Vertiv™ Liebert® CW Model 305, 375, 415
Guide Specifications

1.0 GENERAL

1.1 Summary

These specifications describe requirements for a Thermal Management system. The system shall be designed to control temperature 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.

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 unit's required service access location. No side access shall be required.

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

2.1.1 Air Supply Configurations

1. Bottom Discharge

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

2. Horizontal Discharge

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

2.1.2 Air Return

The return air shall enter the unit from the top.

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 RAL-7021 (black gray). The fan plenum shall be painted to match the color of the main unit.

2.1.4 Electrical and Piping Options Panel Location

1. Data Hall or Bottom Discharge, Left Electric Panel

The main unit display and piping connections shall exit from the left hand (data hall side) of the unit.

2. Data Hall or Bottom Discharge, Right Electric Panel

The main unit display and piping connections shall exit from the right hand (data hall side) of the unit.

3. Gallery, Left Electric Panel

The main unit display and piping connections shall exit from the left hand (gallery side) of the unit.

4. Gallery, Right Electric Panel

The main unit display and piping connections shall exit from the right hand (gallery side) of the unit.

2.2 Filters

The filter chamber shall be located within the evaporator coil cabinet, and filters shall be removable from the designated service side of the unit.

2.2.1 Filters, 4-in. MERV 8 or MERV11

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

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

2.3 Locking Disconnect Switch

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

2.3.1 Dual Locking Disconnect with Reversing Starter and Capacitive Buffer (optional)

The unit shall be provided with two manuals disconnect switches mounted in the high voltage section of the electrical panel. In addition, the unit shall include reversing starter with ATS (automatic transfer switch) control. In the event of a loss of primary power, the unit will automatically switch over to a secondary power source. Upon return of primary power, the unit will automatically return to the primary power source. Also, the unit shall be equipped with an optional capacitive buffer to provide the Vertiv™ Liebert® iCOM™ with a minimum of three minutes of ride-through power. The capacitive buffer shall provide power to the Liebert® iCOM™ control with embedded Unity functionality for continuous connectivity to Building Management System/Building Automation Systems (where applicable). This functionality is not available with valve configured for spring return closed.

2.4 Short Circuit Current Rating (SCCR)

The electrical panel shall provide at least 65,000A SCCR both 60 Hz and 50 Hz units.

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 Backward Curved Direct Drive Fan with Variable Speed Drive

The fans shall be plug/plenum type, single inlet and dynamically balanced. The drive package shall be direct drive and provided with variable speed drives (three drives per unit). The fans shall be located in a plenum above the unit and will blow air over the slab coil to ensure even air distribution and maximum coil performance. Fan motors shall be nominal 15 hp (11.2 kW) each, with a maximum operating speed of 1,800 rpm; quantity three.

2.5.2 Backward Curved Direct Drive Fan with Variable Speed Drive and Total Harmonic Distortion Device—(Optional)

The fans shall be plug/plenum type, single inlet and dynamically balanced. The drive package shall be direct drive and provided with variable speed drives (three drives per unit). The fans shall be located in a plenum above the unit and will blow air over the slab coil to ensure even air distribution and maximum coil performance. Fan motors shall be nominal 15 hp (11.2 kW) each, with a maximum operating speed of 1,800 rpm; quantity three. An optional passive filter, THD mitigation device is installed behind the unit main electric panel and wired in series between the main disconnect switch (or reversing starter) and power distribution block.

2.6 Chilled Water Control Valve

The water circuit shall include a two-way modulating valve. The valve shall be designed for up to 400 PSI (2,758 kPa) water pressure. Valve close off pressure rating is 100 PSI (689 kPa). The Liebert® iCOM™ shall position the valve in response to room conditions.

2.7 Chilled Water COIL

The chilled water coil shall be slab design 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.

3.0 CONTROLS

3.1

3.2 Vertiv™ Liebert® iCOM™ Microprocessor Control With 7 Inch 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 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.
- Parameter Search—The Liebert® iCOM™ shall have search fields for efficient navigation and parameter lookup.
- Context Sensitive Help—The Liebert® iCOM™ shall have an onboard 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 Vertiv™ Liebert® iCOM™ shall have the ability to store the local service or sales contact information.
- Upgradeable - Liebert® iCOM™ firmware upgrades shall be performed through a USB connection.
- Timers/Sleep Mode—The menu shall allow various customer settings for turning on/off unit.
- Menu Layout—The menus shall be divided into two main menu screens: User and Service. The User screen shall contain the menus to access parameters required for basic unit control and setup. The Service screen shall be designed for service personal and provides access to advanced control setup features and diagnostic information.
- Sensor Calibration—The menus shall allow unit sensors to be calibrated with external sensors.
- Maintenance/Wellness Settings—The menus shall allow reporting of potential component problems before they occur.
- Options Setup—The menus shall provide operation settings for the installed components.
- Auxiliary Boards—The menus shall allow setup of optional expansion boards.
- Various Sensors—The menus shall allow setup and display of optional custom sensors. The control shall include four customer accessible analog inputs for field provided sensors. The analog inputs shall accept a 4 to 20mA signal. The user shall be able to change the input to 0 to 5VDC or 0 to 10VDC. The gains for each analog input shall be programmable from the front display. The analog inputs shall be able to be monitored from the front display.
- Diagnostics/Service Mode—The Liebert® iCOM™ shall be provided with self-diagnostics to aid in troubleshooting. The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as on or off at the front display. Control outputs shall be able to be turned on or off from the front display without using jumpers or a service terminal. Each control output shall be indicated by an LED on a circuit board.
- Base Comms for BMS Connectivity—The Liebert® iCOM™ controller shall provide one Ethernet port and RS-485 Port dedicated for BMS Connectivity. Provides ground fault isolated RS-485 Modbus, BACnet IP and Modbus IP network connectivity to Building Management Systems for unit monitoring and management. Also, provides ground fault isolated 10/100 baseT Ethernet connectivity for unit monitoring and management. The supported management interfaces include: SNMP for Network Management Systems, HTTP for web page viewing, SMTP for email, and SMS for mobile messaging. The Liebert® iCOM™ controller can support dual IP on a single network and one 485 protocol simultaneously.

3.3 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™ shall activate an audible and visual alarm in the event of any of the following conditions:

- High Temperature
- Low Temperature
- High Humidity
- Low Humidity
- Fan Fault
- Change Filters

- Loss of Air Flow
- Loss of Power
- Custom Alarms

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

- Leak Under Floor
- Smoke Detected
- Standby Unit On

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

3.4 Vertiv™ Liebert® iCOM™ Control Methods And Options

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

3.4.1 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:

Cooling Capacity

- Supply
- Remote
- Return

Fan Speed

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

3.4.2 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.

3.5 Multi-Unit Coordination

Liebert® iCOM™ teamwork shall save energy by preventing multiple units in an area from operating in opposing modes. Teamwork allows the control to optimize a group of connected 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 derived and shared among the units in the group. Each unit will receive instructions on how to operate from the Master unit based on how far the system deviates from the setpoints. Evaporator fans and cooling capacity are ramped in parallel.
- Teamwork Mode 2 (Independent)—The Vertiv™ Liebert® iCOM™ calculates the worse-case demand for heating, cooling humidification and dehumidification. Based on the greatest demand within the group, each unit operates independently, meaning that the unit may respond to the thermal load and humidity conditions based on the units controlling sensors. All sensor readings are shared.
- Teamwork Mode 3 (Optimized Aisle)—May be applied in large and small rooms with varying heat loads. Optimized Aisle is the most efficient teamwork mode that allows the unit to match cooling capacity with heat load. In the Optimized Aisle mode, the fans operate in parallel. Fans can be controlled exclusively by remote temperature or using static pressure with a secondary remote temperature sensor(s) as an override to ensure that the inlet rack temperature is being met. Cooling (Compressors, Vertiv™ Liebert® Economizer or Vertiv™ Liebert® EconoPhase) is controlled off 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.

3.6 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.

3.7 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 3–Optimized Aisle mode with remote temperature sensors. In Teamwork Mode 3, Cascade mode will stage units on based on the temperature and humidity readings and their deviation from setpoint. Cascade mode coordinates the fan speed dynamically to save energy and to meet cooling demands. For instance, with a 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 needs by cascading units on or putting them back into standby.

3.8 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™ automatically assigns a virtual master. The virtual master shall assume the same responsibilities as the master until communication is restored.

3.9 Virtual Back-Draft Damper

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

3.10 Wired Supply Sensor

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

3.11 System Auto Restart

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

3.12 Sequential Load Activation

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

3.13 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.

3.14 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 subsystems relating to the PI tuning associated with either mode of control and correct those oscillations with zero human intervention. This feature allows for better overall system operation and responds well to increasing/decreasing system load.

3.15 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 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.

4.2 Condensate Pump, Dual Float—Optional

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

4.3 Low Voltage Terminal Package—Optional

Factory installed and factory wired terminals shall be provided.

- Remote Shutdown Terminals—Two additional pairs of terminals provide the customer with additional locations to remotely shut down the unit by field-installed devices or controls.
- Extra Common Alarm Contacts—Two additional pairs of terminals provide the customer with normally open contacts for remote indication of unit alarms.
- Main Fan Auxiliary Switch—One set of normally open contacts wired to the 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—One pair of dry contacts for the Liebert® Liqui-Tect™ sensor signal will provide unit shut down. (Liebert® Liqui-Tect™ sensor is not included.)

4.4 Remote Humidifier Contact—Optional

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

4.5 Fan Overload

The fan fault alarm is standard on all models.

4.6 Wired Remote Sensor(S)—Optional

Each Liebert® iCOM™ can have up to 10 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.

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

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

4.8 Floor Stand—Optional for Raised Floor Applications

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

4.9 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-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.

4.10 Power Monitoring—Optional

The unit shall be equipped with factory programmed/installed power meters to monitor power characteristics for either individual component or total unit. These meters allow the user to monitor meter connection status, input under voltage, input RMS voltage leg-to-leg and leg to ground, input current for each phase, energy consumption in kilowatt hours, and instantaneous power in watts. In multi-unit applications, a phase loss protection routine shall place a unit into standby mode in the event that phase loss is detected.

5.0 EXECUTION

5.1 Installation of Thermal Management Units

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

5.1.1 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.

5.1.2 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.

5.2 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.

5.2.1 Supply, Return, And Drain Water Piping

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

5.3 Field Quality Control

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

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

5.4 Warranty Start-Up and Control Programming

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