Vertiv™ XDU1350
Row Based Coolant Distribution Unit
GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 Summary

These specifications describe requirements for a thermal management system. The system shall be designed to control supply fluid temperature, flow and pressure to cabinets containing fluid cooled electronic equipment. The manufacturer shall design and furnish all equipment to be fully compatible with all requirements of the fluid cooled electronic equipment cabinet.

1.2 Design Requirements

The thermal management system shall be a Vertiv self-contained, factory assembled unit. Standard 60 Hz units shall be cULus certified to the harmonized U.S. and Canadian product safety standard, CSA C22.2 No 236-15/UL 1995 for heating and cooling equipment and shall be marked with the cULus.

1.3 Submittals

Submittals shall be provided with the proposal and shall include:

- Single line diagrams (dimensional)
- Electrical
- Capacity data (piping and electrical connection drawings)

1.4 Acceptable Alternatives

Acceptable alternatives shall be permitted with engineer's prior approval only. Contractor to submit a detailed summary form listing all variations to include size deviations, electrical load differences, functional and component changes, and savings to end user.

1.5 Quality Assurance

The specified system shall be factory tested before shipment. Testing shall include but shall not be limited to quality control checks, Hi-Pot, and full function system test. The system shall be designed and manufactured according to world class quality standards. The manufacturer shall be ISO 9001 certified.

2.0 PRODUCT

2.1 Cooling System

2.1.1 Heat Exchanger

The heat exchanger shall be a S304/S316 stainless steel plate, copper brazed liquid to liquid heat exchanger. The heat exchanger shall be AHRI certified. Performance shall be calculated to provide a minimum of 5% over surfacing (margin). The heat exchanger shall be sized to provide the minimum _____^{0}F approach temperature difference (ATD) for the specific application so as to enable the maximum system efficiency. The fluid circuit shall be designed to distribute fluid into the entire heat exchanger face area on both primary and secondary sides.

2.1.2 Pipe Work and Fitting

The heat exchanger shall be connected to the pipe work with stainless steel hygienic fittings and shall be quickly removeable without special tools or fixtures. All internal pipe work shall be S304/S316 stainless steel. Wetted materials list shall be provided, all materials being compatible with the coolant, secondary circuit, and IT equipment. Both primary and secondary pipework shall be provided with automatic air vents and drains suitable to vent and drain the entirety of both circuits.

2.1.3 Primary (Facility Circuit) Insulation

The primary (facility) side coolant distribution unit (CDU) pipework and heat exchanger shall be insulated with flexible Class O insulation for reliable and continuous condensation control with no additional vapor barrier required. The thermal insulation shall have a very low thermal conductivity, extremely high resistance to water vapor transmission, and excellent fire performance. Primary thermal insulation shall be fitted at factory.

2.1.4 Pressure Relief Valves

The pressure relief valves (PRV) shall be installed in the secondary piping and be rated for either 3 bar, 4 bar, 5 bar, 6 bar or 7 bar depending on customer selection.

2.2 Pumps

2.2.1 Main Pumps

The pump speed shall be variable and automatically regulated to setpoint by the Vertiv controller including weekly automatic seamless changeover control to even run time and improve pump life. Each pump shall have an integral check valve, dedicated motor, and speed controller with fault monitoring circuitry which provides N+1 redundancy with twin pump mode. The inverter parameters such as current, output voltage, frequency, and power shall be reported at the unit display. Pumps shall be direct coupled with the motor and of at least IE3 efficiency rating. Pumps, inverters, and power trains shall be suitably sized to allow simultaneous, dual pump, operation. Pumps shall be connected to the power train via EMC shielded plug/socket connection and fitted with isolation valves in the pipe work at inlet and outlet to allow for concurrent maintainability. Flow shall be monitored by flow meter and differential pressure (DP) sensors.

The Vertiv™ XDU1350 shall be equipped with three pumps.

- When running in triple pump mode the pumps provide maximum secondary flow up of 1800 l/min (475 GPM) at external pressure drop of 2.0 bar (29 psi).

- When running in twin pump in run/standby mode the pump provides 1200 l/min (317 GPM) at external pressure drop of 2.5 bar (36 psi).

- Each XDU1350 pump shall be rated for ___ GPM (__ l/s) at __ ft. (___kPa) of head.

2.3 Filter

2.3.1 Secondary Filtration

The unit can be equipped with a large capacity, removeable, and washable secondary filter assembly on each pump providing filtration to either 25 microns (μ) or 50 microns (μ). The filters shall be concurrently maintainable. The filter shall be designed with sufficient face area to enable a filter media velocity of <0.5 m/s (1.6 ft/s) and in such a way that enables zero filter media bypass. The filters shall be fitted with differential pressure monitoring to report state of cleanliness and indicate an alarm when cleaning is required.

2.4 Wired Temperature Sensors

2.4.1 Liquid Temperature Sensors Secondary Circuit

Each unit shall have triple redundant factory supplied and connected secondary supply temperature sensors that are used to set the primary control valve position and maintaining supply temperature. A sensor shall also measure the secondary return temperature and an indicative value for heat transfer in kW be displayed.

2.4.2 Room Temperature/Humidity Sensor

A temperature and humidity sensor shall be mounted on the front door to enable monitoring of the local environment. These values shall be used to calculate IT environment dewpoint. Dewpoint control shall be a standard feature of the control system to enable automatic setpoint override in the event of a risk of condensation. This sensor may optionally be remote mounted if the CDU is not in the same environment as the cooled devices.

2.4.3 Primary and Secondary Supply/Return Temperature Sensors

Each unit shall have factory supplied and connected primary and secondary supply and return temperature sensors that are used for monitoring and reporting.

2.5 Flow Meters

Each unit shall have one water flow meter monitoring the gallons per minute or liters per minute (LPM) provided at the discharge of the secondary circuit and one flow meter monitoring the GPM or LPM circulating at the inlet of the primary circuit. The secondary circuit flow meter shall determine the speed of the operating pump if running in flow rate set point mode.

2.6 Pressure Sensors

Each unit shall have redundant secondary return pressure sensors, filter differential pressure sensors for filters fitted and secondary supply pressure sensors. The secondary supply and return sensors shall be used to determine pumps speed in differential pressure mode of operation.

2.7 Single Locking Disconnect Switch

A manual disconnect switch shall be mounted in the electrical panel and be capable of disrupting the flow of power to the unit. The electric panel compartment shall be accessible only with the switch in the Off position. It shall be located behind the unit front door for quick access. The disconnect switch shall be lockable in the off position.

2.8 Short Circuit Current Rating (SCCR)

The electrical panel shall provide 65 kA SCCR or 5 kA SCCR depending on customer selection.

2.9 Cabinet Construction and Accessibility

2.9.1 Cabinet Construction

The exterior panels shall be 18 gauge steel and powder coated to protect against corrosion. The unit shall be mounted on an integral base with forklift cutouts for quick installation and provided with holes for bolting down.

2.9.2 Serviceability

The cabinet shall be designed so all components are easily accessible for service and maintenance through either the front or rear of the unit.

3.0 CONTROL

3.1 Vertiv Controller Microprocessor Control with 7-inch Color Touch Screen

The Vertiv controller shall be microprocessor based with a 7-inch, high definition, resistive, color touch screen display and shall be mounted on the unit front door. The controls shall be menu driven.

The system shall display user menus for:

- Status
- Data curves
- Alarms
- Setup
- Configuration
- Service and diagnostics (including the monitoring of room conditions, operational status of each function, date, and time),
- Total run hours,
- All sensors
- Display setup

A password shall be required to make system changes.

Service menus shall include:

- Setpoints, standby settings (lead/lag)
- Timers
- Alarm setup
- Maintenance and alarm threshold settings
- Options setup
- System/network setup
- Diagnostics/service mode

3.1.1 Communications

The Vertiv controller shall provide redundant Ethernet/RS-485 ports dedicated for BMS connectivity (communications). RS-485 communications shall include Modbus RTU. TCP/IP communications and features shall include Modbus over IP, SNMP, FTP, web server, and NTP with automatic daylight saving offsets. A BACnet gateway will provide both BACnet IP and BACnet MSTP client/master devices to read all configured Modbus signals.

3.1.2 Password Protection

The Vertiv controller shall contain four unique password levels to protect against unauthorized changes. An auto hide/show feature shall allow the user to see/edit applicable information based on the login used.

3.1.3 Unit Backup and Restore

The controller shall create safe copies of important control parameters. A log file shall be accessible which allows the end user to download and view unit level settings, parameter names, default values, triggered alarms, newly adjusted values, and performance history. Log files of all parameter values shall be stored on an SD card daily. Additionally, all alarms and events shall be stored in an alarm log and any user changes by whatever method stored in a syslog file.

3.1.4 Unit Status

The Vertiv controller shall show the unit's operating status on the controller home page. The screen shall indicate if the unit has an active alarm, or if the unit is On, Off or in standby status.

3.1.5 Event Log

The Vertiv controller shall automatically store the syslog, alarm log, and parameter data logs for the lifetime of the unit.

3.1.6 Firmware Updates

Vertiv controller upgrades shall be performed through a local USB connection or SD card.

3.1.7 Automatic Start/Stop

The menus shall allow various customer settings for turning the unit On or Off locally at the display, or in response to certain critical alarms.

3.2 User Menu

3.2.1 Home Menu

The unit home menu shall display the unit’s current operating conditions on the screen:

- Primary circuit flow
- Primary circuit supply temperature
- Primary circuit return temperature
- Cooling valve position and feedback
- Pump speed demand
- Secondary circuit flow
- Secondary circuit supply temperature
- Secondary circuit return temperature
- Secondary circuit differential pressure
- Ambient temperature, humidity, and dew point
- Unit status
- Unit mode
- Alarm status
- Firmware name and revision
- A and B IP addresses

3.2.2 Submenus

The menus shall be sub-divided into eight main sections:

- Login screen: Allows access to further information and to adjust various parameters and settings when logged in at service or engineer level.
- Status screen: Displays read-only comprehensive information on the operating condition of the unit.
- Data curves screen: Displays a graphical representation of two pieces of variable data—a red trace for cooling demand and a yellow trace for secondary supply temperature. Both traces update in real time.
- Alarms screen: Displays new or active alarms and allows acknowledgement of these events.
- Setup screen: The setup screen shall display read-only information with user level access with factory settings or parameters set at commissioning. Adjustments to the settings shall be made with higher level access.
- Configuration screen: Sets specific parameters and control functions when logged in at the appropriate user level.
- Service screen: Shall be used to set selected parameters and to assist in commissioning and accessible only with service and engineer logon codes.
- Diagnostics screen: Shall provide information and conversion factors for the status for all universal inputs, resistive inputs, digital inputs, digital outputs, and analogue outputs.

3.3 Alarms

Active alarms shall be shown on the home screen, recorded in a log file and, if configured to do so, flagged through an external building management system (BMS) connection.

Alarms to include:

- Flow, pressure, and temperature alarms
- Inverter and controller fault alarms
- Leak detection alarms
- Communication fault alarms
- Filter condition alarms

If the optional external leak detection tape has been fitted, this shall also be added to the list of unit alarms.

3.4 BMS Connectivity

The Vertiv controller shall communicate over the following protocols:

- Modbus RTU (standard)
- Modbus TCP/IP (standard)
- Web server
- SNMP
- BACnet IP and MSTP

3.5 System Auto Reset

The unit shall start pumps within 5 seconds after a system reboot. The system pumps shall return to running at the last known speed after a reboot, and the primary control valve shall return to its last known position to maintain desired user defined setpoints.

3.6 Controller

The Vertiv controller shall be factory set to allow precise monitoring and control of the fluid flow and temperature leaving the unit.

3.6.1 Flow Rate Control

Fluid flow rate shall be manually set from the Vertiv controller based on the demand of equipment being served by the unit. Once set, the controller shall precisely monitor and modulate the pump speed to always maintain the flow rate. The unit shall be configured to run in either fixed flow mode or fixed differential pressure mode to allow for multiple units in redundant configuration.

3.6.2 Secondary Temperature Control

Secondary supply temperature shall be manually set from the Vertiv controller based on the demand of equipment being served by the unit. Once set, the controller shall precisely monitor and modulate the primary cooling control valve to maintain the secondary supply temperature. The unit shall be configured to run in fixed set point or dew point override. Dew point override is to allow the unit to automatically raise the secondary supply temperature if the ambient conditions are such that there is a risk of condensation in the secondary circuit.

3.6.3 Group Control

Multiple units in a group shall be configurable to operate in group control mode, enabling multiple units to contribute to the total flow and duty requirement and provide redundancy on a system level. Once each unit has been assigned a unique address, the system shall become self-organizing with one unit automatically assuming the role of the master and coordinating the running state of the other units based on the configured level of redundancy, the system pressure requirements, and any alarm conditions.

It shall be possible to make changes to the group settings (for example, number of run units) or system settings (for example, DP setpoint) via any unit touchscreen user interface.

3.7 Remote Device Interfaces

3.7.1 Remote Shutdown

The unit shall support remote remote start/stop options available over Modbus, BACnet, and SNMP.

3.7.2 Leak Detection Sensors

Internal Leak Detection

The unit shall be fitted with internal drip tray and leak detection. If a leak is detected, an alarm shall be generated at the unit, and configured to alarm only or alarm + shutdown.

External Leak Detection—Optional

A twisted pair cable leak detection tape that can sense water anywhere along its length is connected to the unit controller. This sensor provides external leak detection along the length of a secondary fluid network or hose run. If a leak is detected, alarms shall be generated at the unit, and configured to alarm only or alarm + shutdown.

4.0 MISCELLANEOUS OPTIONS

4.1 External Leak Detection Tape—Optional (Ship Loose)

A twisted pair leak detection cable shall be field installed under a raised floor along the length of a secondary fluid network or hose run. If a leak is detected, alarms are generated at the XDU1350 and the unit can be configured to alarm only or alarm + shutdown.

4.2 Primary Stainless Steel Facility Hose Set—Optional (Ship Loose)

Primary hoses allow for flexibility in the positioning of the XDU1350 unit when installing and connecting the primary facility circuit to the XDU1350 primary inlet and outlet tails. The hoses are constructed from stainless steel overbraid, hygienic flange one end, and fitting to ANSI 150 lb. flange.

4.3 Secondary Stainless Steel Hose Set—Optional (Ship Loose)

Secondary hoses allow for flexibility in the positioning of the XDU1350 unit when installing and connecting to the secondary loop that feeds the rear door or fluid cooled equipment. The hoses are constructed from stainless steel overbraid, hygienic flange one end, and fitting to ANSI 150 lb. flange.

4.4 Stainless Steel 10 liter Volume Make-Up Tank—Optional (Factory Fitted)

A stainless steel tank shall be provided upon selection in place of a flexible make-up bag to monitor and maintain the fluid levels in the system. The tank shall be equipped with three level sensors to detect fluid levels and trigger appropriate notification and/or alarms as fluid levels drop. The pump of the tank is integrated into the fluid system to automatically add fluid as needed.

4.5 Automatic Transfer Switch ATS—Optional (Dual Power Supplies) (Site or Factory Fitted)

The ATS shall allow the XDU1350 unit to be connected to A and B electrical supplies. Supply A will be the default power source, but should this supply fail for any reason, then the ATS unit will seamlessly switch over to supply B, without any stoppage or function loss in the XDU1350. When supply A comes back online, the ATS will automatically switch back to this supply as the default.

4.6 Secondary Circuit Fluid Monitoring—Optional (Factory Fitted)

A secondary fluid monitoring system shall be included with three sensors: conductivity sensor, turbidity sensor, and pH sensor monitoring each of the parameters on regular intervals. The system shall include an auxiliary IO module that receives a feedback signal from each of the sensors which is communicated to main controller through Modbus RS485. Alarms shall be generated if any of the set values are out of threshold limits.

5.0 EXECUTION

5.1 Installation of Thermal Management Units

5.1.1 General

Install cooling units in accordance with manufacturer’s installation instructions. Install units, plumb and level, firmly anchored in locations indicated and maintain manufacturer’s recommended clearances.

5.1.2 Electrical Wiring

Install and connect electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish a copy of manufacturer’s electrical connection diagram submittal to the electrical contractor.

5.1.3 Piping Connections

Install and connect devices furnished by manufacturer but not specified to be factory mounted. Furnish a a copy of the manufacturer’s piping connection diagram submittal to piping contractor.

5.1.4 Field Quality Control

Startup cooling units in accordance with manufacturer’s startup instructions. Test the controls to demonstrate compliance with requirements. These specifications describe requirements for a computer room environmental control system. The system shall be designed to maintain flow and temperature conditions for fluid cooled electronic equipment.

The manufacturer shall design and furnish all equipment to be fully compatible with heat dissipation requirements.

5.1.5 Supply and Return Fluid Piping

Connect fluid supply and return to the thermal management system.

5.1.6 Warranty Start Up and Control Programming

The unit shall be installed in accordance with manufacturer's installation instructions provided with seismic option to be firmly anchored to maintain manufacturer's recommended clearances. Mounting requirement details such as anchor brand, type, embedment depth, edge spacing, anchor-to-anchor spacing, concrete strength, special inspection and attachment to non-building structures must be outlined and approved by the engineer of record for the projection or building. Electrical, pipe and duct connections must permit movement in three dimensions and isolate the unit from field connections. Electrical conduit shall be flexible, having at least one bend between the rigid connection at the unit cabinet and the connection to rigid conduit or foundation. The piping flexible connection or loop must be suitable for the operation pressure and temperature of the system. Furnish copy of manufacturer's piping connection diagram submittal to piping contractor.

Engage the manufacturer's field service technician to provide warranty start up supervision and assist in programming of units controls and ancillary panels supplied by them.