LG HVAC SOLUTION
CENTRIFUGAL CHILLER

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World class high efficiency
The advanced technologies of LG achieve the lowest energy consumption and preserve the environment.

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

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

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

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

Simple bolting Structure
The evaporator, condenser, and compressor are final-assembled with simple bolting and flange connections, LG chiller provides an excellent solution for the retrofit and replacement jobs where are critical difficulties in an installation works within a limited space.
High reliability
LG chillers are designed through 3-dimensional and various dynamic analysis and it increased the reliability. All components were reliable test and also exclusively selected and manufactured. Factory-run-test are available for all chillers to make sure quality assurance before factory out as an option by customers.

Optimized & user-oriented control
LG unit controller, LG-CX30 was developed based on advanced algorithm, convenient and reliable control concept. Also it provides various customer-oriented functions; graphical display of key data, operation scheduling, help menu for easy trouble shooting, three language support, various industrial standard interface protocols and more.

AHRI certification program
LG chillers has been certified to the air conditioning and refrigeration Institute(AHRI) as complying with the latest issue of AHRI Standard 550/590. Under this certification program, chillers are regularly tested in strict compliance with this standard. This provides an independent, third-party verification of chiller performance.

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.
- 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.
- Manufactured in an EN ISO 9001 accredited organization.
- ETL - Conforms to ANSI/UL STD 1995 certified to CAN/CSA STD C22.2.
- OSHAS 18001 - Occupational safety and health act.

Equipment overview

Two stage compressor design
LG Chiller uses simple, compact and economic two stage design with two impellers, variable diffuser and economizer. When operating at light loads with high condensing temperatures, it happen unstable operation, called “surge”. But two stage compressor is avoided with two stage design because two stage compressor has wide range of operation. Two stage compressor is possible to flash refrigerant gas at two intermediate pressures between the evaporator and condenser, significantly increasing chiller efficiency. The improvement of efficiency is not available for single stage chiller because all compression is done by single impeller.

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 full test data included. Performance test facilities are able to test up to 3,000RT, 13.8kV and also available to accurately recreate a wide variety of environmental conditions, helping the company to tailor its products to the greatest number of markets.

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

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

Bearing
1. Compressor type : AA ~ EK
   - Ball bearing is composed of isolated bearing on motor shaft and angular contact bearings on the impeller shaft.
   - Ball bearing structure is subjected to a radial and axial load at the same time.
   - Because of less oil flow rate for ball bearings, the rotor dynamic system can be designed with compact size.
2. Compressor type : F1 ~ G3
   - Bearing is composed of bearings in motor shaft, radial bearings and thrust bearings on the impeller shaft.
   - Bearings with white metal are used to achieve persistence and corrosion resistance. Lubrication system prevents bearings from Metal-to-Metal contact during operation.
   - To increase the reliability of the journal bearings, Offset type and 3-Lobe type bearings are applied.

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

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

Robust rotor dynamic system and transmission
High speed rotating system including bearings are designed to secure the robust operation over the life of the machine at various load conditions.

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

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

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

LGX-C30 controller is ready for multi-language support; Chinese, English and Korean. Max. 8 units of LG chiller can be linked together and controlled through only 1 protocol converter (optional).

AC Smart premium

- 10.2-inch color LCD touch screen with high resolution (1,024 x 600)
- Operation scheduling function
- Real time trend display
- Web Access (Additional accessory)
- Running data acquisition
- Easy-to-read display of operational data
- Certified EMI/EMS
- Communication supported: Modbus, RS485 (standard)
- Language: English / Chinese / Korean
**Microprocessor controls**

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

**Safety cutouts**

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

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

**Main menu indications(Control center)**

<table>
<thead>
<tr>
<th>Run Mode Set</th>
<th>User Set</th>
<th>Manual Control</th>
<th>Schedule Set</th>
<th>Service Menu</th>
<th>Run Data Check</th>
<th>Error Data Check</th>
<th>Pager Mode Set</th>
<th>System Menu</th>
<th>Bright Control</th>
</tr>
</thead>
</table>

**Basic display items**

- Chilled water inlet & outlet temperatures(°C)
- Cooling water inlet & outlet temperatures(°C)
- Compressor discharge temperature(°C)
- Compressor bearing temperature(°C)
- Oil tank temperature(°C)
- Motor windings(R.S.T) temperatures(°C)
- Evaporator pressure(kg/cm²)
- Condenser pressure(kg/cm²)
- Oil tank pressure(kg/cm²)
- Oil pump pressure(kg/cm²)
- Ampere(s)(A)
- Voltages(V)
- Watts(kW)
- Chilled water flow(m³/h)R
- Cooling water flow(m³/h)R
- Vane opening(s)(%)
- Remote setting temperature(°C)
- Evaporator temperature(°C)
- Condenser temperature(°C)
- Differential pressure of oil(kg/cm²)
- Hot-gas valve output(%)
- Frequency of cooling tower fan inverter(Hz)
- PID output(%)
- Control output(%)
- Real setting value(°C)

**User settings**

- Chilled outlet temperature(°C)
- Compressor current limit(100%)
- Guide vane high limit(50%)
- Compressor discharge pressure(max)(300 sec, 3.0 sec.)
- 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 START(1.0°C)
- Cooling tower fan delay(60sec) to 240sec.
- Chilled water inlet temperature(31.0°C)
- Chilled water outlet temperature(3.0°C)
- Operational data log time(60 sec.)

**Main menu indications(Control center)**

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

**Stop**

The chiller stops under one of the following events:

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

During the stop process, firstly the compressor is forced to stop. The guide vanes are brought to the closed position. The oil pump and chilled water pump stop in 300 seconds after compressor stops and then cooling water pump will stop. The cooling water pump will stop. After that 3 minutes of 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 when the vane starts to close.

**Re-start**

Restart is activated only after the following;

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

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

**Various interface solutions**

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

**Advanced PID control**

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

**Chilled water temperature reset**

The chilled water temperature can be reset locally or remotely to 2°C or 4 minutes passed from when the vane starts to close.

**Operation scheduling**

The user can program the chiller operation schedule to run and...
Features | Control

stop the chiller automatically and even chilled water target temperature can be scheduled.

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

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

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

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

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

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

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

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

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

Refrigerant cycle
The two Stage Centrifugal chiller uses environment friendly high pressure refrigerant R-134a.
- In this cycle, as shown in the figure, the vaporized low temperature and low pressure refrigerant gas passes the Inlet Guide Vane, and enters the 1st impeller of the compressor. Since the inlet gas amount is dependent on the guide vane’s opening, the chiller capacity can be controlled.
- Refrigerant gas that entered the 1st impeller is compressed to a mid-temperature and mid pressure, passes through the return channel, is mixed with low temperature gas from the economizer, and then enters the 2nd impeller.
- The refrigerant gas enters the 2nd impeller and is compressed as high-temperature and high-pressured refrigerant gas, and discharged to the condenser. The gas loses its heat via cooling water in the heat transfer tubes and eventually condensed to liquid.
- The condensed refrigerant liquid passed the 1st expansion device, becomes mixed state and enters the bottom part of the economizer which divides into gas and liquid of refrigerant. The gas part is mixed with the mid temperature and mid pressured gas which was compressed in the 1st impeller, and then enters the 2nd impeller. The liquid part of the refrigerant enters the bottom part of evaporator via 2nd expansion device.
- The liquid refrigerant entered into the evaporator is then spread into wider surface of evaporator by distributor. Finally the distributed refrigerant is evaporated by taking the heat from the chilled water inside the evaporator tubes and repeats the cycle.
- Some part of the sub-cooled refrigerant liquid in the condenser, flows through the valve, filter, moisture indicator, and enters the motor and oil cooling system individually.
- The refrigerant liquid flow into the motor is being sprayed so that it can cool the motor’s coil and is returned to the evaporator.
- The refrigerant flow into the oil cooling system, flows through the plate type oil cooler. Refrigerant that left the oil cooler is then returned to evaporator.

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

Lubrication cycle
Lubricating oil is pumped in through the manual oil charge valve to oil tank. Oil level can be checked through a sight glass on the oil tank. During the operation, the level should be able to be seen at least from one of the sight glasses. The temperature of the oil tank is indicated on the control panel and its temperature should be below 85°C while operating. What the oil pump does is to transfer the oil from the oil tank to the system and the adequate pressure difference would be more than 0.8kg/cm² that is maintained by the oil pressure controller. The differential pressure can be seen on the control panel by the pressure gauges between oil tank and oil pump. The oil pump also helps to send the oil to the oil filter.
Isolation valves are installed at both ends of oil filter housing so that no need to drain the whole oil when replacing the filter only. After the oil is sent to the oil cooler it is cooled by the refrigerant flowing from the condenser. The refrigerant cools the oil at the temperature below 74°C. A part of the oil flows through the bearing and gear spray, whereas the rest lubricates the motor shaft bearings and the radial bearings.
The oil temperature in the oil tank is measured by temperature sensor and displayed on control panel. The timer automatically activates the oil pump for 120-180 seconds to maintain a constant pressure first before starting compressor. After the system has been shut down, 300-600 seconds of oil circulation is taken place after the compressor is stopped.

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

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

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

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

**Safety devices**

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

<table>
<thead>
<tr>
<th>No.</th>
<th>Safety Devices</th>
<th>Installation Location</th>
<th>Measurement Item</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chilled Water Temperature Low</td>
<td>Chilled water outlet nozzle</td>
<td>Chilled water outlet temperature</td>
<td>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.</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Evaporator Pressure Low (Temperature Low)</td>
<td>Evaporator shell</td>
<td>Vaporizing pressure (temp)</td>
<td>If the pressure inside of evaporator reaches below of the following table, then the chiller stops operation. Standard set value 1.95kg/m²</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Condenser Pressure High (Temperature High)</td>
<td>Condenser shell</td>
<td>Condensing pressure (temperature)</td>
<td>If the pressure inside of condenser reaches above of the following table, then the chiller stops operation. Standard setting value 10.00kg/m²</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Motor Temperature High</td>
<td>Motor coil</td>
<td>Motor coil temperature</td>
<td>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.</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Compressor Temperature High</td>
<td>Compressor outlet</td>
<td>Compressor discharge temperature</td>
<td>If the discharging gas temperature of the compressor exceeds over 70°C, the chiller stops operation.</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Bearing Temperature High</td>
<td>Thrust bearing</td>
<td>Bearing temperature</td>
<td>Temperature sensor is installed on the thrust bearing that holds the impeller’s thrust. Chiller will stop operation if the temperature exceeds 85°C.</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Oil Differential Pressure Low</td>
<td>Oil tank, oil pump outlet</td>
<td>Differential pressure of supplied and intake oil pressure</td>
<td>If the differential pressure between the oil pressure supplied to the bearing and the oil pressure in the oil tank is below 0.08kg/m², the chiller will stop the operation.</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Oil Temperature High</td>
<td>Oil tank</td>
<td>Oil temperature inside of oil tank</td>
<td>The chiller will stop if the oil temperature in the oil tank is above 74°C.</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Oil Temperature Low</td>
<td>Oil tank</td>
<td>Oil temperature inside of oil tank</td>
<td>The temperature should be over 30°C as an initial operating condition to enable the chiller to operate.</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Chilled Water Pump Abnormal</td>
<td>Chilled water header</td>
<td>Chilled water head loss</td>
<td>The chiller will stop if the head loss of the chilled water flow passing through the evaporator tubes decreases so much that the head loss becomes lower than the standard.</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Coaxing Water Pump Abnormal</td>
<td>Chilled water header</td>
<td>Coaxing water head loss</td>
<td>The chiller will stop if the head loss of the coaxing water flow passing through the condenser tubes decreases so much that the head loss becomes lower than the standard.</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Current Limiting Function</td>
<td>Control panel</td>
<td>Current</td>
<td>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.</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Moisture Indicator</td>
<td>Refrigerant supply pipe</td>
<td>Moisture in the refrigerant</td>
<td>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.</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Relief Valve</td>
<td>Evaporator &amp; condenser shell</td>
<td>Relief valves</td>
<td>To prevent the accident by unexpected fire, and so on which can cause pressure increase in the chiller; the relief valve will be operated and exhaust the refrigerant into the air if the pressure exceeds more than the set value. If the chiller is used in a closed environment, please install a pipe that starts from the relief valve to the outer air.</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>Vane Full Close Interlock</td>
<td>Vane motor</td>
<td>Operability of temperature sensors</td>
<td>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.</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>Temperature Sensor Abnormal</td>
<td>6 locations including chilled water nozzle</td>
<td>Each temperature sensor</td>
<td>It alarms when temperature sensor is not connected or due to the sensor’s own flaw.</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>Pressure Sensor Abnormal</td>
<td>4 locations including Evaporator shell</td>
<td>Each pressure sensor</td>
<td>It alarms when pressure sensor is not connected or due to the sensor’s own flaw.</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>Overload relay</td>
<td>Control panel</td>
<td>Current</td>
<td>If overload is imposed on compressor motor or oil pump motor, it stops the motor.</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>Hot Gas Bypass Valve</td>
<td>Evaporator shell, Condenser shell</td>
<td>Guide vane / hot gas valve opening</td>
<td>It prevents frequent start-ups at low load, and hot gas bypass valve opens proportionally when vane becomes 30% or lower. At this time, hot refrigerant gas from condenser goes to evaporator and makes certain chiller load to prevent surge and to prevent frequent stop / start-up of the chiller.</td>
<td>1</td>
</tr>
</tbody>
</table>
### Features | Accessories and options

#### Centrifugal chiller standard summary

<table>
<thead>
<tr>
<th>Item</th>
<th>Standard</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>400kW</td>
<td>380kV</td>
</tr>
<tr>
<td>Hertz</td>
<td>60Hz</td>
<td></td>
</tr>
<tr>
<td>Bearing temperature sensor</td>
<td>0°C (Single type)</td>
<td>Dual type</td>
</tr>
<tr>
<td>Water coil temperature sensor</td>
<td>90°C (Close)</td>
<td>70°C (Open)</td>
</tr>
<tr>
<td>Panel Type</td>
<td>I.G.V + HGBP</td>
<td>I.G.V + HGBP</td>
</tr>
<tr>
<td>Comp. Code</td>
<td>(Stand, AC-DP)</td>
<td>(Stand, AC-DP)</td>
</tr>
<tr>
<td>Control Panel</td>
<td>Oil pump</td>
<td>(2) (2)</td>
</tr>
<tr>
<td>Communication</td>
<td>3Ø 380V</td>
<td></td>
</tr>
<tr>
<td>Auxiliary Power</td>
<td>3Ø 380V</td>
<td></td>
</tr>
<tr>
<td>International protection</td>
<td>440V</td>
<td>440V</td>
</tr>
<tr>
<td>Factory Wiring</td>
<td>Bolt &amp; Flexible</td>
<td>Bolt &amp; Flexible</td>
</tr>
<tr>
<td>Starter type</td>
<td>12.5kA</td>
<td>12.5kA</td>
</tr>
<tr>
<td>Mounted type</td>
<td>2 InCh</td>
<td>2 InCh</td>
</tr>
<tr>
<td>Circuit Breaker Type</td>
<td>Low-V (380V~6600V)</td>
<td>High-V (3800~6600V)</td>
</tr>
<tr>
<td>Breaker Type</td>
<td>Air (Low-V)</td>
<td>Air (High-V)</td>
</tr>
<tr>
<td>Power Access</td>
<td>From the top</td>
<td>From the bottom</td>
</tr>
<tr>
<td>Power Factor Correction Capacitor</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Integrating Watt-meter</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Ground Fault Protection</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Momentary Power Loss Compensation</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

#### EAVI

- Waterbox type: WPC(Rectangle)  
- Waterbox Coating: Marine (Marine + hinged)
- Noise Arrangement (outlet): Marine + hinged
- Noise Type: VSF-Flange  
- Flue proof type(Ref): Sheet V1G(VVDab)
- Waterbox Pressure: 60psi(160kPa)  
- Waterbox Coating: Marine (Marine + hinged)
- Noise Arrangement (outlet): Marine + hinged
- Noise Type: VSF-Flange  
- Flue proof type(Ref): Sheet V1G(VVDab)

#### COND

- Waterbox type: WPC(Rectangle)  
- Waterbox Coating: Marine (Marine + hinged)
- Noise Arrangement (outlet): Marine + hinged
- Noise Type: VSF-Flange  
- Flue proof type(Ref): Sheet V1G(VVDab)

#### Standard specification

1. Power Supply: 400kW, 380kV
2. Hertz: 60Hz
3. Bearing temperature sensor: 0°C (Single type), 0°C (Dual type)
4. Water coil temperature sensor: 90°C (Close), 70°C (Open)
5. Panel Type: I.G.V + HGBP, I.G.V + HGBP
6. Control Panel: Oil pump, 3Ø 380V
7. Communication: 3Ø 380V
8. Auxiliary Power: 3Ø 380V
9. International protection: 440V
10. Factory Wiring: Bolt & Flexible
11. Starter type: 12.5kA
12. Mounted type: 2 InCh
13. Circuit Breaker Type: Low-V (380V~6600V), High-V (3800~6600V)
14. Breaker Type: Air (Low-V), Air (High-V)
15. Power Access: From the top, From the bottom
16. Power Factor Correction Capacitor: No
17. Integrating Watt-meter: No
18. Ground Fault Protection: No
19. Momentary Power Loss Compensation: No

---

### Machine outline

#### Front view
1. Control panel
2. Motor terminal box
3. Lifting hole for compressor overhaul
4. Evaporator safety valve
5. Condenser safety valve
6. Lifting hole for evaporator
7. Lifting hole for condenser
8. Assembly bracket
9. Drain for chilled water
10. Air vent for chilled water
11. Drain for cooling water
12. Air vent for cooling water
13. Actuator for variable diffuser
14. Actuator for vane motor
15. Oil pump
16. Sight glass for oil tank
17. Sight glass for evaporator
18. Name plate of evaporator

#### Rear view
19. Sight glass for economizer
20. Hot-gas bypass
21. Air vent for chilled water
22. Drain for chilled water
23. Assembly bracket
24. Drain for cooling water
25. Air vent for cooling water
26. Filter drier
27. Service valve
28. Sight glass for condenser
29. Name plate of condenser
30. Sight glass for checking the motor rotation direction

---

Notes:
1. This image may not be same with real.
2. To improve the performance, some specification can be changed without notice.

---

2020 LG HVAC Solution | 15
## 2-stage model (12°C ~ 7°C)

### Specification

#### Model

| Type | Cooling Capacity | Unit | Unit Data
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No EA</td>
<td>kW</td>
<td>3 Ph / 3,300 V / 50(60) Hz</td>
<td></td>
</tr>
<tr>
<td>Power Supply</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Evaporator

<table>
<thead>
<tr>
<th>Nozzle Connection Size</th>
<th>m³/CW</th>
<th>Pass EA</th>
<th>Pressure Drop</th>
<th>kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.044</td>
<td>2</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>m³/CW</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Condenser

<table>
<thead>
<tr>
<th>Nozzle Connection Size</th>
<th>m³/hr</th>
<th>Pass EA</th>
<th>Pressure Drop</th>
<th>kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.044</td>
<td>2</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>m³/CW</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Dimension

| | m | |
|------------------------|-----| |
| Length | 3,480 | 3,480 |
| Height | 2,221 | 2,410 |

### Precautions

- LG centrifugal chillers are a combination of compressors, condensers, and evaporators, enabling various model deployment and providing other specifications. In this case, please contact LG Electronics.
- Cooling inlet / outlet temperature: 32°C ~ 37°C

---

## 2-stage model (7°C ~ 7°C)

### Specification

#### Model

| Type | Cooling Capacity | Unit | Unit Data
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No EA</td>
<td>kW</td>
<td>3 Ph / 3,300 V / 50(60) Hz</td>
<td></td>
</tr>
<tr>
<td>Power Supply</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Evaporator

<table>
<thead>
<tr>
<th>Nozzle Connection Size</th>
<th>m³/CW</th>
<th>Pass EA</th>
<th>Pressure Drop</th>
<th>kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.044</td>
<td>2</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>m³/CW</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Condenser

<table>
<thead>
<tr>
<th>Nozzle Connection Size</th>
<th>m³/hr</th>
<th>Pass EA</th>
<th>Pressure Drop</th>
<th>kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.044</td>
<td>2</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>m³/CW</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Dimension

| | m | |
|------------------------|-----| |
| Length | 3,480 | 3,480 |
| Height | 2,221 | 2,410 |

### Precautions

- LG centrifugal chillers are a combination of compressors, condensers, and evaporators, enabling various model deployment and providing other specifications. In this case, please contact LG Electronics.
- Cooling inlet / outlet temperature: 32°C ~ 37°C
Specification

2-stage model(10°C – 5°C)

<table>
<thead>
<tr>
<th>Model</th>
<th>Units</th>
<th>Cooling Capacity</th>
<th>Unit Data</th>
<th>High Ambient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Condition</td>
<td>kW</td>
<td>3000</td>
<td>1,500</td>
<td></td>
</tr>
<tr>
<td>Evaporator</td>
<td>3 Ph / 380 V, 400 / 50 Hz</td>
<td>275</td>
<td>1,050</td>
<td>1,047</td>
</tr>
<tr>
<td>Condenser</td>
<td>3 Ph / 3,300 V, 50(60) Hz</td>
<td>275</td>
<td>1,050</td>
<td>1,047</td>
</tr>
<tr>
<td>Power Supply</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil Pump</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nozzle Connection Size</td>
<td>A</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Rated Flow Rate</td>
<td>m³/hr</td>
<td>65</td>
<td>65</td>
<td>78</td>
</tr>
<tr>
<td>Fouling Factor</td>
<td>m² / CWP</td>
<td>0.018</td>
<td>0.018</td>
<td>0.018</td>
</tr>
<tr>
<td>Pressure Drop</td>
<td>mPa</td>
<td>4.8</td>
<td>4.9</td>
<td>4.1</td>
</tr>
<tr>
<td>Pump</td>
<td>EA</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Type</td>
<td></td>
<td>2-stage Centrifugal Compressor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shipping Weight</td>
<td>kg</td>
<td>5,250</td>
<td>5,350</td>
<td>5,540</td>
</tr>
<tr>
<td>Operating Weight</td>
<td>kg</td>
<td>5,950</td>
<td>6,100</td>
<td>6,250</td>
</tr>
<tr>
<td>Air Inlet</td>
<td>°C</td>
<td>32</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Air Outlet</td>
<td>°C</td>
<td>37</td>
<td>37</td>
<td>37</td>
</tr>
</tbody>
</table>

Precautions:
- LG centrifugal chillers are a combination of compressors, condensers, and evaporators, enabling various model deployment and providing other specifications. In this case, please contact LG Electronics.
- If you want specifications for heat pumps and special conditions, please contact LG Electronics.
- For ease of use, some specifications for heat pumps and special conditions, please contact LG Electronics.
- Cooling inlet / outlet temperature: 32°C / 37°C

2-stage model(10°C – 5°C)

<table>
<thead>
<tr>
<th>Model</th>
<th>Units</th>
<th>Cooling Capacity</th>
<th>Unit Data</th>
<th>High Ambient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Condition</td>
<td>kW</td>
<td>3,516</td>
<td>3,868</td>
<td></td>
</tr>
<tr>
<td>Evaporator</td>
<td>3 Ph / 380 V, 400 / 50 Hz</td>
<td>2,671</td>
<td>3,024</td>
<td></td>
</tr>
<tr>
<td>Condenser</td>
<td>3 Ph / 3,300 V, 50(60) Hz</td>
<td>2,974</td>
<td>3,246</td>
<td></td>
</tr>
<tr>
<td>Power Supply</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil Pump</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nozzle Connection Size</td>
<td>A</td>
<td>300</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Rated Flow Rate</td>
<td>m³/hr</td>
<td>605</td>
<td>665</td>
<td>786</td>
</tr>
<tr>
<td>Fouling Factor</td>
<td>m² / CWP</td>
<td>0.018</td>
<td>0.018</td>
<td>0.018</td>
</tr>
<tr>
<td>Pressure Drop</td>
<td>mPa</td>
<td>7.5</td>
<td>8.9</td>
<td>10.6</td>
</tr>
<tr>
<td>Pump</td>
<td>EA</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Type</td>
<td></td>
<td>2-stage Centrifugal Compressor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shipping Weight</td>
<td>kg</td>
<td>12,200</td>
<td>14,300</td>
<td>17,650</td>
</tr>
<tr>
<td>Operating Weight</td>
<td>kg</td>
<td>14,700</td>
<td>16,900</td>
<td>21,050</td>
</tr>
<tr>
<td>Air Inlet</td>
<td>°C</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Air Outlet</td>
<td>°C</td>
<td>45</td>
<td>45</td>
<td>45</td>
</tr>
</tbody>
</table>

Precautions:
- LG centrifugal chillers are a combination of compressors, condensers, and evaporators, enabling various model deployment and providing other specifications. In this case, please contact LG Electronics.
- If you want specifications for heat pumps and special conditions, please contact LG Electronics.
- Cooling inlet / outlet temperature: 32°C / 37°C
## Specification

### 2-Stage Inverter Model (12°C → 7°C)

<table>
<thead>
<tr>
<th>Model</th>
<th>Units</th>
<th>RCWFHAML</th>
<th>RCWFHAM</th>
<th>RCWFHAN</th>
<th>RCWFHAP</th>
<th>RCWFHBM</th>
<th>RCWFHBN</th>
<th>RCWFHBP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cooling Capacity</strong></td>
<td>kW</td>
<td>703</td>
<td>879</td>
<td>961</td>
<td>1,055</td>
<td>1,407</td>
<td>1,582</td>
<td>1,758</td>
</tr>
<tr>
<td><strong>Shipping Weight</strong></td>
<td>kg</td>
<td>5,550</td>
<td>5,650</td>
<td>5,950</td>
<td>5,970</td>
<td>7,450</td>
<td>7,550</td>
<td>7,570</td>
</tr>
<tr>
<td><strong>Operating Weight</strong></td>
<td>kg</td>
<td>6,250</td>
<td>6,400</td>
<td>6,650</td>
<td>6,700</td>
<td>8,950</td>
<td>8,950</td>
<td>8,800</td>
</tr>
<tr>
<td><strong>Unit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type</strong></td>
<td></td>
<td>2-stage Centrifugal Compressor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Precautions
- LG centrifugal chillers are a combination of compressors, condensers, and evaporators, enabling various model deployment and providing other specifications. In this case, please contact LG Electronics.
- To improve the performance, some specification can be changed without notice.
- Starter panel is supplied as unit-mounted type.
- 1 USRT = 3,024 kcal / h
- It is available at high voltage, please contact LG Electronics if you want.
- Cooling inlet / outlet temperature: 32°C / 37°C

### Table 1

<table>
<thead>
<tr>
<th>Model</th>
<th>Units</th>
<th>RCWFHCM</th>
<th>RCWFHCN</th>
<th>RCWFHCP</th>
<th>RCWFHDN</th>
<th>RCWFHDP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cooling Capacity</strong></td>
<td>kW</td>
<td>1,934</td>
<td>2,110</td>
<td>2,461</td>
<td>2,813</td>
<td>3,165</td>
</tr>
<tr>
<td><strong>Shipping Weight</strong></td>
<td>kg</td>
<td>8,500</td>
<td>9,400</td>
<td>9,600</td>
<td>11,000</td>
<td>12,550</td>
</tr>
<tr>
<td><strong>Operating Weight</strong></td>
<td>kg</td>
<td>9,800</td>
<td>10,950</td>
<td>11,200</td>
<td>12,950</td>
<td>14,950</td>
</tr>
<tr>
<td><strong>Type</strong></td>
<td></td>
<td>2-stage Centrifugal Compressor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th>Model</th>
<th>Units</th>
<th>RCWFHCHM</th>
<th>RCWFHCHN</th>
<th>RCWFHCHP</th>
<th>RCWFHDHM</th>
<th>RCWFHDHN</th>
<th>RCWFHDHP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cooling Capacity</strong></td>
<td>kW</td>
<td>1,934</td>
<td>2,110</td>
<td>2,461</td>
<td>2,813</td>
<td>3,165</td>
<td>3,516</td>
</tr>
<tr>
<td><strong>Shipping Weight</strong></td>
<td>kg</td>
<td>8,500</td>
<td>9,400</td>
<td>9,600</td>
<td>11,000</td>
<td>12,550</td>
<td>12,850</td>
</tr>
<tr>
<td><strong>Operating Weight</strong></td>
<td>kg</td>
<td>9,800</td>
<td>10,950</td>
<td>11,200</td>
<td>12,950</td>
<td>14,950</td>
<td>15,350</td>
</tr>
<tr>
<td><strong>Type</strong></td>
<td></td>
<td>2-stage Centrifugal Compressor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Memo

- LG centrifugal chillers are a combination of compressors, condensers, and evaporators, enabling various model deployment and providing other specifications. In this case, please contact LG Electronics.
- To improve the performance, some specification can be changed without notice.
- Starter panel is supplied as unit-mounted type.
- 1 USRT = 3,024 kcal/h
- It is available at high voltage, please contact LG Electronics if you want.
- Cooling inlet / outlet temperature: 32°C / 37°C

---

Precautions:
- LG centrifugal chillers are a combination of compressors, condensers, and evaporators, enabling various model deployment and providing other specifications. In this case, please contact LG Electronics.
- To improve the performance, some specification can be changed without notice.
- Starter panel is supplied as unit-mounted type.
- 1 USRT = 3,024 kcal/h
- It is available at high voltage, please contact LG Electronics if you want.
- Cooling inlet / outlet temperature: 32°C / 37°C
1. The height is measured from the bottom of the heat exchanger bed. 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 150 Ib.

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

4. The minimum spaces shall be assured around the chiller as follows:
   - Length direction of the chiller: 1,500 mm (AL-AM), 2,000 mm (DN - G3)
   - The left and the right side space for Tube replacement: 3,500 mm (AL-AM), 3,700 mm (DN - G3)
   - Control panel: 1,500 mm (AL-AM), 2,000 mm (DN - G3)
   - Direction of height: 1,000 mm (AL-AM), 1,500 mm (DN - G3)

5. To improve the performance, some specifications can be changed without notice.

Machine components

Outline Dimension
<table>
<thead>
<tr>
<th>Model</th>
<th>Outline Dimension</th>
<th>Base Dimension</th>
<th>Water Flow Pass (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCWFH</td>
<td>AL-AM</td>
<td>3,480</td>
<td>2,780</td>
</tr>
<tr>
<td>RCWFH</td>
<td>AN-AP</td>
<td>3,480</td>
<td>2,780</td>
</tr>
<tr>
<td>RCWFH</td>
<td>BM-BF</td>
<td>3,500</td>
<td>2,950</td>
</tr>
<tr>
<td>RCWFH</td>
<td>CM</td>
<td>3,540</td>
<td>2,950</td>
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<tr>
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<td>CN</td>
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<td>2,950</td>
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<tr>
<td>RCWFH</td>
<td>CP</td>
<td>3,540</td>
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<td>DM</td>
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<tr>
<td>RCWFH</td>
<td>F2</td>
<td>5,180</td>
<td>5,290</td>
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<tr>
<td>RCWFH</td>
<td>F3</td>
<td>5,180</td>
<td>5,290</td>
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<tr>
<td>RCWFH</td>
<td>G1</td>
<td>6,340</td>
<td>6,470</td>
</tr>
<tr>
<td>RCWFH</td>
<td>G2</td>
<td>7,340</td>
<td>7,470</td>
</tr>
<tr>
<td>RCWFH</td>
<td>G3</td>
<td>7,340</td>
<td>7,470</td>
</tr>
</tbody>
</table>

Precautions:
1. The height is measured from the bottom of the heat exchanger bed. 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 150 Ib.
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   - Length direction of the chiller: 1,500 mm (AL-AM), 2,000 mm (DN - G3)
   - The left and the right side space for Tube replacement: 3,500 mm (AL-AM), 3,700 mm (DN - G3)
   - Control panel: 1,500 mm (AL-AM), 2,000 mm (DN - G3)
   - Direction of height: 1,000 mm (AL-AM), 1,500 mm (DN - G3)
5. To improve the performance, some specifications can be changed without notice.
**Vibration isolation & Foundation**

**Typical isolation**

<table>
<thead>
<tr>
<th>Model</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>E (mm)</th>
<th>F (mm)</th>
<th>G (mm)</th>
<th>H (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCWFH AL - AM</td>
<td>3,400</td>
<td>1,750</td>
<td>400</td>
<td>3,100</td>
<td>2,000</td>
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</tbody>
</table>

**Typical piping & Wiring**

**Chilled / cooling water piping**

- As a standard, 10kg/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 decreasing performance.
- 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/cm² of standard flange is adopted for evaporator and condenser nozzles. In general, if the atmospheric temperature falls lower than design temperature 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 degree C of temperature difference between cooling water outlet and chilled water outlet.

---

**Precautions**

1. Using the installation equipment, level the chiller and attach the vibration proof pad to the chiller plate.
2. The operating weight shall be equally distributed on the 4 supports.
3. The foundation height shall be approximately 150-200mm to work piping and drainage easily.

**Notes:**

1. This drawing is the foundation drawing of the standard model. It is possible to differ depend on site conditions.

---

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---

**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.
## Insulation

### Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Material</th>
<th>Specification (Equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shell Plate</td>
<td>Hot rolled steel</td>
<td>SA 516 Gr. 70</td>
</tr>
<tr>
<td>Tube Sheet</td>
<td>Hot rolled steel</td>
<td>SA 516 Gr. 70</td>
</tr>
<tr>
<td>Water-box</td>
<td>Hot rolled steel</td>
<td>SA 516 Gr. 70</td>
</tr>
<tr>
<td>Tubes</td>
<td>Finned copper tube</td>
<td>SB 319 Cl.2200</td>
</tr>
<tr>
<td>Discharge and Suction</td>
<td>Steel</td>
<td>SA 106 Gr. B</td>
</tr>
<tr>
<td>Impeller</td>
<td>Al alloy</td>
<td>SB 209</td>
</tr>
<tr>
<td>Impeller Casing</td>
<td>Cast iron</td>
<td>SB 48</td>
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<tr>
<td>Pipe</td>
<td>Steel</td>
<td>SA 106 Gr. B</td>
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<tr>
<td>Flange</td>
<td>Steel</td>
<td>SA 516</td>
</tr>
<tr>
<td>Support</td>
<td>Steel</td>
<td>SA 516 Gr. 70</td>
</tr>
</tbody>
</table>

Notes: 1. Specification is an equivalent code in ASME (American Society of Mechanical Engineers)

### Insulation

The factory insulation shall include evaporator; suction line up to the compressor suction housing; compressor motor and motor cooling return lines. The insulation shall be completed with 19mm as a standard and 38mm as an optional thickness of rubber sponge.
Part 1. Range of application
This guide specifications is applied to all the models of the two-stage HFC-134a centrifugal chillers (RCWFH**) manufactured and supplied by LG Electronics.

Part 2. General information
2.1 System structure
1) The high-efficiency centrifugal chiller shall use a cycle of 2-stage compression and 2-stage expansion. It shall also use a variable capacity diffuser at the rear end of the 2-stage impeller so that it can work stably even under lower load.
2) Economizer shall be an external type for easy maintenance and the condenser shall include an independent sub-cooled heat exchanger.
3) The refrigerant level controller installed in the condenser and economizer shall be controlled by a micom to provide a cycle so that high efficiency can be achieved under full load and partial load.
4) The compressor shall be a semi-hermetic type to secure reliance for refrigerant leakage and the motor shall be cooled by refrigerant to keep low temperature of motor wire to get high efficiency.

2.2. Performance and quality
2) As the refrigerant, R-134a, environmental refrigerant with Ozone Depleting Potential (ODP) of zero, shall be applied.
3) The pressure vessel shall be designed and inspected in accordance with KGS Code (High-Pressure Gas Safety Control Act) or ASME SEC.VIII (Options) or PED (Pressure Equipment Directive) and certified by the relevant certification agency.

Part 3. Equipment specification
3.1 System structure
The chiller is composed of compressor/motor; evaporator, condenser, external flash tank type economizer, oil system, automatic expansion valve, inlet guide vane, refrigerant piping, control panel, starter, safety devices, and insulation / isolator.

3.2 Compressor/motor
1) The compressor is a high-efficiency semi-hermetic and centrifugal 2-stage type for HFC-134a. The impeller is made of high-strength special aluminum alloy and integrated with Return Channel which makes static pressure recovery in flow path and stable inlet between 1st and 2nd impellers for minimizing efficiency loss. Also it can be helpful for easy maintenance.
2) The motor shall be a liquid refrigerant-cooled type and insulated by anti-humidity materials to prevent condensation. It shall be applicable for 380-13,800V, 50/60Hz and 3Ph. The motor shall have a both-end support structure and built-in motor coil temperature sensors for real-time control by the control panel.
3) The motor coil shall be specially insulated to have refrigerant resistance for HFC-R134a and oil resistance for applied oil.
4) A variable diffuser shall be adopted for optimized partial load performance and stable operation in low load condition. An independent motor controlling the variable diffuser shall be provided with corresponding to IGV opening ratio.
5) Ball or tilting pad type bearing shall be applied. It should include an extra oil sump for constant lubrication for a while after oil pump stop.
6) The inlet guide vane should have multiple vanes to minimize the flow loss at the entrance of the impeller.
7) For a stable operation of high-speed radial and axial bearing, two (including one for spare) bearing temperature sensors shall be installed to monitor and manage the temperature in real time.

3.3 Oil system
1) A trochoid type semi-hermetic oil pump shall be adopted for constant and stable oil supply with low noise / vibration, while allowing the oil volume control by the control valve.
2) The oil pump motor shall be insulated to be refrigerant resistant to HFC-134a and oil resistant to the applied oil. It should be a built-in type and structured to supply oil always stably from the oil tank.
3) The oil filter shall be removable by installing the valve at the both-end and it should include the purge valve and drain plug.
4) The oil cooler shall include an external plate type heat exchanger, which is durable and easy for maintenance, at the rear end of the filter.
5) The oil heater shall be controlled to keep oil temperature to have proper viscosity possible to supply oil to bearings and can be replaced.
6) The gas piping for the refrigerant which returns from Gear Box shall include an external type oil separator to minimize the oil carry over to heat exchangers.

3.4 Evaporator, condenser(including subcooler) and economizer
1) Evaporator and condenser shall have a shell & tube structure and include high-efficiency heat-exchanging tubes. The tubes shall be installed with expanded both ends for easy maintenance. Tube Sheet has holes for the tube fixing on the plate which shall have 2 grooves for protection from leakage.
2) The evaporator shall have 10mm size or less perforated plate structure which can distribute the refrigerant uniformly. The evaporator shell has enough space in upper side to prevent liquid carry-over.
3) The condenser shall have a collision prevention plate, at the gas inlet, which protect tubes from gas jet through discharge pipe.
4) The heat-transfer tubes shall be machined to encourage heat transfer performance inside and outside the tube and parts in contact with tube sheets and tube support plates shall not be machined. The tube support plates for heat-transfer tubes shall be designed for stable support in accordance with TEMA and ASME standards.
5) The pressure vessel shall be designed and inspected in accordance with KGS Code(High-Pressure Gas Safety Control Act) or ASME SEC.VIII(Options) or PED(Pressure Equipment Directive) and certified by the relevant certification agency.
6) On the top of the evaporator and condenser, a safety valve shall be installed in accordance with KGS Code (High-Pressure Gas Safety Control Act) or ASME SEC.VIII (Options). Spring type relief valves are in accordance with ANSI/ASHRAE STANDARD 15-1994 code.
7) Water box shall be designed to select 10kg/cm², 16kg/cm², or 20kg/cm² according to the water pressure with a safety valve. Spring type relief valves are in accordance with American National Standard Institute. The selection valve can be operated manually.

### Guide specification

#### 3.6 Control panel

**1) Structure**

The control panel shall consist of Micom module(HMI/MASTER SLAVE/Vane Control module), a power supply for supplying stable power, breakers for controlling and safety, an electronic contact, and relays for controlling.

**2) HMI/MASTER/SLAVE module**

The module shall use high-performance microprocessor to perform the control function optimized for the equipment. The high-precision analog digital (A/D) converter shall monitor the values of the temperature sensors to display the values on the screen, and apply them to the controlling. The RS-485 communication port is embedded by default to support the remote monitoring and controlling by customers. Customers simply select RS-485 for their building automation.

**3) Indication and operation key module**

The indication and operation key module consists of a display indicating operating data, set points required for the equipment operation, and data of abnormality in characters; a key input section for entering the data or selecting menus; and a LED lamp indicator section showing the equipment operation. The indication and operation key module shall be designed for stable support in accordance with TEMA and ASME standards.

#### 3.7 Features of controller

**1) Convenient operation data management**

A wide 7 inch Color Graphic LCD(800x480) is used to display various pieces of operation information on a single screen, and stores the analog data(e.g., temperature data) up to over 200 cases per channel in the intervals defined by customers for keeping daily operation logs. The real-time display also shows the temperature of the chilled water outlet and the operating current of the compressor motor in graphics for easily identifying the trends of the changes to the temperature and operating current.

**2) Self-diagnosis and failure history storing**

The Micom monitors the conditions of the equipment during shutdown and operation, and notifies operators of the conditions of the equipment by displaying characters, alarm lamps and buzzers, and stores the time and the log of failures for maintenance. In particular, the Micom classifies failures into minor failures and major failures. If a minor failure takes place, the Micom displays the details of the failure in characters and continues the operation of the equipment to minimize the shutdown of the equipment.

**3) Optimized artificial intelligence control algorithm for chiller control**

- **Flexible Startup**
  The vane is slowly operated to prevent impacts on the equipment such as the surge generated from a rapid increase in load at the startup of the equipment.

- **Digital PID Control**
  When the manual mode is changed to the auto mode, the digital PID control integrated with the flexible startup shall recognize the optimal PID control points automatically to minimize the unnecessary shutdown of the equipment and reflect them to the control equation to control the temperature stably and precisely.

- **Preventive Operation**
  The temperature and the pressure of the components are measured in real-time during operation and the primary and secondary preventive operations are performed in accordance with the measurement results to prevent the shutdown of the chiller caused by the overload, the high pressure of the condenser, the low pressure of the evaporator, and others.

- **Scheduled operation**
  The scheduled operation function is provided for the convenient operation of the equipment, which allows the selection of the operation/shutdown and the setting of the control temperature per day of the week, per holiday or 11 times a day.

- **Service functions**
  The following service functions are supported for easy maintenance:
  - Displaying the count of startups and the total operation hours of the pumps and the motors mounted on the body.
  - Printing the operation and the trouble data (Optional).
  - *Power indicator lamp (white)*
  - *Operation indicator lamp (red)*
  - *Stop indicator lamp (green)*
  - *Fault indicator lamp (yellow)*

**3.9 Safety devices**

1) Chilled Water Low Temperature [temperature sensor at chilled water outlet]. Protect the evaporator from freeze.

### Guide specification

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**3.9 Safety devices**

1) Chilled Water Low Temperature [temperature sensor at chilled water outlet]. Protect the evaporator from freeze.
Cold insulation: Standard Specification is NBR material of 19mm or more in thickness and KS or equivalent standard products are to be applied. However, the thickness can be designed and applied to prevent condensation by customer’s requirements and conditions of use.

3.12 Start-up commissioning
A LG engineer or an engineer for the start-up commissioning shall carry out start-up commissioning and provide the operation training. Provide capacity control system capable of reducing unit capacity to 25% of full load.

Part 4. Scope of construction

<table>
<thead>
<tr>
<th>Items</th>
<th>Supplied By</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painting</td>
<td>LGE</td>
<td>Body: Dawn gray</td>
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<tr>
<td></td>
<td></td>
<td>Starter panel: Warm gray</td>
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<tr>
<td></td>
<td></td>
<td>Control panel: Warm gray</td>
</tr>
<tr>
<td>Cold insulation</td>
<td>LGE</td>
<td>Cold insulates the external side of evaporator, chilled water box, and motor. The material is NBR of 3/4”(19mm) and its color is black.</td>
</tr>
<tr>
<td>External piping</td>
<td>Customer</td>
<td>External piping work for chilled water, cooling water and drain</td>
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<tr>
<td>Control system wiring (on the secondary side)</td>
<td>Customer</td>
<td>Control wiring between the starter panel and the control panel</td>
</tr>
<tr>
<td>Power system wiring (on the secondary side)</td>
<td>Customer</td>
<td>Power and ground wiring between the chiller and the starter panel</td>
</tr>
<tr>
<td>Control power</td>
<td>Customer</td>
<td>Control power of 3hp. 380V shall be supplied to the starter panel (minimum power capacity: 4kVA)</td>
</tr>
<tr>
<td>Building and foundation</td>
<td>Customer</td>
<td>Completing the foundation construction prior to installing the chiller</td>
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<tr>
<td>Interlock wiring of the chilled water pump and the cooling water pump</td>
<td>Customer</td>
<td>Wiring between the control panel and the pump control panels</td>
</tr>
<tr>
<td>Relief valve vent piping</td>
<td>Customer</td>
<td>Piping for discharge of refrigerant in emergency</td>
</tr>
</tbody>
</table>

Part 5. Scope of supply

<table>
<thead>
<tr>
<th>Items</th>
<th>Supplied By</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>Centrifuge chiller body</td>
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<td>Refer to the body components</td>
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<tr>
<td>Refrigerant (R-134a)</td>
<td>LGE</td>
<td>Delivery with refrigerant charged (Dioxide or deliver separately if required)</td>
</tr>
<tr>
<td>Lubrication oil</td>
<td>LGE</td>
<td>Delivery with oil charged or separate delivery with chiller</td>
</tr>
<tr>
<td>Isolator Pad</td>
<td>LGE</td>
<td>Vibration absorption pad</td>
</tr>
<tr>
<td>Spare parts</td>
<td>LGE</td>
<td>Provide spare parts as an option if customer is required</td>
</tr>
<tr>
<td>Chiller manual</td>
<td>LGE</td>
<td>Installation and operation manual</td>
</tr>
<tr>
<td>Leveling plate</td>
<td>LGE</td>
<td>Parts for leveling the centrifuge chiller</td>
</tr>
<tr>
<td>Starter panel</td>
<td>LGE</td>
<td>Compressor motor starter (Customer may select)</td>
</tr>
</tbody>
</table>

Part 6. Warranty & Service
6.1 The warranty period shall be the earlier of the following two: “1.5 years of product delivery” or “one year of start-up commissioning.”

6.2 An failure, caused by a defect in the parts, material, or operation occurred during the warranty period, will be inspected by LG ELECTRONICS and fixed free of charge if we agree that it is defective.

6.3 Warranty is not applicable for the following cases
1) If a failure occur after the product is repaired at the shop that is not designated by LG.
2) If the failure is caused by user’s mistakes in using and handling the equipment.
3) If the product is resold or transferred to others during the warranty period.
4) If a failure caused due to a fire or a natural disaster.

Part 7. Notes
7.1 All specification about the manufacturing shall be submitted to the customer side to get the approval from them before the chiller manufacturing can be started. Any requirement not specified here shall be discussed with and approved by the customer before execution.

7.2 When reselling or transferring the product to another party before discarding them, notify LG Electronics.