Vertiv™ CoolPhase Row
Row-based Environmental Control System
Guide Specifications

1.0 GENERAL

1.1 Summary

These specifications describe the requirements for a Thermal Management system. The system shall be designed to control temperature and humidity conditions in rooms containing electronic equipment, with good insulation and vapor barrier. The manufacturer shall design and furnish all equipment to be fully compatible with the heat dissipation requirements of the room.

1.2 Design Requirements

The Thermal Management system shall be CSA-Listed to the harmonized U.S. and Canadian product safety standards "CSA C22.2 No. 60335-1/UL60335-1 Household and similar electrical appliances - Safety - Part 1: General requirements & CSA C22.2 No. 60335-2-40/UL 60335-2-40 Household and similar electrical appliances - Safety - Part 2: Particular requirements for electrical heat pumps, air conditioners and dehumidifiers" and are marked with CSA c-us logo.

The system shall be AHRI Listed, the trusted mark of performance assurance for heating, ventilation, air conditioning and commercial refrigeration equipment, using AHRI Standard 1360.

1.2.1 Submittals

Submittals shall be provided with the proposal and shall include: Single-Line Diagrams; Dimensional, Electrical, and Capacity Data; Piping and Electrical Connection Drawings.

2.0 PRODUCT

2.1 Cooling System

2.1.1 Air-Cooled Refrigeration System

Refrigeration System

The single refrigeration circuit shall include a liquid-line filter drier, a ball valve, a refrigerant sight glass with moisture indicator, an electronic expansion valve, and a liquid-line solenoid valve. The indoor evaporator refrigerant piping shall be spun shut with a nitrogen holding charge. Field relief of the Schrader valve shall indicate a leak-free system.

Hydrophilic-Coated Evaporator Coil

1. Model CRD030

The direct expansion, "V-shape" cooling coil shall have 11 ft^2 (1.02 m^2) face area, three rows deep. It shall be constructed of copper tubes and hydrophilic-coated aluminum fins. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide superior water carryover resistance. Two stainless steel condensate drain pans shall be provided, one in the middle of the coil and one in the bottom side of the coil.

2. Model CRD040

The direct expansion, slab cooling coil shall have 8.26ft^2 (0.768 m^2) face area, six rows deep. It shall be constructed of copper tubes and hydrophilic-coated aluminum fins. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide superior water carryover resistance. Two stainless steel condensate drain pans shall be provided, one in the middle of the coil and one in the bottom side of the coil.

Fan Motors

The CR030 unit shall be equipped with six axial fans and the CR040 with eight axial fans: direct-driven axial fans with diagonal shape impeller and electronically commutated DC motors. The fan speed shall be variable and automatically regulated by the Liebert® iCOM™ through all modes of operation. Each fan should have a dedicated motor, fault monitoring circuitry and speed controller, which provides a level of redundancy. The EC axial fans shall be mounted in front of the unit and draw air through the coil.

2.2 Advanced Airflow Management

2.2.1 Supply Air Baffle System

1. Models CRD030 & CRD040

A field-adjustable, modular, supply-air baffle system shall be located in the discharge air stream on the front of the cabinet to direct air toward the equipment racks and balance air-flow requirements within the row. The five modular baffle segments shall be easily reconfigurable to redirect air flow as cooling requirements change. Controlling the air flow prevents hot spots and maintains high return-air temperatures by not blowing cold air over racks or out the ends of aisles. By focusing the cold air where it is needed and meeting the servers' requirements, the need for excessive air flow and energy consumption is eliminated.

2.3 Cabinet Construction and Accessibility

2.3.1 Cabinet Construction

1. Models CRD030 & CRD040

The exterior panels shall be 20-gauge steel and powder-coated with charcoal color paint to protect against corrosion. The double-wall side panels separate the half-inch, 2.0 $lb./ft^3$ insulation from the air stream and increase unit rigidity. The unit shall be mounted on casters for quick installation and provided

with leveling feet. The perforated inlet and outlet panels shall have 81% open area. The rear door shall utilize a Vertiv™ Liebert® Knürr™ rack style handle and hinges to mirror the appearance of neighboring server racks.

2.3.2 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. Units that are not fully accessible from front and rear or not serviceable in place shall be unacceptable.

1. Models CRD030 & CRD040

The Superior Service Access Panel shall provide additional access to the top of the system components. Side access shall not be required.

The variable-speed EC axial fans shall be individually replaceable through the front door of the unit. The condensate pump and canister humidifier shall be conveniently mounted near the edge of the unit.

2.4 Locking Disconnect Switch

1. Models CRD030 & CRD040

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 Vertiv™ Liebert® iCOM™ display door for quick access.

2.5 Short Circuit Current Rating (SCCR)

1. Models CRD030 & CRD040

The electrical panel shall provide at least 65,000A SCCR.

2. Model CRD030 & CRD040 208-230/1/60Hz

The electrical panel shall provide at least 65,000A SCCR.

3. Model CRD03O & CRD040 208-230/3/60Hz

The electrical panel shall provide at least 65,000A SCCR.

4. Model CRD030 & CRD040 460/3/60Hz

The electrical panel shall provide at least 65,000A SCCR.

2.6 Filtration

1. Models CRD030 & CRD040

    a. MERV 8

The filter channel shall be an integral part of the system, located within the cabinet and serviceable from the rear. The two filters shall be deep-pleated, 4 inches thick with an ASHRAE 52.2 MERV8 rating (30% ASHRAE 52.1). A filter clog alarm shall be included. Mesh type, cleanable filters shall be unacceptable.

    b. Optional - MERV 11

The filter channel shall be an integral part of the system, located within the cabinet and serviceable from the rear. The two filters shall be deep-pleated, 4 inches thick with an ASHRAE 52.2 MERV11 rating (60-65% ASHRAE 52.1). A filter clog alarm shall be included. Mesh type, cleanable filters shall be unacceptable.

2.7 Electric Reheat

The PTC aluminum 6063 tube electric reheat shall be capable of maintaining room dry bulb conditions when the system is calling for dehumidification. The reheat section shall include UL/CSA recognized safety switches to protect the system from overheating. The capacity of the PTC reheat shall be

controlled in one stage.

Must be controlled with control signal 0-10V from main controller and controlled by SSR (Solid State Relays) in phase angle mode.

2.8 Steam Generating Canister Humidifier

A canister-type steam-generating humidifier shall be factory-installed in the cooling unit and operated by the Vertiv™ Liebert® iCOM™. It shall be complete with disposable cylinder, all supply and drain valves, steam distributor and electronic controls. The need to change the canister shall be indicated on the Liebert® iCOM™. The humidifier shall be designed to operate with water conductivity from 75 to 1250 (60Hz) microS/cm. The system shall automatically fill and drain as well as maintain the required water level based on conductivity. An air gap within the humidifier assembly shall prevent back-flow of the humidifier supply water. The humidifier canister shall be removable from the rear of the cabinet.

2.9 Condensate Pump—Models CRD030 & CRD040

The condensate pump shall have a minimum capacity of 2.64 GPM (10 l/min) at 19.69 ft. (6 m) head.

3.0 CONTROL

3.1 Vertiv™ Liebert® iCOM™ Microprocessor Control with 7 Inch Color Touchscreen

The Liebert® iCOM™ shall be microprocessor-based with a 7" color touchscreen display and shall be mounted in an ergonomic, aesthetically pleasing housing. The controls shall be menu driven. The system shall display user menus for active alarms, event log, graphic data, unit view/status overview (including the monitoring of room conditions, operational status in percentage of each function, date, and time), total run hours, various sensors, display setup and service contacts. A password shall be required to make system changes. Service menus shall include setpoints, standby settings (lead/lag), timers/sleep mode, alarm setup, sensor calibration, maintenance/wellness settings, options setup, system/network setup, auxiliary boards, and diagnostics/service mode.

- Password Protection - The Liebert® iCOM™ shall contain two unique passwords to protect against unauthorized changes. An auto hide/show feature shall allow the user to see applicable information based on the login used.
- Unit Backup and Restore - The user shall be able to create safe copies of important control parameters. The Liebert® iCOM™ shall have the capacity for the user to automatically backup unit configuration settings to internal memory or USB storage drive. Configuration settings may be transferred to another unit for a more stream-lined unit startup.
- Parameter Download - The Liebert® iCOM™ shall enable the user to download a report that lists parameter names, factory default settings and user programmed settings in .csv format for remote reference.
- Parameter Search - The Liebert® iCOM™ shall have search fields for efficient navigation and parameter lookup.
- Setup Wizards - The Liebert® iCOM™ shall contain step-by-step tutorials or wizards to provide easy setup of the control.
- Context-Sensitive Help - The Liebert® iCOM™ shall have an on-board help database. The database shall provide context-sensitive help to assist with setup and navigation of the menus.
- Display Setup - The user shall be able to configure the display information based on the specific user's preference. Language, units of measure, screen contrast, home screen layout, back-light timer and the hide/show of certain readouts shall be configurable through the display.
- Additional Readouts - The display shall enable the user to configure custom widgets on the main screen. Widget options will include items such as fan speed, call for cooling, call for free-cooling, maintenance status, call for hot water reheat, call for electric reheat, call for dehumidification, call for humidification, airflow, static pressure, fluid flow rate and cooling capacity.
- Status LED's - The Liebert® iCOM™ shall show the unit's operating status using an integral LED. The LED shall indicate if the unit has an active alarm; if the unit has an active alarm that has been acknowledged; or if the unit is On, Off or in standby status.
- Event Log - The Liebert® iCOM™ shall automatically store the last 400 unit-only events (messages, warnings, and alarms).
- Service Contact Information - The Liebert® iCOM™ shall be able to store the local service or sales contact information.
- Upgradeable - Liebert® iCOM™ upgrades shall be performed through a USB connection.
- Timers/Sleep Mode - The menus shall allow various customer settings for turning the unit On or Off.

- Menu Layout - The menus shall be divided into two main menus: User and Service. The User screen shall contain the menus to access parameters required for basic unit control and setup. The Service screen shall be de-signed for service personnel and shall provide access to advanced control setup features and diagnostic information.
- Sensor Calibration - The menus shall allow unit sensors to be calibrated with external sensors.
- Maintenance/Wellness Settings - The menus shall allow reporting of potential component problems before they occur.
- Options Setup - The menus shall provide operation settings for the installed components.
- Auxiliary Boards - The menus shall allow setup of optional expansion boards.
- Diagnostics/Service Mode - The Vertiv™ Liebert® iCOM™ control shall be provided with self-diagnostics to aid in troubleshooting. The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as On or Off at the front display. Control outputs shall be able to be turned On or Off from the front display without using jumpers or a service terminal. Each control output shall be indicated by an LED on a circuit board.

3.2 Alarms

All unit alarms shall be annunciated through both audio and visual cues, clearly displayed on the screen, automatically recorded in the event log, and communicated to the customers Building Management System/Building Automation System. The Liebert® iCOM™ shall activate an audible and visual alarm in event of any of the following conditions:

- High or Low Pressure
- Discharge High Temperature
- Low discharge superheat
- High- or Low-pressure lock
- Discharge high temperature lock alarm
- Discharge low super heat lock alarm
- Return air high or low temperature alarm
- Supply air high or low temperature alarm
- Remote air high or low temperature alarm
- Filter clogged
- Remote powering off alarm
- Return air temperature sensor failure
- Return air humidity sensor failure
- High- or low-pressure sensor failure
- Suction temperature sensor failure
- Discharge temperature sensor failure
- EEV communication failure
- Compressor driver communication failure
- Electric heater failure

- Water leakage alarm
- Return air high or low humidity alarm
- Air flow loss alarm
- Fan detection board communication failure
- Fan failure alarm
- Power loss alarm
- Power over or under voltage alarm
- Power frequency offset alarm
- High condensate water alarm
- Teamwork addresses duplicated
- Teamwork primary unit loss
- Teamwork secondary unit loss
- Smoke alarm
- Fire alarm
- Custom Alarms

Custom alarm inputs shall be provided to indicate facility-specific events. Custom alarms can be identified with programmable labels. Frequently used alarm inputs include:

- Humidifier failure alarm
- CP driver protect
- CP driver lock
- EEV driver abnormal
- Air pressure sensor failure
- Power meter communication failure
- Filter maintenance

Each alarm (unit and custom) shall be separately enabled or disabled.

3.3 Vertiv™ Liebert® iCOM™ Control Methods and Options

The Liebert® iCOM™ shall be factory-set to allow precise monitoring and control of the condition of the air entering and leaving the unit. This control shall include predictive methods to control air flow and cooling capacity-based control sensors installed. Proportional and Tunable PID shall also be user-selectable options.

3.4 Controlling Sensor Options

Liebert® iCOM™ shall be flexible in the sense that it shall allow for controlling the capacity and fan from multiple different sensor selections. The sensor selections shall be:

Cooling Capacity

- Supply
- Remote
- Return

Fan Speed

- Supply
- Remote
- Return
- Manual (for diagnostic or to receive a signal from the BMS through the Liebert remote monitoring devices or analog input).

3.4.10 Temperature Compensation

The Liebert® iCOM™ shall be able to adjust the capacity output based on supply and return temperature conditions to meet SLA guidelines while operating to highest efficiency.

3.4.10 Humidity Control

Dew point and relative humidity control methods shall be available (based on user preference) for humidity control within the conditioned space

3.5 Multi-Unit Coordination

Liebert® iCOM™ teamwork shall save energy by preventing multiple units in an area from operating in opposing modes. Teamwork allows the control to optimize a group of connected cooling units equipped with Liebert® iCOM™ using the U2U (Unit-to-Unit) network. There shall be three modes of teamwork operation:

- Teamwork Mode 1: Is best in small rooms with balanced heat loads. The controlling temperature and humidity sensor readings of all units in operation (fan on) are collected to be used for an average or worst-case sensor reading (user selectable). The master unit shall send the operating requirements to all operating units in the group. The control band (temperature, fan, and humidity) is divided and shared among the units in the group.
- Teamwork Mode 2: The Liebert® iCOM™ calculates the worse-case demand for heating, cooling humidification and dehumidification. Based on the greatest demand within the group, each unit operates independently, meaning that the unit may respond to the thermal load and humidity conditions based on the unit's controlling sensors.

- Teamwork Mode 3 - Optimized Aisle: May be employed in large and small rooms with varying heat loads. Optimized Aisle is the most efficient teamwork mode that allows the unit to match cooling capacity with heat load. In the Optimized Aisle mode, the fans operate in parallel. Fans can be controlled exclusively by remote temperature or using static pressure with a secondary remote temperature sensor(s) as an override to ensure that the inlet rack temperature is being met. Cooling (Compressors) is controlled through unit supply-air conditions. Vertiv™ Liebert® iCOM™ calculates the average or worst-case sensor reading (user-selectable) for heating, cooling humidification, and dehumidification. Based on the demand within the group, units will be allowed to operate within that mode until room conditions are satisfied.

3.6 Standby Lead - Lag

The Liebert® iCOM™ shall allow scheduled rotation to keep equal run time on units and provide automated emergency rotation of operating and standby units.

3.7 Standby Unit Cascading

The Liebert® iCOM™ cascade feature provides an additional control layer to the standby / lead-lag routine. For situations where all units within a given network group are not required to operate simultaneously, standby units are readily available to 'cascade' ON / OFF in order to assist with cooling, reheat or airflow needs. Cascade in Teamwork Mode 1 is based on cooling / reheat, or cooling needs only while cascade for Teamwork Mode 3 is based on Fanspeed or Fan PI settings.

3.8 Wired Supply Sensor

Each Liebert® iCOM™ shall have one factory-supplied and connected supply-air NTC sensor that may be used as a controlling sensor or reference. When multiple sensors are applied for control purposes, the user shall be able to control based on a maximum or average temperature reading.

3.9 Virtual Primary

As part of the robust architecture of the Liebert® iCOM™ control, it shall allow for a virtual primary that coordinates operation. The Virtual Primary function shall provide smooth control operation if the group's communication is compromised. When the lead unit, which is in charge of component staging in teamwork, unit staging and standby rotation, becomes disconnected from the network, the Liebert® iCOM™ shall automatically assign a virtual primary. The virtual primary shall assume the same responsibilities as the primary until communication is restored.

3.10 Compressor Short Cycle Control

To help maximize the life of the compressor, there shall be start-to-next start delay for the compressor. The control shall monitor the number of compressor starts in an hour. If the compressor starts more than 10 times in 60 minutes, the local display and remote monitoring shall notify the user through a Compressor 1 Short Cycle event.

3.11 Vertiv™ Liebert® CoolPhase Condenser

Units may be matched to a premium efficiency condenser control with enhanced monitoring, alarming, and diagnostics. The condenser control shall have an automated, low-noise mode and fan reversal for cleaning mode.

3.12 System Auto Restart

The auto restart feature shall automatically restart the system after a power failure. Time delay shall be programmable.

3.13 Sequential Load Activation

On initial startup or restart after power failure, each operational load shall be sequenced with a minimum delay of one second to minimize total inrush current.

3.14 Low Pressure Monitoring

Units shall ship standard with low-pressure transducers for monitoring compressor suction pressure. If the pressure falls due to loss of charge or other mechanical cause, the corresponding circuit shall shut down to prevent equipment damage. The user shall be notified of the low-pressure condition through the local display and remote monitoring.

3.15 Winter Start Time Delay - Air - Cooled Models

An adjustable software timer shall be provided to assist with compressor starting during cold weather. When the compressor starts, the low-pressure input shall be ignored for the period set in the user-adjustable timer. Once the time period has elapsed after the compressor start, the low-pressure input should remain in the normal state. If the low-pressure input does not remain in the normal state when the time delay has elapsed, the circuit shall lock out on low pressure. The low-pressure alarm shall be announced on the local display and communicated to remote monitoring systems.

3.16 Refrigerant Pressure Transducer Failure

The control shall monitor the high-side and low-side refrigerant pressure transducers. If the control senses the transducer has failed, has been disconnected, has shorted or the reading has gone out of range, the user shall be notified through an event on the local display and remote monitoring. The corresponding circuit that the failure has occurred on shall be disabled to prevent unit damage.

3.17 Oil Return Protection

The control shall monitor compressor operation and staging to ensure that liquid and hot gas velocity are maintained for proper oil return to the compressor.

3.18 Scroll High Temperature Protection

The control shall monitor digital scroll temperature during unit operation. A compressor temperature limit shall be imposed to help prevent damage to the compressor. If the temperature reaches the maximum temperature limit, the compressor shall be locked out and an alarm shall be annunciated on the local display and through monitoring. After the initial lockout, the control shall continue to monitor compressor temperature during the off-cycle and re enable the circuit once a safe operating temperature is reached. The control shall store the number of high temperature trips. The number of trips shall be accessible through the local display.

3.19 Compressor Run Time Monitoring

The control shall log these compressor statistics:

- Number of high-pressure alarms
- Operating phase in which the high-pressure alarm occurred
- Number of low-pressure alarms
- Operating phase in which the low-pressure alarm occurred
- Number of high-temperature alarms

The user shall have the ability to monitor compressor operating temperature and pressure from the local display to be used as a diagnostic tool.

3.20 Refrigerant Leak Detection (RLD)

Refrigerant Leak Detection (RLD): provided on direct expansion products with R454b low global warming potential (LGWP) refrigerant. The RLD shall detect flammable concentrations of gas within the ambient air during a refrigerant leak event. The RLD shall aid in detecting the lower flammability limit (LFL) of the refrigerant and allow the unit to continue operation during low concentrations or run fan speeds at a dedicated mitigation speed should the concentration level reach undesirable levels.

3.21 Rack Temperature Sensors

The Vertiv™ CoolPhase Row shall be provided with Vertiv™ Liebert® 2T Rack temperature sensor. The sensors shall provide real-time, direct feedback to the cooling unit to optimize the amount of cooling and airflow provided. The sensor data shall be available to remote BMS and monitoring systems. The sensor network shall consist of one CAN wire leaving the cooling unit and connecting to a 2T sensor. Each remaining 2T sensor is connected to the previous sensor.

3.22 Additional CAN Cables for Rack Sensors

_____ additional feet long CAN cables shall be provided.

3.23 Communication Interfaces

3.23.10 Remote Shutdown Terminal

The remote shutdown terminal shall provide a location to remotely shut down the unit, complying with the National Fire Code.

3.23.10 Common Alarm Contact

The common alarm contact shall provide a set of normally open contacts for remote indication of unit alarms.

3.23.10 Vertiv™ CoolPhase Row CRD030 & CRD040 Cabinet Reheat / Humidifier Lockout

The reheat and humidifier lockout shall include the necessary relays to disable the reheat and humidifier from an external 24V signal while on emergency power.

3.23.10 Vertiv™ CoolPhase Row Cabinet (Model CRD030 & CRD040) One Extra Common Alarm Contact

One additional contact (total of two sets) of normally open (n/o) contacts for remote indication of unit alarms shall be provided.

3.23.10 Vertiv™ Liebert® IntelliSlot Unity-DP Card

The Liebert® IntelliSlot Unity Card (IS-UNITY-DP) shall provide ground fault isolated RS-485 Modbus, BACnet IP and Modbus IP network connectivity to Building Management Systems for unit monitoring and management. Also, it shall provide ground fault isolated 10/100 baseT Ethernet connectivity for unit monitoring and management. The supported management interfaces include SNMP for Network Management Systems, HTTP for Web page viewing, SMTP for e-mail and SMS for mobile messaging. The card shall support IP and 485 protocols simultaneously.

3.23.10 Refrigerant Leak Detector

Due to the slightly flammable nature of Refrigerant R-32, a refrigerant leak detector is installed into the unit.

Operation

When the sensor is powered up, a LED will indicate the sensor status. The LED is located on the reverse side of the sensor near the sensor membrane. While the sensor is mounted, the LED will backlight the sensor and be visible by the reflection from the mounting surface.

Model Number	Description
Solid Green	Sensor power-up and self-test
Blinking green	Normal operation (heartbeat)
Solid red	Alarm state – gas detected
Blinking red	Sensor fault

In case of leakage the following actions will be taken:

- The compressor will shut down
- The evaporator and condenser fans will be activated at 50% of their speed
- The EEV will be closed completely
- Shut off Valve activates and will close completely, preventing additional refrigerant flow

NOTES: - In case of leakage the unit will start mitigation actions and will send an alarm - For the alarm to be reset, the sensor reading must be a minimum of 2.5% below the alarm setpoint (threshold). - The mitigation actions will continue 5 minutes after the problem has been solved - The Leak Detector Sensor verifies that there's no leakage - The alarm will disappear from the smart display once the sensor doesn't detect the concentration of R32 refrigerant and the LSR Relay Located in the EBOX has been restarted by authorized personnel. It is imperative to verify physically if the leakage was mitigated before restarting the relay.

4.0 HEAT REJECTION

4.1 Air Cooled Vertiv™ CoolPhase Condenser

4.1.1 Standard Features

The condenser shall consist of microchannel condenser coil(s), propeller fan(s) direct driven by individual fan motor(s), electrical controls, housing. Microchannel coils shall provide superior heat transfer, reduce air side pressure drop, increase energy efficiency, and shall significantly reduce the system refrigerant volume required. EC fans and fan operating techniques shall provide reduced maximum sound levels. Various methods shall be available to match indoor unit type, maximum outdoor design ambient and maximum sound requirements.

The unit includes service valves, low-pressure and high-pressure transducer, crankcase and heating belt for low/ambient application.

4.1.2 Compressor

The compressor shall be scroll-type with variable capacity operation from 20-100%, commonly known as a variable speed scroll. The compressor shall have vibration isolators an 100% operating speed of 5100 rpm at 60Hz for CRD030 and 6000 rpm at 60Hz for CRD040. The compressor shall be located outside the air stream and shall be removable and serviceable from the front of the unit.

R32 Refrigerant

The system shall be designed for use with R32 refrigerant, which meets the U.S. Clean Air Act for phaseout of HCFC refrigerants.

4.1.3 Condenser Coil

Aluminum Microchannel Coil

Microchannel coils shall be constructed of aluminum microchannel tubes, fins, and manifolds. Tubes shall be flat and contain multiple, parallel flow microchannels and span between aluminum headers. Full-depth, louvered aluminum fins shall fill spaces between the tubes. Tubes, fins, and aluminum headers shall be oven-brazed to form a complete refrigerant-to-air heat exchanger coil. Copper stub pipes shall be electric resistance welded to aluminum coils and joints protected with polyolefin to seal joints from corrosive environ-mental elements. Complete coil/piping assembly shall be filled and sealed with an inert gas holding charge for shipment.

Aluminum Microchannel Coil with E-Coat

Aluminum microchannel coil with E-coat shall be epoxy-coated for extended coil life in corrosive environments, such as coastal areas. Factory-applied E-coat using immersion and baking process shall provide a flexible epoxy-coating to all coil surfaces. Coil color shall be black and shall be protected from solar UV ray degradation with a factory-applied UV topcoat. E-coat shall increase coil corrosion protection and shall reduce heat rejection capacity degradation to less than 10% after a severe 2000-hour 5% neutral salt spray test (ref. ASTM B117). The coating process shall ensure complete coil encapsulation.

4.1.4 Fan Motor/Blade Assembly

The fan motor/blade assembly shall have an external rotor motor, fan blades and fan/finger guard. Fan blades shall be constructed of cast aluminum or glass-reinforced polymeric material. Fan guards shall be heavy gauge, close-meshed steel wire, coated with a black, corrosion-resistant finish. Fan terminal blocks shall be located enclosure located on the top of the fan motor. Fan assemblies shall be factory- balanced, tested before shipment and mounted securely to the condenser structure.

EC Fan Motor

The EC fan motors shall be electronically commutated for variable speed operation and shall have ball bearings. The EC fans shall provide internal overload protection through built-in electronics. Each EC fan motor shall have a built-in controller and communication module, linked via RS-485, allowing each fan to receive and respond to precise fan speed inputs from the controller.

4.1.5 Electrical Controls

Electrical controls and service connection terminals shall be provided and factory-wired inside the attached control panel section. A locking disconnect switch shall be factory-mounted and wired to the electrical panel and controlled via an externally mounted locking and lockable door handle. Only high-voltage supply wiring and low-voltage indoor unit communication/interlock wiring shall be required at condenser installation.

Premium Control

The EC fan/Premium Control System shall include an electronic control board, EC fan motor(s) with internal overload protection, refrigerant and ambient temperature thermistors, and refrigerant pressure transducers. The control board shall receive an indoor unit run signal via field-supplied low voltage interlock wires to the compressor side switch via field-supplied CANbus communication wires from the indoor unit's Vertiv™ Liebert® iCOM™ or via both. The control board shall use sensor and communication inputs to maintain refrigerant pressure by controlling each EC fan on the same refrigerant circuit to the same speed.

Locking Disconnect

A locking-type disconnect switch shall be factory-mounted and wired to the electrical panel. The switch shall be accessible from the outside of the unit with the door closed and shall prevent access to the high-voltage electrical components until switched to the Off position. The locking disconnect shall be lockable in support of lockout/tag-out safety programs.

Short Circuit Current Rating

The electrical panel shall provide at least 65,000A SCCR.

4.1.6 Cabinet

The condenser cabinet shall be constructed of galvanized steel sheet with powder coating finish and shall have a fan, Internal structural support members including microchannel supports and wire grill to protect microchannel, shall be galvanized steel with powder coating finish for strength and corrosion resistance. A panel door shall be provided next to the electrical enclosure to permit microchannel cleaning. And an electrical panel shall be contained inside a factory mounted, IP54 weatherproof electrical enclosure.

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 copy of manufacturer's electrical connection diagram submittal to electrical contractor.

5.1.3 Piping Connections

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

5.1.4 Refrigerant Charging

Charge completed cooling system in accordance with manufacturer's refrigerant charging instructions.

5.1.5 Field Quality Control

Start-up cooling units in accordance with manufacturer's startup instructions. Test controls and demonstrate compliance with requirements. These specifications describe requirements for a computer room environmental control system. The system should be designed to maintain temperature and humidity conditions in the rooms containing electronic equipment.

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

5.1.6 Supply and Drain Water Piping

Connect water supply and drains to air conditioning unit. Provide pitch and trap as manufacturer's instructions and local codes require.