

## Vertiv™ CoolPhase Perimeter Guide Specifications

### DA050 – DA165 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 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 heat dissipation requirements of the room.

##### 1.2 Design Requirements

The Thermal Management system shall be a Vertiv™ self-contained, factory-assembled 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.

##### 1.3 Submittals

Submittals shall be provided with the agreement of the proposal and shall include: Single-Line Diagrams; 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 front of the unit.

##### 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 end user.

##### 1.6 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." 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 Frame

The frame shall be welded, formed sheet metal. It shall be protected against corrosion using the autophoretic coating process. The frame shall be capable of being separated into three parts in the field to accommodate rigging through small spaces.

#### 2.1.1 Downflow Air Supply Configurations

- Downflow Air Bottom Discharge  
The supply air shall exit from the bottom of the unit.
- Downflow Air Front Discharge  
The supply air shall exit from the front of the unit.

#### 2.1.2 Downflow Air Return

The return air shall enter the unit from the top.

#### 2.1.3 Upflow Air Supply Configuration

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

#### 2.1.4 Upflow Air Return, Front

The return air shall enter the unit from the front of the cabinet through factory-installed grilles. Grilles shall be painted black.

#### 2.1.5 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 \_\_\_\_\_.

### 2.2 Filters - DA050, DA080, DA085

For downflow units, the filter chamber shall be located within the cabinet, and filters shall be removable from the top of the unit.

For upflow units, the filter chamber shall be located within the cabinet, and filters shall be removable from the front 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.

#### 2.2.2 Filters, 2-in. MERV8 and 2-in. MERV11

Filters shall be deep-pleated, 2-in. (51 mm) filters with an ASHRAE 52.2-2007 MERV8 rating, plus 2-in. (51 mm) MERV11 filters.

#### 2.2.3 Extra Filter Set

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

### 2.3 Filters—DA125, DA150 AND DA165

The filter plenum shall be exterior to the main cooling unit and shall be field assembled and installed. The filters shall be removable from the front or top of the filter plenum. The filter plenum shall be painted to match the panel colors of the indoor cooling unit.

**2.3.1 Filters, 4-in. MERV8 or MERV11 or MERV13**

Filters shall be deep-pleated, 4-in. (102 mm) filters with an ASHRAE 52.2-2007 MERV8 or MERV11 or MERV13 rating.

**2.3.2 Filters, 2-in. MERV8 and 2-in. MERV11**

Filters shall be deep-pleated, 2-in. (51 mm) filters with an ASHRAE 52.2-2007 MERV8 rating, plus 2-in. (51 mm) MERV11 filters.

**2.3.3 Filters, 2-in. MERV8 and 2-in. MERV13**

Filters shall be deep-pleated, 2-in. (51 mm) filters with an ASHRAE 52.2-2007 MERV8 rating, plus 2-in. (51 mm) MERV13 filters.

**2.3.4 Extra Filter Set**

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

**2.4 Locking Disconnect Switch**

The manual disconnect switch shall be mounted in the high voltage section of 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.

**2.5 Short Circuit Current Rating (SCCR)**

The electrical panel shall provide at least 65,000A SCCR (60 Hz).

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.

**2.6 Fan Section****2.6.1 Electronically Commutated (EC) Fans**

The fans shall be plug/plenum type, motorized impellers, single inlet and dynamically balanced. The drive package shall be direct drive, electronically commutated and variable speed. The fans shall be located to draw air over the coil to ensure even air distribution and maximum coil performance. EC fans shall be capable of being lowered into a raised floor (during field installation with EC-fan lowering jack) with minimum height of 24 in. (609.6 mm). EC fans shall also be capable of operating within the cooling cabinet, instead of under the floor.

The EC fans shall be available on upflow models and fans shall operate outside the unit in a factory-provided plenum with a minimum height of 24 in. (610 mm).

- Downflow DA050 fan motor(s) shall be nominal 4.9 hp (3.7 kW) each with a maximum operating speed of 1400 rpm; quantity, 1.
- Downflow/Upflow DA080, DA085 fan motors shall be nominal 4.15 hp (3.1 kW) each with a maximum operating speed of 1520 rpm; quantity, 2.
- Downflow DA125, DA150 and DA165 fan motors shall be nominal 3.75 hp (2.8 kW) each, with a maximum operating speed of 1210 rpm; quantity, 3.

## 2.7 Three Stage Reheat (Optional)

The Thermal Management unit shall include a factory-installed reheat to control temperature during dehumidification.

The electric reheat coils shall be low watt density, 304/304 stainless steel fin tubular construction, protected by thermal safety switches, shall be \_\_\_\_ kW (\_\_\_\_ BTUH) controlled in three (3) stages. The reheat elements shall be removable from the front of the cabinet. A ground-current detection device shall disable reheat in the case where a ground-fault is detected in the reheat element.

## 2.8 Refrigeration System

### 2.8.1 Single Circuit DA050

Each unit shall include one independent refrigeration circuit and shall include a liquid-line filter drier, refrigerant sight glass with moisture indicator and electronic expansion valve. Compressor shall be located outside the air stream and shall be removable and serviceable from the front of the unit.

### 2.8.2 Dual Circuit - DA080, DA085, DA125-165

Each unit shall include two (2) 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 front of the unit. Each compressor circuit shall be connected to the full-face area of the evaporator coil.

## 2.9 Compressors

### 2.9.1 Digital Scroll Compressors—DA050, DA080, DA085

The compressors shall be scroll-type with a variable capacity operation capability. 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.

### 2.9.2 Tandem Digital Scroll Compressors—DA125, DA150 and DA165

The compressors shall be tandem, 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.

## 2.10 Crank Case Heaters

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

## 2.11 Evaporator Coil

The evaporator coil shall be A-frame design for downflow units and V-frame design for upflow units (DA080 and DA085 only) and have \_\_\_\_\_ sq. ft. (\_\_\_\_ sq. m) face area, \_\_\_\_ rows deep. It shall be constructed of rifled copper tubes and aluminum fins with a maximum face velocity of \_\_\_\_ ft. per minute (\_\_\_\_ m/s) at \_\_\_\_ CFM (\_\_\_\_ CMH). A stainless-steel condensate drain pan shall be provided.

### 2.11.1 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. Installing contractor shall cut the evaporator piping and shall evacuate and charge the system. Refrigerant shall be supplied by the installing contractor.

## 3.0 CONTROLS

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

The 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 Liebert® iCOM™ control shall provide Ethernet/RS-485 ports dedicated for BMS connectivity (i.e., Base-Comms).

- **Password Protection** – The 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 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 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.
- **Parameter Directory** – The 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 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 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.
- **Additional Readouts** – The 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 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 Liebert® iCOM™ shall automatically store the last 400 unit-only events (messages, warnings, and alarms).
- **Service Contact Information** – The 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 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 designed 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.
- **Various Sensors** – The menus shall allow setup and display of optional custom sensors. The control shall include four customer-accessible analog inputs for sensors provided by others. 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. When configuring the analog inputs, the selectable items to choose shall include air pressure, fluid pressure, temperature, percentage, general amperage, condenser amps, compressor amps, reheat amps, humidifier amps, unit amps, fan amps factory standard, and not used.
- **Diagnostics/Service Mode** – The 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.
- **Base-Comms for BMS Connectivity** – The 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 & 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 Liebert® iCOM™ controller can support dual IP on a single network and one 485 protocol simultaneously.
- **DSE System Optimization** – Allows for efficiency improvements for the DSE system during 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. DSE System Optimization provides an opportunity for additional energy savings by increasing the utilization of the PRE-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 occurs when utilizing the PRE-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™ control shall activate an audible and visual alarm in the event of any of the following conditions:

- High Temperature
- Low Temperature
- High Humidity
- Low Humidity
- EC Fan Fault
- Change Filters
- Loss of Air Flow
- Loss of Power
- Compressor Overload (Standard on DA050 and Optional DA080 to DA165)
- Humidifier Problem
- High Head Pressure
- Low Suction Pressure
- 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 time delay of 0 to 255 seconds.

## 3.3 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.

### 3.3.1 Controlling Sensor Options

The 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 diagnostics or to receive a signal from the BMS through Vertiv™ remote monitoring devices or analog input)
- Static Pressure

### 3.3.2 Temperature Compensation

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

### 3.3.3 Humidity Control

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

### 3.4 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 with Vertiv™ 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 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.
- **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, Economizer or Vertiv™ Liebert® EconoPhase) is controlled through unit supply-air conditions. The 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 Liebert® iCOM™ shall allow scheduled 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 the cooling demands. For instance, with a Liebert® iCOM group of six units and only 50% of the heat load, the 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 Liebert® iCOM™ shall automatically respond to the additional 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 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 Liebert® iCOM™ shall automatically assign a virtual master. The virtual master shall assume the same responsibilities as the master until communication is restored.

### 3.8 Virtual Back-Draft Damper

The Liebert® iCOM™ shall allow the use of a virtual back-draft damper, eliminating the need for a mechanical damper. This shall allow the fans of a stand-by unit to spin slower (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 MC and Vertiv™ Liebert® EconoPhase Communication

The Liebert® iCOM™ shall communicate directly with the Vertiv™ CoolPhase Condenser MC and/or Liebert® EconoPhase unit via field-supplied CANbus communication wires and via field-supplied, low voltage interlock wires. This communication shall allow Liebert® iCOM™ to control Vertiv™ CoolPhase MC Condenser/Liebert® EconoPhase modes and operation and to monitor their health and alarm status.

### 3.11 Wired Supply Sensor

Each 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.

### 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.

### 3.13 Sequential Load Activation

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

### 3.14 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.

### 3.15 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.

### 3.16 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 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.

### 3.17 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.

### 3.18 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.

### 3.19 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.

### 3.20 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.

### 3.21 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.

### 3.22 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 (Models DA080-DA165).
- Auto: The unit shall automatically stage compressors to keep each unit's run time within 8 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.

### 3.23 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 Liebert® iCOM™ shall automatically adjust to prevent damage to the cooling unit or reduction in its reliability.

### 3.24 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 (scroll compressors)

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

### **3.25 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.

### **3.26 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.

## 4.0 MISCELLANEOUS OPTIONS

### 4.1 High-Temperature Sensor

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

The smoke sensor shall immediately shut down the 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

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 Low Voltage Terminal Package

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

- **Remote Shutdown Terminals** – 2 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** – 2 additional pairs of terminals provide the customer with normally-open contacts for remote indication of unit alarms.
- **Main-Fan Auxiliary Switch** – 1 set of normally-open contacts wired to the EC-fan motor contactor will close when EC-fan operation is required. This set of dry contacts could also be used to initiate air economizer operation. Air economizer and associated devices by others.
- **Vertiv™ Liebert® Liqui-Tect™ Shutdown** – 1 pair of dry contacts for the Liebert® Liqui-Tect™ sensor signal will provide unit shut down. (Liebert® Liqui-Tect™ sensor is not included.)

### 4.5 Remote Humidifier Contact

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.

### 4.6 EC Fan Overload

The EC fan fault is standard on all models.

### 4.7 Compressor Overload - Standard on DA050 (Optional on DA080 -DA165)

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

#### 4.8 Quick Start Function

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 Liebert® iCOM™ powers down. Upon power restoration to the 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™ Liebert® 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 a UPS or capacitive buffer to provide the Liebert® iCOM™ with a minimum of 3 minutes of ride-through power. The capacitive buffer shall provide power for continuous connectivity to the Building Management System(s) via Liebert® iCOM™ control.

#### 4.9 Wired Remote Sensors

Each Liebert® iCOM™ can have up to 10 (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.

#### 4.10 Vertiv™ Liebert® vNSA Network Switch

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

- Vertiv™ Liebert® vNSA14 – enclosure with network switches only.
- Liebert® vNSA14 iCOM™-H – enclosure with network switches and 9-in. 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 Liebert® iCOM™ controller unit-to-unit networking. The 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.

#### 4.11 Vertiv™ Liebert® Liqui-Tect™ Sensors, Maximum of 2 Per Unit

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

#### 4.12 Floor Stand

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.

##### 4.12.1 Seismic Rated Floor Stand

The floor stand shall be seismic rated per IBC2015 and shall be attached to the unit frame (field-installed). The floor stand shall also be capable of being anchored to the subfloor.

#### 4.13 Return Air Plenum for Downflow Units

The air plenum shall be constructed of 20-gauge steel, powder coated to match unit color. The plenum shall be \_\_\_in. (\_\_\_\_mm) high. A door shall be included in the front of the plenum to enable front filter access. Air shall enter the plenum from the top.

**4.14 Discharge Air Plenum for Upflow Units with Discharge Grilles (Optional DA080 and DA085 Only)**

The air plenum shall be constructed of 20-gauge steel, powder coated to match unit color. The plenum shall be \_\_\_in. (\_\_\_mm) high. Discharge air grilles shall be painted black and shall be included on the (front), (rear), (left side) or (right side) of the plenum. Compressor plenum is optional.

**4.15 Discharge Air Plenum for Upflow Units without Discharge Grilles (Optional DA080 and DA085 Only)**

The air plenum shall be constructed of 20-gauge steel, powder coated to match unit color. The plenum shall be \_\_\_in. (\_\_\_mm) high. Air shall discharge from the top of the plenum. Compressor plenum is optional.

## 5.0 VERTIV™ LIEBERT® ECONOPHASE CYCLE

### 5.1 Liebert® EconoPhase Cycle (Optional)

During cold outdoor temperatures, refrigerant pumps shall circulate refrigerant through the cooling system, in lieu of operating the compressors. The compressors shall ramp down during Liebert® EconoPhase operation, and, if able to completely offset the load, the control system shall shut the compressors off. Refrigerant pump(s) (PR050 has 1 pump, PR085-200 has 2 pumps) shall be housed in an enclosure, with each pump dedicated to its own refrigerant circuit. The Liebert® EconoPhase system shall include a variable-speed drive on each refrigerant pump to enable the pumps' speed to adjust in response to the load.

## 6.0 HEAT REJECTION

### 6.1 Vertiv™ CoolPhase Condenser MC Options

#### 6.1.1 Vertiv™ CoolPhase Condenser MC Summary

These specifications describe requirements for a air-cooled Vertiv™ CoolPhase 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 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 shall be marked with the CSA c-us logo.

The condenser model number shall be: \_\_\_\_\_

#### 6.1.2 Vertiv™ CoolPhase Condenser MC Design Requirements

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

The unit is to be supplied for operation using a \_\_\_\_ Volt \_\_\_\_ phase, \_\_\_\_ Hz power supply.

#### 6.1.3 Vertiv™ CoolPhase Condenser MC Standard Features

Condenser shall consist of microchannel condenser coil(s), propeller fan(s) direct driven by individual fan motor(s), electrical controls, housing and mounting legs. The air-cooled Vertiv™ CoolPhase 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 reduce sound levels.

#### 6.1.4 Vertiv™ CoolPhase Condenser MC Coil

Vertiv™ CoolPhase Condenser MC 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 (2068 kPag). 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. Complete coil/piping assembly shall be then filled and sealed with an inert gas holding charge for shipment.

##### **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.

### 6.1.5 Vertiv™ CoolPhase Condenser MC 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 in an IP54 enclosure on the top of the fan motor. Fan assemblies shall be factory-balanced, tested before shipment, and mounted securely to the condenser structure.

#### Vertiv™ CoolPhase Condenser MC 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.

### 6.1.6 Vertiv™ CoolPhase Condenser MC Electrical Controls

Electrical controls and service-connection terminals shall be provided and factory-wired inside the attached control panel section. Only high voltage supply wiring and low voltage indoor-unit communication/interlock wiring are required at condenser installation.

#### EC Fan Speed and Premium Control

The Vertiv™ CoolPhase Condenser MC 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 Premium Control Board shall be rated to a temperature of – 30°F to 125°F (–34.4°C to 51.7°C) and shall be factory-set for fan speed control.

The mode of the Vertiv™ CoolPhase Condenser MC shall be controlled by the 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.

#### Locking Disconnect Switch

A locking-type disconnect switch shall be factory-mounted and wired to the electrical panel and be capable of disrupting the flow of power to the unit and controlled via an externally mounted locking and lockable door handle. The locking disconnect shall be lockable in support of lockout/tagout safety programs.

#### Short Circuit Current Rating

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

#### 575-Volt 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.

## 6.1.7 Cabinet

The condenser cabinet shall be constructed of bright aluminum sheet and divided into individual fan sections by full-width baffles. Internal structural support members, including coil support frame, shall be galvanized steel for strength and corrosion resistance. Panel doors shall be provided on two sides of each coil/fan section to permit coil cleaning. An electrical panel shall be contained inside a factory mounted NEMA 3R weatherproof electrical enclosure. Units with the 575V option shall include a second, factory mounted, NEMA 3R weatherproof electrical enclosure opposite the main electrical enclosure.

## 6.1.8 Vertiv™ CoolPhase Condenser MC Mounting Legs

### Standard 60-in. Height Galvanized Legs with Bracing

Condenser shall be shipped with 60-in. (1524mm) mounting legs with stabilization bracing. Legs, bracing and hardware shall be galvanized steel and shall be field installed and anchored to the mounting surface.

### Optional Height Galvanized Legs with Bracing

Condenser shall be shipped with [36 in. (914 mm)] [48 in. (1219 mm)] mounting legs with stabilization bracing. Legs, bracing and hardware shall be galvanized steel.

### Optional Height 18-in. Legs

Condenser shall be shipped with 18-in. (457 mm) legs to mount unit for vertical air discharge with rigging holes for hoisting the unit into position. Hardware shall be galvanized steel.

## 6.1.9 Vertiv™ CoolPhase Condenser MC Accessories

### Vertiv™ CoolPhase Perimeter DA Receiver Kit (Optional)

Vertiv™ CoolPhase Perimeter DA Receiver Kit shall contain a painted, un-insulated receiver with integral fusible plug, formed copper pipe for ease of connecting condenser liquid line to receiver and mounting bracket. Additional full-length leg is shipped with condenser (18 in., 36 in., and 48 in.) or with 60-in. leg kit and should be secured to the mounting surface. One receiver kit shall be field installed per refrigerant circuit.

### IBC/OSHPD Seismic Certification and IBC Wind/Snow Load Compliant (Optional)

IBC/OSHPD Seismic Certification and IBC Wind/Snow Load Compliant condensers shall be provided with any applicable bracing and field-installation instructions. Condensers shall bear a label certifying compliance with IBC/OSHPD requirements.

## 6.2 Vertiv™ Liebert® EconoPhase

The Liebert® EconoPhase has variable-speed refrigerant pumps, one per circuit, controlled by individual VFDs, factory-wired electrical panel, and factory-piped and tested refrigerant piping all housed within a bright aluminum NEMA 3R enclosure. The Liebert® 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 Liebert® EconoPhase pumps to be controlled independently to provide full economization.

## 6.3 Vertiv™ CoolPhase Condenser MCV (Optional)

### 6.3.1 Vertiv™ CoolPhase Condenser MCV Summary

These specifications describe requirements for a air-cooled Vertiv™ CoolPhase 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: \_\_\_\_\_

### 6.3.2 Vertiv™ CoolPhase Condenser MCV Design Requirements

The air-cooled Vertiv™ CoolPhase Condenser shall be a factory-assembled unit, complete with integral electrical panel, Vertiv™ Liebert® 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 \_\_\_\_\_ volt/3phase/60Hz power supply.

### 6.3.3 Vertiv™ CoolPhase Condenser MCV Standard Features – All Condensers

Condenser shall consist of all-aluminum microchannel condenser coil configured in V-banks, propeller fans direct-driven by individual EC fan motors, mounting base, and electrical controls, suitable for mounting outdoors. The air-cooled Vertiv™ CoolPhase Condenser shall provide the heat rejection of two refrigeration circuits, matching heat-rejection capacity varying with the outdoor ambient temperatures and compressor or Liebert® EconoPhase pump heat-rejection requirements. 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.

### 6.3.4 Vertiv™ CoolPhase Condenser MCV 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 environmental elements. Coil assemblies shall be factory leak-tested at a minimum of 300 psig (2068 kPag). 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.

#### 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.

### 6.3.5 Vertiv™ CoolPhase Condenser MCV Fan

The fan motor/blade assembly shall have an external rotor motor, fan blades, fan/finger guard, and integral orifice plate. 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. Orifice plate shall be 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.

### 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.

### 6.3.6 Vertiv™ CoolPhase Condenser MCV 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. High voltage supply wiring and low voltage indoor unit communication/interlock wiring shall be factory-wired to customer connection boxes mounted on the base.

#### Premium Efficiency Fan Control

The Vertiv™ CoolPhase Condenser MCV 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 range (from minimum design ambient to maximum design ambient) is 125°F (70°C) or less.

The mode of the Vertiv™ CoolPhase Condenser MCV shall be controlled by the 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.

#### High Voltage Supply Connection Box

A high voltage, customer connection box shall be provided for each Vertiv™ CoolPhase Condenser MCV and matching Liebert® EconoPhase to provide a single, high voltage connection. The connection box shall be factory-mounted to the condenser base and wired to the electrical panels of the Vertiv™ CoolPhase Condenser MCV and the Liebert® EconoPhase units. A locking-type disconnect 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.

#### Low Voltage Connection Box

A low voltage connection box shall be provided for each Vertiv™ CoolPhase Condenser MCV and matching Liebert® EconoPhase unit to provide a single, low voltage connection from the indoor Vertiv™ CoolPhase Perimeter unit. The connection box shall be factory-mounted to the condenser base and wired to the electrical panels of the Vertiv™ CoolPhase Condenser MCV and the Liebert® EconoPhase units.

#### Short Circuit Current Rating

The high voltage electrical configuration shall provide at least 65,000A SCCR and shall be labeled to speed site approvals by AHJs.

**575-Volt (Optional)**

A secondary electrical enclosure shall be mounted to the condenser base and shall contain a factory-wired transformer and fusing to support 575-V input power to the Vertiv™ CoolPhase Condenser MCV and Vertiv™ Liebert® EconoPhase units. Vertiv™ CoolPhase Condenser MCV and Liebert® EconoPhase units shall be 460-V units. All internal wiring shall be provided to connect the connection-box transformer to Vertiv™ CoolPhase Condenser MCV and Liebert® EconoPhase electrical enclosures. High voltage supply connections from the building shall be made in the high voltage connection box.

**6.3.7 Vertiv™ CoolPhase Condenser MCV Cabinet**

The condenser cabinet shall be divided into multiple fan/coil sections by configuring two coils into a V-bank arrangement for each variable-speed EC fan. Fan/coil sections shall be created and protected by galvanized panels on each V-bank end. 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.

**6.3.8 Vertiv™ CoolPhase Perimeter DA Receiver Kit (Optional)**

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

**6.3.9 Liebert® EconoPhase**

The Liebert® 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 Liebert® EconoPhase is mounted, wired, and piped into the Vertiv™ CoolPhase Condenser MCV Skid to provide significant jobsite installation savings. The Liebert® 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 Liebert® EconoPhase pumps to be controlled independently to provide full economization.

**6.3.10 Vertiv™ CoolPhase Condenser MCV Single Skid Assembly**

The Vertiv™ CoolPhase Condenser MCV Single Skid Assembly shall consist of a galvanized-steel base with the Vertiv™ CoolPhase Condenser MCV, Liebert® EconoPhase, and Vertiv™ CoolPhase Perimeter DA Receivers (optional) mounted to provide a single, high-density heat-rejection unit to support one Vertiv™ CoolPhase Perimeter unit. All components shall be factory-wired to a centralized connection location for high voltage connection and low voltage connection boxes. Refrigeration components shall be factory piped, insulated, secured to a common location on the base, and sealed with an inert gas for shipment. Field relief of the Schrader valve shall indicate a leak-free system. Job-site transportation, rigging, anchorage, and connections shall be simplified for fast deployment.

### 6.3.11 Vertiv™ CoolPhase Condenser MCV Double Skid Assembly (Optional)

The Vertiv™ CoolPhase Condenser MCV Double Skid Assembly shall consist of 2 independent Single skid assemblies that are bolted together, creating a common assembly for ease of transportation and job-site rigging. The double skid assembly shall support two Vertiv™ CoolPhase Perimeter units. All components shall be factory-wired to a centralized connection location on one end of the double skid for high voltage connection and low voltage connection boxes.

Refrigeration components shall be factory piped, insulated, and secured to a common location on same end of the double skid as electrical connections. Piping shall be sealed with an inert gas for shipment, and field relief of the Schrader valve shall indicate a leak-free system. Job site transportation, rigging, anchorage and connections shall be simplified for fast deployment.

## 7.0 EXECUTION

### 7.1 Installation of Thermal Management Units

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

#### 7.1.1 General

Install 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.

#### 7.1.2 Electrical Wiring

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

#### 7.1.3 Piping Connections

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

#### 7.1.4 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.

### 7.2 Field Quality Control

Start cooling units in accordance with the manufacturer's start-up 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.

### 7.3 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 copy of manufacturer's piping connection diagram submittal to 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.