

Vertiv™ Liebert® CW Guide Specifications Chilled Water Environmental Control System

1.0 GENERAL

1.1 Summary

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

1.2 Design Requirements

The Thermal Management system shall be a Liebert 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 Liebert® CW system performance shall be AHRI Certified, the trusted mark of performance assurance for heating, ventilation, air conditioning and commercial refrigeration equipment, using AHRI Standard 1360.

1.3 Submittals

Submittals shall be provided with 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 unit's side and front [CW038-084], front [CW106-181].

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 constructed of welded tubular steel. It shall be painted using the autophoretic coating process for maximum corrosion protection.

2.1.1 Downflow Air Flow Configurations

1. **Downflow Air Supply**

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

2. **Downflow Air, EC Fans Lowered into Floor Stand**

The supply air shall exit from all sides of the floor stand.

3. **Downflow Air, Front Discharge**

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

4. **Downflow Air, Rear discharge**

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

5. **Downflow Air Return**

The return air shall enter the unit from the top.

2.1.2 Upflow Air Flow Configurations

1. **Upflow Top Air Supply, Front Throw**

The supply air shall exit from the top of the cabinet (or plenum) with the air throw toward the front.

2. **Upflow Top Air Supply, Rear Throw**

The supply air shall exit from the top of the cabinet (or plenum) with the air throw toward the back.

3. **Upflow Rear Air Supply**

The supply air shall exit from the back of the cabinet.

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.

5. **Upflow Air Return, Rear**

The return air shall enter the unit from the back of the cabinet.

6. **Upflow Air Return, Bottom**

The return air shall enter the unit from the bottom of the cabinet.

2.1.3 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 _____. The accent color shall be _____.

2.2 Filters

- The filter chambers for CW038-084 filters are located within the cabinet and serviceable from either end of the unit.
- The filter chambers for CW106 and CW114 are located within the cabinet and serviceable from the front of the unit.
- The filter chambers for CW146 and CW181 are field mounted on the top of the cooling unit. The filters are located in an 18-in. (457-mm) plenum, which is serviceable from the front of the unit.
- For CW038-084 units with rear-return filter boxes, the filter chambers shall be field-mounted on the rear of the cooling unit and are serviceable from either end of the unit.

2.2.1 Filters, 4-in. MERV8 and MERV11

Filters shall be deep-pleated 4-in. filters with an ASHRAE 52.2-2007 MERV8 or ASHRAE 52.2-2007 MERV11.

2.2.2 Filters, 2-in. Pre-filter with 4-in. Filter MERV8 and MERV11

Filters shall be 2-in. ASHRAE 52.2-2007 MERV8 pre-filter, with 4-in. ASHRAE 52.2-2007 MERV8 or MERV11 efficiency filter.

2.2.3 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 be accessible from the outside of the unit with the door closed and 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 (60hz).

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.

2.5 Fan Section

2.5.1 Electronically Commutated (EC) Fans

The fans shall be plug/plenum type, single-inlet and shall be dynamically balanced. The drive package shall be direct drive, electronically commutated and variable speed. The fans shall be located to draw air over the A-frame coil to ensure even air distribution and maximum coil performance. EC fans shall be available on downflow models, and fans may be lowered into a raised floor with a minimum height of 24 in. (610 mm). EC fans may operate within the Vertiv™ Liebert® CW cabinet, instead of under the floor.

EC fans shall be available on upflow models and fans shall operate outside the unit in a factory-provided plenum.

- **Upflow CW038-114:** The fan motor(s) shall be 4.0 hp (3.0 kW) with maximum speed of 1520 rpm; quantity 1 for CW038-41; 2 for CW051-084; 3 for CW106-114.
- **Downflow CW038-CW041:** The fan motor shall be 4.0 hp (3.0 kW) with a maximum operating speed of 1520 rpm; quantity 1.
- **Downflow CW051 and CW060:** The fan motors shall be 3.4 hp (2.5 kW) with a maximum operating speed of 1700 rpm; quantity 2. (Power rating for 380-480V. For 200-240V, power is 3.6 hp [2.7 kW]).

- **Downflow CW076–CW084:** The fan motors shall be 4.0 hp (3.0 kW) with a maximum operating speed of 1520 rpm; quantity 2.
- **Downflow CW106–CW114:** The fan motors shall be 4.0 hp (3.0 kW) with a maximum operating speed of 1520 rpm; quantity 3.
- **CW146:** The fan motors shall be 3.7 hp (2.8 kW) with a maximum operating speed of 1230 rpm; quantity 3.
- **CW181:** The fan motors shall be 4.9 hp (3.7 kW) with a maximum operating speed of 1370 rpm; quantity 3.

2.5.2 Forward Curved Blower—Optional

- The blower section shall be designed for ___ CFM (___CMH) at an external static pressure of ___ in. wg. (Pa). The fan shall be the centrifugal type, double-width, double-inlet, and shall be factory-balanced as a completed assembly. The shaft shall be heavy-duty steel with self-aligning ball bearings with a minimum lifespan of 100,000 hours.
- The fans shall be located to draw air over the A-frame coil to ensure even air distribution and maximum coil performance. The fan motor shall be ___ hp at 1750 rpm at 60 Hz and mounted on an adjustable slide base. The drive package shall be two-belt, variable speed, sized for 200% of the fan motor horsepower.

2.6 Chilled Water Control Valve

The water circuit shall include a 2-way (3-way) modulating valve. The valve shall be designed for up to 400 PSI (2758 kPa) water pressure. The Vertiv™ Liebert® iCOM™ shall position the valve in response to room conditions.

2.7 Chilled Water Coil

- The evaporator coil shall be A-frame design for downflow and upflow units and have ___ ft² (m²) face area, ___ rows deep.
- It shall be constructed of copper tubes and aluminum fins and have a maximum face velocity of ___ ft per minute (m/s) at ___ CFM (m³).
- The water circuit shall be designed to distribute water into the entire coil face area. The coil shall be supplied with ___ °F (°C) entering water temperature, with a ___ °F (°C) temperature rise. The coil shall require ___ GPM (l/s) of chilled water and the pressure drop shall not exceed ___ PSI (kPa). The entire coil assembly shall be mounted in a stainless steel-condensate drain pan.

2.8 Humidifier

2.8.1 Infrared Humidifier—Optional

A humidifier shall be factory-installed inside the unit. The humidifier shall be of the infrared type, consisting of high-intensity quartz lamps mounted above and out of the water supply. The humidifier pan shall be stainless steel and arranged to be serviceable without disconnecting water-supply lines, drain lines or electrical connections. The complete humidifier section shall be pre-piped ready for final connection. The infrared humidification system shall use by-pass air to prevent over-humidification of the controlled space. The auto-flush system shall automatically flush deposits from the humidifier pan. The system shall be field adjustable to change the cycle time to suit local water conditions.

A minimum 1-in. (25-mm) air gap within the humidifier piping assembly, in compliance with ASME A112.1.2 section 2.4.2 (backsiphonage testing), shall prevent back-flow of the humidifier supply water.

2.9 Reheat

2.9.1 Electric Reheat—Optional

The Thermal Management unit shall include a factory-installed reheat to control temperature during dehumidification. The low-watt density, 304/304, stainless-steel, finned-tubular electric reheat coils. The reheat section shall include UL/CSA recognized safety switches to protect the system from overheating.

2.9.2 Hot Water Reheat—Optional

The hot water reheat coil shall have copper tubes and aluminum fins. The control system shall be factory pre-piped with a 2-way motorized control valve. A cleanable Y-strainer is factory-installed on hot-water supply line. Upflow model requires a 22 ¾-in. (58-cm) high plenum with grille.

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-inch, 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 shall allow the user to see applicable information based on the login used.
- **Unit Backup and Restore** - The user shall be able to create safe copies of important control parameters. The Liebert® iCOM™ shall have the capacity for the user to automatically backup unit configuration settings to internal memory or USB storage drive. Configuration settings may be transferred to another unit for a more 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™ will have an on-board help database. The database shall provide context sensitive help to assist with setup and navigation of the menus.
- **Display Setup** - The user shall be able to configure the display information based on the specific user's preference. Language, units of measure, screen contrast, home screen layout, back-light timer and the hide/show of certain readouts will be configurable through the display.
- **Additional Readouts** - The Liebert® iCOM™ shall enable 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 LED's** - The Liebert® iCOM™ shall provide the user with the unit's operating status using an integral LED. The LED shall indicate if the unit has an active alarm; if the unit has an active alarm that has been acknowledged; or if the unit is On, Off or in standby status.
- **Event Log** - The Liebert® iCOM™ shall automatically store the last 400 unit-only events (messages, warnings and alarms).
- **Service Contact Information** - The Liebert® iCOM™ shall have the capacity to store the local service or sales contact information.

- **Upgradeable** - Vertiv™ Liebert® iCOM™ firmware upgrades shall be performed through a USB Upgradeable connection.
- **Timers/Sleep Mode** - Menu shall allow various customer settings for turning on/Off unit.
- **Menu Layout** - The menus will be broken out into two main menu screens: User screen and Service screen. The User screen contains the menus to access parameters required for basic unit control and setup. The Service screen is designed for service personnel 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 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.
- **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.

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 Liebert® iCOM™ control shall activate an audible and visual alarm in 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
- Custom Alarms

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

- Leak Under Floor
- Smoke Detected
- Standby Unit On

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

3.3 Vertiv™ Liebert® iCOM™ Control Methods and Options

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

3.3.1 Controlling Sensor Options

The 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:

1. Cooling Capacity

- Supply
- Remote
- Return

2. Fan Speed

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

3.3.2 Temperature Compensation

The 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 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 space.

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 shall allow the control to optimize a group of connected cooling units equipped with Liebert® iCOM™ using the U2U (Unit to Unit) network. There shall be three modes of teamwork operation:

- **Teamwork Mode 1 (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 divided 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):** Is best applied in large rooms with unbalanced heat loads. 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 the inlet rack temperature is being met. Cooling (Chilled Water Valve or Economizer) 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 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 Liebert® iCOM™ cascade option shall allow the units to turn On and Off based on heat load when utilizing Teamwork Mode 1, Independent mode or Teamwork Mode 3, Optimized Aisle mode with remote temperature sensors. In Teamwork Mode 1, Cascade mode will stage units on based on the temperature and humidity readings and their deviation from setpoint. In Teamwork 3 Mode, Cascade mode dynamically coordinates the fan speed 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 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 need by cascading units On or putting them 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 provides 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™ automatically assigns a virtual master. The virtual master assumes the same responsibilities as the master until communication is restored.

3.8 Virtual Back-Draft Damper

Vertiv™ Liebert® iCOM™ shall allow the use of a virtual back-draft damper, eliminating the need for a mechanical damper. This shall allow the fans to spin slowly (15% or less) to act as a damper.

3.9 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 failure.

3.10 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.

3.11 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 CW Quick Start

Each Liebert® iCOM™ controller shall have the option to enable Chilled Water Quick-Start. After a loss of power, Liebert® iCOM™ application normally requires approximately 60 seconds to reboot prior to the unit providing airflow and cooling output. With CW Quick-Start enabled, the end-user may configure a specific airflow output percentage and cooling capacity output percentage as desired. The unit shall operate at these configured values within approximately 10 seconds after a power restoration all while the Liebert® iCOM™ application is rebooting. After Liebert® iCOM™ has fully booted, the unit will continue normal operation.

3.13 Adaptive PID CW Auto-Tuning

Liebert® iCOM™ shall support the use of Liebert's auto-tuning feature called Adaptive PID. Adaptive PID may be used for fan speed control or cooling capacity control. With Adaptive PID selected, Liebert® iCOM™ shall automatically recognize oscillations across multiple sub-systems relating to the PI tuning associated with either mode of control or correct those oscillations with zero human intervention. This feature allows for better overall system operation and responds well to increasing/decreasing system loads.

3.14 Supply Sensor Aggregation

Each Liebert® iCOM™ controller shall support the Supply Sensor Aggregation feature. Supply Sensor Aggregation allows for the use of additional remote 2T temperature sensors that are used to calculate an aggregated supply air temperature value which may be used for cooling capacity control. Each Liebert® iCOM™ controller can support up to five additional remote 2T sensors for supply sensor aggregation.

4.0 MISCELLANEOUS OPTIONS

4.1 Flow Switch—Optional

The flow switch shall activate the alarm system should the chilled water supply be interrupted. The switch shall be designed for up to 400 PSI (2758 kPa) water pressure and shipped loose for field installation.

4.2 Variable Speed Drive—Optional

A variable speed drive (VSD) is available for models CW106 and CW114 to reduce energy consumption. The fan motor speed shall be varied from 100% to 60% of rated speed in response to room conditions. This shall be controlled automatically by the Vertiv™ Liebert® iCOM™ control. The variable-speed-drive option shall be available with an infrared humidifier.

4.3 Wired Remote Sensor(S)—Optional

Each Liebert® iCOM™ shall have up to 10 2T sensors (20 sensor readings total) for control or reference. As part of the U2U network, these sensors shall be shared and used to control the cooling units and provide greater flexibility, visibility and control, using that to respond to changes in the conditioned space. When the sensors are used for control, the user may set the control to be based on a maximum or average of a selected highest temperature reading.

4.4 Dual Chilled Water Valve Staging—Optional

- The control shall provide special staging options on dual chilled water valve applications. The chilled-water valves may be staged in parallel, cascade or alternate lead operation.
- Parallel control shall allow both chilled-water valves to operate at the same time, following the same open/close command as the room conditions deviate from the setpoint.
- Cascade control shall allow the valves to operate in stages. Only 1 circuit shall be operated to maintain the conditioned space temperature. If the room condition is not held with 1 circuit in operation, the control will automatically stage a second valve on to maintain room conditions. An automatic timer may be used to alternate the lead valve to keep equal component run time.
- Alternate operation shall allow 1 circuit to work as lead and the second circuit to act as backup. The lead valve will rotate based on valve run time, or the user can alternate the lead valve using a customer input connection.

4.5 High Temperature Sensor—Optional

The high temperature sensor shall immediately shut down the environmental control system when activated. The high temperature sensor shall be mounted in the electrical panel with the sensing element in the return air.

4.6 Condensate Pump, Dual Float—Optional

The pump shall have a capacity of _____ GPM (_____ l/m) at _____ ft head (_____ kPa). The pump shall be complete with integral dual-float switch, pump, motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut-down the unit upon a high-water condition. The pump shall be shipped loose for field installation on Chilled Water units that are upflow with bottom return. They are also shipped loose for under-floor field installation on CW038-CW060 units with EC fans.

4.7 Vertiv™ Liebert® Liqui-Tect™ Sensors (Maximum of 2 Per Unit)—Optional

Provide ____ (quantity) solid-state water sensors under the raised floor.

4.8 Smoke Sensor—Optional

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.

4.9 Vertiv™ Liebert® SiteScan™ Site Monitoring System—Optional

Provide a Liebert® SiteScan™ monitoring system with the Liebert CW. The Liebert® SiteScan™ shall have the capability of monitoring and changing (at the user's direction) the temperature setpoints and sensitivities of each unit. The printer shall provide the user with chronological alarm information. It shall also be capable of being programmed to print out environmental conditions or operating modes at each unit.

4.10 Low-voltage Terminal Package Includes—Optional

- 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.)

4.11 Reheat & Humidifier Lockout—Optional

The reheat and humidifier lockout includes the necessary relays to disable the reheat and humidifier from an external customer supplied 24-V signal while on emergency power.

4.12 Remote Humidifier Contact—Optional

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

4.13 Vertiv™ Liebert® vNSA Network Switch—Optional

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

- Liebert® vNSA14 – enclosure with network switches only
- Liebert® vNSA14- Liebert® iCOM™ - H – enclosure with network switches and 9" 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.

4.14 Floor Stand—Optional

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

4.14.1 EC-fan Lowering Jack—Optional

An EC-fan lowering jack shall be supplied to assist the lowering of EC fans from downflow unit into the floor stand. Only available with downflow units with EC fans and “Under-the-floor” options when floor stands are selected. Ships with floor stand.

4.14.2 Seismic-rated Floor Stand—Optional

The floor stand shall be seismic-rated and shall be bolted to the unit frame.

4.15 Return-Air Plenum For Downflow Units—Optional

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

4.16 Discharge Air Plenum For Upflow Units, With Discharge Grille(S)—Optional

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

4.17 Discharge Air Plenum For Upflow Units, Without Discharge Grille(S)—Optional

The air plenum shall be constructed of 20-gauge steel, powder coated to match unit color. Air shall discharge from the top of the plenum.

5.0 EXECUTION

5.1 Installation of Thermal Management Units

5.1.1 General

The user shall install Thermal Management units in accordance with manufacturer's installation instructions. The units shall be installed plumb and level, firmly anchored in locations indicated and shall maintain manufacturer's recommended clearances.

5.1.2 Electrical Wiring

The user shall install and connect electrical devices furnished by the manufacturer but not specified to be factory mounted. The manufacturer shall furnish a copy of manufacturer's electrical connection diagram submittal to electrical contractor.

5.1.3 Piping Connections

The user shall install and connect devices furnished by the manufacturer but not specified to be factory-mounted. The manufacturer shall furnish a copy of piping connection diagram submittal(s) to the piping contractor.

5.1.4 Supply and Drain Water Piping

The user shall startup Thermal Management units in accordance with the manufacturer's startup instructions. The manufacturer shall test controls and demonstrate compliance with requirements.

5.2 Field Quality Control

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

5.3 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.