

**HVAC Guide Specifications
Air-Cooled Liquid Chiller**

Size:
10 Nominal Tons

Carrier Model Number:
30RAP

Part 1 — General

1.01 SYSTEM DESCRIPTION

Microprocessor controlled, air-cooled liquid chiller utilizing digital scroll compressor, low sound Aeroacoustic™ fans, electronic expansion valve, hydronic dual pump system.

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 Manufacturing Quality Standard.
- D. Unit shall be full load run tested at the factory and a copy of this report shall be made available to the customer.

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 of Puron® refrigerant, 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. Standard 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 are not acceptable.
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 compressor must be provided to allow for unloading down to at least 20% capacity to accurately meet the varying loads of the process. Chillers that do not utilize digital scroll compressor and cannot unload to at least 20% capacity with a minimum of 13 steps of unloading capability are not acceptable.
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. Digital compressor unloading control shall be provided with a minimum of 13 steps of unloading control.

E. Cooler:

1. Cooler shall be rated for a refrigerant working-side pressure of 505 psig and shall be tested for a maximum waterside pressure of 150 psig 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 have one independent refrigerant circuit.
5. Cooler shall have 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. All connections shall use standard Victaulic-type fittings.
8. Cooler fluid inlet line shall have a 40 mesh strainer just ahead of the cooler.

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.
2. 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.
3. Tubes shall be cleaned, dehydrated, and sealed.
4. Assembled condenser coils shall be leak tested and pressure tested at 656 psig.

G. Refrigeration Components:

Refrigerant circuit components shall include filter drier, moisture indicating sight glass, electronic expansion device and complete operating charge of sides both Puron® refrigerant 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 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:
 - 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 a BACnet™ local equipment network 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.
 - 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) 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. Fan Motors:
- 1. Condenser fans shall be direct-drive Aero-Acoustic™ type, discharging air vertically upward.
 - 2. All condenser fan motors shall be totally enclosed 3-phase type with permanently lubricated ball bearings, class F insulation and internal, automatic reset thermal overload protection or manual reset calibrated circuit breakers.
 - 3. Shafts shall have inherent corrosion resistance.
 - 4. Fan blades shall be statically and dynamically balanced.
 - 5. Condenser fan openings shall be equipped with PVC coated steel wire safety guards.
- 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.
- L. Chilled Water Circuit:
- 1. Chilled water circuit with optional pump package are rated for 150 psig 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 factory hydronic package shall be provided as follows:
 - a. Field pipe connections shall be copper Victaulic type.
 - b. Shall contain primary/stand-by operation pump systems. Dual pump systems shall have a pump discharge check valve.
 - c. Pumps shall be single stage design, capable of being serviced without disturbing piping connections.
 - 1) Pump casing shall be of class 30 cast iron.
 - 2) The impeller shall be of cast bronze, closed type, dynamically balanced, keyed to the shaft and secured by locking cap screw.

- 3) The hydronic kit will be provided with a flush line connection to ensure lubrication at the seal face and allow for positive venting of the seal chamber.
- 4) Pump shall be rated for 150 psig working pressure.
- 5) The pump case shall have gage tappings at the suction and discharge nozzles and include drain ports.
- 6) Motors shall totally enclosed 3-phase type with grease lubricated ball bearings.
- 7) Each pump shall be factory tested per Hydraulic Institute Standards.
- 8) Pump motors shall be VFD compatible.
- d. Fluid expansion tank shall be factory installed within the chiller cabinet insulates, pre-charged and rated for a maximum working pressure of 150 psig.
- e. Water pressure taps (2) shall be factory installed across the cooler and rated for 150 psig
- f. Balancing valve shall be factory installed to set flow gage ports shall be factory-installed and rated for 300 psig.
- g. Hydronic assembly shall have factory-supplied electric freeze protection to $-20\text{ F } (-29\text{ C})$ when optional heaters are used.
- h. Piping shall be type-L seamless copper tubing.

M. Special Features:

Chiller shall be provided with the below special features factory installed.

1. **Low-Ambient Operation:**
Unit shall be capable of operating down to $-20\text{ F } (-29\text{ C})$ 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. Motormaster® V control is standard.
NOTE: The motors associated with Motormaster® V fan will be open type and shall have class B insulation.
2. **BACnet Communication Option:**
Shall provide factory-installed communication capability with a BACnet MS/TP network. Allows integration with i-Vu® Open control system or a BACnet building automation system.
3. **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.
4. **Freeze Protection Cooler Heaters:**
Cooler heaters shall provide protection from cooler freeze-up to $-20\text{ F } (-29\text{ C})$.
5. **Ultra-Low Sound:**
Shall provide sound blankets around each compressor in conjunction with low-sound Aero-Acoustic™ fans to provide significant chiller sound reduction.
6. **Digital Compressor Option:**
Shall provide a factory-installed digital compressor to provide 13 incremental steps for tighter temperature control.