Vertiv™ CoolPhase Perimeter
Guide Specifications
DA250-DA265 Models
1.0 GENERAL

1.1 Summary

These specifications describe requirements for a Vertiv Thermal Management system. The system shall be designed to control temperature in rooms containing electronic equipment, with good insulation and a 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 Vertiv Thermal Management system shall be a factory assembled self-contained unit. Standard 60 Hz units shall be CSA-certified to the harmonized U.S. and Canadian product safety standard, "CSA C22.2 No 236/UL 1995 for Heating and Cooling Equipment" and are marked with the CSA c-us logo. The system shall be AHRI Certified, the trusted mark of performance assurance for heating, ventilation, air conditioning and commercial refrigeration equipment, using AHRI Standard 1360. The system sensible coefficient of performance (SCOP) shall meet ASHRAE 90.1.

The unit is to be supplied for operation using a _____V, 3 phase, _____ Hz power supply.

1.3 Submittals

Submittals shall be provided with the agreement of the proposal and shall include single-line diagrams, as well as dimensional, electrical and capacity data, piping, and electrical connection drawings.

1.4 Serviceability/Access

The cabinet shall be designed so that all components are easily accessible for service and maintenance through the unit's service (non-data center) side.

1.5 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 the end user.

1.5.1 Quality Assurance

The specified system shall be factory-tested before shipment. Testing shall include, but not be limited to: Quality Control Checks, "Hi-Pot." The system shall be designed and manufactured according to world-class quality standards. The manufacturer shall be ISO 9001 certified.

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2.0 PRODUCT

2.1 Frame DA250 and DA265

The unit frame section and fan plenum frame shall be welded, formed sheet metal. They shall be protected against corrosion using the autophoretic coating process. The unit section and the fan plenum shall be shipped as two separate sections. The fan plenum shall be field mounted on top of the unit frame section.

2.1.1 IBC Seismic Rated Option

The unit frame shall be rated for IBC certification with Sds = 2.5 and Ip = 1.0, using optional bracing and when installed properly per 20000346.

2.1.2 Downflow Air-Supply Configurations

2.1.2.1 Downflow Air Bottom Discharge

The supply air shall exit from the bottom of the unit.

2.1.2.2 Downflow Air Horizontal Discharge

The supply air shall exit from the front (data hall side) of the unit.

2.1.3 Downflow Air Return

The return air shall enter the unit from the top.

2.1.4 Exterior Panels

The exterior panels shall be insulated with a minimum 1 in. (25 mm), 1.5 lb. (0.68 kg) density fiber insulation. The main front panel shall have captive quarter-turn fasteners. The main unit color shall be _RAL-7021 (gray black). The fan plenum shall be painted to match the color of the main unit.

2.2 Filters—DA250 and DA265

The filter chamber shall be located within the evaporator coil cabinet, and filters shall be removable from the service side (non-data center side) of the unit.

2.2.1 Filters, 4 in. MERV 8 or MERV11

Filters shall be deep-pleated, 4 in. (102 mm) filters with an ASHRAE 52.2-2007 MERV8 or MERV11 rating.

Extra Filter Set

____ extra set(s) of filters shall be provided per system.

2.3 Locking Disconnect Switch

The manual disconnect switch shall be mounted in the high voltage section of the electrical panel. The switch shall prevent access to the high voltage electrical components until switched to the OFF position.

2.4 Short-Circuit Current Rating (SCCR)

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

Short-circuit current rating (SCCR) is the maximum short-circuit current a component or assembly can safely withstand when protected by a specific overcurrent protective device(s) or for a specified time.

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2.5 Fan Section

Plenum Fans with Direct Drive Motors and Variable Speed Drive

The fans shall be plug/plenum type, motorized impellers, single inlet and dynamically balanced. The drive package shall be direct drive and provided with variable speed drives (three drives per unit). The fans shall be located to blow air over the slab coil to ensure even air distribution and maximum coil performance.

- Downflow DA250 and DA265 fan motors shall be nominal 15 hp (11.2 kW) each, with a maximum operating speed of 1800 rpm; quantity, three.
    - Nominal 15 hp (11.2 kW) each
    - Maximum operating speed of 1800 rpm
    - Quantity, three

2.6 Fan Overload

The fan fault alarm shall be standard on all models.

2.7 Refrigeration System

2.7.1 Dual Circuit - DA250 and DA265

Each unit shall include two independent refrigeration circuits, and each circuit shall include liquid line filter driers, refrigerant sight glass with moisture indicator and electronic expansion valves. Compressors shall be located outside the air stream and shall be removable and serviceable from the service side of the unit. Each compressor circuit shall be connected to the full-face area of the evaporator coil.

2.8 Compressors

2.8.1 Tandem Digital Scroll Compressors—DA250 and DA265

The compressors shall be tandem, digital scroll-type with a variable capacity operation capability of one compressor of the pair. Compressor solenoid valve shall unload the compressor and allow for variable capacity operation. The compressor shall have vibration isolators, thermal overloads, automatic reset high pressure switch with lockout after three failures, service valves, suction line strainer and a maximum operating speed of 3500 rpm. The compressor motor shall be suction gas cooled.

2.8.2 Compressor Overload

A pair of N/O contacts shall be factory installed and wired to each compressor to indicate Compressor Overload.

2.9 Crankcase Heaters

The compressors shall include crankcase heaters, powered from the indoor unit electric panel.

2.10 Evaporator Coil

2.10.1 DA250

The evaporator coil shall be Slab design for bottom/horizontal discharge units and have ___67.5___ sq. ft. (___6.3___ sq m) face area, __4__ rows deep. It shall be constructed of rifled copper tubes and aluminum fins with a maximum face velocity of __541___ ft. per minute (__2.7___ m/s) at __36,500___ CFM (__62,014___ CMH). A stainless-steel condensate drain pan shall be provided.

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2.10.2 DA265

The evaporator coil shall be Slab design for bottom/horizontal discharge units and have ___67.5___ sq. ft. (___6.3___ sq m) face area, __5__ rows deep. It shall be constructed of rifled copper tubes and aluminum fins with a maximum face velocity of __541___ ft. per minute (__2.7___ m/s) at __36,500___ CFM (__62,014___ CMH). A stainless-steel condensate drain pan shall be provided.

2.11 R-454B Refrigerant

The system shall be designed for use with R-454B refrigerant, which meets the U.S. Clean Air Act for phase-out of HCFC refrigerants. Refrigerant shall be field supplied, and field charged by the installing contractor.

2.12 Air Cooled Systems

The indoor evaporator unit shall include refrigerant piping and shall have a factory holding charge of nitrogen. The hot gas and liquid lines shall be spun shut and each shall include a factory-installed Schrader valve. Field-relief of the Schrader valve shall indicate a leak free system from the factory. The installing contractor shall cut the evaporator piping and shall evacuate and charge the system. Refrigerant shall be supplied by the installing contractor.

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3.0 CONTROLS

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

The Vertiv Liebert iCOM shall be microprocessor-based with a 7 in., high definition, capacitive, color touchscreen display and shall be mounted in an ergonomic, aesthetically pleasing housing. The display and housing shall be viewable while the front panel is open or closed. 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. The Vertiv Liebert iCOM control shall provide Ethernet/RS-485 ports dedicated for BMS connectivity (i.e., Base Comms).

- Password Protection – The Vertiv Liebert iCOM shall contain two unique passwords to protect against unauthorized changes. An auto hide/show feature allows 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 Vertiv 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 streamlined unit startup.
- Parameter Download – The Vertiv 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 Vertiv Liebert iCOM shall have search fields for efficient navigation and parameter lookup.
- Parameter Directory – The Vertiv Liebert iCOM shall provide a directory that lists all parameters in the control. The list shall provide Line ID numbers, parameter labels, and current parameter values.
- Context-sensitive Help – The Vertiv 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 have the ability to configure the Vertiv Liebert iCOM 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.

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- Additional Readouts – The Vertiv Liebert iCOM shall permit the user to configure custom widgets on the main screen. Widget options shall 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 LEDs – The Vertiv Liebert iCOM shall provide the user with the unit's operating status using an integrated 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 Vertiv Liebert iCOM shall automatically store the last 400 unit-only events (messages, warnings, and alarms).
- Service Contact Information – The Vertiv Liebert iCOM shall have the ability to store the local service or sales contact information.
- Upgradeable – Vertiv Liebert iCOM firmware upgrades shall be performed through a USB connection.
- Timers/Sleep Mode – The menu shall allow various customer settings for turning the unit on/off.
- Menu Layout – The menus shall be divided into two main menu screens: 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 designed for service personal and provides 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.
- Various Sensors – The menus shall allow setup and display of optional custom sensors. The control shall include four customer-accessible analog inputs for field-provided sensors. The analog inputs shall accept a 4 to 20mA signal. The user shall be able to change the input to 0 to 5VDC or 0 to 10VDC. The gains for each analog input shall be programmable from the front display. The analog inputs shall be able to be monitored from the front display.
- Diagnostics/Service Mode – The Vertiv Liebert iCOM 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.
- Base-Comms for BMS Connectivity – The Vertiv Liebert iCOM controller shall provide one Ethernet Port and RS-485 port dedicated for BMS connectivity. Provides ground fault isolated RS-485 Modbus, BACnet IP, and Modbus IP network connectivity to building management systems for unit monitoring and management. Also provides 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 email, and SMS for mobile messaging. The Vertiv Liebert iCOM controller can support dual IP on a single network and one 485 protocol simultaneously.

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- Vertiv™ CoolPhase Perimeter System Optimization – Allows for efficiency improvements for the Vertiv CoolPhase Perimeter system during Vertiv™ EconoPhase mode. By optimizing liquid refrigerant temperature and pressure setpoints, the result is a reduction in power consumption of the condenser fan during mid and high ambient conditions. Vertiv CoolPhase Perimeter System Optimization provides an opportunity for additional energy savings by increasing the utilization of the Vertiv EconoPhase pumps and decreasing the utilization of the condenser fans but always maintaining appropriate heat capacity rejection during mid to high ambient outdoor conditions. Energy savings occur when utilizing the Vertiv EconoPhase pump package; a pump consumes roughly 1/10th of the power consumed by the compressor.

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 customer's building management system/building automation system. The Vertiv Liebert iCOM shall activate an audible and visual alarm in the event of any of the following conditions:

- High Temperature
- Low Temperature
- High Humidity
- Low Humidity
- Fan Fault
- Change Filters
- Loss of Air Flow
- Loss of Power
- Compressor Overload
- High Head Pressure
- Low Suction Pressure
- Refrigerant Leak Detection
- 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 shall include:

- Leak Under Floor
- Smoke Detected
- Standby Unit On

Each alarm (unit and custom) shall be separately enabled or disabled, selected to activate the common alarm and programmed for a delay of 0 to 255 seconds.

A complete listing of alarms is available in the Vertiv Liebert iCOM Installer/User Guide, SL-80185.

3.3 Vertiv™ Liebert® iCOM™ Control Methods and Options

The Vertiv 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.

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3.3.1 Controlling Sensor Options

The Vertiv Liebert iCOM shall be flexible in the sense that it shall allow 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 diagnostics or to receive a signal from the BMS through remote monitoring devices or analog input)
- Static Pressure

3.3.2 Temperature Compensation

The Vertiv Liebert iCOM shall have the ability to adjust the capacity output based on supply and return temperature conditions to meet SLA guidelines while operating to the highest efficiency.

3.4 Multi-Unit Coordination

Vertiv 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 equipped with Vertiv Liebert iCOM using the U2U (Unit-to-Unit) network. There shall be three modes of teamwork operation:

- Teamwork Mode 1 (Parallel) – 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 derived and shared among the units in the group. Each unit will receive instructions on how to operate from the master unit based on how far the system deviates from the setpoints. Evaporator fans and cooling capacity are ramped in parallel.
- Teamwork Mode 2 (Independent) – The Vertiv 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. All sensor readings are shared.

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- Teamwork Mode 3 (Optimized Aisle) – May be applied 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, Vertiv™ Economizer or Vertiv EconoPhase) is controlled off unit supply air conditions. The 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. This is the best form of control for a room with an unbalanced load.

3.5 Standby/Lead Lag

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

3.6 Standby Unit Cascading

The Vertiv Liebert iCOM cascade option shall allow the units to turn On and Off based on heat load when utilizing Teamwork Mode 3–Optimized Aisle mode with remote temperature sensors. In Teamwork Mode 3, Cascade mode will stage units On based on the temperature and humidity readings and their deviation from setpoint. Cascade mode coordinates the fan speed dynamically to save energy and to meet cooling demands. For instance, with a Vertiv Liebert iCOM group of six units and only 50% of the heat load, the Vertiv Liebert iCOM shall operate only four units at 80% fan speed and leave the other two units in standby. As the heat load increases, the Vertiv Liebert iCOM shall automatically respond to the new load and bring on another unit, increasing the units in operation to five. As the heat load shifts up or down, the control shall meet the needs by cascading units On or putting them back into standby.

3.7 Virtual Master

As part of the robust architecture of the Vertiv Liebert iCOM control, it shall allow for a virtual master that coordinates operation. The Virtual Master 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 Vertiv Liebert iCOM automatically assigns a virtual master. The virtual master shall assume the same responsibilities as the master until communication is restored.

3.8 Virtual Backdraft Damper

The Vertiv Liebert iCOM shall allow the use of a virtual backdraft damper, eliminating the need for a mechanical damper. This shall allow the fans of a standby unit to spin in reverse at a low speed (15% or less) to act as a damper.

3.9 Compressor Short Cycle Control

Compressor short cycle control shall be available to prevent compressor short-cycling and needless compressor wear.

3.10 Vertiv™ CoolPhase Condenser and Vertiv™ EconoPhase Communication

Units shall be matched with Vertiv CoolPhase Condenser Premium Condensers and/or optional Vertiv EconoPhase unit and shall communicate with them via field supplied CANbus wires. This communication shall allow Vertiv Liebert iCOM to control Vertiv CoolPhase Condenser/Vertiv EconoPhase modes and operation and to monitor their health and alarm status.

3.11 Wired Supply Sensor

Each Vertiv Liebert iCOM shall have one factory-supplied and connected supply air 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.

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3.12 System Auto Restart

The auto restart feature shall automatically restart the system after a power failure. Time delay shall be programmable. An optional capacitive buffer may be provided for continuous control operation through a power outage.

3.12.1 Sequential Load Activation

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

3.12.2 Low Pressure Monitoring

Units shall ship standard with low pressure transducers for monitoring individual 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.

3.13 Winter Start Time Delay

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 delay after the compressor start has elapsed, the low-pressure input should remain in the normal state. If the low-pressure input does not remain in the normal state after the 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.

3.13.1 Advanced Freeze Protection

Units shall ship standard with advanced freeze protection enabled. The advanced freeze protection shall monitor the pressure of each circuit using a transducer. The control shall interact with the fan and compressor to prevent the unit coil from freezing if circuit suction pressure drops. Applying fan speed to direct expansion systems requires limitations to avoid freezing condensate on the coil when the unit operates below 100% fan speed. Vertiv Liebert iCOM's advanced freeze protection provides the ability to predict freeze conditions and correct this condition automatically by the adjusting fan speed and compressor capacity. If a freeze condition is detected, the user shall be notified through the local display and remote monitoring systems.

3.13.2 Advanced High-Pressure Protection

When the compressor is initially activated, the system shall be monitored for a high pressure. When high pressure is detected, the control shall reduce the system discharge pressure by altering the compressor loading and the condenser fan speed, preventing circuit shut down. If the unit is unsuccessful in correcting the problem through this interaction, an alarm shall occur, and the affected compressor shall be immediately locked off. The control shall automatically re-enable the compressor when pressure returns to a safe level.

3.14 Refrigerant Pressure Transducer Failure

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

3.15 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.

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3.16 Digital 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 for 30 minutes 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 and the 30 minutes has elapsed. The control shall store the number of high temperature trips. The number of trips shall be accessible through the local display.

3.17 Digital Scroll Sensor Failure

The control shall monitor the status of the digital scroll sensor(s). If the control senses the thermistor becomes disconnected, shorted or the reading goes out of range, the user will be notified through an event on the local display and remote monitoring.

3.18 Compressor Sequencing

A user-selectable compressor sequencing parameter shall be provided and access through the local control. This sequencing parameter presents the user with three choices:

- Always use Compressor 1 as lead compressor.
- Always use Compressor 2 as lead compressor.
- Auto: The unit shall automatically stage compressors to keep each unit's run time within eight hours of the other unit's run time. NOTE: The Auto setting attempts to maintain equal run times between compressors. However, the control will not turn Off a compressor to equalize run time when it is needed to control the space.
    - **First priority –** If the safety timings are acceptable for only one compressor, that compressor shall be the next to be started/stopped.
    - **Second priority –** If both compressors are Off, the one with fewer working hours shall be the next to start.
    - **Third priority –** If both compressors are in operation, the one that has been operating longer since the last start shall be the next to be stopped.

3.19 Compressor High and Low Temperature Limit Protection

The control shall monitor the return air to ensure that the compressor(s) are operated within the manufacturer's defined window of operation. If the return air temperature deviates from the manufacturer's window of operation, the Vertiv Liebert iCOM shall automatically adjust to prevent damage to the cooling unit or reduction in its reliability.

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3.20 Compressor Run Time Monitoring

- The control shall log these compressor statistics:
  - Number of compressor starts
  - Run hours
  - Average run time
  - Starts per day
  - Starts per day worst
  - 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 compressor overloads
  - 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.

3.21 Manual Compressor Disablement

The user shall have the ability to disable compressor operation using a set of either normally open or normally closed dry contacts tied directly to the control or through remote monitoring. An additional enable/disable feature shall be provided to allow the user to permanently disable an individual compressor circuit for maintenance using the local display.

3.22 Manual Compressor Operation

The user shall be able to operate each compressor manually from the local display. The user shall be able to energize refrigeration components including liquid-line solenoid valves, compressor contactors, electronic expansion valves and adjust capacity for troubleshooting or repair. The control shall monitor the compressor during manual operation and shall shut the compressor down if needed to prevent electrical or mechanical damage.

3.23 Refrigerant Leak Detection (RLS) System

The refrigerant leak detection system is a solid-state sensor with no moving components. Upon detecting a refrigerant leak, it triggers an alarm, stops cooling, closes safety shutoff valves (if equipped), and activates the fans at the appropriate mitigation speed.

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4.0 MISCELLANEOUS OPTIONS

4.1 High Temperature Sensor—Optional

The high temperature sensor shall be factory-installed in the unit and shall be factory-set to 125°F (52°C). It shall immediately shut down the environmental control system when activated. The sensor shall be mounted with the sensing element in the return air.

4.2 Smoke Sensor—Optional

The smoke sensor shall immediately shut down the Vertiv Thermal Management system and activate the alarm system when activated. The smoke sensor shall be mounted in the electrical panel with the sensing element in the return air compartment. The smoke sensor is not intended to function as or replace any room smoke detection system that may be required by local or national codes. The smoke sensor shall include a supervision contact closure.

4.3 Condensate Pump, Dual Float—Optional

The pump shall have a capacity of _____ GPM (_____ L/m) at _____ ft head (_____ kPa). It shall be complete with integral dual-float switches, pump-and-motor assembly, and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water condition.

4.4 Dual Input Power—Optional

The unit shall be provided with two manual disconnect switches mounted in the high voltage section of the electrical panel. In addition, the unit shall include a reversing starter with an automatic transfer switch (ATS) control. In the event of a loss of primary power, the unit will automatically switch over to a secondary power source. Upon the return of primary power, the unit will automatically return to the primary power source.

On the DA250 and DA265, this configuration includes:

- Dual disconnect with reversing starter
- High-voltage subfeed from indoor unit to condenser and Vertiv EconoPhase—Vertiv CoolPhase Condenser Heat Rejection Skid (includes condenser and Vertiv EconoPhase) is powered from the indoor unit. The indoor unit and heat rejection skid should be on the same power source.
- Capacitive buffer and quick start feature—When enabled, the quick-start feature will become available in the event the capacitive buffer is no longer able to maintain power to the Vertiv Liebert iCOM controller and Vertiv Liebert iCOM powers down. Upon power restoration to the Vertiv Liebert iCOM controller, the quick-start feature shall activate and provide fan/cooling output. The quick-start feature shall support the full range of cooling operating modes for the Vertiv CoolPhase Perimeter system: DX Mode, Mixed Mode, and Pump Mode (Vertiv EconoPhase). Upon a system power restoration, the Vertiv CoolPhase Perimeter unit will continue operation and start in the last known cooling operating mode that was active prior to the loss of power. Unit restart time for full cooling shall be 40 seconds or less after power to the unit has been restored, with fans starting within 15 seconds. The unit shall be equipped with capacitive buffer to provide the Vertiv Liebert iCOM with a minimum of three minutes of ride-through power. The capacitive buffer shall provide power for continuous connectivity to the Building Management System(s) via Vertiv Liebert iCOM control.

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4.5 Low Voltage Terminal Package—Optional

Factory-installed and factory-wired terminals shall be provided.

- **Remote Shutdown Terminals** – Two additional pairs of terminals provide the customer with additional locations to remotely shut-down the unit by field-installed devices or controls.
- **Extra Common Alarm Contacts** – Two additional pairs of terminals provide the customer with normally open contacts for remote indication of unit alarms.
- **Main Fan Auxiliary Switch** – One set of normally-open contacts wired to the fan enable relay will close when fan operation is required. This set of dry contacts could also be used to initiate the air economizer operation. Air economizer and associated devices by others.
- **Vertiv™ Liebert® Liqui-Tect™ Shutdown** – One pair of dry contacts for the Vertiv Liebert Liqui-Tect sensor signal will provide unit shut down. (The Vertiv Liebert Liqui-Tect sensor is not included.)

4.6 Remote Humidifier Contact—Optional

A pair of N/O contacts provided for connection to a remote humidifier that allow the unit's humidity controller to control a humidifier outside the unit. Power to operate the remote humidifier does not come from the unit.

4.7 Compressor Power Factor Correction—Optional

Capacitors are installed in the compressor circuit to increase the power factor (PF), improving the efficiency of the compressor. The capacitors help to minimize the reactive power (kVAR) required for the compressor to operate, will reduce the compressor current draw and improve voltage, resulting in more efficient compressor performance and longer compressor life. The Vertiv Power Factor Correction option is designed to achieve a power factor around 0.88-0.93 during full load. Do not add additional power factor correction that leads to overcompensation as it may damage the compressors and other equipment.

4.8 Wired Remote Sensor(s)—Optional

Each Vertiv Liebert iCOM can have up to ten 2T sensors (20 sensor readings total) for control or reference. As part of the U2U network, those sensors shall be shared and used to control the cooling units and provide greater flexibility, visibility, and control to respond to changes in the conditioned space. When the sensors are used for control, the user may set the control to be based off a maximum or average of a selected highest temperature reading.

4.9 Vertiv™ Liebert® vNSA Network Switch—Optional

The Vertiv Liebert vNSA network switch is designed for networking multiple Vertiv Liebert iCOM unit-level controllers together. There shall be two different styles of the Vertiv Liebert vNSA14 panel available:

- Vertiv Liebert vNSA14 – enclosure with network switches only
- Vertiv Liebert vNSA14- Vertiv™ Liebert® iCOM™-H – enclosure with network switches and 9 in. Vertiv Liebert iCOM color touchscreen display

Each offering shall be housed inside a steel enclosure secured with a key lock and contain two network switches, providing a total of 14 Ethernet ports available for Vertiv Liebert iCOM controller unit-to-unit networking. The Vertiv Liebert vNSA requires field supplied, hard wiring, 16AWG, 100-240VAC universal (12V, 1.5A) single-phase input power supply for 120V or 230V operation with factory supplied power connector.

4.10 Vertiv™ Liebert® Liqui-Tect™ Sensors (Maximum of Two Per Unit)—Optional

____ (quantity) solid state water sensors shall be provided for installation under the raised floor.

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4.11 Floor Stand—Optional for Raised Floor Applications

The floor stand shall be constructed of a welded steel frame. The floor stand shall have adjustable legs with vibration isolation pads. The floor stand shall be ____ in. (_____mm) high.

4.12 Seismic Rated Floor Standard—Optional for Raised Floor Applications

The floor stand shall be rated to meet IBC certification when properly installed with Vertiv CoolPhase Perimeter evaporator unit with IBC certified seismic rated bracing per 20000346. The floor stand shall be constructed of a welded steel frame. The floor stand shall be _____ in. (_____mm) high.

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5.0 HEAT REJECTION

5.1 Vertiv™ CoolPhase Condenser Summary

These specifications describe requirements for an air-cooled condenser for a Vertiv Thermal Management system. The condenser shall be designed to reject waste heat to outdoor air and to control refrigerant head pressure as indoor equipment loading and outdoor ambient conditions change.

The manufacturer shall design and furnish all equipment in the quantities and configurations shown on the project drawings. Standard 60 Hz units are CSA-certified to the harmonized U. S. and Canadian product safety standard CSA C22.2 No 236/UL 1995 for “Heating and Cooling Equipment” and are marked with the CSA c-us logo.

The condenser model number shall be: _____

5.1.1 Vertiv™ Heat Rejection Skid

The heat rejection skid integrates the Vertiv CoolPhase Condenser, Vertiv EconoPhase pump, and Vertiv CoolPhase Perimeter receivers (when used with DA250 units only) onto a common base. Skid assemblies include all internal plumbing and wiring completed. These assemblies allow for a single crane lift of heat rejection equipment and fast job site completion. All field piping and wiring connections are made on one common end.

5.1.2 Single or Dual Skid Assemblies

These are available to provide heat rejection needs of one or two Vertiv CoolPhase Perimeter units, respectively. Dual skids have two Vertiv CoolPhase Condensers, two Vertiv EconoPhase units, four Vertiv CoolPhase Perimeter receivers (when used with DA250 units only), two sets each of piping connections, two high voltage connection boxes, and two low voltage communication connection boxes.

5.2 Vertiv™ CoolPhase Condenser Design Requirements

The air-cooled condenser shall be a factory-assembled unit, complete with an integral electrical panel, Vertiv EconoPhase pump package, and designed for outdoor installation. The condenser shall be a draw-through design.

The unit is to be supplied for operation using a _____V, 3 phase, _____Hz power supply.

5.2.1 Voltage Configurations

There are four voltage configurations

1. 460V, 3 phase, 60 Hz

2. 380V, 3 phase, 60 Hz

3. Customer connection is 575V with 575/460V stepdown transformer to 460V condenser and PRE components. Condenser and PRE will have 460V serial tag values.

4. 415V with a 380-415V condenser and 415V PRE.

5.3 Vertiv™ CoolPhase Condenser Standard Features—All Condensers

The condenser shall consist of microchannel condenser coil(s), propeller fan(s) direct driven by individual fan motor(s), and electrical controls. The air-cooled condenser shall provide positive refrigerant head pressure control to the indoor cooling unit by adjusting heat rejection capacity. Microchannel coils shall provide superior heat transfer, reduce air-side pressure drop, increase energy efficiency, and significantly reduce the system refrigerant volume required. EC fans and fan operating techniques shall provide reduced maximum sound levels.

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5.4 Vertiv™ CoolPhase Condenser Coil

5.4.1 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 environmental elements. Coil assemblies shall be factory leak-tested at a minimum of 300 psig (2068k Pag). Hot gas and liquid lines shall be copper and shall be brazed using nitrogen gas flow to the stub pipes with spun closed ends for customer piping connections.

5.4.2 Aluminum Microchannel Coil with E-Coat (Optional)

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.

5.5 Condenser Fan

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 in an IP54 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.

5.5.1 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 RS485 communication wire to each fan and the Premium Control Board, allowing each fan to receive and respond to precise fan speed inputs from the Premium Control Board.

5.6 Condenser 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 are required at condenser installation.

5.7 Premium Efficiency Fan Control

The Vertiv CoolPhase Condenser 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 Premium Control Board shall communicate directly with the indoor unit's Vertiv Liebert iCOM control via field supplied CANbus communication wires and via field-supplied low voltage interlock wires. 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. The control system provides refrigerant head pressure and system starting for outdoor ambient temperature as low as -30°F (-35 °C), provided the total temperature design range (from minimum to maximum) is 125°F (70°C) or less.

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The mode of the Vertiv CoolPhase Condenser shall be controlled by the Vertiv Liebert iCOM control and shall be in either DX, EconoPhase or Idle Mode by each refrigerant circuit. Dual circuit condensers shall operate fans to meet airflow needs and mode of each circuit independent of the other. Fan(s) on common refrigerant circuit shall operate in synchronous speed when that circuit is active.

5.8 Skid 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.

5.8.1 Short Circuit Current Rating

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

5.8.2 575V Option

The secondary electrical enclosure shall contain a factory wired transformer and fusing to support 575V input power. All internal wiring shall be provided to connect main and secondary electrical enclosures. High voltage supply and low voltage indoor unit communication/interlock connections shall be made in the main electrical enclosure.

5.9 Cabinet

The condenser cabinet shall be divided into fan and coil sections by full width baffles per corresponding DX circuits. Internal structural support members, including coil support frame, shall be painted or galvanized steel for strength and corrosion resistance. Panel doors are provided on the outside of each coil/fan section to provide for coil cleaning. An electrical panel shall be contained inside a factory mounted, NEMA 3R weatherproof electrical enclosure. Galvanized steel base is available and required to support the condenser mounting, rigging, and airflow.

5.10 Vertiv™ CoolPhase Perimeter Receiver (Not included with DA265)

Vertiv CoolPhase Perimeter receiver shall be a painted, uninsulated receiver with integral fusible plug, formed copper pipe for ease of connecting the condenser liquid line to the receiver and the mounting bracket. These receivers are factory installed and piped to the Vertiv CoolPhase Condenser Skid assembly

5.11 Vertiv™ EconoPhase

The Vertiv EconoPhase has two variable speed refrigerant pumps controlled by individual VFDs, factory wired electrical panel, factory piped and tested refrigerant piping all housed within a bright aluminum NEMA 3R enclosure. The Vertiv EconoPhase is mounted, wired, and piped into the Vertiv CoolPhase Condenser Skid to provide significant jobsite installation savings. The Vertiv EconoPhase refrigerant pumps are individually activated and speed controlled during cooler outdoor ambient, coordinated with Vertiv CoolPhase Perimeter compressors idled and refrigerant bypassed around them. Cool temperatures, such as mild weather and at night, partial economization and power savings is provided with one pump activated and one compressor idled. Colder temperatures, such as winter weather, allow both Vertiv CoolPhase Perimeter compressors to be idled and Vertiv EconoPhase pumps to be controlled independently to provide full economization

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5.12 Condenser Housing

The condenser housing is constructed of galvanized steel and divided into individual fan sections by full width baffles. Internal structural support members, including coil support frame, are galvanized steel for strength and corrosion resistance. Panel doors are provided on the outside of each coil/fan section to provide for coil cleaning. Galvanized steel base is available and required to support the condenser mounting, rigging and airflow.

Condenser shall be shipped pre-installed on a base structure that includes the Vertiv EconoPhase pumped refrigerant economizer, refrigerant receivers, and all associated piping.

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6.0 EXECUTION

6.1 Installation of Vertiv Thermal Management Units

The customer or the customer's representative shall be responsible for the following:

6.1.1 General

Install Vertiv Thermal Management units in accordance with the manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated and maintain the manufacturer's recommended clearances.

6.1.2 Electrical Wiring

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

6.2 Piping Connections

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

6.2.1 Drain Water Piping

Connect the water drain to the air-conditioning unit. Provide pitch and trap as manufacturer's instructions and local codes require.

6.3 Field Quality Control

Start cooling units in accordance with the manufacturer's startup instructions. Test controls and demonstrate compliance with requirements. These specifications describe requirements for a computer room environmental control system. The system shall 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.

6.4 Warranty Start-up and Control Programming

Install the indoor unit in accordance with manufacturer's installation instructions provided with seismic option. Firmly anchor maintaining 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 a copy of manufacturer's piping connection diagram submittal to the piping contractor.

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

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