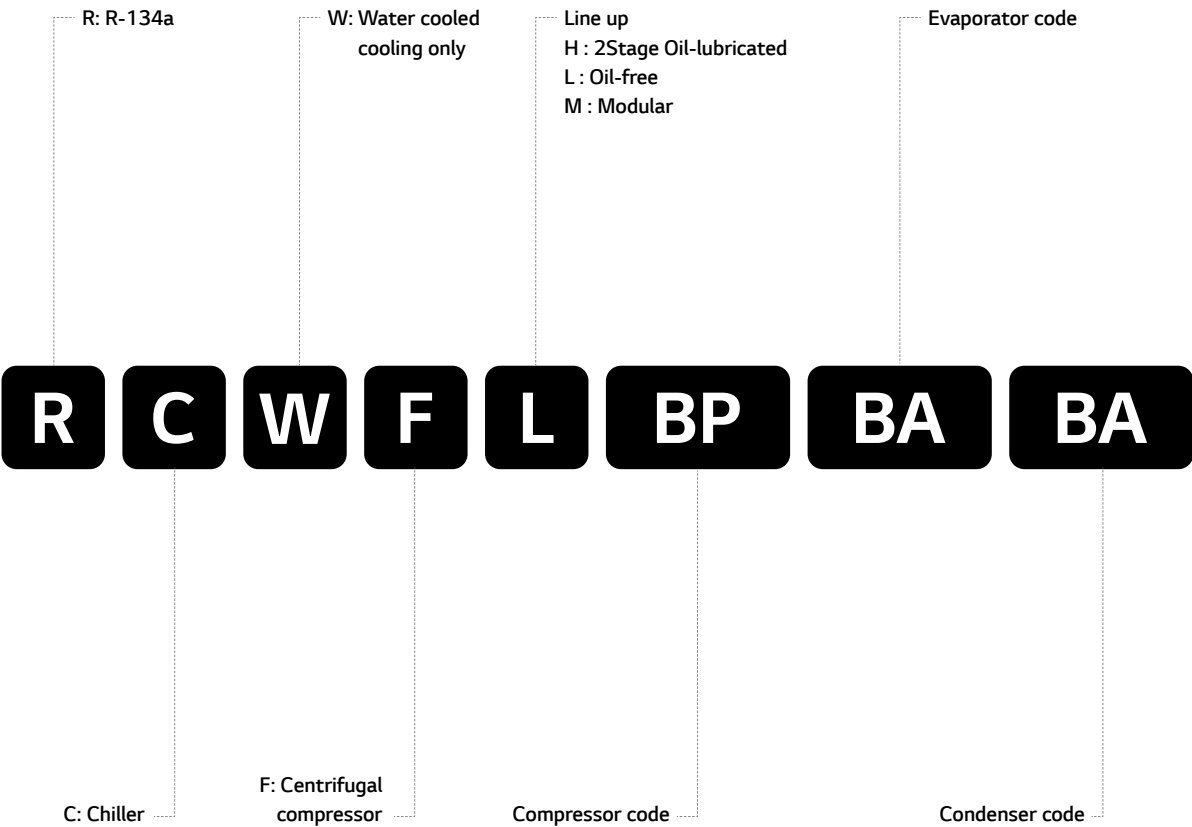


LG HVAC Solution

Oil-Free Magnetic Bearing Centrifugal Chiller

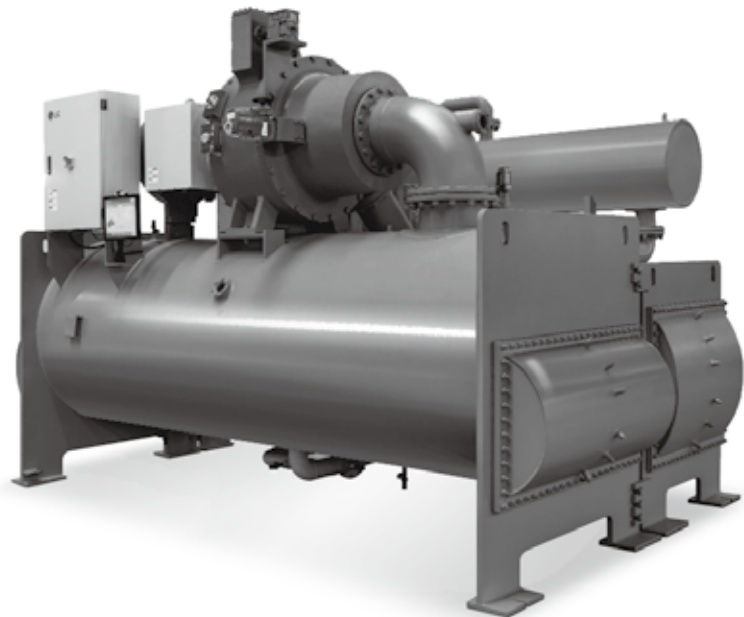


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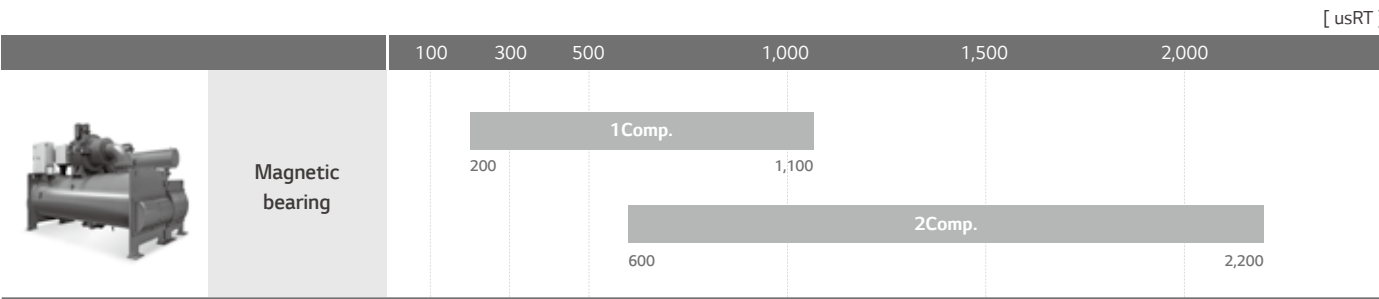


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Line up



* Please contact us if you want a specification other than the standard model.(Customized product available on request)

Innovative centrifugal chiller with a proven technology

LG has been trying to lead the HVAC industry for customers at the frontline of innovation. LG opens up new horizons of the centrifugal chiller with LG's own active magnetic bearing.

LG RCWFL(magnetic bearing type) chillers provide

- Chlorine-free HFC-134a refrigerant
- Easy maintenance and low maintenance cost with oil free technology
- High-precision chilled water leaving temperature control within $\pm 0.1^{\circ}\text{C}$

World-class efficiency



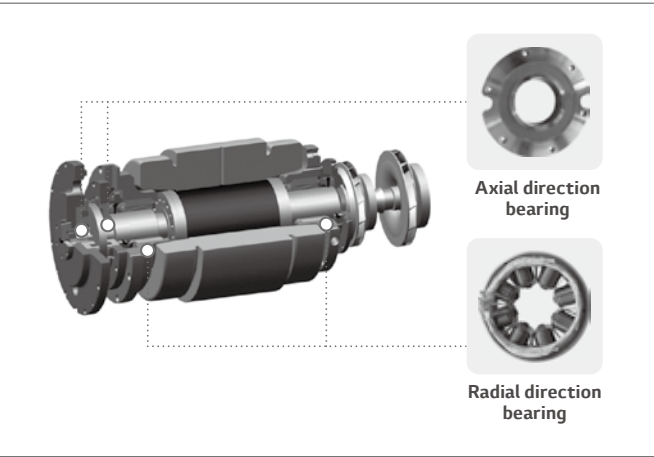
New solution for saving energy with Oil-free technology

The chiller using a magnetic bearing and high speed direct driven system developed by the technology of LG implements oil free technology.

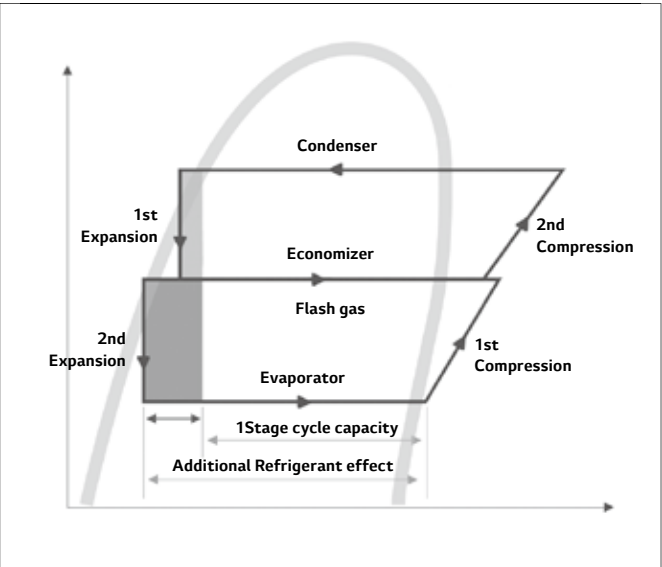
Applying technologies of no contact magnetic bearing and direct connection structure between impeller and drive shaft is able to reduce lubrication losses by 2 ~ 3% as compared with conventional oil lubricated system, which increases energy efficiency. The installed Inlet guide vane(I.G.V) is able to secure stable operation range against surge.

Also, LG RCWFL magnetic bearing compressors are using 2 stage compression cycle with the flash type economizer from the existing LG centrifugal chiller(H Series) line up. The advantage of this cycle is reducing energy consumption of the 1st stage compressor at the both of full and partial load. Because flash gas generated from the expansion process

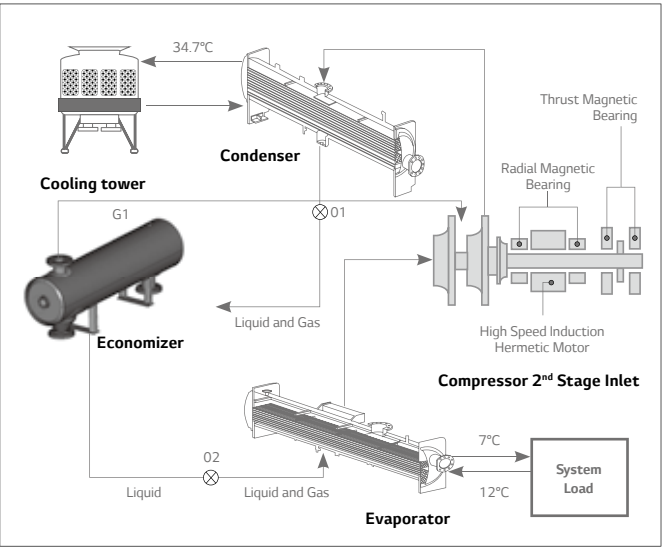
begins to get compressed from the intermediate pressure which is higher than evaporating pressure. Moreover, the refrigerant effect is increased as decreasing the quality of refrigerant at the inlet of evaporator.



Machine overview



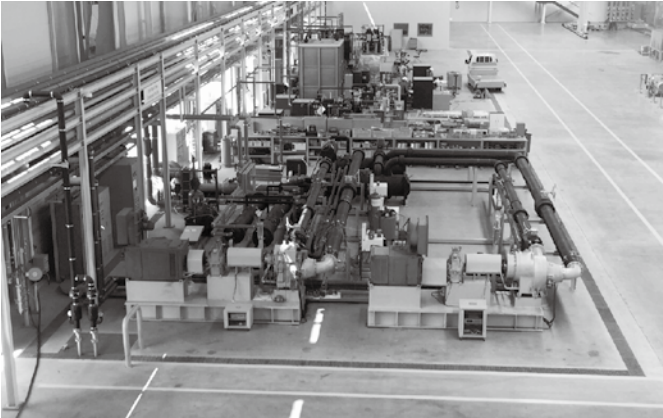
P-H Diagram for 2 stage compression with economizer



Refrigerant flow of 2 stage compression with economizer

LG RCWFL magnetic bearing chiller are applying Variable Speed Drive(VSD) as starting and capacity control device. Operation with VSD provides energy-efficient capacity adjustment at the partial load. In LG RCWFL magnetic bearing chillers, variable speed control combined with Inlet Guide Vane(IGV) or Discharge Gas Recirculation(DGR) allows operation closer to highest compressor efficiency and wide operation conditions. Vane of IGV is precisely controlled by modulated motor to smoothly adjust chilled water temperature when only cooling load is decreased at the certain fixed lift or head condition. The DGR uses impeller discharge gas creating the bypass flow to control refrigerant flow optimally at the compressor inlet, depending on the load. To minimize vibration at the high speed, the impeller undertakes dynamic balancing work. It also guarantees the overall reliability of the impellers by

undergoing the strength test, hardness test, non-destructive test for every impellers produced. Also, LG RCWFL magnetic bearing chiller can provide customized impeller and diffuser design to optimize performance at each high, middle and low lift application. So LG RCWFL magnetic bearing chiller can cover.



Compressor test facility

High reliability

Non-contact magnetic bearing supports rotor which directly connected with shaft and impellers, and it designed for the simple structure without any lubrication system such as oil pumps, reservoirs, heaters, cooler, filters and valves. Most of problems are directly or indirectly related with this lubrication system. With the removing of lubrication system, the reliability of RCWFL magnetic bearing chillers increases.

The reliability of core components; aerodynamic parts, heat exchangers, expansion system and main control system have been proven in many practical global sites as form of H-series during more than 5 years.

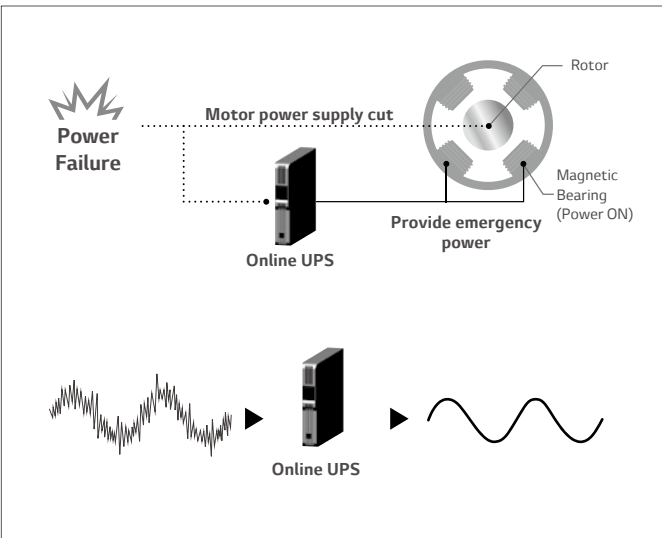
In case of sudden power failure, applied online UPS is being delivered power to the bearing and control system during maximum 15 min. Since the power is being supplied through UPS, there is no change in input or affected by noise, delivering high quality power.

- Below are applied to protection logic for high reliability.
- Motor Over Current Limit and Protection
 - Inverter Temperature High Protection
 - Ground Fault Detection
 - Voltage Low & High Protection

Machine overview



Built-in DC reactor



Online UPS system

LG own oil-free technology

The rotor is levitated by well-controlled electromagnetic force which adjusts a distance between rotor and bearing surface with electric signal from precise proximity sensor based on LG mobile technology. Accurate sensors simultaneously detect shaft location and send signal to bearing controller for adjusting magnitude of electromagnetic field, correcting any deviations or perturbation within mere microns. By using this in-house developed/assembled compressor, LG can reduce service lead time and easily support customer on site condition.

Compact design

LG's RCWFL magnetic chiller is designed for less installation space and compact size with single large tonnage compressor and positive pressure refrigerant. It is favorable to small area that needs both remodeling and new buildings where is a minimized machine room can provide a valuable extra space and a cost saving of construction.

Quiet

An customer's common pain point with typical centrifugal chillers is the noise pollution that can disturb building occupants, neighbors and facilities operators in close proximity. LG's RCWFL magnetic chiller is achieved significant low noise by load base rotation control.

As a result, LG RCWFL magnetic bearing chiller sound level can reach 73 dBA*.

* Note: The above level indicate the noise values under the optimum operating conditions and may vary depending on the operating and environmental conditions.

Heat exchanger

Heat exchanger of LG RCWFL magnetic bearing 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.

A relief valve for an abnormal situation is at the upper part of the heat exchanger.

High Performance Tube

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.

Condenser

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.

Flooded evaporator(Standard)

"Flooded" shell and tube type evaporator having refrigerant in the shell and chilled water inside the tubes. The shell is of welded carbon steel construction with steel tube sheets and copper heat exchange tubes. Removable steel water boxes at both ends of the cooler allow tube cleaning without disturbing the refrigerant circuit. Tubes are mechanically expanded into tube sheets with double grooves to ensure leak tight and trouble free operation.

Machine overview



Isolation valves of refrigerant filter(Options)

Isolation valves allow pump-down of refrigerant. These valves are installed for less service time and less expense. It is attached at the inlet and discharge of compressor and economizer port.

Pressure vessel(Options)

The evaporator and condenser can be provided with either ASME or PED pressure vessel codes certification.

Falling film evaporator(Options)

Falling film shell and tube type evaporator having refrigerant in the shell and chilled water inside the tubes. Advantage of this type evaporator is higher heat transfer performance and reduced refrigerant charge amount. LG patented distributor located on the top side of inside shell makes uniform flow of liquid refrigerant, and this flow goes down by gravity as a form of continuous film. The shell is of welded carbon steel construction with steel tube sheets and copper heat tubes. Removable steel water boxes at both ends of the evaporator allow tube cleaning without disturbing the refrigerant circuit. Tubes are mechanically expanded into tube sheets with double grooves to ensure leak tight and trouble free operation.

Expansion device and economizer

The condensed refrigerant liquid passed the 1st expansion device enters the economizer which divides into refrigerant gas and liquid. The refrigerant gas is mixed with mid-temperature, mid-pressure gas compressed in the 1st impeller. The refrigerant liquid goes through 2nd Expansion device to be taken into evaporator. The mid-temperature and mid-pressured 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 decreasing 1st impeller discharge gas, the power required by the compressor is decreased-increasing the cycle efficiency. The efficiency increase much higher than by the 1 Stage compressing method.

Quality control

LG's entire quality control process from design to shipment is strictly managed by internal quality assurance principle and international standard, such as ISO 9001 & 14001. At the design phase, LG RCWFL series chillers are designed by 3-dimensional CAD tool to virtually lay out its parts and assemble each other. Both of experimental approach and computational analysis method are used to simulate and improve core parts efficiency such as aerodynamic and heat transfer performance.

All core components tested before assembly, and also all of sub vendors are strictly managed by LG quality policy and KS standards. The documentation of manufacturing, testing and quality assurance procedures are prepared to meet a customer's requirements.

Standards and codes

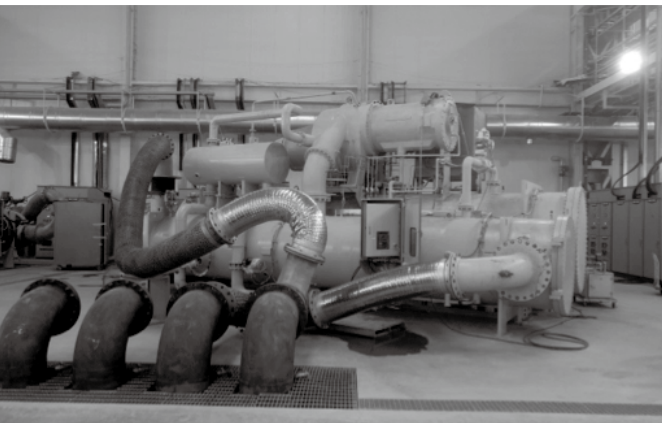
- AHRI 550/590 - Water chilling packages using the vapor compression cycle.
- ANSI/ASHRAE 34 - Number designation and safety classification of refrigerants.
- ASME section VIII - Boiler and pressure vessel.
- CE - Conform to CE testing services for construction of chillers and provide CE listed mark.
- KGS AA111/112 – Facility / Technical / Inspection code for manufacture of high pressure gas refrigerators.
- KS B 6270 - Manufacturing, testing and quality assurance procedures based KS standard in centrifugal chillers.
- ANSI/ASHRAE Standard 15 safety code.
- Manufactured in an EN ISO 9001 accredited organization.
- ETL – Conforms to ANSI/UL STD 1995 certified to CAN/CSA STO C22.2.
- N.E.C. – National electrical code.
- OSHAS 18001 - Occupational safety and health act.

Machine overview



Unit performance test

LG has established one of the largest chiller testing facility in the world. Each LG chiller is thoroughly tested prior to shipment, and is delivered to the customer with test report including measured performance. Witness test is also available for all of lineup of RCWFL series, and also non-standard test such as zero-tolerance and constant cooling water are available as options.



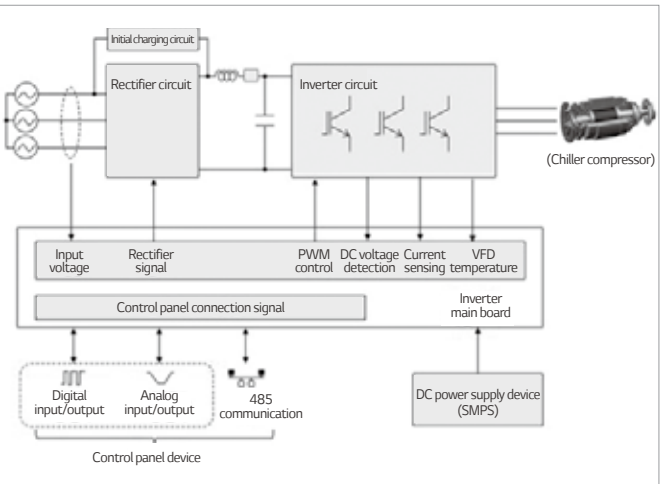
Unit performance test

Sustainable refrigerant

LG RCWFL magnetic bearing chiller uses R-134a as refrigerant. LG chiller Division fully supports the further regulation agenda for HFCs in the amendment of the Montreal Protocol. Furthermore, we are studying and preparing next generation chillers compatible with refrigerants which have zero ODP and low GWP to satisfy social demands for protecting environment in near future. In conjunction with new chiller development policy, we will continue to supply products to market with R-134a until there is a new policy that supports switching to a new refrigerant that has a better environmental friendly characteristic.

Inverter technology

It is an electric panel that can change the rotation speed and voltage of the compressor motor. It has protection functions such as input overvoltage and output overcurrent, and the motor is driven and the rotation speed is variable.



Electrical precautions

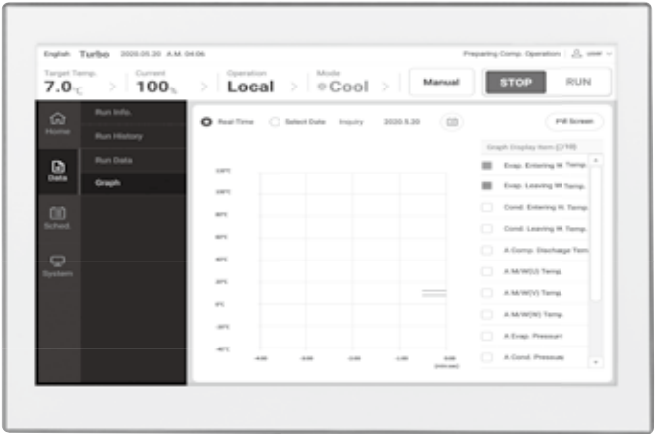
Inverter chiller products generate harmonics according to the characteristics of the inverter and may affect surrounding system facilities and power supply transformers. Accordingly, the design of the surrounding system in consideration of the product characteristics must be reflected. - LG inverter harmonic characteristics: THDv < 5%, TDDi < 30% (Standard Type) It is recommended to use a transformer (considering the K-factor) that reflects the inverter characteristics. When using a transformer without considering the K-factor into account, it may affect peripheral equipment and cause the noise from harmonics. It is required to install a harmonic filter if necessary. (h K-factor: a constant that defines the harmonic load that can use the transformer without overheating) In particular, in the case of capacitors for improving power factor, capacitors can easily be affected by harmonics depending on their characteristics, so please consider them thoroughly when designing the system.

Chiller AI engine

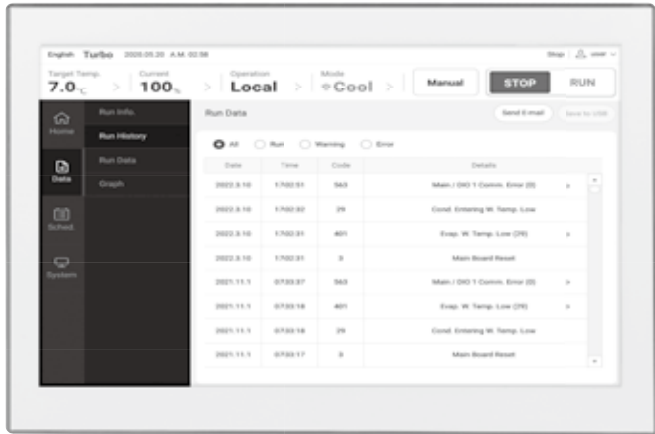
- 15-inch color LCD and resistive touch screen
- Operation scheduling function
- Real time trend display
- Running data acquisition
- Easy-to-read display of operational data
- Communication supported: Modbus, RS485(Standard)
- Language: English / Chinese / Korean



Main Screen



Operation Graph



Operation Schedule



User Report

Microprocessor controls

The unit controller is factory mounted, wired and tested before shipment. And BACnet™, MODBUS™ protocol converter module and Modem are equipped as an option.

Safety control

Safety devices are installed in the chiller for safe operation and device protection.

- Chilled water temperature low
- Evaporator pressure(temperature) low
- Condenser pressure(temperature) high
- Motor temperature high
- Compressor temperature high
- Inverter temperature high
- Chilled water pump abnormal
- Cooling water pump abnormal
- Current limit function
- Moisture indicator
- Relief valve
- Temperature sensor abnormal
- Pressure sensor abnormal
- Surge protection valve

Basic display items

- Chilled water inlet & outlet temperatures(°C)
- Cooling water inlet & outlet temperatures(°C)
- Compressor discharge temperature(°C)
- Operating Frequency(Hz)
- DC Link Voltage(Vdc)
- VSD input current(A)
- VSD output current(A)
- VSD temp(°C)
- Motor windings(R.S.T) temperatures(°C)
- Evaporator pressure(kg/cm²)
- Condenser pressure(kg/cm²)
- Amperes(A)
- Remote setting temperature(°C)
- Evaporator temperature(°C)
- Condenser temperature(°C)
- Hot-gas valve output(%)
- PID output(%)
- Pump interlock(On/Off)
- Flow Contact(On/Off)
- DGR Valve(%)

Variable speed driver

- VSD Controller : VSD Panel Control(Communication/Motor Speed Control)
- DC Reactor : Built-in Harmonic Filter
- UPS : Power supply to magnetic bearing and work as a back up battery
- Rectifier Power Module : AC To DC Converter, DC power conversion for inverter variable frequency control
- DC Link Capacitor : Stable supply of DC converted power to inverter power module
- Inverter Power Module : Motor rotation frequency control

Magnetic bearing controller

- Levitation control : Controls levitation based on operation load UPS maintains stable levitation control even at power outage situation.

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 the chiller starts, stops 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 during the absence of the operator.

Soft loading

At the start-up, the vane opening is controlled with gradual slow- open to prevent surge, 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.

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.

Surge avoidance function

While the chiller operates in the site, it learns the surge operation area by itself and updates the logic in real time to provide the optimum operation for the site.

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 inlet nozzle	Chilled water inlet 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/cm ²	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/cm ²	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	Inverter Overcurrent	VSD	Current sensor	Stop the chiller if rated current is above 140% to protect the compressor	3
8	DC-Link Low Voltage/Over Voltage	VSD	Voltage sensor	Stop the chiller if rated voltage is below 70% or above 140% to protect the inverter	1
9	Inverter Heat Sink(High Temp.)	VSD	Heat sink temperature sensor	Stop the chiller if temperature is above 65 °C to protect the inverter	3
10	M,I,T Bearing Trajectory Error	MBC	M,I,T Bearing gap sensor	Stop the chiller if bearing trajectory is maintained at back up clearance of 50% to protect the compressor	3
11	M,I,T Bearing Temperature (High Temp.)	MBC	M,I,T Bearing temperature sensor	Stop the chiller if bearing temperature is maintained at 95 °C for bearing stability	3
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 loss head 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 loss head 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 standard. 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	Inlet guide vane / Hot gas bypass valve	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 of condenser goes to evaporator and makes certain chiller load to prevent surge and to prevent frequent startup stop of the chiller.	1

Oil-free Magnetic chiller standard summary

Items			Standard	Option		
Compressor	Power Supply		<input type="checkbox"/> 380~460V			
	Hotgas by Pass		<input type="checkbox"/> Standard			
Control Panel	Communication		<input type="checkbox"/> Modbus	<input type="checkbox"/> BACnet	<input type="checkbox"/> TCP/IP	<input type="checkbox"/> etc()
	International Protection		<input type="checkbox"/> IP41	<input type="checkbox"/> IP54		
	Momentary Power Loss Compensation		<input type="checkbox"/> N/A	<input type="checkbox"/> Yes		
Factory Wiring			<input type="checkbox"/> Duct & Flexible	<input type="checkbox"/> Open Wiring		
Starter Panel	*Power Supply		<input type="checkbox"/> 380V	<input type="checkbox"/> 400	<input type="checkbox"/> 415	<input type="checkbox"/> 440 <input type="checkbox"/> 460 <input type="checkbox"/> 480 <input type="checkbox"/> etc()
	Hertz		<input type="checkbox"/> 50Hz	<input type="checkbox"/> 60Hz		
	Circuit Breaker	Low V(380V/440V)	<input type="checkbox"/> MCCB	<input type="checkbox"/> ACB		
	Power Access		<input type="checkbox"/> From the Top	<input type="checkbox"/> From the Side of Bottom		
	Integrating Watt-meter		<input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> etc()		
	Harmonic Filter		<input type="checkbox"/> N/A	<input type="checkbox"/> Passive Filter <input type="checkbox"/> Active Filter		
EVAP.	*Waterbox Type		<input type="checkbox"/> NIH(Rectangle)	<input type="checkbox"/> NIH(Circle) <input type="checkbox"/> Marine <input type="checkbox"/> Marine + hinged		
	*Waterbox Pressure		<input type="checkbox"/> 150 psig(10kg/cm ²)	<input type="checkbox"/> 230psig(16kg/cm ²) <input type="checkbox"/> 300psig(20kg/cm ²) <input type="checkbox"/> etc()		
	Waterbox Coating		<input type="checkbox"/> Standard	<input type="checkbox"/> Epoxy Coating <input type="checkbox"/> etc()		
	*Nozzle Arrangement(Inlet)		<input type="checkbox"/> Motor End	<input type="checkbox"/> Compressor End		
	*Nozzle Arrangement(Outlet)		<input type="checkbox"/> Motor End	<input type="checkbox"/> Compressor End		
	Nozzle Type		<input type="checkbox"/> ANSI-Flange	<input type="checkbox"/> ANSI-Victaulic(AGS) <input type="checkbox"/> ANSI-Victaulic(OGS) <input type="checkbox"/> etc()		
	Safety Valve type(Ref.)		<input type="checkbox"/> Relief V/V(Single)	<input type="checkbox"/> Relief V/V(Dual)		
COND.	*Waterbox Type		<input type="checkbox"/> NIH-Rectangle	<input type="checkbox"/> NIH-Circle <input type="checkbox"/> Marine <input type="checkbox"/> Marine + Hinged		
	*Waterbox Pressure		<input type="checkbox"/> 150 psig(10kg/cm ²)	<input type="checkbox"/> 230psig(16kg/cm ²) <input type="checkbox"/> 300psig(20kg/cm ²) <input type="checkbox"/> etc()		
	Waterbox Coating		<input type="checkbox"/> Standard	<input type="checkbox"/> Epoxy Coating <input type="checkbox"/> etc()		
	*Nozzle Arrangement(inlet)		<input type="checkbox"/> Motor End	<input type="checkbox"/> Compressor End		
	*Nozzle Arrangement(outlet)		<input type="checkbox"/> Motor End	<input type="checkbox"/> Compressor End		
	Nozzle Type		<input type="checkbox"/> ANSI-Flange	<input type="checkbox"/> ANSI-Victaulic(AGS) <input type="checkbox"/> ANSI-Victaulic(OGS) <input type="checkbox"/> etc()		
	Safety Valve Type(Ref.)		<input type="checkbox"/> Relief V/V(Single)	<input type="checkbox"/> Relief V/V(Dual)		
*Refrigerant R134a Charge			<input type="checkbox"/> Separated Shipping	<input type="checkbox"/> Customer supplied <input type="checkbox"/> Factory Charged		
Welding Method			<input type="checkbox"/> Standard	<input type="checkbox"/> etc()		
Packing			<input type="checkbox"/> Shrink film	<input type="checkbox"/> Wooden Packing		
Insulation			<input type="checkbox"/> N/A	<input type="checkbox"/> 19mm <input type="checkbox"/> 38mm <input type="checkbox"/> etc()		
Sound Attenuator			<input type="checkbox"/> N/A	<input type="checkbox"/> Discharge Only <input type="checkbox"/> Condenser + Discharge		
Isolation			<input type="checkbox"/> Neoprene PAD	<input type="checkbox"/> Spring 1inch <input type="checkbox"/> Spring 2 inch		
Anchor Bolt for Foundation			<input type="checkbox"/> N/A	<input type="checkbox"/> Yes(Set-Anchor) <input type="checkbox"/> Yes(L-TYPE(M20*250L))		
Level Sensor (2stage, Economizer)			<input type="checkbox"/> N/A	<input type="checkbox"/> Yes		
Counter Pipe Flange			<input type="checkbox"/> N/A	<input type="checkbox"/> Yes		
*Certification			<input type="checkbox"/> Standard(KGS)	<input type="checkbox"/> ASME VIII Only <input type="checkbox"/> CE(PED) <input type="checkbox"/> PED <input type="checkbox"/> (C)UL(ETL) <input type="checkbox"/> GB		
Factory Performance Test & Process Inspection			<input type="checkbox"/> N/A	<input type="checkbox"/> Report Only <input type="checkbox"/> Customer Witness <input type="checkbox"/> Process Inspection		
Partial Load Test			<input type="checkbox"/> N/A	<input type="checkbox"/> 75% <input type="checkbox"/> 50% <input type="checkbox"/> 25%		
Operating Training			<input type="checkbox"/> N/A	<input type="checkbox"/> Yes		
Warranty-Compressor			<input type="checkbox"/> 1yr	<input type="checkbox"/> etc()		
Warranty-Ass'y			<input type="checkbox"/> 1yr	<input type="checkbox"/> etc()		
Labor Warranty			<input type="checkbox"/> N/A	<input type="checkbox"/> etc()		
Standard Specification			1) Starter Panel(Supplied by Factory) - Starter Type : Inverter(VSD), Power Access : Unit Mounted, International Protection : IP4X, Door Type : 1Door			
			2) Control Panel Controller : Micom, Communication : Modbus, Display : 15 inch			
			3) Color : Dawn Gray (Starter /Control Panel : Warm Gray)			
			4) Standard Provide Internal Inspection Lamp and Emergency Stop Switch			
			5) Flow Proof Type : DP Switch (Evaporator, Condenser)			
			6) Motor Winding Temperature Sensor : Single			

RCWFL Series

Model		Units	RCWFLAL	RCWFLAM	RCWFLAN	RCWFLAP	RCWFLBM	RCWFLBN	RCWFLBP	RCWFLCM	RCWFLCN	RCWFLCP
Cooling Capacity		usRT	200	250	275	300	400	450	500	550	600	700
		kW	703.4	879.2	967.1	1055.1	1406.7	1582.6	1758.4	1934.3	2110.1	2461.8
Weight	Shipping	kg	5,800	5,900	6,000	6,000	7,400	7,500	7,600	9,500	10,000	10,600
	Operating	kg	6,400	6,600	6,800	6,800	8,700	8,800	8,900	10,900	11,500	12,300
Compressor	Type	-	MAGNETIC BEARING									
	No.	EA	1 Compressor									
Motor Power		kW	234	234	234	234	390	390	390	543	543	543
Power Supply		Ph / V / Hz	3 / 380~460V / 50(60) Hz									
Evaporator	Nozzle Connection	A	150	150	150	150	200	200	200	200	250	250
	Flow Rate	m ³ /h	110	137	151	165	220	247	275	302	330	385
	Pressure Drop	mH ₂ O	3.51	3.53	3.53	3.54	3.42	3.42	3.53	2.97	3.53	4.07
	Pass Number	EA	2	2	2	2	2	2	2	2	2	2
Condenser	Nozzle Connection	A	150	150	150	150	200	200	200	200	250	250
	Flow Rate	m ³ /h	136	169	186	203	269	303	336	370	403	470
	Pressure Drop	mH ₂ O	4.83	4.84	4.84	4.86	3.83	3.83	4.96	4.03	3.68	4.98
	Pass Number	EA	2	2	2	2	2	2	2	2	2	2
Dimension	Length	mm	3,506	3,506	3,506	3,506	3,506	3,506	3,506	3,506	3,506	3,506
	Width	mm	2,576	2,576	2,576	2,576	2,592	2,592	2,592	3,029	3,029	3,029
	Height	mm	1,981	1,981	1,981	1,981	2,042	2,042	2,042	2,530	2,530	2,530

Note:
1. 1 usRT = 3,024 kcal / hr = 3.517 kW, 1mH2O = 9.8 kPa
2. Fouling factor of water in condenser is 0.0440 m² · °C / kW, in evaporator is 0.018 m² · °C / kW
3. Cooling water temperature outlet is 34.61 °C, inlet is 29.44 °C
Chilled water temperature outlet is 6.67 °C, inlet is 12.22 °C
4. Due to our policy of innovation some specifications may be changed without prior notification.
5. All data in this table is rated in accordance with AHRI Standard 550 / 590.

RCWFL Series

Model		Units	RCWFOLDM	RCWFOLDN	RCWFOLDP	RCWFOLDP	RCWFLAW	RCWFBLBW	RCWFCLCW	RCWFOLDW	RCWFOLDX
Cooling Capacity		usRT	800	900	1,000	1,100	600	1,000	1,400	2,000	2,200
		kW	2813.5	3165.2	3516.9	3867.9	2109.8	3516.3	4922.8	7032.6	7735.8
Weight	Shipping	kg	12,400	13,900	14,200	11,514	11,900	14,100	19,600	30,300	31,000
	Operating	kg	14,500	16,300	16,700	13,723	13,200	17,400	23,100	35,400	36,000
Compressor	Type	-	MAGNETIC BEARING								
	No.	EA	1 Compressor				2 Compressor				
Motor Power		kW	775	775	775	775	234*2	390*2	543*2	775*2	775*2
Power Supply		Ph / V / Hz	3 / 380-460V / 50(60) Hz								
Evaporator	Nozzle Connection	A	250	300	300	300	250	300	350	450	450
	Flow Rate	m ³ /h	440	495	550	605	330	550	770	1,100	1,210
	Pressure Drop	mH ₂ O	4.95	5.60	6.13	7.40	6.46	12.01	11.64	5.81	6.22
	Pass Number	EA	2	2	2	2	2	2	2	1	1
Condenser	Nozzle Connection	A	250	300	300	300	250	300	350	450	450
	Flow Rate	m ³ /h	537	603	668	738	406	674	939	1,341	1,482
	Pressure Drop	mH ₂ O	3.60	6.50	7.96	8.10	11.04	12.07	14.49	7.62	7.34
	Pass Number	EA	2	2	2	2	2	2	2	1	1
Dimension	Length	mm	4,156	4,156	4,156	4,150	4,986	5,500	5,981	7,306	7,306
	Width	mm	3,550	3,550	3,550	3,550	2,576	2,592	3,320	3,249	3,249
	Height	mm	3,377	3,377	3,377	3,377	1,981	2,042	2,796	2,970	2,970

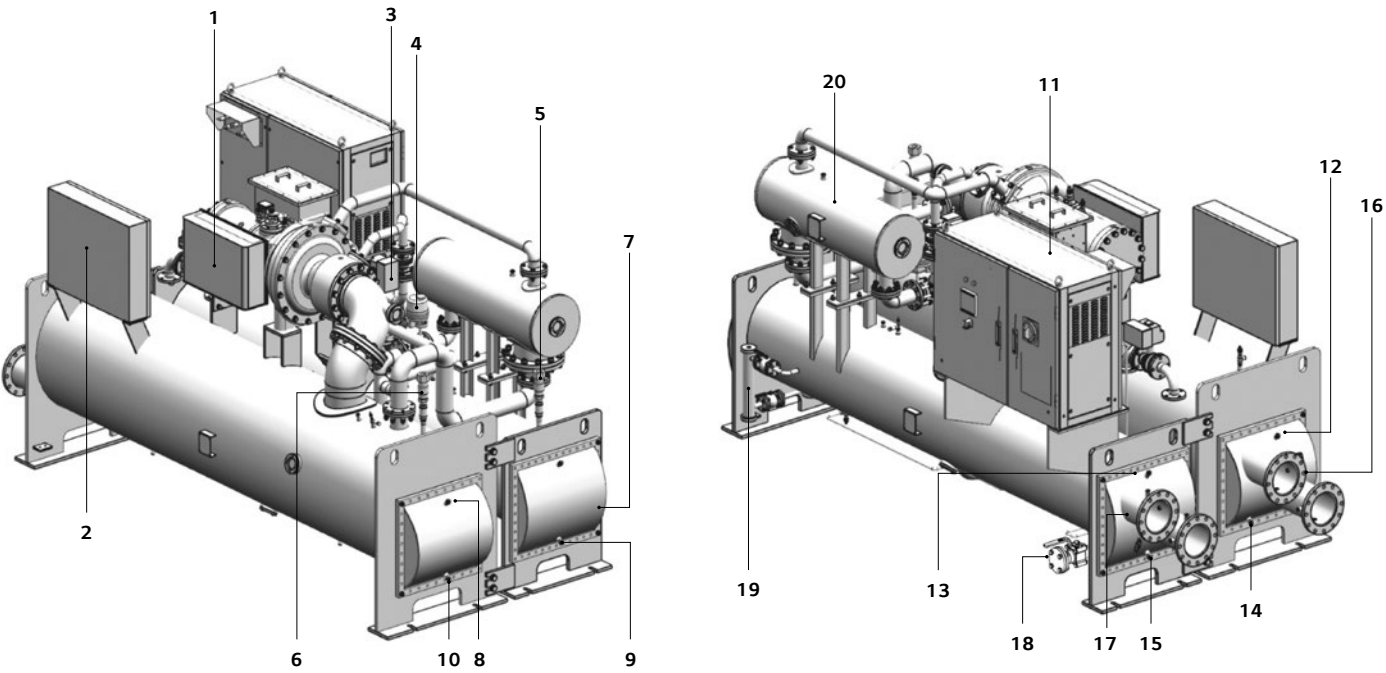
Note:
1. 1 usRT = 3,024 kcal / hr = 3.517 kW, 1mH2O = 9.8 kPa
2. Fouling factor of water in condenser is 0.0440 m²·°C / kW, in evaporator is 0.018 m²·°C / kW
3. Cooling water temperature outlet is 34.61 °C, inlet is 29.44 °C
Chilled water temperature outlet is 6.67 °C, inlet is 12.22 °C
4. Due to our policy of innovation some specifications may be changed without prior notification.
5. All data in this table is rated in accordance with AHRI Standard 550 / 590.

VSD Starter data

Model		250kW	350kW	500kW	750kW
Max. Output Power(kw)		250	350	500	750
Efficiency(%)		96.5	96.5	96.5	96.5
Frequency(Max)		330	260	220	180
Dimension	Length(mm)	1,250	1,250	1,580	1,580
	Height(mm)	850	850	910	910
	Width(mm)	550	550	1,087	1,087
Operation Ambient Temperature(°C)		40			
Remark		Humidity, 95% non-condensing			

* For continual product development, LG reserves the right to change specifications or designs without notice.

Machine outline



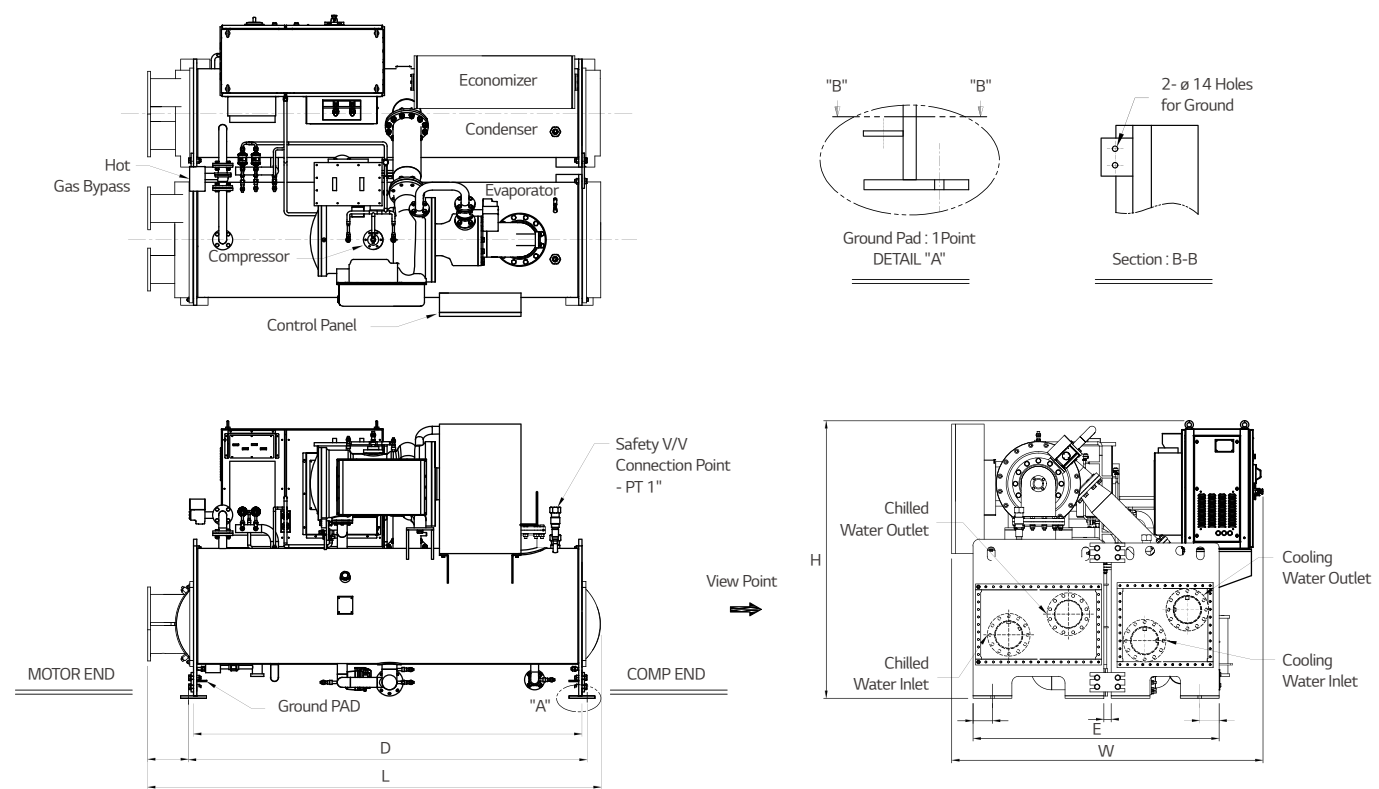
Front view

- 1. MBC(Magnetic Bearing Controller)
- 2. Control Panel
- 3. DGR(Discharge Gas Recirculation) valve
- 4. Condenser level control valve
- 5. Condenser safety valve
- 6. Evaporator safety valve
- 7. Air vent(Cooling water)
- 8. Air vent(Chilled water)
- 9. Drain(Cooling water)
- 10. Drain(Chilled water)

Rear view

- 11. Inverter(Variable Speed Driver)
- 12. Air vent(Chilled water)
- 13. Air vent(Cooling water)
- 14. Drain(Chilled water)
- 15. Drain(Cooling water)
- 16. Water box(Chilled water)
- 17. Water box(Cooling water)
- 18. Flange for vacuum(For service)
- 19. Condenser level sensor
- 20. Economizer

1 Compressor



Unit : mm

Model		Dimension					Nozzle Connection (A)	
		L	W	H	D	E	Evaporator	Condenser
		2 pass					2 pass	2 pass
RCWFL	AL-AP	3,506	2,550	1,950	3,080	1,620	150	150
	BM-BP	3,506	2,404	2,143	3,080	1,900	200	200
	CM-CP	3,506	2,882	2,445	3,080	2,070	200~250	200~250
	DM-DP	4,156	3,390	2,995	3,730	2,610	250~300	250~300

Note:

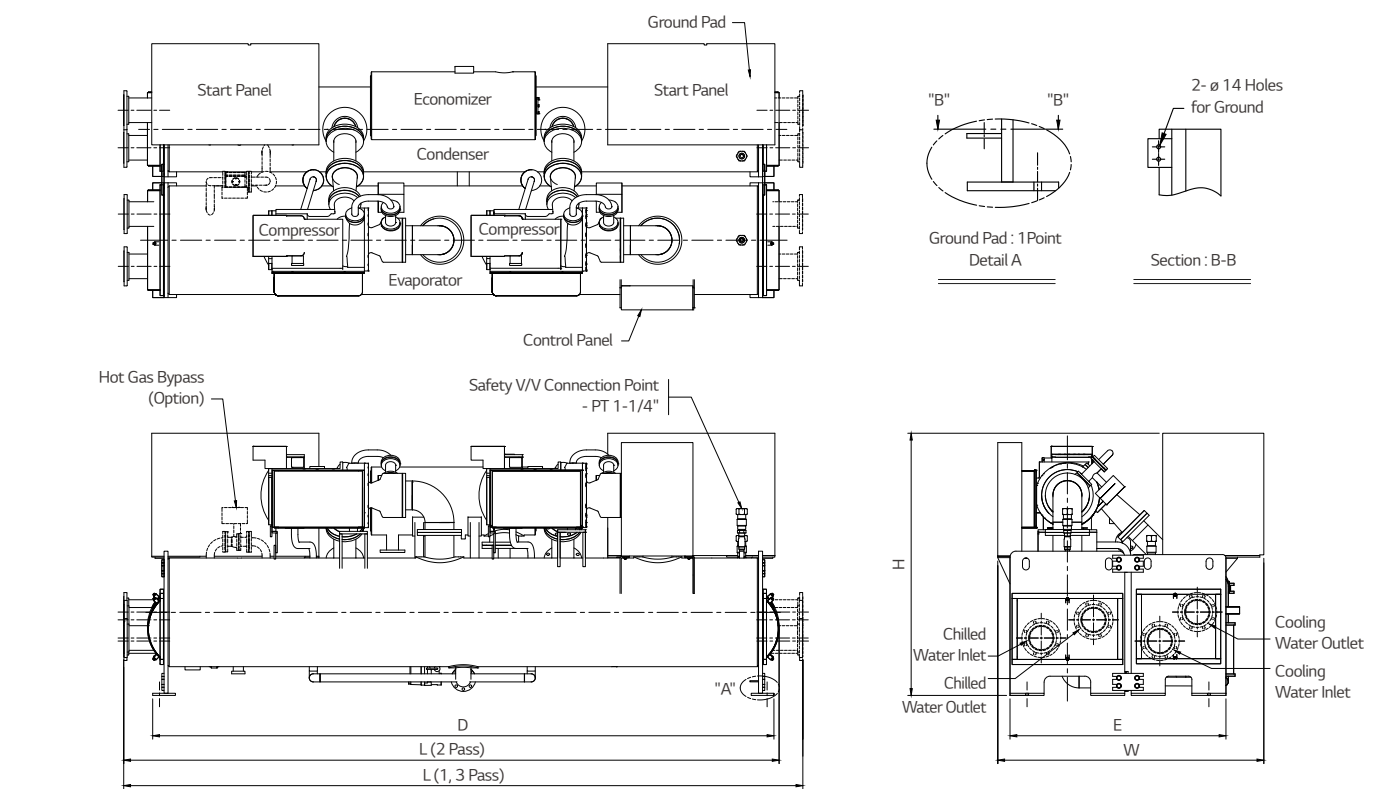
1. The height is measured from the bottom of the heat exchanger.
This value does not include the height of the foundation and the vibration-absorbing pedestal.

2. All of the chilled water and cooling water connection flanges are of ANSI 150lb.

3. The water pipe facility shall be designed to prevent external force to the chiller.

4. All specifications are subject to change without notice.

2 Compressor



Unit : mm

Model		Dimension						Nozzle Connection (A)	
		L		W	H	D	E	Evaporator	Condenser
		2 pass	1, 3 Pass					2 pass	2 pass
RCWFL	AR-AW	3,506	5,170	2,660	2,350	4,680	1,620	250	250
	BT-BW	3,506	5,180	2,810	2,480	4,680	1,900	300	300
	CT-CW	3,506	5,700	3,180	2,750	5,200	2,070	350	350
	DT-DS	4,156	7,400	3,280	3,570	6,700	2,610	450	450

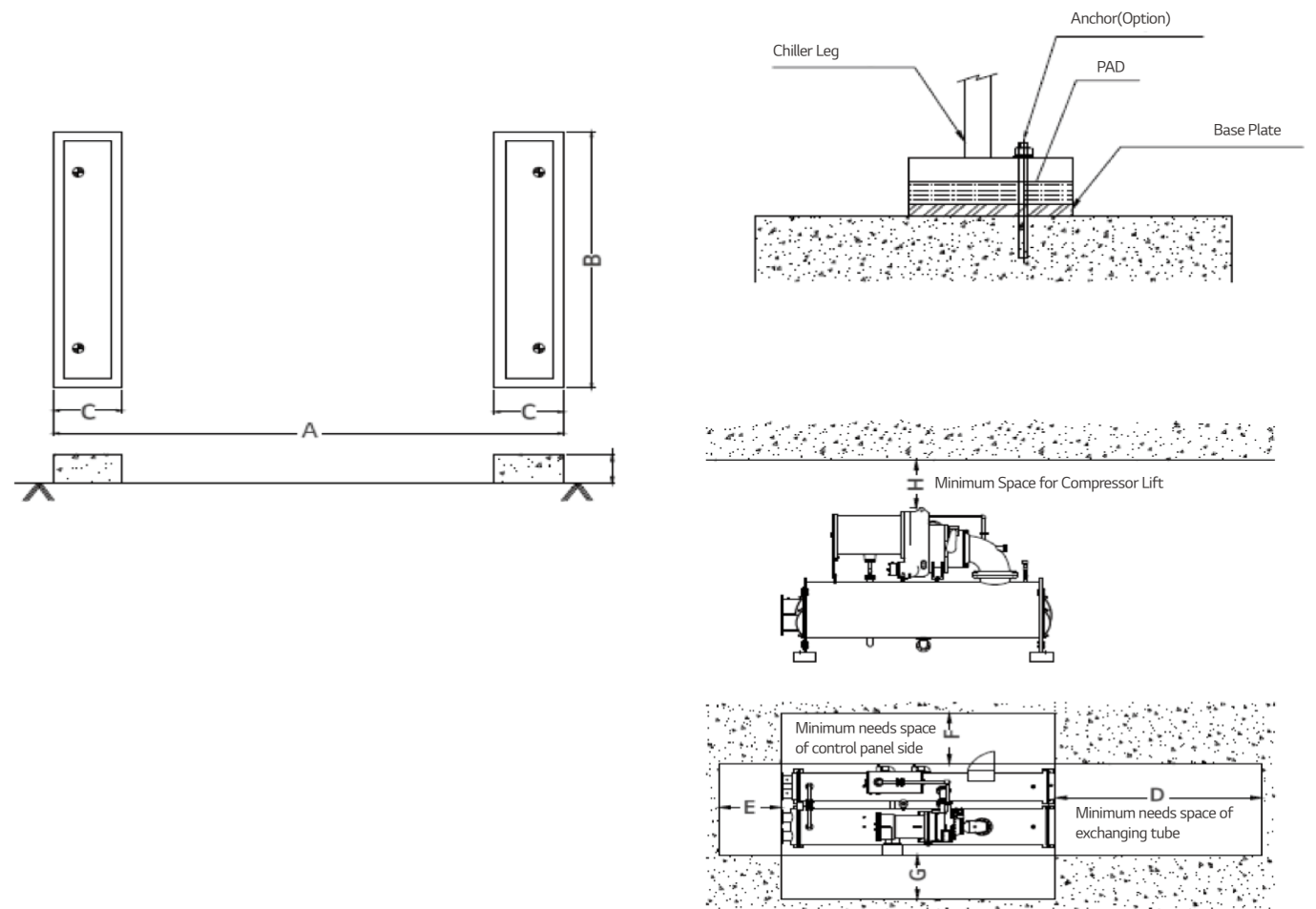
Note:

1. The height is measured from the bottom of the heat exchanger.
This value does not include the height of the foundation and the vibration-absorbing pedestal.

2. All of the chilled water and cooling water connection flanges are of ANSI 150lb.

3. The water pipe facility shall be designed to prevent external force to the chiller.

4. All specifications are subject to change without notice.



Unit : mm

Model		A	B	C	D	E	F	G	H
RCWFL	AL-AP	3,400	1,820	400	3,100	2,000	1,500	1,500	1,500
	BM-BP	3,400	2,100	400	3,100	2,000	1,500	1,500	1,500
	CM-CP	3,400	2,270	400	3,100	2,000	1,500	1,500	1,500
	DM-DP	4,050	2,810	400	3,750	2,000	1,500	1,500	1,500
	Ak	4,880	1,820	400	4,580	2,000	1,500	1,500	1,500
	BK	5,400	2,100	400	5,100	2,000	1,500	1,500	1,500
	CK	6,400	2,270	400	6,100	2,000	1,500	1,500	1,500
	DK-DS	6,950	2,800	400	6,650	2,000	1,500	1,500	1,500

Note:
1. It is possible to differ depend on site condition.

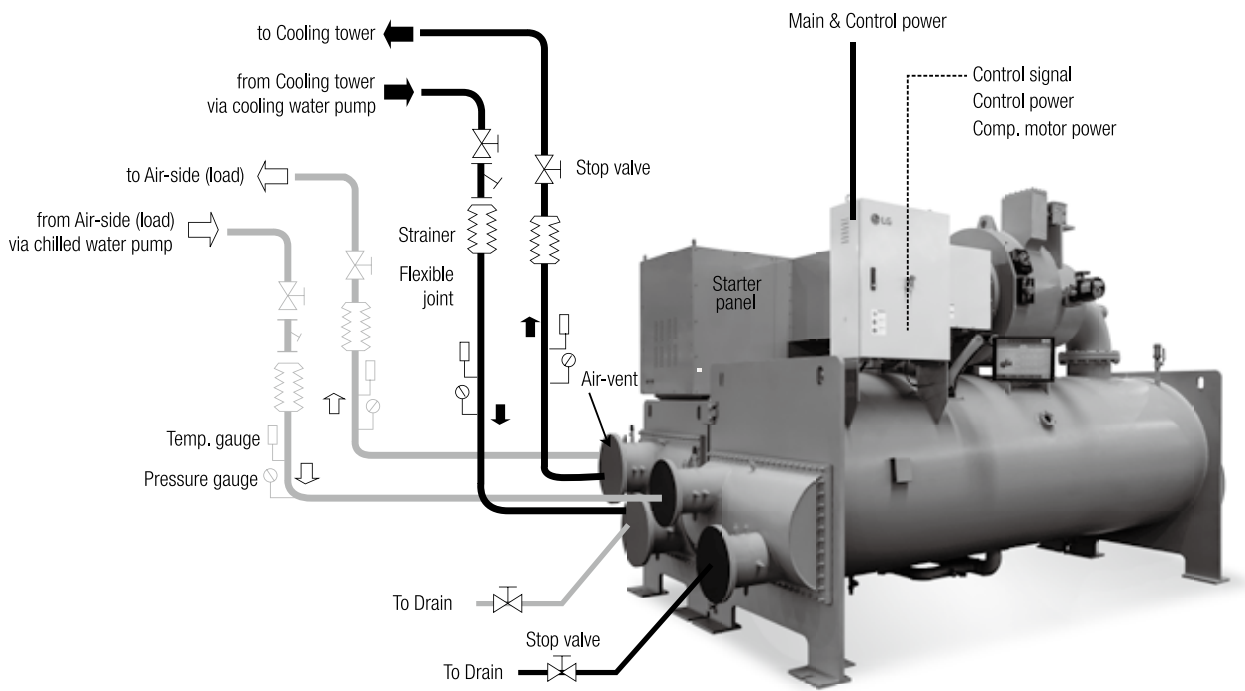
Chilled/cooling water piping

- As a standard, 10 kg/cm² of flange is adopted for evaporator and condenser nozzles.
- The inlet nozzle is located on the lower side and the outlet is positioned on the upper side as a standard.
- All piping should be supported independently in order not to convey any stress and vibration onto the Chiller and have sufficient space for maintenance purpose.
- On each water box of evaporator and condenser, it is requested to install air-vent cock, drain valve and piping as well.
- It is strongly to install strainers on each inlet of evaporator and condenser in order to filter foreign materials. If the foreign materials are flowed into the heat exchanger, there is high possibility of freezing.
- It is recommended to install thermometer, pressure gauge and flow meter to measure the chiller operational condition.

Control of cooling water temperature

As a standard, 10 kg/cm² of standard flange is adopted for evaporator and condenser nozzles. In general, if the atmospheric temperature falls below than design the temperature of condition cooling water from the cooling tower decrease as well. Therefore, for whole-year-operation chillers, it is strongly recommended to control the cooling tower fan according to outlet temperature of cooling tower and adopt by-pass system in parallel. The by-pass system is positioned on the outlet of cooling water and bypass the cooling water through 3-way control valve working at condensation pressure.

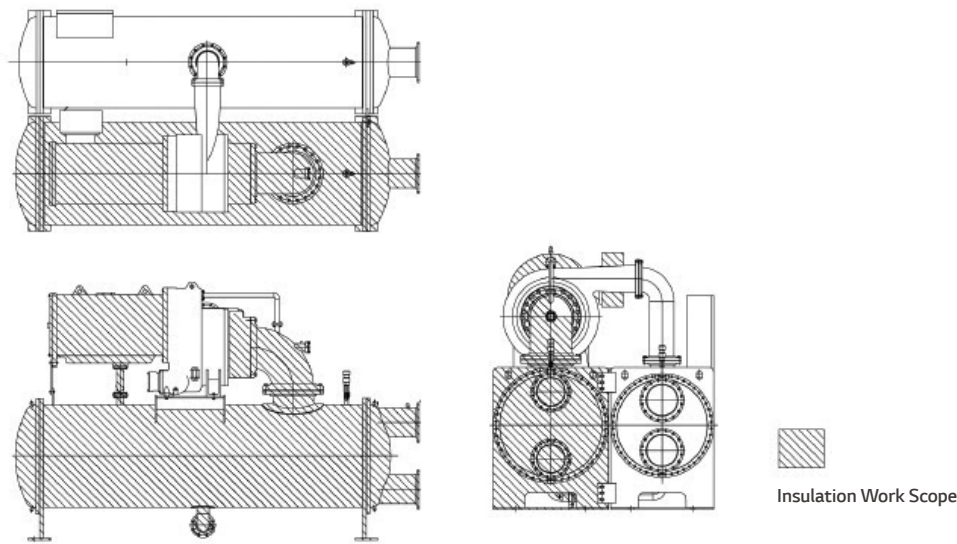
The 3-way control valve can be alternated with 2 units of butterfly valve. The system should maintain min. 14°C of temperature difference between cooling water outlet and chilled water outlet.



Note:
1. Control power - 3Phase/220V/50Hz (60Hz) - should be provided by the customer apart from main power source.
2. The Main power wiring to the starter and 2nd wiring between the chiller and starter must be done based on local regulation. And the work scope is purchaser's.

Insulation material

- Acrylonitrile-Butadiene Rubber (NBR), Black, Thickness : 19mm↑



Insulation work scope

- Compressor Motor, Suction refrigerant pipe, Evaporator, Economizer, Water box, Chilled inlet/outlet nozzle, Low pressure liquid refrigerant pipe, Refrigerant charging pipe and so on.

Caution for insulation work

- 1) Be careful not to cover the operating part (Vane starter, valve, handle etc.) with the insulation material or touch the insulation material.
- 2) Set up the insulation so that the insulation material can be removed at the part where the bolts are tightened in the water box so that the water box can be opened when cleaning the tube of the heat exchanger. Also consider keeping the cover of the water box easy to separate. (Also install the flange for the water pipe so that it is easy to separate.)
- 3) For the part where the compressor and main pipe bolts are located, set up the insulation so that it is easy to remove the insulation material during overhaul or check.
- 4) Be careful not to block the liquid level gauge and window with the insulation material.
- 5) Set up the insulation so that it is easy to separate and replace the temperature sensor etc.
- 6) For the insulation material, use product with thermal conductivity and quality or higher than specified in the specification provided LG Electronics.
- 7) Install the insulation material firmly using adhesive and completely close the gap between insulation material and the insulating part so that air does not go in.
- 8) For the thickness and specification of the insulation material, follow the construction drawing of insulation approved by LG Electronics and the standard design condition is as follows.
 - Dry bulb temperature
 - Relative humidity
- 9) After the insulation, be careful not to expose to excessive sunlight or cause any damage while working. Deformed or damaged part causes dew drops to form and must be reworked.

Guide specification

Oil-Free Magnetic Bearing Centrifugal Chiller
RCWF L Series
(Oil-Free, Magnetic, HFC-134a)

Contents

1. Range of application
2. Special specifications
3. Equipment features
4. Scope of construction
5. Scope of supply
6. The warranty and service
7. General details
8. Caution details

Guide specification

1. Range of application

This specification is applied to all the models of the high efficient two-stage HFC-134a oil-free magnetic bearing centrifugal chillers(RCWFL*) manufactured and supplied by LG Electronics.

2. Special specifications

- 1) Heat exchange efficiency should be improved by applying the oil-free system because of no containing of the oil into the refrigerant.
- 2) It should be a highly efficient product by applying the two-stage compression and two-stage expansion cycle (economizer equipped).
- 3) Because the inverter is applied, when the chiller starts, the peak current by soft starting should be low.
- 4) The capacity control should be controlled using the discharge gas recirculation(DGR) and inverter.
- 5) The chiller manufacturer must possess the production technology of the compressor, the core part. The compressor and heat exchanger should be produced and delivered from in the same manufacturer to guarantee the equipment performance.

3. Equipment features

3.1. System structure

- 1) The high efficiency centrifugal chillers apply the two-stage compression and two-stage expansion cycle and should be designed to operate stably at the partial load condition by applying the DGR in front of the impeller.
- 2) The compressor is applied with motor direct drive system and doesn't need the increasing gear. It should be applied with the magnetic bearing that doesn't need oil supply to lubricate.
- 3) The economizer makes the maintenance convenient with external type.
- 4) By Controlling the refrigerant level of condenser and economizer, so that achieve high efficiency in the full load and partial load condition.

3.2. Performance and quality

- 1) The product should be evaluated complying with the standard of AHRI(Air Conditioning, Heating And Refrigeration Institute) Standard 550-590/551-591, the international authorized certified institute.
- 2) The refrigerant, R-134a, environmental refrigerant with Ozone Depleting Potential(ODP) of zero, shall be applied.
- 3) The pressure vessel should be designed, produced, tested, complying with KGS Code, and certified in related authorized institute. On the top of evaporator and condenser, the safety valve should be installed according to KGS Code.

3.3. Equipment specification

3.3.1. Equipment composition

The Chiller consists of the compressor and motor, evaporator, condenser, economizer, lubrication system, refrigerant control device, capacity control device, refrigerant pipe, control panel, stater panel, safety device, cold insulation & vibration isolator device for insulation and vibration-proof.

The starter panel is supplied by the manufacturer with chiller.

3.3.2. Compressor and motor

- 1) The compressor is a high-efficiency semi-hermetic and centrifugal type for HFC-134a. The impeller is made of high-strength special aluminum alloy. It should have structure that minimizes efficiency loss and easy service.
- 2) The DGR controlling the compressor capacity should be a structure minimizing the flow loss in the suction of impeller.
- 3) The compressor is applied with motor direct drive system and doesn't need the increasing gear. It should be applied with the magnetic bearing that doesn't need oil supply to lubricate.
- 4) The motor shall be liquid refrigerant-cooled type and the outside of the motor should be insulated with anti-humidity insulation to prevent condensation.
- 5) The power specifications of the motor for compressor is 3Ph / 380 V / 60 Hz.
- 6) The motor shaft should be a both-end support structure with high efficiency. Motor winding temperature should be monitored at the control panel in real-time when running by embedding the motor winding temperature sensor.
- 7) The motor winding should have special insulation to keep refrigerant resistance about the HFC-R134a and oil resistance in lubrication.
- 8) By applying a magnetic bearing, lubrication by oil should not be required.
- 9) The magnetic bearings should be prevented from damage by using the UPS(Uninterruptible power supply) as a default specification and by supplying the stable power to the magnetic bearings in case of the power failure.
- 10) In case the UPS breakdown, ball bearings should be installed for auxiliary use.
- 11) At the full load or partial load condition, the number of rotation should be controlled automatically to control the compressor capacity.
- 12) The efficiency of the chiller should be improved by applying a two-stage cycle that is inflowing refrigerant from the economizer outlet to the two-stage compressor inlet.
- 13) The shaft vibration level should always be checked on the control panel in real time so that the customer can directly check the integrity of the compressor.
- 14) Magnetic bearing controller has separate storage devices so critical phenomena that occurs during compressor trip or abnormal operation can be checked later and swift action would follow.

3.3.3. Evaporator, condenser and economizer

- 1) The evaporator and condenser should be applied with the structure of the shell & tube type and high-efficiency heat-transfer tubes. The heat-transfer tubes shall be combined with mechanical expansion on the tube sheet so that it can be replaced for service. The tube sheet holes for the assemble of heat-transfer tubes should secure the long-term safety of leakage.
- 2) In the evaporator, a distribution plate with perforated sheet type should be installed at the liquid refrigerant inlet so that the refrigerant distribution can be uniformly supplied.
- 3) The condenser should have an anti-collision plate installed at the gas inlet, and the anti-collision plate must have a structure that allows noise reduction and stable diffusion of flow paths.
- 4) The heat-transfer tubes shall be machined to improve heat transfer performance inside and outside the tube and parts in contact with tube sheets and tube support plates shall not be machined.
- 5) The pressure vessel should be designed, produced, tested, complying with KGS Code, and certified in related authorized institute. On the top of evaporator and condenser, the safety valve should be installed according to KGS Code.
- 6) The design pressure on the chilled water side of the evaporator is 10k g/cm²(150 psig).
- 7) The design pressure on the chilled water side of the condenser is 10k g/cm²(150 psig).
- 8) It should be a structure available for air vent on top of the water box and drain at the bottom of the water box.
- 9) The economizer is the external type and able to manage the service and operation state. It is manufactured with structure that has the function of separating the liquid and gaseous phases inside.
- 10) The water box of the evaporator applies the Head (Rectangle) type.
- 11) The chilled water inlet nozzle of the evaporator is installed in the direction of the compressor motor side.
- 12) The water box of the condenser applies the Head (Rectangle) type.
- 13) The cooling water inlet nozzle of the condenser is installed in the direction of the compressor motor side.

3.3.4. Refrigerant level and flow control device

- 1) The level detecting sensor should be attached to maintain the optimal cycle on the condenser and economizer at the full load or partial load. By controlling two automation valves for controlling the refrigerant flow rate installed in the liquid refrigerant pipe, the optimal refrigerant level in each cycle should be maintained. The refrigerant level control sensor installed in the condenser and economiser should make it possible without extracting refrigerant in case of inspection because the isolation valves are installed to make the service and maintenance easy.

3.3.5. Control panel

- 1) The composition of the control panel
 - The control panel should compose the micom module(main module, input/output module, display and operation key, or touchpad module), power supply system to supply the stable power, breaker to perform the other control or secure the safety, electromagnetic contactor, and control relay.
 - The protection grade of the control panel is IP41.
- 2) Main module
 - The control feature optimized to the mechanical device by applying the high-performance microprocessor shall be implemented. The high resolution A/D convertor(Analogue /Digital) shall be applied to display on screen or control by measuring each kind of temperature sensor value in real time. Also, it makes the customer's building automation ease response because the RS-485 communication port to support the customer's remote monitoring control is embedded in a standard.
- 3) Display and touchpad module
 - The display and touchpad module is composed of ① the display part to display the various kinds operation data, setting value important for equipment operation and the abnormal data with the letter, ② the touch input part to input the various kinds data and select the menu, ③ the display part to display equipment run/stop state important for equipment run, compressor run, chilled water/cooling water flow, abnormal occur state, refrigerant valve manual selection states with the letter. Especially as for the operational function to use often by the operator when equipment is operating, it should be improved operator's convenience by operating with direct touch and other operation by choosing the menu. Especially, the operator's convenience should be improved by allowing the operator to directly touch and control the frequently used control functions while the equipment is operating, and for other function to control by selecting the menu.
 - The touchpad should offer the operation and monitoring convenience by composing the letter display part and menu choosing button on display. Also, the display part should display by choosing the operating state such as inlet/outlet temperature of chilled/cooling water, compressor discharge temperature, motor bearing temperature, condenser and evaporator pressure, operating current, refrigerant valve opening rate into Korean, Chinese, English.
- 4) Input/output module
 - The input/output module should be composed of the digital input part to check the operation state of various kinds of switches and the digital output to control the equipment operation. Also, the input/output port has a photo coupler blocking each kind of noise. Since all data is transmitted and received with the main module through communication, it secures high reliability by preventing the malfunction caused by electromagnetic wave to happen

when transmitting and receiving the data of general cable.

3.3.6. The feature of control function

- 1) Convenient operation data management
 - The controller makes any operation information check on one screen simultaneously by applying the big graphic liquid crystal display(15 inches). In addition, It also makes analog data(ex: temperature data) saved in every 5 second up to one year times and operation/error history(ex: run, stop) saved until 300 times are used when recording operation reports and maintaining the management. In addition, the trend identification of temperature and operation current change by marking the graphical information such as chilled water outlet temperature and operation current of the compressor motor should be easy. This graph should be checked in real time, and possible to call and check the saved operation data on a daily basis.
- 2) Self-diagnosis and save of abnormality history
 - Micom monitors the chiller state during chiller stop or running, makes notice to operator using a text, alarm lamp, buzzer, makes auto-saving of failure data and occurring time which can be utilized in repairing conveniently. Especially, the types of failures are classified into minor failure and major failure, and when a minor failure occurs, the contents of the minor failure are displayed in text and the operation continues to minimize unnecessary chiller stop.
- 3) It should be control the chiller by applying the optimized AI control algorism as follow.
 - a. Soft start
 - The inverter frequency should be controlled slowly to prevent machinery shock such as surging caused by sudden increase in load when the chiller is starting.
 - b. Digital PID control
 - When starting or changing the operating mode from manual to automation, by perceiving the optimized PID control point automatically and reflecting it in the control equation, the digital PID control that combined with soft start makes unnecessary machinery stop minimize and makes more stable and precised temperature control.
 - c. Preventive operation
 - By measuring each part temperature and pressure during the operation in real-time and performing the primary and secondary preventive operation according to measurement result, It should prevent the chiller stop caused by abnormality such as overload, high pressure of condenser, low pressure of evaporator, surging in advance.
 - d. Scheduled operating function
 - Scheduled operating function is available to choose the operation mode, set temperature, limit of motor current, which makes the convenience on chiller operation by applying the scheduled operating function one time or by day or by time within the selected period. It should be possible to choose the exception day of(reservation

operating)scheduled operating and to register the overlapped schedule on the same day.

e. Service function

- It makes the maintenance convenient by supporting the service function of the below content.
- The automatic sensor setting function that automatically sets each sensor by software.
- The function to display the number of starts and total operation time of the pump and motor attached to the main body.
- The function to send the operation data or abnormal data by email.

4) Strong customer support function

a. Help function

If the breakdown occurs, it makes the operator's convenience by recording failure details, and showing clarification of how to respond if the operator selects the type of failure from the menu.

b. Communication function for building automation and remote monitoring control

It is equipped with the Modbus communication function available to conveniently connected with the customer's monitoring system.

The zero voltage input/output should be provided to run/stop in the remote or to monitor the operating state of the chiller using the simple electric wiring.

5) Indications

All Indications are displayed as text on LCD.

- a. Chiller run / stop
- b. Compressor operation
- c. Inverter normal
- d. Bearing levitation
- e. Chilled water flow normal
- f. Cooling water flow normal
- g. Vane manual
- h. RPM manual

3.3.7. Inverter

- 1) The inverter is a unit mounted type and is equipped on the top of the chiller. It embeds the soft starter, converter, inverter, mainboard, fan, SMPS, communication connection board. It should be connected with the exterior through the power input terminal, motor output terminal, communication connection terminal. It perceives the H/W Fault(abnormal IGBT module part, abnormal sensor) and S/W Fault(Input part, IGBT module part, thyristor module part, abnormal of inverter drive) since self-diagnosis is possible with the embedded Micom. The inverter control should be possible with Modbus 485 communication and contact control.
- 2) H/W Fault
 - a. Perceives the abnormality of IGBT module and sensor.
 - b. IGBT module part abnormal : abnormal current(IGBT module trip stop)

- c. Sensor abnormal : abnormal CT sensor offset, abnormal DC voltage sensing part
- 3) S/W Fault
 - Perceive the abnormality of input part, IGBT module part, thyristor module part, inverter drive.
 - a. Input part: detects the input part current
 - b. IGBT module part :
 - abnormal current(Overcurrent/overload protection control), abnormal temperature(High temperature protection function)
 - c. Thyristor module part : abnormal temperature (High temperature protection function)
 - d. Inverter drive abnormal :
 - abnormal voltage(DC-LINK over voltage / low voltage protection control)
- 4) The starter type of compressor motor is VSD.
- 5) The starter panel is attached and installed to the chiller unit.
- 6) The Starter panel power cable is supplied from the top of panel.
- 7) The harmonic filter has applied the standard(TDDi < 30%).

3.3.8. Safety device

- 1) Chilled Water Low Temperature [temperature sensor at chilled water outlet] _ Protect the evaporator from freeze.
- 2) Evaporator Low Pressure [evaporator pressure sensor] _ Protect evaporator from abnormal low pressure.
- 3) Condenser High Pressure [condenser pressure sensor] _ Protect chiller from abnormal high pressure of condenser.
- 4) Chilled Water Pump Abnormal [interlock with chilled water pump] _ Protect chiller from chilled water pump.
- 5) Cooling Water Pump Abnormal [interlock with cooling water pump] _ Protect chiller from abnormal cooling water pump.
- 6) Chilled Water Flow Rate Abnormal [chilled water differential pressure switch] _ Protect chiller from abnormal chilled water flow rate.
- 7) Cooling Water Flow Rate Abnormal [cooling water differential pressure switch]_ Protect chiller from abnormal cooling water flow rate.
- 8) Surge Abnormal [control panel] _ Protect compressor from surges.
- 9) Motor/inverter overcurrent _ protects chiller when motor/ inverter overcurrent happened.
- 10) Safety Valve [evaporator] _ Discharge refrigerant to protect the chiller in case of the pressure is abnormally high.
- 11) Safety Valve [condenser] _ Discharge refrigerant to protect the chiller in case of the pressure is abnormally high.
- 12) Current Limiting Function [control panel] _ Operation current limited operation, compressor protection / user convenience
- * The temperature of the cooling water shall be adjusted to keep the temperature difference 14°C or higher between the chilled water outlet and the cooling water outlet.

- 3.3.9. Isolator
 - The sandwich-type vibration-proof pad(Material : rubber and cork) for vibration isolator device is supplied.
- 3.3.10. Cold insulation
 - 1) The cold Insulation is excluded from the supply range of the manufacturer(LG Electronics).
- 3.3.11. Start-up commissioning
 - 1) LG engineer or designated engineer for the start-up commissioning shall carry out start-up commissioning and provide the operation training.

4. Scope of construction

Items	Supplied by	Notes
Painting	LG Electronics	Main body : Dawn gray inverter & control panel : Warm gray
Transportation and installation	LG Electronics	Transportation installation of installation place or basis
Leaking test, Insulation test, Put the refrigerant	LG Electronics	The work doing before start-up commissioning at the installation place
External piping	Customer	Mean the external pipe construction such as chilled water, cooling water and drain
Power system wiring (on the first side)	Consumer	Power wiring between customer MCC and inverter
Control system wiring (on the first side)	Consumer	Supplies the 3Ph, 440V / 380V / 220VAC of control power
Grounding	Customer	Grounding wiring construction of ground Pad installed in the main body of the chiller
Power system wiring (on the second side)	Customer	Power and grounding wiring construction between the chiller and inverter
Control system wiring (on the second side)	Customer	Means the control wiring between inverter and control panel
Building and foundation	Customer	Prepare the basis construction for chiller installation before its installation
Chiller horizontality work	LG Electronics	The work at the time of chiller installation
Start-up commissioning and operating guidance	LG Electronics	Conduct 1 time a day (8 hours) (Supply the necessary electricity, chilled water, cooling water)
Interlock wiring work for chilled water, cooling water pump	Customer	Wiring between control panel and pump control panel

5. Scope of supply

Items	Supplied by	Notes
Chiller body	LG Electronics	Refers to the body components
Refrigerant (R-134a)	LG Electronics	Separate delivery
Vibration proof pad	LG Electronics	The pad for vibrational absorption.
The chiller instruction manual	LG Electronics	Installation and operation manual
Horizontal plate	LG Electronics	Parts used to horizontal level of chiller (Provided if request)
Packing	LG Electronics	Shrink film

6. The warranty and service

- 6.1. Standard warranty period is 12 Months from date of commissioning or 18 Months from the date of shipment (STD) from factory whichever comes first. It's valid only if start up & commissioning work is carried out by certified LG Electronics service. Also, warranty shall not apply, if the Products have been subjected to misuse, abuse, negligence, improper installation, improper maintenance, improper transportation, accident, alteration or design change by anyone other than LGE.
- 6.2. Failure, caused by a defect in the parts, material, or operation during the warranty period, will be inspected by LG ELECTRONICS and fixed free of charge if it is agreed that it is defective.
- 6.3. For the following, LG ELECTRONICS don't fix free of charge.
 - 1) If a failure occurs after the product is repaired at the shop that is not designated by LG ELECTRONICS.
 - 2) If the failure is caused by user's mistakes in using and handling the equipment.
 - 3) The monopoly or handover to other places during the warranty period
 - 4) If a failure is caused by a fire or a natural disaster.

7. General details

- 7.1. Before producing the chillers, getting the approval is required by submitting all the details about production to the customer and the production should be implemented after getting a permit in the negotiation with the customer, as for the details not included marked in these specifications.
- 7.2. Before the disposal of the product, if you monopoly or hand it over to others, you should inform LG electronics.

8. Caution details

- 8.1. In case of drain work is progressed after completing the hydraulic pressure test or the circulation test of chilled/ cooling water before the start-up and commissioning of the chiller, the chiller should be kept with opening each drain valve of pipe because the freeze and burst can occur by remaining water under the environmental condition of below 0°C outdoor temperature.(Until filling up the make-up water)