

## HVAC Guide Specifications Air-Cooled Liquid Chiller

### Basis of Design:

Carrier Model Number:

**CH-1 30RAP0606**

**CH-2 30RAP0406**

**Substitutions to be submitted prior to bid for approval**

### Part 1 — General

#### 1.01 SYSTEM DESCRIPTION

Microprocessor controlled, air-cooled liquid chiller utilizing scroll compressors, low sound fans, electronic expansion valve.

#### 1.02 QUALITY ASSURANCE

- A. Unit shall be rated in accordance with AHRI Standard 550/590, latest edition (U.S.A.) and all units shall be ASHRAE 90.1 compliant.
- B. Unit construction shall comply with ASHRAE 15 Safety Code, UL latest edition, and ASME applicable codes (U.S.A. codes).
- C. Unit shall be manufactured in a facility registered to ISO 9001:2000 Manufacturing Quality Standard.
- D. Unit shall be full load run tested at the factory.

#### 1.03 DELIVERY, STORAGE AND HANDLING

- A. Unit controls shall be capable of withstanding 150 F (66 C) storage temperatures in the control compartment.
- B. Unit shall be stored and handled per unit manufacturer's recommendations.

### Part 2 — Products

#### 2.01 EQUIPMENT

##### A. General:

Factory assembled, single-piece chassis, air-cooled liquid chiller. Contained within the unit cabinet shall be all factory wiring, piping, controls, refrigerant charge (R-410A), and special features required prior to field start-up.

##### B. Unit Cabinet:

1. Frame shall be of heavy-gage, galvanized steel.
2. Exterior panels shall be galvanized steel with a baked enamel powder or pre-painted finish.
3. Cabinet shall be capable of withstanding 500-hour salt spray test in accordance with the ASTM (U.S.A.) B-117 standard.

##### C. Fans:

1. Condenser fans shall be direct-driven, 9-blade airfoil cross-section, reinforced polymer construction, shrouded-axial type, and shall be statically and dynamically balanced with inherent corrosion resistance.
2. 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 ARI 370 as confirmation of unit sound characteristics.
3. Air shall be discharged vertically upward.
4. Fans shall be protected by coated steel wire safety guards.

##### D. Compressor/Compressor Assembly:

1. Fully hermetic, direct-drive, digital scroll type compressors. Digital compressor to provide incremental steps for tighter temperature control
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. Digital compressor unloading control shall be available as an option.

##### E. Cooler:

1. Cooler shall be rated for a refrigerant working-side pressure of 505 psig (3482 kPa) on sizes 010-025 and 565 psig (3896 kPa) on sizes 030-060 and shall be tested for a maximum water-side pressure of 300 psig (2068

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kPa) or 150 psig (1034 kPa) when optional hydronic package is installed.

2. Shall be single-pass, ANSI type 316 stainless steel, brazed plate construction.
3. Shell shall be insulated with 3/4-in. (19 mm) closed-cell, polyvinyl-chloride foam with a maximum K factor of 0.28.
4. Shall incorporate 2 independent refrigerant circuits on sizes 035 to 060; sizes 010 to 030 shall have one independent refrigerant circuit.
5. Cooler shall have an optional factory-installed heater, to protect cooler from ambient temperature freeze down to -20 F (-29 C).
6. Unit shall be provided with a factory-installed flow switch.
7. Shall be equipped with Victaulic-type water connections.

### F. Condenser:

1. Coil shall be air-cooled Novation® heat exchanger technology with microchannel (MCHX) coils and shall have a series of flat tubes containing a series of multiple, parallel flow microchannels layered between the refrigerant manifolds. Coils shall consist of a two-pass arrangement. Coil construction shall consist of aluminum alloys for fins, tubes, and manifolds in combination with a corrosion-resistant coating. If copper tube aluminum fin condenser coils are used, provide a dipped hasarite coating after coil has been built.
2. Tubes shall be cleaned, dehydrated, and sealed.
3. Assembled condenser coils shall be leak tested and pressure tested at 656 psig (4522 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-410A 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. Single 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 cooler entering and leaving fluid temperatures, outdoor ambient temperature, and suction temperature. Provision for field installation of accessory sensor to measure compressor return gas temperature.
2. Unit controls shall include the following functions:
  - a. Automatic circuit lead/lag for dual circuit chillers.
  - b. Hermetic scroll compressors are maintenance free and protected by an auto-adaptive control that minimizes compressor wear.
  - c. Capacity control based on leaving chilled fluid temperature and compensated by rate of change of return-fluid temperature with temperature set point accuracy to 0.1° F (0.06° C).
  - d. Limiting the chilled fluid temperature pulldown rate at start-up to an adjustable range of 0.2° F to 2° F (0.11° C to 1.1° C) per minute to prevent excessive demand spikes at start-up.
  - e. Seven-day time schedule.
  - f. Leaving chilled fluid temperature reset from return fluid and outside air temperature.
  - g. Chilled water pump start/stop control and primary/standby sequencing to ensure equal pump run time.
  - h. Dual chiller control for parallel chiller applications without addition of hardware modules and control panels (additional thermistors and wells are required).
  - i. Timed maintenance scheduling to signal maintenance activities for pumps, condenser coil cleanings, strainer maintenance and user-defined maintenance activities.
  - j. Boiler enable signal to initiate system heating mode.
  - k. Low ambient protection to energize cooler and hydronic system heaters.
  - l. Periodic pump start to ensure pump seals are properly maintained during off-season periods.
  - m. Single step demand limit control activated by remote contact closure.
  - n. 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 scrolling marquee display capable of indicating the safety lockout condition by displaying a code for which an explanation may be scrolled at the display.
  - b. Information included for display shall be:

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- 1) Compressor lockout.
- 2) Loss of charge.
- 3) Low fluid flow.
- 4) Cooler freeze protection.
- 5) Cooler set point.
- 6) Chilled water reset parameters.
- 7) Thermistor and transducer malfunction.
- 8) Entering and leaving-fluid temperature.
- 9) Compressor suction temperature.
- 10) Evaporator and condenser pressure.
- 11) System refrigerant temperatures.
- 12) Chiller run hours.
- 13) Compressor run hours.
- 14) Compressor number of starts.
- 15) Low superheat.
- 16) Time of day:
  - a) Display module, in conjunction with the microprocessor, must also be capable of displaying the output (results) of a service test. Service test shall verify operation of every switch, thermistor, fan, and compressor before chiller is started.
  - b) Diagnostics shall include the ability to review a list of the 20 most recent alarms with clear language descriptions of the alarm event. Display of alarm codes without the ability for clear language descriptions shall be prohibited.
  - c) An alarm history buffer shall allow the user to store no less than 20 alarm events with clear language descriptions, time and date stamp event entry.
  - d) The chiller controller shall include multiple connection ports for communicating with the local equipment network, the Carrier Comfort Network® (CCN) system and access to chiller control functions from any point on the chiller.
  - e) 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) Loss of refrigerant charge.
  - 2) Reverse rotation.
  - 3) Low chilled fluid temperature.
  - 4) Thermal overload.
  - 5) High pressure.
  - 6) Electrical overload.
  - 7) Loss of phase.
- b. Factory pump motors shall have external overcurrent protection.

#### I. Operating Characteristics:

1. Unit shall be capable of operating down to -20 F (-29 C) on size 010 and 015 units, 45 F (7 C) on size 018-030 units, and 32 F (0° C) on size 035-060 units as standard.
2. Unit shall be capable of starting and running at outdoor ambient temperatures up to 120 F (50 C) for all sizes. Unit shall additionally be able to stay online when running with a 125 F (52 C) ambient temperature.
3. Unit shall be capable of starting up with 95 F (35 C) entering fluid temperature to the cooler.

#### J. Motors:

Condenser-fan motors shall be totally enclosed single-speed, 3-phase type with permanently lubricated bearings and Class F insulation (except Motormaster® V control motors which shall be open type and shall have Class B insulation).

#### K. Electrical Requirements:

1. Unit/module primary electrical power supply shall enter the unit at a single location.
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.

#### L. Chilled Water Circuit:

1. Chilled water circuit shall be rated for 300 psig (2068 kPa). Units with optional pump package are rated for

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- 150 psig (1034 kPa) working pressure.
2. Solid-state flow monitor with integral relay shall be factory installed and wired.
3. Brass body strainer with 40 mesh screen and ball type blow down.
4. Optional hydronic package:
  - a. Field pipe connections shall be copper Victualic type.
  - e. Water pressure taps (2) shall be factory installed across the cooler and rated for 150 psig (1034 kPa).
  - f. Balancing valve shall be factory installed to set flow gage ports shall be factory installed and rated for 300 psig (2068 kPa).
  - g. Hydronic assembly shall have factory supplied electric freeze protection to -20 F (-29 C) when optional heaters are used.
  - h. Piping shall be type-L seamless copper tubing.

### M. Special Features:

Certain standard features are not applicable when the features designated by \* are specified. For assistance in amending the specifications, contact your Carrier representative.

#### \* 1. Low-Ambient Operation:

Unit shall be capable of operating down to -20 F (-29 C) with the addition of the field or factory-installed solid-state Motormaster® V control with condenser coil temperature sensor. In addition, adequate field-supplied antifreeze with suitable corrosion inhibitor protection shall be field-installed in the evaporator circuit. Additional components shall be required and used in conjunction with the low ambient device. Components include field-installed wind baffles and hot gas bypass. Motormaster® V control is standard on sizes 010 and 015.

#### 2. Unit-Mounted Non-Fused Disconnect:

Unit shall be supplied with factory-installed, non-fused electrical disconnect for main power supply.

#### 6. Hot Gas Bypass:

Unit shall be equipped with factory (or field) installed, microprocessor-controlled, hot gas bypass that shall permit unit operation down below the minimum step of capacity.

#### 7. Energy Management Module:

A factory or field-installed module shall provide the following energy management capabilities: 4 to 20 mA signals for leaving fluid temperature reset, cooling set point or demand limit control; 2-point demand limit control (from 15% to 100%) activated by a remote contact closure; and discrete input for "Ice Done" indication for ice storage system interface.

#### 8. Security Grilles/Hail Guards:

Unit shall be supplied with factory-installed, louvered, sheet metal panels which securely fasten to the chiller and provide condenser coil protection against hail and other physical damage.

#### 9. Vibration Isolation:

Vibration isolation pads shall be supplied for field installation at unit mounting points. Pads shall help to reduce vibration transmission into the occupied space.

#### 11. BACnet Translator Control:

Unit shall be supplied with field-installed interface between the chiller and a BACnet Local Area Network (LAN, i.e., MS/TP EIA-485).

#### 12. LON Translator control:

Unit shall be supplied with field-installed interface between the chiller and a Local Operating Network (LON, i.e., LonWorks FT-10A ANSI/ EIA-709.1).

#### 13. Navigator™ Hand Held Display:

- a. Portable hand held display module with a minimum of 4 lines and 20 characters per line, of clear English, Spanish, Portuguese or French language.
- b. Display menus shall provide clear language descriptions of all menu items, operating modes, configuration points and alarm diagnostics. Reference to factory codes shall not be accepted.
- c. RJ-14 connection plug shall allow display module to be connected to factory-installed receptacle.
- d. Industrial grade coiled extension cord shall allow the display module to be moved around the chiller.
- e. Magnets shall hold the display module to any sheet metal panel to allow hands-free operation.
- f. Display module shall have NEMA 4x housing suitable for use in outdoor environments.
- g. Display shall have back light and contrast adjustment for easy viewing in bright sunlight or night conditions.
- h. Raised surface buttons with positive tactile response.

#### 14. Touch Pilot™ Display:

Unit shall be supplied with a remote mount touch screen display for network attachment to the chiller.

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15. GFI Convenience Outlet:  
Shall be factory installed to provide the chiller with a 4 amp GFI receptacle. The receptacle shall have independent fuse protection. The convenience outlet is a 115-v female receptacle.
16. Freeze Protection Cooler Heaters:  
Cooler heaters shall provide protection from cooler freeze-up to  $-20\text{ F}$  ( $-29\text{ C}$ ).
17. Low Sound Fans:  
Shall provide propeller-type fans for applications that are sound-sensitive.
18. Ultra-Low Sound:  
Shall provide an acoustic enclosure around each compressor in conjunction with low-sound aero-acoustic fans to provide significant chiller sound reduction.
20. Digital Compressor Option:  
Shall provide a factory-installed digital compressor to provide incremental steps for tighter temperature control