

SECTION 23 81 24

COOLING DISTRIBUTION UNIT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this and other Sections of Division 23.

1.2 SUMMARY

- A. Provide an overall price ("base bid") for the complete equipment package specified; complete with all accessories and services specified.
- B. This Section includes Specification for Cooling Distribution Units (CDU) and their accessories intended specifically for computer-room applications.
- C. Equipment Supplier shall be responsible for the following in a coordinated and phased deployment with remobilization as required to support the project:
 1. Factory testing: All costs related to travel and lodging for owner, engineer, contractor, and commissioning agent (total four representatives) shall be borne by the individual traveler.
 2. Startup and Commissioning: Manufacturer shall provide services associated with start-up of the equipment, installation supervision and technical personnel on site for construction meetings, testing and commissioning. Manufacturer shall support the Commissioning Agent including all commissioning efforts, paperwork and Acceptance/Integrated Systems Testing. Manufacturer will be on-site to support the project as required.
 3. Documentation: Full documentation, including interconnect and point-to-point wiring diagrams, nameplate schedule, Operation and Maintenance Manuals.
 4. Storage: Equipment shall be stored in spaces with a controlled environment that meets the manufacturer's ambient temperature and humidity tolerances for non-operating equipment.
 5. Delivery: Equipment shall be in fully enclosed vehicles after specified environmental conditions have been permanently established in spaces where equipment is to be placed. Units can be shipped on open vehicle if, and only if, manufacturer provides weather and transportation protection of the units and assists with job-site inspection. Delivery of left hand/ right hand units shall be coordinated with install schedule, i.e.. A batch of all right hand units is not acceptable.
 6. FOB Delivery: Delivery of the equipment FOB to the Construction Manager's designated location for unloading and installation by the Installing Contractor by air ride truck, including necessary insurance coverage.
 7. Tracking: Responsible for tracking all shipments and is expected to provide the Owner and Installing Contractor with a weekly shipping status, at a minimum
 8. Training: Owner/operator training for each system. Provide pricing for eight (8) hours of training with hourly rates for training beyond eight (8) hours (See Alternate 4.3).
 9. Damage Repair: At their expense, repair and/or replace all damage due to improper preparation, damage or crating while in transport. If repairs are needed,

the entire panel shall be replaced. Touchup painting of exterior panel is allowed only at the Owner's discretion.

- D. Release to manufacture any equipment included in this Specification shall be contingent upon the receipt and approval of submittals and shop drawings as outlined in this Specification.
- E. Installing Contractor shall be responsible for the following:
 - 1. Assuming complete responsibility for equipment upon delivery, perform a level 2 site acceptance check and execute documentation as to the equipment's adherence to the PO, bid package, etc. Where deficiencies exist, the list is to be created and agreed upon as a team. The General Contractor is to own that deficiency list with the OFCI equipment vendor.
 - 2. Unloading, rigging, and setting in place. If any additional costs for handling, storage, or rigging are incurred due to manufacturer not meeting scheduled dates, or units are shipped prior to contractor being ready to accept them, the manufacturer is responsible for these costs.
 - 3. Providing support during startup and commissioning of equipment.
 - 4. Storing all spare parts in a secure space for Owner turnover at the end of the project. Storage location shall be climate-controlled in accordance with manufacturer's requirements.

1.3 DEFINITIONS

- A. Equipment Supplier: The manufacturer of the equipment specified herein, or the manufacturer's agent or representative who shall take responsibility for the preparation of bids, submittals, and delivery of the specified equipment and services to the Owner
- B. Installing Contractor: The person, firm, integrator or other entity contracted by the Owner or Owner's agent to take delivery of the specified equipment, install, and make operational and ready for service
- C. Manufacturer: The Manufacturer, or Manufacturer's representative, of the specific equipment being described
- D. Contractor: The Construction General Contractor or Construction Manager
- E. CDU: Cooling Distribution Unit
- F. Engineer: kW Mission Critical Engineering (KWMCE)
- G. Drawings: KWMCE documents for this project
- H. Purchaser: Owner or their purchasing agent (Serverfarm)
- I. OFCI: Owner furnished, Contractor Installed
- J. Commission Agent: Independent Testing Party
- K. BMS: Building Management System—Building heating ventilating and air conditioning system utilizing direct digital control (DDC) hardware and software. The system communicates using one or more digital communication networks.

1.4 BID DOCUMENTATION REQUIREMENTS

- A. Compliance Review: In addition to the submittal requirements of this section, preorder bidders shall provide a Compliance Review of the Specifications and Addenda. The Compliance Review shall be a paragraph-by-paragraph review of the Specifications with the following information, "C", "D," or "E" marked in the margin of the original Specifications and any subsequent Addenda.
 - 1. "C": Comply with no exceptions.

2. "D": Comply with deviations. For each and every deviation, provide a numbered footnote with reasons for the proposed deviation and how the intent of the Specification can be satisfied.
 3. "E": Exception, do not comply. For each and every exception, provide a numbered footnote with reasons and possible alternatives.
 4. Unless a deviation or exception is specifically noted in the Compliance Review, it is assumed that the Bidder is in complete compliance with the plans and Specifications. Deviations or exceptions taken in cover letters, subsidiary documents, by omission or by contradiction do not release the Bidder from being in complete compliance, unless the exception or deviation has been specifically noted in the Compliance Review submitted with the Bid.
- B. Provide proposed equipment schedule with time durations for product data submittal creation, fabrication, initial delivery to site, follow up deliveries, completion of final delivery, and close out documentation creation (record product data, installation, operation, maintenance, spare parts list, warranty, etc.).

1.5 PROJECT CONDITIONS AND PERFORMANCE REQUIREMENTS

- A. Environmental Conditions: Systems and components shall withstand the following environmental conditions without damage or degradation of performance capability:
1. Ambient Temperatures:
 - a. Outdoor: 60°F DB – 104°F DB
- B. Seismic Restraint Loading Design Criteria: The equipment and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the Structural Engineer’s Design Criteria (listed below for reference):

Parameter	Clarksville, AR
Ambient Temperature Maximum/Minimum	110°F/-2.2°F DB, 84.3°F/-3.0°F WB
Elevation Above Sea Level	500 feet
Relative Humidity	0 to 95%
Seismic Risk Category	II
Seismic Importance Factor	1.00
Seismic Spectral Response Coeff, Sds	0.45
Seismic Spectral Response Coeff, Sd1	0.28
Seismic Design Category	D

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70-2017, by a qualified testing agency, and marked for intended location and application.

1.6 SUBMITTAL DOCUMENTATION REQUIREMENTS

- A. Equipment Submittal Documentation Requirements:

1. The equipment product data, performance data, shop drawings, installation, operation, maintenance, service, testing and training, and record as-built documentation referred to within shall be submitted to the Owner and Engineer in a searchable Adobe Acrobat or Microsoft Word format electronically.
 2. Submittals shall be presented in a logical and clear format, contain a cover page and table of content, marked and/or highlighted to identify project specific data. Unedited, general data sheets will not be accepted.
 3. The Drawings referenced within shall be submitted in REVIT and AutoCAD format electronically. Simple, one-line drawings/diagrams may be submitted in AutoCAD or Microsoft Visio format electronically.
- B. Product Data: Include rated capacities, operating characteristics, electrical characteristics, color chart, and furnished specialties and accessories.
- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components and location and size of each field connection.
1. Wiring Diagrams: Detail wiring for power, signal and control systems and differentiate between Manufacturer installed and field installed wiring.
 2. Equipment Support Details: Detail fabrication including anchorages and attachments to structure or floor stands and to equipment. Provide Manufacturer's product literature for applied equipment like variable frequency drives, pumps, heat exchangers, control valves, and sensors.
 3. Document access requirements around other work, including working clearances to mechanical controls and electrical equipment.
- D. Coordination Drawings
1. Drawings on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - a. Structural Supports.
 - b. Piping roughing-in requirements.
 - c. Conduit and wiring roughing-in requirements for controls and electrical power, including spaces reserved for controls and electrical equipment.
 - d. Access requirements, including working clearances for controls and electrical equipment, and service clearances. Mark and label clearances.
- E. Warranty Information
1. Provide a generic copy of the manufacturer's warranty certificate as part of the initial submittal. Provide the actual warranty certificate as part of the project closeout phase.
 2. The Equipment Supplier shall warrant that the equipment supplied is a proven design and can meet the requirements specified. Workmanship shall be of the best quality, free from any defects that might render the equipment unsuitable or inefficient for the purpose for which it is to be used. In the event of problems or malfunctions, the Equipment Supplier shall have qualified technicians capable of affecting all necessary repairs and restoring the system to full operation within eight hours of notification. There shall be no cost to the Owner for corrective repairs or firmware upgrades during the first twelve (12) months following successful substantial completion. Owner and Engineer shall be made aware prior to any firmware flashes after equipment has left the factory.
 3. If at any time during the first twelve (12) months following substantial completion, the Owner shall accumulate sufficient evidence to reasonably indicate that the

equipment or any part thereof, is not in accordance with the Specifications, the Owner shall so notify the Equipment Supplier in writing, and the Equipment Supplier shall repair or replace the defective components. The cost of removal, reinstallation and complete re-testing of the equipment, and any associated freight charges or service engineering charges, shall be at the Equipment Supplier's expense. The warranty for the repaired or replaced equipment shall be extended for twelve (12) months from the completion of repairs or replacement.

4. If the equipment fails to meet the specific performance guarantees, the Equipment Supplier shall recommend to the Owner adjustments or modification. Upon approval by the Owner, the adjustments or modifications shall be made, and tests shall be rerun. The cost of these adjustments or modifications and complete re-testing shall be made at the Equipment Supplier's expense. After such adjustments or modifications, should the equipment fail to achieve the guaranteed performance, an equitable settlement shall be made which may, without limitation, include an adjustment of the contract price.
5. Complete re-testing, as referred to in this Section, shall mean site acceptance testing as stipulated in testing portions of this Specification. The conditions, which apply to original testing requirements, shall also apply to the re-testing of any equipment performed under the conditions of this warranty.
6. Commercial operation is defined as commencing on the date on which the equipment covered by these Specifications has successfully completed final site integrated acceptance testing.

1.7 INITIAL SUBMITTAL DATA

- A. The documents detailed in this section shall be submitted with the manufacturer's proposal, at the time of bid submission. Failure to comply and include this information within the manufacturers bid, shall render the vendors bid unqualified and be grounds for dismissal.
- B. Product Data / Technical Data Sheets: Include rated capacities, electrical load data, physical dimensional data, weights (shipping, installed, and operating), component specifications, power and control wiring diagrams, furnished specialties, and accessories.
- C. Performance Data Sheet: Provide manufacturers standard performance data sheet showing the performance data for the scheduled conditions.
- D. Shop Drawings: Provide project specific dimensional drawings, including required service clearances.
- E. Installation Procedures: Provide step by step descriptions and details for the field installation of the equipment. Include fabrication details for anchorage and attachment to the structure and to support the equipment.
- F. Lead times to manufacture equipment and to deliver equipment to project site.

1.8 CLOSE OUT SUBMITTAL DATA

- A. The close out documentation shall include submittals, shop drawings, installation procedures, operations & maintenance (O&M) manuals as follows.
 1. Close out documentation submissions:
 - a. Final Submittal: Upon approval of the initial submittal provide portable document format (PDF) file to the Owner and Engineer,.

2. Shop drawings shall be submitted in either AutoCAD or REVIT format electronically.
- B. Submit Operations and Maintenance (O&M) Manuals for system and components as specified Division 1 Specifications.
- C. In addition to requirements included in the Sections referenced above, include the following:
 1. Contact information for service work.
 2. List of special tools recommended to be stored at the site for ready access.
 3. Detailed operating instructions.
 4. Copy of approved submittal and shop drawing.
 5. Document indicating the recommended service intervals.
 6. Field Test and Observation Reports: Indicate and interpret test results for compliance with performance requirements.
 7. Complete list of user access credentials, including usernames and passwords for each level of access to which the Owner is entitled.
 8. Where applicable, complete list of relays, meters, etc. with configurations both in native format and tabular format.

1.9 SUBMITTALS FOR RELEASE TO MANUFACTURER

- A. In the event there are corrections to be made to the Bid Submittals prior to equipment being manufactured, the Engineer may request the Bid Submittals be resubmitted with corrections included prior to authorizing the manufacture of equipment.
- B. Manufacture lead time shall start upon receipt of either "No Exceptions Taken" or "Make Corrections Noted" submittal response provided by Engineer. If submittal response is "Make Corrections Noted," provide final record copy with the submittal updated to incorporate the review comments.
- C. Submit shop drawings for review and approval as outlined below, prior to proceeding with any fabrication or assembly of equipment.
- D. All drawings and data shall be identified with the Project Name and Specification reference. Drawings shall contain revision boxes to describe all revisions in detail. Indication of items changed in the latest revision shall be made by means such as a triangle enclosed number. Drawings to be submitted in Revit format. The following items shall be included at a minimum:
 1. All connection points, rigging points and accoutrements explicitly included (control panel, maintenance clearances, etc.).
 2. Qualification Data: For testing agency and personnel performing the specified tests.
 3. Factory test procedures for approval.
 4. Site acceptance test procedures for approval.
 5. Bill of material for each drawing showing all components, ratings, and catalog numbers.
 6. Warranties.
 7. Recommended preventive maintenance procedures (outline form).
 8. List of all recommended protection settings.
 9. List of all software information and alarm/monitoring points available to interface with BMS/EPMS system in the future.
 10. Recommended alarm set points.

1.10 QUALITY ASSURANCE

- A. Source Limitations: Manufacturer shall be responsible for all components specified herein. Provide a product built from components that have proven reliable and compatible with each other and are coordinated to operate as a unit as evidenced by a minimum of three years of successful operation at end-user sites and successful completion of specified testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. National Electrical Code (NEC - NFPA 70-2017)

1.11 DELIVERY, STORAGE AND HANDLING

- A. Deliver equipment with protective factory installed crating and covering. The materials shall be shipped by direct and dedicated carrier on an air ride truck. Final delivery location, date, and timing shall be coordinated with the Owner-assigned Construction Manager prior to shipment of the equipment. The shipping costs shall be included in the Bid.
- B. CDUs shall be shipped with piping and control wiring factory installed.
- C. CDUs shall be shipped with firmly attached labels that indicate name of manufacturer, model number, and serial number.

1.12 DELIVERY, STORAGE AND HANDLING

- A. The Equipment Supplier shall perform the following to prepare the equipment for shipping from factory to factory, factory to site, and for final assembly at the site:
 - 1. All equipment shall be adequately packed to prevent damage from handling, weather, shock, vibration and corrosion during shipment on a dedicated air ride truck by common carrier. The Equipment Supplier shall be responsible for compliance with local trucking requirements at the Project location and in any states transited.
 - 2. All metering and equipment shall be protected to ensure cleanliness during shipment, storage and erection.
 - 3. Each item of equipment shall be clearly marked. All boxes, crates and shipments shall be numbered and identified with the Owner's purchase order number, Owner's name and delivery location, Equipment Supplier's name and address and contents.
 - 4. All equipment shall have provisions for lifting and/or skidding. All lifting points shall be clearly marked.
 - 5. Each shipping unit shall be braced adequately and rigidly, both internally and externally, to prevent damage during transit or in the process of erection.
 - 6. When assemblies are supplied that require disassembly for installation or are shipped disassembled, each piece of the subassembly so affected shall be uniquely identified as to its assembly position. All loose peripheral equipment shall be boxed, crated or otherwise completely enclosed and protected during storage, handling and shipment.
 - 7. Equipment Supplier shall be responsible for the repair, at their expense, of all damage due to improper preparation, crating or damage while in transport. Touch up painting of exterior panels is not allowed. If painting repairs are needed, the entire panel shall be replaced or refinished.

8. Equipment supplier is responsible for tracking all shipments and is expected to inform the Owner, Contractor and Installing Contractor weekly shipping status at a minimum.
9. Installing Contractor shall upon delivery of shipped items, immediately take inventory of all items and confirm completeness of the shipment.
10. Installing Contractor shall store all spare parts in a secure space for Owner turnover at the end of the project. Storage location shall be climate controlled in accordance with manufacturer's requirements.
11. Equipment supplier shall be fully responsible to cover added cost of unit handling, storage, rigging, etc. that is incurred due to the equipment supplier not meeting agreed upon delivery dates. This includes shipping equipment to the job site earlier without write approval from the receiving contractor or equipment arriving onsite past the required delivery date.
12. All pipe connections shall be sealed and protected from debris prior to delivery to the Installing Contractor.
13. CDUs shall be shipped with piping and control wiring factory installed.
14. CDUs shall be shipped with firmly attached labels that indicate name of manufacturer, model number, and serial number.

1.13 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: A written warranty, executed by the manufacturer and signed by the Contractor, agreeing to replace components that fail in materials or workmanship within the specified warranty period, provided manufacturer's written instructions for installation, operation and maintenance have been followed. Manufacturer shall provide parts, and labor, as required.
 1. Warranty Coverage: Entire unit.
 2. Manufacturer's standard, but not less than one year after date of project substantial completion by the Owner. If the manufacturer's standard warranty is one year from startup or 18 months from shipment, whichever comes first, then the manufacturer must provide extended warranty to cover the time to one year from project substantial completion.
 3. Identify any manufacturer's standard warranty periods that exceed the time frame listed above.
 4. Alternate Bids:
 - a. Special Warranty: Provide a separate price in the Bid Proposal for a four year extended parts and labor warranty.

1.14 COMMISSIONING

- A. Commissioning of an equipment or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Construction Manager and the Commissioning Authority. Project Closeout is dependent on successful completion of the commissioning procedures, documentation, and issue closure. Refer to Commissioning Specification sections for detailed commissioning requirements.

1.15 FACTORY WITNESS TESTING

- A. Scope: A single machine for the project shall be tested.
- B. Scheduling: Submit a schedule to the Owner, Engineer and Commissioning Agent within 4 weeks of the schedule testing for review and comment by the owner and engineer of record. Submit any safety requirements for attendees in advance (i.e. safety glasses, clothing, shoes). The Owner shall determine the parties who shall be in attendance for the factory witness test.
- C. Travel Expenses: All costs related to travel and lodging for owner, engineer, contractor, and commissioning agent (total four representatives) shall be borne by the individual traveler.
- D. Sensor calibration: Documentation to be present during the testing verifying calibration of the sensors (temperature, pressure, flow, etc.)
- E. A recommended factory test procedure shall be provided by the Equipment Supplier and approved by the Owner's designated representative and Engineer.
 - 1. Testing shall include at a minimum;
 - a. Full load capacity based on scheduled/unit selection data
 - b. Unit response to 50% secondary side load at constant primary side temperatures.
 - c. Unit response to 50% secondary side load at rising primary side temperature. Test shall start at design entering primary side water temperature and rise 10 degrees over setpoint. Temperature rise should be constant over a duration of no less than 10 minutes.
 - 2. The manufacturer shall be responsible for providing power source, full capacity load and all meters required to demonstrate the equipment meets the specification requirements.
 - a. Electrical power quality testing shall demonstrate compliance with this specification and shall including values for kW, KVA, kVAR, THDi, and THDv at load intervals of 0%, 25%, 50%, 75%, and 100% as a minimum.

PART 2 - PRODUCTS

2.1 PACKAGED COOLANT DISTRIBUTION UNIT

- A. Manufacturers:
 - 1. Munters
 - 2. Vertiv
 - 3. Approved others
- B. Units shall be of the configuration, capacity and style as indicated on the drawings and Equipment Schedule and as specified herein.
 - 1. The unit shall be designed for top inlet primary fluid connections and secondary fluid connections.
 - 2. The unit shall be designed for maintenance access and serviceability on no more than three sides. This means no maintenance or component replacement activity shall be required from no more than 3 sides of the unit.
- C. Where desired by the manufacturer, it is permissible that the unit be comprised of multiple modules stacked on top of each other. All electrical and control panels associated with the unit shall be integrated to lower unit for ease of operator access from grade.

- D. Each unit shall be brand new, certified as such from the factory, with a date of manufacture engraved on the unit.
- E. The units shall be constructed for Indoor installation.
- F. The CDU shall be provided with modulating two-way motorized control valves on the primary side configured to fail in last commanded position.
- G. The units shall consist of water pump(s), heat exchanger(s), stainless steel piping, manual and motorized valves, strainers, glycol feeders, expansion tanks, controls and all required trim as documented on the design documents,
- H. The unit is to be shipped factory assembled in one complete section.
- I. Provide with stainless steel drain pan with low point drain to ensure capture of any drips from internal piping.
 - 1. Provide with integral leak detection cable or float switch tied to unit controller.
- J. Internal components shall include:
 - 1. Air vents installed at high point (primary and secondary side)
 - 2. Low point drains with ½" ball valve and cap
 - 3. Pressure/temperature plugs for sampling of heat exchanger and pump inlets and outlets and located to verify any permanently installed sensors
 - 4. Differential Pressure transmitter for pump control (secondary side only, N+1 redundant)
 - 5. Primary inlet pressure sensor
 - 6. Primary outlet pressure sensor
 - 7. Secondary outlet temperature sensor (N+1 redundant)
 - 8. Secondary inlet temperature sensor
 - 9. Primary inlet temperature sensor
 - 10. Primary outlet temperature sensor
 - 11. Pump(s) sized for scheduled capacities (secondary side only)
 - 12. Brazed plate heat exchanger(s)
 - 13. 25 micron strainer (secondary side)
 - 14. 50 mesh strainer (primary side, may be in external piping)
 - 15. Secondary side flowmeter
 - 16. Primary side flowmeter
 - 17. Check valve on discharge side of each pump (secondary side only)
 - 18. Two-way modulating control valve for each Heat exchanger (primary side only)
 - 19. Unit isolation valves on primary and secondary piping
 - 20. Glycol reservoir with feed pump and fill pump
 - a. Reservoir shall have low level and high level sensors.
 - 21. Expansion Tanks (N+1 redundant)
- K. Pump Construction:
 - 1. Casing: 304 or 316L Stainless Steel, with replaceable wear rings, threaded gage tappings at inlet and outlet, and threaded companion-flange connections.
 - 2. Impeller: Stainless Steel; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
 - 3. Pump Shaft: Stainless steel.
 - 4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N or EPT bellows and gasket. Include water slinger on shaft between motor and seal.
 - 5. Pump Bearings: Permanently lubricated ball bearings or Oil lubricated; bronze-journal or thrust type.

6. Motor: Variable speed, secured to mounting frame, with adjustable alignment.
 - a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application
 - b. TEFC (totally enclosed fan cooled)
- L. Brazed plate heat exchanger
 1. Brazed assembly consisting of embossed or pressed stainless-steel plates brazed together and two end plates, one with threaded or flanged nozzles and one with pattern-embossed plates
 2. Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.
 3. End-plate, plate and nozzles shall all be constructed of 304 or 316L stainless steel materials
 4. Heat exchanger shall be sized for scheduled temperatures. Mixing of primary side water shall not be required to meet specified conditions.
- M. Control Valve
 1. Pressure Independent 2-Way modulating Linear Control Valve
 2. Control Valve: Linear control valve from Bray, Danfoss, Belimo or approved equal.
 3. Valve shall fail to last position if control power or signal is lost.
 4. Flow Characteristics: Equal percentage characteristics.
 5. NPS 2" and Smaller: Forged brass body rated at no less than 300 PSI working pressure. Flow Regulator shall utilize a spring and diaphragm cartridge.
 6. NPS 2-1/2" through 12": Cast iron or ductile iron body rated at no less than 232 psi cold working pressure. Bodies shall be compatible with ANSI 150 flanges
 7. Accuracy: The control valves shall accurately control the flow from 0 to 100% full rated flow. The flow shall not vary more than +/-5% due to system pressure fluctuations across the valve with a minimum of 5 psid across the valve.
 8. All pressure independent control valves shall include two P/T ports
 9. lose-Off (Differential) Pressure Rating: 200 psi.
 10. Actuator shall be compatible with both the valve and the unit controller.
- N. Hydronic Piping
 1. Primary Side may be any of the below:
 - a. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
 - b. Schedule 40 carbon steel pipe, Class 150 wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
 - 1) Alternate: Threaded joints may be used for pipe under 2 1/2" in diameter
 2. Secondary Side: Comply with ASTM A 269, Type 316L stainless steel pipe.
 - a. Joints shall be either butt welded with flanges or sanitary tri-clamps rated for 250 psig and 150°F
 3. A 4" fill port shall be included on the Secondary side for each CDU. Fill port shall include 4" ball isolation valve and threaded reducer ending in a 3/4" hose valve connection. This is to allow fill from either a 3/4" hose or upon removal of reducer a full 4" hose for rapid fill.
- O. Y-Pattern Strainers:
 1. Primary Side only

- a. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 - b. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
 - c. Strainer Screen: Stainless-steel, 40-mesh strainer, or perforated stainless-steel basket.
 - d. CWP Rating: 150 psig for closed loop systems.
- P. Microprocessor Control System:
1. An electronic programmable microprocessor-based logic controller shall be factory furnished, wired and programmed to control the data center cooling unit.
 2. All sensors, as required to accomplish the specified sequence of control, shall be provided and factory wired to the extent possible.
 3. All internal components listed in section 2.1.J shall be capable of being displayed on control panel and reported to BAS through controls integration.
 4. Unit controls shall be compatible with the BAS through BACnet MS/TP or BACnet IP. Unit manufacturer shall provide a complete controls sequence with set points and alarms in the submittal package.
- Q. Controller shall be powered from factory provided power supply from the main power feed.
- R. A touchscreen display shall be provided to view and where allowed, modify setpoints. The display shall also allow for the user to view alarm history and access a service menu to diagnose alarms.

2.2 ELECTRICAL

- A. All electrical work shall be installed in full compliance with the National Electric Code. All electrical components shall be UL grooved labeled. The units shall be provided with a UL or ETL label.
- B. Integral Electrical Power Components: Unit-mounted electrical enclosure with piano-hinged door, grounding lug, combination magnetic starters with overload relays, circuit breakers and cover interlock, and fusible control-circuit transformer. All components shall be fully wired to the utility power terminal identified below.
1. The operating mechanism for the NEMA 1 disconnect switch(es) shall not be higher than 4'-6" above the floor on which service personnel stand.
 2. Short Circuit Withstand Rating of the CDU electrical enclosure shall be 480V, 35,000 Amps.
 3. Input Power Termination: Terminal(s) shall be able to accommodate Aluminum or Copper conductors of scheduled size and quantity as shown on the electrical one-line diagrams.
 4. Provide each unit with a factory welded (prior to finish painting) ground lug in an accessible, concealed location.
- C. An integral electrical control panel shall be provided that has a tooled access panel with an approved locking device. All required safety and automatic operating controls, including motor protection, and motor thermal overloads shall be included.
- D. All internal power and control wiring shall be connected to a numbered terminal strip for easy troubleshooting.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The equipment shall be installed by the Installing Contractor, following the procedures set forth by the Equipment Supplier. The Equipment Supplier shall assist the Installing Contractor as required in interpreting the installation instructions. The Equipment Supplier's representative shall attend weekly on-site construction meetings as required.
- B. The Installing Contractor shall provide all necessary rigging required for unloading and installation of equipment and associated materials. After set in place, remove temporary blocking, lifting eyes and other shipping components from the equipment.
- C. The Installing Contractor shall review and coordinate work to accommodate all installation of material and hardware provided by Equipment Supplier.
- D. The Installing Contractor shall coordinate with other trade contractors and the owner to ensure work by others that affects the Installing Contractors work is fully coordinated.
- E. If necessary, Installing Contractor shall recommend and review revised locations and layout of equipment and components with Engineer to suit vendor's specific design. Field Verify all installation locations, clearances, conduit layouts, etc. Provide written notice to the Contractor and the Owner of any unacceptable condition.
- F. Installing Contractor shall install all equipment and components in accordance with manufacturer's instructions and anchor to floor with expansion anchors. All units shall be installed plum, level, and true.
- G. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70-2016.
- H. Connections: Inspect all connections to the equipment:
 - 1. Chilled Water and Technical Water Piping Connections: Verify connections comply with the Manufacturer's requirements.
 - 2. Verify service and maintenance clearances comply with the Manufacturer's requirements.
 - 3. Power: Verify all power connections comply with the Manufacturer's requirements.
 - 4. Controls and Monitoring: Verify all building controls or monitoring systems connections comply with the Manufacturer's requirements. Coordinate with the building controls and monitoring systems installers to verify all connections operate as specified. Provide all necessary technical support to the building controls and monitoring systems installers for the proper operation of digital communications interfaces to the units.
 - 5. Piping connections shall be thoroughly cleaned of all scale and foreign matter before the piping is assembled and connected to the unit(s).
 - 6. Water shall be treated and flushed in accordance with the requirements of Specification Section 23 25 13 prior to being circulated through the unit(s).

3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and unit installation, including piping and electrical connections. Report results in writing.
- B. Manufacturer Provided Start-up
 - 1. Manufacturer's Supervision: A factory trained service representative of the manufacturer shall supervise the field assembly (if any), final installation, checkout

- and startup of each CDU. Prepare manufacturer's written report/log of the installation and startup signed by the service representative and the Owner.
2. Representative shall instruct the Owner's operating personnel in the operation and service of the units. This instruction shall be concurrent with startup.
 3. Manufacturer shall supply the following literature:
 - a. Start-up, operation and maintenance instructions.
 - b. Installation instructions.
 - c. Field wiring diagrams.
 - d. One complete set of certified drawings.
- C. Complete installation and startup checks according to manufacturer's written instructions.

3.3 CLEANING

- A. After installation, including outlet fittings and devices, contractor shall inspect unit components, remove dirt and debris and repair damaged finish to match original finish.

3.4 COMMISSIONING ASSISTANCE

- A. A factory-authorized service representative shall be on-site, when requested, during the commissioning process.
- B. A factory-authorized service representative shall correct any deficiencies discovered during the commissioning process. The construction timeline, duration, and schedule shall be dictated by the Owner and Construction Manager.
- C. Fluid quality verification: After filling the system and prior to putting the unit into service, the installing contractor shall provide a fluid sample from the system, not the reservoir, to the Manufacturer and Owner. Prior to putting the unit into service, the Manufacturer and Owner shall provide written approval that the fluid meets their specifications.

3.5 DEMONSTRATION

- A. A factory-authorized service representative shall train Owner's maintenance personnel as specified below.
 1. Schedule training with Owner, through the Construction Manager with at least 7 days of notice.
 2. Provide a minimum of 8-hours of on-site technician-level training. Training to be performed within one year of the substantial completion date.
 3. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
 4. Review data in the maintenance manuals.
 5. Provide the software and hardware necessary to access the system logic for service training.

PART 4 - ALTERNATE BIDS

4.1 SECONDARY FLUID MONITORING SYSTEM

- A. State the amount to be added to the Base Bid for providing an integrated secondary fluid monitoring system with the CDU. The fluid monitoring system will, at a minimum, monitor and alarm the pH, Conductivity, and Turbidity of the secondary fluid.

4.2 EQUIPMENT MAINTENANCE CONTRACT

- A. State the amount to be added to the Base Bid for providing an annually renewable maintenance and service contract, for up to five years. The first year shall only include the preventive maintenance of the equipment, while the remaining four (4) years shall include preventive and corrective maintenance. Include all manufacturer's recommended services and intervals. Assume the contract shall begin after acceptance of the complete system by the Owner. The Owner or his designated representative will execute contract. Contract shall include a maximum 4-hour response time. Submit detailed information on what is included in the preventative maintenance contract including but not limited to coverage of travel, labor, parts and service, recommended for the equipment checks, tests, and inspections.

4.3 EQUIPMENT SPARE PARTS

- A. State the amount to be added to the Base Bid for providing the manufacturer's different levels of recommended Spare Parts Kits to be stored on site. The quantity of Spare Part Kits shall be, at a minimum, one of each equipment size.

4.4 TRAINING

- A. State the amount to be added to the Base Bid for providing in-person training in 4 hour increments for training the Owner's operations personnel.

END OF SECTION 23 81 24

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