Vertiv™ CoolPhase Wall
3.5 kW, 7 kW and 11 kW Units
Guide Specification

1.0 General

1.1 Summary

These specifications describe requirements for a wall-mounted, split system, Thermal Management system. The system shall be designed to control the temperature in rooms containing electronic equipment, with good insulation and vapor barrier. The manufacturer shall design and furnish all equipment in the quantities and configurations shown on the project drawings.

The thermal management system shall be a Vertiv CoolPhase Wall, split-system, factory assembled unit with cooling capacity of 3.5kW, or 7kW, or 11kW and energy efficiency rating SCOP greater than 3.4.

Systems shall meet ETL and CE certifications, which pass the **UL 60335** and **EN 60335** tests, and are marked with the ETL and CE logo.

The evaporator unit shall be designed for wall-mount installation. The heat rejection condensing shall be installed outdoors or is approved to be installed within an indoor ceiling plenum.

The system shall have a net total cooling capacity of _____ BTU/hr (kW) and net sensible cooling capacity of _____BTU/hr (kW), based on entering air conditions of _____°F (____°C) drybulb temperature and ___°F (____°C) wet bulb temperature.

The evaporator electrical supply shall be ____ Volts, _____ phase, ____ Hz.

The heat rejection condensing unit electrical supply shall be _____ Volts, _____ phase, _____ Hz.

1.2 Submittals

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

2.0 CoolPhase Wall Evaporator

2.1 Evaporator Cabinet Construction

All cabinet panels shall be painted, hot-dip galvanized sheet metal, with the side panels covered with insulation cotton.

The unit shall be equipped with two wall-mounted brackets to facilitate on-site service personnel with mounting the evaporator section to the wall.

On the left and right sides of the indoor unit, there are drainage quick connectors, air pipe quick joints and liquid pipe quick connectors, which are convenient for the flexible pipe wiring on the customer's site and connect the indoor unit and the outdoor unit.

2.2 Cabinet Serviceability and Accessibility

The evaporator cabinet shall be designed so all components are easily accessible for service and maintenance through either the front or side of the unit.

The upper front cover of the unit opens, allowing easy access to the filter and temperature and humidity detection board.

The left side panel is removable with maintenance access to refrigerant leak sensors, EEV, temperature and pressure sensors, filter driers, water level detection boards and other electrical components, so that field service personnel can quickly replace these components.

2.3 Fan Section

The units are equipped with direct-driven centrifugal fans with backward-curved blades and electronically-commutated DC motors. The fan speed shall be variable and automatically regulated by the ICOM™ Edge through all modes of operation. Each fan shall have a dedicated motor, fault monitoring circuitry and speed controller which provides a level of redundancy for models with multiple fans. The entire fan assembly shall be removed from the front of the cabinet.

Return air to the evaporator shall be through the front, towards the top of the cabinet. The supply air shall be horizontal, near the bottom of the cabinet.

The evaporator fan output adjustment range is 40%-100%.

Each system shall deliver ___ CFM (___CMH) at full-air flow.

2.4 Refrigeration System

A single refrigeration circuit shall include factory installed evaporator coil, electronic expansion valve, low pressure switch, fan(s), and refrigerant check valve. The indoor evaporator refrigerant piping shall be spun shut with a nitrogen holding charge. Field relief of the Schrader valve shall indicate a leak-free system. The evaporator unit shall by powered by the condensing unit or a separate source, with_____V, ___ ph, ___ hz power.

2.5 Evaporator Coil

The evaporator shall be constructed of copper tubes and hydrophilic-coated aluminum fins. The hydrophilic coating improves condensate drainage from the fins to reduce the risk of water carryover.

2.6 Electronic Expansion Valve

The Electronic Expansion Valve (EEV) shall be designed for precise modulation of refrigerant mass flow in response to varying system loads. The EEV shall incorporate sensors for simultaneous collection of temperature and pressure signals to accurately regulate refrigerant

flow. The valve shall operate within a wide envelope, enabling it to reduce condensing pressure when conditions allow, thereby optimizing energy consumption.

2.7 Refrigerant filter drier

A factory installed filter drier shall be designed to remove moisture and contaminants from the refrigeration system that may otherwise clog or damage the refrigeration system.

2.8 R32 refrigerant

The system shall use R32 refrigerant, with a GWP_{100} of 675. Refrigerant shall be field supplied, and field charged.

2.9 Short Circuit Current Rating (SCCR)

The customer electrical panel shall provide at least 5000A SCCR.

2.10 Air Filtration

The filter channel shall be located inside the evaporator cabinet and can be quickly accessed by opening the front cover. The filters are all washable mesh structures, including filter clog alarm and regular maintenance warnings.

3.0 ICOM Edge Control

3.1 Display

The display is 128 × 64 dot screen with white backlight, symbolic representation of unit functions, diagnostics feature. A buzzer provides audible indication in case of the ‘Warning’ or ‘Alarm’ event.

A password shall be required to make system changes. Service menus shall include setpoints, standby settings (lead/lag), timers, alarm setup, maintenance/wellness settings, options setup, system setup.

The display is equipped with a 3m 22AWG cable when it leaves the factory, which is convenient for customers to wire and install the display on site.

- **Password Protection -** The iCOM™ Edge 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 iCOM™ Edge shall have the capacity for the user to automatically backup unit configuration settings to internal memory or USB storage drive. Configuration settings may be transferred to another unit for a more stream-lined unit startup.
- **Parameter Download -** The iCOM™ Edge 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.
- **Setup Wizards -** The iCOM™ Edge shall contain step-by-step tutorials or wizards to provide easy setup of the control.
- 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, back-light timer and the hide/show of certain readouts shall be configurable through the display.
- **Status LED's -** The iCOM™ Edge shall show the unit's operating status using an integral LED. The LED shall indicate if the unit has an active alarm; if the unit has an active alarm that has been acknowledged; or if the unit is On, Off or in standby status.
- Event Log - The iCOM™ Edge shall automatically store the last 400 unit-only events (messages, warnings, and alarms).
- **Service Contact Information -** The iCOM™ Edge shall be able to store the local service or sales contact information.
- **Upgradeable -** iCOM™ Edge upgrades shall be performed through a USB connection.
- **Menu Layout -** The menus shall be divided into two main menus: User and Service. The User screen shall contain the menus to access parameters required for basic unit control and setup. The Service screen shall be de-signed for service personnel and shall provide access to advanced control setup features and diagnostic information.
- **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.

3.2 Alarms

All unit alarms shall be annunciated through both audio and visual cues, clearly displayed on the screen, automatically recorded in the event log, and communicated to the customers Building

Management System/Building Automation System. The iCOM™ Edge 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 Power
- High Pressure
- High Discharge Temperature
- Low Suction Pressure
- Refrigerant Leakage alarm
- Sensor Failure alarm
- Communication Failure alarm

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

- 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.

3.3 Control Methods and Options

The iCOM™ Edge 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 cooling capacity-based control sensors installed. Proportional and Tunable PID shall also be user selectable options.

3.4 Controlling Sensor Options

ICOM™ Edge 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
- Return

3.4.1 Temperature Compensation

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

3.5 Multi-Unit Co-ordination

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

- **Teamwork Mode 1:** Is best in small rooms with balanced heat loads. The controlling temperature and humidity sensor readings of all units in operation (fan on) are collected to be used for an average or worst-case sensor reading (user selectable). The master unit shall send the operating requirements to all operating units in the group. The control band (temperature, fan, and humidity) is divided and shared among the units in the group.
- **Teamwork Mode 2:** The ICOM™ Edge calculates the worse-case demand for heating, cooling humidification and dehumidification. Based on the greatest demand within the group, each unit operates independently, meaning that the unit may respond to the thermal load and humidity conditions based on the unit's controlling sensors.
- **Teamwork Mode 3:** Optimized Aisle: May be employed in large and small rooms with varying heat loads. Optimized Aisle is the most efficient teamwork mode that allows the unit to match cooling capacity with heat load. In the Optimized Aisle mode, the fans operate in parallel. Fans can be controlled exclusively by remote temperature or using static pressure with a secondary remote temperature sensor(s) as an override to ensure that the inlet rack temperature is being met. Cooling (Compressors) is controlled through unit supply-air conditions. Vertiv™ ICOM™ Edge calculates the average or worst-case sensor reading (user-selectable) for heating, cooling humidification, and dehumidification. Based on the demand within the group, units will be allowed to operate within that mode until room conditions are satisfied.

3.6 Standby Lead

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

3.7 Standby Unit Cascading

The ICOM™ Edge cascade option shall allow the units to turn On and Off based on heat load when utilizing Optimized Aisle, Teamwork Mode 3 and remote temperature sensors. Cascade mode dynamically coordinates the fan speed to save energy and to meet the cooling demands. For instance, with an ICOM™ Edge group of six units and only 50% of the heat load, the ICOM™ Edge shall operate only four units at 80% fan speed and leave the other two units in standby. As the heat load increases, the ICOM™ Edge shall automatically respond to the additional 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 into standby.

3.8 Wired Supply Sensor

Each ICOM™ Edge shall have one factory-supplied and connected supply-air sensor that may be used as a controlling sensor or reference.

3.9 Virtual Master

As part of the robust architecture of the ICOM™ Edge 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 ICOM™ Edge shall automatically assign a virtual master. The virtual master shall assume the same responsibilities as the master until communication is restored.

3.10 Low Noise Operation

Units may be matched to a premium efficiency condensing unit control with enhanced monitoring, alarming, and diagnostics. The condensing unit control shall have an automated, low-noise night mode.

3.11 System Auto Restart

The auto restart feature shall automatically restart the system after a power failure.

3.12 Sequential Load Activation

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

3.13 Low/High Pressure Monitoring

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

3.14 Advanced Low/High Pressure Protection

When the compressor is initially activated, the system shall be monitored for high pressure and low pressure. When high or low pressure is detected, the control shall alter the compressor operating speed to decrease high pressure or increase low pressure, preventing circuit shut down. If the issue cannot be resolved through this adjustment and the alarm duration or trigger count reaches the preset threshold, an alarm shall occur, and the affected compressor shall be immediately locked off. When the pressure returns to a safe level, the unit must be restarted to resume operation.

3.15 Low/High Pressure Transducer Failure

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

3.16 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.

3.17 High Temperature Protection

The control shall monitor the discharge temperature of compressor 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 shutdown/locked out and an alarm shall be announced on the local display and through monitoring. After the initial lockout, the control shall continue to monitor compressor temperature during the off-cycle. Once the temperature returns to a safe operating range, the unit shall require a manual restart.

3.18 Compressor High and Low Temperature Protection Adjustment

The Vertiv™ ICOM™ Edge shall automatically adjust the compressor speed according to high/low pressure, discharge/suction temperature at the high or low outdoor ambient temperature to ensure the stability and reliability of the unit in each ambient temperature.

3.19 Compressor Run Time Monitoring

The control shall log these compressor statistics:

- Run hours
- Number of high-pressure alarms

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

3.20 Communication Interfaces

3.20.1 Remote Shutdown Terminal

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

3.20.2 Common Alarm Contact

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

3.20.3 Vertiv™ IntelliSlot™ Unity-DP Card

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

3.21 R32 Refrigerant Leakage Sensor

The unit shall be equipped with refrigerant leak detection sensor(s) for real-time monitoring of refrigerant leaks.

When the unit detects that the refrigerant concentration in the air exceeds the threshold, it will shut down the compressor and control the internal fan to operate at high speed to reduce the ambient refrigerant concentration and an alarm shall be announced on the local display and through monitoring.

4.0 CoolPhase Condensing Unit

4.1 CoolPhase Condensing Unit

4.1.1 Standard Features

The condensing unit shall consist of a TCP coated microchannel condensing unit coil, an axial EC fan, electrical controls, housing. Microchannel coils shall provide superior heat transfer, reduce air side pressure drop, increase energy efficiency, and shall reduce the system refrigerant volume required. EC fan motors and fan operating techniques shall provide reduced sound levels when able to run at a reduced speed.

The standard Condensing Unit Model shall operate with ambient temperatures between 4~118°F (-20~48°C), and the low ambient Condensing Unit shall operate -31~118°F (-35~48°C).

4.1.2 Cabinet

The condensing unit cabinet is made of galvanized steel sheet and is divided into separate fan chambers and compressor chambers by partitions. The internal structural supports, including the coil supports, are made of galvanized steel and powder-coated on the outer surface for strong strength and corrosion resistance. A service panel is provided on the compressor chamber side for easy cleaning and maintenance. Inside the compressor chamber is a drive mounting box with independent fresh air. On the side of the unit, there is an IPX4 waterproof electric control box for external cables.

4.1.3 Aluminum Microchannel 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.

TCP-Coating

TCP-coating shall be included on the condensing unit coil to resist corrosion caused by atmospheric conditions; regular coil cleaning is required to reduce the effects of corrosion.

4.1.4 Condensing unit EC Fan

The condensing unit EC fan shall have an EC motor, fan blades and fan/finger guard. Fan guards shall be heavy gauge, 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 shall be tested before shipment and mounted securely to the condensing unit structure.

The EC fan output adjustment range is 10%-100%.

4.1.5 Rotary Compressor

The compressor shall be rotary type, suitable for operation with an inverter drive to adjust capacity in response to changing room loads.

The compressor output adjustment range is 20%-100%.

4.1.6 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 wiring shall be required at condensing unit installation.

Premium Control

The Premium Control System shall include an inverter (Variable Frequency Drive), EC fan motor, discharge temperature sensor, and refrigerant pressure transducers. The inverter board shall receive an indoor unit run signal via field-supplied low voltage interlock wires to the compressor side switch via field-supplied RS485 communication wires from the indoor unit's Vertiv™ ICOM™ Edge or via both. The inverter board shall use refrigerant transducer and communication inputs to maintain system pressure by controlling EC fan.

Variable Frequency Drive

The Condensing Unit uses a variable frequency drive to control the frequency of the compressor, thereby controlling and regulating the entire refrigeration system.

Refrigerant leak protection

When the refrigerant leaks, the hardware will be protected. The compressor will be forced to stop . The indoor fans will be forced to start, and outdoor fans will shut down .

4.2 Installation

1. Hoisting bracket

Each Condensing Unit is equipped with two hoisting brackets, one side can be connected to the top of the unit, and the other side can be connected to the sling or eye, so that the unit can be hoisted into place.

2. Multi-scenario installation

Securely attach the Condensing Unit to the roof, a condensing unit pad, base rails, or another mounting platform securely anchored to the ground or building structure with M10 anchor bolts.

5.0 Ship-Loose Accessories

5.1 Evaporator Accessories

5.1.1 Condensate pump

The standard configuration of the indoor unit is to rely on gravity for natural drainage, if the customer has upward drainage needs, there are water pump accessories to choose from, the maximum head of the water pump is 16.4ft/5m.

5.2 Condensing Unit Accessories

a. Hail Guard Kit

Hail Guards protect the coil against hail produced during storms. It is recommended to add this accessory when the unit is in a place with extreme weather conditions.

b. Wind Baffle Kit

The wind baffle allows cooling-mode operation at lower ambient outdoor temperatures.

c. Duct Kit

The duct kit is needed when the unit is required to be adapted to a duct system; this kit must be attached before mounting the unit to the ceiling for proper component access and installation. For further details of the kit's components, please refer to the accessory Quick Installation Guide.

6.0 Execution

6.1 Installation of Thermal Management Units

6.1.1 General Arrangement

Install cooling units in accordance with manufacturer’s installation instructions. Install units plumb and level, firmly anchored in locations indicated and maintain manufacturer’s recommended clearances.

6.1.2 Electrical Wiring

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

6.1.3 Piping Connections

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

6.1.4 Refrigerant Charging

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

6.1.5 Field Quality Control

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

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

6.1.6 Plenum Installation Option

The outdoor unit is equipped with air duct installation accessories, and you can choose to install the air duct according to the supplier's instructions and requirements, and the outdoor unit can flexibly choose the installation site.