# In-Row Chilled Water-Cooling Units - Section 23 81 23

# PART 1 - GENERAL

## 1.01 SUMMARY

1. The In-Row product design closely couples the cooling with the IT heat load. This design prevents hot air recirculation while improving cooling predictability. The existing systems do not have a remote chiller, as a result the heat load is not expelled in an effective manner. The existing units will be replaced with units of the same footprint.
2. The new In-Row Chilled Water systems are anticipated to have rooftop mounted chillers, with humidity control. The intelligent controls of the In-Row Chilled Water products actively adjust fan speed and chilled water flow to match the IT heat load to maximize efficiency and address the dynamic demands of the environments.
3. The In-Row Chilled Water Units automatically monitor and control cooling and filtering functions for the conditioned space. There will be two 300mm wide units (APC P/N #CRC301S or Vertiv P/N CR019RW are preapproved and the basis of design) for standard entering water temperatures and designed specifically for precision temperature and humidity control applications. They will automatically monitor and control heating, cooling, humidifying, dehumidifying, and filtering functions for the conditioned space.
4. The systems shall be built to the highest quality engineering and manufacturing standards and shall be raised floor mounted and configured for horizontal airflow, with draw-through air pattern, to provide uniform air distribution over the entire face of the coil.

## 1.02 DESIGN REQUIREMENTS

1. The system is described in the following specification shall be:
	1. Total net cooling capacity: 78.6 kW (MBH)
	2. Return air temperature: 95 ºF DB
	3. Entering chilled water temperature: 67.9 ºF WB
	4. Humidity: 24 % RH
	5. Air quantity: 15.4 CFM
	6. Electrical supply: 208-230V, 3 Ph, 60 Hz

## 1.03 SUBMITTALS

1. Submittals shall be provided with the proposal and shall include: cooling capacity data, electrical connection and usage data, physical data, electrical connection drawing and piping connection drawing.

## 1.04 QUALITY ASSURANCE

1. The system shall be completely factory-tested prior to shipment. Testing shall include, but not be limited to, complete pressure and leak testing to ensure system integrity, “Hi-Pot” test, and controls calibration and settings. Each system shall ship with a completed test report to verify completion of factory testing procedure. The system shall be NTRL listed, MCA, and UL Listed to UL 1995 and CSA 22.2 No. 236.

## 1.05 WARRANTY

1. System parts shall be warranted for a period of 18 months from date of shipment and 12 months from startup. Optional extended warranties are available.

# PART 2 - PRODUCTS

## 2.01 STANDARD COMPONENTS

1. CABINET CONSTRUCTION
	1. Exterior panels shall be 18 gauge steel with 3.7lb/ft3 (60kg/m^3) density foam insulation. Insulation complies with UL94 HB. Front and rear exterior panels shall be 18 gauge perforated steel with 80% open free area, and equipped with a keyed lock to provide a means of securing access to the internal components of the unit.
	2. The frame shall be constructed of 16 gauge formed steel welded for maximum strength. All units shall provide maintenance from the front and rear, allowing units to be placed within a row of racks.
	3. All exterior panels and frame shall be powder coated for durability and attractive finish.
	4. Units shall include casters and leveling feet to allow ease of installation in the row and provide a means to level the equipment with adjacent IT racks.
2. VARIABLE SPEED FAN ASSEMBLY
	1. The unit shall be configured for a draw-through air pattern to provide uniform air flow over the entire face of the coil. Each unit shall include eight 200 mm mixed flow direct drive DC axial fans. Each fan assembly should be designed to provide 188.8 l/s (400 CFM) for total unit airflow of 1510.2 l/s (3200 CFM) for ACRC301S. Each fan assembly should be designed to provide 247.8 l/s (525 CFM) for total unit airflow of 1982.1 l/s.
	2. Variable Speed Fans: Fans shall be variable speed capable of modulating from 30-100%.
	3. Fan Protection: Each fan assembly shall consist of integral fan finger guards.
	4. Operation and Service: The unit should be capable of operation in the event of a fan failure. Fans shall be replaceable while the unit is in operation.
	5. Each fan unit should provide passive noise control.
3. DUAL POWER SUPPLIES
	1. Power Supplies: The unit shall include two power supplies, each capable of running the unit at 75% capacity in the event of a single power supply failure.
	2. Unit power consumption is not to exceed 1.9 kW during normal operation.
	3. Operation and Service: Power supply shall be hot swappable.
4. MAIN DISCONNECT SWITCH
	1. Unit shall be provided with a fuse rated per UL 248-1/UL 248-14/CSA-C22.2 No. 248.1/CSA-C22.2 No. 248.14
	2. Units shall include a fused live and neutral lines located on the NE panel in order to individually disconnect primary/secondary power inputs
	3. Units shall include main disconnect switches located on the E-panel in order to individually disconnect primary/secondary power inputs.
5. PRIMARY/SECONDARY POWER INPUT
6. Input Power Feeds: Primary/secondary power inputs should be a locking NEMA or IEC plug or hardwired connection suitable for the input power selected, specify required connection type in submittal. Each power input shall be capable of running the unit at 100% capacity in the event of a main power failure.
7. MICROPROCESSOR CONTROLLER
8. Monitoring and Configuration: The master display shall allow monitoring and configuration of the cooling unit through an external screen and control panel. Functions include status reporting, set-up, and temperature set points. LEDs report the operational status of the connected air conditioning unit.
9. Controls: The microprocessor controller shall allow the user to navigate between menus, select items, and input alpha numeric information.
10. Alarms: The microprocessor controller shall activate a visible and audible alarms.
11. Logging: The microprocessor controller shall log and display all available events. Each alarm log shall contain a time/date stamp. Controller shall display the run time hours for major components.
12. NETWORK MANAGEMENT CARDS
13. Each unit shall include a network management card to provide management through a computer network through TCP/IP. Management through the network should include the ability to change set points as well as view and clear alarms.
14. Each unit will report independently to the monitoring system and are not to be ‘daisy chained’.
15. Modbus TCP/IP and RTU: Units shall support Modbus TCP/IP and RTU.
16. COOLING COIL
17. The cooling coil shall be a minimum of a raised aluminum fin and 9.5-mm (3/8-in OD) copper tube coils. Coil end supports shall be a minimum 18-gauge galvanized steel. Coil shall be rated for a maximum pressure of 2070 kPa (300 psig). The coil is configured in a counterflow arrangement to enhance heat transfer efficiency.
18. Cooling Fluids a. Chilled Water and solutions of propylene or ethylene glycol up to 50% may be used. Solutions of brine or other aqueous salt are NOT permitted.
19. Freeze Protection - Per ASHRAE Handbook Fundamentals 2001 21.5, a maximum of 30% ethylene glycol and 35% propylene glycol are needed for freeze protection. Consult the ASHRAE handbook for more details.
20. 2/3-WAY MODULATING VALVE
	1. A proportional valve shall be microprocessor controlled to automatically direct the proper amount of chilled water in the cooling coil to maintain desired conditions. A shut-off valve located in the bypass line may be manually adjusted for 2-way flow if so desired.
	2. Three-way control valve shall be rated for 360 psig with a brass body and nickel/chromium-plated brass ball.
	3. Valve Actuator: Actuator shall be a direct connect rotary proportional actuator with analog signal feedback and should be capable of being replaced without disconnecting piping from the valve. Ability for manual operation is also provided.
21. CONDENSATE PAN
22. The unit shall consist of a primary drain pan and a secondary drain pan. The secondary drain pan shall be piped to the primary pan for removal of condensate. The primary drain pan shall include a condensate pump and dual floats for control and overflow protection.
23. CONDENSATE PUMP
24. The factory-installed condensate pump is piped internally to the condensate pan. It is capable of pumping 5 L/h (1.3 GPH) liquid a maximum distance of 15.2 m (50 ft), which may include a maximum lift of 4.9 m (16 ft). Dual floats are included with the unit. One float is used for condensate pump control, the other to generate condensate pan overflow alarms.
25. FILTERS
26. The standard air filter shall be <20% efficient per ASHRAE 52.1, MERV 1 per ASHRAE 52.2,1/2-in washable mesh filter.
27. The optional air filter shall be high capacity 2-in pleated, UL 900 Class 2, Moisture with average atmospheric dust spot efficiency of 30% per AHRAE Standard 52.1, MERV 8 per ASHRAE 52.2.
28. TEMPERATURE AND HUMIDITY SENSORS
29. Internal Sensors
	1. Internal Temperature Sensors: Thermister temperature sensors shall be mounted behind the front and rear doors to provide control inputs based on supply and return air temperature. Sensor accuracy shall be within ±2°F accuracy.
	2. Internal Humidity Sensors: Humidity sensors shall be mounted behind the rear door
30. Remote Temperature Sensors
	1. One remote temperature sensor shall be shipped with the unit for placement in the field to provide control input based on rack inlet temperature.
31. Water Temperature Sensors: Internal supply and return chilled water temperature sensors shall be installed into sealed wells. Wells are filled with thermal conducting heat transfer grease to provide accurate temperature sensors.
32. SELECTABLE TOP OR BOTTOM PIPING
33. Bottom piping connections are standard from factory. Unit can be field modified for optional top piping. Unit connections shall be made internal to the unit.
34. FLOW METER
35. The flow meter shall be factory piped inside the unit and connected to microprocessor controls to provide water flow rate through the unit. The microprocessor controller shall also use this information to provide total unit capacity out of the unit while in operation.
36. The flow meter shall be a glass filled nylon construction vortex-sensing meter, compatible with glycol/water solutions up to 50% with accuracy of 2.5% FS @ 10–200 LPM (2.6–53 GPM).
37. PIPING
38. The unit shall be piped in accordance with the highest commercial quality procedures. The chilled water piping shall be insulated with closed cell elastomer insulation. All piping connections should be made at the rear of the unit for top or bottom accessibility.
39. CONFIGURATIONS
40. Cool setpoints shall range from 18°C – 35°C. Delta-T shall range from 5.6-22.2°C in.
41. Two identical cooling units shall be mounted in place of the existing units, there will be no grouping of units.
42. CABLE WATER DETECTOR (OPTIONAL)
43. An optional leak detection sensing cable can be shipped loose with the unit. If water or other conductive liquids contact the cable anywhere along its length, the main controller visually and audibly annunciates the leak.
44. Cable may be cascaded up to 24.4 m (80 ft).

# PART 3 - EXECUTION

## 3.01 GUIDELINES FOR INSTALLATION

A. GENERAL

1. The new In-Row units shall incorporate the latest system design innovations to provide optimum efficiency, reliability, and accuracy of control.
2. The In-Row units will provide years of trouble-free service, when installed and maintained by technically qualified personnel. Provide more detailed information during submission by including the Installation and Maintenance Manual.

B. ROOM CONDITIONS

1. During proposal submission process, the existing design of the room and access to the roof must be taken into consideration. Consideration should include the following factors.
2. Ease of entry for the system, floor-loading factors, and accessibility of piping and wiring (power connections shall be made by the Owner’s Electrical Contractor, and not part of this scope, but coordination with the EC is included).
3. The room must be sealed with a vapor barrier to minimize migration of moisture. Replace broken ceiling tiles and raised floor tiles.

C. SERVICE ACCESS

1. Clear space exists in front of and behind the unit for routine service.
2. The old units shall be removed and properly disposed of under this scope of work. Provide the Owner with proof of proper disposal of removed items.

E. RIGGING

1. The Proposer is responsible for any and all rigging needed to place the units on the 12th floor and/ or roof top (14th floor).
2. Exercise caution when maneuvering and transporting the cooling units, the Proposer is responsible for the new units until acceptance by the Owner.

F. CONDENSATE DRAIN ROUTING

1. Condensate from the evaporator pan is collected and discharged by the condensate pump to a 5 mm (0.188 in ID) condensate line supplied with the unit. Additional condensate piping may be required to route the condensate line to the building.

## 3.02 FIELD QUALITY CONTROL

A. SPECIFICATION CLARIFICATIONS

1. The propose is responsible to a complete turnkey solution to include In-Row units, roof top DX units, pathways and piping between these units.
2. Electrical disconnection, reconnection, and any new work is by others. Provide details during proposal submission.
3. There are two existing DX units that support cooling in the UPS Room (on the Roof). This contractor will reinstall cooling line insulation that has been damaged.