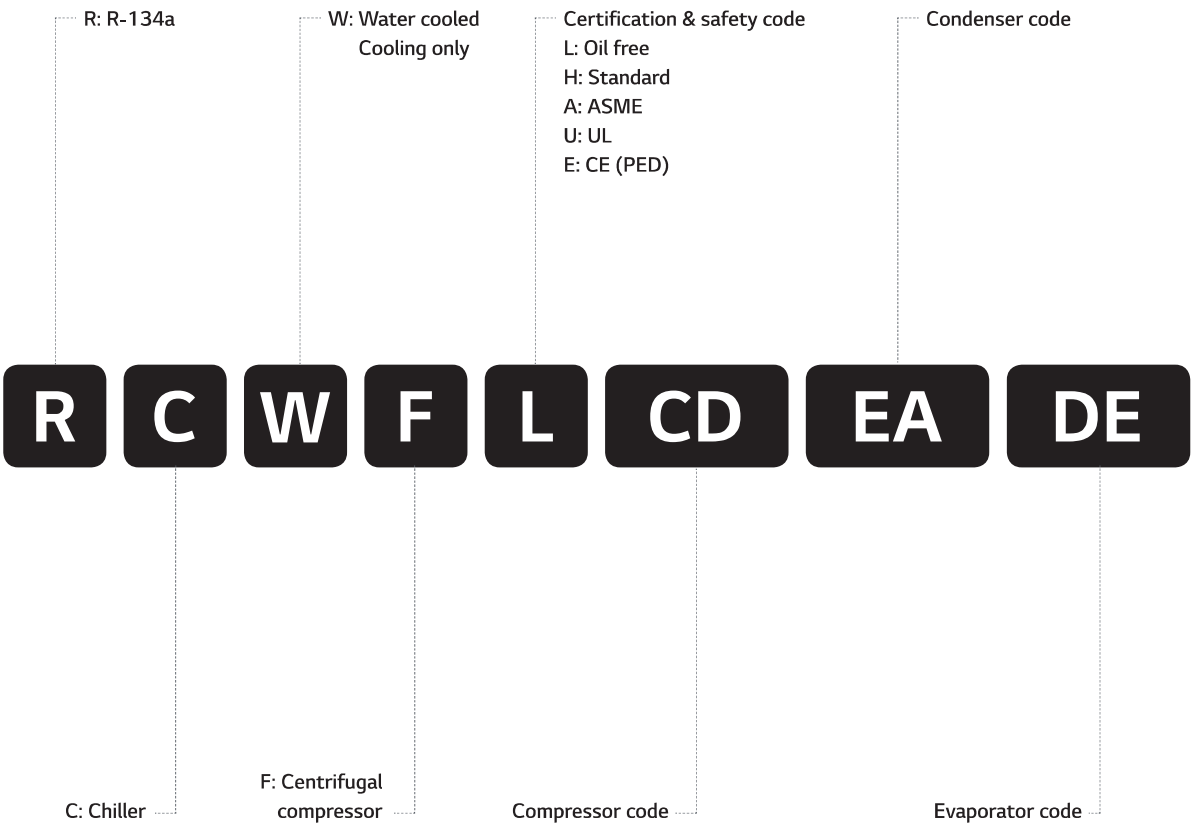
LG Business Solutions

STEKON air technology

LG HVAC SOLUTION

OIL-FREE MAGNETIC VSD CENTRIFUGAL CHILLER

Nomenclature



Contents

Line up

Oil-free VSD centrifugal chiller

Unit: usRT

Model	300	500	1,000	2,000
 Magnetic bearing	1Comp. 260RT – 1,100RT			
		2Comp. 520RT – 2,200RT		

* Please contact us if you want a specification other than the standard model. (Customized product available on request)
* Dual compressor model will be available after 1Q of 2018.

Innovative centrifugal chiller with a proven technology

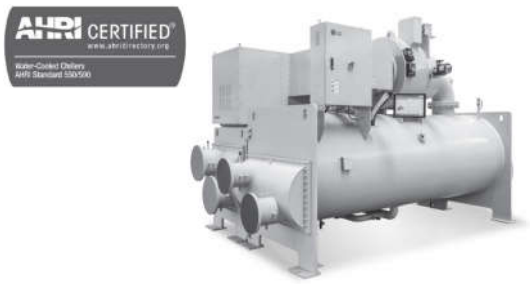
LG has been trying to lead the HVAC industry for customers at the frontline of innovation. LG opens up new horizons of the centrifugal chiller with LG's own active magnetic bearing.

LG RCWFL (magnetic bearing type) chillers provide

- Full load efficiency: 0.50 kW/RT based on AHRI 550/590 condition
- Integrated part load value (IPLV): 0.29 kW/RT
- Chlorine-free HFC-134a refrigerant
- Easy maintenance and low maintenance cost with oil free technology
- High-precision chilled water leaving temperature control within ±0.1°C

World-class

COP 7.0 / IPLV 12.0



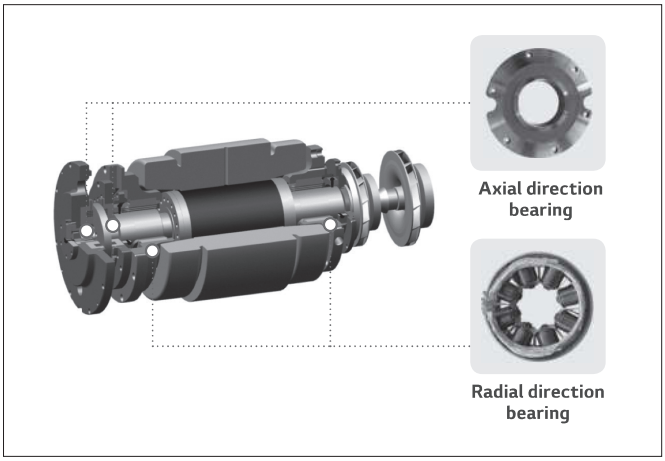
New Solution for saving energy with Oil-free technology

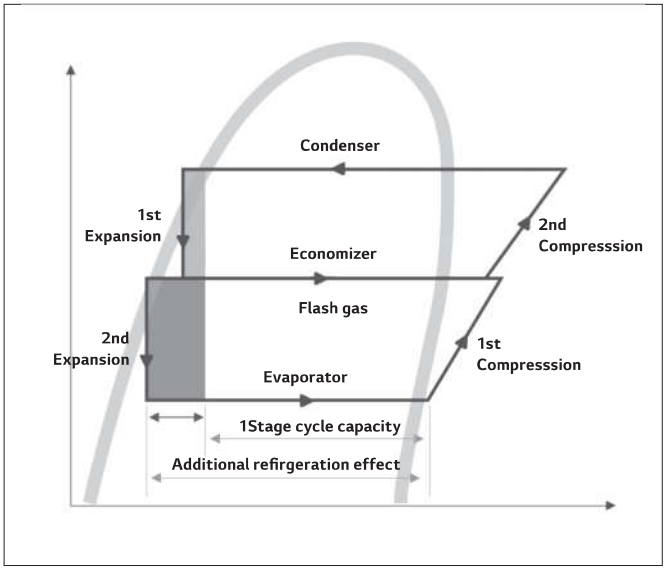
The chiller using a magnetic bearing and high speed direct driven system developed by the technology of LG implements oil free technology.

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) and optional 2nd stage I.G.V are able to secure stable operation range against surge.

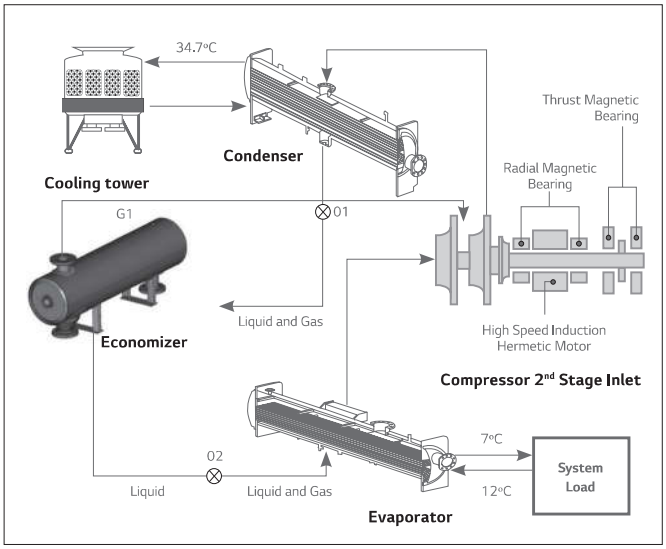
Also, LG RCWFL magnetic bearing compressor are using 2 stage compression cycle with the flash type economizer from the existing LG centrifugal chiller (H Series) line up. The advantage of this cycle is reducing energy consumption of the 1st stage compressor at the both of full and partial load.

Because flashed gas generated from the expansion process began to compress 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.





P-H Diagram for 2 stage compression with economizer



Refrigerant flow of 2 stage compression with economizer

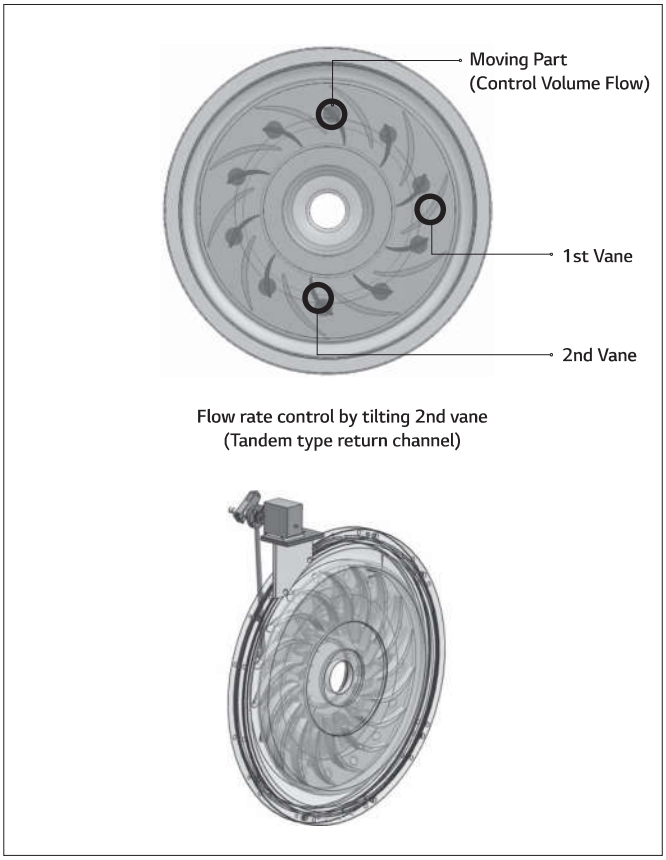
LG RCWFL magnetic bearing chiller are applying variable speed drive (VSD) as starting and capacity control device. Operation with VSD provides energy-efficient capacity adjustment at the partial load. In LG RCWFL magnetic bearing chillers, variable speed control combined with Inlet guide vane (I.G.V) and second IGV 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 decrease at the certain fixed lift or head condition.

In a two-stage compressor, IGV which is located on the 1stage is not affected to the 2nd stage compressor characteristics. LG RCWFL magnetic bearing chiller are applying 2nd IGV to directly adjust the flow angle of 2nd stage impeller inlet for optimizing suction condition and extending part load operation range. The 2nd IGV is located in the return channel of tandem type compressor configuration.

In the LG RCWFL magnetic bearing compressor, 2nd IGV have two types vane and only 2nd vane is movable to control volume flow rate of 2nd stage.

By changing 1st and 2nd vane opening, the performance of each impeller can be optimized and it results to improve chiller efficiency at part load condition.



Flow rate control by tilting 2nd vane
(Tandem type return channel)

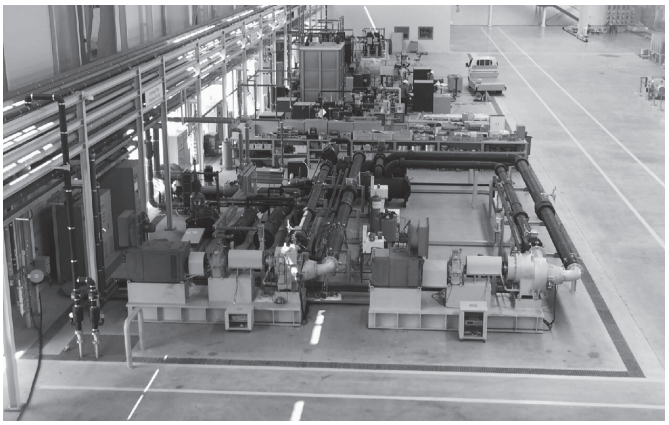
Aerodynamically-contoured impellers which utilize 11 back sweep main blades and 11 splitters are to improve compression efficiency. The blade 3D profiles are designed by using 3 dimensional computational fluid dynamics (CFD) based on database of experimental compressor tests.

It guarantees the aerodynamic reliability and performance at any operational ranges.

Using simple 2D air-foils, the low solidity diffuser is able to increase peak compression efficiency and expand operation range without additional moving parts.

To minimize vibration at the high speed, the impeller took dynamic balancing work. It also guarantees the overall reliability of the impellers by taking 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 was directly or indirectly related with these lubrication system. As removing lubrication system, the reliability of RCWFL magnetic bearing chillers increased.

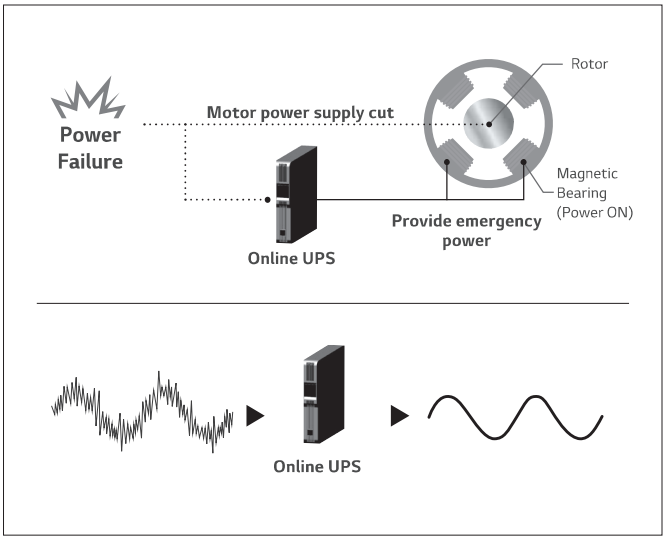
The reliability of core components; aerodynamic parts, heat exchangers, expansion system and main control system have been proven in many practical global sites as form of H-series during more than 5 years.

The compressor is operated by LG VSD to drive motor from zero to high speed rpm (~300 Hz). With built-in AC/DC reactor, LG VSD can achieve low harmonic distortion (THDv<5%) and higher power factor (>0.95).

As integrating proven technology from Texas Instrument and Infineon and LG own VSD technology, LG magnetic chiller guarantees higher reliability. Applied semiconductor processor for bearing control is Global No1 high reliable DSP (digital signal processor). Infineon power device (German technology) was applied as power module and driving circuit.

In case of sudden power failure, applied online UPS is being delivered power to the bearing and control system during maximum 30 min. Since the power is being supplied through UPS, there is no change in input or affected by noise, delivering high quality power.

Built-in AC and 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 calculate shaft balance 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 minimized machine room for returning a valuable extra space

and a cost saving of construction.

Ultra Quite

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 72 dBA, without any sound attenuation option. (Based on 500RT unit, AHRI Condition at 100% load)

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 decrease in part load operation. Efficiency increasing purpose sub cooler is adopted for the subcooling 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.

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. Entering condenser water flows into sub-cooler from cooling tower and then flows through the upper part of condenser tube. This helps to lower the condensing temperature and thus reduce consumption of compressor power.

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.

Isolation valves of refrigerant filter(Options)

Isolation valves allow pump-down of refrigerant. These valves is 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 distributer 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.

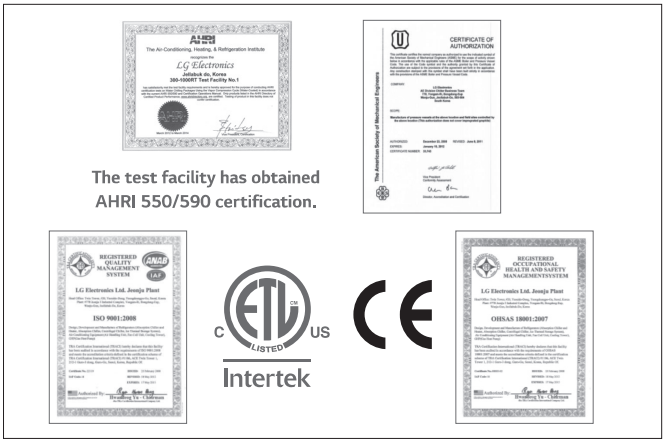
Quality Control

LG's the 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 design by 3-dimensional CAD tool to virtually laid 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 were strictly managed by LG quality policy and KS standards. The documentation of manufacturing, testing and quality assurance procedures were prepared to meet a customer's requirements.

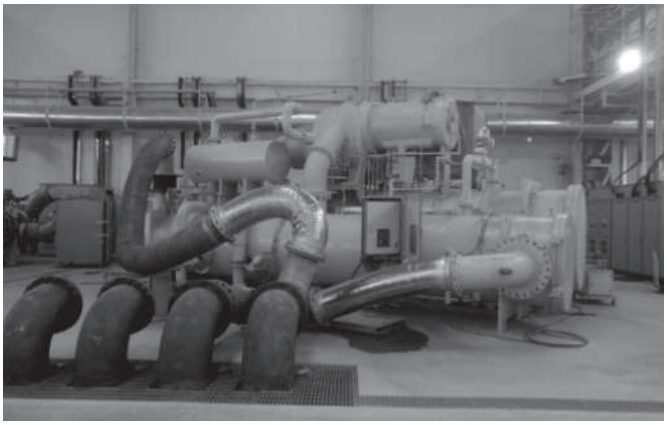
Standards and codes

- AHRI 550/590 - Water chilling packages using the vapor com-pression 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
- GB/T 18430.1 - Water chilling (Heat pump) packages using the vapor compression cycle - Part 1: Water chilling (Heat pump) packages for Industrial & commercial and similar applications.
- GB25131 - Safety requirements for water chillers (Heat pump) using the vapor compression cycle.
- GB150/151 - Steel pressure vessels/tubular heat exchangers.
- 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.



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 enable 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.

Microprocessor-based controls

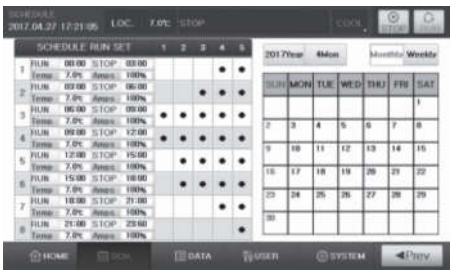
LG's Microprocessor-based controller, LGC-X30 enables the user to monitor and control the chiller with high-class accuracy and confidence. The exclusively designed algorithm allows the optimized operation.

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 Another machine Max 255 units of LG chiller can be linked together and controlled through only 1 protocol converter.

10.2" Touch Panel

Operation data trend



Reserve operation

State of evaporator

State of condenser

State of compressor

Operation history

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 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
- 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 (°C)
- Cooling water inlet & outlet temperatures (°C)
- Compressor discharge temperature (°C)
- Compressor bearing 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/cm^2)
- Condenser pressure (kg/cm^2)
- Amperes (A)
- Voltages (V)
- Watts (kW)
- Chilled water flow (m^3/h)ƒR
- Cooling water flow (m^3/h)ƒR
- Vane openings (%)
- Remote setting temperature (°C)
- Evaporator temperature (°C)
- Condenser temperature (°C)
- Differential pressure of oil (kg/cm^2)
- Hot-gas valve output (%)
- Frequency of cooling tower fan inverter (Hz)
- PID output (%)
- Control output (%)
- Real setting value (°C)
- These items are optional.

User settings

- Chilled outlet temperature (7°C)
- Compressor current limit (100%)
- Guide vane high limit (50%)
- Cooling mode P & I & D (6.8°C, 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°C)
- Cooling tower fan RUN (32.0°C)
- Cooling tower fan STOP (28.0°C)
- Cooling tower fan STEP (1.0°C)
- Cooling tower fan delay (60sec)
- Cooling water inlet temperature (31.0°C)
- Cooling tower fan P & I & D (4.0°C, 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)

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Variable Frequency Driver

- VSD Controller : VSD Panel Control (Communication/Motor Speed Control)
- AC / 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.

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 only activate 30 minutes(expiration of re-start prevention timer) after normal-start or 3 minutes(expiration of starting oil pump circulation timer) after auto-stop in order to protect compressor.

Firstly, the chilled water pump is energized, and then the cooling water pump is energized 5 seconds later. And the chiller will proceed to next sequence only after chilled water and cooling water flows reach the limits. If the chilled water temperature is 2°C less than setting temperature, only the chilled water pump will run.

Once the chiller started, the compressor starts from the soft-loading mode to open the vane slowly in order to prevent rapid increase of power consumption. Then the capacity control follows. When the troubles occur after compressor energized, the compressor stops, and the alarm lamp is on, and the shutdown status is displayed on the touch panel, and also shutdown information is recorded into the 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 vane is brought to the closed position. The oil pump and chilled water pump stop 300 seconds after the compressor stops. 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)

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

increase of power consumption. Then the capacity control follows. When the troubles occur after compressor energized, the compressor stops, and the alarm lamp is on, and the shutdown status is displayed on the LCD, and also shutdown information is recorded into the RAM of controller.

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.

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The remote monitoring and control of the chillers is possible via BACnet™/ Ethernet, BACnet™/IP, MODBUS™, Modem or RS-232C/RS-485.

Safety devices

Safety devices

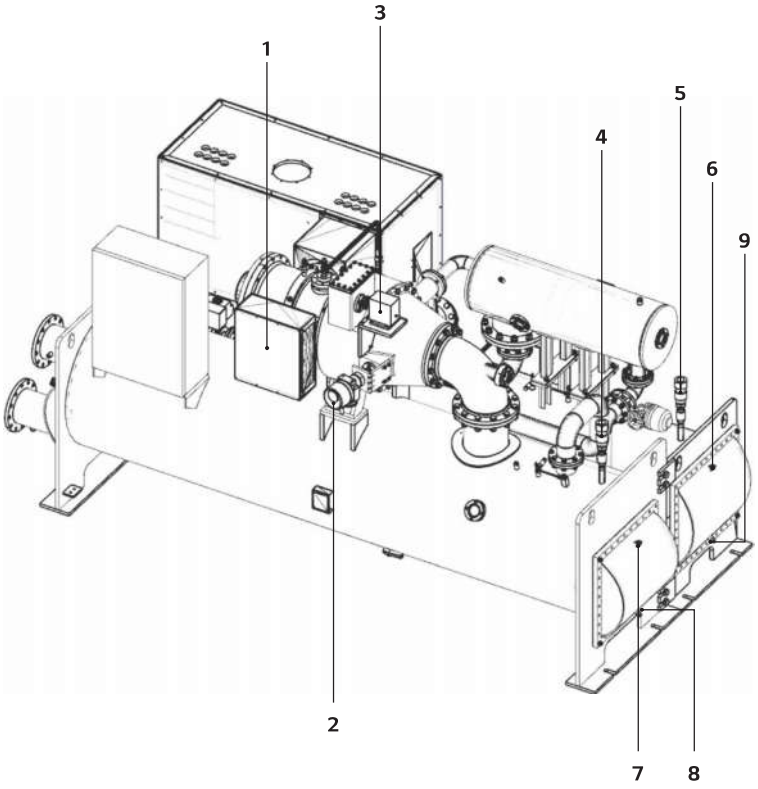
For the sake of safe operation and the protection of the chiller, safety devices are ready as the next table.

No.	Safety Devices	Installation Location	Measurement Item	Description	Quantity
1	Chilled Water Temperature Low	Chilled water 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	VFD	Current sensor	Stop the chiller if rated current is above 140% to protect the compressor	3
8	DC-Link Low Voltage/Over Voltage	VFD	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.)	VFD	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	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 of condenser goes to evaporator and makes certain chiller load to prevent surge and to prevent frequent startup stop of the chiller.	1

Options

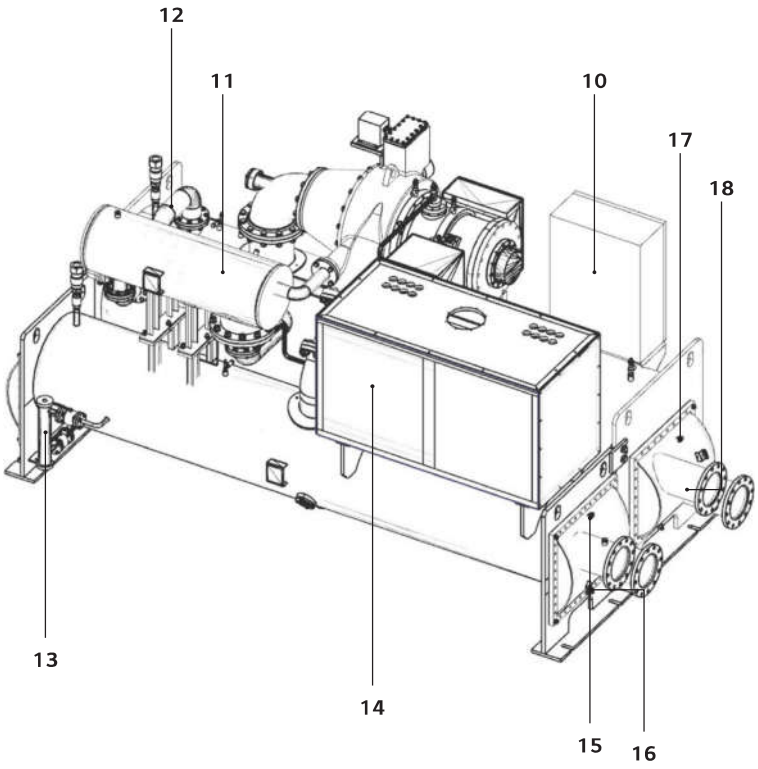
Items	Option
Refrigerant charging	√
Hot-gas bypass	√
Marine water boxes on the evaporator or condenser	√
High pressure water side construction (max. 350 psig)	√
Non-standard tubes (e.g., Cu/Ni, titanium)	√
Outdoor installation construction (non-hazardous areas)	√
Special construction for hazardous-area 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	√

Machine outline



Front view

1. MBC(Magnetic bearing Controller)
2. Main IGV actuator
3. 2nd IGV actuator
4. Evaporator safety valve
5. Condenser safety valve
6. Air vent (Cooling water)
7. Air vent (Chilled water)
8. Drain (Cooling water)
9. Drain (Chilled water)

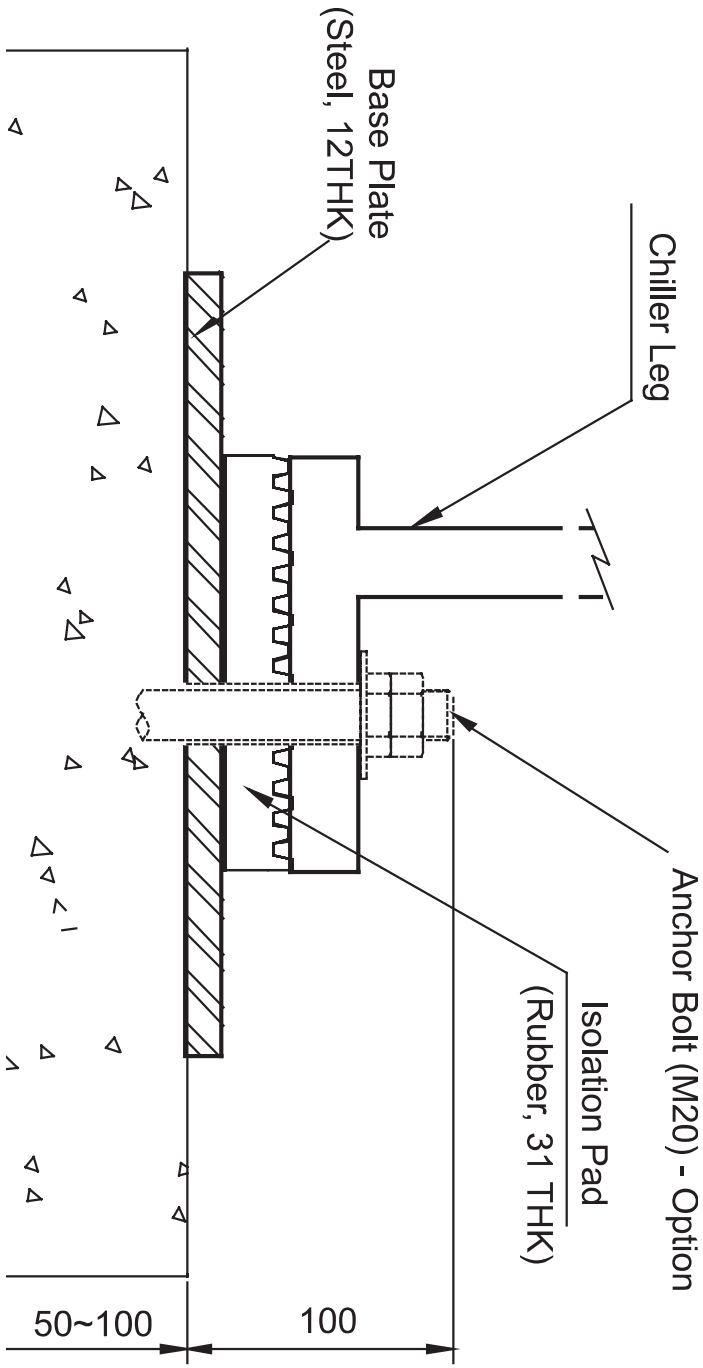


Rear view

10. Control panel
11. Economizer
12. Hot gas bypass valve
13. Liquid level sensor (Condenser)
14. VSD starter
15. Air vent (Cooling water)
16. Drain (Cooling water)
17. Air vent (Chilled water)
18. Drain (Chilled water)

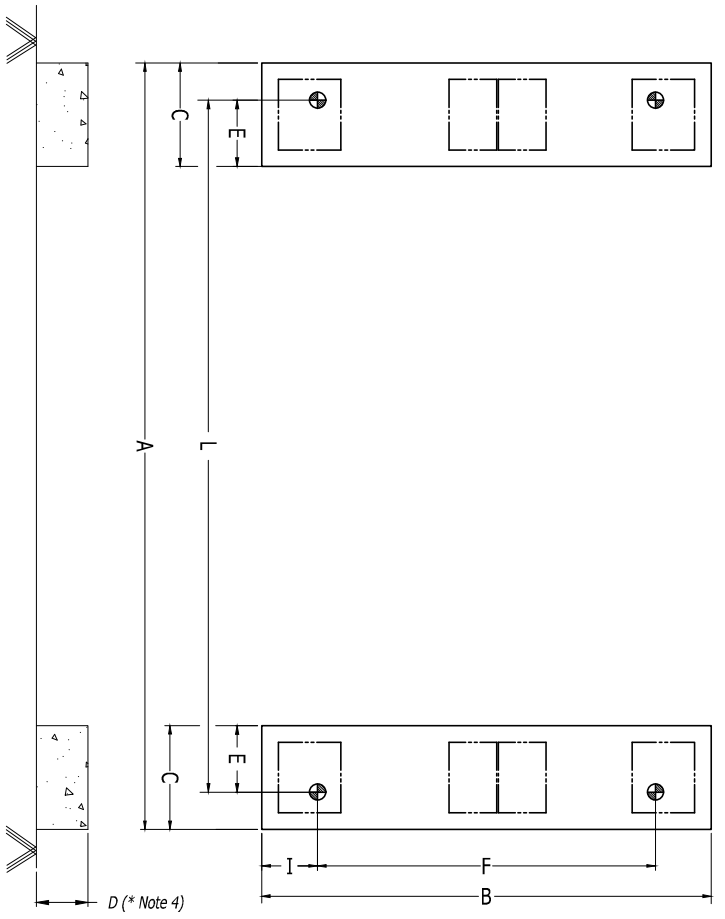
Vibration isolation

Typical isolation



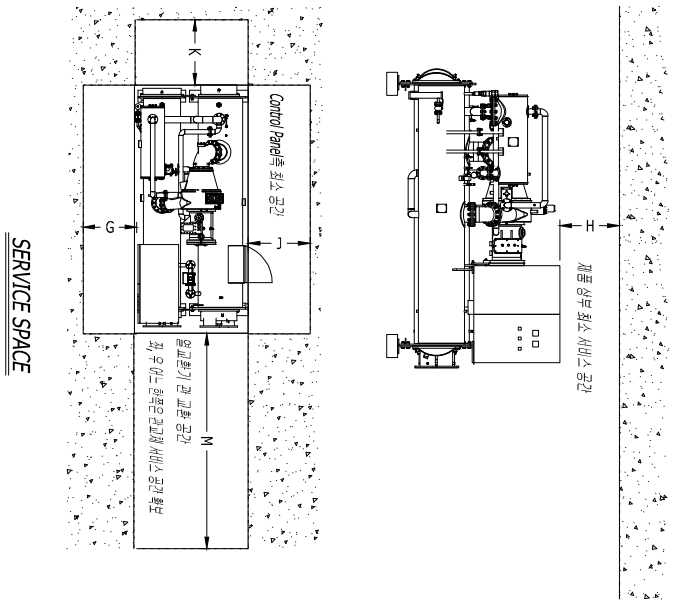
Notes: 1. Unit is in millimeter
2. As a standard isolation package, Base plate, Isolation pad and Level plates are supplied.
3. Foundation height is recommended for piping and drain.

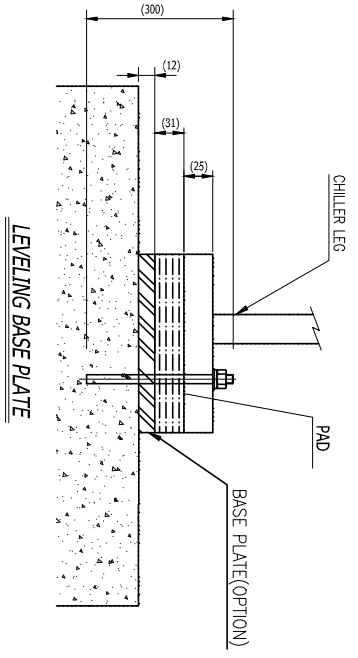
1 Compressor



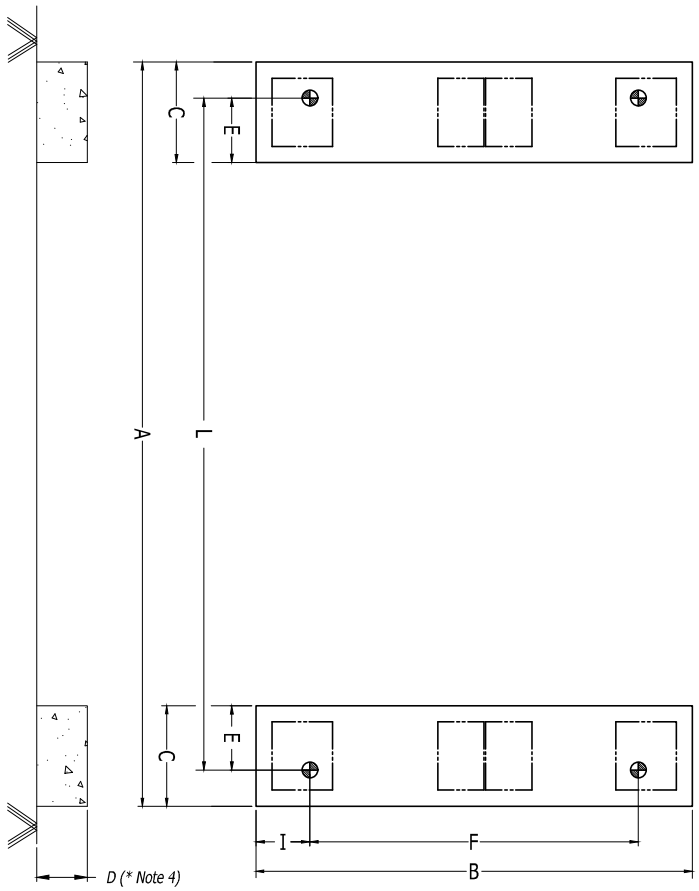
* SIZE CHART (UNIT : mm)

위치	EVAPORATOR	CONDENSER	A	B	C	D	E	F	G	H	I	J	K	L	M
RCWFLAB~AD	AQ	AK	4,000	2,116	300	150~200	173	1,846	1,500	1,500	135	2,000	1,500	3,746	4,500
RCWFLAB~BB	AR~BK	AQ~BN	4,000	2,285	300	150~200	173	1,985	1,500	1,500	150	2,000	1,500	3,746	4,500
RCWFLBD	BL	BN	4,000	2,406	300	150~200	173	2,106	1,500	1,500	150	2,000	1,500	3,746	4,500
RCWFLCB	CL	BK	4,000	2,561	300	150~200	173	2,211	1,500	1,500	175	2,000	1,500	3,746	4,500
RCWFLCD	CM	BL	4,000	2,736	300	150~200	173	2,386	1,500	1,500	175	2,000	1,500	3,746	4,500
RCWFLDB~DD	CF~DB	CF~DB	4,000	2,961	300	150~200	173	2,561	1,500	1,500	190	2,000	1,500	3,746	4,500



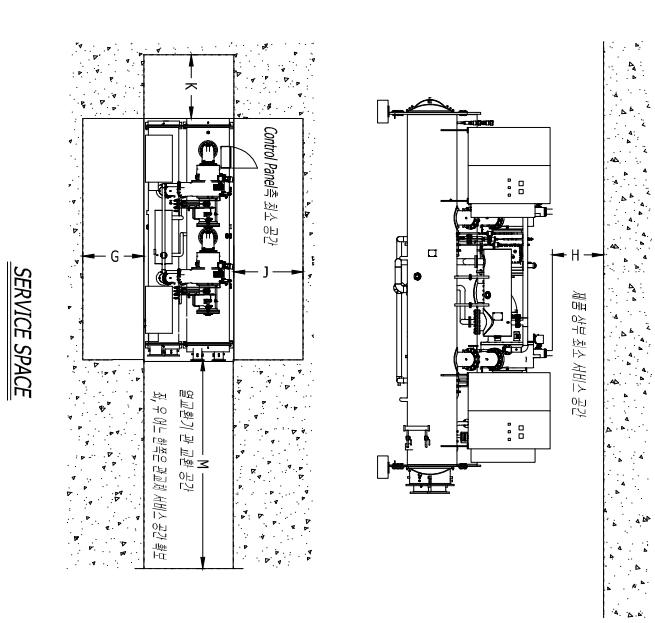


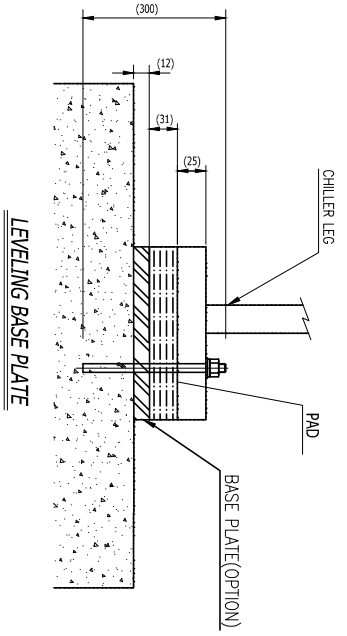
2 Compressor



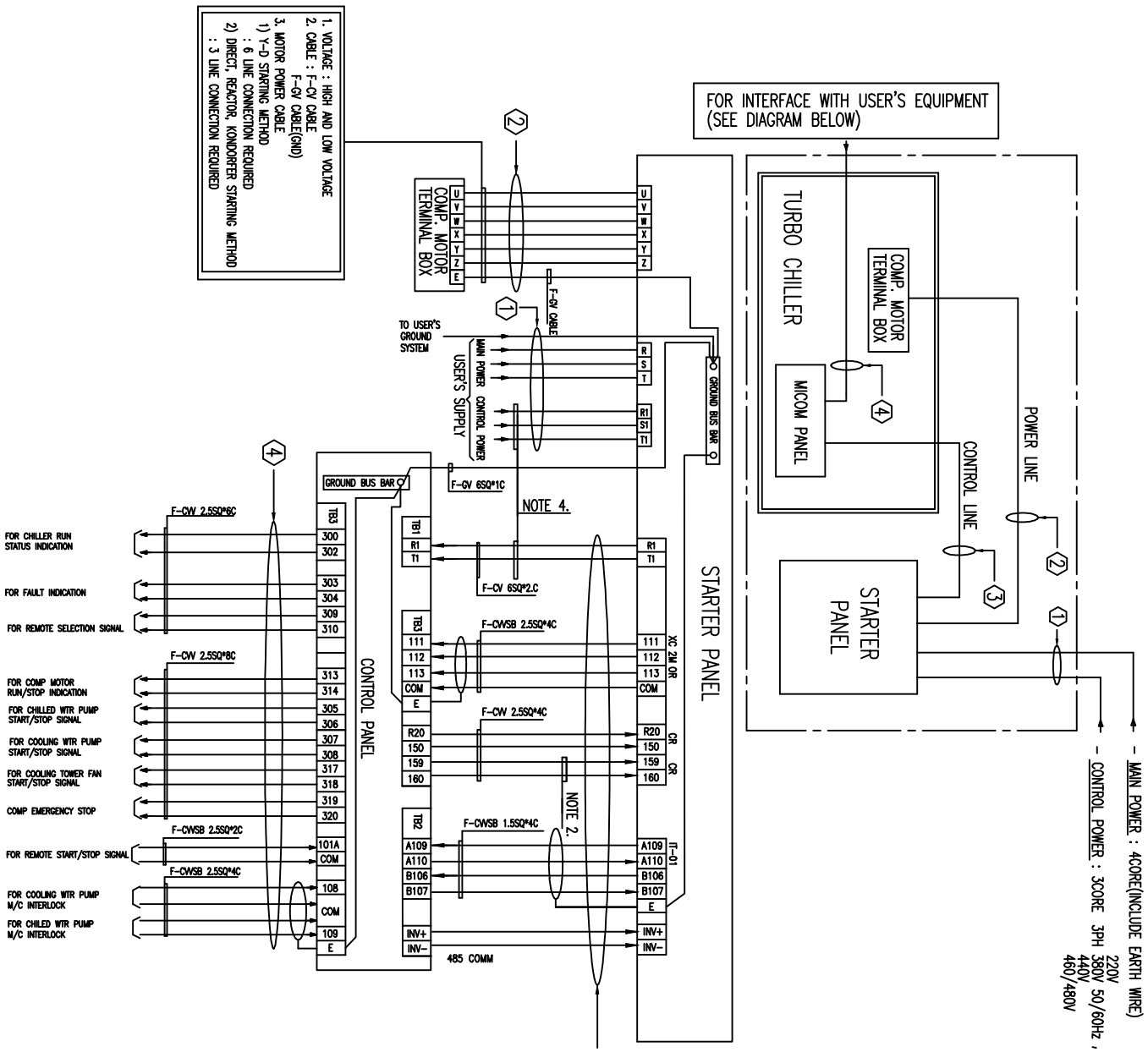
* SIZE CHART (UNIT : mm)

취지	EVAPORATOR	CONDENSER	A	B	C	D	E	F	G	H	I	J	K	L	M
RCWFLAG~AK	AU	AR	4,000	2,116	300	150~200	173	1,846	1,500	1,500	135	2,000	1,500	3,746	4,500
RCWFLG~BG	AX~BJ	AT~BR	4,000	2,285	300	150~200	173	1,985	1,500	1,500	150	2,000	1,500	3,746	4,500
RCWFLBDK	BM	BT	4,000	2,406	300	150~200	173	2,106	1,500	1,500	150	2,000	1,500	3,746	4,500
RCWFLCG~CK	CQ	CN	4,000	2,736	300	150~200	173	2,386	1,500	1,500	175	2,000	1,500	3,746	4,500
RCWFLDG~DK	DL~DM	DL	4,000	2,961	300	150~200	173	2,581	1,500	1,500	190	2,000	1,500	3,746	4,500



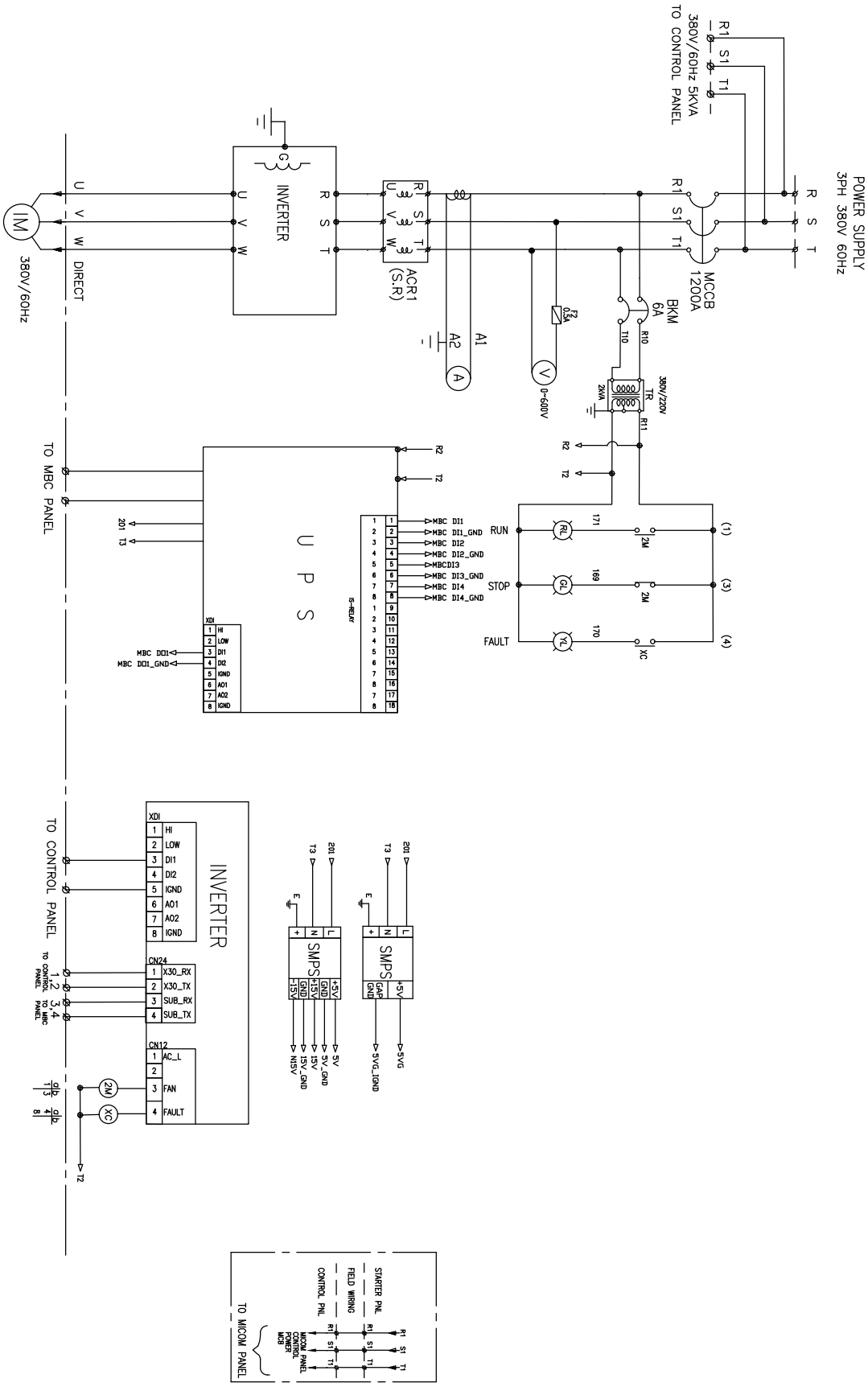


Interface wiring diagram

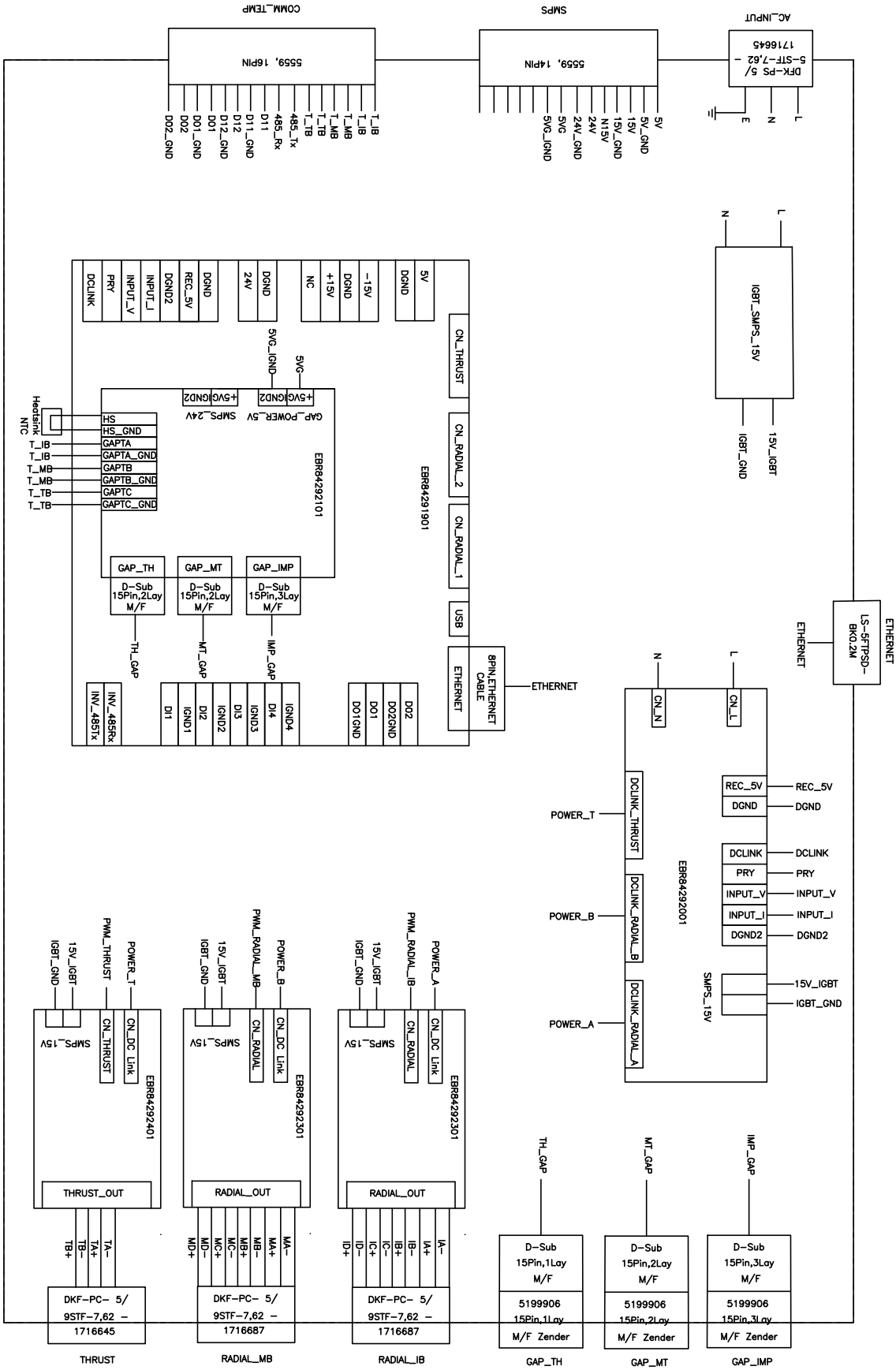


Notes: 1. Only for high voltage starter panel (3300V, 6600V).
2. Control panel wire should be 2.0mm^2 or above and control power cable should be 5.5mm^2 or above.
3. For other details, refer to certified Schematic Diagram.

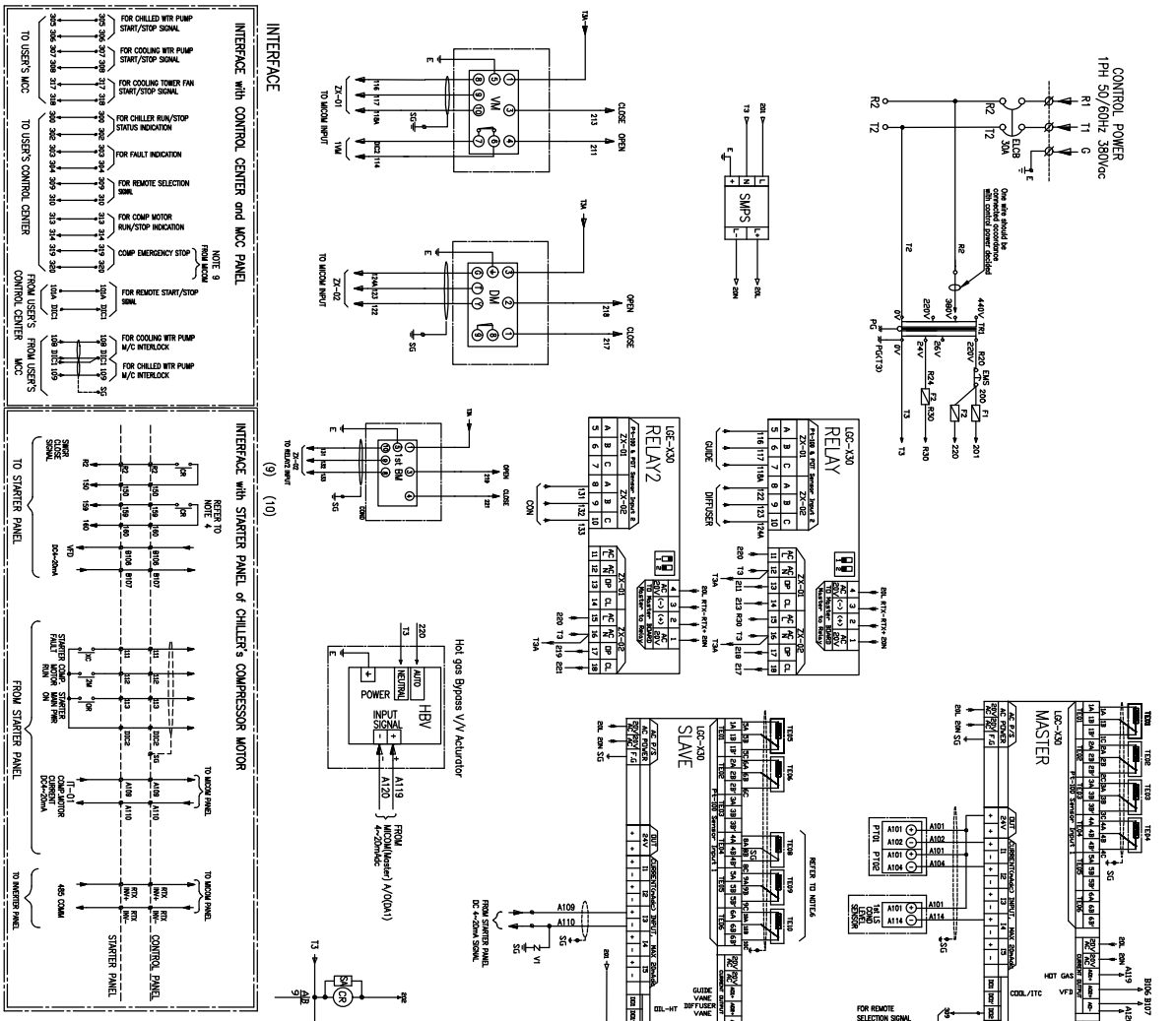
Starter diagram 1



Starter diagram 2



Schematic diagram (Typical)



SYMBOL	DESCRIPTION	REMARKS
2M	AUX.CONTACT	FROM STARTER(COMP MOTOR RUN SIGNAL)
1W	VANE MOTOR	
4I1	REMOTE RUN/STOP SIGNAL	SUPPLIED BY USER
S2CO	AUX.CONTACT	SUPPLIED BY USER(COOLING WTR PUMP)
S2C	AUX.CONTACT	SUPPLIED BY USER(CHILLED WTR PUMP)
69W	DIFF.PRESS SWITCH	CUTOUT BELOW 50KG/CHILLED WTR
1st LS	COND. LEVEL SENSOR	AC 24V, DC 4~20mA
1st BM	COND. BUTTERFLY V/V MOTOR	AC 220V
3C	AUX.RELAY CONTACT	FROM STARTER(STARTER PANEL FAULT)
BZ	BUZZER	
ELCB	EARTH LEAKAGE CIRCUIT BREAKER	2POLES, 30MF, 30A
TR2	TRANSFORMER	AC 440/380,220V/5220,28V/24V,700VA
CR	POWER CLOSING RELAY	STARTER RUN/STOP
EMS	EMERGENCY SWITCH	
F1~F3	FUSE	F1~2:250V,2A F3:250V,3A
69CO	DIFF.PRESS SWITCH	CUTOUT BELOW 50KG/CHILLED WTR
16W	HOT GAS V/V ACTUATOR	AC220V, DC4~20mA 4CMD100~4PC
VI	VARISTOR(ZNO)	471S~10A
MTD	MOTOR TEMP DETECTOR	CUTOUT ABOVE 90°C
SA	SURGE ABSORBER	250V, 0.1uF/120ohm
OR	AUX RELAY CONTACT	FROM STARTER(MAIN POWER ON
PT-01	EVAP PRESS TRANSMITTER	Range : 0~1Mpa/cnt.Out : 4~20mAdc
PT-02	COND PRESS TRANSMITTER	Range : 0~1Mpa/cnt.Out : 4~20mAdc
SMPS	SWITHED MODE POWER SUPPLY	
TD1	CHILD WTR INLET TEMP SENSOR	PT100ohm
TD2	CHILD WTR OUTLET TEMP SENSOR	PT100ohm
TD3	COOLING WTR INLET TEMP SENSOR	PT100ohm
TD4	COOLING WTR OUTLET TEMP SENSOR	PT100ohm
TD5	COMP.DISCHARGE TEMP SENSOR	PT100ohm
TD6	OIL TANK TEMP SENSOR	PT100ohm
TD7	MOTOR WINDING TEMP SENSOR(R)	PT100ohm
TD8	MOTOR WINDING TEMP SENSOR(S)	PT100ohm
TD9	MOTOR WINDING TEMP SENSOR(T)	PT100ohm
TE10	MOTOR WINDING TEMP SENSOR(T)	PT100ohm

Typical piping & Wiring

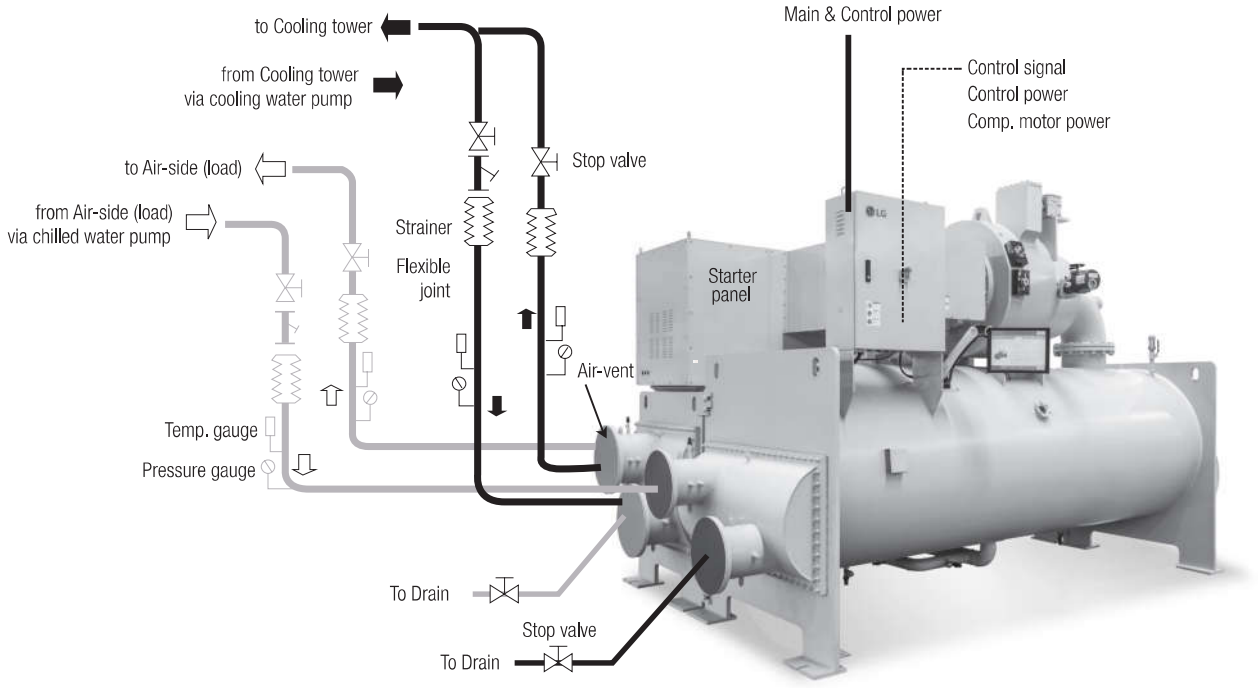
Chilled / cooling water piping

- As a standard, 10kg/cm^2 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, 10kg/cm^2 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 maintainmin. 14°C of temperature difference between cooling water outlet and chilled water outlet.



Notes: 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.

LG Business Solutions

Ver. 201705

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