Product Data

Variable Speed Air Cooled Heat Pump

Cooling Capacity 18.4 Tons (4.69 kW)
Heating Capacity 263.9 MBH (77.35 kW)

30RQM020 Air-Cooled Heat Pump with R-454B Refrigerant
Cooling capacity: 18.4 Tons (64.69 kW)
Heating capacity: 263.9 MBH (77.35 kW)
60 Hz

Features/Benefits

Carrier's innovative chiller design provides savings at initial purchase, at installation, and for years afterward.

- Rotatory, Hermetic VFD compressor
- Opteon™[1] XL41(R-454B)
- Energy Efficiency Ratios (EERs) for all units meet ASHRAE (American Society of Heating, Refrigeration, and Air-conditioning Engineer) Standard 90.1-2022
- Easy to use PIC6.1 Controls.
- Outdoor coils are designed with RTPF (Al/Cu) and are provided with an epoxy coating for additional corrosion resistance.
- Water flow switch and Wye strainer come factory-installed and standard on all units.
- Outdoor coils are protected by security grilles; other main components of the unit are covered by panels.
- Compressors are wrapped with acoustic blankets.
- Standard SCCR value is 25KA on 460V units.
- Standard SCCR value is 50KA on 230V units.

Energy-Efficient

- High efficiency rotary compressors designed for R-454B.
- Dual compressor, dual refrigeration circuit design, providing low starting current and high part-load efficiency.
- Inrush current is low due to the use of a variable frequency drive, and the number of running units can be matched according to the load, thus reducing energy consumption.
- Fan utilizes variable frequency control, resulting in significantly lower power consumption compared to standard axial fans.
- Electronic expansion valve control for precise control of condensing pressure and better cooling efficiency.
- Evaporator heat exchanger volume results in optimized superheat.
- Heat pump unit adopts intelligent defrosting control to optimize the defrosting cycle time, which avoids unnecessary heat loss, and improves the stability of hot water outlet temperature, resulting in excellent heating performance.

Easy and Compact Installation

- Unit structure design is compact, lightweight, and convenient for transportation, and the site layout is flexible. All units in the system have water access on the same side.
- Overall compact structure saves valuable installation space. Compared with similar products, the single machine installation area and the multiple parallel installation area are reduced.
- Unit factory provides a Y-Filter pipe, the customer can choose the connection mode freely on site, the installation is convenient and fast.
- Unit has a responsive and maintenance-free target flow switch; Therefore, the system runs more reliably and efficiently.
- Modular design saves site installation time.

Quiet Operation

- New generation of completely enclosed rotary compressors have smooth and stable operation, low vibration, and low noise.
- Unique design of compressor elastic damping base and optimal arrangement of suction and exhaust pipes effectively block compressor vibration transmission.
- Optimized design of the outdoor "V" fin heat exchange coil results in more uniform and quiet air flow crossing the coil surface.
- Low-noise axial fans operate more quietly, greatly reducing the production of low-frequency noise.

Flexible Combination

- A single control system can manage up to 16 modular units, enabling control of up to 320 Tons (1125 kW) of cooling and 4222.4 MBH (1237.6 kW) of heating. The control panel used for this setup is the same standard panel included with each individual unit, eliminating the need for any additional or specialized control hardware to meet the flexible needs of each application.
- The standard modular design results in easy system expansion. Suitable for phased investment, and convenient for customers to flexibly arrange their investment.

1. Third-party trademarks and logos are the property of their respective owners.

Table of contents

Features/Benefits (cont)

Compressor

- The 30RQM020 units use hermetic VFD motor rotary compressor and use environmentally balanced refrigerant R-454B.
- Each compressor is equipped with a crankcase oil heater, and comes with vibration isolators, installed between the unit chassis and the compressor base plate.

All units are provided with hot gas bypass capability, thus permitting unit operation down below the minimum standard step of capacity.

Waterside Exchanger (BPHE)

- The Water exchanger is BPHE (brazed plate heat exchanger), and the water connections are victaulic.
- The heat exchanger is externally insulated with 10 mm thick polyurethane foam.

Strainer Included

A 20-mesh strainer is provided with every 30RQM unit.

Other manufacturers also require the use of a strainer with BPHE ,but they may not supply this item or account for this item in system pressure drop (influence pump selection) calculations.

Fan

- Each motor is VFD driven and is three-phase, permanently lubricated and sealed, with class F insulation.

EXV (Electronic Expansion Valve)

- EXV is equipped with a stepper motor (Drive power DC12V, Excitation 1~2 phases), which is controlled by the control Board.

Airside Exchanger (Outdoor Coil)

- This coil is comprised of copper tubes with aluminum fins.

Control/Communication Methods

- Both BACnet®[1] IP&MSTP and Modbus capability are provided as standard on all units.
- Remote connectivity (Carrier Smart) capability is standard on all units.
- BACnet IP&MSTP
- Modbus

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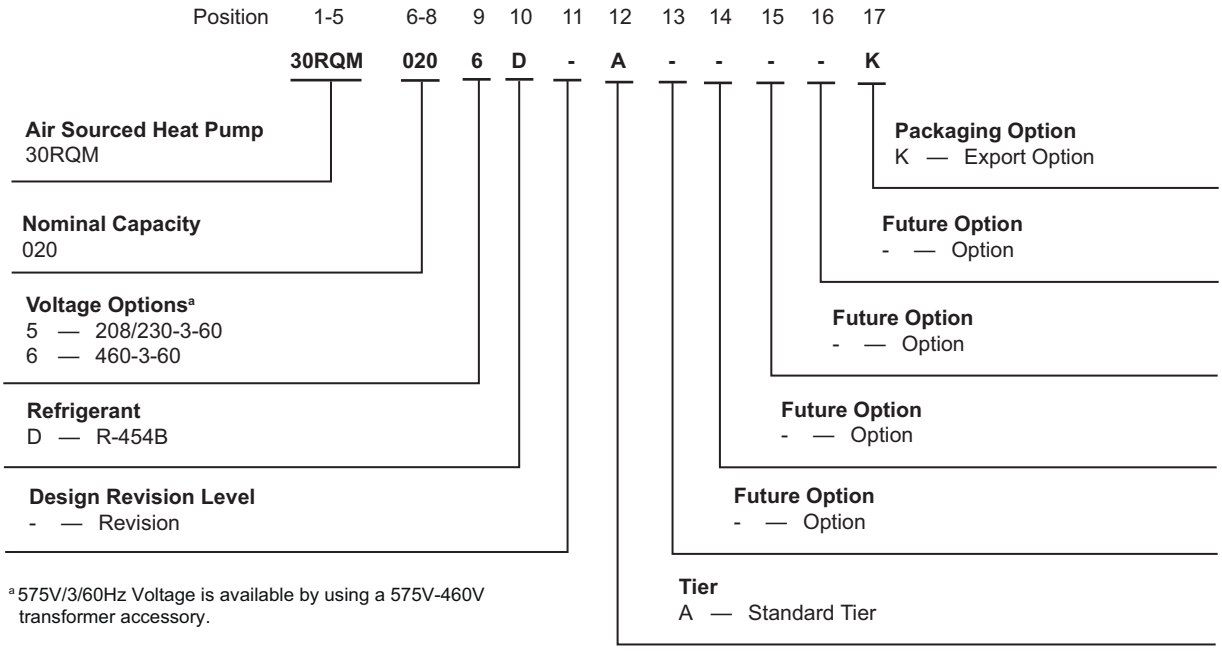
Model number nomenclature



[a] 575V/3/60Hz Voltage is available by using a 575V-460V transformer accessory.

Physical data

Physical Data, 30RQM020 — English

MODEL	30RQM0205D-A----K	30RQM0206D-A----K
Refrigerant	R-454B	
Charge Volume, Circuit A (lb)	13.12	13.12
Charge Volume, Circuit B (lb)	13.12	13.12
Compressor	Rotary, Hermetic	
Quantity Circuit A (set)	1	1
Quantity Circuit B (set)	1	1
Capacity Step	Stepless (Variable Frequency Drive)	
Minimum Cooling Capacity (%)	20	20
Control System	Microcomputer control system	
Outdoor Coil	Copper tube, aluminum plate fin	
Fan Type	Variable frequency low noise axial flow fan	
Number of Fans	2	2
Fan Speed (rpm)	200-980	200-980
Water Heat Exchanger	Brazed plate exchanger	
Water Volume (g)	2.14	2.14
Water Connection	Victaulic	
Nominal Diameter (in.)	2	2
Electrical Parameters		
Main Power Supply	230V-3Ph-60Hz	460V-3Ph-60Hz
Control Power	24V AC built-in control transformer	
MCA/MOP (amps)	113.12/225	55.43/175
Fan Power (kW)	1.1/1.1	1.1/1.1
Unit Length (in.)	88.03	88.03
Unit Width (in.)	47.24	47.24
Unit Height (in.)	85.67	85.67
Shipping Weight (lb)	1708.6	1472.7
Operating Weight (lb)	1794.6	1582.9

Physical data (cont)

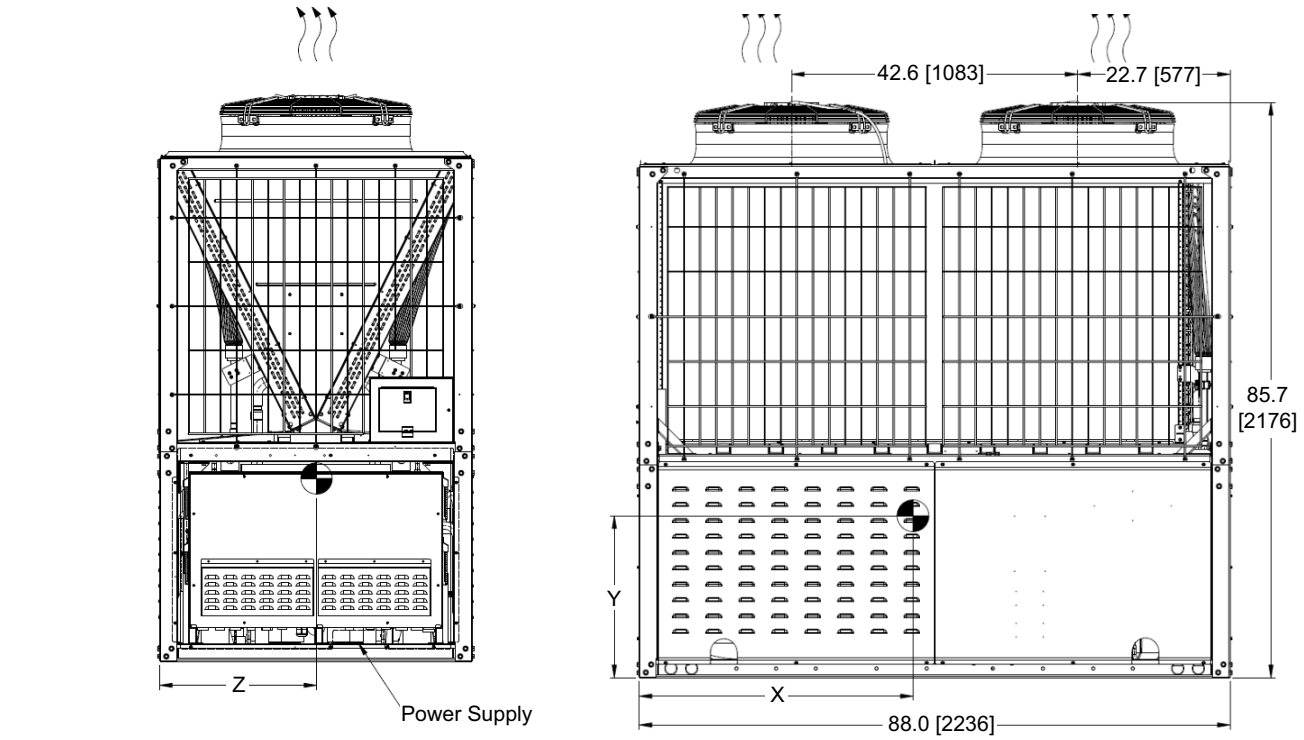
Physical Data, 30RQM020 — SI

MODEL	30RQM0205D-A----K	30RQM0206D-A----K
Refrigerant	R-454B	
Charge Volume, Circuit A (kg)	5.95	5.95
Charge Volume, Circuit B (kg)	5.95	5.95
Compressor	Rotary, Hermetic	
Quantity Circuit A (set)	1	1
Quantity Circuit B (set)	1	1
Capacity Step	Stepless	
Minimum Cooling Capacity (%)	20	20
Control System	Microcomputer control system	
Fin Coil	Copper tube, aluminum plate fin	
Fan Type	Variable frequency low noise axial flow fan	
Number of Fans	2	2
Fan Speed (rpm)	200-980	200-980
Water Heat Exchanger	Braze plate heat exchanger	
Water Volume (L)	8.1	8.1
Water Connection	Victaulic	
Nominal Diameter (DN)	50	50
Electrical Parameters		
Main Power Supply	230V-3Ph-60Hz	460V-3Ph-60Hz
Control Power	24V AC built-in control transformer	
MCA/MOP (amps)	113.12/225	55.43/175
Fan Power (kW)	1.1/1.1	1.1/1.1
Unit Length (mm)	2236	2236
Unit Width (mm)	1200	1200
Unit Height (mm)	2176	2176
Shipping Weight (kg)	775	668
Operating Weight (kg)	814	718

Dimensions

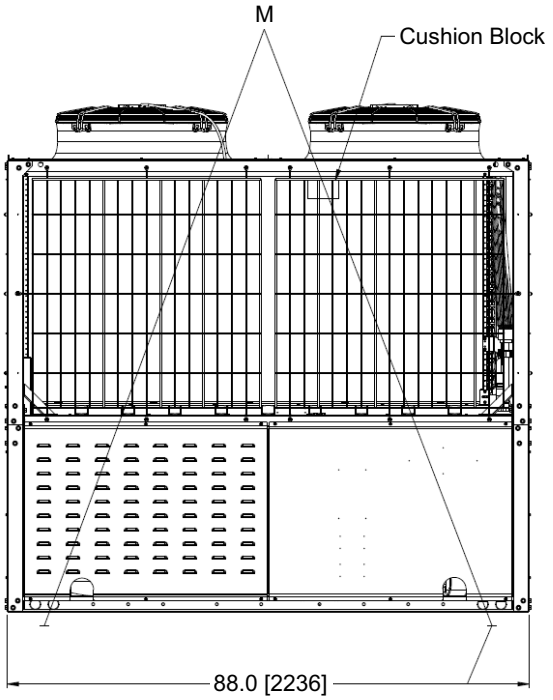
Outline and Installation Gaps

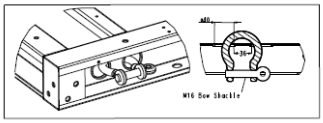
UNIT MODEL	ENGLISH			SI		
	X in.	Y in.	Z in.	X mm	Y mm	Z mm
30RQM0205D-A----K	40.7	26.8	23.6	1033	680	600
30RQM0206D-A----K	42.2	30.2	23.6	1073	766	599

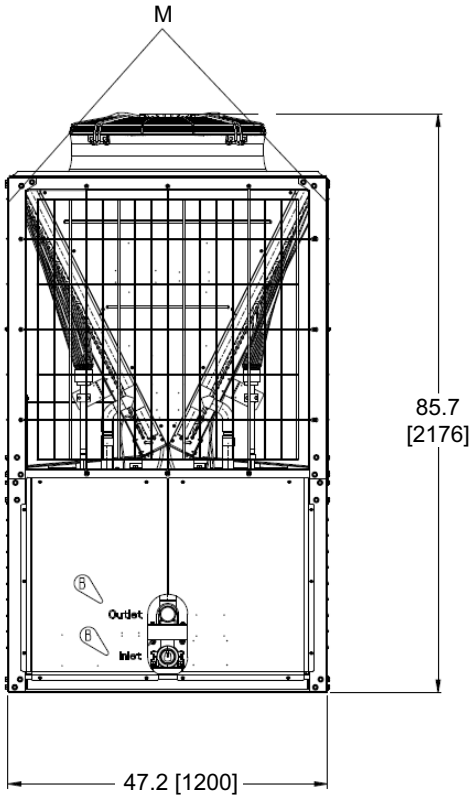


NOTE: Dimensions are in inches [mm].

Dimensions (cont)



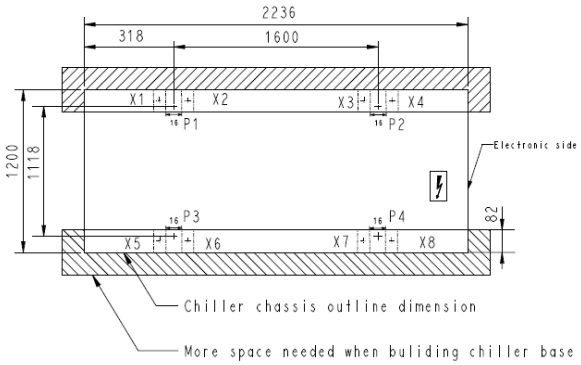


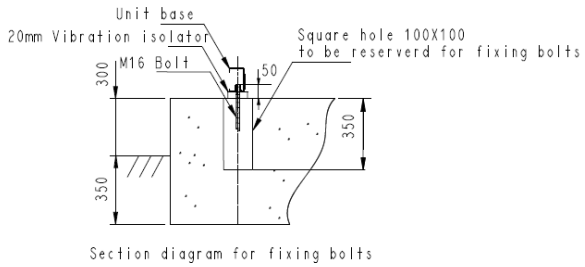


NOTE: Dimensions are in inches [mm].

Dimensions (cont)

Foundation





NOTES:

- Place the sling in a round hole.
- Lift the unit with two slings of 315 in. (8 m), φ1 in. (23 mm) or more.
- Place a gasket or spacer in the place where the rope is in contact with the unit to prevent damage to the unit.
- Do not hang the sling on the wooden support to lift work to avoid accidents.
- Avoid cross lifting.

Operating Weights — English

UNIT MODEL	OPERATING WEIGHT [lb]	P1 [lb]	P2 [lb]	P3 [lb]	P4 [lb]
30RQM0205D-A----K	1794	461	436	461	436
30RQM0206D-A----K	1582	405	386	405	386

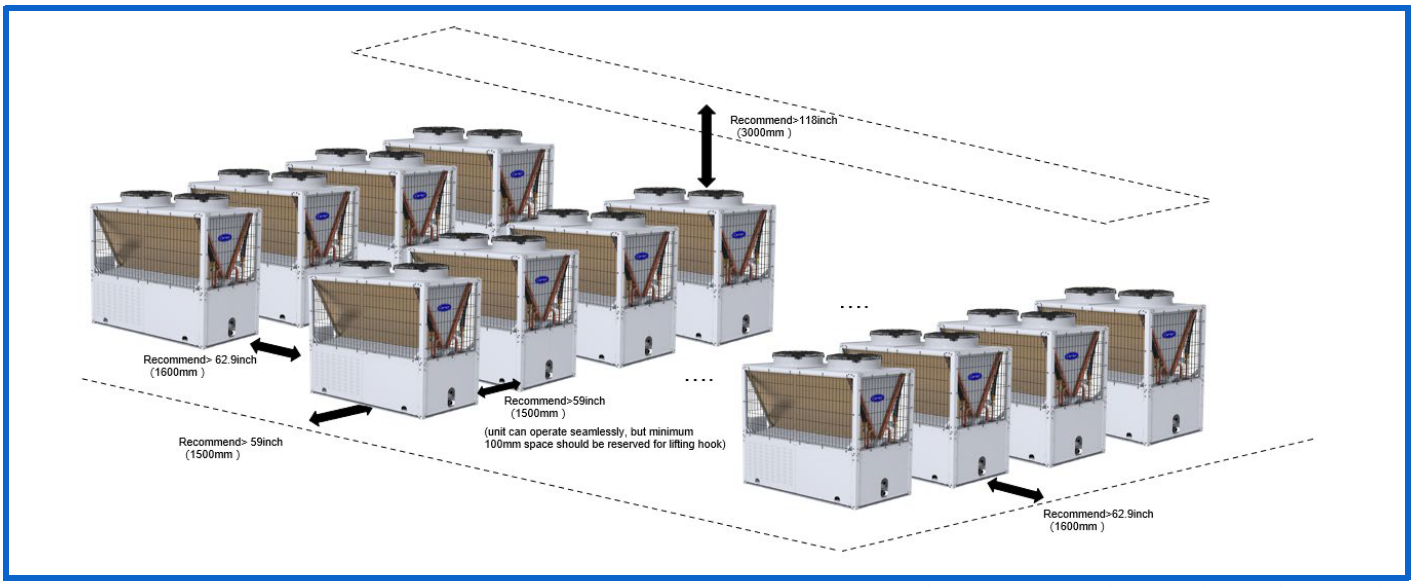
Operating Weights — SI

UNIT MODEL	OPERATING WEIGHT (kg)	P1 (kg)	P2 (kg)	P3 (kg)	P4 (kg)
30RQM0205D-A----K	814	209	198	209	198
30RQM0206D-A----K	718	184	175	184	175

The 30RQM020 unit must be installed outdoors.

- The base should be designed to accommodate the long side installation of the unit, as shown in the left figure.
- Anchor bolt specification: M16 X 300.
- Anchor bolt positions are marked as P1, P2, P3, P4 in the figure.
- When installing the unit, a maintenance space of no less than 4.72 in. (120 mm) beneath the water filter should be reserved.
- During installation, it is recommended to use SD-type square rubber cushions with basic dimensions of 4 in. (85 mm) x 4 in. (85 mm) x 1 in. (20 mm), installed at positions marked as X1-X8 in the figure.
- It is recommended to use dampers. The base of this product requires special treatment; please consult local technical support in advance. Choose dampers with a load of 881.7 lb (400 kg) 992 lb (450 kg), such as the MHD-400 / MHD-450.
- Ensure that the ODU (outdoor unit) is horizontally installed in a sturdy location to prevent vibration and noise.
- Use a base wider than ODU to support the air conditioning. Face of the rubber pad should cover the entire load-bearing surface of the base.
- Drainage channels should be arranged around the base to ensure that all condensate generated during operation is completely drained away.

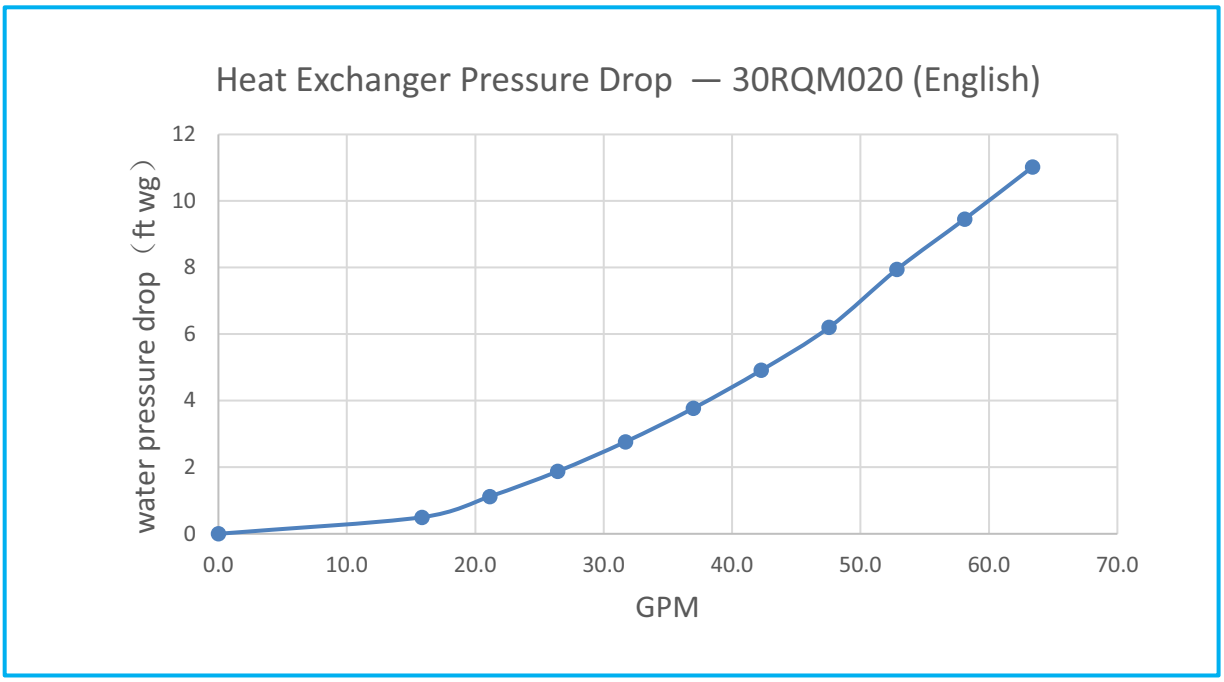
Dimensions (cont)

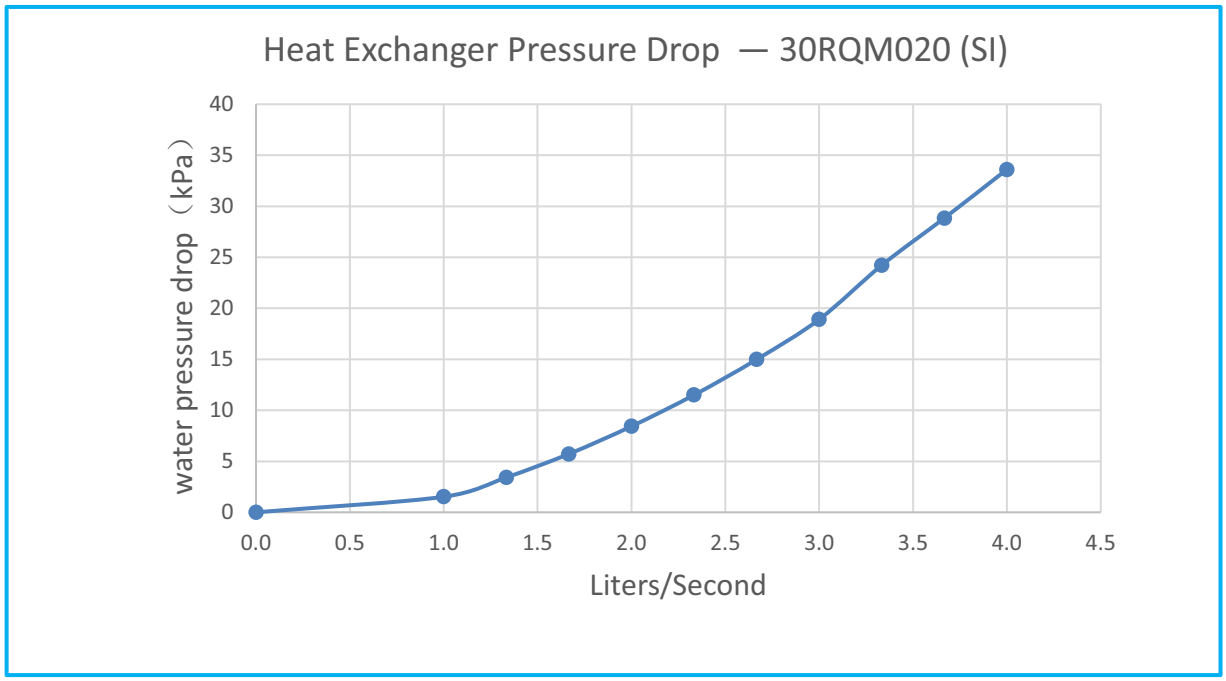


NOTES:

- When designing installation, please refer to the installation dimension diagram provided.
- For this installation gap, the disassembly and assembly of the unit coils/fans must be reserved by lifting.
- The height of surrounding structures must not be larger than 78 in. (2 m).

Performance data





Electrical data

MODEL[a]	30RQM0205D-A----K	30RQM0206D-A----K
Rated Voltage	230-3-60	460-3-60
Voltage Limits	207-253	414-506
Control Power	24V AC built-in control transformer	
Maximum Starting Current[b] (amps)	279.28	139.64
Max FLA (amps)	91.26	43.96
MCA/MOP (amps)	113.12/225	55.43/175

NOTE(S):

a. Unit power includes compressors, fans and control systems.
b. Instantaneous starting current.

Electrical Data of Compressor

COMPRESSOR	I MAX (Un)	I MAX (Un-10°)	LRA	PF MAX	CIRCUIT	30RQM0205D-A----K	30RQM0206D-A----K
9VD650	55	60	113	0.97	A	1	1
					B	1	1

LEGEND

I Max — 30RQM0205 maximum operating current A at 207V.
30RQM0206 maximum operating current A at 414V.
LRA — Locked Rotor Current A
PF — Power Factor
MCA — Minimum Circuit Ampacity
MOP — Maximum Current Rating of Overcurrent Protective Device

Field Wiring Sizes[a,b,c]

CONNECTION TYPE	30RQM UNIT SIZES	MCA RANGE	WIRE SIZE RANGE	MAXIMUM NUMBER OF WIRES PER PHASE
Terminal Block (460V Standard)	20	MCA up to 175	4AWG~1AWG (22-38mm^2)	1
Terminal Busbar (230V Option)	20	MCA up to 225	3AWG~AWG (25-38mm^2)	1

NOTE(S):

a. Wiring for main field supply must be rated 75°C. Use copper conductors only.
b. Units with high SCCR option and terminal block must use approved MCCB to meet high SCCR rating.
c. Currently, MCCB in EBOX has a breaking capacity of 25 kA (at 460V) / 50 kA (at 220V). If MCCB with a high breaking capacity is required, additional type selection and certification procedures are needed.)

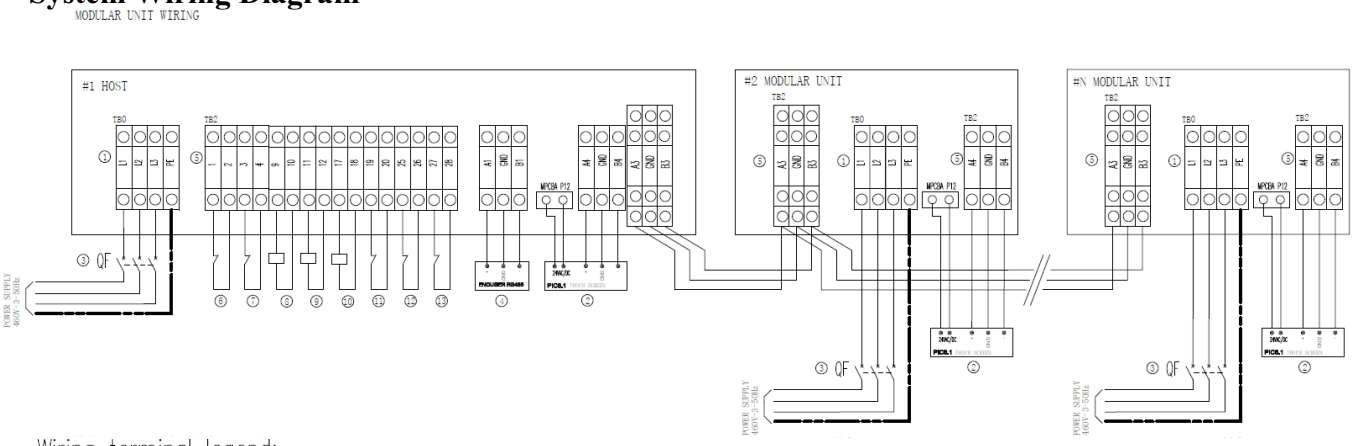
LEGEND

AWG — American Wire Gauge
SCCR — Short Circuit Current Rating

Typical wiring diagram

Field Control Connection

System Wiring Diagram



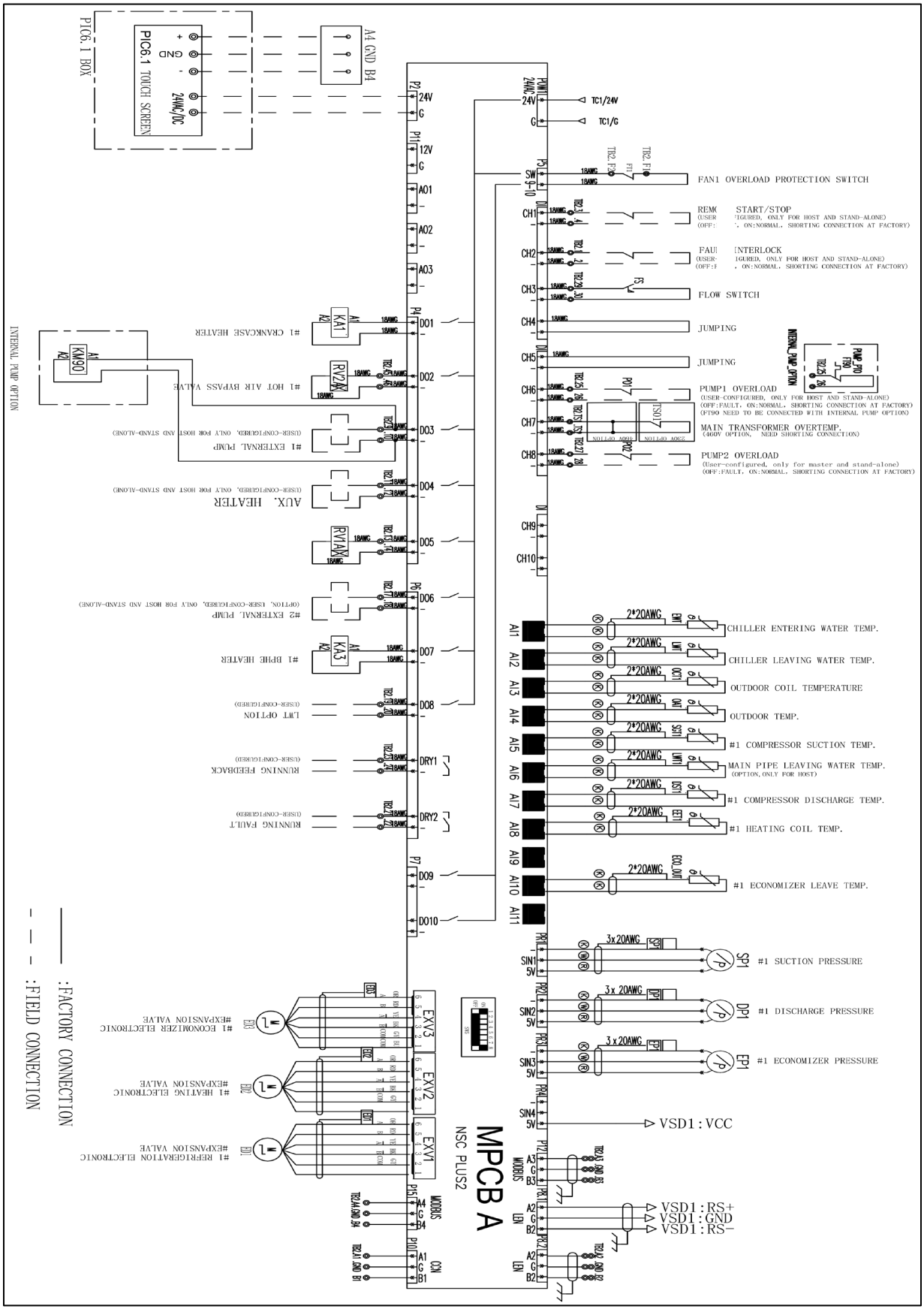
Wiring terminal legend:
PE Protective earth
L1 Phase line
L2 Phase line
L3 Phase line

① Single ODU power terminal block TB0
② System controller (for host and single unit only)
③ Single unit main power switch
④ Enduser Remote RS485 device
⑤ Single ODU terminal block TB2
⑥ Remote fault interlock (user supplied, for host and single unit only)
⑦ Remote start/stop (user supplied, for host and single unit only)
⑧ #1 Internal pump (Option)
⑨ Auxiliary heater (user supplied, for host and single unit only)
⑩ #2 external pump (Option,user supplied, for host and single unit only)
⑪ #1 Internal pump overload (Option)
⑫ #2 pump overload (Option, user supplied, for host and single unit only)
⑬ Water circuit solenoid (Option)
⑭ HMI controller (for each unit)

*Note: Each ODU must be connected to power and equipped with its own short circuit protection device. Sharing a short circuit protection device among multiple units is prohibited.

Typical wiring diagram (cont)

Single Unit Wiring Diagram



Application data

Operating Range of Unit

COOLING CONDITIONS	30RQM020 (ENGLISH)[a]	
Evaporator (Brazed Plate Heat Exchanger)	Minimum temp.	Maximum temp.
Outlet Water Temp. (F)	41°	68°
Inlet/Outlet Temp. Max Difference (F)	5.4°	15°
Condenser (Coil)	Minimum temp.	Maximum temp.
Inlet Air Dry Bulb Temp. (F)[b]	32°	118.4°

NOTE(S):

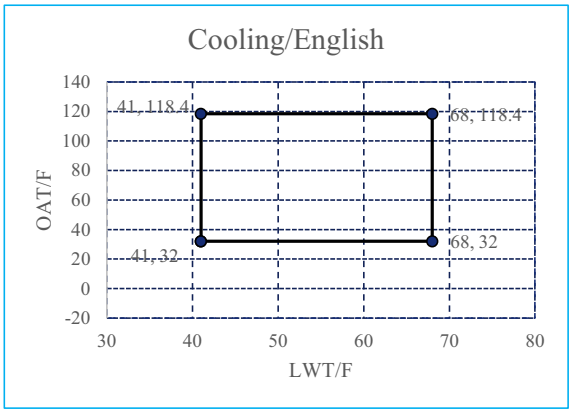
a. For application in conditions below 37.4°F (3°C), please use an appropriate antifreeze solution.
b. Maximum external temperature: The temperature range for unit transport and storage is –13°F (-25°C) to +140°F (+60°C). When transporting the unit in container, please observe the above temperature range.

HEATING CONDITIONS	30RQM020 (ENGLISH)[a]	
Evaporator (Brazed Plate Heat Exchanger)	Minimum temp.	Maximum temp.
Outlet Water Temp. (F)	68°	140°
Inlet/Outlet Temp. Max Difference (F)	5.4°	15°
Condenser (Coil)	Minimum temp.	Maximum temp.
Inlet Air Dry Bulb Temp. (F)[b]	–16.6°	109.4°

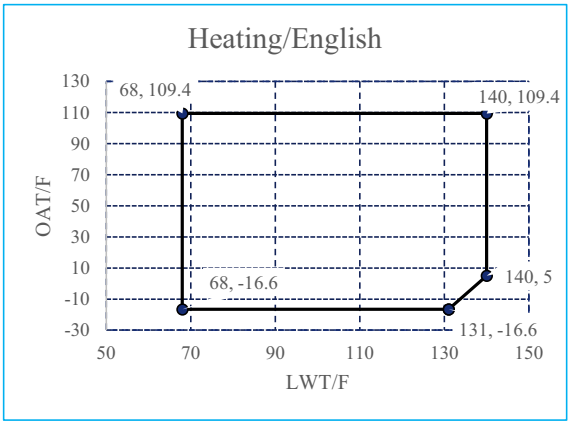
NOTE(S):

a. For application in conditions below 37.4°F (3°C), please use an appropriate antifreeze solution.
b. Maximum external temperature: The temperature range for unit transport and storage is –13°F (–25°C) to +140°F (+60°C). When transporting the unit in container, please observe the above temperature range.

30RQM020 Cooling Mode (English)



30RQM020 Heating Mode (English)



Application data (cont)

COOLING CONDITIONS	30RQM020 (SI)[a]	
Evaporator (Brazed plate heat exchanger)	Minimum temp.	Maximum temp.
Outlet water temp. (C)	5°	20°
Inlet/outlet temp. max difference (C)	—	7°
Condenser (coil)	Minimum temp.	Maximum temp.
Inlet air dry bulb temp. (C)[b]	0°	48°

NOTE(S):

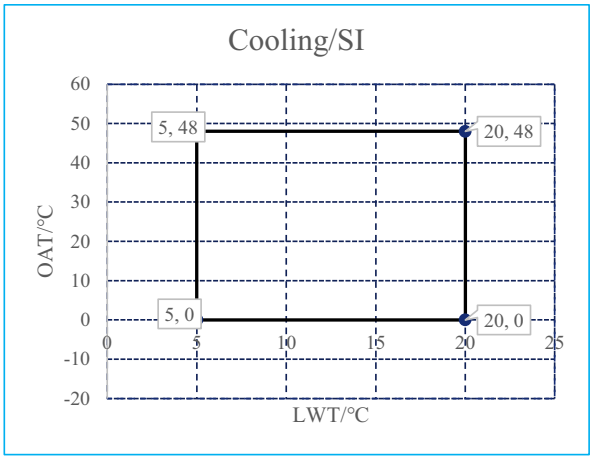
a. For application in conditions below 37.4°F (3°C), please use an appropriate antifreeze solution.
b. Maximum external temperature: The temperature range for unit transport and storage is –13°F (–25°C) to +140°F (+60°C). When transporting the unit in container, please observe the above temperature range.

HEATING CONDITIONS	30RQM020 (SI)[a]	
Evaporator (Brazed plate heat exchanger)	Minimum temp.	Maximum temp.
Outlet water temp. (C)	20°	60°
Inlet/outlet temp. max difference (C)	—	7°
Condenser (coil)	Minimum temp.	Maximum temp.
Inlet air dry bulb temp. (C)[b]	–27°	43°

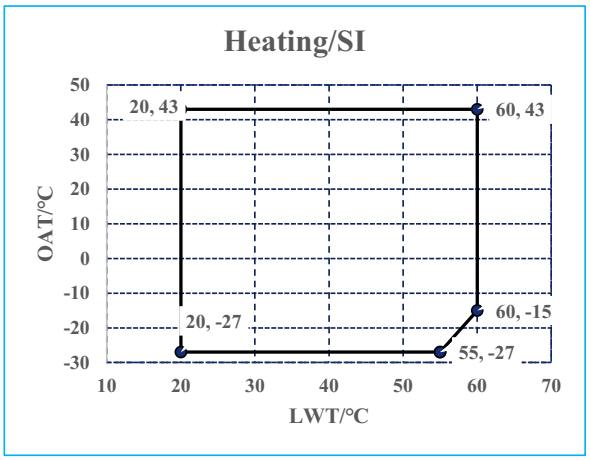
NOTE(S):

a. For application in conditions below 37.4°F (3°C), please use an appropriate antifreeze solution.
b. Maximum external temperature: The temperature range for unit transport and storage is –13°F (–25°C) to +140°F (+60°C). When transporting the unit in container, please observe the above temperature range.

30RQM020 Cooling Mode (SI)



30RQM020 Heating Mode (SI)



NOTES:

- The ambient temperature range for unit running in the heating mode is –16.6°F (–27°C) to +109.4°F (+43°C). The ambient temperature over-limit protection failure will occur when ambient temperature is lower than –16.6°F (–27°C) and higher than +111.2°F (+44°C). The alarm recovery condition is the ambient temperature is higher than –13°F (–25°C) and lower than +102.2°F (+39°C).
- The ambient temperature range for unit running in the cooling mode is 32°F (0°C) to +118.4°F (+48°C). The ambient temperature over-limit protection failure will occur when ambient temperature is lower than 31.1°F (–0.5°C) and higher than +140°F (+60°C). The alarm recovery condition is the ambient temperature is higher than 35.6°F (2°C) and lower than +131°F (+55°C).
- The above operating range is only applicable to pure water medium. If you use a different heat transfer medium (antifreeze), please consult the local Carrier office for the operating range.
- The maximum water temperature difference depends on the flow rate at the closing point of the water flow switch.

The operating conditions within the ambient temperature limit range do not mean that the compressor is always fully loaded; they also need to be related to the operating status of the system.

Application data (cont)

Minimum Water Flow

If the flow rate during installation is lower than the minimum flow rate, scaling in the water system piping will accelerate and lead to uneven water flow distribution in the plate heat exchanger, eventually causing the plate heat exchanger to freeze.

NOTE: To prevent the brazed plate heat exchanger from freezing, the Open/Close values set for flow switch are as follows. The unit can be started only when the water flow reaches the Close value:

UNIT MODEL	OPEN VALUE	CLOSE VALUE	MINIMUM WATER FLOW
30RQM020	29.3 gpm	31.83 gpm	31.83 gpm
	1.848 L/s	2.008 L/s	2.008 L/s

Circulating Water Flow

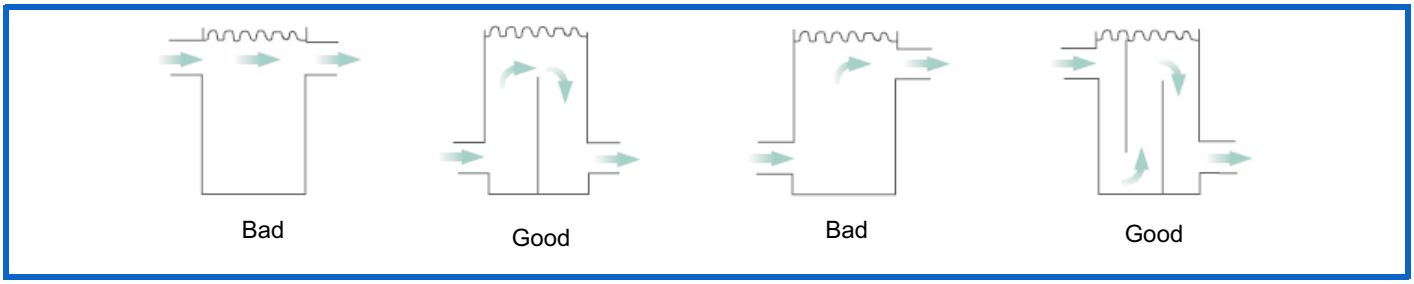
Minimum water capacity

The minimum water capacity of the water circulation system is given by the following formula:

Volume = CAP × N where CAP is the nominal cooling capacity under standard conditions.

APPLICATION TYPE	N	VOLUME
30RQM020	10 (L/kW)	703L
	10 (gal/Ton)	200gal

When the actual water capacity of the system is less than the minimum water capacity in the table above, an additional buffer water tank is required. The volume of the buffer water tank should be bigger than the difference between the actual water capacity of the system and the minimum water capacity. Adding a buffer water tank helps resolve system temperature fluctuations, achieving good thermal stability, preventing rapid water temperature fluctuations leading to frequent compressor starts and stops, and preventing rapid water temperature drops during defrosting. The installation of the buffer water tank is shown in the figure below:

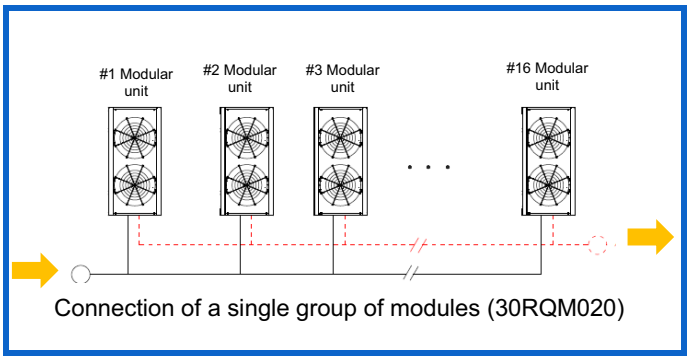


Application data (cont)

Water System Connection

The water system is suitable for closed-loop water systems, which can be divided into direct return and reversed return according to the flow relationship of supply and return water in the piping system. Schematic diagrams of both configurations can be found in the figures below.

- Direct return system: The lengths of pipes through each parallel loop are not equal. The direct return system is simple, consumes less piping material, and is of simpler construction. This is NOT recommend.
- Reverse return system: The lengths of pipes through each parallel loop are basically equal. If the resistance loss per length of the pipeline is nearly equal, the resistance of the pipe network can maintain balance without adjustment. In the reversed return system, the hydraulic stability of the system is good, the water distribution among the equipment is balanced, and adjustment is convenient. For 30RQM020 modular units, when multiple units are combined for operation, reversed return water system connection is recommended, as shown in the figure below.

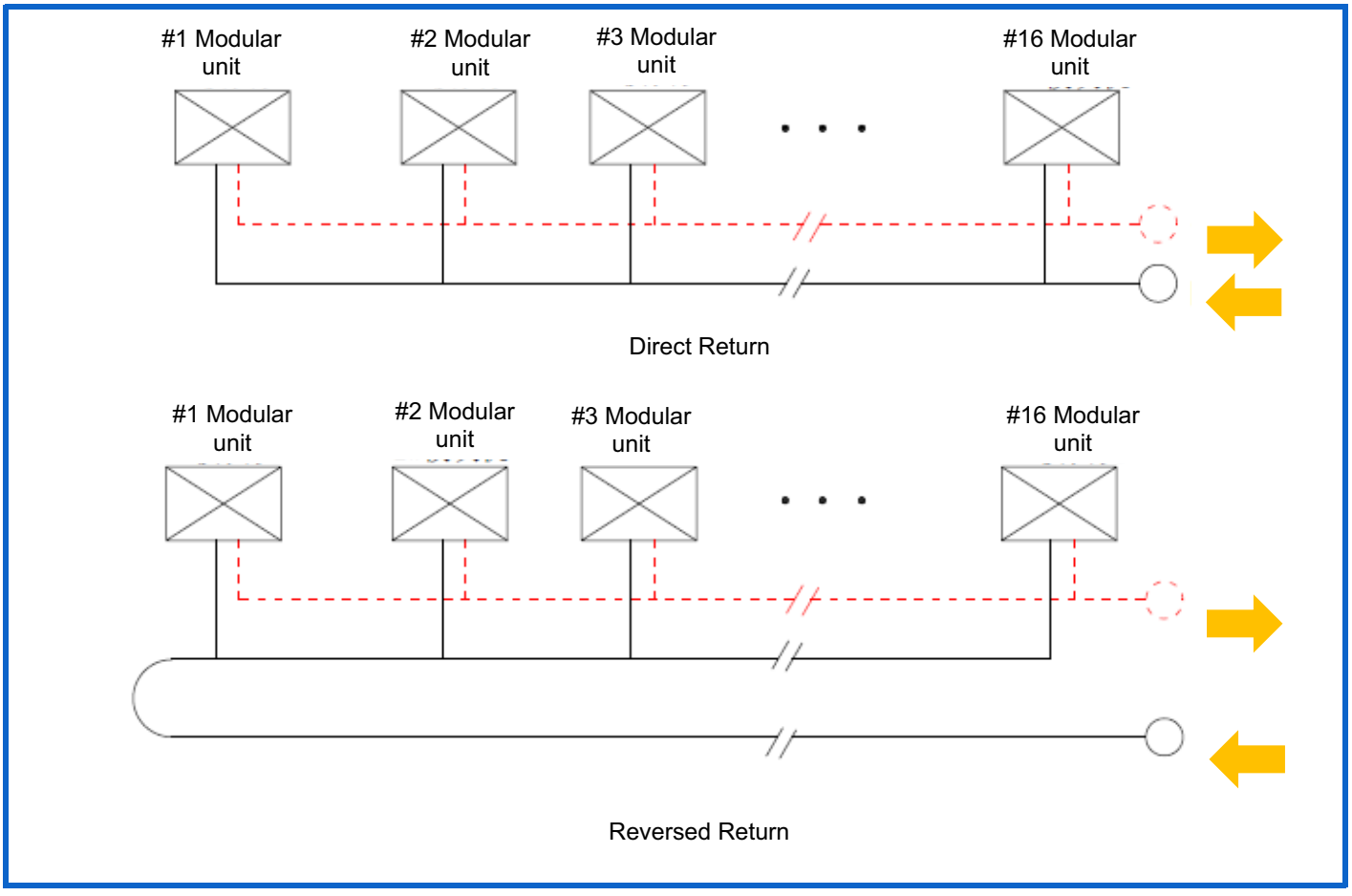


Connection of a single group of modules (30RQM020)

For a single group of units (8 or less units), if only direct return system is available due to limited space for water pipeline arrangement, it is necessary to install flow regulating valves on each parallel branch pipe to adjust the flow to avoid the occurrence of unit flow alarms caused by uneven system flow distribution. At the same time, during flow regulation, the opening degree of the regulating valves will cause additional water pressure to drop. The owner needs to fully consider this extra pipe pressure drop when selecting pumps.

For groups of units (or a single group with more than 8 units), the direct return system cannot be used. Only the reversed return connection can be adopted.

NOTE: When the unit's water system is arranged in direct return layout, flow regulating valves must be installed on the water branch pipes to ensure the water flow distribution of the units.



Direct Return

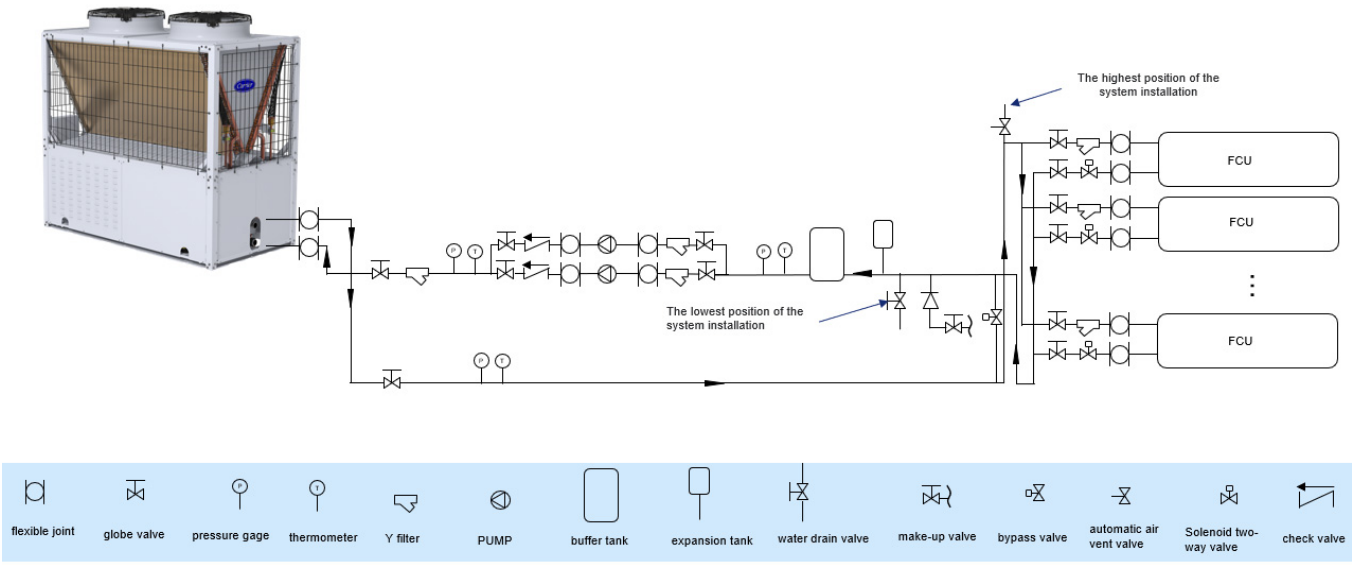
Reversed Return

Application data (cont)

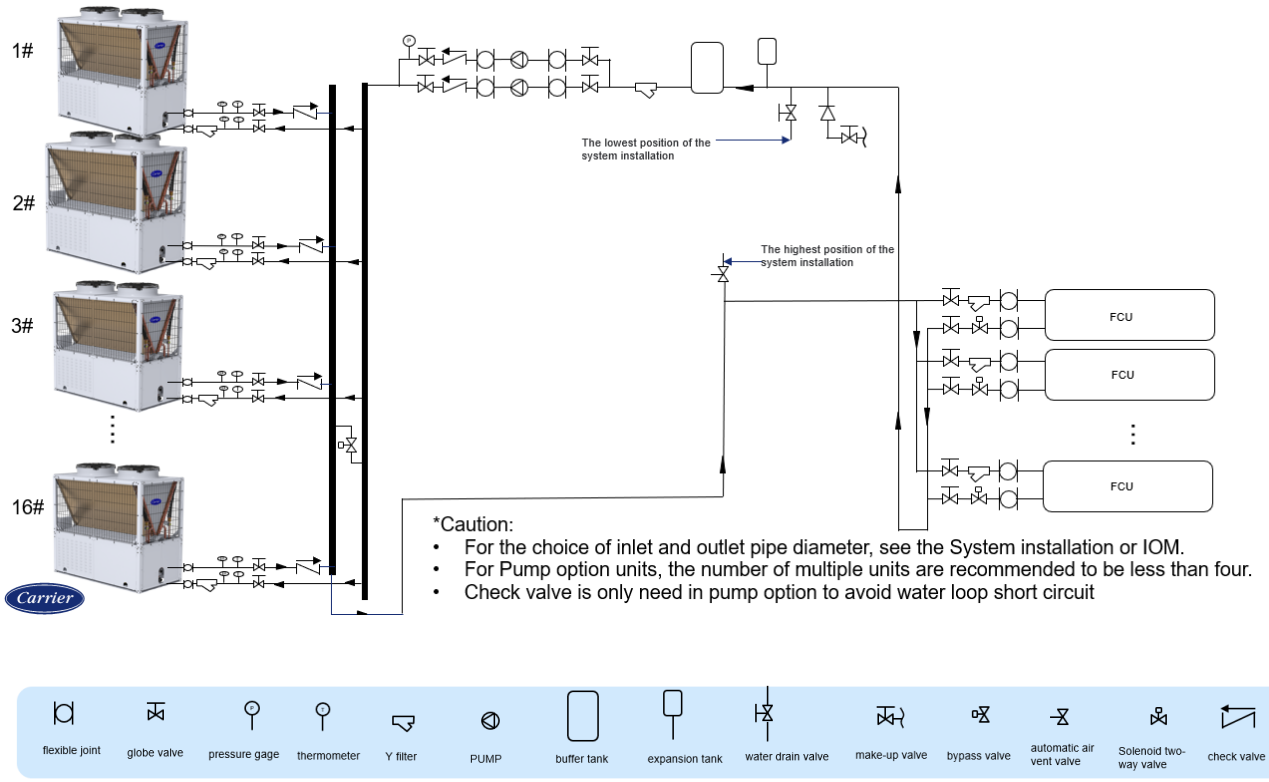
Connection of 30RQM Water System

Refer to the typical water system diagram for 30RQM020 below. For water make-up to the water system, use the exhaust valves to expel the air from the system.

Typical Water System Diagram for Single 30RQM020 (Standard Units with No Pump)



Typical Water System Diagram for Multiple 30RQM020 (Standard Units with No Pump)



Application data (cont)

NOTES:

- The system exhaust valves must be installed at the highest point of the water circuit. In case of significant height variations in the water circuit pipelines, installing exhaust valves at the highest points of the bends is advised.
- The system drain valves must be installed at the lowest point of the water circuit.
- 30RQM020 uses a mechanical flow switch, installed on the inlet side of the BPHE, inside the unit.
- The flow regulating valves can be butterfly valves, gate valves, etc., ball valves or other shut-off valves are not recommended.
- For the 30RQM020, the Y-type filter is shipped with the unit, including the piping, and should be installed by the customer.
- Reversed return system is recommended.

Control Scope

The control system controls overall unit operation and controls a number of processes simultaneously. These processes include internal timers, reading inputs, analog to digital conversions, output relay control, namely actuator control and function control.

Function control includes the control of capacity calculation and allocation, startup, shutdown, defrost, antifreeze, prevention, and override.

Actuator control includes the control of compressors, fan, water pump, electronic expansion valve and other auxiliary actuator or equipment.

Sensors

Thermistors are used to control temperature-sensing inputs to the control system. The following temperature sensors are provided on 30RQM020 units:

- Leaving fluid (supply) temperature (LWT)
- Entering fluid (return) temperature (EWT)
- Outside air temperature (OAT)
- Discharge gas temperature.
- Cooling suction gas temperature
- Heating suction gas temperature
- Economizer temperature
- Fan coil temperature.

Three refrigerant pressure transducers are used in each circuit for sensing suction pressure, discharge pressure and economizer pressure.

The pressure transducers above are also used to calculate the following values:

- Saturated condensing temperature
- Saturated evaporator temperature
- Saturated economizer temperature

Main Function Control

Off cycle

Heaters including evaporator heater, compressor crankcase heater, and water flow switch heater will be turned on or off when ambient temperature, water temperature, unit heat cool mode meets certain criteria.

Startup

After the ON command from user, the prestart process takes place. The capacity control won't be enabled until the flow and temperature stabilize. This is designed to avoid unnecessary compressor usage.

Capacity control

The variable speed compressor provides more water temperature control accuracy than fixed speed units. However, the accuracy is still affected by water loop volume, loop flow rate, load, outdoor-air temperature, and the number of ODUs.

A PID (proportion Integration Differentiation) calculator based on the deviation from entering-fluid (return) temperature set point is used to determine the load demand, within a deadband of ±0.5°C. The controls respond to the return temperature to adjust the compressors' speed to match load requirements.

As additional cooling/heating is required, the compressor speed will change, and an additional compressor will be energized to meet the demand. The added or reduced compressor speed is controlled by temperature deviation from set point and the rate of fluid temperature change.

For single ODU and system with multiple ODUs, the control system has quick loading logic upon receiving ON command from the user. It also has quick unloading logic if there is rapid reduction of load.

For system with multiple ODUs. The control system implements:

- Balance strategy that the control system intends to open one of two circuits first for all ODUs, then load the remaining loops with the sequence by accrued the run time hours from short to long (unloading sequence is on the contrary).
- Economic compressor speed strategy so that compressor speed is restricted to 55 Hz to 80 Hz when loading and unloading.

Key safety

Leaving fluid (supply) temperature low or high override

This feature prevents LWT from overshooting the set point in both cooling and heating.

Compressor envelope safety

Safety cuts out if the compressor running outside of envelope for a certain time.

Sensor failures

Failures are detected by the PCB control board.

Antifreeze

Level 1: the system pump will be turned on when water temperature is less than 41°F (5°C).

Level 2: the compressor will be turned on in heating mode when water temperature is less than 39.2°F (4°C).

Defrost

During heating, the unit will defrost when a certain time and temperature condition have been met. Dual circuit will cooperate to maintain water temperature while one circuit is defrosting (providing cooling capacity) while the other circuit should wait and continue providing heating capacity. For system with multiple ODUs, there is limitation of defrost proportion to prevent water temperature from dropping too much.

Diagnostics (Quick Test)

The quick test feature allows a technician to confirm that the PCB control board is functional, informs observer through displaying the condition of each sensor and switch in the unit, and allows the observer to check for proper operation of each actuator.

Main Actuator Control

Compressor control

Compressors have these control features:

- Speed changes according to the PID value, determined by capacity control.
- Startup speed platform at 50 Hz for 90s to120s.
- The second speed platform during speed increasing at 65 Hz for 120s.
- Shutdown platform 30 Hz for 30s.

Controls (cont)

- The upper limit speed will be restricted to 65Hz for the first compressor when the second compressor is starting. The restriction will be unfrozen when the speed of two compressors gets within 10 Hz deviation or 10 minutes have elapsed.
- Oil return management.
- Envelope prevention control.

Fan control

Dual circuits in the ODU share the fan system which contains two variable speed fans installed in parallel.

- In most cases, both fans start before the compressor.
- Fan speed is controlled to maintain SCT (saturated condensing temperature) or SET (saturated evaporating temperature) within the compressor envelope.
- In most cases, both fans run with a fixed 30 rpm speed difference.
- In some extreme conditions, only one fan is turned on or both fans remain off.

EXV/EcoEXV control

Each circuit contains separate main EXV (electronic expansion valve) for CO and HE mode, and one economizer EXV (EcoEXV).

The EXV/EcoEXV controls refrigerant flow to the BPHE (brazed plate heat exchanger) / economizer for different operating conditions by varying an orifice size to increase or decrease the flow area through the valve based on control command input.

- The orifice of EXV and EcoEXV are positioned by a stepper motor through approximately 500 discrete steps and is monitored every 10 seconds for EXV and every 15 seconds for EcoEXV.
- The PID controller is used to make the EXV maintain an approximate 10.8°F (6°C) for cooling and 5.1~7.2°F (3~4°C) for heating refrigerant superheat entering the compressor.
- The PID controller is used to make the EcoEXV maintains an approximate 18°F (10°C) for cooling and -3.6~18°F (-2~5°C) for heating refrigerant superheat entering the compressor.
- EXV opens before the compressor at a certain initial opening.
- EcoEXV turns on or off depending on the condition.
- Feedforward control: EXV opening will be adjusted when the compressor speed varies.
- Prevention control mode: in some cases, valve opening is forced to keep the system from abnormal shutdown.

Guide specifications

Outdoor variable speed 60 Hz Air-Cooled Heat Pump

HVAC Guide Specifications - 30RQM

Size Range: **Cooling capacity: 20 Tons (70.34 kW)**
Heating capacity: 263.9 MBH (77.35 kW)
Carrier Model Number: 30RQM

Part 1 — Part1 — General

1.01 SYSTEM DESCRIPTION

A. Microprocessor controlled, variable speed air-cooled heat pump for outdoor installation, utilizing rotary compressors, low sound fans, electronic expansion valve, all fans are controlled with variable speed fan drive motors. Chiller software shall be specifically developed to coordinate optimal fan speed for application conditions and provide refrigerant circuit optimization, resulting in higher part load efficiency and reduced acoustic levels.

1.02 QUALITY ASSURANCE

A. Unit shall be rated in accordance with AHRI (Air-Conditioning, Heating and Refrigeration Institute) Standard 550/590, latest edition (U.S.A.) and all units shall be ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) 90.1-2019 compliant.

B. Unit construction shall comply with ASHRAE 15 Safety Code, UL (Underwriters Laboratories) latest edition, and ASME (American Society of Mechanical Engineers) applicable codes (U.S.A. codes).

C. The management system governing the manufacture of this product is ISO (International Organization for Standardization) 9001:2015 certified.

D. An operational test, in which the chiller is run under load, is performed at the factory. This test checks for proper operation of fans as well as various controls and safeties, and a Certificate of Unit Testing, indicating successful end-of-line testing, is provided with the unit.

1.03 1.03 DELIVERY, STORAGE AND HANDLING

A. Unit controls shall be capable of withstanding 140°F (60°C) storage temperatures in the control compartment.

B. Unit shall be stored and handled per unit manufacturer's recommendations.

Part 2 — Part 2 — Products

2.01 EQUIPMENT

A. General:

1. Factory assembled, single-piece chassis, air-cooled heat pump. Contained within the unit cabinet shall be all factory wiring, piping, controls, refrigerant charge (R-454B), and special features required prior to field start-up.

B. Materials of Construction:

1. Frame shall be of heavy-gauge, galvanized steel. The film thickness is greater than 70 µm; The test panels must be scribed with a 1 mm scribe and withstand 500 hours in salt spray per ASTM B117 without showing wrinkling, cracking, loss of paint adhesion, or blistering. The scribe creepage rating shall be 6 or greater (ASTM D1654) after the 500 hours.
2. Exterior panels shall be galvanized steel with a baked enamel powder or pre-painted finish.

C. Fans:

1. Standard fans shall be direct driven (VFD [variable frequency drive] controlled), 4 metal blades, good corrosion and weather resistance, statically and dynamically balanced, with inherent corrosion resistance.
2. The variable speed drives for the fans on 30RQM shall include an AC link reactor.
3. Fan operation shall allow reduced sound levels during scheduled unoccupied operating periods. Manufacturers without unoccupied reduced sound capability shall submit 1/3 octave band data and sound power data as measured according to AHRI 370 as confirmation of unit sound characteristics.
4. Air shall be discharged vertically upward.
5. Fans shall be protected by coated steel wire safety guards.
6. Fan blades shall have serrated edges to minimize the sound that is produced.

D. Compressor/Compressor Assembly:

1. Fully hermetic, variable frequency direct-drive, rotary-type compressors.
2. Compressor motors shall be cooled by refrigerant gas passing through motor windings and shall have either internal line break thermal and current overload protection or external current overload modules with compressor temperature sensors.
3. Compressors shall be mounted on rubber in shear vibration isolators.
4. Staging of compressors shall provide unloading capability.
5. Each compressor should be equipped with crankcase heaters to minimize oil dilution.

E. Brazed Plate Heat Exchanger:

1. The Brazed Plate Heat Exchanger shall be designed for a refrigerant working-side pressure of 653 psig (4502 kPa) and water working-side pressure of 464 psig (3200 kpa).
2. Shall be dual-pass, ANSI (American National Standards Institute) type 316 stainless steel, brazed plate construction.
3. The thermal insulation material is independent foamed synthetic rubber; Density: 70-95kg/m^3; Vacuum water absorption test less than 10%; The compression rebound rate is greater than 70%; thickness is 10 mm and the thermal conductivity is 0.024W/(m · K).

4. Shall incorporate 2 independent refrigerant circuits.
5. The Brazed Plate Heat Exchanger shall have factory-installed heater, to protect Evaporator from ambient temperature freeze down to –16.6°F (–27°C). Unit shall be provided with a factory- installed flow switch.
6. All connections shall use standard Victaulic type fittings.
7. The Brazed Plate Heat Exchanger shall be supplied with a 20-mesh Y strainer to be field installed.

F. Outdoor Coil:
1. Coil shall be RTPF (Al/Cu). The coils of 30RQM020 are internally enhanced copper tubes with aluminum fins.
2. Coils shall be constructed of seamless copper tuber mechanically bonded to aluminum fins. Fins shall have wavy enhancements. Tubes shall be cleaned, dehydrated, and sealed.
3. Coils shall be provided with epoxy coatings that provide extra protection in corrosive environments.
4. Assembled condenser coils shall be leak tested and pressure tested at 696 psig (4800 kPa).

G. Refrigeration Components:

Refrigerant circuit components shall include filter drier, moisture indicating sight glass, electronic expansion device and complete operating charge of both refrigerant R-454B and compressor oil.

H. Controls, Safeties, and Diagnostics:
1. Unit controls shall include the following minimum components:
   a. Microprocessor with non-volatile memory. Battery backup system shall not be accepted.
   b. Separate terminal block for power and controls.
   c. Control transformer to serve all controllers, relays, and control components.
   d. ON/OFF control switch.
   e. Replaceable solid-state controllers.
   f. Pressure sensors shall be installed to measure suction and discharge pressure for each circuit. Thermistors shall be installed to measure evaporator entering and leaving fluid temperatures, outdoor ambient temperature, and discharge temperature.
2. Unit controls shall include the following functions:
   a. Automatic circuit primary/secondary for dual circuit chillers.
   b. Hermetic rotary compressors are maintenance free and protected by an auto-adaptive control that minimizes compressor wear.
   c. Seven-day time schedule.
   d. Leaving chilled fluid temperature reset from return fluid and outside air temperature.
   e. Chilled water pump start/stop control and primary/standby sequencing to ensure equal pump run time.
   f. Dual chiller control for parallel chiller applications without addition of hardware modules and control panels (additional thermistors and wells are required).
   g. Timed maintenance scheduling to signal maintenance activities for pumps, condenser coil cleanings, strainer maintenance and user-defined maintenance activities.
   h. Low ambient protection to energize evaporator and hydronic system heaters.
   i. Periodic pumps start to ensure pump seals are properly maintained during off-season periods.
   j. Single step demand limit control activated by remote contact closure.
   k. Nighttime sound mode to reduce the sound of the machine by a user-defined schedule.
3. Diagnostics:
   a. The control panel shall include, as standard, a display:
      1) Color touch screen display with stylus.
      2) Display shall allow a user to navigate through menus, select desired options, and modify data.
   b. Features of the display shall include:
      1) BACnet IP&MSTP
      2) Modbus
      3) Remote Connectivity (Carrier Smart)

      NOTE: BACnet IP may require additional programming.
   c. Automatic reporting of alarms.
   d. Display shall allow access to configuration, maintenance, service, set point, time schedules, alarm history, and status data.
   e. Three levels of password protection against unauthorized access to configuration and maintenance information, and display set up parameters.
   f. Display shall be capable of displaying the last 50 alarms, with clear full text description and time and date stamp.
   g. Display run hours and number of starts for machine and individual compressors.
   h. The control system shall allow software upgrade without the need for new hardware modules.
4. Safeties:
   a. Unit shall be equipped with thermistors and all necessary components in conjunction

with the control system to provide the unit with the following protections:

1) Reverse rotation.
2) Low chilled fluid temperature.
3) Motor overtemperature.
4) High pressure.
5) Electrical overload.
6) Thermal overload.
7) Loss of refrigerant charge.
8) Low pressure.
9) Over-temperature protection.

b. Condenser fan motors shall have internal overcurrent protection.

I. Operating Characteristics:

1. Unit shall be capable of operating down to –16.6°F (–27°C) on heating mode, Unit shall be capable of operating down to 32°F (0°C) on cooling mode.
2. Unit shall be capable of starting and running at outdoor ambient temperatures up to 118.4°F (48°C) for all sizes.
3. Unit shall be capable of starting up with 95°F (35°C) entering fluid temperature to the evaporator.

J. Fan Motors:

1. Condenser fan motors shall be totally enclosed, air over, 3-phase type with permanently lubricated bearings and Class F insulation.

K. Electrical Requirements:

1. Unit/module primary electrical power supply shall enter the unit at a single electrical box.
2. Unit shall operate on 3-phase power at the voltage shown in the equipment schedule.
3. Control points shall be accessed through terminal block.
4. Unit shall be shipped with factory control and power wiring installed.
5. 460v Unit shall have a standard SCCR (short circuit current rating) of 25 KA.
6. 230V unit shall have a standard SCCR (short circuit current rating) of 50 KA.

L. Water Circuit:

1. Chilled water circuit shall be rated to 150 psig (1034 kpa) working pressure.
2. Solid-state flow monitor with integral relay shall be factory installed and wired.
3. Brass body blow strainer with 20 mesh screen and ball type blow down.

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