LG Electronics, Home appliance & Air solution company
Two IFC, 10 Gukjegeumyung-ro, Yeongdeungpo-gu, Seoul, 150-945, Korea.

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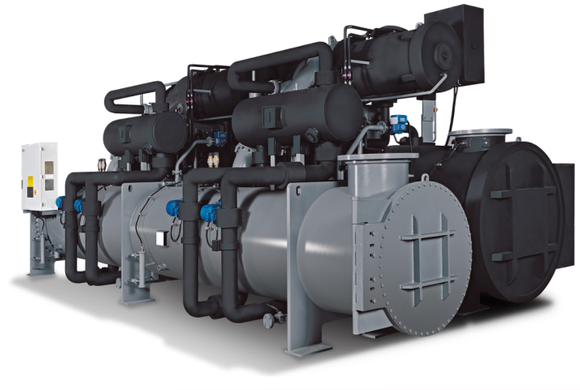
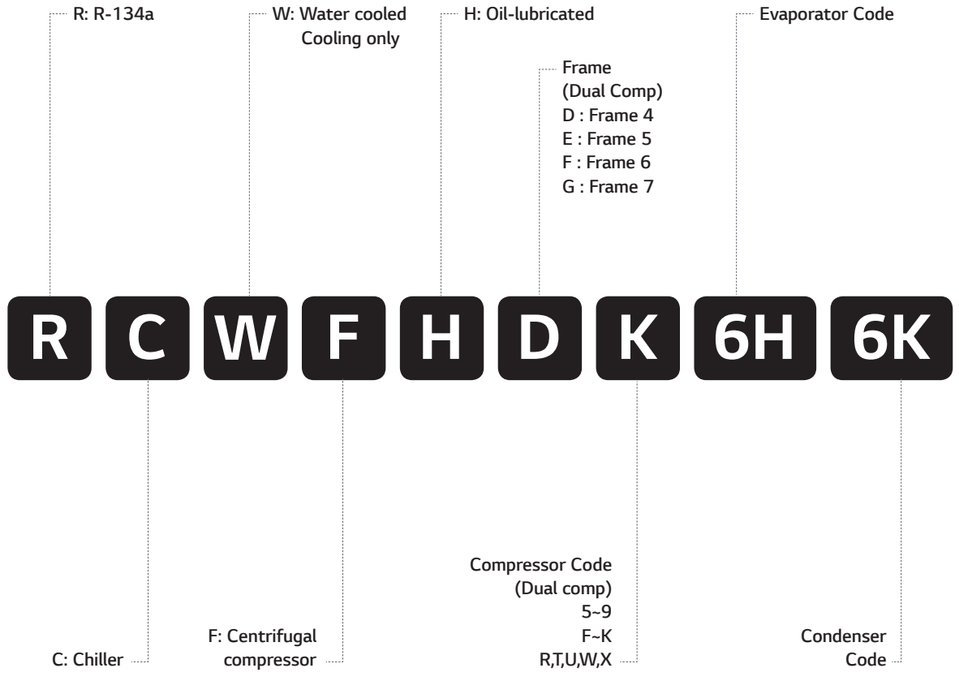
LG 2 STAGE DUAL-COMPRESSOR CENTRIFUGAL CHILLER



Nomenclature



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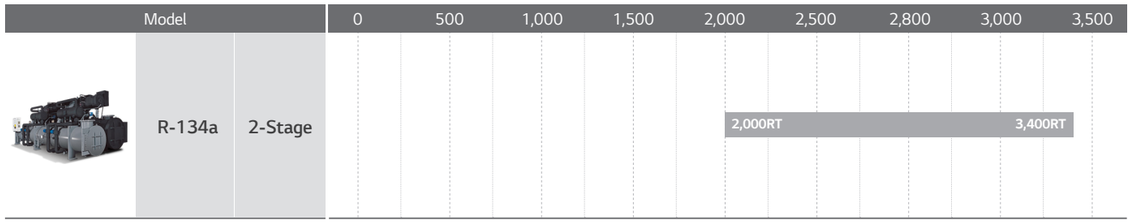
Line up



* This line-up is limited to LG standard models and if you would like to select other models, please contact us.

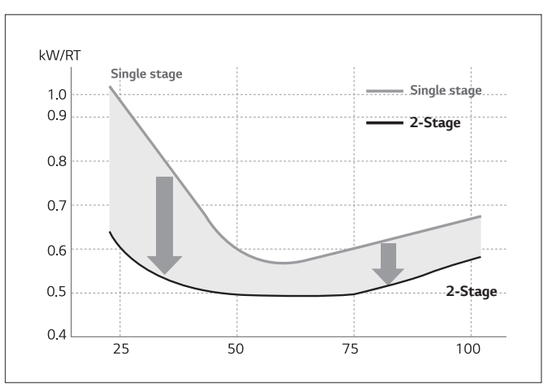
World class high efficiency

The advanced technologies of LG achieve the lowest energy consumption and preserve the environment.

LG chiller offers high-efficiency chlorine-free water-cooled centrifugal chillers using HFC-134a refrigerant. Over three decades of chiller manufacturing and experience in HVAC industry, it has significantly reduced the power consumption of centrifugal chiller with positive-pressure refrigerant HFC-134a, and introduces most cost effective & reliable solutions to all valuable customers. Decreasing hydraulic-head helps to minimize energy loss even further.

Advanced solution for saving energy

The chiller using a two stage compressor developed by the technology of LG increases energy efficiency by 10% ~ 13% at full load conditions as compared to the chiller with single stage compressor, and increases energy efficiency under partial load conditions by 24% or more.



Eco-friendly chiller

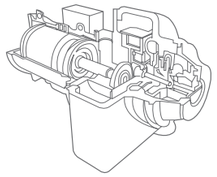
The LG chillers use chlorine-free HFC-134a refrigerant having zero ozone-depletion potential.
LG chiller will work as an excellent harmony with environmental friendly facilities.

Saving installation space

LG's optimized chiller design using positive pressure refrigerant minimizes the machine room space and so return a valuable extra space and a cost saving to the customers.

Simple bolting structure

The evaporator, condenser, and compressor are final-assembled with simple bolting and flange connections, LG chiller provides an excellent solution for the retrofit and replacement jobs where are critical difficulties in an installation works within a limited space.



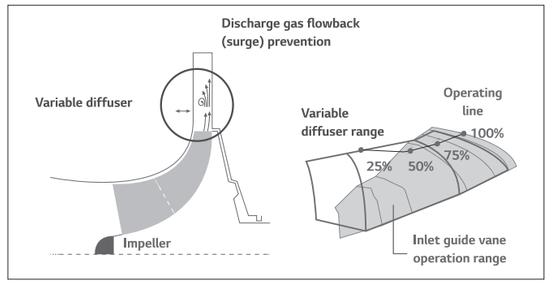
Compressor test facility

Inlet guide vanes

LG chiller adopts IGV (Inlet Guide Vanes) for the capacity control.
However, the vane opening is precisely controlled by a modutrol motor. Precise and smooth control of the chilled water temperature can be provided with this simple device.
It adjusts the refrigerant mass flow rate taken through the compressor inlet to adjust the capacity of the chiller, and it adjusts the opening of the vanes using the external actuator. The amount of refrigerant taken in is adjusted according to the set of chilled water outlet temperature.

Variable diffuser

Provides wider operation range at a low-load condition, and prevents stall from discharge gas for stable operation.



Bearing

1. Compressor type : AA ~ EK
- Ball bearing is composed of isolated bearing on motor stall from discharge gas for stable operation. And angular contact bearings on the impeller stall from discharge gas for stable operation.
- Ball bearing structure is subjected to a radial and axial load at the same time.
- Because of less oil flow rate for ball bearings, the rotor dynamic system can be designed with compact size.

2. Compressor type : F1 ~ G3
- Bearing is composed of bearing in motor shaft, radial bearings and thrust bearings on the impeller shaft.
- Bearings with white metal are used to achieve persistence and corrosion resistance. Lubrication system prevents bearings from Metal-to-Metal contact during operation.
- To increase the reliability of the journal bearings, Offset type and 3-Lobe type bearings are applied.

Aerodynamically-shaped impeller

Impellers that utilize 11 back sweep main blades and 11 splitters are aerodynamically shaped to improve compressor efficiency. The blade 3D profiles are designed by using 3D-CFD (Computational Fluid Dynamics) and design database based on compressor tests.
- The vane of impeller designed aerodynamically based on the 3D fluid analysis, guarantees the reliability in any operational condition.
- To minimize vibration, the impeller shall be balanced dynamically. Overall reliability of impellers shall be secured by taking the strength test, hardness test, non-destructive test, etc. for all impellers produced.

Low solidity airfoil diffuser

Using simple 2D airfoils, the low solidity diffuser increases compressor peak efficiency and widen operating range with no moving parts.

Robust rotor dynamic system and transmission

High speed rotating system including bearings are designed to secure the robust operating over the life of the machine at various load conditions.

Oil pump

The oil pump is driven by an electric motor from the separate power source to prevent the lubrication failure due to abnormal compressor shutdown. It delivers fluent oil to the gears and the 4 bearings when compressor start-up and normal operation.

Oil heater

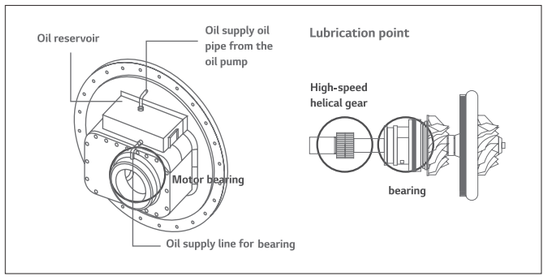
High speed rotating system including bearings are designed with oil heater installed in the oil sump is mainly used to dry out the refrigerant mixed in the reclaimed oil from the transmission and the evaporator. Also, the heater prevents the abrupt mix of oil and refrigerant while compressor shutdown and pre-heats the oil before start-up. All the operation of the heater is controlled by the microprocessor controller.

Oil cooler

A compact refrigerant-oil heat exchanger is used for the oil cooler. The liquid refrigerant can be a safe and effective cooling source in the system. A small amount of liquid refrigerant is extracted at the bottom of the condenser and it cools the hot oil (after lubricating the rotor dynamic system) at the heat exchanger and returns to the evaporator.

Oil reservoir

During the power failure, oil reservoir shall automatically supply oil for compressor bearings to prevent any compressor damage.



Refrigerant-cooled Semi-hermetic Motor

The motor is bolt-connected to the compressor gear housing and the shaft labyrinth seal prevents refrigerant leakage from the motor to the gear box. This semi-hermetic motor is more compact and makes less noise than the air-cooled motor. No heat is ejected to the machine room. No expensive mechanical seal is required. Using motor shaft as a bull gear shaft, no coupling is needed and it minimizes the shaft alignment problems. Like oil cooler, the motor is cooled by the condensed liquid refrigerant, so that the motor wiring can keep low temperature to improve motor efficiency. The liquid refrigerant is sprayed to the several stator locations of the motor for efficient cooling. The optimum locations and the liquid flow rate is designed by a lot of motor tests.

Heat exchangers

Heat exchanger of two-stage centrifugal chiller is composed of two shell type for easy separation into evaporator and condenser. The tubes are arranged so as to maximize the heat exchanging ability. It is also designed so that the refrigerant can be spread evenly on all tubes for the sake of surge prevention and the COP increase in part load operation.
Efficiency increasing purpose sub cooler is adopted for the subcool of the condensed refrigerant.
A relief valve for an abnormal situation is at the upper part of the heat exchanger.

High performance tubes

Heat transfer coefficients on inner surface are significantly enhanced by selecting optimal ridge size and angle without sacrificing pressure drop. In addition, Enhancement of heat transfer on outer surfaces are respectively designed and tested for easy condensation and evaporation.

Effectively-designed Condenser

LG condenser has a baffle to prevent direct impingement of high-velocity refrigerant gas on the tube surface and thus eliminate the related vibration and noise. Cooling water flows into sub-cooler from cooling tower and flows to upper part of condenser. This helps to enlarge chiller capacity and increase system efficiency.

Durable heat exchanger

Expansion of tube in double-grooved hole at tube sheet prevents leakage and increases durability of heat exchanger.

Isolation valves of refrigerant filter

This valve allows us to replace filter without pump-down of refrigerant. This is installed for less service time and less maintenance cost.

Pressure vessel (options)

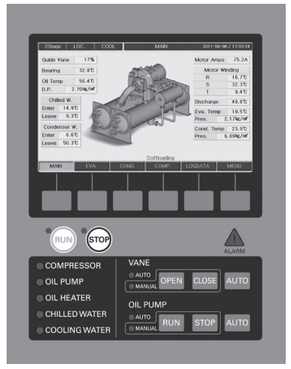
The evaporator and condenser can be provided with either ASME or PED pressure vessel codes as an option and KS pressure vessel design is standard.

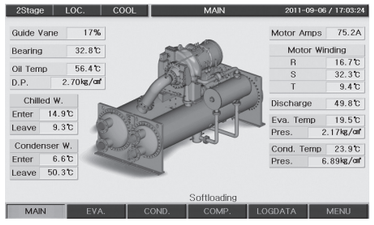
Expansion device and economizer

The condensed refrigerant liquid passed the 1st expansion where refrigerant gas and liquid are segregated. The refrigerant gas is mixed with mid-temperature, mid-pressure gas compressed in the 1st impeller. The refrigerant liquid goes through 2nd Expention device to be taken into evaporator. The mid-temperature and mid-pressure gas between the 1st and the 2nd impeller become cool by mixing with the cool refrigerant gas supplied from economizer before sucked in to the 2nd impeller. As such, when the 2nd impeller discharge gas temperature is decreased by mixing gas from economizer with discharge gas from 1st impeller, power consumption required by compressor is decreased (increasing cycle efficiency).
The efficiency increase much higher than by the 1 Stage compressing method.

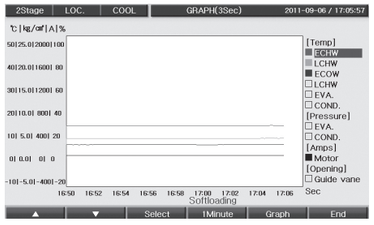
Microprocessor-based controls

LG's Microprocessor-based controller, LGC-X30 enables the user to monitor and control the chiller with high-class accuracy and confidence. The exclusively designed algorithm allows the optimized operation.
LGC- X30 controller is ready for multi-language support; Chinese, English and Korean.
LGC- X30 has 100% H/ W compatibility and freely interfaced with LG Absorption Machine.
Max. 8 units of LG chiller can be linked together and controlled through only 1 protocol converter (optional).

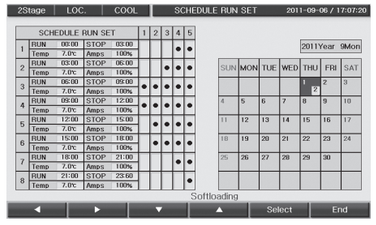




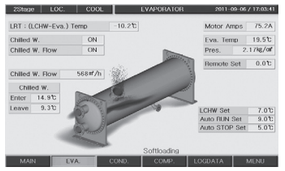
7" Color LCD with high resolution



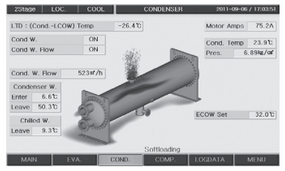
Operation data trend



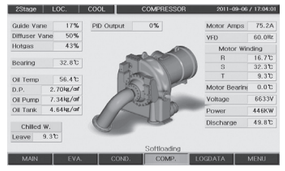
Reserve operation



State of evaporator



State of condenser



State of compressor

Operation history

AC Smart premium

- 10.2-inch color LCD screen with high resolution (1,024 x 600)
- Operation scheduling function
- Real time trend display
- Web Access
- Running data acquisition
- Easy-to-read display of operational data
- Certified EMI/EMS
- Communication supported: RS485 (standard) and Ethernet (optional)
- Language: English / Chinese / Korean
- Auto-printing function (optional)

Microprocessor controls

The unit controller is factory mounted, wired and tested before shipment. And a built-in printer, BACnetTM, MODBUSTM protocol converter module and Modem are equipped as an option.

Safety cutouts

The all safety control inputs and, if required, shuts down the chiller or limits the guide vanes to protect the chiller from possible damage from and of the following conditions:

- High bearing temperature
- High motor winding temperature
- High discharge temperature
- Low oil pressure
- Low cooler refrigerant temperature/pressure
- Condenser high pressure or low pressure
- Inadequate water cooler and condenser flow
- Excessive motor acceleration time
- Excessive starter transition time
- Lack of motor current signal
- Excessive motor amps
- Excessive compressor surge
- Temperature and transducer faults
- Soft start system
- Soft stop system
- Control circuit fuse
- Control module fuse
- Oil heater fuse
- Oil pump motor fuse
- Safety relief valve

Main menu indications (Control center)

- Run Mode Set
- User Set
- Manual Control
- Schedule Set
- Service Menu
- Run Data Check
- Error Data Check
- Pager Mode Set
- System Menu
- Bright Control

Basic display items

- Chilled water inlet & outlet temperatures (℃)
- Cooling water inlet & outlet temperatures (℃)
- Compressor discharge temperature (℃)
- Compressor bearing temperature (℃)
- Oil tank temperature (℃)
- Motor windings (R.S.T) temperatures (℃)
- Evaporator pressure (kg/cm2)
- Condenser pressure (kg/cm2)
- Oil tank pressure (kg/cm2)
- Oil pump pressure (kg/cm2)
- Amperes (A)
- Vane openings (%)
- Remote setting temperature (℃)
- Evaporator temperature (℃)
- Condenser temperature (℃)
- Differential pressure of oil (kg/cm2)
- Hot-gas valve output (%)
- PID output (%)
- Real setting value (℃)

Optional display items

- Voltages (V)
- Watts (kW)
- Chilled water flow (m3/h)ƒR
- Cooling water flow (m3/h)ƒR
- Frequency of cooling tower fan inverter (Hz)

User settings

- Chilled outlet temperature (7℃)
- Compressor current limit (100%)
- Guide vane high limit (50%)
- Cooling mode P & I & D (6.8℃, 300 sec., 3.0 sec.)
- Hot-gas valve- Vane % (30%)
- Hot-gas valve max. (100%)
- Hot-gas valve min. (0%)
- Chilled water brine temperature (-5.0℃)
- Cooling tower fan RUN (32.0℃)
- Cooling tower fan STOP (28.0℃)
- Cooling tower fan STEP (1.0℃)
- Cooling tower fan delay (60sec)
- Cooling water inlet temperature (31.0℃)
- Cooling tower fan P & I & D (4.0℃, 400sec, 20.0 sec.)
- Operational data log time (60 sec.)
- Year
- Month

- Date
- Week
- Hour
- Minute
- Second
- LCD light on time (60 sec.)

- The values in ( ) are default setting values.

Main menu indications (Control center)

- Run Mode Set
- User Set
- Manual Control
- Schedule Set
- Service Menu
- Run Data Check
- Error Data Check
- Pager Mode Set
- System Menu
- Bright Control

Control sequence

Start

The chiller is starting to run by pressing the RUN-key on the control center of unit controller, the key must be pressed for 2 seconds as a minimal. During the manual operation, RUN type must be set as "local mode". Second start-up will be activated only after 30 minutes (expiration of re-start prevention timer) for normal-start or 3 minutes (expiration of oil pump circulation timer) for auto-stop in order to protect compressor motor.

Firstly, Cooling water pump is running in 5 seconds after chilled water pump starts running. And the chiller will proceed to next sequence only after chilled water and cooling water flows reach enough flow rate. If the chilled water temperature is less than target temperature by 2 degree C, compressor will stop automatically.

When the chiller starts, soft-loading mode is activated to open IGV slowly in order to prevent any damage from compressor. Then the capacity When the compressor stops due to serious trouble, alarm lamp is on, and the shutdown status is displayed on the LCD, and also shutdown information is recorded at RAM of controller.

Stop

The chiller stops under one of the following events:

- The Stop button is pressed for at least 2 seconds or the remote-stop signal is delivered to the controller.
- Auto-stop at " Setting temperature - 2°C "
- Time schedule is stop-mode
- Alarm states

During the stop process, firstly the compressor is forced to stop. The guide vanes are brought to the closed position. The oil pump and chilled water pump stop in 300 seconds after compressor stops and then cooling water pump will stop. The cooling water pump will stop. And 3minutes of starting oil pump circulation timer will count down.

If the stop button is pressed or remote-stop signal is delivered, the guide vanes will close. And the chiller will stop, if the vane full-close limit switch is closed or the vane opening is less than 10% or 4 minutes passed from that the vane starts to close.

Re-start

Restart is activated only after the followings;

- After expiration of re-start prevention timer (30 minutes)
- After expiration of starting oil pump circulation timer (3 minutes)

If the chiller stop due to a safe-stop, the reset button must be pressed before restarting the chiller.

Various interface solutions

Using industrial standard protocol converters, the chiller can be interfaced with BAS(Building Automation System).
The remote monitoring and control of the chillers is possible via BACnet™/ Ethernet, BACnet™/IP, MODBUS™, Modem or RS-232C/RS-485.

Advanced PID control

The advanced algorithm provides an optimum control during start, stop of chillers and even normal-operation. The advanced PID control minimizes the overshoot and undershoot during the chiller starts and normal operation, and also enables accurate and quick response to temperature control.

Chilled water temperature reset

The chilled water temperature can be reset locally or remotely to readjust the chilled water outlet temperature and save energy.

Operation scheduling

The user can program the chiller operation schedule to run and stop the chiller automatically and even chilled water target temperature can be scheduled.

Soft loading

At the start-up, the vane opening is controlled with gradual slow- open to prevent surge, oil foaming and finally to protect compressor. This control lasts until the chilled water temperature reaches the target value.

Preventive control

The preventative control is executed before abnormal-stop point and so unnecessary chiller-stops can be minimized.

Direct control of peripheral equipment

It is possible to control chilled/cooling water pumps and cooling tower fan with direct connection with LG unit controller. The cooling tower fan can be 4-step controlled or PID-controlled, the inverter applied.

Self-diagnosis and help function

Self-diagnosis is always performed before start-up and enables safe operation. And the help function informs the user a proper action to be taken if problem occurs.

Data acquisition & storing

Maximum 300 records of operational data including alarm status can be accumulated. And the data collection interval can be set with every 1 second interval from min. 5 seconds to max. 360 seconds and the alarm data is always stored regardless of setting interval.

Graphical display

Various key data is also displayed graphically and so the user acknowledge the data trend with very convenient and easy ways.

Built-in printer (option)

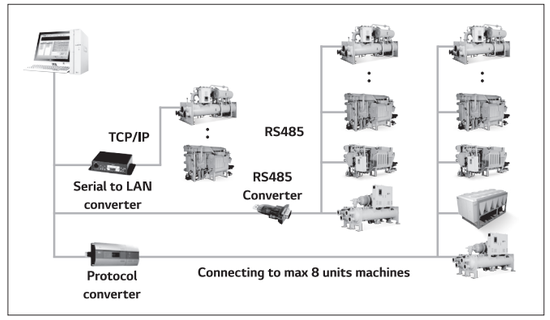
The built- in printer allows the user to check and keep the operational data with hard-copy format.

Password protected

Unauthorized access to the control is protected with random-generated password.

Communication protocol support

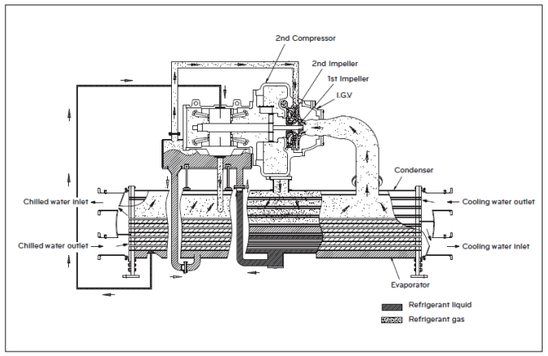
- Communication method
  - Basic: RS-485, Ethernet(option)
- Protocol
  - Basic: MODBUS
  - Option: BACnet, TCP/IP



Refrigerant cycle

The two Stage Centrifugal chiller uses environment friendly high pressure refrigerant R-134a.

- In this cycle, as shown in the figure, the vaporized low temperature and low pressure refrigerant gas passes the Inlet Guide Vane, and enters the 1st impeller of the compressor. Since the inlet gas amount is dependent on the guide vane's opening, the chiller capacity can be controlled.
- Refrigerant gas that entered the 1st impeller is compressed to a mid-temperature and mid pressure, passes through the return channel, is mixed with low temperature gas from the economizer, and then enters the 2nd impeller.
- The refrigerant gas entered the 2nd impeller is compressed as high-temperature and high-pressured refrigerant gas, and discharged to the condenser. The gas loses its heat via cooling water in the heat transfer tubes and eventually condensed to liquid.
- The condensed refrigerant liquid passed the 1st expention device, becomes mixed state and enters the bottom part of the economizer which divides into gas and liquid of refrigerant. The gas part is mixed with the mid temperature and mid pressured gas which was compressed in the 1st impeller, and then enters the 2nd impeller. The liquid part of the refrigerant enters the bottom part of evaporator via 2nd expention device.
- The liquid refrigerant entered into the evaporator, is then spread into wider surface of evaporator by distributor. Finally the distributed refrigerant is evaporated by taking the heat from the chilled water inside the is evaporated tubes and repeats the cycle.
- Some part of the sub-cooled refrigerant liquid in the condenser, flows through the valve, filter, moisture indicator, and enters the motor and oil cooling system individually.
- The refrigerant liquid flew the motor is being sprayed so that it can cool the motor's coil and is returned to the evaporator.
- The refrigerant flew into the oil cooling system, flows through the plate type oil cooler. Refrigerant that left the oil cooler is then returned to evaporator.



Two stage centrifugal chiller

Lubrication system

Introduction

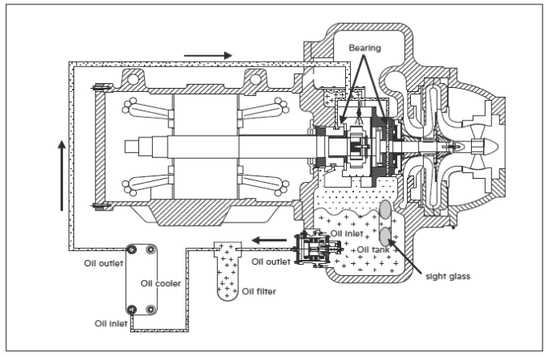
The discharged lubricating oil by the oil pump enters the oil filter to get rid of any unnecessary foreign substance.
This oil becomes cooled to the temperature appropriate for operation condition after going through the oil cooler, part of it directly enters gear and high speed side bearings, and the remainder directly enters motor shaft bearings.
After the process, it will be drained into the oil tank. The above figure shows the lubrication system of two-stage compression type.

Lubrication cycle

Lubricating oil is pumped in through the manual oil charge valve to oil tank. Oil level can be checked through a sight glass on the oil tank. During the operation, the level should be able to be seen at least from one of the sight glasses. The temperature of the oil tank is indicated on the control panel and its temperature should be below 85°C while operating. What the oil pump does is to transfer the oil from the oil tank to the system and the adequate pressure difference would be more than 0.8kg/cm^2 that is maintained by the oil pressure controller. The differential pressure can be seen on by the pressure gauges between oil tank and oil pump. The oil pump also helps to send the oil to the oil filter.

Isolation valves are installed at both ends of oil filter housing so that no need to drain the whole oil when replacing the filter only. After the oil is sent to the oil cooler it is cooled by the refrigerant flowing from the condenser. The refrigerant cools the oil at the temperature below 74°C. A part of the oil flows through the bearing and gear spray, whereas the rest lubricates the motor shaft bearings and the radial bearings.

The oil temperature in the oil tank is measured by temperature sensor and displayed on control panel. The timer automatically activates the oil pump for 120~180 seconds to maintain a constant pressure first before starting compressor. After the system has been shut down, 300~600 seconds of oil circulation is taken place after the compressor is stopped.



Lubrication cycle

Oil reclaim system

Oil reclaim system provides the system to reclaim the oil from the heat exchanger and let it come back to the oil tank. Normally, it is reclaimed from evaporator, and IGV housing.

Maintenance

Most of the lubrication related deficiencies in rotating parts of the chiller are because of the oil itself. If adequate viscosity, pressure and flow are not obtained, lubricating performance will decrease. Impure substances that are present in the oil also are a cause for the deficiencies. Freon type refrigerant have chemical attraction with the oil.

The viscosity changes according to the temperature and pressure of oil. We have designed the chiller with these problems into consideration. An oil pump run by hermetic electro motor and a heater controlled by the controlling device are installed in the oil tank to prevent the trouble caused by the refrigerant inflow into the oil, decrease of the viscosity, damage of the pump caused by the cavitation (vaporizing of water and foaming bubbles as becoming partially low pressurized when water or flow at high speed) and the oil inflow into the refrigerant by forming.

For these reasons the oil tank is maintained at a high temperature. The reason to start the oil pump for certain while before the startup of the chiller, is to prevent the compressor's initial unsteady operation because the left over oil in bearings or in the oil line may contain significant amount of refrigerant flow in during the stoppage. After the chiller has been shut down, oil pump will be operated until the shaft will be still rotating due to inertia force. The only action that can be taken to prevent lubrication inferiority caused by blazing of the oil is replacing the oil itself. Thus before chiller operation, make sure that you do the oil replacing adequately.

Safety devices

Safety devices

For the sake of safe operation and the protection of the chiller, safety devices are ready as the next table.

No.	Safety Devices	Installation Location	Measurement Item	Description	Quantity
1	Chilled Water Temperature Low	Chilled water outlet nozzle	Chilled water outlet temperature	Chiller stops operation if the chilled water outlet temperature below 3˚C to prevent freezing of the chilled water. Do not change this set value.	1
2	Evaporator Pressure Low (Temperature Low)	Evaporator shell	Vaporizing pressure (temp.)	If the pressure inside of evaporator reaches below of the following table, then the chiller stops operation. Standard set value 1.95kg/cm2	1
3	Condenser Pressure High (Temperature High)	Condenser shell	Condensing pressure (temperature)	If the pressure inside of condenser reaches above of the following table, then the chiller stops operation. Standard setting value 10.00kg/cm2	1
4	Motor Temperature High	Motor coil	Motor coil temperature	To prevent the motor of the compressor, temperature sensors were installed on each phase of coil and when the temperature exceeds 90˚C, the chiller stops operation.	3
5	Compressor Temperature High	Compressor outlet	Compressor discharge temperature	If the discharging gas temperature of the compressor exceeds over 70˚C, the chiller stops operation.	1
6	Bearing Temperature High	Thrust bearing	Bearing temperature	Temperature sensor is installed on the thrust bearing that holds the impeller's thrust. Chiller will stop operation if the temperature exceeds 85˚C.	1
7	Oil Differential Pressure Low	Oil tank, oil pump outlet	Differential pressure of supplied and intake oil pressure	If the differential pressure between the oil pressure supplied to the bearing and the oil pressure in the oil tank is below 0.8kg/cm2 , the chiller will stop the operation.	1
8	Oil Temperature High	Oil tank	Oil temperature inside of oil tank	The chiller will stop if the oil temperature in the oil tank is above 74˚C.	1
9	Oil Temperature Low	Oil tank	Oil temperature inside of oil tank	The temperature should be over 30˚C as an initial operating condition to enable the chiller to operate.	1
10	Chilled Water Pump Abnormal	Chilled water header	Chilled water head loss	The chiller will stop if the head loss of the chilled water flow passing through the evaporator tubes decreases so much that the head loss becomes lower than the standard.	1
11	Cooling Water Pump Abnormal	Chilled water header	Cooling water head loss	The chiller will stop if the head loss of the cooling water flow passing through the condenser tubes decreases so much that the head loss becomes lower than the standard.	1
12	Current Limiting Function	Control panel	Current	It is a controlling function of Motor Amps that can be set freely in the range of 40 ~ 100% to adjust the current load to the motor of compressor.	1
13	Moisture Indicator	Refrigerant supply pipe	Moisture in the refrigerant	The moisture indicator changes the color depending on the amount of moisture in the refrigerant. When there is no moisture it will be green, but if not it will be yellow. It is the time to change into a new filter if you can see the yellow color.	1
14	Relief Valve	Evaporator & condenser shell	Relief valves	To prevent the accident by unexpected fire, and so on which can cause pressure increase in the chiller, the relief valve will be operated and exhaust the refrigerant into the air if the pressure exceeds more than the set value. If the chiller is used in a closed environment, please install a pipe that starts from the relief valve to the outer air.	1
15	Vane Full Close Interlock	Vane motor	Operability of temperature sensors	To minimize the starting current, it is a function to enable the compressor to operate only after full close of the guide vane installed at the inlet of the impeller.	1
16	Temperature Sensor Abnormal	6 locations including chilled water nozzle	Each temperature sensor	It alarms when temperature sensor is not connected or due to the sensor's own flaw.	1
17	Pressure Sensor Abnormal	4 locations including Evaporator shell	Each pressure sensor	It alarms when pressure sensor is not connected or due to the sensor's own flaw.	1
18	Overload relay	Control panel	Current	If overload is imposed on compressor motor or oil pump motor, it stops the motor.	1
19	Hot Gas Bypass Valve	Evaporator shell, Condenser shell	Guide vane / hot gas valve opening	It prevents frequent start ups at low load, and hot gas bypass valve opens proportionally when vane becomes 30% or lower. At this time, hot refrigerant gas from condenser goes to evaporator and makes certain chiller load to prevent surge and to prevent frequent stop / start-up of the chiller.	1

Options

Items	Option
Refrigerant charging	√
Hot-gas bypass	√
Marine water boxes on the evaporator or condenser	√
High pressure water side construction (max. 350 psig)	√
Non-standard tubes (e.g., Cu/Ni, titanium)	√
Outdoor installation construction (non-hazardous areas)	√
Special construction for hazardous-area installation	√
Unit-mounted soft starter (available up to 390kW motor outputs with 440V max.)	√
Built-in data printer	√
BACnet™ protocol converter module	√
Remote unit control panel (max. 1,000m)	√
Factory-charged refrigerant	√
Sectional shipment (three parts with interconnection pipe)	√
Factory-completed thermal insulation	√
Factory sound attenuation work	√
Factory performance test with witness	√
Extended warranty	√
Starter	√
• Enclosure protection upgrade (IP54)	√
• Power factor correction capacitor	√
• Midium-voltage vacuum circuit breaker (fixed or upgraded to the draw-out type)	√
• Midium-voltage vacuum contactor switch (upgraded to the draw-out type)	√
• Surge arrestor	√
• Ground fault protection for the motor	√
• Overvoltage protection (motor)	√
• Undervoltage protection (motor)	√
• Watt hour meter	√

Mechanical data & Electrical data

Model name			RCWFADJ	RCWFAEF	RCWFAEG
Cooling Capacity		USRT	2,000	2,200	2,400
Comp. Motor Power		V	11,000	11,000	11,000
RLA		A	92.8	100.2	107.2
Min Circuit ampacity		-	123.6	133.6	143.0
Max. Overcurrent Protection		-	222.4	240.4	257.2
Starter Type		-	Direct	Direct	Direct
Refrigerant Charged		kg	2,200	2,600	2,800
Efficiency		kW/RT	0.660	0.683	0.672
Evaporator	Entering chilled water temperature	℃	13.3	13.3	13.3
	Leaving chilled water temperature	℃	4.4	4.4	4.4
	Mass flow rate	m^3/h	680	748	815
	Pressure drop	mH_2O	3.6	3.7	3.8
	Pass	-	1	1	1
	Water pipe size	-	300A	300A	300A
Condenser	Entering chilled water temperature	℃	35	35	35
	Leaving chilled water temperature	℃	40.5	40.5	40.5
	Mass flow rate	m^3/h	1,306	1,444	1,572
	Pressure drop	mH_2O	9.6	9.4	9.4
	Pass	-	1	1	1
	Water pipe size	-	400A	450A	450A
Dimension	Length	mm	8,855	9,255	9,255
	Width	mm	2,614	3,055	3,055
	Height	mm	2,804	3,096	3,096
Weight	Rigging Weight	kg	31,100	34,000	34,700
	Operation Weight	kg	38,100	41,700	42,500

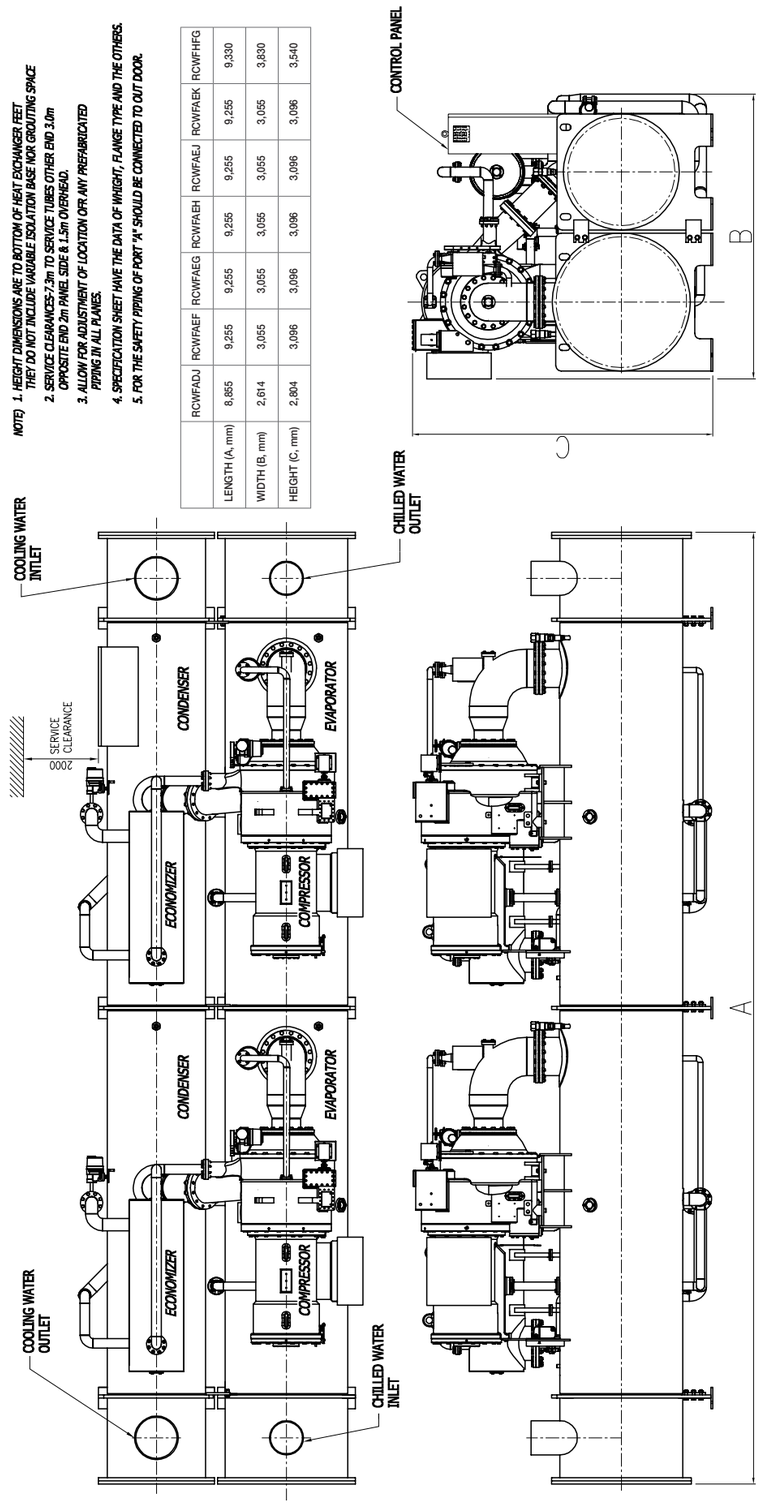
Note : Submitted Capacity can be changed in accordance with Temperature Conditions

Mechanical data & Electrical data

Model name			RCWFAEH	RCWFAEJ	RCWFAEK	RCWFHFG
Cooling Capacity		USRT	2,600	2,800	3,000	3400
Comp. Motor Power		V	11,000	11,000	11,000	11000
RLA		A	117.2	127.4	132.2	139.6
Min Circuit ampacity		-	156.2	169.8	176.2	174.5
Max. Overcurrent Protection		-	281.0	305.8	317.2	314.1
Starter Type		-	Direct	Direct	Direct	Direct
Refrigerant Charged		kg	3,100	3,300	3,600	4000
Efficiency		kW/RT	0.671	0.658	0.662	0.715
Evaporator	Entering chilled water temperature	℃	13.3	13.3	13.3	13.3
	Leaving chilled water temperature	℃	4.4	4.4	4.4	4.4
	Mass flow rate	m^3/h	883	951	1,019	1155
	Pressure drop	mH_2O	3.6	3.7	3.5	3.5
	Pass	-	1	1	1	1
	Water pipe size	-	350A	350A	400A	450A
Condenser	Entering chilled water temperature	℃	35	35	35	35
	Leaving chilled water temperature	℃	40.5	40.5	40.5	40.5
	Mass flow rate	m^3/h	1,702	1,828	1,960	2250
	Pressure drop	mH_2O	9.3	9.3	9.5	5.1
	Pass	-	1	1	1	1
	Water pipe size	-	500A	500A	500A	500A
Dimension	Length	mm	9,255	9,255	9,255	9330
	Width	mm	3,055	3,055	3,055	3830
	Height	mm	3,096	3,096	3,096	3540
Weight	Rigging Weight	kg	35,300	35,900	36,500	52400
	Operation Weight	kg	43,300	44,100	44,800	63400

Note : Submitted Capacity can be changed in accordance with Temperature Conditions

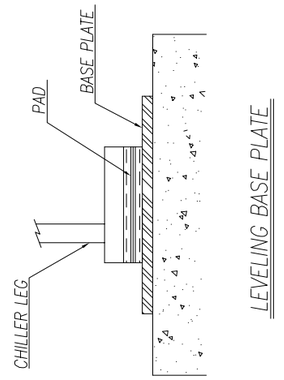
Outline drawing



NOTE) 1. HEIGHT DIMENSIONS ARE TO BOTTOM OF HEAT EXCHANGER FEET
THEY DO NOT INCLUDE VARIABLE ISOLATION BASE NOR GROUTING SPACE
2. SERVICE CLEARANCES-2.3m TO SERVICE TUBES OTHER END 3.0m
OPPOSITE END 2m PANEL SIDE & 1.5m OVERHEAD.
3. ALLOW FOR ADJUSTMENT OF LOCATION OFR ANY PREFABRICATED
PIPING IN ALL PLANES.
4. SPECIFICATION SHEET HAVE THE DATA OF WHIGHT, FLANGE TYPE AND THE OTHERS.
5. FOR THE SAFETY PIPING OF PORT "H" SHOULD BE CONNECTED TO OUT DOOR.

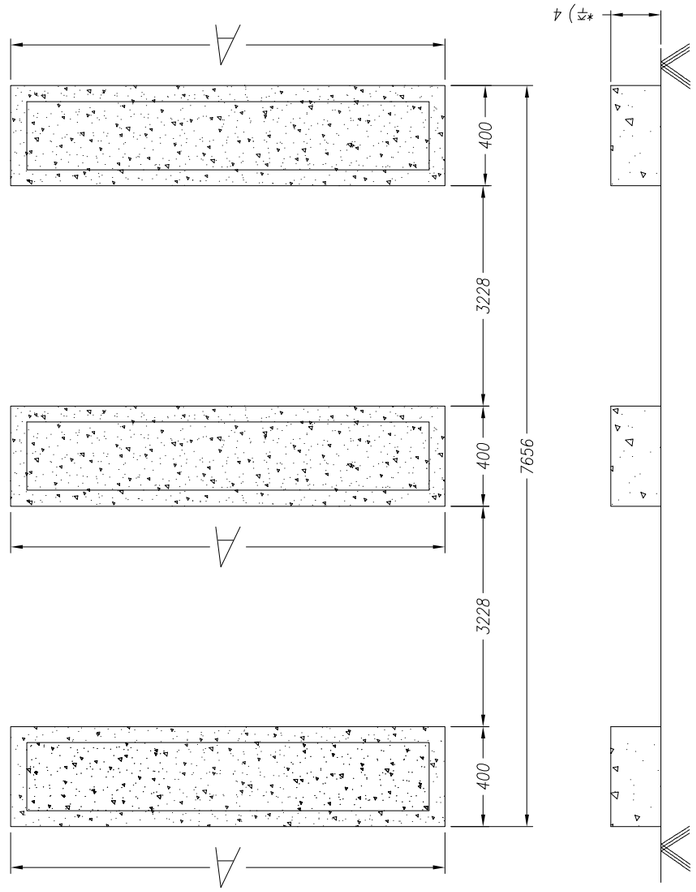
	RCWFADJ	RCWFAEF	RCWFAEG	RCWFABH	RCWFAEJ	RCWFAEK	RCWFHFG
LENGTH (A, mm)	8,855	9,255	9,255	9,255	9,255	9,255	9,330
WIDTH (B, mm)	2,614	3,055	3,055	3,055	3,055	3,055	3,830
HEIGHT (C, mm)	2,804	3,096	3,096	3,096	3,096	3,096	3,540

Foundation

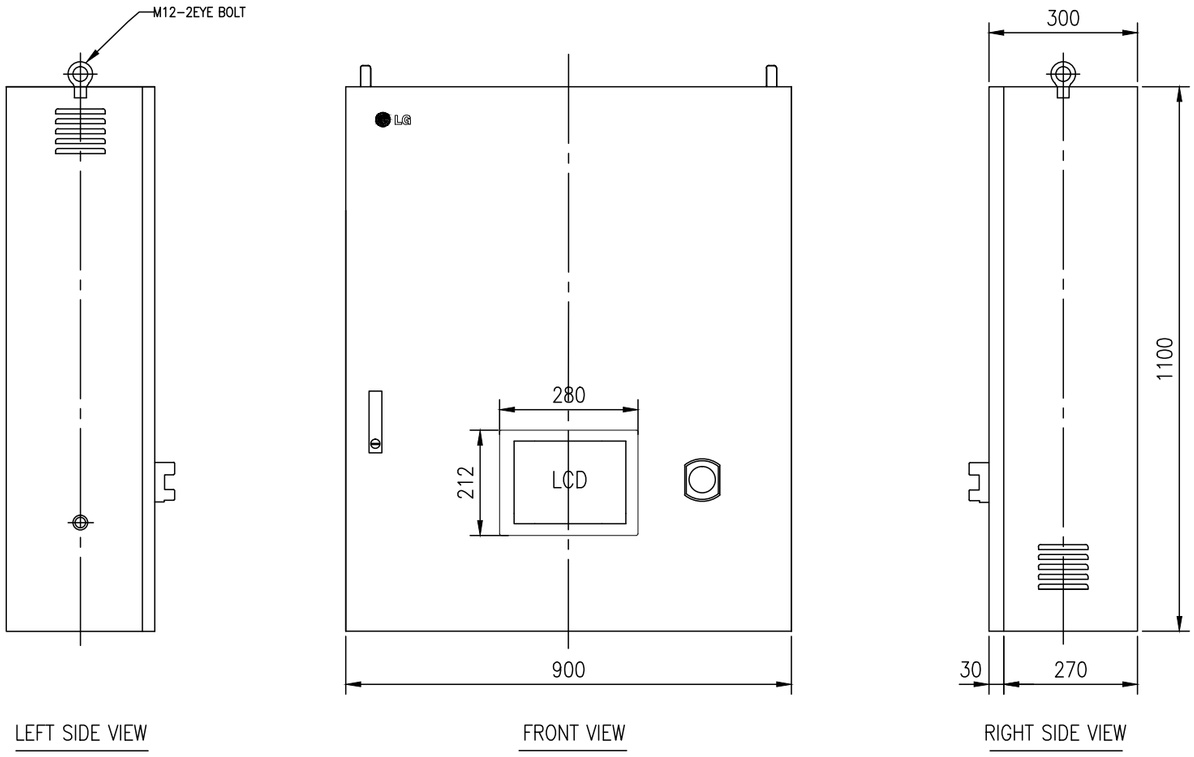


LEVELING BASE PLATE

	RCWFADJ	RCWFAEF ~ RCWFAEK
WIDTH (A, mm)	2,600	3,050



Control panel outline



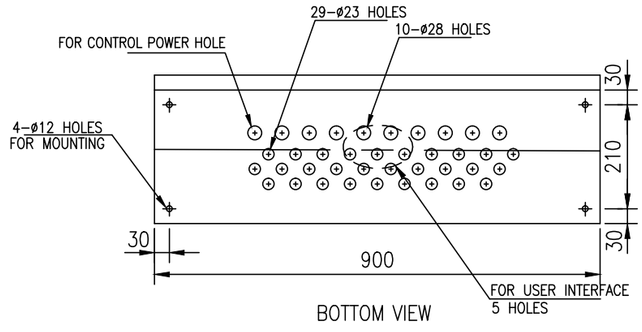
LEFT SIDE VIEW

FRONT VIEW

RIGHT SIDE VIEW

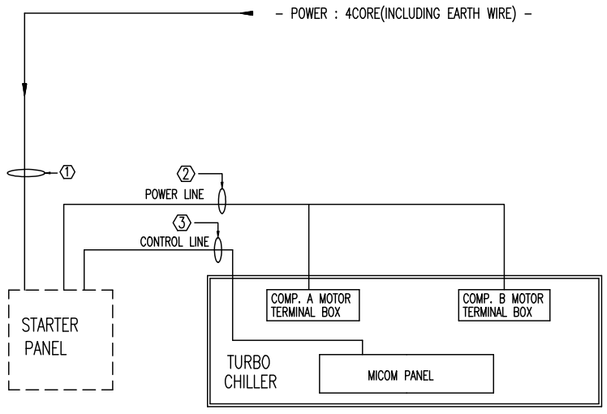
NOTE

1. (PAINTING COLOR)
   : WARM GREY
2. (PANEL THICKNESS)
   : SPHC 2.0T
3. (PROTECTION GRADE)
   : IP41



BOTTOM VIEW

Interface diagram



NOTE

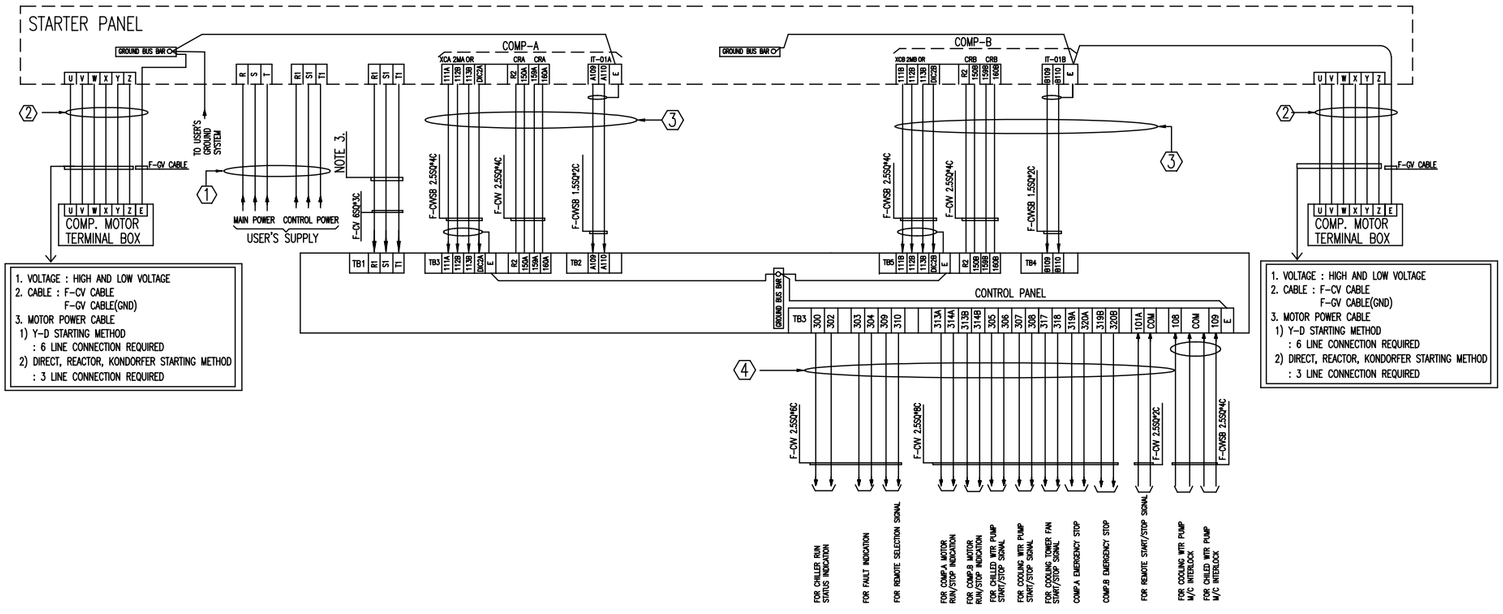
1. Reference LGC standard : F8-174
2. Control signal wire should be 2.5SQ, or above.[SQ=mm²]
3. Control power cable shouled be 6SQ, or above.[SQ=mm²]
4. Reference DWG : Schematic Diagram
5. (Work Scope)

SYMBOL	①	②	③	④	REMARKS
DESCRIP.	(1st PWR)	(2nd PWR)	(2nd Control)	(USER INTERFACE)	
STD SUPPLY SCOPE	BUYER	BUYER	BUYER	BUYER	
FINAL SUPPLY SCOPE	( )	( )	( )	( )	

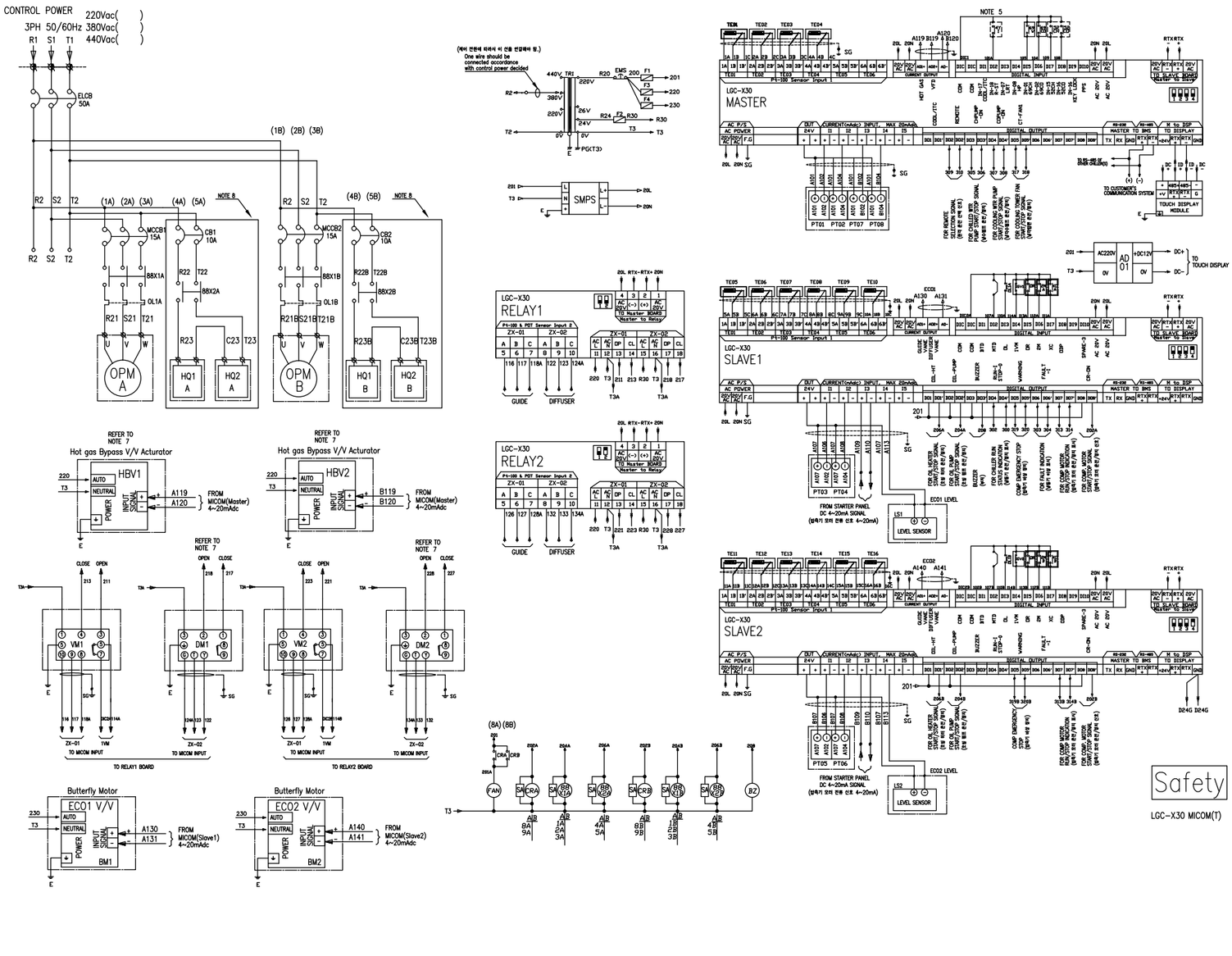
6. For remote RUN/STOP connection diagram

CASE 1. Continuous signal
No voltage contact

SELECTOR SWITCH
STOP
START
101A-DIC1 CLOSE : START
101A-DIC1 OPEN : STOP



Schematic diagram 1



SYMBOL	DESCRIPTION	REMARKS
2M	AUX.CONTACT	FROM STARTER:COMP MOTOR RUN SIGNAL
IGV1,2	VANE MOTOR	
4Y1	REMOTE RUN/STOP SIGNAL	SUPPLIED BY USER
52CO	AUX.CONTACT	COOLING WTR FLOW SWITCH
52CH	AUX.CONTACT	CHILLED WTR FLOW SWITCH
69W	DIFF.PRESS SWITCH	CUTOUT BELOW 50㎪:CHILLED WTR
88X1A,B	OIL PUMP MAGNETIC SWITCH	
88X2A,B	OIL HEATER MAGNETIC SWITCH	
OL1A,B	OIL PUMP THERMAL RELAY	
BZ	BUZZER	
ELCB	EARTH LEAKAGE CIRCUIT BREAKER	
MCCB1,2	MOLDED CASE CIRCUIT BREAKER	
CB1~2	CIRCUIT BREAKER	
CR(8)	SWGR CLOSING RELAY	STARTER RUN/STOP
EMS	EMERGENCY SWITCH	
F1~4	FUSE	F1,2: 2A, F3,4: 3A
SA	SURGE ABSORBER	
AD-01	ADAPTOR	AC 220V / DC 12V
FAN	COOLING FAN	
69CO	DIFF.PRESS SWITCH	CUTOUT BELOW 50㎪:COOLING WTR
MCCB1,2	MOLDED CASED CIRCUIT BREAKER	15A
OR	AUX RELAY CONTACT	FROM STARTER:MAIN POWER ON
OPMA,B	OIL PUMP MOTOR	
HQ1,2A,B	OIL PRE-HEATER	
SMPS	HNPS75S-24-T	
TR1	TRANSFORMER	700VA
TE01	CHLD WTR INLET TEMP SENSOR	PT100ohm
TE02	CHLD WTR OUTLET TEMP SENSOR	PT100ohm
TE03	COOLING WTR INLET TEMP SENSOR	PT100ohm
TE04	COOLING WTR OUTLET TEMP SENSOR	PT100ohm
TE05,11	COMP.DISCHARGE TEMP SENSOR	PT100ohm
TE06,12	OIL TANK TEMP SENSOR	PT100ohm
TE07,13	BEARING TEMP SENSOR	PT100ohm
TE08,14	MOTOR WINDING SENSOR(R)	PT100ohm
TE09,15	MOTOR WINDING SENSOR(S)	PT100ohm
TE10,16	MOTOR WINDING SENSOR(T)	PT100ohm
XC	AUX RELAY CONTACT	FROM STARTER:STARTER PANEL FAULT
PT-01,07	EVAP PRESS TRANSMITTER	Range : 0~16㎏/㎠ OUT : 4~20mAdc
PT-02,08	COND PRESS TRANSMITTER	Range : 0~16㎏/㎠ OUT : 4~20mAdc
PT-03,05	OIL TANK PRESS TRANSMITTER	Range : 0~16㎏/㎠ OUT : 4~20mAdc
PT-04,06	OIL DISCHARGE TRANSMITTER	Range : 0~16㎏/㎠ OUT : 4~20mAdc
HBV1,2	HOT GAS BYPASS V/V ACTUATOR	
LS1	EC0.1 LEVEL SENSOR	AC 24V, DC 4~20mA
LS2	EC0.2 LEVEL SENSOR	AC 24V, DC 4~20mA
BM1	EC0.1 BUTTERFLY V/V MOTOR	AC 220V
BM2	EC0.2 BUTTERFLY V/V MOTOR	AC 220V

NOTE

1. THESE PARTS SHOULD BE SUPPLIED BY BUYERS.
2. THESE PARTS ARE LOCATED ON CHILLER BODY.
3. INTERFACE WITH USER's SYSTEM or STARTER PANEL
4. THESE PARTS SHOULD BE CONNECTED WITH ONLY HIGH VOLTAGE STARTER PANEL(3300V, 6600V).
5. REFERENCE DWG : INTERFACE CONNECTION DIAGRAM
6. COMP EMERGENCY STOP(CES) – OPTION
7. HOT GAS BYPASS V/V ACTUATOR, VANE MOTOR – OPTION
8. WHEN THE CONTROL POWER IS 220VAC, REFER TO THIS DRAWING →