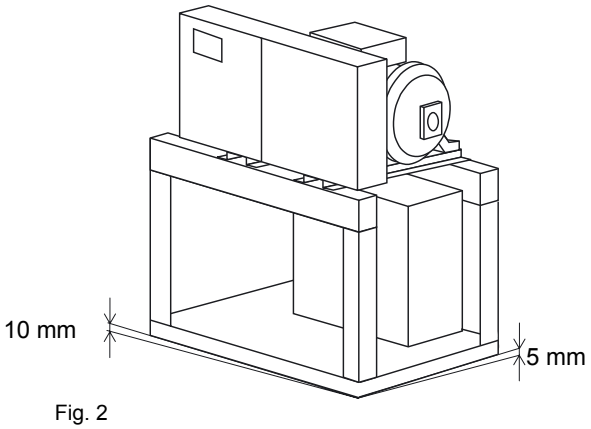
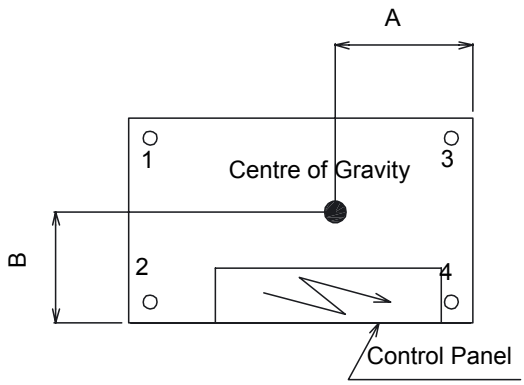


Fig. 2

5.3. CENTRE OF GRAVITY

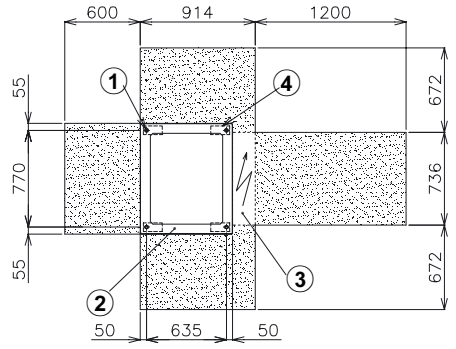
Centre of Gravity



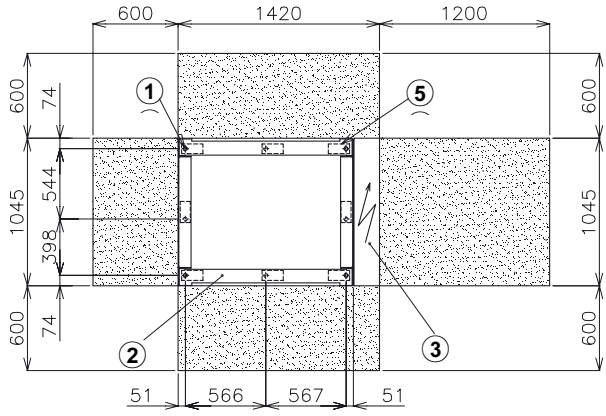
Model	RCUE -					
	40CLG	50CLG	60CLG	80CLG	100CLG	120CLG
Location	Weight Distribution (kg)					
1	190	205	225	350	405	425
2	120	130	135	290	325	335
3	210	230	250	335	355	385
4	130	145	150	275	285	305
Operating Weight						
(Kg)	650	710	760	1250	1370	1450
Location of Centre of Gravity (mm)						
Dimension A	420	415	415	535	555	550
Dimension B	565	570	575	895	905	910

5.4. SERVICE SPACE AND FOUNDATION

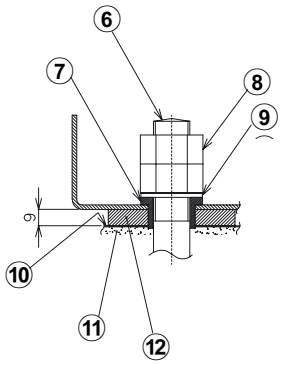
RCUE 40, 50 60CLG



RCUE 80, 100, 120CLG



Detail Of Foundation (example: RCUE60CLG)



N°	Name	N°	Name
1	4-∅ 26 (Mounting Holes)	7	Rubber Bush (OPTION)
2	Base Frame	8	Nut
3	Electrical Box	9	Washer
4	Vibration proof Rubber Mat (4 positions)	10	Steel Plate (1 mm)
5	Vibration proof Rubber Mat (8 positions)	11	Concrete
6	Foundation bolt (M20)	12	Vibration proof Rubber Mat (1 mat per position) OPTION

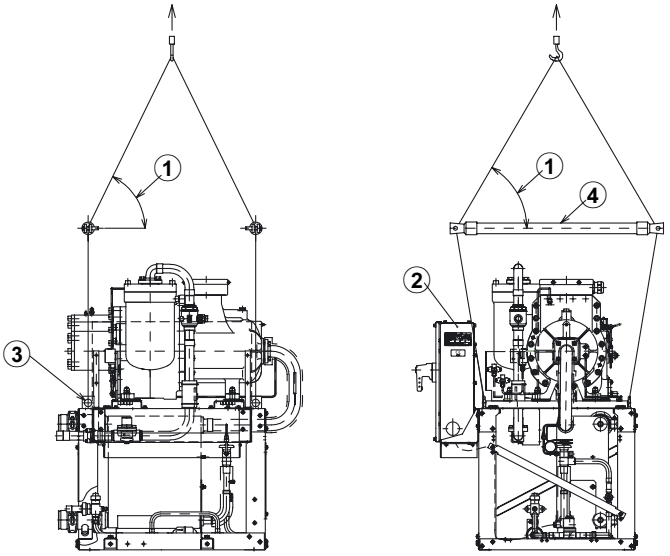
5.5. TRANSPORTATION BY RIGGING

5.5.1. TRANSPORTATION BY RIGGING

Hook wire cables and apply field-supplied spreader bars on the top of the unit (see below figure) to prevent the unit from damage due to cable scratches. The unit should remain in an upright position even during rigging. The wire cable to rig the unit shall be three times stronger than the unit weight. Check to ensure that the rigging bolts are tightly fixed to the unit. The rigging angle shall be greater than 60° as shown. The weight of the unit is indicated on the unit label.

DANGER:
Do not stand below the unit when rigging.

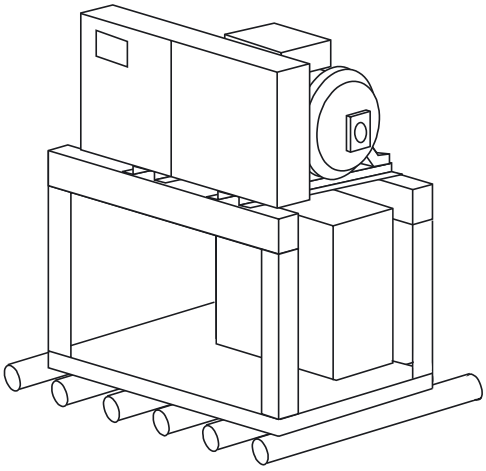
CAUTION:
Put clothes between wires and the unit to avoid damages.



N°	Name
1	60° (or more)
2	Electrical Box
3	4 x Rigging Holes
4	Spreader Bar (Field supplied)

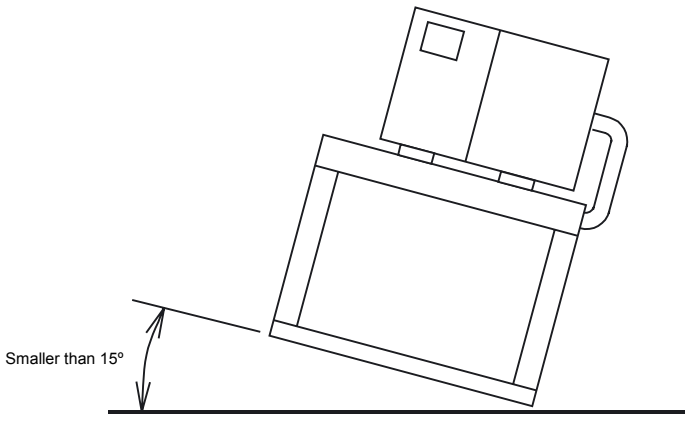
5.5.2. TRANSPORTATION BY ROLLER

When rolling the unit, put at least 6 equal-sized rollers under the base frames. Each roller must carry both the outer frames, and must be suited to balance the unit (see the centre of gravity in page 5/7).



5.5.3. DECLINING THE UNIT DURING TRANSPORTATION.

WARNING:
Do not decline the unit more than an angle of 15° as shown in the figure during transportation. If declined more than an angle of 15°, the unit may fall down.



6. INSTALLATION

6.1. ELECTRICAL WIRING

■ **Tools and Instruments**
One Set of Wiring tools and Electrical Tester (Clamp Meter)

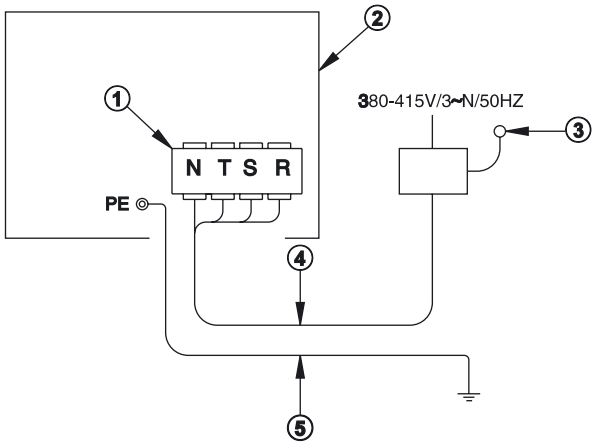
■ **Schedule Check**

DANGER:
- *Switch OFF main interruptor (M.I.) for any work inside electrical box.*

WARNING:
- *Confirm that the field-selected electrical components (main power switch, fuses, wires, conduit connections, wire terminals and others) are properly selected according to the "Electrical Data" in this Technical Catalogue, and ensure that they comply with national and local codes.*
- *It is recommended that the main power switch be locked in the "OFF" position, to prevent against accidental supply of power during equipment servicing.*
- *Check to ensure that an earthling wire is correctly connected to the unit. This wire protects from an electric shock. Utilisation of an earth leakage breaker is necessary.*

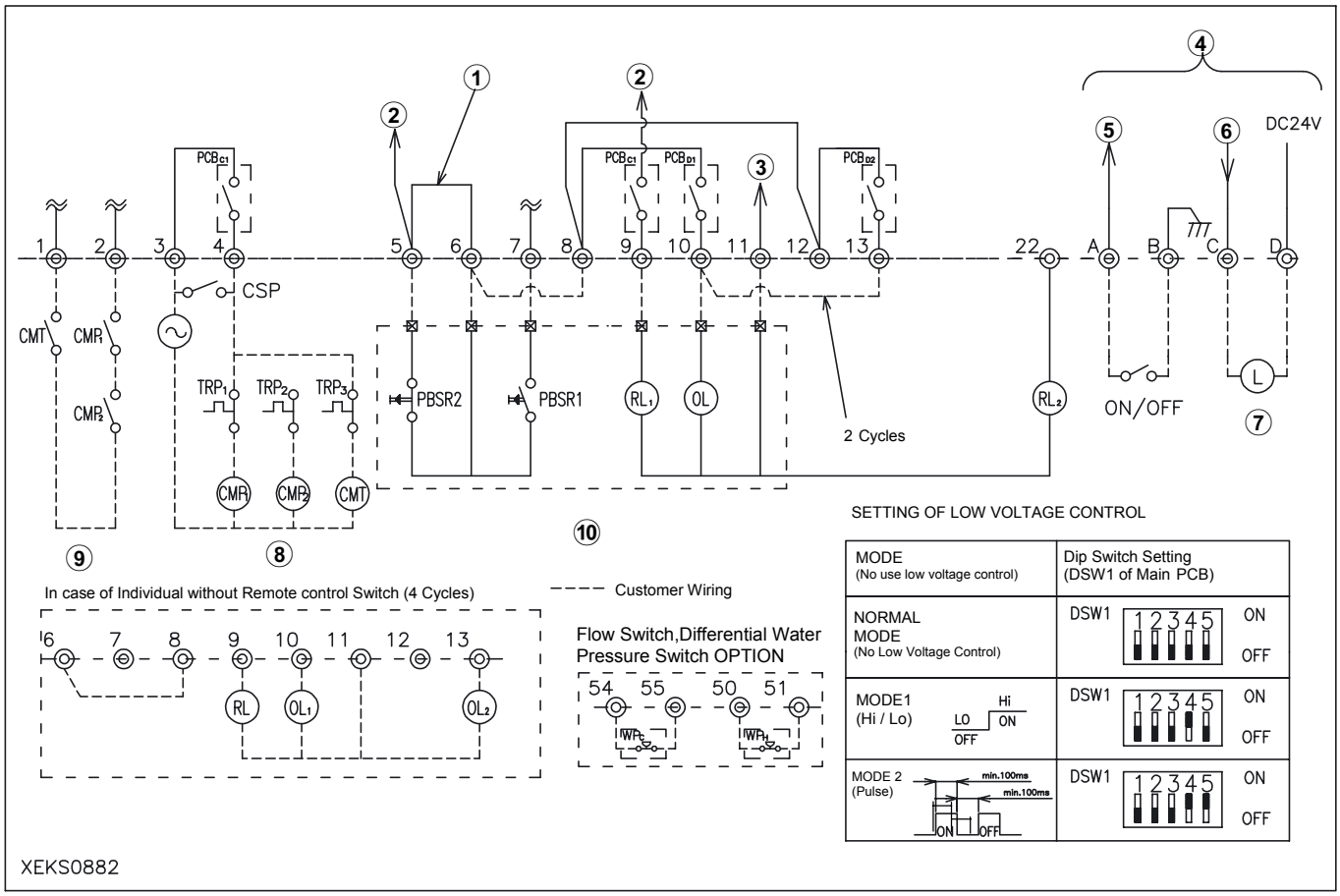
■ **Main Power Wiring Procedures**
Confirm that electrical power is not being supplied to the installation location prior to any electrical installation work.

1. Install the field-supplied main switch box (es) at a properly selected location.
2. Install conduit connectors in the hole for the power wiring.
3. Lead main power wires and the earthing wire through the connector to the screw terminals for main power and earthling in the magnetic switch box. The neutral wires for 380/50 Hz and 415 V/50 Hz power supply should also be led through the connector.
4. Firmly connect the wires with wire terminals to unit screw terminals R, S, T and N according to below figure.
5. Connect the wires between the power source and the field-supplied magnetic switches.
6. Consider that the main power source will not be left turned OFF, easily, because it is necessary to energise the oil heater even during unit stoppage.



N°	Name
1	Main Power/Terminal Board (R,S,T,N)
2	Electrical Box
3	Main Power Switch
4	Main Power Wiring
5	Earth Wiring

■ **Control Wiring**
Connect the interlock wiring and control wiring between the unit terminals and the magnetic switches for the water pumps, according to page or the wiring label. The main connection to terminal N is required.



N°	Name
1	In case of remote control operation this wire shall be removed.
2	R Phase
3	Neutral
4	Low Voltage / Remote Control
5	Run/Stop Signal
6	Alarm Signal
7	Alarm Lamp
8	Pump Operation
9	Pump Interlock
10	Remote control Switch (RSW-A) (Option)

***NOTE**:*

1. *All the setting shall be performed before Power ON.*
2. *Remote / Local Change over Switch on Operation Switch shall be set, to Remote.*
3. *Terminals 1 ◎~/13◎ are for AC220-240V,Terminals A ◎~D ◎ are for DC24V.*

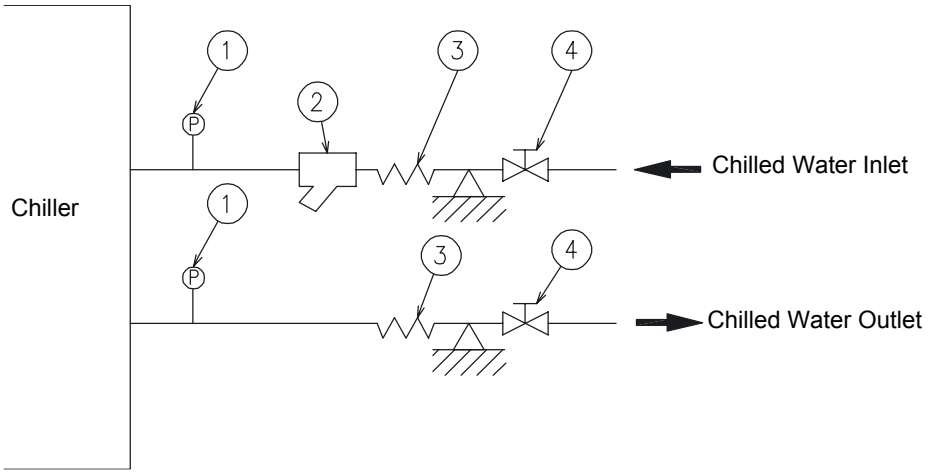
6.2. WATER PIPING

■ When piping connections are performed (condenser: In case of water-cooled type):

1. Connect all pipes as close as possible to the unit (condenser: In case of water-cooled type), so that disconnection can be easily performed when required.
2. Connect the condenser and water coolers in the same unit to the same common water piping.
3. It is recommended for the piping of the chilled water inlet and outlet that flexible joints be utilised, so that vibration will not transmit.
4. Whenever permissible, sluice valves should be utilized for water piping, in order to minimize flow resistance and to maintain sufficient water flow.
5. Proper inspection should be performed to check for leaking parts inside and outside the system, by completely opening the condenser and chilled water inlet and outlet valves to the condenser and water cooler.Additionally, equip valves to the inlet and outlet piping.Equip an air purge cock and a drain cock on the water piping. The cock handle should be removed so that the cock can not be opened under normal circumstances. If this cock is opened during operation, trouble will occur due to water blow-off.
6. Sufficiently perform insulation to keep the chilled water piping cool and to prevent sweating of the piping.
7. Under the condition where the ambient temperature is low in winter, there is a case where equipment and piping will become damaged during the shutdown periods at night, because the water in the pump or piping will be frozen. To prevent freezing of the water, it is effective to operate the pumps even during shutdown period.
   HITACHI Chiller has the pump ON/OFF operation control (see Wiring Diagram) water from piping. Additionally, in a case where measures such as water draining are difficult, utlize antifreeze mixture of ethylene glycol type or propylenen glycol type.
8. The common water pipes (Inlet/Outlet of condenser and cooler, field supplied, should be connected to condenser and cooler directly.

⚠ ***CAUTION:***

- *Never use an antifreeze mixture of the salt type, because it possesses strong corrosion characteristics, and water equipment will be damaged*
- *This product is equipped with plate type heat exchangers. In the plate heat exchanger, water flows through a narrow space between the plates. Therefore, there is a possibility that freezing may occur if foreign particles or dusts are clogged. In order to avoid this clogging, provide a 20 mesh water strainer at the inlet of condenser and chilled water piping near the product. A 20 mesh water strainer is available as an option.*



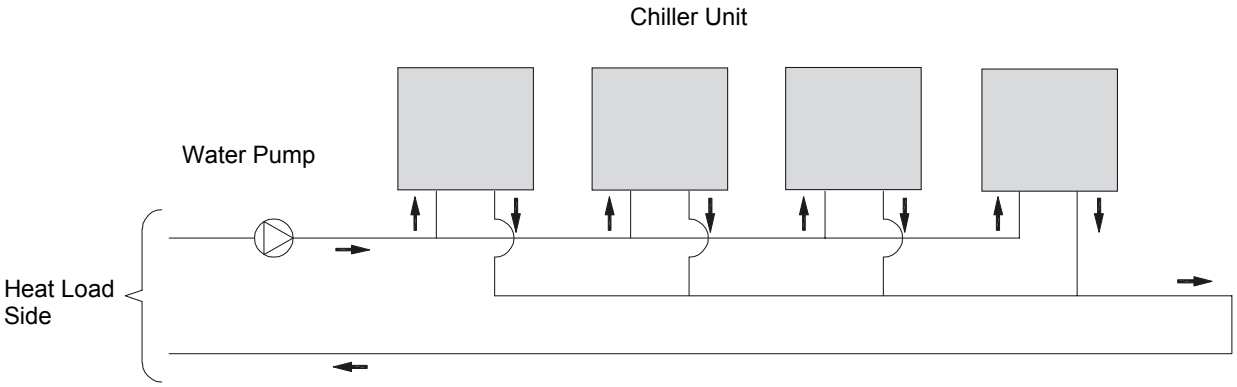
N°	Name
1	Pressure Gauge
2	Strainer
3	Flexible Joint
4	Valve

NOTE:

HITACHI chiller has the pump ON/OFF operation control (see wiring diagram)

CAUTION:

In case of connecting some units to the same water piping, design the water piping so that the water distribution to each unit is equal (refer to figure below) Imbalance of water distribution may cause a serious damage like a water freezing in the heat-exchanger.



6.3. MINIMUM INTERNAL SYSTEM WATER VOLUME

To ensure the cooling operation at least 5 minutes without interruption, the internal chilled water volume in the piping system should be greater than the minimum volume as shown below.

NOTE:

Minimum internal system water volume written below is for standard ON/OFF differential, minimum internal system water volume shall be increased by the setting of differential

.

Model RCUE - CLG			**40**	**50**	**60**	**80**	**100**	**120**
Chilled Water Flow Range	Min.	m^3/h	15.5	18.7	23.2	31.0	37.4	46.4
	Max.	m^3/h	34.4	41.6	51.6	68.8	83.2	103.2
Minimum Internal Water Volume		m^3	0.38	0.46	0.57	0.76	0.92	1.15
Internal Water Volume of Cooler		litre	8.7	12.1	15.9	25.6	32.3	40.7

6.4. WATER CONTROL

CAUTION:

When industrial water is applied for chilled water and condenser water, industrial water rarely causes deposits of scales or other foreign substances on equipment. However, well water or river water may in most cases contain suspended solid matter, organic matter, and scales in great quantities. Therefore, such water should be subjected to filtration or softening treatment with chemicals before application as chilled water.

It is also necessary to analyse the quality of water by checking pH, electrical conductivity, ammonia ion content, sulphur content, and others, and to utilise industrial water only if problem is encountered through these check.

The following is the recommended standard water quality.

Item	Chilled Water System		Tendency (1)	
	Circulating Water (20 ºC Less than)	Supply Water	Corrosion	Deposits of Scales
Standard Quality pH (25 °C)	6.8 ~ 8.0	6.8 ~ 8.0	❍	❍
Electrical Conductivity (mS/m) (25°C) {μS/cm} (25 °C) (2)	Less than 40 Less than 400	Less than 30 Less than 300	❍	❍
Chlorine Ion (mg Cl^-/l)	Less than 50	Less than 50	❍	
Sulphur Acid Ion (mg SO_4^{2-}/l)	Less than 50	Less than 50	❍	
The Amount of Acid Consumption (pH 4.8) (mg $CaCO_3$/l)	Less than 50	Less than 50		❍
Total Hardness (mg $CaCO_3$ /l)	Less than 70	Less than 70		❍
Calcium Hardness (mg $CaCO_3$ /l)	Less than 50	Less than 50		❍
Silica L (mg SIO_2 /l)	Less than 30	Less than 30		❍
Reference Quality Total Iron (mg Fe/l)	Less than 1.0	Less than 0.3	❍	❍
Total Cupper (mg Cu/l)	Less than 1.0	Less than 0.1	❍	
Sulphur Ion (mg S^{2-}/l)	It shall not be detected.		❍	
Ammonium Ion (mg NH_4^+/l)	Less than 1.0	Less than 0.1	❍	
Remaining Chlorine (mg Cl/l)	Less than 0.3	Less than 0.3	❍	
Floating Carbonic Acid (mg CO_2/l)	Less than 4.0	Less than 4.0	❍	
Index of Stability	6.8 ~ 8.0	-	❍	❍

NOTE:

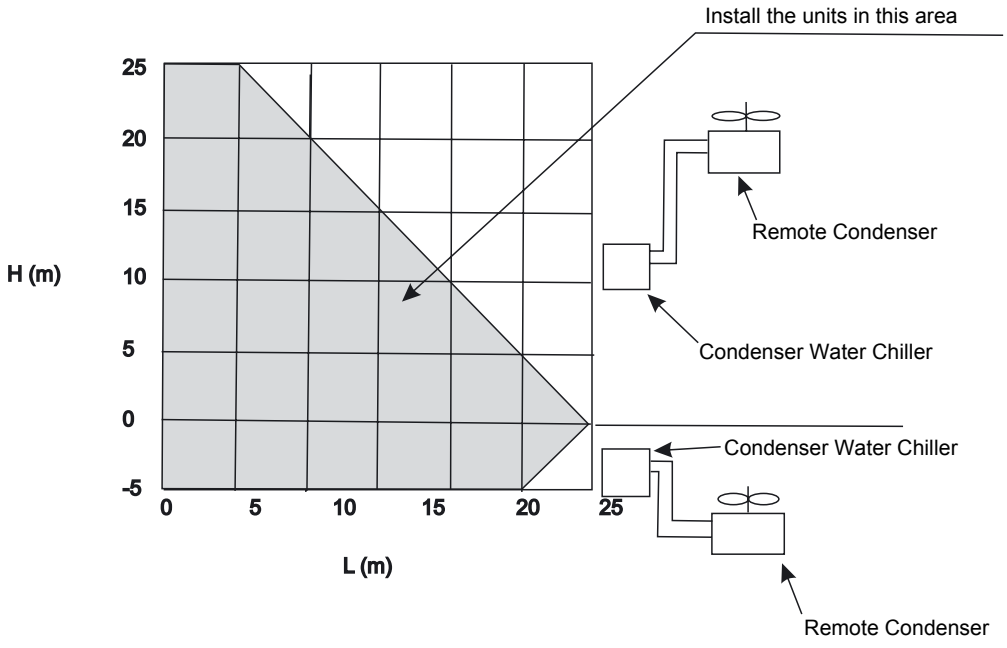
1. The mark "❍" in the table means the factor concerned with the tendency of corrosion or deposits of scales.

2. The value showed in "{}" are for reference only according to the former unit.

6.5. REFRIGERANT PIPING

6.5.1. PIPING CONNECTION

The refrigerant piping between the water chiller, and the remote condenser should be designed by using the following chart.



H: Vertical Distance between the Chiller Unit and Remote Condenser
L: Horizontal Distance between the Chiller Unit and Remote Condenser

■ Selected Pipes

The pipes sizes of the connection piping with the remote condenser is indicated in below table. When selecting the pipes sizes, both pressure drop and velocity must be considered. The pipe size should no be so small that the practical friction loss is excessive or emits noise due to high velocity. Also ensure that the selected pipe size satisfies sufficient gas speed to return the oil by entrainment of gas refrigerant.

■ Piping Accessories

Confirm that prepared piping accessories, as such field-supplied check valve(s), liquid refrigerant receiver(s) and other fittings are properly selected.

■ Piping Procedures

A holding charge is applied to these units. Do not open the unit stop valves until it is ensured that preparation has been performed for field piping leakage checking.

1. These units have been dehydrated and refrigerant charged approximately 1 Kg at the factory. Some air and moisture enter the system during installation. It is very important that all moisture in the piping be removed from the piping system.
2. Perform the connection piping, in which the piping, in wich the piping accessories are included, by soldering, brazing or flare connections. The oil trap and liquid loop should be situated at the position as shown in figure.
3. These chiller units are equipped with an unloader system. In this system, the pipe diameter of the discharge piping must be selected so that sufficient oil will be carried even during minimum unloader operation. For this reason, an excessively big diameter can not be selected.
4. The equivalent piping length shall be shorter than 30 meters. Additionally, the difference in height shall be a maximum of 25 meters in a case where the water chiller is lower than the remote condenser, and a maximum of 5 meters in the case where the water chiller is higher than the remote condenser.
5. Insulate the liquid line, if required. Insulation of the liquid line is recommended only where the line is exposed to a higher temperature than surrounding.
6. After the completion of piping work, then charge a small amount of refrigerant, and inspect for leakage with a gas leak detector, or the pressure indication of a gauge which can be attached at the service joint for the liquid line.

⚠ ***CAUTION:***
The oil in the compressor easily absorbs moisture from the atmosphere, if the valves are opened, and it is difficult to remove the moisture in the oil even by evacuation for a long time.

NOTE:
1. *All piping methods must comply with applicable national and local codes.*
2. *All horizontal discharge piping should be pitched downward in the direction of the refrigerant flow, in consideration of any oil which might be pumped over from the compressor. Additionally, the long discharge line from the compressor should be looped to form a trap so that oil can not drain from the discharge piping to the compressor head during compressor stoppage.*

Gas Piping	Liquid Piping
Outer Diameter and thicknes of Pipe (mm)	
41.3 x 2.0	28.6 x 1.6

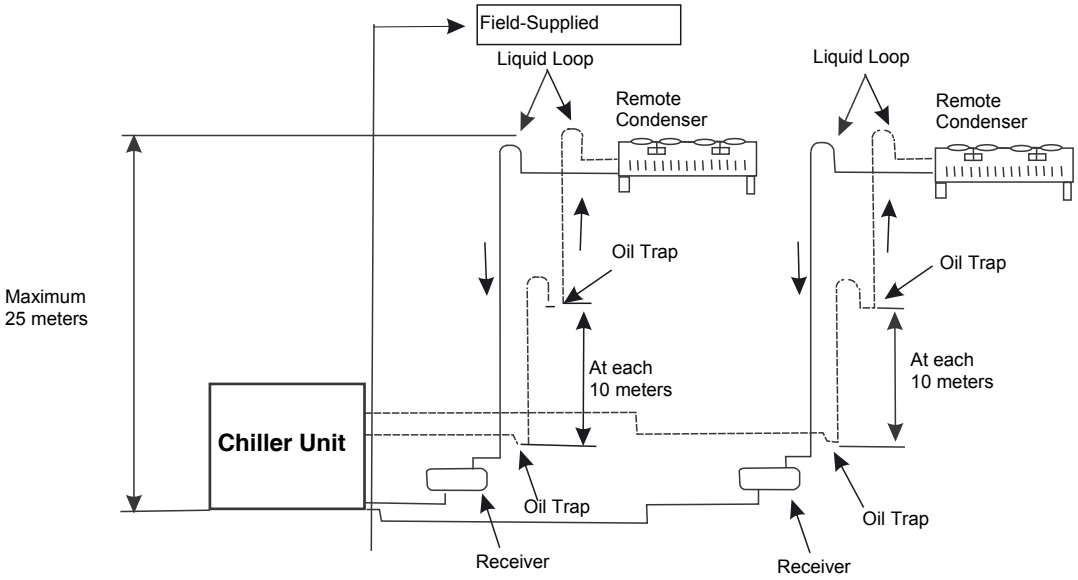
■ Maximum Piping Length and Lift

	Maximum Equivalent Piping Length (m)	Maximum Difference in Heigh (m)
Water Chiller is below Remote Condenser	30	25
Water Chiller is above Remote Condenser	30	5

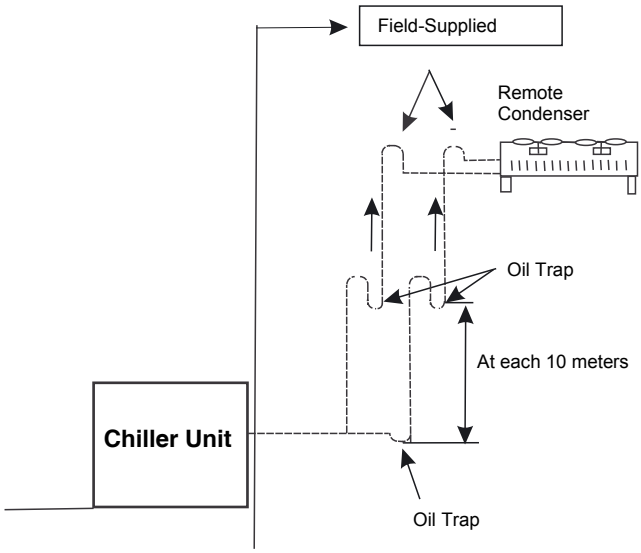
⚠ ***CAUTION:***
Do not charge Oxygeon, Acetylene or other flammable and poisonous gases into the refrigeration cycle when performing a leakage test or an airtight test. These types of gases are extremely dangerous, beause explosion can occur. It is recommended that compressed air, nitrogen or refrigerant be charged for these types of tests.

■ Refrigerant Piping Arrangement

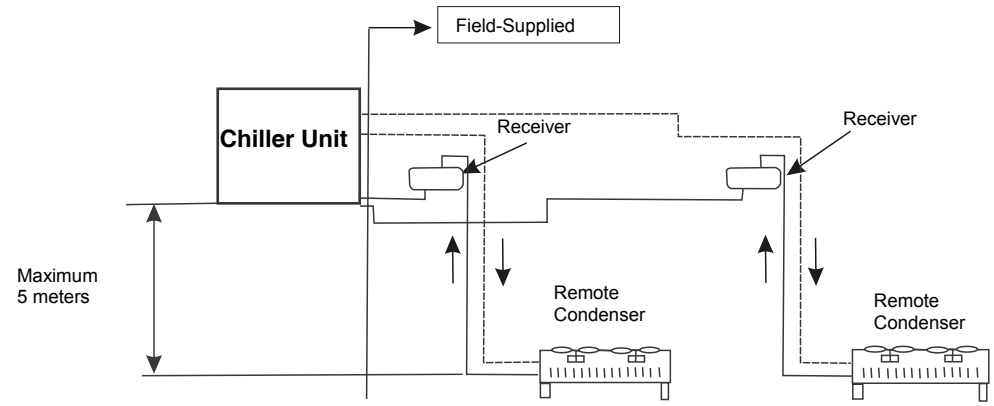
- Water Chiller is below the Remote Condenser:



- Example of Double Riser:



- Water Chiller is above the Remote Condenser:



6.5.2. EVACUATION AND REFRIGERANT CHARGE

■ Evacuation Procedures

Before charging, the part of refrigerant circuit between after discharge-side stop valve and before liquid-side stop valve must be completely evacuated and dehydrated. Connect the vacuum pump and the low pressure compound gauge to the field-supplied service joint of the liquid side.

1. Operate the vacuum pump to perform evacuation of the refrigerant circuit.
2. Continue vacuum pump operation until the pressure indication on the gauges shows approximately -756 mmHg.
3. Stop the vacuum pump, wait for about 5 minutes and confirm the vacuum pressure. Close the vacuum pump connection line by setting the liquid inlet stop valve to the backseat position.
4. Slowly open the liquid inlet stop valve and the gas outlet stop valve of equipped the unit. Do not set the liquid inlet stop valve to the backseat position.

■ Refrigerant Charge

Exchange the vacuum pump with the refrigerant cylinder placed on the weighing scales.

1. Purge air from the cylinder connection line.
2. Charge liquid refrigerant R-407C into the refrigeration cycle by weighing the refrigerant cylinder.
3. Remove the charging hose.
4. After all evacuation and charging work, tighten the packing gland and the cap nuts of the unit stop valves.

NOTE:

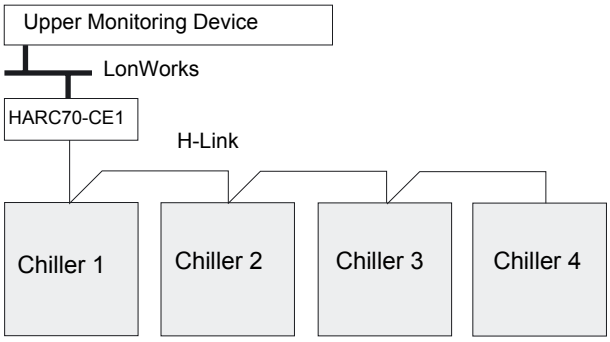
1. A gauge manihold or equivalent piping connected with a vacuum pump and a refrigerant cylinder is useful for quick evacuation and charging work.

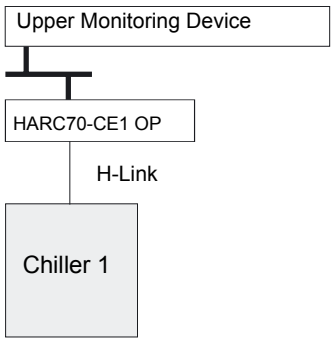
2. When charging by weight is ceased due to high ambient temperature, close the liquid inlet stop valve. Then operate the entire system at the stage of initial start-up.

6.6. BMS CONNECTION

6.6.1. SYSTEM

BMS connection is available by using HARC70-CE1(OP), optional BMS interface unit.





One interface HARC70-CE1 can connect up to 4 Chillers from a remote place using H-Link connection (Hitachi communications protocol).
Protocol used by HARC70-CE1 (OP) is LonWorks.
Physical channel connection with interface is FTT-10A

6.6.2. SIGNAL

Control Operation	ON/OFF Chiller	All HARC'S
	Outlet Water Setting	All HARC'S
State Monitoring	ON/OFF	All HARC'S
	Chilled Water Outlet Setting	All HARC'S
	Chilled Water Outlet Temperature	All HARC'S
	Chilled Water Inlet Temperature.	All HARC'S
	Alarm Codes	All HARC'S
	Operation Status	All HARC'S
	Discharge Pressure 1,2	Only HARC OP
	Suction Pressure 1,2	Only HARC OP
	Discharge Temperature 1,2	Only HARC OP
	Suction Temperature 1,2	Only HARC OP
	Compressor Status (ON/OFF) 1,2	Only HARC OP
	Outlet Water Temp. 1	Only HARC OP
	Water Temp. In Evap. Backside 1	Only HARC OP

6.6.3. CAUTION ON USE HARC70-CE1 (OP)

Please use it correctly according to the following "CAUTION ON USE."

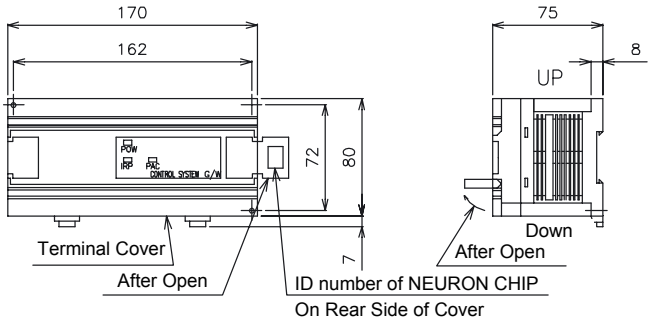
As for the following:

- *"HARC" indicate " HARC70-CE1" or "HARC70-CE1 OP"*
- *"Monitoring Device " indicate " upper connecting device for supervise ", and*
- *"Control Panel" indicate "Control panel of Chiller unit".*
- *"SNVT" Indicate "Standard Network Variables Types"*

1. Install HARC in a grounded metal box.
2. Install a short circuit breaker in the power supply of HARC.
3. The transmission line between HARC and Chiller unit should be "0.75mm2 twisted-Pair cable". If it is not used, then it cannot communicate between HARC and Chiller unit, and it does not work properly.
4. After an abnormal transmitting occurs between HARC and Chiller unit, and Chiller unit stops, in the case of operation starting by the hand operation, then once turn off Chiller unit's power supply, and turn on the power supply. If it isn't carried out, then Chiller unit keeps the condition of transmission alarm.
5. After an abnormal transmitting occurs between HARC and Chiller unit, and Chiller unit stops, in the case of operation starting by Monitoring Device, then transmit an operation order after you transmit a stop order once. If it isn't carried out, it can't start.
6. After Chiller unit, under control by HARC, is stopped by the control panel, and operation is done from the Monitoring Device, then transmit an operation order after you transmit a stop order once. If it isn't carried out, it can't start.
7. Don't set the setting temperature to Chiller unit, under control by HARC, by the control panel. If it is done the, setting temperature is changed. And, as for the setting temperature, which changed in this case, transmit to Monitoring device.
8. After the setting temperature is changed by Monitoring Device, in the case of turned off Chiller unit's power supply, set the setting temperature by Monitoring device again. If it isn't carried out, then the setting temperature becomes to the temperature by setting control panel.
9. If power failure occurs in Chiller unit, under control by HARC, it may not revert to the condition before the power failure. Try to detect that the operation condition of Chiller unit changed, by the Monitoring Device. If Chiller unit stopped due to the power failure, then transmit an operation order from the Monitoring Device after the power supply restoration. And, transmit the setting temperature, mode from the Monitoring device. If it isn't carried out, and then Chiller unit is stopping, and the setting temperature, mode is the initialisation value by Chiller unit.
10. When SNVT which is transmitted from HARC, is used by other control device, premise that there is two minutes delay between the transmitting SNVT and the movement Chiller unit . If it isn't premised, then a problem may occurs in the control system.
11. Don't interrupt the power supply of HARC when you use SCPT in HARC. Even if it exceeds MaxSendTime, when SNVT is not transmitted from HARC, and SNVT is transmitted below with the setting value of MinSendTime, then transmit SCPT again . If it isn't carried out, SCPT value continues maintaining "0".
12. If the setting of control panel change Remote to Locally, and set Remote again, then set the setting temperature and mode from the Monitoring Device again. If it does not set, then the setting temperature and mode continue maintaining the initialisation value by Chiller unit.
13. When the abnormal transmitting occurs between the Monitoring Device and HARC, then the condition of the Monitoring Device may not correspond with the condition of HARC. Set MaxSendTime and, try that the condition of the Monitoring Device corresponds with the condition of HARC in the interval of MaxSendTime .
14. It can't be used with the except for " stop signal of input terminal of Chiller unit ".

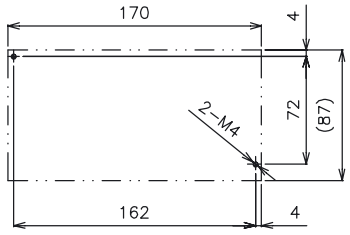
6.6.4. DIMENSIONAL DRAWING AND SPECIFICATIONS OF HITACHI GATEWAY (MODEL HARC70-CE1/HARC70-CE1 0P)

■ **Structural Drawing**

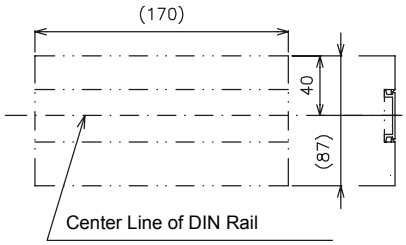


■ **Mounting Dimensions**

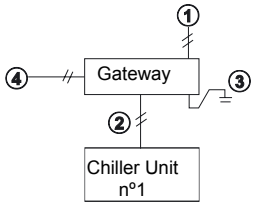
Mounting by Screw



Mounting on DIN Rail

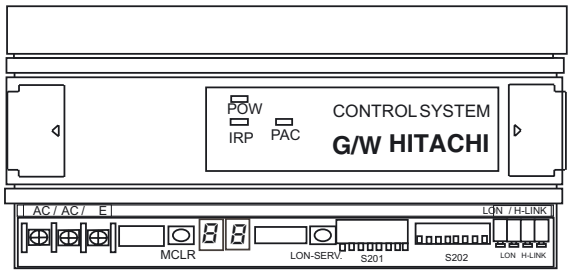


■ **System Wiring**



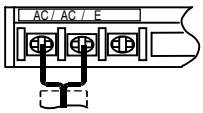
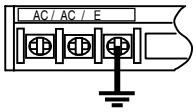
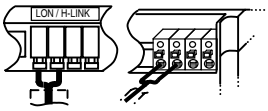
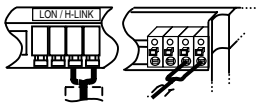
N°	Description	Wire Size
①	Power Supply Power Wire AC 220/240V (Field Supplied)	2mm2 Shielded
②	Connection Wiring Between Chiller Signal Wiring DC 5V (Field Supplied)	0.75mm^2 Twisted-Pair Coble Max. Length 1000m
③	Ground Earth Wire (Field Supplied)	-
④	Connection Wire Between LonWorks Signal Wire DC 5V (Field Supplied)	-

■ Marking of Terminals



Mark	Indication
POW	Red: Power Supply (AC220/240V)
IRP	Green: Lighted During Transmission Between LONWORKS
PAC	Yellow: Lighted During Transmission Between Chiller

■ Wiring Procedures

Section		Wiring Method	Remark
Power Line	1φ220-240V Power Source — HARC70-CE1(OP)		
	Earthing Wire		
Control Circuit	Upper System — HARC70-CE1(OP)		Non-polar
	HARC70-CE1(OP) — Water Chillers		Non-polar

■ Network Variables and Setting (HARC70-CE1)

Chiller Number	Water Cooled	Condenser less	Air Cooled	Air Heat Pump	SVNT Number	Name	Type	LONMARK SNVT No	Description	Contents	Remarks
0	O	O	O	O	nv0	nviChillerEnable_0	SNVT_switch	95	On/Off Order	Byte 1: Value 0 (Fixed) Byte 2: State 0/1 = STOP/RUN	Provide an interval of 5 seconds of more between each setting
0	O	O	O	O	nv1	nviCoolSetpt_0	SNVT_temp_p	105	Cool Water Temperature Setting	2 Bytes: -2000 ~ 2500 = -20 ~ 25 ºC	
0	O	O	O	O	nv2	nviMode_0	SNVT_hvac_mode	108	Operation Mode Setting	1 byte: 1 = HVAC_HEAT (Heating) 3 = HVAC_COOL (Cooling)	
0	-	-	-	O	nv3	nviHeatSetpt_0	SNVT_temp_p	105	Hot Water Temperature Setting	2 bytes: 3000 ~ 6000 = 30 ~ 60 ºC	
0	O	O	O	O	nv4	nvoOnOff_0	SNVT_switch	95	On/Off state	Byte 1: Value 0 (Fixed) Byte 2: State 0/1 = STOP/RUN	Those values are updated each 60 seconds. When setting points are changed from HARC change to related point is detected not waiting 60 seconds. If no water chiller is connected these values are set to 0
0	O	O	O	O	nv5	nvoActiveSetpt_0	SNVT_temp_p	105	Temperature Setting	2 Bytes: -2000 ~ 6000 = -20 ~ 60 ºC	
0	-	-	-	-	nv6	nvoActualCapa_0	SNVT_lev_percent (Not Available)	81	Operation Capacity (Not used for continous capacity)	NOT USED	
0	O	O	O	O	nv7	nvoLvgCHWTemp_0	SNVT_temp_p	105	Chilled outlet temperature	2 Bytes: -2000 ~ 6000 = -20 ~ 60 ºC	
0	O	O	O	O	nv8	nvoEntCHWTemp_0	SNVT_temp_p	105	Chilled inlet temperature	2 Bytes: -2000 ~ 6000 = -20 ~ 60 ºC	
0	O	O	O	O	nv9	nvoAlarmDescr_0	SNVT_str_asc	36	Alarm code	31 Bytes: 4 first bytes alarm description as shown in chiller. 5th byte always 0. Others undefined	
0	O	O	O	O	nv10	nvoChillerStat_0	SNVT_chlr_status	127	Chiller Status	3 bytes: Byte 1: Chiller Run Mode 0: Chlr_Off (OFF Mode) 2:Chlr_Run (Run Mode) Byte 2: Chiller Operation Mode 1: HVAC_HEAT (Heating) 3:HVAC_COOL (Cooling) A: HVAC_FREE_COOL (Cooling Thermostat Off) Byte 3: Chlr State bit 0: 0/1 (no alarm / alarm) bit 1: 0/1 (run not available / run available) bit 2: 0/1 (central / local) bits 3 ~ 7: Not used	
0	-	-	-	-	nv11	untest_0	SNVT_press (Not Available)	30	NOT USED	NOT USED	Not used
0	-	-	-	-	nv12	untest_1					
0	-	-	-	-	nv13	untest_2					
0	-	-	-	-	nv14	untest_3					
1	O	O	O	O	nv15	nviChlrEnable_1	SNVT_switch	95	On/Off Order	Same than nv0	Provide an interval of 5 seconds of more between each setting
1	O	O	O	O	nv16	nviCoolSetpt_1	SNVT_temp_p	105	Cool Water Temperature Setting	Same than nv1	
1	O	O	O	O	nv17	nviMode_1	SNVT_hvac_mode	108	Operation Mode Setting	Same than nv2	
1	-	-	-	O	nv18	nviHeatSetpt_1	SNVT_temp_p	105	Hot Water Temperature Setting	Same than nv3	
1	O	O	O	O	nv19	nvoOnOff_1	SNVT_switch	95	On/Off state	Same than nv4	Those values are updated each 60 seconds. When setting points are changed from HARC change to related point is detected not waiting 60 seconds. If no water chiller is connected these values are set to 0
1	O	O	O	O	nv20	nvoActiveSetpt_1	SNVT_temp_p	105	Temperature Setting	Same than nv5	
1	-	-	-	-	nv21	nvoActualCapa_1	SNVT_lev_percent (Not Available)	81	Operation Capacity (Not used for continous capacity)	NOT USED	
1	O	O	O	O	nv22	nvoLvgCHWTemp_1	SNVT_temp_p	105	Chilled outlet temperature	Same than nv7	
1	O	O	O	O	nv23	nvoEntCHWTemp_1	SNVT_temp_p	105	Chilled inlet temperature	Same than nv8	
1	O	O	O	O	nv24	nvoAlarmDescr_1	SNVT_str_asc	36	Alarm code	Same than nv9	
1	O	O	O	O	nv25	nvoChillerStat_1	SNVT_chlr_status	127	Chiller Status	Same than nv10	
1	-	-	-	-	nv26	untest_4	SNVT_press (Not Available)	30	NOT USED	NOT USED	Not used
1	-	-	-	-	nv27	untest_5					
1	-	-	-	-	nv28	untest_6					
1	-	-	-	-	nv29	untest_7					
2	O	O	O	O	nv30	nviChlrEnable_2	SNVT_switch	95	On/Off Order	Same than nv0	Provide an interval of 5 seconds of more between each setting
2	O	O	O	O	nv31	nviCoolSetpt_2	SNVT_temp_p	105	Cool Water Temperature Setting	Same than nv1	
2	O	O	O	O	nv32	nviMode_2	SNVT_hvac_mode	108	Operation Mode Setting	Same than nv2	
2	-	-	-	O	nv33	nviHeatSetpt_2	SNVT_temp_p	105	Hot Water Temperature Setting	Same than nv3	
2	O	O	O	O	nv34	nvoOnOff_2	SNVT_switch	95	On/Off state	Same than nv4	Those values are updated each 60 seconds. When setting points are changed from HARC change to related point is detected not waiting 60 seconds. If no water chiller is connected these values are set to 0
2	O	O	O	O	nv35	nvoActiveSetpt_2	SNVT_temp_p	105	Temperature Setting	Same than nv5	
2	-	-	-	-	nv36	nvoActualCapa_2	SNVT_lev_percent (Not Available)	81	Operation Capacity (Not used for continous capacity)	NOT USED	
2	O	O	O	O	nv37	nvoLvgCHWTemp_2	SNVT_temp_p	105	Chilled outlet temperature	Same than nv7	
2	O	O	O	O	nv38	nvoEntCHWTemp_2	SNVT_temp_p	105	Chilled inlet temperature	Same than nv8	
2	O	O	O	O	nv39	nvoAlarmDescr_2	SNVT_str_asc	36	Alarm code	Same than nv9	
2	O	O	O	O	nv40	nvoChillerStat_2	SNVT_chlr_status	127	Chiller Status	Same than nv10	
2	-	-	-	-	nv41	untest_8	SNVT_press (Not Available)	30	NOT USED	NOT USED	Not used
2	-	-	-	-	nv42	untest_9		30			
2	-	-	-	-	nv43	untest_10		30			
2	-	-	-	-	nv44	untest_11		30			
3	O	O	O	O	nv45	nviChlrEnable_3	SNVT_switch	95	On/Off Order	Same than nv0	Provide an interval of 5 seconds of more between each setting
3	O	O	O	O	nv46	nviCoolSetpt_3	SNVT_temp_p	105	Cool Water Temperature Setting	Same than nv1	
3	O	O	O	O	nv47	nviMode_3	SNVT_hvac_mode	108	Operation Mode Setting	Same than nv2	
3	-	-	-	O	nv48	nviHeatSetpt_3	SNVT_temp_p	105	Hot Water Temperature Setting	Same than nv3	
3	O	O	O	O	nv49	nvoOnOff_3	SNVT_switch	95	On/Off state	Same than nv4	Those values are updated each 60 seconds. When setting points are changed from HARC change to related point is detected not waiting 60 seconds. If no water chiller is connected these values are set to 0
3	O	O	O	O	nv50	nvoActiveSetpt_3	SNVT_temp_p	105	Temperature Setting	Same than nv5	
3	-	-	-	-	nv51	nvoActualCapa_3	SNVT_lev_percent (Not Available)	81	Operation Capacity (Not used for continous capacity)	NOT USED	
3	O	O	O	O	nv52	nvoLvgCHWTemp_3	SNVT_temp_p	105	Chilled outlet temperature	Same than nv7	
3	O	O	O	O	nv53	nvoEntCHWTemp_3	SNVT_temp_p	105	Chilled inlet temperature	Same than nv8	
3	O	O	O	O	nv54	nvoAlarmDescr_3	SNVT_str_asc	36	Alarm code	Same than nv9	
3	O	O	O	O	nv55	nvoChillerStat_3	SNVT_chlr_status	127	Chiller Status	Same than nv10	
3	-	-	-	-	nv56	untest_12	SNVT_press (Not Available)	30	NOT USED	NOT USED	NOT USED
3	-	-	-	-	nv57	untest_13		30			
3	-	-	-	-	nv58	untest_14		30			
3	-	-	-	-	nv59	untest_15		30			
	O	O	O	O	nv60	nciMaxSendTime					
	O	O	O	O	nv61	nciMinSendTime					

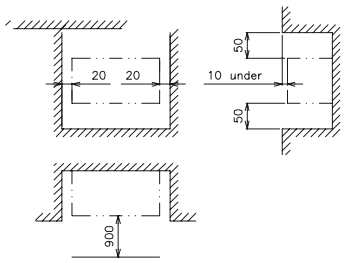
■ Network Variables and Setting (HARC70-CE1 OP)

Water Cooled	Condenser less	Air Cooled	Air Heat Pump	SVNT Number	Name	Type	LONMARK SNVT No	Description	Contents	Remarks
O	O	O	O	nv0	nviChillerEnable_0	SNVT_switch	95	On/Off Order	Byte 1: Value 0 (Fixed) Byte 2: State 0/1 = STOP/RUN	
O	O	O	O	nv1	nviCoolSetpt	SNVT_temp_p	105	Cool Water Temperature Setting	2 Bytes: -2000 ~ 2500 = -20 ~ 25 ºC	Provide an interval of 5 seconds of more between each setting
O	O	O	O	nv2	nviMode	SNVT_hvac_mode	108	Operation Mode Setting	1 byte: 1 = HVAC_HEAT (Heating) 3 = HVAC_COOL (Cooling)	
-	-	-	O	nv3	nviHeatSetpt	SNVT_temp_p	105	Hot Water Temperature Setting	2 bytes: 3000 ~ 6000 = 30 ~ 60 ºC	
O	O	O	O	nv4	nvoOnOff	SNVT_switch	95	On/Off state	Byte 1: Value 0 (Fixed) Byte 2: State 0/1 = STOP/RUN	
O	O	O	O	nv5	nvoActiveSetpt	SNVT_temp_p	105	Temperature Setting	2 Bytes: -2000 ~ 6000 = -20 ~ 60 ºC	
-	-	-	-	nv6	nvoActualCapa	SNVT_lev_percent (Not Available)	81	Operation Capacity (Not used for continous capacity)	NOT USED	
O	O	O	O	nv7	nvoLvgCHWTemp	SNVT_temp_p	105	Chilled outlet temperature	2 Bytes: -2000 ~ 6000 = -20 ~ 60 ºC	
O	O	O	O	nv8	nvoEntCHWTemp	SNVT_temp_p	105	Chilled inlet temperature	2 Bytes: -2000 ~ 6000 = -20 ~ 60 ºC	
O	O	O	O	nv9	nvoAlarmDescr	SNVT_str_asc	36	Alarm code	31 Bytes: 4 first bytes alarm description as shown in chiller. 5th byte always 0. Others undefined	
O	O	O	O	nv10	nvoChillerStat	SNVT_chlr_status	127	Chiller Status	3 bytes: Byte 1: Chiller Run Mode 0: Chlr_Off (OFF Mode) 2:Chlr_Run (Run Mode) Byte 2: Chiller Operation Mode 1: HVAC_HEAT (Heating) 3:HVAC_COOL (Cooling) A: HVAC_FREE_COOL (Cooling Thermostat Off) Byte 3: Chlr State bit 0: 0/1 (no alarm / alarm) bit 1: 0/1 (run not available / run available) bit 2: 0/1 (central / local) bits 3 ~ 7: Not used	
O	O	O	O	n11	nvoDpress1	SNVT_press	30	Discharge Pressure 1	2 Bytes:0~30000 = 0~3,000 kPa	
O	O	O	O	n12	nvoDpress1	SNVT_press	30	Discharge Pressure 2	2 Bytes:0~30000 = 0~3,000 kPa	
O	-	O	-	n13	nvoDpress1	SNVT_press	30	Discharge Pressure 3	2 Bytes:0~30000 = 0~3,000 kPa	
O	-	O	-	n14	nvoDpress1	SNVT_press	30	Discharge Pressure 4	2 Bytes:0~30000 = 0~3,000 kPa	
-	-	O	-	n15	nvoDpress1	SNVT_press	30	Discharge Pressure 5	2 Bytes:0~30000 = 0~3,000 kPa	
-	-	O	-	n16	nvoDpress1	SNVT_press	30	Discharge Pressure 6	2 Bytes:0~30000 = 0~3,000 kPa	
O	O	O	O	n17	nvoSpress1	SNVT_press	30	Suction Pressure 1	2 Bytes:0~30000 = 0~3,000 kPa	
O	O	O	O	n18	nvoSpress2	SNVT_press	30	Suction Pressure 2	2 Bytes:0~30000 = 0~3,000 kPa	
O	-	O	-	n19	nvoSpress3	SNVT_press	30	Suction Pressure 3	2 Bytes:0~30000 = 0~3,000 kPa	Those values are updated each 60 seconds. When setting points are changed from HARC change to related point is detected not waiting 60 seconds. If no water chiller is connected these values are set to 0
O	-	O	-	n20	nvoSpress4	SNVT_press	30	Suction Pressure 4	2 Bytes:0~30000 = 0~3,000 kPa	
-	-	O	-	n21	nvoSpress5	SNVT_press	30	Suction Pressure 5	2 Bytes:0~30000 = 0~3,000 kPa	
-	-	O	-	n22	nvoSpress6	SNVT_press	30	Suction Pressure 6	2 Bytes:0~30000 = 0~3,000 kPa	
O	O	O	O	n23	nvoDtemp1	SNVT_temp_p	105	Discharge Temp 1	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
O	O	O	O	n24	nvoDtemp2	SNVT_temp_p	105	Discharge Temp 2	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
O	-	O	-	n25	nvoDtemp3	SNVT_temp_p	105	Discharge Temp 3	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
O	-	O	-	n26	nvoDtemp4	SNVT_temp_p	105	Discharge Temp 4	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
-	-	O	-	n27	nvoDtemp5	SNVT_temp_p	105	Discharge Temp 5	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
-	-	O	-	n28	nvoDtemp6	SNVT_temp_p	105	Discharge Temp 6	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
O	O	O	O	n29	nvoSTemp1	SNVT_temp_p	105	Suction Temp 1	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
O	O	O	O	n30	nvoSTemp2	SNVT_temp_p	105	Suction Temp 2	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
O	-	O	-	n31	nvoSTemp3	SNVT_temp_p	105	Suction Temp 3	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
O	-	O	-	n32	nvoSTemp4	SNVT_temp_p	105	Suction Temp 4	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
-	-	O	-	n33	nvoSTemp5	SNVT_temp_p	105	Suction Temp 5	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
-	-	O	-	n34	nvoSTemp6	SNVT_temp_p	105	Suction Temp 6	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
-	-	O	O	n35	nvoODtemp	SNVT_temp_p	105	Outdoor Temperature	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
O	O	O	O	n36	nvoCompOnOff1	SNVT_state x 16	83	Compressor Information	32 Bytes: Byte 1: b0: 0/1 = STOP/RUN	
O	O	O	O	n37	nvoCompOnOff2	SNVT_state x 16	83	Compressor Information	32 Bytes: Byte 1: b0: 0/1 = STOP/RUN	
O	-	O	-	n38	nvoCompOnOff3	SNVT_state x 16	83	Compressor Information	32 Bytes: Byte 1: b0: 0/1 = STOP/RUN	
O	-	O	-	n39	nvoCompOnOff4	SNVT_state x 16	83	Compressor Information	32 Bytes: Byte 1: b0: 0/1 = STOP/RUN	
-	-	O	-	n40	nvoCompOnOff5	SNVT_state x 16	83	Compressor Information	32 Bytes: Byte 1: b0: 0/1 = STOP/RUN	
-	-	O	-	n41	nvoCompOnOff6	SNVT_state x 16	83	Compressor Information	32 Bytes: Byte 1: b0: 0/1 = STOP/RUN	
O	O	O	O	n42	nvoLvgCHWTemp 1	SNVT_temp_p	105	Outlet Water Temp 1	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
O	-	O	O	n43	nvoLvgCHWTemp 2	SNVT_temp_p	105	Outlet Water Temp 2	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
O	-	O	-	n44	nvoLvgCHWTemp 3	SNVT_temp_p	105	Outlet Water Temp 3	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
O	O	-	-	n45	nvoLvgCHWTemp 4	SNVT_temp_p	105	Water Temp in Cooler BackSide 1	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
O	-	-	-	n46	nvoLvgCHWTemp 5	SNVT_temp_p	105	Water Temp in Cooler BackSide 2	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
O	-	-	-	n47	nvoLvgCHWTemp 6	SNVT_temp_p	105	Water Temp in Cooler BackSide 3	2 Bytes: -12700 ~12700 = -127 ~ 127 ºC	
-	-	-	-	n48	unused 1	SNVT_temp_p	105	NOT USED	NOT USED	NOT USED
-	-	-	-	n49	unused 2	SNVT_temp_p	105	NOT USED	NOT USED	NOT USED
-	-	-	-	n50	unused 3	SNVT_temp_p	105	NOT USED	NOT USED	NOT USED
-	-	-	-	n51	unused 4	SNVT_temp_p	105	NOT USED	NOT USED	NOT USED
-	-	-	-	n52	unused 5	SNVT_temp_p	105	NOT USED	NOT USED	NOT USED
-	-	-	-	n53	unused 6	SNVT_temp_p	105	NOT USED	NOT USED	NOT USED
-	-	-	-	n54	unused 7	SNVT_temp_p	105	NOT USED	NOT USED	NOT USED
-	-	-	-	n55	unused 8	SNVT_temp_p	105	NOT USED	NOT USED	NOT USED
-	-	-	-	n56	unused 9	SNVT_temp_p	105	NOT USED	NOT USED	NOT USED
O	O	O	O	nv57	nciMaxSendTime					
O	O	O	O	nv58	nciMinSendTime					

NOTE:

Set and use the variables in accordance with the above tables. (The variables based on "Chiller Part of LonMark®Function Profile", however, some function and setting range have limitation).

■ Space Requirements



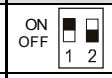
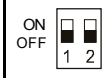
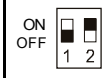
NOTE:

1. *Before operating this gateway, initial settings by a system integrator for the local LonWorks system are necessary*
2. *This gateway is designed to be connected with LonWorks network, and will not function by itself when it is not connected.*
3. *The power lines and the signal lines shall be separated with a minimum distance of 15cm.*
4. *It is necessary to set and adjust the Chillers and gateway, before operating the system.*
5. *"LonWork" "LonMark" are trademarks of Echelon Corporation registered in the USA and other countries.*

■ Specifications

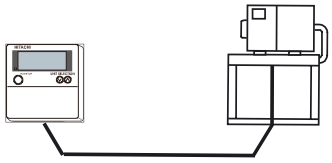
Item	Specifications
Connection Capacity	Maximum 4H-Link PCBs of Hitachi Chiller
Power Supply	AC 1-PH, 220~240V±10% 50/60Hz
Power Consumption	Maximum 10W
Ambient Condition Temperature Relative Humidity	0-45°C 10-80% (with condition of no condensation)
Net weight	0.6kg
Colour	Grey (Munsell 5Y7/1 our similar)
Material of Box	ABS resin molding material
Mounting Method	Wall Mount (By 2 x M4 Screws), or on DIN Rail (35mm)
Mounting Location	In Weather and Dust-Proofed Control Panel
Accessories	Core x 1, Capacitor x 1
Transceiver	Using FTT-10A
Warranty	No warranty shall be applied for the control and operation of the upper "LonWorks" side. Hitachi's liability shall cover only Hitachi Chillers, this gateway, and accessibility by "LonWorks"

■ Transmitting Setting (On Chiller Control PCB)

Operation	DSW
Before shipment, No. 1 pin of DSW10 is set at ON side	
In case that Chiller Unit quantity in the same H-Link is 2 or more, set No. 1 pin of DSW10 at the OFF side from 2nd Unit. If only one Chiller Unit is used, no setting is required.	
In case of applying high voltage to the terminal TB1 (E,F), the fuse on the PCB is cut. In such a case, first connect the wiring to TB1 (E,F) and then turn “ON” DSW-2	

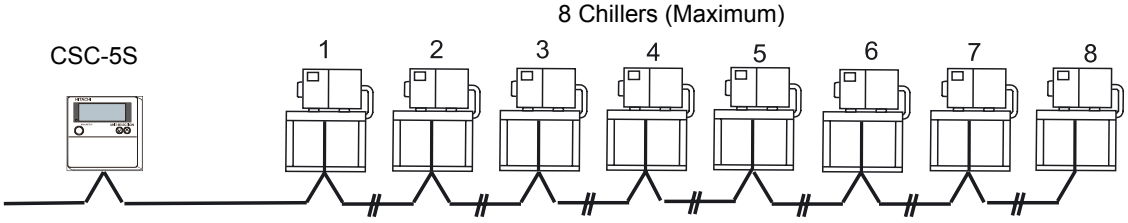
6.7. CSC-5S

CSC-5S is a remote controller for Hitachi Water Chillers



6.7.1. SYSTEM

CSC-5S allows the individual control of a Chiller Unit as well as it allows a centralized and grouped controls of a maximum number of 8 chillers.



6.7.2. SIGNAL

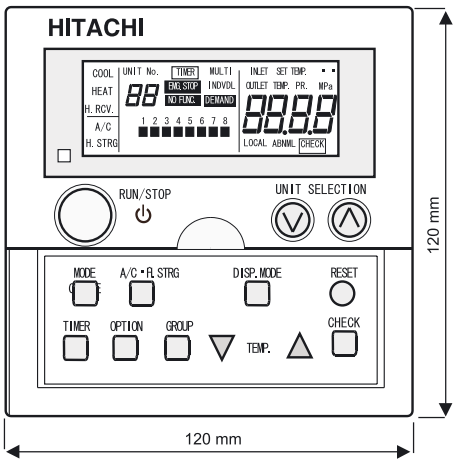
Indication code	Indication Content	Unit	Remark	Control Monitoring
	ON/OFF unit operation			Control Data
	Setting Temperature COOL	°C		
	Setting Temperature HEAT	°C		
	Operation Mode			
C1Pd ~ C2Pd	Discharge Pressure	MPa	Indicate Max. 2 Refrigerant Circuit Data	Monitoring Data
C1Ps ~ C2Ps	Suction Pressure	MPa		
C1td ~ C2td	Discharge Gas Temperature	°C		
C1ts ~ C2ts	Suction Gas Temperature	°C		
C1tr ~ C2tr	Liquid Refrigerant Temperature	°C		
CEL	Inlet Water Temperature	°C		
CoL	Outlet Water Temperature	°C		
CcoL	Individual Water Piping Outlet Temperature	°C	The display contents depend on chiller unit.	
tSC	Setting Temperature of Chilled Water	°C		
tSH	Setting Temperature of Hot Water	°C		
tSCd	Setting Analog Temperature of Chilled Water	°C	Not available	
tSHd	Setting Analog Temperature of Hot Water	°C	Not available	
dF	Differential Setting	°C		
tA	Ambient Temperature	°C		
Crno	ROM No. of Chiller Unit			
CvEr	Version No. of Chiller Unit			
rno	ROM No. of Controller (CSC-5S)			

6.7.3. CAUTION ON USE OF CSC-5S

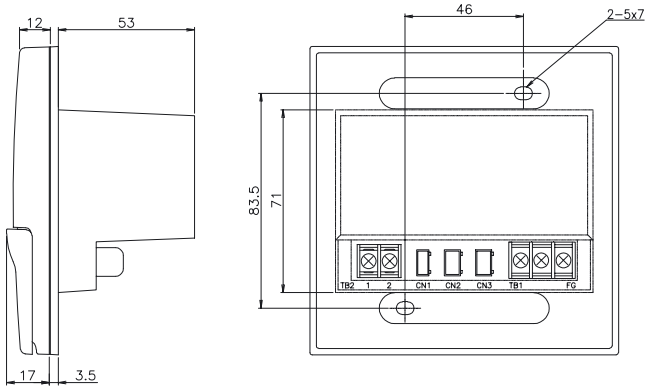
Follow strictly instructions of CSC-5S Installation Manual. This controls requires power supply 1~, 220-240V.

6.7.4. DIMENSIONAL DRAWING AND SPECIFICATIONS OF CSC-5S

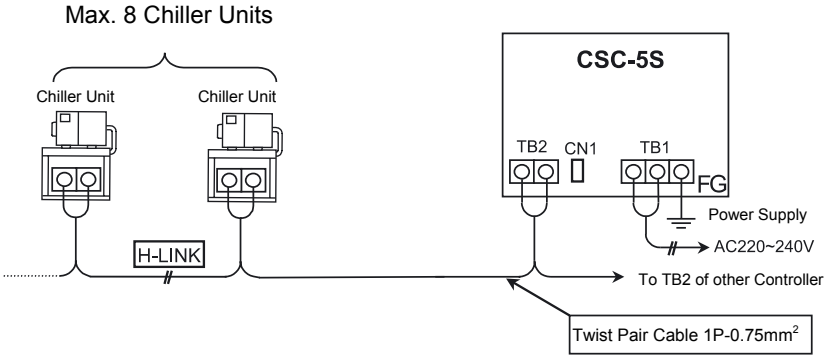
■ **Structural Drawing**



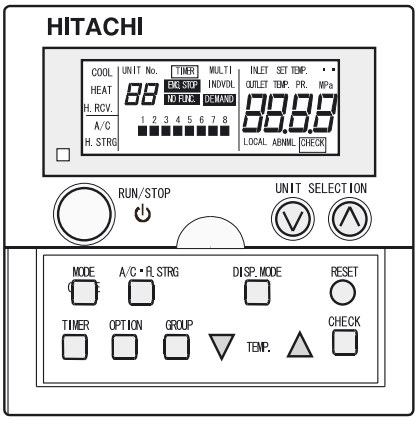
■ **Mounting Dimensions**



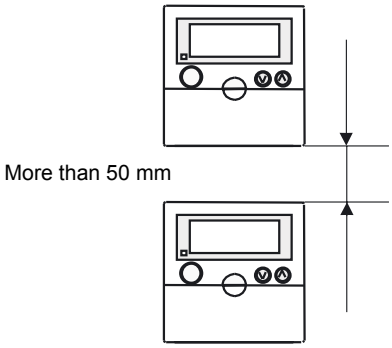
■ **System Wiring**



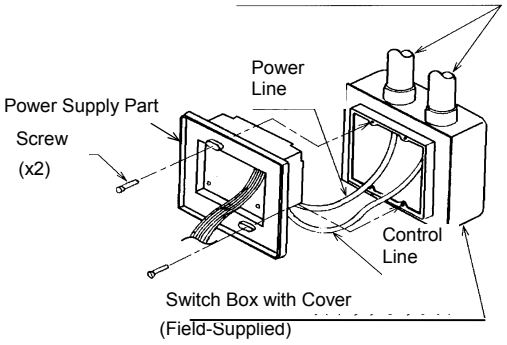
■ CSC-5S LAYOUT

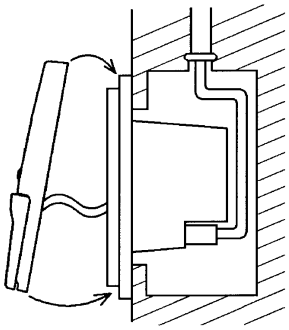


■ SPACE REQUIREMENTS



Do not run the power line and the control line through the same conduit tube.





■ TRANSMITTING SETTING (ON CHILLER CONTROL PCB)

Operation	DSW
Before shipment, No. 1 pin of DSW10 is set at ON side	ON OFF 1 2
In case that Chiller Unit quantity in the same H-Link is 2 or more, set No. 1 pin of DSW10 at the OFF side from 2nd Unit. If only one Chiller Unit is used, no setting is required.	ON OFF 1 2
In case of applying high voltage to the terminal TB1 (E,F), the fuse on the PCB is cut. In such a case, first connect the wiring to TB1 (E,F) and then turn “ON” DSW-2	ON OFF 1 2

6.8. INSTALLATION FINAL CHECK

Inspect the installation work according to all documents and drawings. Sub-chapter 6.6.1 shows the minimum check points.

6.8.1. INSTALLATION WORK CHECK LIST

1. Is the unit solidly mounted and levelled?

2. Is the installation location adequate?

- ☐ Indoor Installation
- ☐ Space for Maintenance Work
- ☐ Noise and Vibration
- ☐ Sunshine and other Heat Sources
- ☐ Appearance

3. Is the water piping system adequate?

- ☐ Tube Size
- ☐ Length
- ☐ Flexible Joint
- ☐ Insulation
- ☐ Strainer
- ☐ Water Drain
- ☐ Water Control
- ☐ Air Purge
- ☐ Pressure Control

4. Is the electrical wiring system adequate?

- ☐ Wire Size
- ☐ Switch Size
- ☐ Fuse Size
- ☐ Voltage and Hz
- ☐ Tightened Connections
- ☐ Operation Control Devices
- ☐ Safety Devices
- ☐ Interlock

5. Have the R, S and T phases of the Chiller correctly been connected to the R, S and T phases of the main power source?

6. Are the stop valves for the condenser liquid line open?

7. Have the packing glands and the cap nuts for the stop valves been tightened?

8. Is BMS connected correctly and operate as decided?

7. TEST RUNNING

7.1. PREPARATION

■ **Tools and instruments**
High Pressure Compound Gauge. Low Pressure Compound Gauge. Electrical Tester and General Tools.

⚠ ***CAUTION:***
- *Switch On the main power switch, and energise the oil heater for 12 hours before start-up, to sufficiently warm the oil.*
- *Check to ensure that valves are correctly opened. If not opened, serious damage will occur to the compressor due to an abnormally high pressure.*
- *Remove the foreign particles and substances from the water piping without going through the water coolers and condensers, and cleaning the water strainer filter before test runningg. Check to ensure that no foreign particle and substance exists in the water piping*

7.2. TEST RUNNING

Test running should be performed as follows, when the unit is wired according to the HITACHI standard wiring label.

1. Switch ON the field-supplied pump and the cooling tower, and the pump and cooling tower will be started immediately. Check the condition and operation state of these components (Cooling tower: In the case of water-cooled)
2. Fully open the liquid line stop valve.
3. Set the operation switch to "ON", and the compressor will be started in a few minutes after this operation, according to the following Operation Sequence Chart (Refer to chapter 10).

Test running should be accomplished as follows.

⚠ ***DANGER***:
Switch OFF main interruptor (M.I.) for any work inside electrical box.

⚠ ***CAUTION:***
- *When the unit is wired according to the HITACHI standard wiring shown on the wiring label. Switch ON the main power switch, and energize the oil heater for 12 hours before start-up to sufficiently warm the oil.*
- *Each rotation direction of two rotors in the compressor is fixed so that a reversal phase protection device is equipped.*
- *However, the rotation direction should be checked with a following method:*
  - *Confirm that phases R, S and T for the compressor is correctly connected. The correct phase connection can be checked by a phase sequence indicator. If not, the compressor does not start due to activation of the reversal phase protection device.*
  - *Cut the main switch and interchange two of three terminals, R, S and T on the main terminals at the field connection side in the unit.*
    1. *Operate the pump for chilled water and other auxiliary equipment such as fan coil units and air handling units.Check to ensure that the chilled water flows sufficiently and that other auxiliary equipment operate properly.*
    2. *Set the switch at the desired temperature.*
    3. *Depress the “ON“ push button, the compressor will be started. Refer to “Standard Operation Sequence” (Refer to chapter 10).*
    4. *After system operation becomes stabilized, check the discharge and suction pressures by 7-segment on control panel. Refer to the discharge and suction pressure curves (Refer to chapter 11).*
    5. *Check to ensure that the thermostat functions properly.*
    6. *Check to ensure that the control and protective devices function properly (Refer to chapter 11)*
    7. *Starting timer and unload-starting timer are set at five (5), thirty (30) seconds, respectively, in accordance with operation characteristics. Therefore, local adjustment should be avoided.*

NOTE:
- *A loud sound occurs when this compressor is stopped after the normal operation. However, this sound indicates no abnormalities and stops within a few seconds by the activation of the check valve. This sound is due to the reverse rotation of the screw rotors, resulting from the pressure difference between the discharge and the suction pressure.*
- *Each compressor may show the different values of running current due to individual capacity control for each compressor. This is not abnormal.*

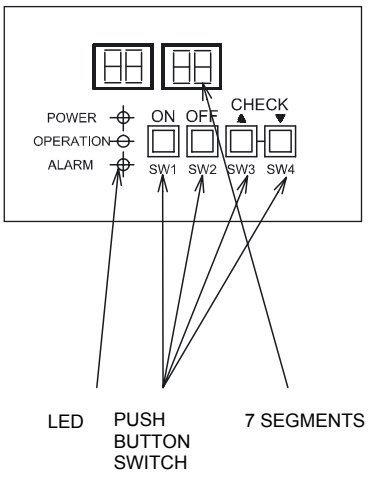
7.3. INSTRUCTIONS AFTER TEST RUNNING

When the test running is completed, please instruct customers about operation and periodic maintenance methods before leaving the unit, by using Installation, Operation and Maintenance Manual. A special attention is required to the following caution:

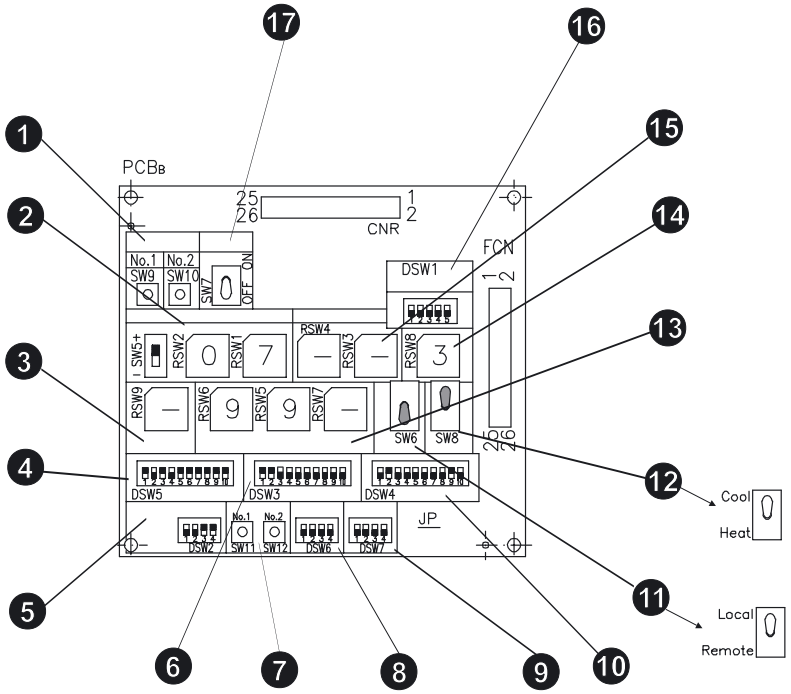
⚠ ***CAUTION:***

- *Do not cut off the power source switch during the operating season. When the power source switch is cut off, the oil heater for screw compressor is not energised, and the compressor might be damaged due to oil foaming at starting.*
- *When the operation season starts after long disconnection of the power source switch, please turn on the power source switch 12 hours before starting operation.*

8. CONTROLLER ADJUSTMENT



SWITCH POSITION	
ON / OFF	ON
ON / OFF	OFF



❶ High Cut Check (Fan Stop for Checking)
(NOT AVAILABLE)

❷ Chilled Water Temperature Setting
(STANDARD: "+07")

❸ Defrosting Set by Ambient Temperature (Heat Pump)
(NOT AVAILABLE)

❹ Continuous Capacity Control Setting
(STANDARD)

❺ Compressor starting Delay Time (STANDARD: 3 min)
High Cut Check Setting (Stop Fan Selection: NOT AVAILABLE.)

❻ Mode Set Switch A
(DEPEND ON MODEL)

❼ Manual Defrost (Heat Pump)
(NOT AVAILABLE)

❽ Optional Function B
(STANDARD: ALL OFF)

❾ Optional Function C
(STANDARD: ALL OFF)

❿ Mode Set Switch B

⓫ Local/Remote Changeover Switch
(STANDARD: "Local")

⓬ Cool/Heat Changeover Switch
(STANDARD: "Cool")

⓭ Current Limitation
(Not Available)

⓮ Neutral Zone Setting
(STANDARD: "3")

⓯ Hot Water Temperature Setting for Heat Pump
(NOT AVAILABLE)

⓰ Optional Function A (Outernals signals, Self-Checking mode)
(STANDARD: ALL OFF)

⓱ Pump Operation (STANDARD: OFF)

8.1. CONTROL SYSTEM

Electrical Operation Control advanced HITACHI Condenser less Chillers are as follows.

■ Capacity Control

All models are equipped with an unloading system for each compressor, in order to adjust the cooling capacity and to provide precise temperature control for the chilled water, coupled with electronic thermostats.

■ Control Panel

ON switch, OFF switch, Power Supply Lamp, Operation Lamp, Alarm Lamp, Operation/Alarm Indicator for each refrigerant cycle and check switch are mounted in the Control Panel. The Control Panel is located at a position where easy access is available. Operation/Alarm indicator can display individual alarm codes such as High-Cut, Low-Cut etc. this function is very useful for detecting what alarm has occurred. Check switches are for checking chilled water temperature and alarm occurrence data. Chilled water temperature setting switches, ON/OFF Differential Setting Switches, Remote-Local Switch and so on are located at the rear side of Control Panel, in order not to access during operation.

■ Operation Hour-Meter

This hour-meter indicates the sum of the compressor operation

■ Printed Circuit Board

A micro-processor, relays and electronic components are mounted on the Printed Circuit Board. Increased reliability is assured due to the elimination of mechanical parts and wires. This board contains various function by applying micro-processor as follows:

Screw Compressor Cycling Protection Circuit.
The electronic timer of the screw compressor cycling protection (ccp) connected in the compressor control circuit delays the screw compressor restarting period for approximately three (3) minutes for No.1 compressor, four (4) minutes for No.2 compressor.

Electronic Thermostat Circuit.
The electronic thermostat senses chilled water outlet temperature, and operate capacity control solenoid valves of HITACHI screw compressor.

Screw Compressor Reversing Protection Circuit.
This circuit is composed of a reverse-phase protection devices, preventing reverse operation of the screw compressor, because the screw compressor definitely cannot be operated in the wrong direction, due to the misconnection of the main power phases
Restart after Short Period Power-Failure.
In the case that a power failure shorter than 2 seconds occurred, compressors can be restarted automatically within 3 minutes after power supply.

Power Supply
All models need only single power supply . Control circuit is powered from main power circuit. For remote control, pump interlock and pump operation, see the diagram of "Customer Wiring"

8.2. CONTROLLER ADJUSTMENT

Layout of control panel of printed circuit board is shown in the Figure of the last page.
Setting functions are followings:

■ Chilled Water Outlet Temperature Setting Switch = RSW1 and RSW2

= 7°C for chilled water outlet temperature is recommended. The RSW1 and RSW2 dials are already set at 7 and 0.
Setting at the figures from 3 to 9 of the RSW2 dial should not be permitted.

■ Current limitation = RSW5, 6, 7

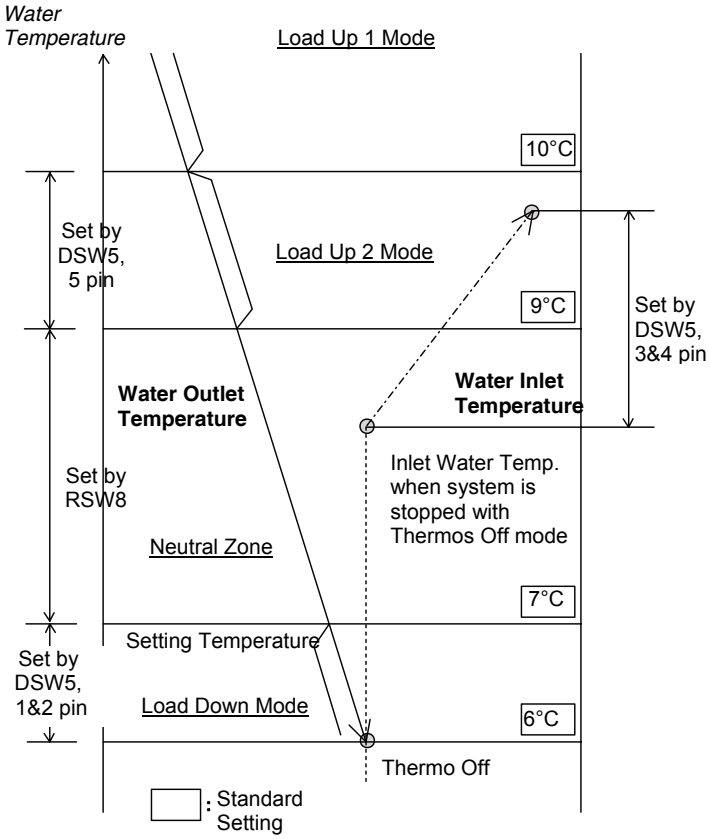
= The RSW5, RSW6 and RSW7 should not be permitted.

■ Neutral Zone Setting Switch = RSW8

= 2 degrees is standard. The RSW8 dial is already set at 3 = 2 degrees.
The figures at the RSW8 dial means as follows:

Figure	0	1	2	**3**	4	5	6	7	8	9
Band(degree)	0.5	1.0	1.5	**2.0**	2.5	3.0	3.5	4.0	4.5	5.0

■ Continuous Capacity Control Setting Switch = DSW5 Definition of Special Terms.



■ Continuos Capacity Control Setting Switch=DSW5

Temperature Band for Stop Setting Switch
= 1 degree is standard. The figure 1 and 2 of the DSW5 switch are already set at figure 1 = ON side, 2 = OFF side. The locations at the figure 1 and 2 of the DSW5 mean as follows.

Figure	1	2	**1**	**2**	1	2	1	2
Location	ON	ON	**ON**	**OFF**	OFF	ON	OFF	OFF
Band(degree)	0.5		**1.0**		1.5		2.0	

Temperature Band for Restart Setting Switch
= 2 degree is standard. The figure 3 and 4 of the DSW5 switch are already set at figure 3 = ON side, 4 = OFF side. The locations at the figure 3 and 4 of the DSW5 mean as follows.

Figure	3	4	**3**	**4**	3	4	3	4
Location	ON	ON	**ON**	**OFF**	OFF	ON	OFF	OFF
Band(degree)	1.0		**2.0**		3.0		4.0	

Differential Temperature of Load-up 2 Mode Setting Switch
= 1 degree is standard. The figure 5 of the DSW5 switch is already set at ON side.
The locations at the figure 5 of the DSW5 mean as follows.

Figure	**5**	5
Location	**ON**	OFF
Band(degree)	**1.0**	3.0

Output Signal Time for Load-up 1 Mode Setting Switch
= 12 seconds is standard. The figure 6 of the DSW5 switch is already set at ON side.
The locations at the figure 6 of the DSW5 mean as follows.

Figure	**6**	6
Location	**ON**	OFF
Time(second)	**12**	24

Output Signal Time for Load-up 2 and Load-down Mode Setting Switch
= 2 seconds is standard. The figure 7 and 8 of the DSW5 switch are already set at figure 7 = ON side,
8 = ON side.
The locations at the figure 7 and 8 of the DSW5 means as follows.

Figure	**7**	**8**	7	8	7	8	7	8
Location	**ON**	**ON**	ON	OFF	OFF	ON	OFF	OFF
Time(second)	**2**		4		6		8	

Interval of Output Signal Time for Load-up 2 and Load-down Mode Setting Switch.
=60 seconds is standard. The figure 9 and 10 of the DSW5 switch are already set at figure 9=ON side, 10=ON side.
The locations at the figure 9 and 10 o f the DSW5 mean as follows.

Figure	**9**	**10**	9	10	9	10	9	10
Location	**ON**	**ON**	ON	OFF	OFF	ON	OFF	OFF
Time(second)	**60**		90		120		30	

■ Setting of Compressor Cycling Protection Start = DSW2

* Time Delay Starting for Compressor Setting Switch *
The compressor will be started after this setting time.
= 3 minutes is standard. The figure 1 and 2 of the DSW2 switch are already set at figure 1 = OFF side, 2 = OFF side.
The locations at the figure 1 and 2 of the DSW2 mean as follows.

Figure / Time (minute)	Location 1	2	3	4
0.5	ON	ON	ON	ON
1	OFF	ON	ON	ON
2	ON	OFF	ON	ON
3	OFF	OFF	ON	ON
4	ON	ON	OFF	ON
5	OFF	ON	OFF	ON
6	ON	OFF	OFF	ON
7	OFF	OFF	OFF	ON
8	ON	ON	ON	OFF
9	OFF	ON	ON	OFF
10	ON	OFF	ON	OFF

■ Manual Set Switch A = DSW3

* Compressor Forcedly Stop Mode Setting Switch *
Switches "DSW3-1" is for No.1 compressor, "DSW3-2" for No.2.
If necessary to stop any compressors, turn these switches (DSW3-1, DSW3-2) to the OFF side, the compressors corresponding to these switches are turned to the OFF side will be stopped.
The figures of the DSW3 switch are initially set as follows depend on the compressor quantity.
This switch is for servicing, therefore, all the compressors shall be ON for normal operation.

Figure	1	2	3	4	1	2	3	4
Location	ON	OFF	OFF	OFF	ON	ON	OFF	OFF
Model	1 Comp. System				2 Comp. System			

Setting at the figures from 5 to 10 of the DSW3 switch should not be permitted (always at OFF side).

Note: *The figures 2, 3 and 4 of DSW3 which are Not corresponding to the equipped compressor number are always turned to the OFF side.*

■ Manual Set Switch B = DSW4

The figure 2 of the DSW4 switch must be turned to the ON side.
The figures 3 and 7 of the DSW4 switch are initially set as follows depend on the unit model.
Setting at the figures 1, 4, 5, 6 and 8 of the DSW4 switch should not be permitted (always at OFF side).

Figure	3	7	3	7
Location	ON	ON	ON	OFF
Type of Chiller/Refrigerant	R407C LW		R22 LW (Not Available)	

Figure	3	7	3	7
Location	OFF	ON	OFF	OFF
Type of Chiller/Refrigerant	R407C ST		R22 ST (Not available)	

ST: Standard model
LW: Low Ambient (option)

The figures 9 and 10 of DSW4 switch are for compressor size setting as follows.

Figure	9	10	9	10	9	10
Location	OFF	ON	ON	OFF	ON	ON
Compressor	40 HP		50 HP		60 HP	

■ Selection Switch for Cooling/ Heating Operation = SW8

= All model in this series are for cooling only. So that Heating function is Not available.
The SW8 Selection Switch must be turned to the ***upper side***.

■ Selection Switch for Local/ Remote Operation = SW6

= Local operation is standard. So that the SW6 selection switch is turned to the upper ***side***.
If Remote operation is required, the SW6 selection switch is turned to the upper side.

■ Selection Switch for Local/ Remote Pump Operation = SW7

= The SW7 selection switch is turned to the ***lower ("OFF") side*** as remote setting.
If local operation is required, the SW7 selection switch is turned to the upper side.

■ Anti-freeze Control by Pump Operation = DSW6-2pin

If the ambient temperature get lower than 2 °C, water pump is operated forcedly and it protect water line Against freezing. OFF side setting of DSW6-2pin makes this control available.
This control is available only when the pump is controlled by Chiller (See wiring diagram).

■ Other Switches = SW5, DSW6, RSW9 and DSW1

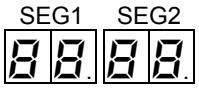
This control panel is equipped with other switches:
The SW5 selection switch for chilled water/brine water, so that this switch must be turned to the ***upper side ("water")***. DSW6 and RSW9 for operation mode and setting change of these switches are not available.
The figure 2 of DSW6 must be turned to the upper side.
It is recommended that the setting is not changed at site.
Also, the DSW1 switch is equipped with. This switch is used for only checking, resulting in easy troubleshooting.

9. SELF-INSPECTION FUNCTIONS

9.1. ALARM INDICATION

■ Alarm Indication

If the unit is operated under abnormal conditions, an alarm code(refer to the table below) is indicated and the "Alarm" LED is lighted.
Function of 7-Segment Light Emitted Diode on Control Panel is as shown in the table below.



7 Segments on Control Panel

Code		Content
No.1 Cycle	No.2 Cycle	
C1-H1	C2-H2	Activation of High Pressure Switch
C1-L1	C2-L2	Excessively Low Pressure
C1-t1	C2-t2	Low Pressure Protection with Suction Gas Thermistor
C1-51	C2-52	Activation of Thermal Relay for Compressor
C1-71	C2-72	Activation of Compressor Internal Thermistor
C1-61	C2-62	Activation of Discharge Gas Thermostat
C1-o1	C2-o2	Activation of Differential Pressure Control
C1-28	C2-28	Failure of Suction Gas Pressure Sensor (Open / Short)
C1-27	C2-27	Failure of Discharge Gas Pressure Sensor (Open / Short)
C1-26	C2-26	Failure of Suction Gas Thermistor (Open / Short)
C1-21	C2-21	Failure of Cooler Inlet Refrigerant Thermistor (Open/Short)
C1-23	C2-23	Failure of Discharge Gas Thermistor (Open / Short)
C1-P6	C2-P6	Freezing Protection Control by Cooler Inlet Refrigerant Temperature
C1-91	C2-92	Low Temperature Protection with Cooler Inlet Refrigerant.
6E-6E		Alarm of Water Failure (Differential Water Pressure Switch Option)
AP-AP		Activation of Additional Protection Device
13-13		Freezing Protection
C1-05	C2-05	Phase Abnormally
C1-5P	C2-5P	No Signal Feedback from Water Pump
"C1"-"Pu"	"C2"-"Pu"	Alarm of Excessively High Water Temperature
40-40		Malfunction
11-11		Failure of Water Inlet Temperature Thermistor (Open / Short)
12-12		Failure of Water Outlet Temperature Thermistor (Open / Short)
C1-25	C2-25	Failure of Water Outlet Temperature Thermistor in cooler site (Open / Short)

" " **-** " " : Flickering. **XX - XX** : SEG1-SEG2

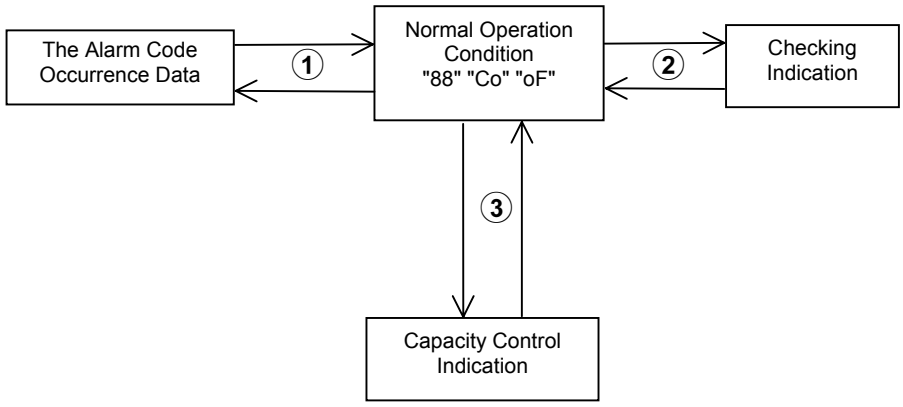
9.2. NORMAL INDICATION

If the unit is operated under a normal operation condition, the operation code (refer to the table below) is indicated on 7-Segment LEDs of the control panel.

Code		Content
No.1 Cycle	No.2 Cycle	
C1-88	C2-88	Power Supply, After Stoppage
C1-Co	C2-Co	Cooling Operation
C1-oF	C2-oF	Stoppage by Thermo-Off
C1-Pu	C2-Pu	Pump Operation Only, Warning of Pump Feedback

9.3. FUNCTION FOR INDICATION OF OPERATION CONDITION

The setting temperature, chilled water temperature sensed at the thermistor, the setting differential temperature and the last alarm code are digitally indicated on the control panel.



① Press the check "Δ" and "∇" switches simultaneously for more than 3 sec.
It is changed to the normal mode by pressing the "Δ" and "∇" switches simultaneously for more than 3 sec. again.

② Press the check "Δ" switch for more than 3 sec.
It is changed to the normal mode by pressing the "Δ" switch for more than 3 sec. again.

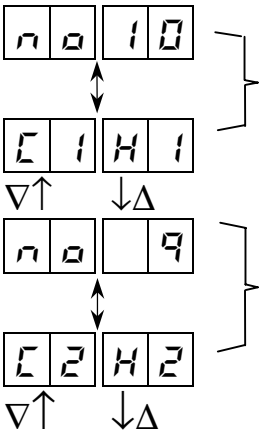
③ Press the check "∇" switch for more than 3 seconds.
It is available only while the "∇" switch is pressed. It changes to normal mode after 3 seconds automatically.

Note: *Each indication mode shall be changed from the normal mode.*

■ Indication Mode of Alarm Occurrence Data ①

The content of abnormal stoppage including activation of safety devices is memorised and indicated on the con panel

Alarm Occurrence Data (Max.10 data)



In case of No. 1 cycle high pressure alarm occurrence

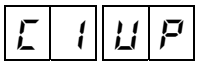
In case of No. 2 cycle high pressure alarm occurrence

NOTE:

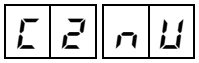
If an abnormal operation is occurred under this indication mode, this indication mode is changed to the alarm indication mode.

■ Capacity Control Indication ②

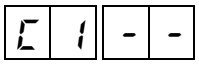
Example



No.1 Comp Load Up



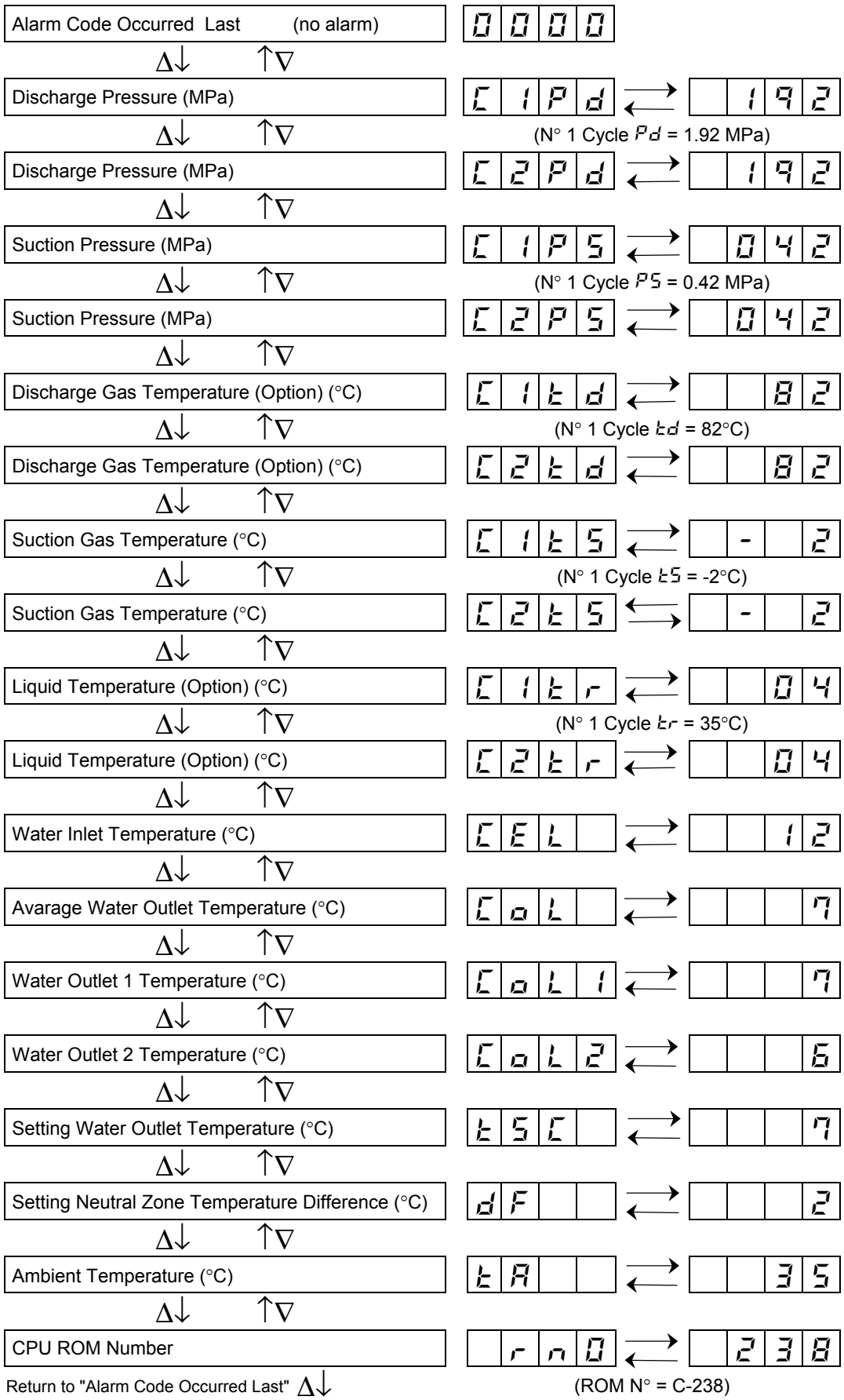
No.2 Comp Hold



No.1 Comp Thermo-off Starting Control

■ **Checking Indication ③**

Back to "CPU ROM numbre" ↑∇



10. CONTROL SYSTEM

■ **Standard Operating Sequence for RCUE 40CLG, RCUE 50CLG and RCUE 60CLG**

Control Stage / Control Devices		Starting Control								Capacity Control							Safety Devices			Shut Down		
Main Power Switch		OFF	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF
Chilled Water Pump		-	OFF	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF
Condenser Water Pump		-	OFF	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF
Operation Switch (ON/OFF)		-	-	-	ON	-	-	-	-	-	-	-	-	-	-	-	-	-	OFF	-	OFF	-
Controller	Load Up	-	-	-	-	-	-	O	O	-	-	-	-	-	-	-	-	-	-	-	-	
	Neutral	-	-	-	-	-	-	-	-	-	O	-	-	-	-	O	O	-	-	O	-	
	Load Down	-	-	-	-	-	-	-	-	O	-	O	O	-	-	-	-	-	-	-	-	
Safety Devices	Nº 1	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS			CLS	OPN	CLS	CLS	CLS	CLS	CLS
Power Supply Lamp		OFF	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON			ON	ON	ON	ON	ON	ON	OFF
Operation Lump		OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON	ON			ON	ON	OFF	ON	OFF	OFF	OFF
Alarm Lumpr		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF			OFF	ON	OFF	OFF	OFF	OFF	OFF
Oil Heater	CH1	OFF	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON			OFF	ON	ON	ON	ON	ON	OFF
Motor for Compressor	MC1	OFF	OFF	OFF	OFF	STA (ULD) 15%	DLT (ULD) 15%	DLT (FLD) 100%	DLT (FLD) 100%	DLT (ULD) 15%	DLT (ULD) 15%	DLT (ULD) 15%	OFF			DLT (ULD) 15%	OFF	OFF		DLT (FLD) 100%	OFF	OFF
Solenoid Valve	SV11	OFF	OFF	OFF	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	ON			OFF	OFF	OFF	OFF	OFF	OFF	OFF
	SV12	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON	OFF			OFF	OFF	OFF	OFF	OFF	OFF	OFF
	SV13	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF			OFF	OFF	OFF	OFF	OFF	OFF	OFF
Time Schedule		5sec.																				
		30sec.																				
		3min.																				
		Minimum 3min.																				

CLS: Close, OPN: Open, STA: Star, DLT: Delta
ULD: Unload, FLD: Full Load

■ Standard Operating Sequence for RCUE 80CLG, RCUE 100CLG and RCUE 120CLG

Control Stage / Control Devices		Starting Control											Capacity Control				Safety Devices				Shut Down		
Main Power Switch		OFF	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF
Chilled Water Pump		-	OFF	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF
Condenser Water Pump		-	OFF	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF
Operation Switch (ON/OFF)		-	-	-	ON	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OFF	-	OFF	-
Controller	Load Up	-	-	-	-	-	-	-	-	O	O	-	-	-	-	-	-	O	O	-	-	-	-
	Neutral	-	-	-	-	-	-	-	-	-	-	O	-	-	-	-	O	-	-	-	O	-	-
	Load Down	-	-	-	-	-	-	-	-	-	-	-	O	-	O	O	-	-	-	-	-	-	-
Safety Devices	Nº 1	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	OPN	OPN	CLS	CLS	CLS	CLS
	Nº 2	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	CLS	OPN	CLS	CLS	CLS	CLS
Power Supply Lamp		OFF	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF
Operation Lump		OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	OFF	ON	OFF	OFF
Alarm Lump		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF
Oil Heater	CH1	OFF	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON	ON	ON	OFF	ON	OFF
	CH2	OFF	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	ON	ON	OFF	ON	OFF
Motor for Compressor	MC1	OFF	OFF	OFF	OFF	STA (ULD) 15%	DLT (ULD) 15%	STA (ULD) 15%	DLT (ULD) 15%	DLT (ULD) 15%	DLT (FLD) 100%	DLT (FLD) 100%	DLT (ULD) 15%	DLT (ULD) 15%	DLT (ULD) 15%	0FF	DLT (ULD) 15%	OFF	OFF	OFF	DLT (FLD) 100%	OFF	OFF
	MC2	OFF	OFF	OFF	OFF	OFF	OFF	STA (ULD) 15%	DLT (ULD) 15%	DLT (ULD) 15%	DLT (FLD) 100%	DLT (FLD) 100%	DLT (ULD) 15%	DLT (ULD) 15%	DLT (ULD) 15%	OFF	DLT (ULD) 15%	DLT (ULD) 15%	OFF	OFF	DLT (FLD) 100%	OFF	OFF
Solenoid Valve	SV11	OFF	OFF	OFF	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	SV12	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	SV13	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	SV21	OFF	OFF	OFF	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	SV22	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	SV23	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
Time Schedule		3min.				5sec. / 60sec.		5sec. / 30sec.															

Minimum 3min.

The compressor which started finally will be started first.

CLS: Close, OPN: Open, STA: Star, DLT: Delta
ULD: Unload, FLD: Full Load

11. MAINTENANCE

The unit should be periodically inspected according to the same items as those described in the paragraph titled “Test Running“. In order to ensure dependable performance and long life operation, the following additional items should be given for particular attention.

WARNING:
If a fire accidentally occurs, turn OFF the main switch and use an extinguisher for an oil fire and an electric fire.
Do not operate the unit near flammable gases such lacquer, paint oil, etc. to avoid a fire or an explosion.
Turn OFF the main switch when electrical box covers are removed for setting the temperature. Do not operate the unit without fixing panels.

DANGER:
Switch OFF main interruptor (M.I.) for any work inside electrical box.

CAUTION:
Perform periodical maintenance according to the “INSTRUCTIONS“ to maintain the unit in a good condition.
Do not touch the parts at the discharge gas side by hand, since the pipes at the discharge side are heated by refrigerant and the temperature becomes higher than 100 °C.
Do not utilize this unit for cooling or heating of drinking water or food. Comply with local codes and regulations.
Turn OFF all the main switches if refrigerant leakage or chilled / hot water leakage occurs. Also, if the unit can not be stopped by the control switch, turn OFF all the switches for power source.

11.1. COMPONENTS

■ Compressor

The semi-hermetic screw compressor requires periodic maintenance, including replacement of parts. See the HITACHI Service Handbook for Screw Compressors, for details.

■ Electrical Equipment

Always pay careful attention to working voltage, amperage and phase balance. Check for faulty contact caused by loosened terminal connections, oxidised contacts, foreign matter, and others.

■ Control and Protective Devices

Do not readjust the settings in the field unless the setting is maintained at the point other than the point listed in the table on chapter 11.

11.2. LUBRICATION

■ Compressor

The compressors are charged at the factory with the correct oil listed in “Component Data” and the compressor nameplate. It is not necessary to add oil, if the refrigerant cycle remains sealed.

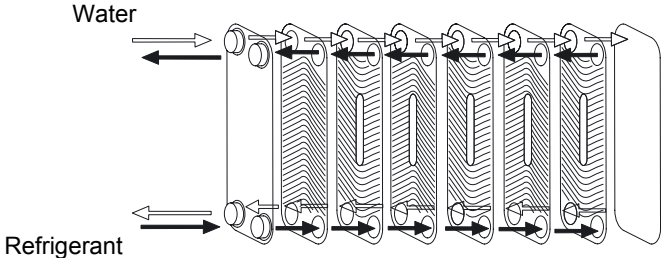
11.3. DEPOSITS

Lime and other minerals in the condenser water or chilled water tend to deposit on inside surfaces of plates over a long period of operation. As deposits of these minerals increase, excessive high discharge pressure or lower operation pressure are detected, indicating evidence of deposits on the condenser or the water cooler. The figure in page 31 indicates the range where cleaning is required. (Condenser: In the case of water-cooled type)

CAUTION:
- *Cleaning of plate type heat exchangers shall be performed by specialists. Please contact your contractor or dealer of HITACHI.*
- *Clean the water strainer filter periodically according to its clogging degree. If not cleaned periodically, the water strainer will be broken due to an excessive pressure to the strainer screen.*

WARNING:
- *This product is equipped with plate type heat exchangers. In the plate type heat exchanger, water flows through a narrow space between plates. Therefore, there is a possibility that freezing may occur if foreign particles or dusts are clogged. In order to avoid this clogging, provide a 20 mesh water strainer at the inlef of the chilled water piping near the product. If clogging in the plate type heat exchanger occurs seriously, this will cause insufficient cooling performance or local freezing in the plate type heat exchanger. It is strongly recommended that the heat exchanger be cleaned at the same time when the filter is cleaned.*

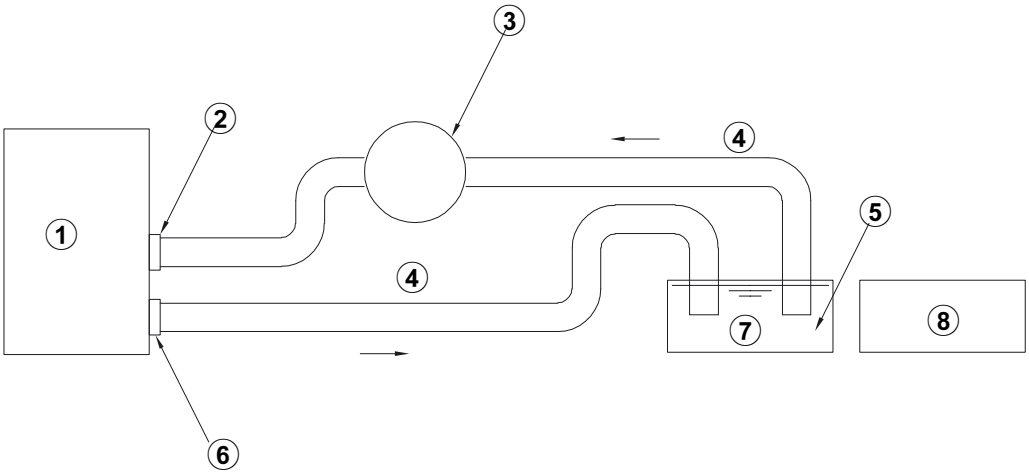
Pay attention to the following caution and normal cleaning method. For details, contact your Hitachi installer.



CAUTION:

- *Correctly select cleaning agent depending on scales in the plate type heat exchangers. The cleaning chemicals are different depending on fouling degree.*
- *This plate type heat exchanger is made of stainless steel. Do not use a cleaning agent containing hydrochloric acid or fluorine compound. If used, the heat exchanger will be damaged, resulting in refrigerant leakage.*
- *After cleaning with cleaning agent, clean inside of water piping including the heat exchangers by using clean water. Perform water treatment (preventive treatment) in order to prevent the water circuit from corrosion or re-adhering of scales after cleaning.*
- *In the case that a cleaning agent is used adjust concentration of the cleaning Agent, cleaning period and temperature according to the scale degree.*
- *In the case that acid cleaning is performed, neutralisation treatment is required after cleaning. Treatment for neutralisation fluid should be performed by a waste fluid contractors.*
- *The cleaning agent and neutralizing agent are erosive and stimulative against eyes, skin, mucous membrane etc. Therefore use protection tools (protection glasses, protection gloves, protection shoes, protection cloth, protection mask, etc.) in order not to absorb or touch these agents during this cleaning work.*

11.4. CLEANING METHOD



N°	Name	N°	Name
1	Chiller Unit	5	Diluted Cleaning Fluid
2	Chilled Water / Inlet Piping	6	Chilled Water / Outlet Piping
3	Acid-resistant Type Water Pump	7	Cleaning Water Tank
4	Hose	8	Waste Fluid Tank

1. Installation of Cleaning Circuit

- Stop the water Chiller unit.
- Stop the circulating water pump.
- Disconnect the connections at the chilled water inlet or cooling water inlet and install a circulating water circuit by using an acid-resistant type water pump.

2. Check of Circulating Circuit

Pour water in the cleaning tank and operate the acid-resistant type water pump.

- Check to ensure that no water leakage exists.
- Check to ensure that the water hose is firmly fixed.
- Check to ensure that the cleaning Agent will not damage equipment near the water Chiller even if bubbles occur and touch them.
- Check to ensure that good ventilation is available.
- Check to ensure that no abnormal sound occurs.

3. Cleaning Work

- Discharge water in the water circuit of the air conditioning system.
- Supply diluted cleaning fluid from the cleaning water tank by operating the acid-resistant pump.
- Circulate the cleaning fluid for an appropriate period of time (the operating time should be determined according to the type of cleaning Agent, concentration and fouling degree).

4. Waste Fluid

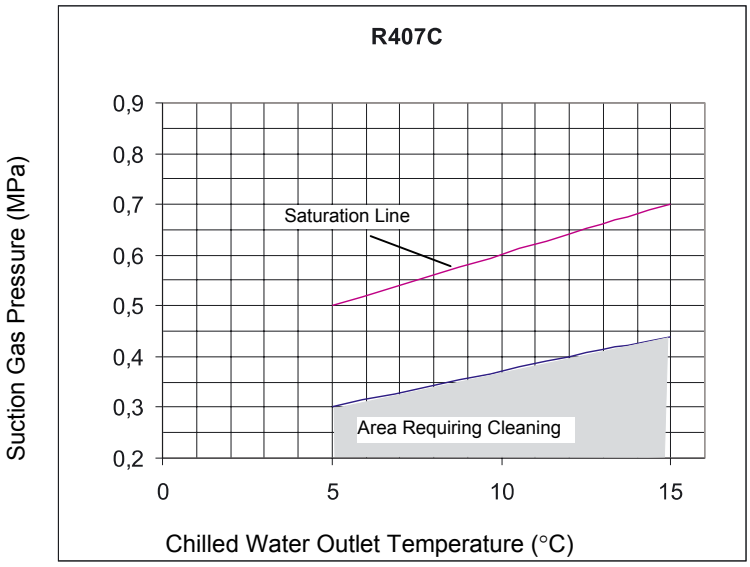
- Stop the acid-resistant pump.
- Put the waste fluid into the waste fluid tank.
- Supply water into the cleaning tank and operate the pump for water cleaning.
- Put the cleaning water into the waste fluid tank as same as the waste fluid.
- Measure pH degree by using a pH test sheet and neutralize the waste fluid by gradually adding neutralizing agent.
- After neutralization ask a waste fluid treatment contractors to handle it.

5. Neutralisation Treatment in the Water Piping

- Put water into the cleaning tank.
- Operate the acid-resistant pump after air-purging.
- Measure the pH degree and gradually add neutralizing agent until the pH reaches pH = 7.
- Operate the pump for a specified period of time for neutralization.
- Discharge the used water.
- Operate the circulating pump and clean the circuit with water until no fouling fluid is observed.

6. Re-starting

- Reconnect the water piping as they were so that the water Chiller can operate.
- After cleaning, perform water treatment (preventive treatment) in order to prevent the water circuit from corrosion.



11.5. WINTER SHUTDOWN

When shutting down the unit for winter, clean the inside and outside of the cabinet, and dry the unit. Pump down the refrigerant to the condenser and close the liquid outlet stop valves. This unit should be covered during shutdown, in order to protect it from dust and environmental conditions. Be sure to tighten the packing glands and the cap nuts of the valves.

Remove the drain plug and drain all residual water from the condenser and water cooler piping systems, as such water may freeze during the cold season. It is very helpful to supply brine (anti-freezer) to the piping systems.

11.6. SPRING START-UP

After any extended shutdown period, prepare the unit for operation as follows.

1. Thoroughly inspect and clean the unit.
2. Clean the water piping lines and the strainer.
3. Inspect the pump, the cooling tower and/or regulating valve.
4. Tighten all wiring connections and access panel.

⚠ ***CAUTION:***
When the main switch for this unit has been at the OFF position for an extended period of time, it should be switched ON at least 12 hours before start-up, so that oil in the compressor discharge casing may be warmed enough, to prevent oil foaming by the oil heater during start-up.

11.7. PART REPLACEMENT

Replacement of parts should be undertaken by ordering from the HITACHI Spare Parts List.

⚠ ***CAUTION:***
Do not replace with spare parts which are not the equivalent.

11.8. REFRIGERATION CYCLE

■ Strainer

Check for clogging each time when the refrigeration cycle is opened.

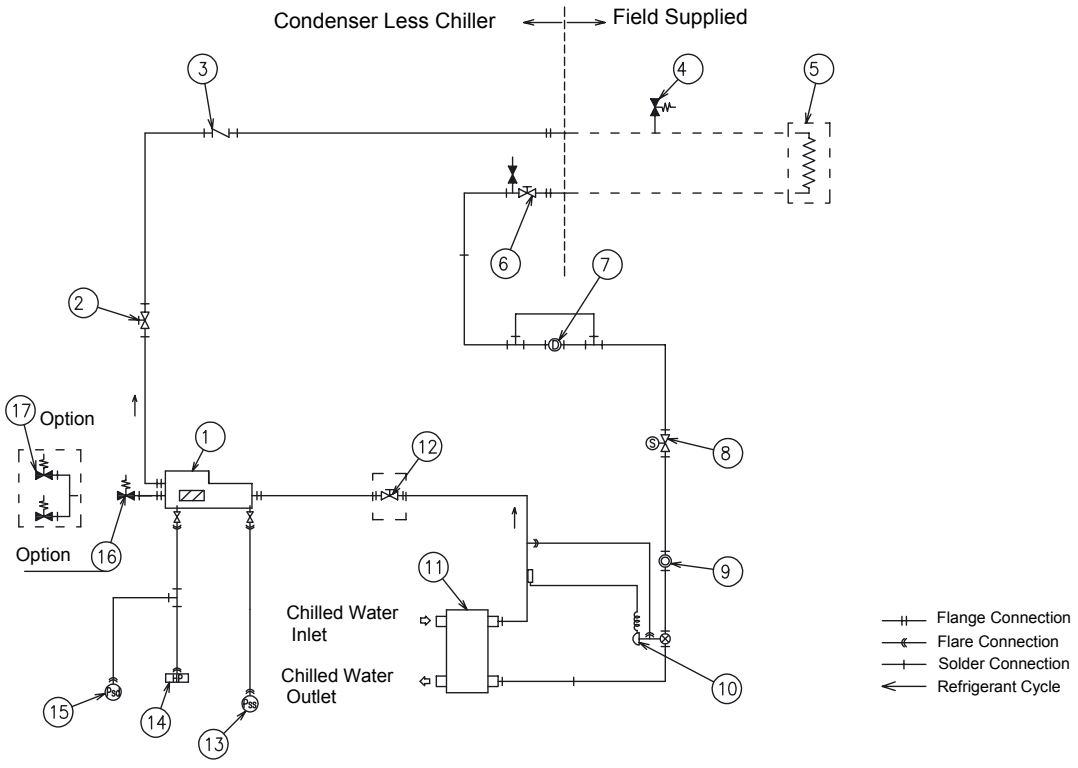
■ Refrigerant Charge

Inspect the refrigerant charge of the system by checking the discharge and suction pressures. Perform a leakage test, if any leakage is suspected, and always perform such a test after a refrigeration cycle component is replaced. When refrigerant charge is required, follow the following instructions given for two cases:

1. When Refrigerant Gas Completely Leaked.
   Before charging the entire cycle must be completely evacuated and dehydrated. A gauge manifold or equivalent piping preparation shown below is recommended as a convenient procedure regarding both charging and evacuation.
   - Fully open all the stop valves.
   - Connect the evacuation line to the check joints of the high and the low pressure sides.
   - Completely evacuate the entire cycle with a vacuum pump.
   - Charge refrigerant to the refrigeration cycle by weighing the charging cylinder. The proper refrigerant charge is listed on the nameplate.
   - When charging by weight is stopped due to high ambient temperature, close the valve and operate the unit after circulating the chilled water through the water cooler.
2. When Only Additional Refrigerant is Required.
   Connect a gauge manifold to check joint of low pressure side, and connect a charge cylinder to gauge manifold. Operate the unit after circulating the chilled water.

   Repeat the following procedure until pressure becomes proper (refer to page 44)
   - Charge the gas refrigerant a little slowly into refrigeration cycle from check joint for low pressure.
   - Check the pressure after refrigeration cycle becomes stable.

11.9. REFRIGERANT CYCLE DIAGRAM OF HITACHI CONDENSER LESS CHILLER (RCUE 40, 50, 60, 80, 100, 120 CLG)



No.	Name	No.	Name
1	Compressor	10	Expansion Valve
2	Stop Valve	11	Water Cooler
3	Check Valve	12	Stop Valve (Option)
4	Pressure Relief Valve (Field Supplied)	13	Pressure Sensor (Low)
5	Remote Condenser (Field Supplied)	14	High Pressure Switch
6	Stop Valve (with check joint)	15	Pressure Sensor (High)
7	Drier	16	Compressor Safety Valve (Option)
8	Solenoid Valve	17	Compressor Dual Safety Valve (Option)
9	Sight Glass		

NOTE:

R407C shall be charged by LIQUID.

⚠ ***CAUTION:***

- *Do not charge OXYGEN, ACETYLENE or other flammable and poisonous gases into the refrigeration cycle when performing a leakage test or an airtight test. These types of gases are extremely dangerous, because explosion can occur. It is recommended that compressed air or nitrogen be charged for these types of tests.*
- *Mineral deposits on water cooler plates act as thermal insulators, and also act as resistance Against water flow, causing the water flow to decrease running through them, and resulting in a decreasing of the cooling capacity. Deposits on the plates should be inspected at regular, intervals, experience with the water Chiller will dictate accurate inspection intervals.*
- *These deposits should be removed by circulating diluted acid through the water passes after the water has been drained. As water in different localities contains different minerals, different acids are required, depending upon the thickness of the deposits.*
- *This unit is equipped with an operation hour meter. In the case that the total operation time reaches 40,000 (water-cooled) hours or 5 years. and 24,000 (air-cooled) hours or 3 years pass after installation, exchange the bearings of the compressor. For details, refer to the Service Handbook for HITACHI Screw Compressors.*

11.10. COMPRESSOR REMOVAL

■ When Removing the Compressor

Remove the compressor while completing the following procedures.

1. Collect all refrigerant into a condenser before this work.
2. Turn off the switch, DSW3 of the PCB in the electrical box in order not to operate the compressor except for the cycle.
3. Circulate the chilled and cooling water sufficiently through the water cooler and condenser, and operate the water Chiller for 10 minutes, and check to ensure that the oil level is maintained at a stable condition.
4. Stop the Chiller and completely close the liquid stop valve.
5. Operate the Chiller after circulating water through the water cooler and field supplied condenser.
6. Stop the Chiller when the low pressure reaches at approximately 0.05 MPa. Do not operate at the pressure lower than 0.05 MPa. If operated, it will cause a damages to the compressor.
7. Wait for several minutes. If the low pressure increase up to 0.15 to 0.2 MPa, repeat the above procedures 5 and 6 four or five times.
8. Turn OFF the power supply to the unit.
9 Remove the bolts on the discharge and suction flanges of the compressor.

11.11. SAFETY AND PROTECTION CONTROL

The safety and protective devices are equipped with the unit to ensure dependable and long life operation.

Their functions should be carefully noted, and field adjustment is not recommended, if the setting is maintained at the point listed in the table.

■ Compressor protection

1. Fuse and thermal relay equipped in the control box cut out each compressor operation when the current to the compressor exceeds the setting
2. The internal thermostat embedded in the motor winding cuts out each operation, when the temperature exceeds the setting
3. The oil heater in the compressor prevents from oil foaming during cold starting. This heater warms the oil, while the compressor is stopped

■ Refrigeration Cycle

1. The high pressure switch and low pressure control protect against excessive discharge pressure and exceedingly low suction pressure. The switch and control cut out compressor operation when discharge pressure or suction pressure is abnormal.
2. The pressure relief field supplied valve is equipped on discharge gas line. When high pressure exceeds the setting, gas refrigerant will be discharged to prevent abnormal high pressure

■ Water Cooler

Pump interlock, freeze protection control, low pressure control and suction gas temperature control can protect water cooler against water cooler freezing

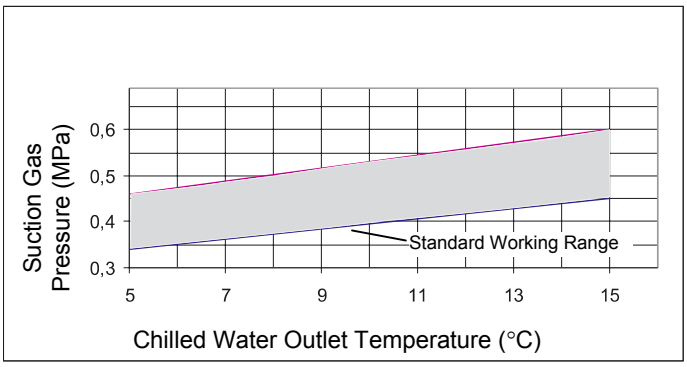
11.11.1. SAFETY AND CONTROL DEVICE SETTING

Model	RCUE -CLG	40	50	60	80	100	120
For Compressor High Pressure Switch	Manual Reset, Non-Adjustable (One Switch for Each Compressor Motor)						
Cut-Out	MPa	2,74	2,74	2,74	2,74	2,74	2,74
Low Pressure Switch (Pressure Sensor)	Electronic Control						
Cut-Out	MPa	0,05	0,05	0,05	0,05	0,05	0,05
Internal Thermostat for Compressor	Manual Reset, Non-Adjustable (One Switch for Each Compressor Motor)						
Cut-Out	°C	115	115	115	115	115	115
Cut- In	°C	93	93	93	93	93	93
Compressor Motor (380-415V/50Hz)							
Fuse	A	125	160	160	125	160	160
Thermal Relay	Manual Reset, Adjustable (One Three-Phase Set for Each Compressor Motor)						
	A	54	65	80	54	65	80
Circuit Protector(Option)	Manual Reset, Adjustable (One Three-Phase Set for Each Compressor Motor)						
	A	112	136	160	112	136	160
Oil Heater	One Heater for Each Compressor Motor						
Capacity	W	150	150	150	150	150	150
Discharge Gas (Electronic Control)	(One for Each Cycle)						
Cut-Out	°C	140	140	140	140	140	140
Cut- In	°C	110	110	110	110	110	110
CCP Timer	Non-Adjustable (One Timer for Each Compressor)						
Setting Time	S	180	180	180	180	180	180
Star-Delta	S	5	5	5	5	5	5
Unloading during Starting	S	30	30	30	30	30	30
For Refrigerant Circuit	(One for Each Circuit)						
Pressure Relief Valve Setting Pressure	MPa	3,0	3,0	3,0	3,0	3,0	3,0
Freeze Protection Thermostat	(One for Each Water Cooler)						
Cut-Out	°C	2	2	2	2	2	2
Cut- In	°C	6	6	6	6	6	6

11.12. NORMAL OPERATING PRESSURE

Check to ensure that Chiller is operating within the working range as shown below, after at least 15 minutes operation.
Low Pressure: The normal operating low pressure of the water chiller is indicated in the figure below; lower than 0.3 Mpa indicates an abnormal condition.

Discharge Pressure: low than 0.9 Mpa or higher than 2.2 Mpa indicates an abnormal condition



CAUTION:

- ***Periodical Maintenance***
  Perform periodical maintenance according to the "INSTRUCTIONS" to maintain the unit in a good condition.
- ***Fire***
  If a fire accidentally occurs, turn OFF the main switch and use an extinguisher for an oil fire and electric fire.
- ***Flammable Gases***
  Do not operate the unit near the flammable gases such as lacquer, paint, oil, etc. to avoid a fire or an explosion.
- ***Service Panels and Electrical Box Cover***
  Turn OFF the main switch when service panels or electrical box covers are removed for setting the temperature.
  Do not operate the unit without fixing panels.
- ***Heated Pipe***
  Do not touch the parts at discharge gas side by hand, since the pipes at the discharge side are heated by refrigerant and temperature becomes higher than 100 ° C.
- ***Use***
  Do not utilize this unit for cooling of drinking water or food. Comply with local codes and regulations.
- ***Failure***
  Turn OFF all the main switches if refrigerant leakage or chilled water leakage occurs. Also, if the unit can not be stopped by the control switch, turn OFF all the switches for power source.
- ***Activation of Safety Device***
  In the case that one of safety devices is activated and unit is stopped, remove the cause of the stoppage and restart the unit. The protection devices are utilized to protect the unit from an abnormal operation.
  Therefore, if one of safety devices is activated, remove the cause by referring the "Troubleshooting" in the "INSTRUCTION" or call the local agency.
- **Fuse**
  Utilize a fuse with specified capacity. Do not use a steel wire or a copper wire instead of a fuse. If an incorrect wire is utilized, a serious accident such as a fire will occur.
- **Safety Devices**
  Do not make a short-circuit at the protection line. If a short-circuit is made, a serious accident will occur.
- **Setting of Safety devices**
  Do not change the setting of safety devices, if changed, a serious accident will occur.
  Do not touch any electrical parts except for the operation switches during the operation.
  Do not press the button on the magnetic switch. If pressed, a serious accident will occur.

11.13. TEST RUNNING AND MAINTENANCE RECORD

MODEL: RCUE MFG. NO.
COMPRESSOR MFG. NO.

CUSTOMER'S NAME AND ADRESS:

DATE:

1. Is there adequate water flow for the condenser (in case of water cooled type) and the water cooler? ☐
2. Has all water piping been checked for leakage? ☐
3. Have the cooling water pump, fan and motor (in case of air cooled) been lubricated? ☐
4. Has the unit been operated for at least twenty minutes? ☐

5.Check Chilled Water Temperature:

Inlet ☐ °C Outlet ☐ °C

6.Check Condenser Water Temperature (Water-Cooled Type):

Inlet ☐ °C Outlet ☐ °C

7.Check Condenser Air Inlet Temperature (Air-Cooled Type):

Inlet ☐ °C Outlet ☐ °C

8. Check Suction Line Temperature and Superheat:

Suction Line Temperature:	☐ °C	☐ °C
Superheat:	☐ °C	☐ °C

9. Check Pressure:

Discharge Pressure:	☐ MPa	☐ MPa
Suction Pressure:	☐ MPa	☐ MPa

10.Has the unit been checked for refrigerant leakage? ☐

11.Is the unit clean inside and outside? ☐

12. Are all cabinet panels free from rattling? ☐

11.14. DAILY OPERATING RECORDS

Model: Date: Weather: Time of Operation Start:			Stop. ( )			
Ambient Temperature	DB	°C				
	WB	°C				
Room Temperature		°C				
Compressor	High Pressure	Mpa				
	Low Pressure	Mpa				
	Voltage	V				
	Current	A				
Condenser Water Temperature: (Water-Cooled Type) Condenser Air Temperature: (Air-Cooled Type)	Inlet	°C				
	Outlet	°C				
Chilled Water Temperature	Inlet	°C				
	Outlet	°C				
Current for Condenser Water Pump (In the case of Water-Cooled Type)		A				
Current for Chilled Water Pump		A				
Current for Cooling Tower (In the case of Water-Cooled Type)		A				
NOTES:						

11.15. SERVICING FOR R407C REFRIGERANT SYSTEM

■ Refrigerant

This R407C refrigerant is HFC type so that it has a feature of no ozone depletion. If it is mixed with another refrigerant, the serious changing would occur on its character. Therefore notice the following point when handling this refrigerant.

- Charge the refrigerant in LIQUID condition and NOT in GAS. As "R407C" is zeotropic mixed refrigerant, if gas charging is performed, only the easy vaporising refrigerant would be charged into the system and the difficult vaporising one would be remained in the charge cylinder.

The cylinder, gauge equipped manifold and charge hose are only used for R407C refrigerant.

Adjust the cylinder setting to charge in liquid.

■ Refrigerant Oil

Japan Energy “Freol” UX300, which R407C refrigerant is easy to blend into it, is used for this system. The other oil is prohibited to use, so that not to be mixed with another kind of oil at the maintenance and service work. This oil is very hygroscopic.
Therefore minimum humidity handling is necessary.

■ Servicing Equipment

When servicing R407C system, servicing equipment such as Charging Cylinder, Charging Hose, Vacuum Pump and so on, shall not be mixed with R22 equipment to avoid R407C composition change.

12. TROUBLESHOOTING

■ **The following table shows efficient checking procedures for trouble.**

Fault	Possible Cause	Check/Corrective Action
Compressor Does Not Operate	Interlock Circuit for Chilled Water Pump is Open	1. Check the pump contactor. Repair or replace, if necessary. 2. Check for the faulty pump.
	Electrical Protective Devices Are Tripped.	1. Remove the causes, and reset the “ON” button. See the following causes.
	Incorrect Wiring Connection for Compressor Power Source	1. Interchange two of three terminals R, S and T at the main power source terminals.
Compressor Stops on High Pressure Switch	Excessively High Discharge Pressure	1. See “High Discharge Pressure”
	Malfunction of High Pressure Switch	1. Readjust the setting or replace, if defective.
Compressor Stops on Overcurrent Relay	Excessively High Discharge Pressure and Suction Pressure	1. See “High Discharge Pressure” and “High Suction Pressure”.
	High or Low Voltage, Single-Phase or Phase Imbalance	1. Check the power supply line and contactors. Repair, if necessary.
	Loose connection	1. Tighten the loose electrical connection or repair, if necessary.
	Faulty Overcurrent Relay	1. Replace it, if necessary.
Compressor Stops on Freeze Protection Thermistor	Excessively Low Chilled water Outlet Temperature	1. Check for excessively low setting of the chilled water setting knob.
	Defective Thermistor	1. Check for malfunction of the thermistor. Replace, if necessary.
	Shortage of Chilled Water Flow	1. Check the rotation of the pump.
	Air in water Circuit	1. Purge air.
Compressor Stops on Internal Thermostat or Discharge Gas Thermistor	High or Low Voltage, Single-Phase or Phase Imbalance	1. Check the power supply line and contactors. Repair, if necessary.
	Excessive Superheat	1. Check for refrigerant leakage
	Defective Element	1. Check the contact of the internal thermostat during the cold condition.
	Excessive High Discharge Pressure and Low Suction Pressure	1. See “High Discharge Pressure” and “High Suction Pressure”.
Insufficient Cooling	High Discharge Pressure or Low Suction Pressure	1. See “High Discharge Pressure” and “Low Suction Pressure”.
	Improper Thermostat Setting	1. Readjust the setting.
	Defective Unload Mechanism	1. Adjust unload mechanism. Repair or replace unloaded parts, if necessary.
Noisy Compressor	Slugging Due to Liquid Flooding Back to Compressor	1. Check the superheat of suction gas. Keep the superheat in proper range.
	Worn parts	1. Check for the sound of internal parts. Replace the compressor, if necessary.
Miscellaneous Noise	Loose Fixed Screw	1. Tighten the screws of all parts.
Unloaded Does not Function	Trouble with the Thermistor	1. Adjust the setting temperature. 2. Replace the thermistor.
	Trouble with the Solenoid Valve	1. Check the coil in the solenoid valve. 2. Check oil passage for clogging.
	Worn Unloader Mechanism	1. Check the unloaded system parts in the compressor.
High Discharge Pressure	Warm inlet water or Insufficient Water Flow Through the Condenser	1. Open the valve
	Gas Outlet Valve on the Condenser Not Completely Open	1. Check the valves, capillary tubes and strainer. Replace, if necessary.
	Overcharged Refrigerant	1. Purge the refrigerant.
	Condenser Plates Coated with Scales, Lime, Corrosion and Others	1. Clean the Condenser water plates by chemical cleaner
	Suction Pressure is Higher than Standard	1. See “High Suction Pressure”.
	High Condenser Air Temperature or Insufficient Air Flow through the condenser	1. Check the fan operation 2. Check for coil clogging; clean, if necessary.

Fault	Possible Cause	Check/Corrective Action
Low Discharge Pressure	Too Much Water Flowing through the Condenser, or Water is too Cold	1. Adjust the water cock or the regulating valve. 2. Check the operation of cooling tower.
	Insufficient Refrigerant Charge	1. Add Refrigerant.
	Leakage from the Condenser Gas Outlet Valve	1. Check to determine how long it takes to balance high and low pressure after shipping the compressor 2. Check unit operation amperage 3. Change the condenser gas outlet valve if necessary.
	Liquid Refrigerant Flooding Back from the Water Cooler, Causing Oil to Foam..	1. Check the operation and adjustment of the expansion valve; be sure that the feeler bulb is tightly connected to the suction pipe and that it is completely insulated. 2. Inlet water temperature is considerably lower than the limited temperature.
	Suction Pressure is lower than Standard	1. See “Low Suction Pressure”
High Suction Pressure	High Discharge Pressure	1. See “High Discharge Pressure”
	Refrigerant Overcharged	1. Purge the refrigerant
	Liquid Refrigerant Flooding Back from the Water Cooler	1. Check the operation and adjustment of the expansion valve. Be sure that the feeler bulb is tightly connected to the suction pipe and completely insulated. 2. Inlet chilled water temperature to the unit is considerably higher than the standard temperature.
	Leakage from the Condenser Gas Outlet Valve	1. Check the condenser gas outlet valve
	Insufficient Insulation for the Chilled Water Piping	1. Check the insulation of the piping
Low Suction Pressure	Condenser Liquid Outlet Valve Not Completely Open	1. Open the valve.
	Expansion Valve not properly adjusted, or faulty valve	1. .Adjust for correct superheat. Check for loss of refrigerant in the feeler bulb.
	Inlet Chilled Water Temperature is Considerably lower than standard Temperature.	1. .Check the insulation specifications
	Improperly adjusted Expansion Valve or Faulty Valve.	1. .Adjust for correct superheat. Repair or replace, if necessary.
	Insufficient Refrigerant Charge	1. .Add Refrigerant
	Excessive Oil Circulatin in the System	1. .Check the oil charge
	Insufficient Chilled Water Flow through the water cooler.	1. .Check the chilled water piping lines for pressure loss.
	Low Discharge Pressure	1. .Adjust the water shutoff valve
	Scales on Water Cooler Plates	1. .Clean the plates

13. GENERAL SPECIFICATIONS

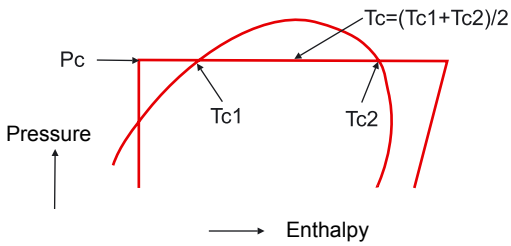
13.1. GENERAL DATA

Model (R407C)			RCUE40CLG	RCUE50CLG	RCUE60CLG
Cooling Capacity		kW	120	145	180
Total Power Input		kW	34.4	42.4	52.1
Outer Dimension	Height	mm	1,343	1,343	1,343
	Width	mm	1,064	1,088	1,152
	Depth	mm	935	935	935
Cabinet Coler			Natural Gray		
Shipping Weight		kg	630	680	730
Compressor Type		-	Semi-Hermetic Screw Type		
Model		-	40ASC-Z	50ASC-Z	60ASC-Z
Quantity		-	1	1	1
Oil Heater		W	150		
Oil Type		-	UX300 (Ester)		
Capacity Control		Step	Continuous Capacity Control		
		%	15~100		
Refrigerant Type			R407C		
Flow Control		-	Thermal Expansion Valve		
Number of Independent Circuits		-	1		
Evaporator			Brazing plate type		
Control System		-	Micro-Processor		
Piping Connections					
Evaporator Water Piping			3” Victaulic (1xINLET/1xOUTLET)		
Refrigerant Gas Piping		mm	∅ 41.3 (Outer Diameter)		
Refrigerant Liquid Piping		mm	∅ 28.6 (Outer Diameter)		
Chilled Water Outlet Temperature		°C	5~15		
Condensing Temp. (Tc)		°C	30~55		
Permissible Water Pressure of Evaporator		MPa	1.03		
Safety and Protection Devices		-	Reverse Phase Protection Device, Fuse and Thermal Relay for Compressor, Internal Thermostat for Compressor Compressor Oil Heater,Control Circuit Fuse, High Pressure Switch, Low Pressure Control, Suction Gas Temperature Control, Freeze Protection Control and Compressor Operation Hour Meter.		
Power Supply		-	3~,N/380-415V/50Hz		

NOTE:

The nominal cooling capacities are based on the following conditions.

- Chilled Water Inlet Temperature: 12 °C
- Chilling Water Outlet Temperature: 7 °C
- Condensing Temperature: 45 °C

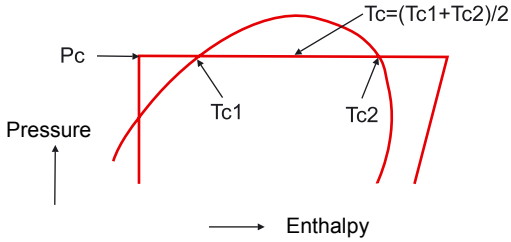


Model (R407C)			RCUE80CLG	RCUE100CLG	RCUE120CLG
Cooling Capacity		kW	240	290	360
Total Power Input		kW	68.8	84.8	104.2
Outer Dimension	Height	mm	1,531	1,531	1,531
	Width	mm	1,184	1,184	1,184
	Depth	mm	1,432	1,432	1,432
Cabinet Coler			Natural Gray		
Shipping Weight		kg	1,200	1,310	1,380
Compressor Type		-	Semi-Hermetic Screw Type		
Model		-	40ASC-Z	50ASC-Z	60ASC-Z
Quantity		-	2	2	2
Oil Heater		W	150x2		
Oil Type		-	UX300 (Ester)		
Capacity Control		Step	Continuous Capacity Control		
		%	7.5,15~100		
Refrigerant Type			R407C		
Flow Control		-	Thermal Expansion Valve		
Number of Independent Circuits		-	2		
Evaporator		-	Brazing Plate Type		
Control System		-	Micro-Processor		
Piping Connections					
Evaporator Water Piping		inch	4" Victaulic (1 x INLET / 1 x OUTLET)		
Refrigerant Gas Piping		mm	∅ 41.3 (Outer Diameter) x 2		
Refrigerant Liquid Piping		mm	∅ 28.6 (Outer Diameter) x 2		
Chilled Water Outlet Temperature		°C	5~15		
Condensing Temperature (Tc)		°C	30~55		
Permissible Water Pressure of Evaporator		Mpa	1.03		
Safety and Protection Devices		-	Reverse Phase Protection Device, Fuse and Thermal Relay for Compressor, Internal Thermostat for Compressor, Compressor Oil Heater, Control Circuit Fuse, High Pressure Switch, Low Pressure Control, High Pressure Relief Valve, Discharge Gas Temperature Control, Suction Gas Temperature Control, Freeze Protection Control and Compressor Operation Hour Meter		
Power Supply		-	3~,N/380-415V/50Hz		

NOTE:

The nominal cooling capacities are based on the following conditions.

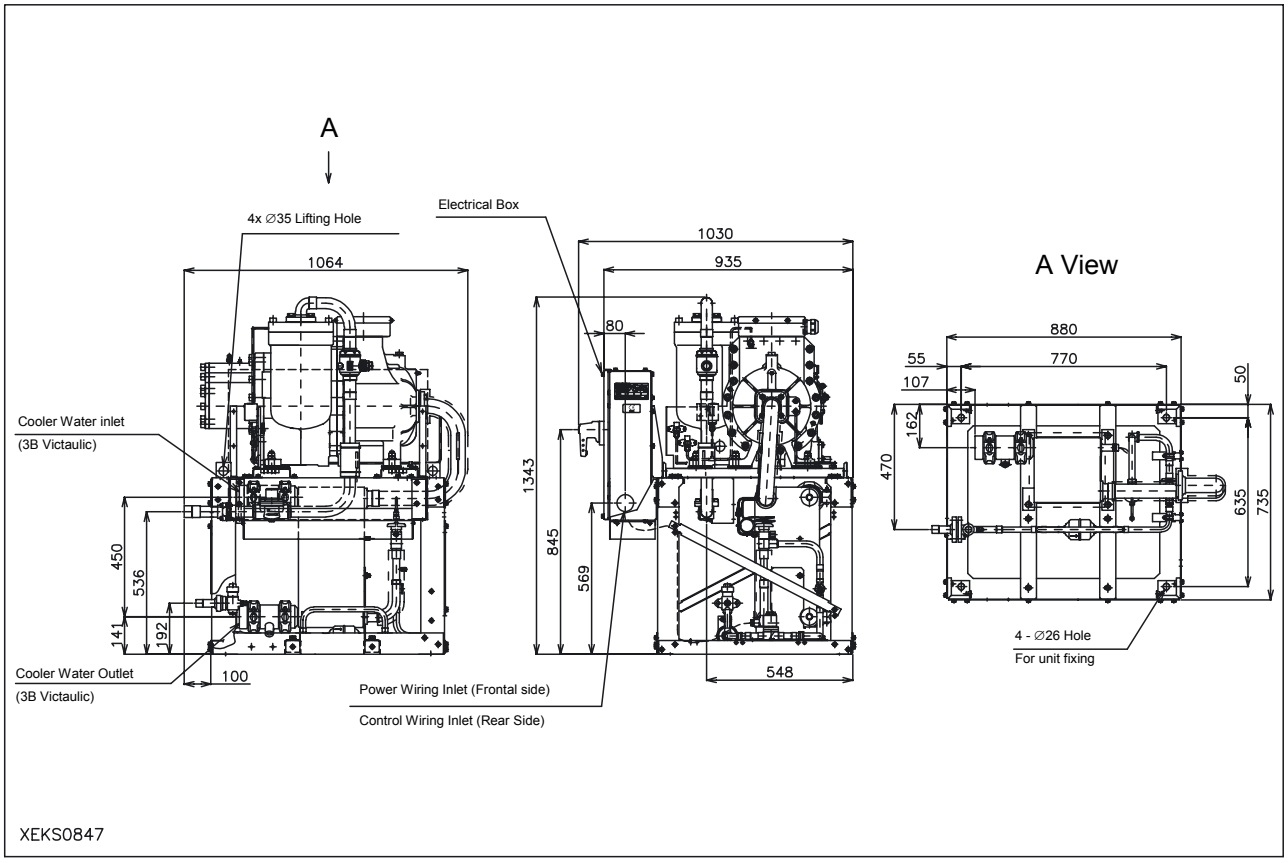
- Chilled Water Inlet Temperature: 12 °C
- Chilling Water Outlet Temperature: 7 °C
- Condensing Temperature: 45 °C



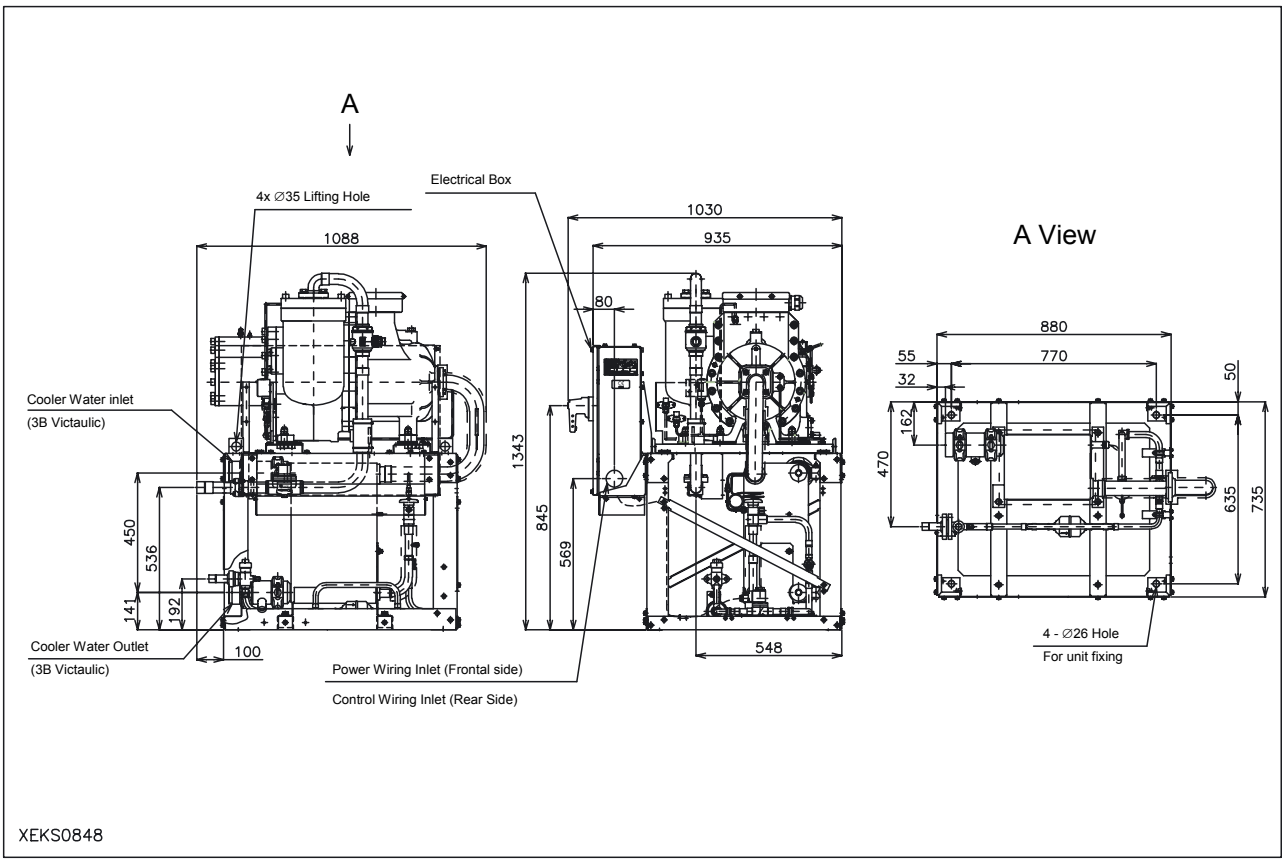
14. DRAWINGS

14.1. DIMENSIONAL DRAWINGS

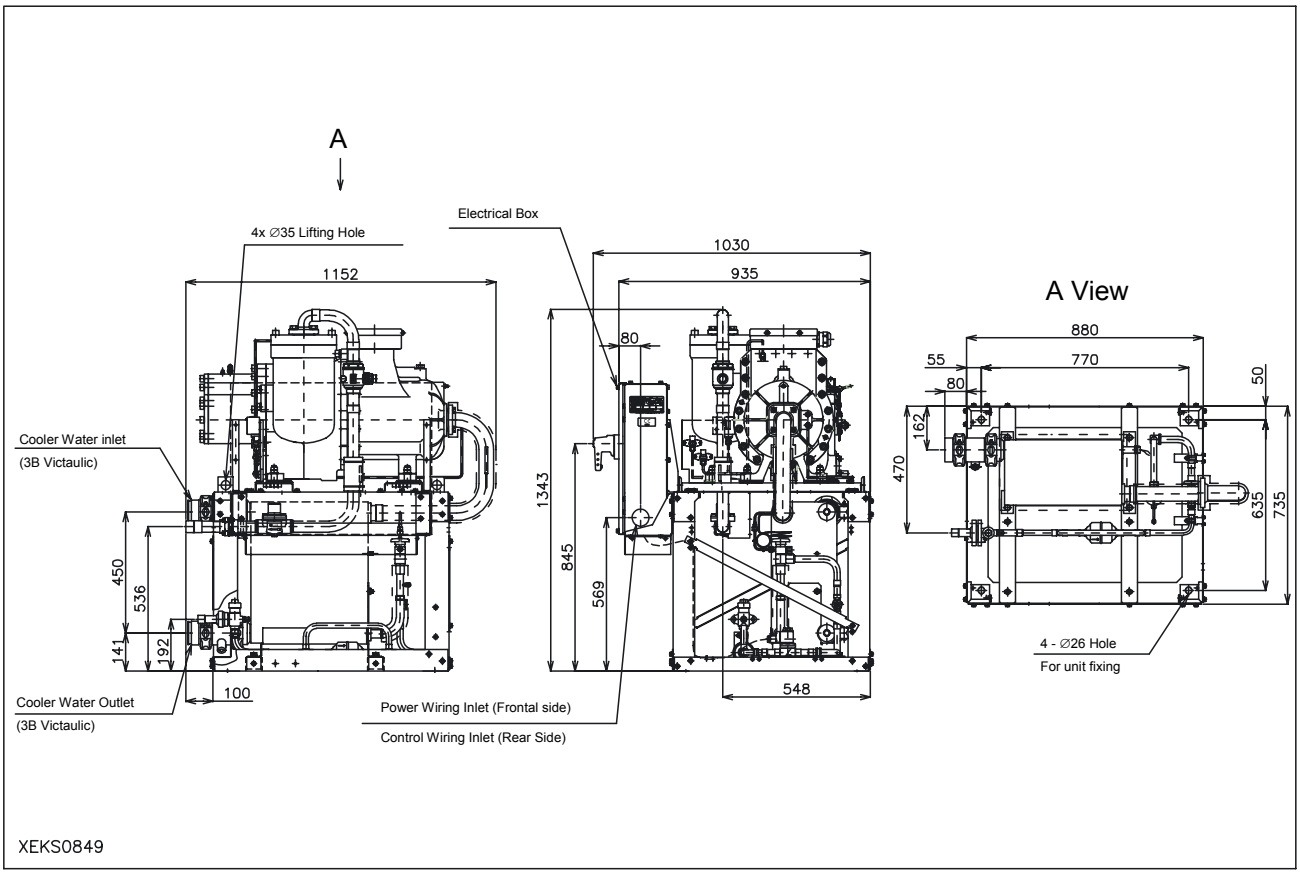
RCUE 40CLG



RCUE 50CLG

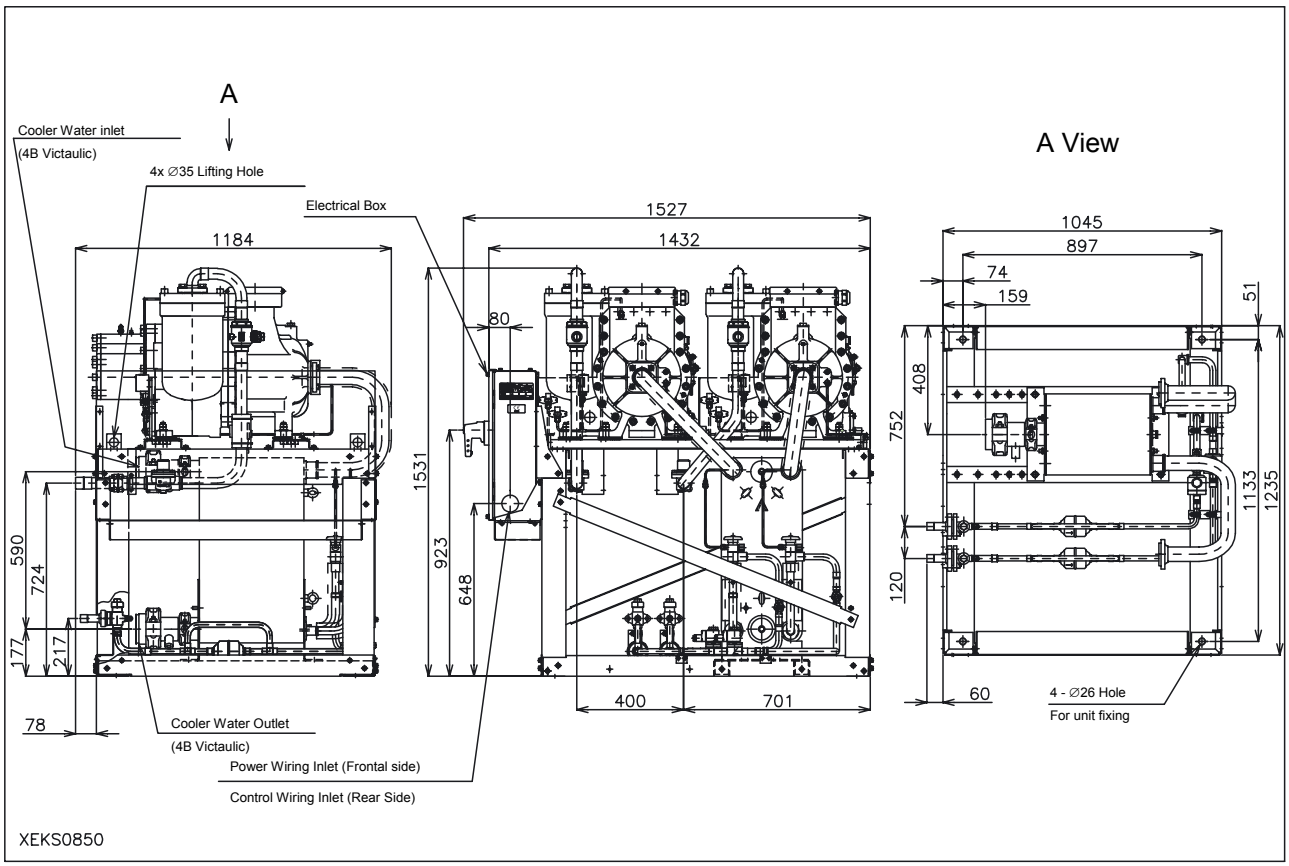


RCUE 60CLG



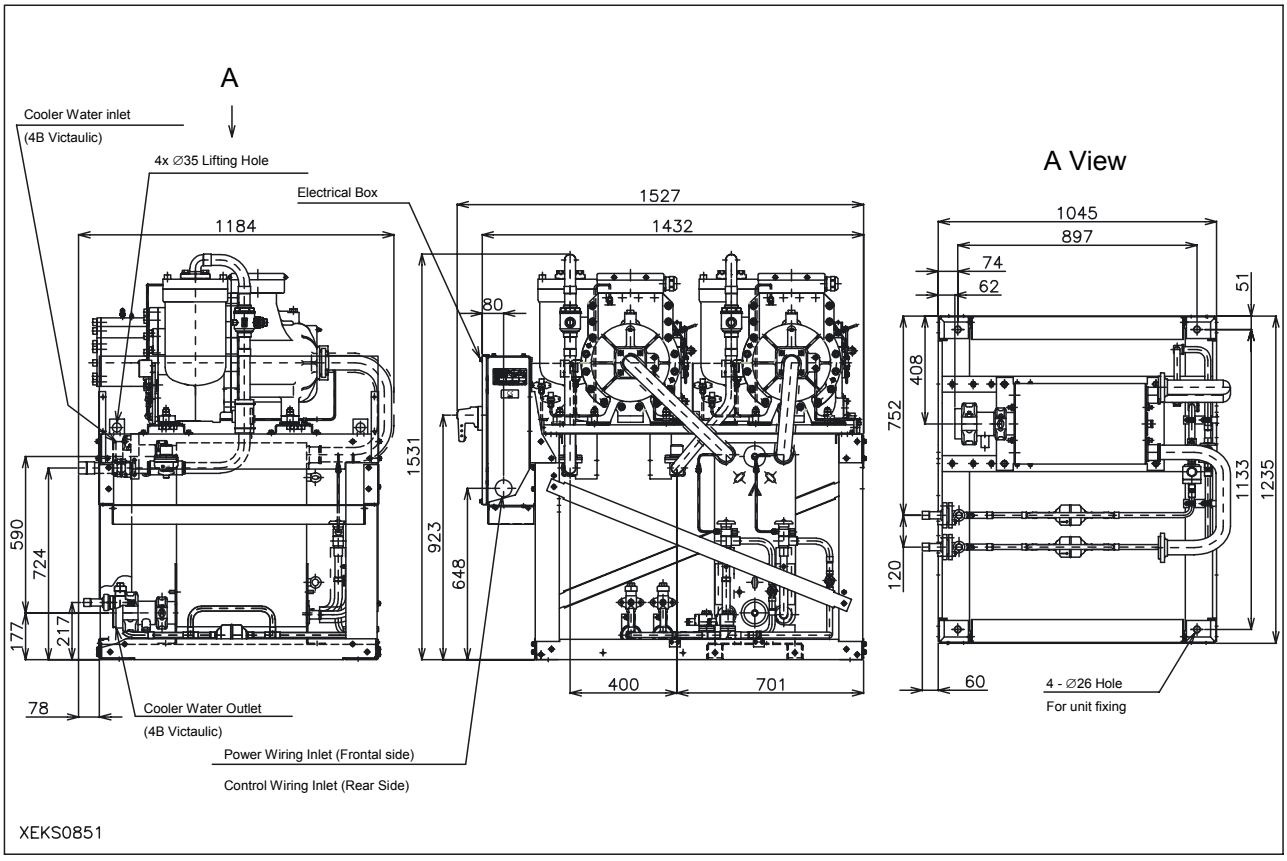
XEKS0849

RCUE 80CLG

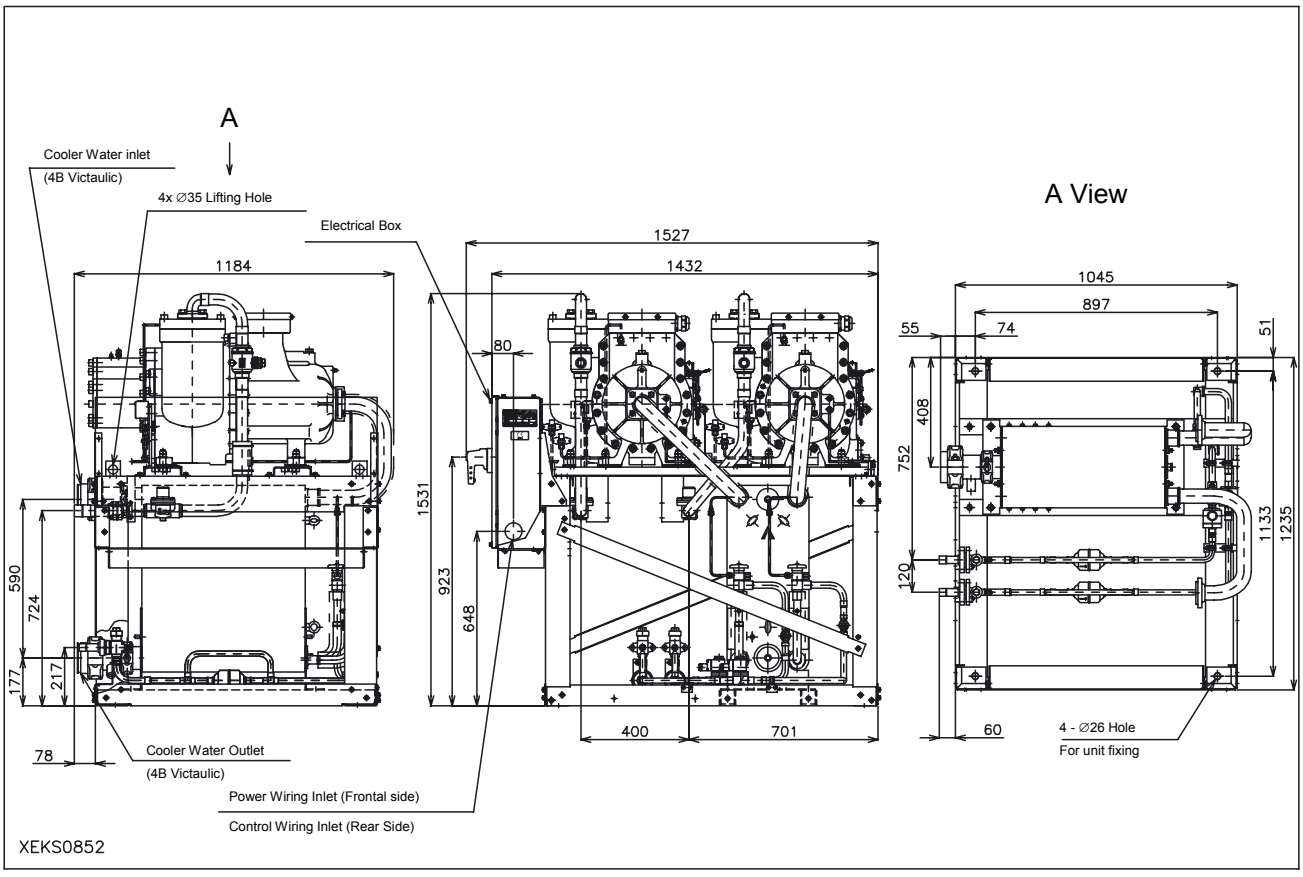


XEKS0850

RCUE 100CLG



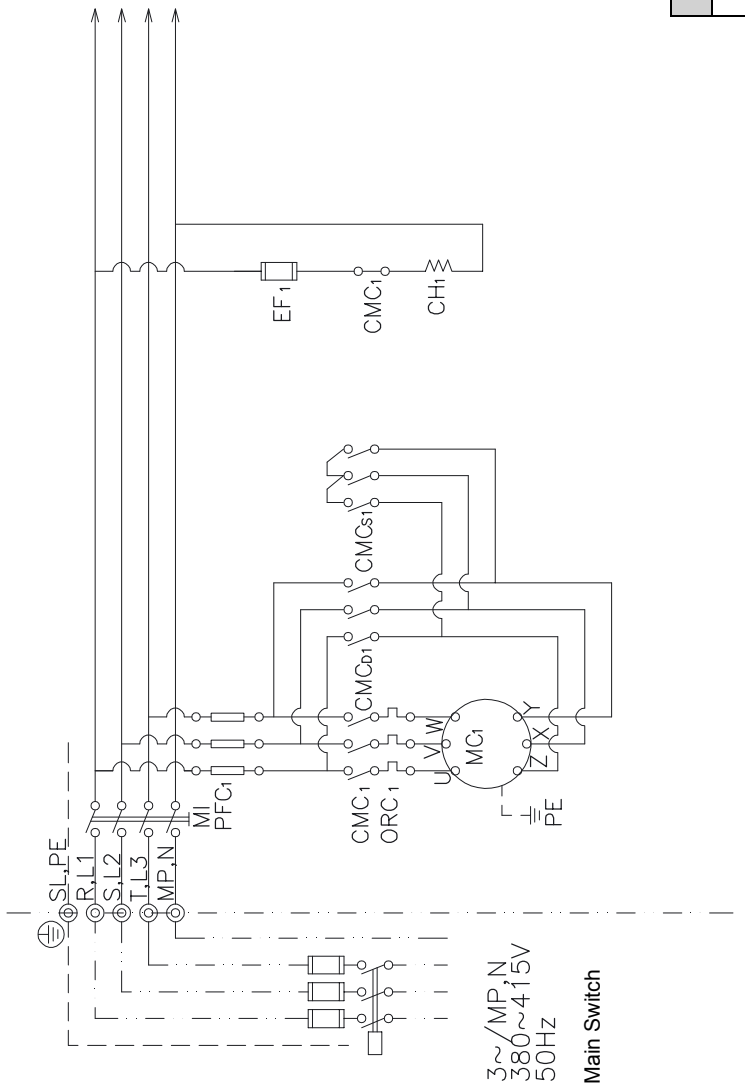
RCUE 120CLG



14.2. WIRING DIAGRAMS

POWER CIRCUIT FOR RCUE 40CLG, RCUE 50CLG, RCUE 60CLG

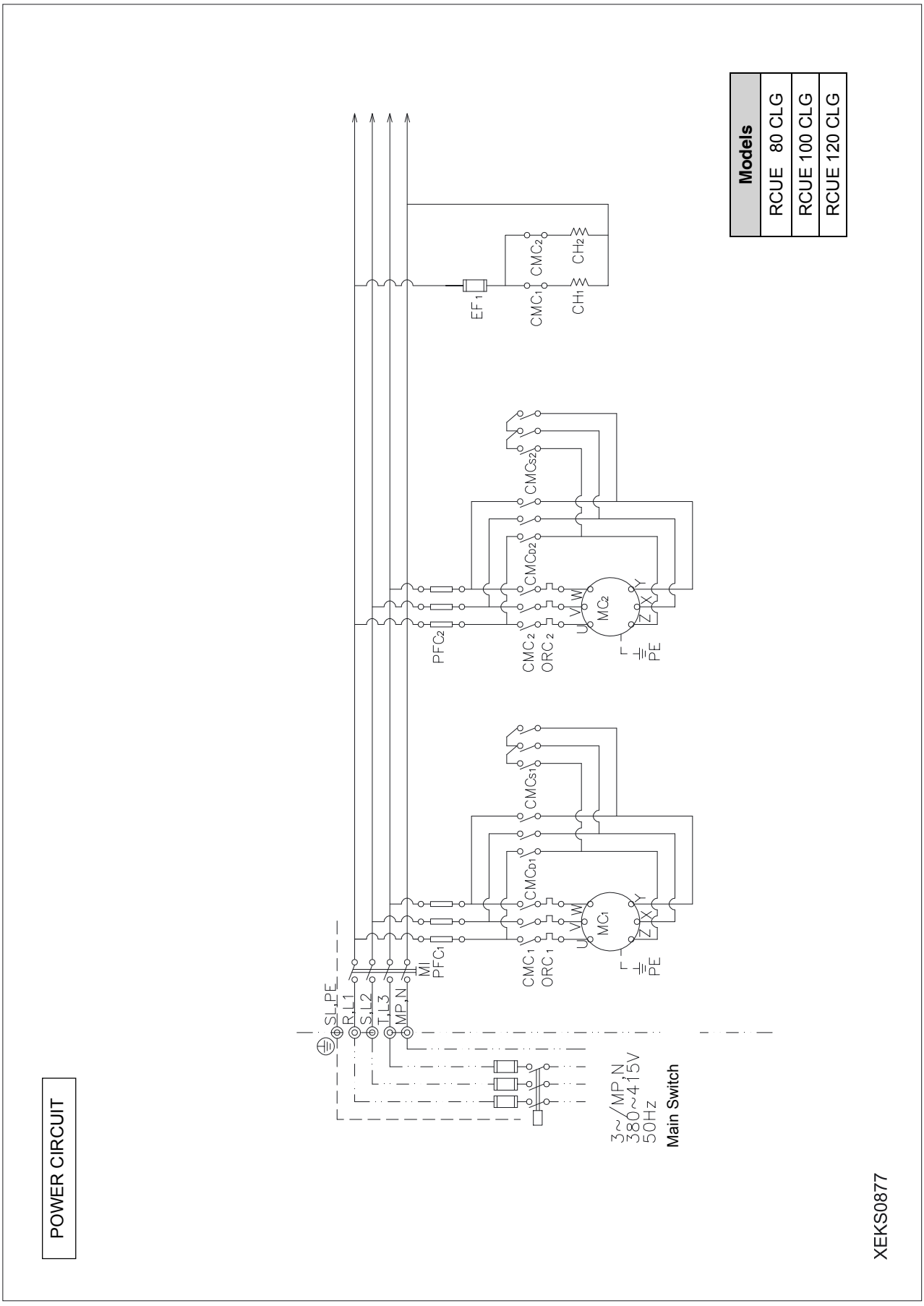
Models
RCUE 40CLG
RCUE 50CLG
RCUE 60CLG



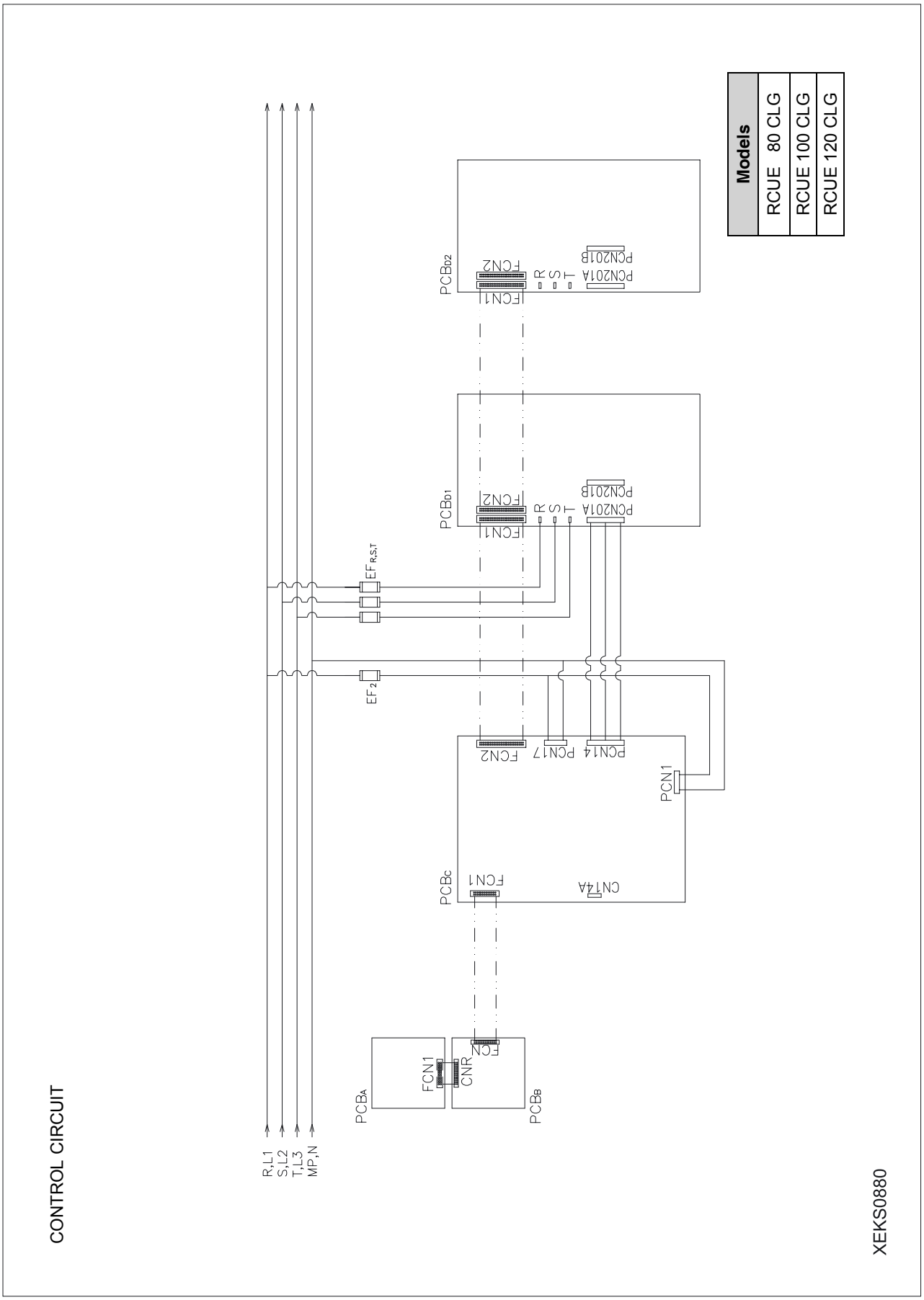
POWER CIRCUIT

XEKS0878

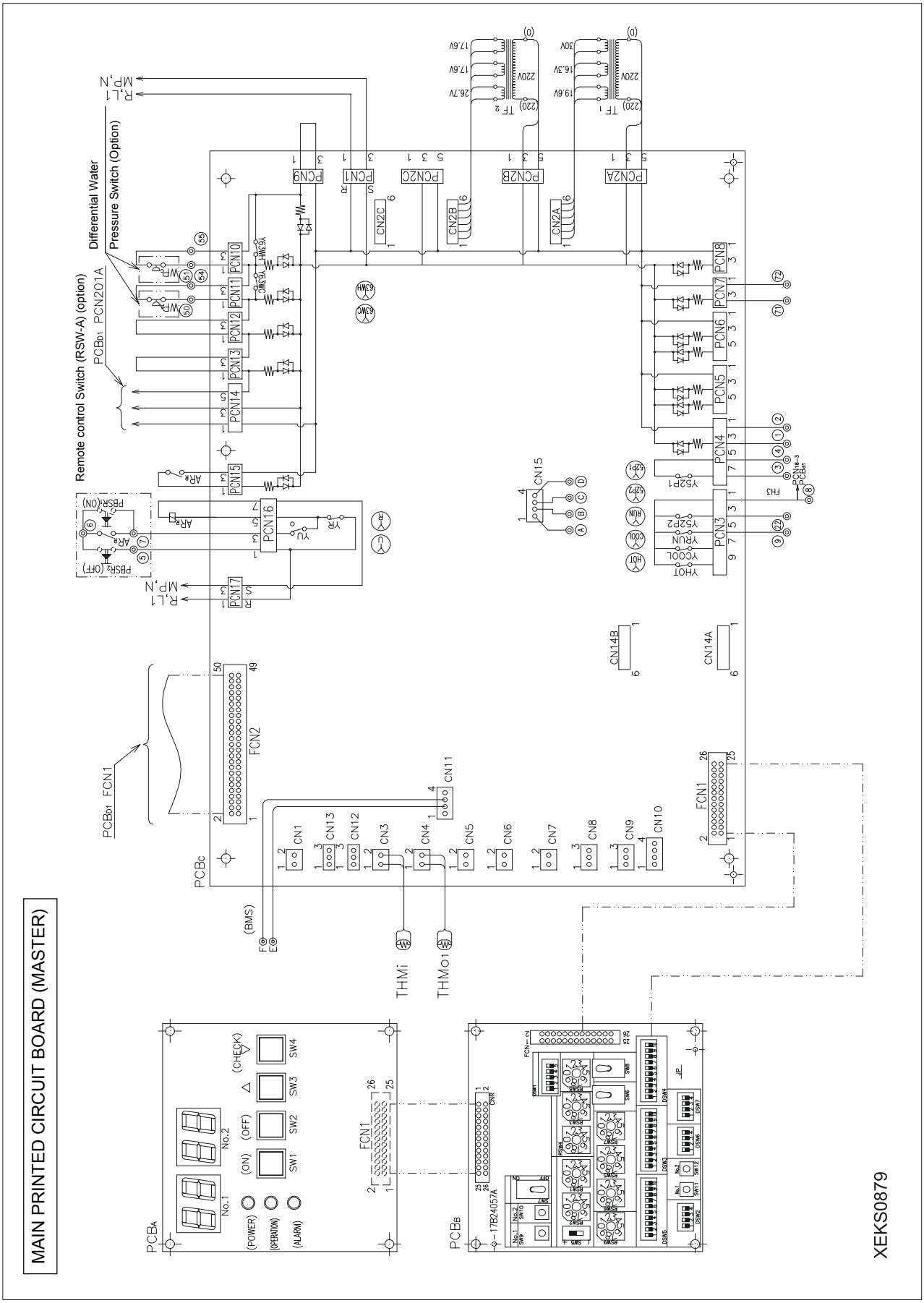
POWER CIRCUIT FOR RCUE 80CLG, RCUE 100CLG, RCUE 120CLG



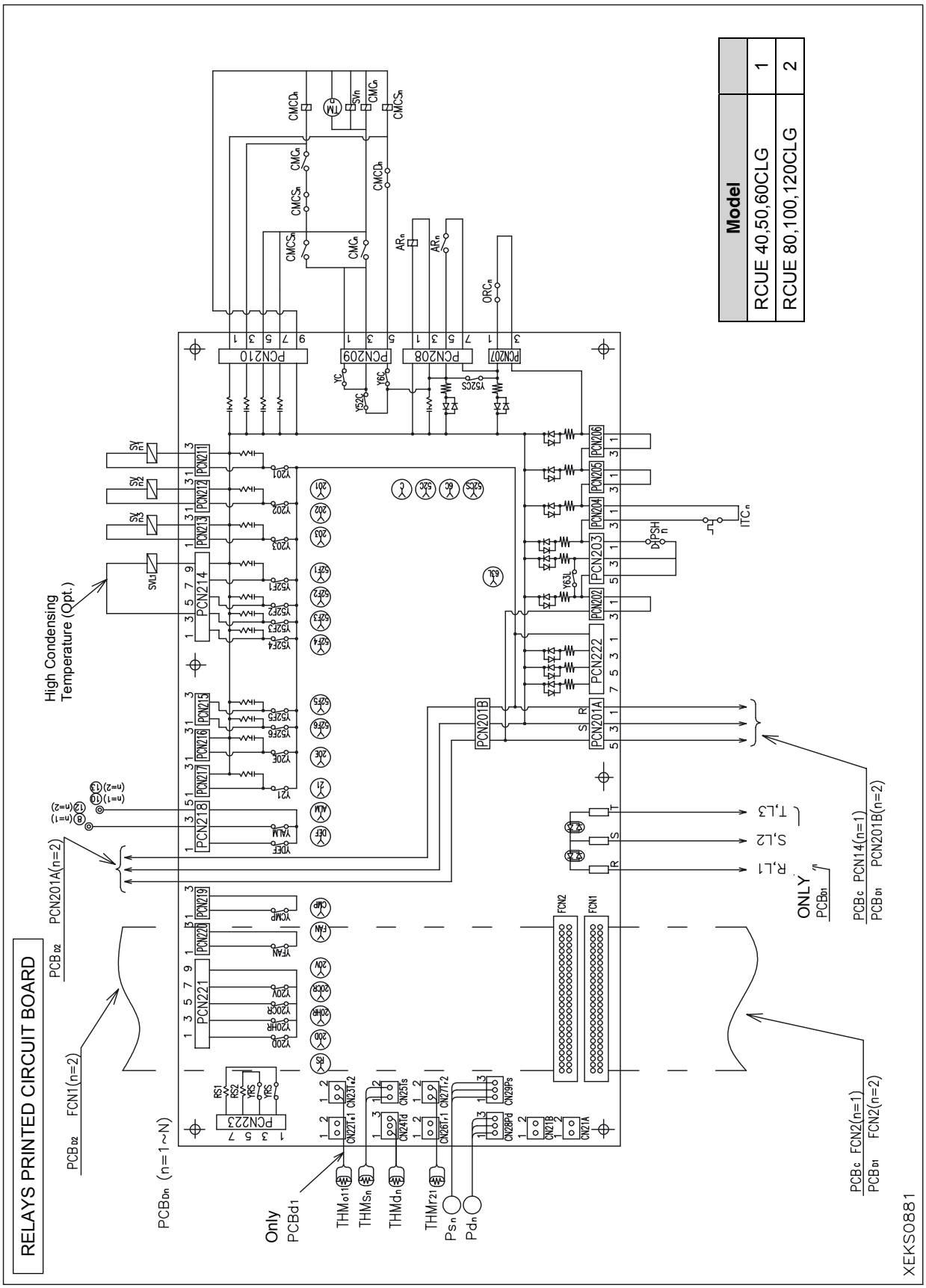
CONTROL CIRCUIT FOR RCUE 80CLG, RCUE 100CLG, RCUE 120CLG



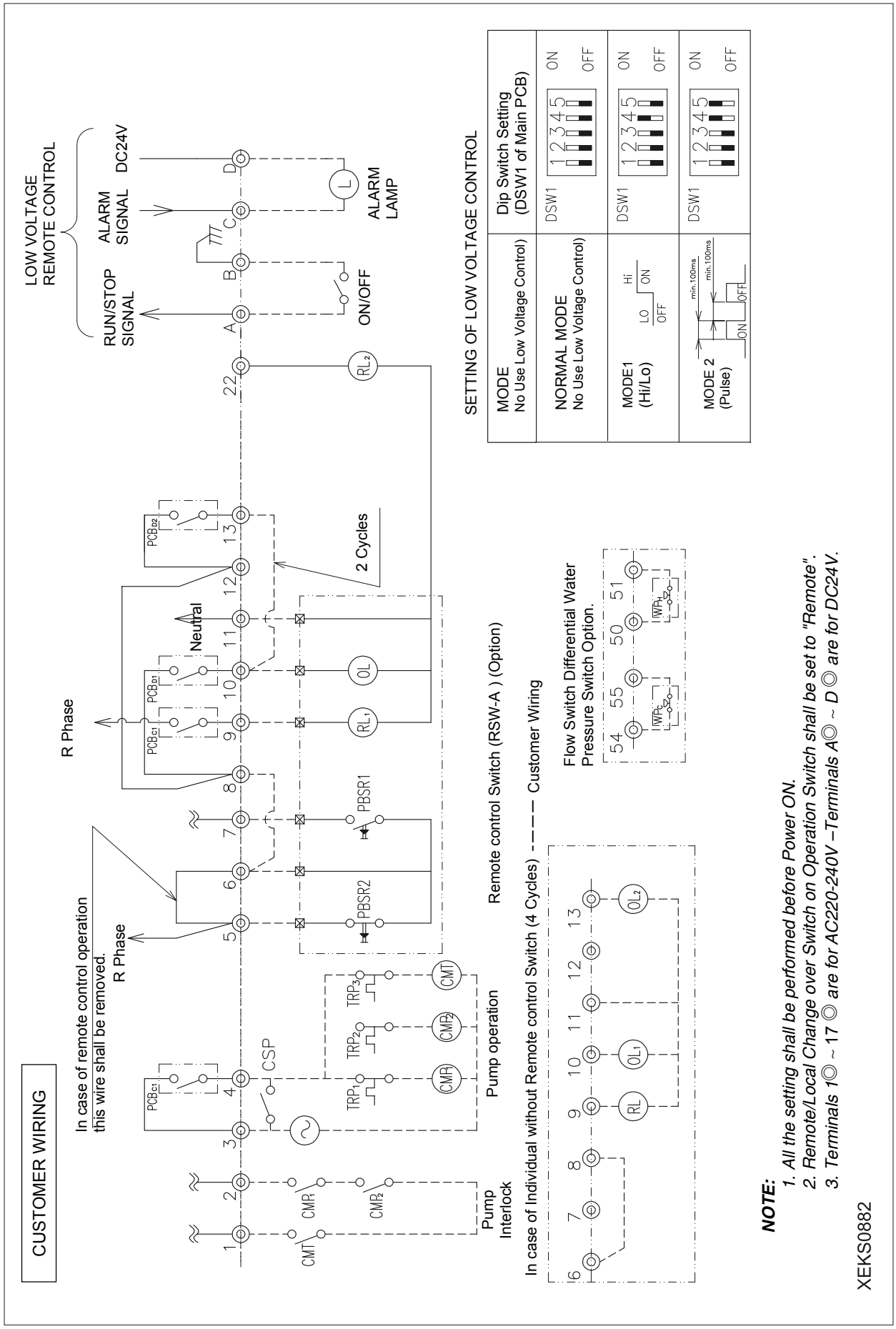
MAIN PRINTED CIRCUIT BOARD



RELAYS PRINTED CIRCUIT BOARD



CUSTOMER WIRING



NOTE:

1. *All the setting shall be performed before Power ON.*
2. *Remote/Local Change over Switch on Operation Switch shall be set to "Remote".*
3. *Terminals 1◎ ~ 17 ◎ are for AC220-240V –Terminals A◎ ~ D◎ are for DC24V.*

XEKS0882

PARTS LIST

(n=1,2)

Mark	Name	Remark	Mark	Name	Remark
MC_{1-n}	Compressor Motor		$EF_{1\sim5}$	Fuse	6A
MI	Main Isolator		SV_{11-n1}	Solenoid Valve for starting	
CMC_{1-n}	Contactor for Compressor Motor		SV_{12-n2}	Solenoid Valve for Load-down	
CMC_{s1-sn}	Contactor for Compressor Motor (Start Operation)		SV_{13-n3}	Solenoid Valve for Load-up	
CMC_{D1-Dn}	Contactor for Compressor Motor (Delta Operation)		SV_n	Solenoid Valve	
PFC_{1-n}	Fuse holder for Compressor Motor	or optional Circuit Breaker	TM_{1-n}	Hour Meter	
EFC_{11-n3}	Fuse for Compressor Motor	or optional Circuit Breaker	PCB_A	Printed Circuit Board for Display	
ORC_{1-n}	Overcurrent Relay for Compressor Motor		PCB_B	Printed Circuit Board for Operation	
ITC_{1-n}	Internal Thermostat for Compressor		PCB_{C1}	Printed Circuit Board for CPU	
CH_{1-n}	Crankcase Heater		PCB_{D1-Dn}	Printed Circuit Board for Relay	
$AR_{,h,r,1-n}$	Auxiliary Relay		WP_C	Water Pressure Switch, Water Flow Switch, Evaporator Circuit	OPTION
PSH_{1-n}	High Pressure Switch	OFF: 2.75Mpa ON: Manual Reset	$PBSR_1$	Push Button Switch for Starting (REMOTE)	Field Supplied
Pd_{1-n}	High Pressure Sensor		$PBSR_2$	Push Button Switch for Stoppage (REMOTE)	
THM_i	Inlet Water Temperature Thermistor		$RL_{(1-n+1)}$	Pilot Lamp for Remote Indication (Unit Operation, Cool/Heat)	
THM_{01}	Outlet Water Temperature Thermistor		$OL_{(1-n)}$	Pilot Lamp for Remote Indication (Alarm)	
THM_{S1-n}	Suction Gas Temperature Thermistor		CMP_{1-2}	Contactor for Pump	
$THMd_{1-n}$	Discharge Temperature Thermistor		TRP	Thermal Relay for Pump	
$THMr2_{1-n}$	Temperature Thermistor Before Exp. Valve		WP_H	Water Pressure Switch, Water Flow Switch, Condenser Circuit	
$THM_{0\ 11}$	Outlet Water Temperature Thermistor (Evap.)		CMT	Contactor for Tower	

Model	N
RCUE 40, 50, 60 CLG	1
RCUE 80, 100, 120 CLG	2

15. MODEL SELECTION

15.1. SELECTION EXAMPLE

1. Determine the system requirements

Condensing Temperature:	40 °C
Chilled Water Inlet Temperature:	12 °C
Chilled Water Outlet Temperature:	7 °C
Cooling Load:	300 kw
Refrigerant:	R407C

2. Select Model and Read the Performance

From the cooling capacity table, model RCUE100CLG can be selected with the following performance.

Cooling Capacity:	302.1kw
Heat Rejection	377.7 kw
Chilled Water Flow Rate:	52.0 m³/h
Water Cooler Pressure Drop:	54.7 kPa
Compressor Input Power:	75.5 kW

3. Determine a Matching Remote Condenser.
From the above heat rejection requirements, select a matching remote condenser according to the manufacturer's data

4. Check the Balancing Condensing Temperature.
Determine the final balancing point at the designed conditions, and confirm that the condensing temperature balanced at the maximum temperature conditions does not exceed the permissible condensing temperature range specified in "working range".

NOTE:

The condensing temperature can generally be predetermined by adding approximately 16°C to the designed outdoor temperature for air-cooled remote condensers, and approximately 5°C to the condenser water outlet temperature for water-cooled condensers.

5. Correct the Data

-Flow Rate

When the water Inlet/Outlet temperature difference is not 5°C, correct the flow rate by the following formula:

$$\text{Corrected Flow Rate} = \frac{5(°C) \times \text{Tabulated Flow Rate (CFR)}}{\text{Given Temp. Difference}(°C)}$$

The corrected Flow Rate must be confirmed to be within the working range.

-Cooling Capacity and Compressor Input.

When the fouling factor is taken into consideration, the cooling capacity and the compressor input will be different from the value indicated in the cooling capacity table.

$$\text{Corrected Capacity} = Kfc \times CAP$$

$$\text{Corrected Input} = Kfi \times IPT$$

CAP: Tabulated Cooling Capacity
IPT: Tabulated Compressor Input
Kfc: Capacity Correction Factor
Kfi: Compressor Input Correction Factor

	Fouling Factor $m^2h\,°C/kcal$ ($m^2\,°C/kW$)	Kfc	Kfi
Water Cooler	0	1.00	1.00
	0.00005(0.043)	1.00	1.00
	0.0001(0.086)	0.99	1.01

6. Water Pressure Drop

Water pressure drop is given by the following formula

$$PD = \alpha \times Q^{\beta}$$

PD: Pressure Drop (kPa)
Q: Water Flow (m^3/h)
α, β Parameters (table below)

	Model:	Parameter	
	RCUE-CLG	α	β
Cooler	40	0.0943	1.863
	50	0.0574	1.883
	60	0.0357	1.901
	80	0.0348	1.919
	100	0.0261	1.936
	120	0.0205	1.953

15.2. PERFORMANCE TABLE (R407C)

		RCUE 40 CLG					RCUE 50 CLG					RCUE 60 CLG				
CT	CLOT	CCAP	CFR	CPD	HRJ	IPT	CCAP	CFR	CPD	HRJ	IPT	CCAP	CFR	HRJ	HCAP	IPT
35.0	5,0	123,4	21,2	28,0	149,7	26,3	149,2	25,7	25,8	181,6	32,4	185,2	31,8	25,7	225,0	39,8
	6,0	126,9	21,8	29,5	153,5	26,6	153,4	26,4	27,2	186,1	32,7	190,4	32,7	27,1	230,6	40,2
	7,0	130,4	22,4	31,0	157,3	26,8	157,6	27,1	28,7	190,7	33,1	195,6	33,6	28,5	236,3	40,6
	8,0	133,9	23,0	32,6	161,0	27,1	161,8	27,8	30,1	195,2	33,4	200,9	34,6	30,0	241,9	41,0
	9,0	137,4	23,6	34,2	164,8	27,4	166,0	28,6	31,6	199,8	33,7	206,1	35,5	31,5	247,6	41,4
	10,0	140,9	24,2	35,8	168,5	27,6	170,3	29,3	33,2	204,3	34,0	211,4	36,4	33,1	253,2	41,8
	11,0	144,4	24,8	37,5	172,3	27,9	174,5	30,0	34,7	208,9	34,4	216,6	37,3	34,6	258,8	42,2
	12,0	147,9	25,4	39,2	176,0	28,1	178,7	30,7	36,3	213,4	34,7	221,9	38,2	36,2	264,5	42,6
	13,0	151,4	26,0	40,9	179,8	28,4	182,9	31,5	38,0	218,0	35,0	227,1	39,1	37,9	270,1	43,0
	14,0	154,9	26,6	42,7	183,6	28,7	187,2	32,2	39,6	222,5	35,3	232,3	40,0	39,6	275,8	43,4
	15,0	158,4	27,2	44,5	187,3	28,9	191,4	32,9	41,3	227,1	35,7	237,6	40,9	41,3	281,4	43,8
40.0	5,0	118,0	20,3	25,7	148,2	30,2	142,6	24,5	23,8	179,8	37,2	177,1	30,5	23,6	222,7	45,7
	6,0	121,5	20,9	27,2	151,9	30,4	146,8	25,3	25,1	184,3	37,5	182,3	31,4	25,0	228,3	46,0
	7,0	125,0	21,5	28,6	155,7	30,6	151,1	26,0	26,5	188,8	37,8	187,5	32,3	26,3	233,9	46,4
	8,0	128,5	22,1	30,2	159,4	30,9	155,3	26,7	27,9	193,3	38,0	192,8	33,2	27,8	239,5	46,8
	9,0	132,0	22,7	31,7	163,1	31,1	159,5	27,4	29,3	197,9	38,3	198,0	34,1	29,2	245,1	47,1
	10,0	135,5	23,3	33,3	166,9	31,3	163,7	28,2	30,8	202,4	38,6	203,3	35,0	30,7	250,7	47,5
	11,0	139,0	23,9	34,9	170,6	31,6	168,0	28,9	32,3	206,9	38,9	208,5	35,9	32,2	256,3	47,8
	12,0	142,5	24,5	36,5	174,3	31,8	172,2	29,6	33,9	211,4	39,2	213,8	36,8	33,8	261,9	48,2
	13,0	146,0	25,1	38,2	178,1	32,1	176,4	30,3	35,5	215,9	39,5	219,0	37,7	35,4	267,5	48,6
	14,0	149,5	25,7	40,0	181,8	32,3	180,6	31,1	37,1	220,4	39,8	224,2	38,6	37,0	273,2	48,9
	15,0	153,0	26,3	41,7	185,5	32,5	184,9	31,8	38,7	225,0	40,1	229,5	39,5	38,7	278,8	49,3
45.0	5,0	113,0	19,4	23,7	147,4	34,4	136,5	23,5	21,9	179,0	42,4	169,5	29,2	21,7	221,6	52,2
	6,0	116,5	20,0	25,1	151,1	34,6	140,8	24,2	23,2	183,4	42,6	174,7	30,1	23,0	227,1	52,4
	7,0	120,0	20,6	26,5	154,4	34,4	145,0	24,9	24,5	187,4	42,4	180,0	31,0	24,4	232,1	52,1
	8,0	123,5	21,2	28,0	158,4	34,9	149,2	25,7	25,9	192,2	43,0	185,2	31,9	25,7	238,1	52,9
	9,0	127,0	21,8	29,5	162,0	35,1	153,4	26,4	27,3	196,7	43,2	190,5	32,8	27,1	243,6	53,1
	10,0	130,5	22,4	31,0	165,7	35,2	157,7	27,1	28,7	201,1	43,4	195,7	33,7	28,6	249,1	53,4
	11,0	134,0	23,0	32,6	169,4	35,4	161,9	27,8	30,2	205,5	43,6	200,9	34,6	30,0	254,5	53,6
	12,0	137,5	23,6	34,2	173,0	35,5	166,1	28,6	31,6	209,9	43,8	206,2	35,5	31,5	260,0	53,8
	13,0	141,0	24,2	35,8	176,7	35,7	170,3	29,3	33,2	214,3	44,0	211,4	36,4	33,1	265,5	54,1
	14,0	144,5	24,8	37,5	180,3	35,9	174,5	30,0	34,7	218,8	44,2	216,7	37,3	34,7	271,0	54,3
	15,0	147,9	25,4	39,2	184,0	36,0	178,8	30,7	36,3	223,2	44,4	221,9	38,2	36,3	276,5	54,6
50.0	5,0	108,0	18,6	21,8	146,3	38,3	130,4	22,4	20,1	177,7	47,2	161,9	27,9	19,9	219,9	58,0
	6,0	111,5	19,2	23,1	149,9	38,4	134,7	23,2	21,3	182,0	47,3	167,2	28,8	21,2	225,3	58,2
	7,0	114,9	19,8	24,5	153,5	38,5	138,9	23,9	22,6	186,4	47,5	172,4	29,7	22,4	230,7	58,3
	8,0	118,4	20,4	25,9	157,1	38,6	143,1	24,6	23,9	190,7	47,6	177,7	30,6	23,8	236,1	58,5
	9,0	121,9	21,0	27,3	160,7	38,7	147,3	25,3	25,3	195,1	47,7	182,9	31,5	25,1	241,6	58,6
	10,0	125,4	21,6	28,8	164,3	38,8	151,6	26,1	26,6	199,4	47,9	188,1	32,4	26,5	247,0	58,8
	11,0	128,9	22,2	30,3	167,9	38,9	155,8	26,8	28,1	203,8	48,0	193,4	33,3	27,9	252,4	59,0
	12,0	132,4	22,8	31,9	171,5	39,0	160,0	27,5	29,5	208,1	48,1	198,6	34,2	29,4	257,8	59,1
	13,0	135,9	23,4	33,5	175,1	39,1	164,2	28,2	31,0	212,5	48,3	203,9	35,1	30,9	263,2	59,3
	14,0	139,4	24,0	35,1	178,7	39,3	168,5	29,0	32,5	216,8	48,4	209,1	36,0	32,4	268,6	59,5
	15,0	142,9	24,6	36,7	182,3	39,4	172,7	29,7	34,1	221,2	48,5	214,4	36,9	34,0	274,0	59,6
55.0	5,0	102,8	17,7	19,9	145,0	42,2	124,2	21,4	18,3	176,2	52,0	154,2	26,5	18,2	218,1	63,9
	6,0	106,3	18,3	21,2	148,5	42,3	128,4	22,1	19,5	180,5	52,1	159,4	27,4	19,3	223,4	64,0
	7,0	109,8	18,9	22,5	152,1	42,3	132,7	22,8	20,7	184,8	52,1	164,7	28,3	20,6	228,7	64,1
	8,0	113,3	19,5	23,8	155,6	42,4	136,9	23,5	22,0	189,1	52,2	169,9	29,2	21,8	234,1	64,2
	9,0	116,8	20,1	25,2	159,2	42,4	141,1	24,3	23,3	193,4	52,3	175,2	30,1	23,1	239,4	64,2
	10,0	120,3	20,7	26,6	162,7	42,5	145,3	25,0	24,6	197,7	52,3	180,4	31,0	24,5	244,7	64,3
	11,0	123,8	21,3	28,1	166,3	42,5	149,5	25,7	26,0	202,0	52,4	185,6	31,9	25,8	250,0	64,4
	12,0	127,3	21,9	29,6	169,8	42,6	153,8	26,4	27,4	206,2	52,5	190,9	32,8	27,2	255,4	64,5
	13,0	130,8	22,5	31,1	173,4	42,6	158,0	27,2	28,8	210,5	52,5	196,1	33,7	28,7	260,7	64,6
	14,0	134,3	23,1	32,7	176,9	42,7	162,2	27,9	30,3	214,8	52,6	201,4	34,6	30,2	266,0	64,6
	15,0	137,7	23,7	34,3	180,5	42,7	166,4	28,6	31,8	219,1	52,7	206,6	35,5	31,7	271,3	64,7

Where,
CT: Condensing Temperature (°C)
CLOT: Chilled Water Outlet Temperature (°C)
CCAP: Cooling Capacity (kW)

CFR: Chilled Water Flow Rate at 5°C (m^3/h)
CPD: Water Cooler Pressure Drop (kPa)
HRJ: Heat Rejection (Kw)
IPT: Compressor Input Power (kW)

Conversion Multiplier:
1 kW = 860 kcal/h
= 3412 Btu/h
1 kPa = 0.102 mAq

Performance Table (R407C) (cont.)

		RCUE 80 CLG					RCUE 100 CLG					RCUE 120 CLG				
CT	CLOT	CCAP	CFR	CPD	HRJ	IPT	CCAP	CFR	CPD	HRJ	IPT	CCAP	CFR	HRJ	HCAP	IPT
35.0	5,0	246,9	42,5	46,3	299,5	52,6	298,3	51,3	53,4	363,1	64,8	370,3	63,7	68,4	450,0	79,7
	6,0	253,9	43,7	48,9	307,0	53,1	306,7	52,8	56,4	372,2	65,5	380,8	65,5	72,2	461,2	80,5
	7,0	260,9	44,9	51,5	314,5	53,7	315,2	54,2	59,4	381,3	66,1	391,3	67,3	76,2	472,5	81,3
	8,0	267,8	46,1	54,2	322,0	54,2	323,6	55,7	62,5	390,4	66,8	401,8	69,1	80,2	483,8	82,1
	9,0	274,8	47,3	56,9	329,5	54,7	332,1	57,1	65,7	399,5	67,4	412,2	70,9	84,4	495,1	82,9
	10,0	281,8	48,5	59,7	337,1	55,2	340,5	58,6	69,0	408,6	68,1	422,7	72,7	88,6	506,4	83,7
	11,0	288,8	49,7	62,6	344,6	55,8	349,0	60,0	72,4	417,7	68,7	433,2	74,5	92,9	517,7	84,5
	12,0	295,8	50,9	65,5	352,1	56,3	357,4	61,5	75,8	426,8	69,4	443,7	76,3	97,4	529,0	85,3
	13,0	302,8	52,1	68,5	359,6	56,8	365,9	62,9	79,3	435,9	70,0	454,2	78,1	101,9	540,3	86,1
	14,0	309,8	53,3	71,6	367,1	57,4	374,3	64,4	82,9	445,0	70,7	464,7	79,9	106,6	551,5	86,9
	15,0	316,8	54,5	74,7	374,7	57,9	382,8	65,8	86,5	454,1	71,3	475,2	81,7	111,3	562,8	87,7
40.0	5,0	236,1	40,6	42,5	296,4	60,3	285,3	49,1	49,0	359,6	74,3	354,1	60,9	62,7	445,4	91,3
	6,0	243,1	41,8	45,0	303,8	60,8	293,7	50,5	51,8	368,6	74,9	364,6	62,7	66,4	456,7	92,1
	7,0	250,1	43,0	47,5	311,3	61,3	302,1	52,0	54,7	377,7	75,5	375,1	64,5	70,1	467,9	92,8
	8,0	257,0	44,2	50,0	318,8	61,7	310,6	53,4	57,7	386,7	76,1	385,6	66,3	74,0	479,1	93,5
	9,0	264,0	45,4	52,7	326,2	62,2	319,0	54,9	60,8	395,7	76,7	396,0	68,1	78,0	490,3	94,2
	10,0	271,0	46,6	55,4	333,7	62,7	327,5	56,3	64,0	404,8	77,3	406,5	69,9	82,1	501,5	95,0
	11,0	278,0	47,8	58,2	341,2	63,2	335,9	57,8	67,2	413,8	77,9	417,0	71,7	86,3	512,7	95,7
	12,0	285,0	49,0	61,0	348,6	63,6	344,4	59,2	70,5	422,8	78,4	427,5	73,5	90,6	523,9	96,4
	13,0	292,0	50,2	63,9	356,1	64,1	352,8	60,7	73,9	431,9	79,0	438,0	75,3	95,0	535,1	97,1
	14,0	299,0	51,4	66,9	363,6	64,6	361,3	62,1	77,4	440,9	79,6	448,5	77,1	99,4	546,3	97,8
	15,0	306,0	52,6	69,9	371,0	65,1	369,7	63,6	80,9	449,9	80,2	459,0	78,9	104,0	557,5	98,6
45.0	5,0	226,0	38,9	39,1	294,9	68,9	273,1	47,0	45,0	358,0	84,9	339,0	58,3	57,6	443,3	104,3
	6,0	233,0	40,1	41,4	302,2	69,2	281,5	48,4	47,7	366,8	85,3	349,5	60,1	61,1	454,3	104,8
	7,0	240,0	41,3	43,9	308,8	68,8	290,0	49,9	50,6	374,8	84,8	360,0	61,9	64,7	464,2	104,2
	8,0	247,0	42,5	46,3	316,8	69,8	298,4	51,3	53,4	384,5	86,1	370,4	63,7	68,5	476,2	105,8
	9,0	254,0	43,7	48,9	324,1	70,1	306,9	52,8	56,4	393,3	86,5	380,9	65,5	72,3	487,2	106,2
	10,0	260,9	44,9	51,5	331,4	70,5	315,3	54,2	59,5	402,2	86,8	391,4	67,3	76,2	498,1	106,7
	11,0	267,9	46,1	54,2	338,7	70,8	323,7	55,7	62,6	411,0	87,2	401,9	69,1	80,3	509,1	107,2
	12,0	274,9	47,3	56,9	346,0	71,1	332,2	57,1	65,8	419,8	87,6	412,4	70,9	84,4	520,1	107,7
	13,0	281,9	48,5	59,7	353,3	71,4	340,6	58,6	69,0	428,7	88,0	422,9	72,7	88,7	531,0	108,2
	14,0	288,9	49,7	62,6	360,6	71,7	349,1	60,0	72,4	437,5	88,4	433,4	74,5	93,0	542,0	108,6
	15,0	295,9	50,9	65,6	367,9	72,0	357,5	61,5	75,8	446,3	88,8	443,8	76,3	97,4	553,0	109,1
50.0	5,0	215,9	37,1	35,8	254,2	38,3	260,9	44,9	41,2	308,1	47,2	323,9	55,7	52,7	381,9	58,0
	6,0	222,9	38,3	38,1	261,3	38,4	269,3	46,3	43,8	316,7	47,3	334,4	57,5	56,0	392,5	58,2
	7,0	229,9	39,5	40,4	268,4	38,5	277,8	47,8	46,5	325,3	47,5	344,8	59,3	59,5	403,2	58,3
	8,0	236,9	40,7	42,8	275,5	38,6	286,2	49,2	49,3	333,8	47,6	355,3	61,1	63,1	413,8	58,5
	9,0	243,9	41,9	45,2	282,6	38,7	294,7	50,7	52,2	342,4	47,7	365,8	62,9	66,8	424,5	58,6
	10,0	250,9	43,1	47,8	289,7	38,8	303,1	52,1	55,1	351,0	47,9	376,3	64,7	70,6	435,1	58,8
	11,0	257,9	44,4	50,3	296,8	38,9	311,6	53,6	58,1	359,6	48,0	386,8	66,5	74,5	445,7	59,0
	12,0	264,8	45,6	53,0	303,9	39,0	320,0	55,0	61,2	368,1	48,1	397,3	68,3	78,5	456,4	59,1
	13,0	271,8	46,8	55,7	311,0	39,1	328,5	56,5	64,3	376,7	48,3	407,7	70,1	82,6	467,0	59,3
	14,0	278,8	48,0	58,5	318,1	39,3	336,9	57,9	67,6	385,3	48,4	418,2	71,9	86,8	477,7	59,5
	15,0	285,8	49,2	61,3	325,2	39,4	345,4	59,4	70,9	393,9	48,5	428,7	73,7	91,1	488,3	59,6
55.0	5,0	205,6	35,4	32,6	290,0	84,4	248,4	42,7	37,5	352,4	104,0	308,4	53,0	47,9	436,2	127,8
	6,0	212,6	36,6	34,8	297,1	84,5	256,9	44,2	40,0	361,0	104,2	318,9	54,8	51,1	446,9	128,0
	7,0	219,6	37,8	37,0	304,2	84,6	265,3	45,6	42,6	369,6	104,3	329,4	56,6	54,4	457,5	128,1
	8,0	226,6	39,0	39,3	311,3	84,7	273,8	47,1	45,2	378,2	104,4	339,8	58,5	57,9	468,1	128,3
	9,0	233,6	40,2	41,6	318,4	84,8	282,2	48,5	48,0	386,8	104,5	350,3	60,3	61,4	478,8	128,5
	10,0	240,5	41,4	44,1	325,5	84,9	290,7	50,0	50,8	395,3	104,7	360,8	62,1	65,0	489,4	128,6
	11,0	247,5	42,6	46,6	332,6	85,0	299,1	51,4	53,7	403,9	104,8	371,3	63,9	68,8	500,1	128,8
	12,0	254,5	43,8	49,1	339,7	85,1	307,5	52,9	56,7	412,5	104,9	381,8	65,7	72,6	510,7	128,9
	13,0	261,5	45,0	51,7	346,8	85,2	316,0	54,4	59,7	421,1	105,1	392,3	67,5	76,6	521,4	129,1
	14,0	268,5	46,2	54,4	353,8	85,3	324,4	55,8	62,8	429,6	105,2	402,8	69,3	80,6	532,0	129,3
	15,0	275,5	47,4	57,2	360,9	85,5	332,9	57,3	66,0	438,2	105,3	413,2	71,1	84,8	542,7	129,4

Where,
CT: Condensing Temperature (°C)
CLOT: Chilled Water Outlet Temperature (°C)
CCAP: Cooling Capacity (kW)

CFR: Chilled Water Flow Rate at 5°C (m^3/h)
CPD: Water Cooler Pressure Drop (kPa)
HRJ: Heat Rejection (Kw)
IPT: Compressor Input Power (kW)

Conversion Multiplier:
1 kW = 860 kcal/h
= 3412 Btu/h
1 kPa = 0.102 mAq

15.3. ELECTRICAL DATA (R407C)

Model	Power supply (3N~)		Applicable Voltage (V)		Commpressor Motor			Maximum Unit Current	STC*2 Unit Maximum
					STC*1	RNC	IPT		
	(V)	(Hz)	Maximum	Minimum	(A)	(A)	(kW)	(A)	(A)
RCUE 40CLG	380	50	418	342	114	59,4	34,4	74	114
	415	50	457	374	125	57,7	34,4	72	125
RCUE 50 CLG	380	50	418	342	148	73,2	42,4	92	148
	415	50	457	374	161	71,1	42,4	89	161
RCUE 60 CLG	380	50	418	342	178	88,0	52,1	110	178
	415	50	457	374	195	84,3	52,1	105	195
RCUE 80 CLG	380	50	418	342	114	118,8	68,8	149	134
	415	50	457	374	125	115,4	68,8	144	144
RCUE100 CLG	380	50	418	342	148	146,4	84,8	183	172
	415	50	457	374	161	142,2	84,8	178	184
RCUE120 CLG	380	50	418	342	178	176,0	104,2	220	207
	415	50	457	374	195	168,6	104,2	211	223

NOTE:

1. *This data is based on the following conditions*
   Chilled Water Inlet/Outlet Temperature: 12/7℃,
   Condensing Temperature: 45℃.
2. *The "Maximum Unit Current" shown in the above table is the maximum total unit running current at the following conditions.*
   Supply Voltage: 90% of the rated voltage, Unit Capacity: 100% at max. operating conditions
3. *The power supply cables must be sized to cover this maximum current value.*
4. *Starting Current (*1, *2) means as follows.*
   **1:First Compressor Starting Current*
   **2:Unit Maximum Starting Current, when Last Compressor starts.*
5. *Compressor motor is star-delta starting*

VOL: Rated Unit Supply Voltage(V)

STC: Starting Current(A)

Hz: Frequency(Hz)

RNC: Running Current(A)

IPT: Input Power (kW)

15.4. SOUND DATA

■ Standard Models

Model	Sound Pressure Level (dB) Frequency Band (Hz)								Overall (dBA)
	63	125	250	500	1000	2000	4000	8000	
RCUE40CLG	74	67	67	68	59	61	47	36	68
RCUE50CLG	76	68	67	64	65	64	51	35	69
RCUE60CLG	77	69	67	62	68	66	53	35	71
RCUE80CLG	77	70	70	71	62	64	50	39	71
RCUE100CLG	79	71	70	67	68	67	54	38	72
RCUE120CLG	80	72	70	65	71	69	56	38	74

NOTE:

1. *The sound pressure is based on the following conditions.*
   - *1 meter from the control panel surface and 1.5 meter from the floor level.*
   - *Voltage of the power source is 380V. In case of 415V, the values increase 1 dB.*
   - *The above data was measured in an anechoic chamber, so that reflected sound should be taken into consideration in the field.*
2. *Operating conditions are as follows.*
   Standard Models: Cooler Water Inlet/Outlet Temperature 12/7 °C, Condensing temperature 45°C.

15.5. OPTIONS

Following table shows options:

(✓ mark shows available)

Specifications		Standard	Option	Remarks
Low Water Temperature	Outlet Temperature: 0~4°C (Low1)		✓	
	Outlet Temperature: -1~5°C (Low2)		✓	
	Outlet Temperature: -6~10°C (Low3)		✓	
Compressor	Expanded Minimum Capacity Control	✓		DSW7-3 ON
Control System	Compressor Circuit Breaker Protector		✓	For Each Compressor
	Main Isolator Switch	✓		
	Local/Remote Changeover Switch	✓		
	Individual Alarm	✓		by Alarm Code
	Operation Hour Meter	✓		
	Pressure Sensor (High and Low)	✓		
	Pump Operation Circuit	✓		Pump Operation Contact
	Non Voltage Contact for Remote Indication	✓		Pump, Chiller, Alarm
	DC24V Outernal Control	✓		Level or Pulse
	Short Period Power OFF Protection	✓		
	Remote Control Switch		✓	AC 220-240V
	BMS Control (HARC-70CE1 / HARC-70CE1 OP)		✓	LON-WORKS
Refrigeration Cycle	Independent Circuit	✓		
	Discharge Valve	✓		
	Suction Valve		✓	
	Compressor Safety Valve (40HP, 80HP not available)		✓	
	Compressor Dual Safety Valve (40HP, 80HP not available)		✓	
	Pressure Display (High and Low)	✓		Standard: Pressure Display on Operation Panel
Water Cooler	PED Certificate (97/23/EC)	✓		PED: Pressure Equipment Directive (Except Compressor safety Valve Option)
	10 bar Water Pressure	✓		
	PN 16 Flange		✓	With Companion Flanges
	Water Pressure Switch		✓	
	Water Flow Switch (Field Install)		✓	
Others	Witness Test		✓	
	Foundation Rubber Mats		✓	

16. APPLICATION DATA

16.1. WORKING RANGE

■ **Working Range**

Item		R407C	Remark
Power Supply	Working Voltage	90% ~ 110% of Rated Voltage	
	Voltage Imbalance	Within ± 3% Deviation from Each Voltage at Compressor Terminals	
		Higher than 85% of Rated Voltage	
Condensing Temperature	35~55°C		
Cooler Water Outlet Temperature	Standard	5 ~ 15 °C	Water
	Low Temperature Option	4 ~ 0 °C (Low1) -1~ -5 °C (Low2) -6 ~ -10 °C (Low3)	Ethylene glycol
Max. Permissible Water Pressure		1.0 Mpa	

16.2. PART LOAD PERFORMANCE

Model: RCUE40CLG, RCUE50CLG, RCUE60CLG

Condensing Temperature	Performance		Compressor Load									
			15~99%								Full	
55°C	Capacity	%	20	30	40	50	60	70	80	90	92	
	Input	%	43	52	59	68	77	89	103	119	123	
	COP	%	47	58	68	74	78	79	78	76	75	
50°C	Capacity	%	20	30	40	50	60	70	80	90	96	
	Input	%	37	46	53	60	68	77	88	104	112	
	COP	%	54	65	75	83	88	91	91	87	86	
45°C	Capacity	%	20	30	40	50	60	70	80	90	100	
	Input	%	33	39	46	53	59	66	76	87	100	
	COP	%	61	77	87	94	102	106	105	103	100	
40°C	Capacity	%	20	30	40	50	60	70	80	90	100	104
	Input	%	28	35	40	45	51	58	66	73	85	89
	COP	%	71	86	100	111	118	121	121	123	118	117
35°C	Capacity	%	21	30	40	50	60	70	80	90	100	109
	Input	%	25	30	34	39	44	51	54	62	70	78
	COP	%	84	100	118	128	136	137	148	145	143	140

Model: RCUE80CLG, RCUE100CLG, RCUE120CLG

Condenser Water Outlet Temperature	Performance		Compressor Load										
			7.5* %	15~99%								Full	
55°C	Capacity	%	10	20	30	40	50	60	70	80	90	92	
	Input	%	22	43	52	59	68	77	89	103	119	123	
	COP	%	47	47	58	68	74	78	79	78	76	75	
50°C	Capacity	%	10	20	30	40	50	60	70	80	90	96	
	Input	%	19	37	46	53	60	68	77	88	104	112	
	COP	%	54	54	65	75	83	88	91	91	87	86	
45°C	Capacity	%	10	20	30	40	50	60	70	80	90	100	
	Input	%	17	33	39	46	53	59	66	76	87	100	
	COP	%	61	61	77	87	94	102	106	105	103	100	
40°C	Capacity	%	10	20	30	40	50	60	70	80	90	100	104
	Input	%	14	28	35	40	45	51	58	66	73	85	89
	COP	%	71	71	86	100	111	118	121	121	123	118	117
35°C	Capacity	%	11	21	30	40	50	60	70	80	90	100	109
	Input	%	13	25	30	34	39	44	51	54	62	70	78
	COP	%	84	84	100	118	128	136	137	148	145	143	140


:Standard Condition
(Condensing temperature: 45°C)
(Cooler Water Inlet/Outlet: 12/7°C)

NOTE:

1. Capacity: Cooling Capacity (Kw)
   Input: Compressor Input Power (Kw)
   COP: Capacity/Input (kw/kw)
2. Operating Conditions:
   Chilled Water Outlet Temperature: 7°C
   Water Flow Rate: Constant
3. Above Table shows the percentage of Capacity, input and COP based on the standard condition.

Therefore, each valued can be calculated as below example:
Example: Model RCUE100 CLG

Standard Condition		CondensingTemperature 40 °C	
Capacity:	290 kW	Capacity:	290×0.8 = 232 kW
Input:	84.8 kW	Input:	84.8×0.66 = 56.0 kW
COP:	3.4	COP:	3.4×1.21 = 4.11

4. Control marked (*) is available by the optional selection switch DSW7-3 / ON: Minimum Load Extension.

16.3. ETHYLENE GLYCOL APPLICATION

■ Low Water Temperature Application (Option)

When utilizing water less than 5 °C, antifreezing mixture of ethylene glycol shall be input to the water system.
Low water temperature Option is categorised 3 level depending on water outlet temperature.
Therefore, please specify the level when ordering .
Freeze Protection Thermostat has been set in the factory.
Table shows Required Ethylene Glycol percentage for each category.

1. Category

Category	Outlet Water Temp. (°C)	Required Ethylene Glycol (wt%)	Ethylene Glycol Freezing Temp. (°C)
Low 1	4 ~ 0	20	-7
Low 2	-1 ~ -5	30	-13
Low 3	-6 ~ -10	40	-22

NOTE:
Freeze Protection Thermostat is the electronic control, but non-adjustable.

For the performance, Each value can be given by using following table. (See example in the next page)

2. Performance

Ethylene glycol (wt%)	Outlet Water Temp. (°C)	Flow Rate Correction Factor (Kf)	Pressure Drop Correction Factor (Kp)	Condensing Temperature (°C)							
				35		40		45		50	
				CAP (%)	IPT (%)	CAP (%)	IPT (%)	CAP (%)	IPT (%)	CAP (%)	IPT (%)
20	4	1.011	1.15	100	76	96	87	91	100	89	111
	3	1.012	1.16	97	75	93	86	88	99	84	111
	2	1.013	1.17	94	74	90	86	85	99	81	110
	1	1.013	1.18	91	73	87	85	83	98	78	110
	0	1.014	1.19	88	73	84	84	80	98	75	110
30	-1	1.034	1.30	85	72	81	84	77	97	73	110
	-2	1.035	1.32	83	71	78	83	74	97	70	109
	-3	1.037	1.34	80	70	75	82	71	96	67	109
	-4	1.037	1.36	77	70	72	81	68	96	69	109
	-5	1.038	1.38	74	69	69	81	65	96	61	108
40	-6	1.073	1.50	71	68	66	80	62	95	58	108
	-7	1.075	1.52	68	67	63	79	59	95	55	108
	-8	1.076	1.54	65	66	61	79	56	94	52	107
	-9	1.076	1.56	62	66	58	78	54	99	49	107
	-10	1.077	1.58	59	65	55	77	51	93	46	107

NOTE:

1. *CAP: Cooling Capacity, IPT: Compressor Input*
2. *Capacity and Compressor Input show the percentage of the standard condition: Condensing temperature 45°C, Chilled Water Inlet/Outlet12/7°C.*
3. *Water Flow Rate and Pressure Drop can be calculated by the Correction Factor Kf and Kp.*
4. *Example:*

a) Model: RCUE100CLG

b) Standard Condition: Capacity 290kW, Compressor Input 84.8kW

c) Outlet/Inlet Water Temperature -3/2°C, Condensing Temp. 40°C

- Ethylene glycol: 30%

*- Capacity = 290*0.75=217,5 kW, Compressor Input = 84.8*0.82=69.5 kW*

*- Water Flow(m^3/h) = Kf*Capacity(kW)*0.86/ΔT (ΔT=Inlet Temp.- Outlet Temp.)*

*= 1.037*217.5*0.86/(2-(-3))*

= 38.8 m^3/h

*- Pressure Drop = Kp*Pressure Drop (water)*

= $1.34*0.0261*38.8^{1.936}$

= 42 kPa

where, Pressure Drop(water)= $\alpha \times Q^{\beta}$: see "Water Pressure Drop"

17. COMPONENTS DATA

17.1. COMPRESSOR

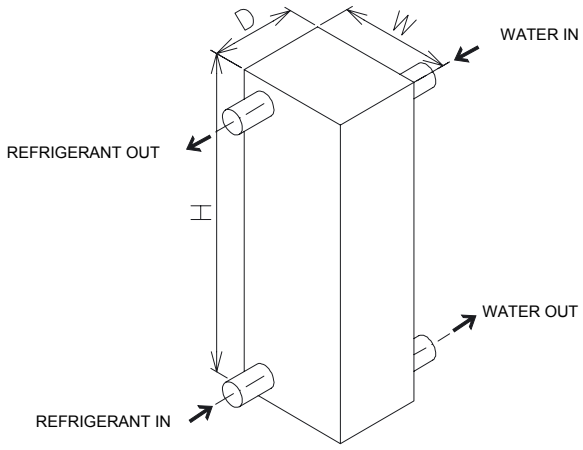
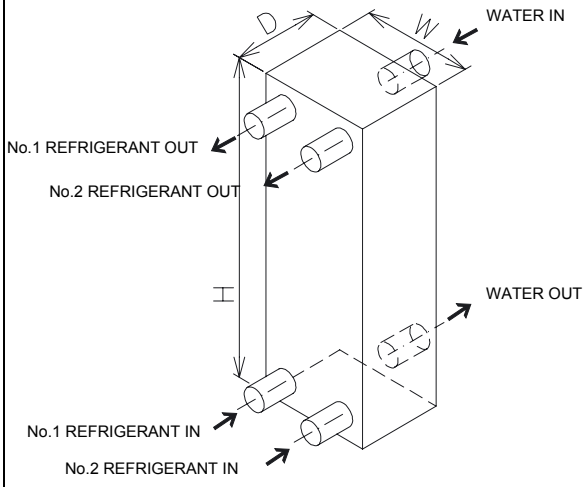
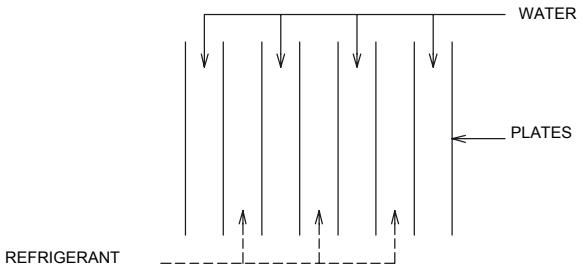
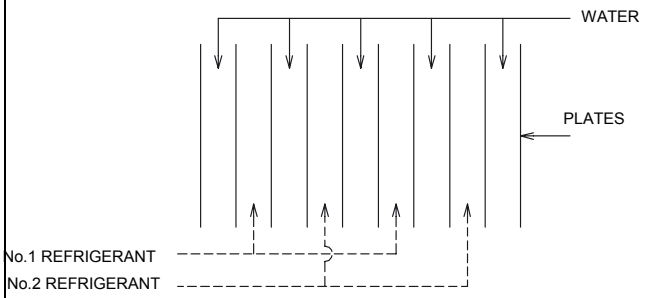
Model			40ASC-Z	50ASC-Z	60ASC-Z
Type			Semi-Hermetic		
Revolution		rpm	2880		
Displacement		m^3/h	137.4	169.5	208.7
Capacity Control		%	100 ~ 15.0	100 ~ 15. 0	100 ~ 15. 0
Pneumatic Pressure					
	High Side	MPa	3.0		
	Low Side	MPa	2.0		
Motor Type			Special Squirrel Cage, Three-Phase Motor		
	Starting Method		Star-Delta Starting		
	Nominal Output	kW	30	37	45
	Poles		2		
	Insulation		E		
Oil	Name		JAPAN ENERGY, Freol UX300		
	Charge	Litre	6		
Net Weight		kg	400	440	460

17.2. WATER COOLER

Model RCUE-CLG	40	50	60	80	100	120
Water Cooler	Brazed Type Plate Heat Exchanger					
Type (Quantity) See Table Below-	A(1)	B(1)	C(1)	D(1)	E(1)	F(1)

TYPE			SINGLE TYPE			DUAL TYPE		
			A	B	C	D	E	F
REFRIGERANT CYCLE			40HP	50HP	60HP	80HP	100HP	120HP
Dimensions								
	Height (H)	mm	525	525	525	694	694	694
	Width (W)	mm	243	243	243	304	304	304
	Depth (D)	mm	244	319	431	392	489	606
Maximum Permissible Pressure								
	Refrigerant Side	MPa	1.8	1.8	1.8	1.8	1.8	1.8
	Water Side	MPa	1.0	1.0	1.0	1.0	1.0	1.0
Internal Volume								
	Refrigerant Side	Litre	11.8	15.7	21.4	2 × 15.9	2 × 20.2	2 × 25.3
	Water Side	Litre	12.1	15.9	21.7	32.3	40.7	50.7
Material			Stainless Steel					
Approval			PED (1)					

NOTE:
Pressure equipment Directive (97/23/EC)

SINGLE TYPE COOLER	DUAL TYPE COOLER
	
	

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