# CoolPhase Ceiling

## Installer/User

Ceiling Mounted Environmental Control System

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### Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit https://www.vertiv.com/en-us/support/ for additional assistance.

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# 1 Important Safety Instructions

SAVE THESE INSTRUCTIONS

This manual contains important safety instructions that should be followed during the installation and maintenance of the Vertiv™ CoolPhase Ceiling. Read this manual thoroughly before attempting to install or operate this unit.

Only qualified personnel should move, install or service this equipment.

Adhere to all warnings, cautions, notices and installation, operating and safety instructions on the unit and in this manual. Follow all installation, operation and maintenance instructions and all applicable national and local building, electrical and plumbing codes.

**WARNING! Arc flash and electric shock hazard. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death.**

**Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable.**

**Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power.**

**WARNING! Risk of electric shock. Can cause equipment damage, injury or death. Open all local and remote electric power supply disconnect switches and verify with a voltmeter that power is off before working within any electric connection enclosures. Service and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.**

**WARNING! Risk of electric shock. Can cause serious injury or death. Vertiv™ iCOM™ does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "unit off" mode of the iCOM™. Open all local and remote electric power disconnect switches and verify with a voltmeter that power is Off before working on any component of the system.**

**WARNING! Risk of over-pressurization of the refrigeration system. Can cause explosive discharge of high-pressure refrigerant, loss of refrigerant, environmental pollution, equipment damage, injury, or death. This unit contains fluids and gases under high pressure. Use extreme caution when charging the refrigerant system. Do not pressurize the system higher than the design pressure marked on the unit's nameplate.**

Relieve pressure before cutting into or making connections/disconnections to the piping system. Local building or plumbing codes may require installing a pressure-relief device in the system. Consult local building and plumbing codes for installation requirements of additional pressure-relief devices when isolation valves are field-installed. Do not isolate any refrigerant circuit from over-pressurization protection.

Do not close off any field-installed, refrigerant-line isolation valves for repairs unless a pressure-relief valve is field- installed in the line between the isolation valve and the check valve. The pressure-relief valve must be rated 5% to 10% higher than the system-design pressure. An increase in ambient temperature can cause the pressure of the isolated refrigerant to rise and exceed the system-design pressure rating (marked on the unit nameplate).

WARNING! Risk of improper moving. Can cause equipment damage, injury or death. Use only lifting equipment that is rated for the unit weight by an OSHA-certified rating organization. The center of gravity varies depending on the unit size and selected options. The slings must be equally spaced on either side of the center of gravity indicator. Unit weights are listed in Table 3.1 Vertiv™ CoolPhase Ceiling Unit Weights.

WARNING! Risk of contact with high-speed rotating fan blades. Can cause serious injury or death. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is off, and verify that all fan blades have stopped rotating before working in the unit cabinet or on the fan assembly. If control voltage is applied, the fan motor can restart without warning after a power failure. Do not operate the unit with any or all cabinet panels removed.

WARNING! Risk of improper wiring, piping, moving, lifting and handling. Can cause equipment damage, serious injury or death. Installation and service of this equipment should be done only by qualified personnel who have been specially trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE.

WARNING! Risk of improper wire sizing/rating and loose electrical connections. Can cause overheated wire and electrical connection terminals resulting in smoke, fire, equipment and building damage, injury or death. Use correctly sized copper wire only and verify that all electrical connections are tight before turning power On. Check all electrical connections periodically and tighten as necessary.

WARNING! Risk of improper humidifier-canister maintenance. Can cause smoke and fire, activation of fire suppression systems, building evacuation, dispatching of fire/rescue equipment and personnel, and catastrophic canister failure resulting in water leaks, equipment damage, injury, or death. Using a humidifier canister that has reached the end of its service life can be extremely hazardous. If the canister cannot be replaced immediately at the end-of-life condition, turn Off the power and water supply to the humidifier and remove the canister until a replacement canister can be installed. Do not ignore humidifier problem alarms. Resetting the humidifier without addressing the cause may result in fire or damage due to leaking water.

**CAUTION: Risk of improper moving, lifting and handling. Can cause equipment damage or injury. Only properly trained and qualified personnel should work on this equipment. Evaporator fan modules weigh in excess of 66 lb (30kg). Use proper lifting techniques and wear appropriate, OSHA-approved PPE to avoid injury and dropping the fan module during removal. Equipment used in handling/lifting, and/or installing the fan assembly must meet OSHA requirements. Use handling/lifting equipment rated for the weight of the fan assembly. Use ladders rated for the weight of the fan assembly and technicians if used during installation. Refer to handling/lifting, and/or installation equipment operating manual for manufacturer's safety requirements and operating procedures.**

**CAUTION: Risk of contact with sharp edges, splinters, and exposed fasteners. Can cause injury. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should attempt to move, lift, remove packaging from or prepare the unit for installation.**

**CAUTION: Risk of contact with hot surfaces. Can cause injury. The electronics housing, humidifier components, compressor, refrigerant discharge lines, fan motor, and some electrical components are extremely hot during unit operation. Allow sufficient time for them to cool to a touch-safe temperature before working within the unit cabinet. Use extreme caution and wear appropriate, OSHA-approved PPE when working on or near hot components.**

**CAUTION: Risk of exposure to harmful noise levels. Can cause hearing injury or loss. Depending on the installation and operating conditions, a sound pressure level greater than 70 dB(A) may arise. Take appropriate technical safety measures. Operating personnel must wear appropriate, OSHA-approved PPE and observe all appropriate hearing-protection safety requirements.**

**NOTICE**

Risk of improper power supply connection. Can cause equipment damage and loss of warranty coverage.

Prior to connecting any equipment to a main or alternate power source (for example: back-up generator systems) for start-up, commissioning, testing, or normal operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. In general, power source voltages should be stabilized and regulated to within ±10% of the load nameplate nominal voltage. Also, ensure that no three-phase sources are single phased at any time.

**NOTICE**

Risk of oil contamination with water. Can cause equipment damage.

CoolPhase Ceiling systems require the use of POE (Polyolester) oil. POE oil absorbs water at a much faster rate when exposed to air than previously used oils. Because water is the enemy of a reliable refrigeration system, extreme care must be used when opening systems during installation or service. If water is absorbed into the POE oil, it will not be easily removed and will not be removed through the normal evacuation process. If the oil is too wet, it may require an oil change. POE oils also have a property that makes them act as a solvent in a refrigeration system. Maintaining system cleanliness is extremely important because the oil will tend to bring any foreign matter back to the compressor.

**NOTICE**

Risk of improper refrigerant charging. Can cause equipment damage.

Refrigerant charge must be weighed into air-cooled compressorized systems before they are started. Starting digital scroll compressors without proper refrigerant charging can cause the compressors to operate at less than 5° F (–15° C) evaporator temperature and at less than 55 psig (379 kPa). Operation for extended periods at less than 55 psig (379 kPa) can cause premature compressor failure.

**NOTICE**

Risk of clogged or leaking drain lines and leaking water supply lines. Can cause equipment and building damage.

This unit requires a water drain connection. Drain lines must be inspected at start-up and periodically, and maintenance must be performed to ensure that drain water runs freely through the drain system and that lines are clear and free of obstructions and in good condition with no visible sign of damage or leaks.

Improper installation, application and service practices can result in water leakage from the unit. Water leakage can result in catastrophic and expensive building and equipment damage and loss of critical data center equipment.

Do not locate unit directly above any equipment that could sustain water damage.

We recommend installing a monitored fluid detection system to immediately discover and report coolant fluid system and condensate drain line leaks.

**NOTICE**

Risk of leaking water/glycol. Can cause equipment and building damage. Improper installation, application, and service practices can result in water leakage from the unit. Do not mount this unit over equipment and furniture that can be damaged by leaking water. Install a water-tight drain pan with a drain connection under the cooling unit and the ceiling mounted water/glycol condensing unit. Route the drain line to a frequently used maintenance sink so that running water can be observed and reported in a timely manner. Post a sign to alert people to report water flowing from the secondary drain pan. We recommend installing monitored leak detection equipment for the unit and supply lines and in the secondary drain pan. Check drain lines periodically for leaks, sediment buildup, obstructions, kinks and/or damage and verify that they are free running.

**NOTICE**

Risk of piping-system corrosion and freezing fluids. Can cause leaks resulting in equipment and very expensive building damage. Cooling coils and piping systems are at high risk of freezing and premature corrosion. Fluids in these systems must contain the proper antifreeze and inhibitors to prevent freezing and premature coil and piping corrosion. The water or water/glycol solution must be analyzed by a competent local water treatment specialist before start-up to establish the inhibitor and antifreeze solution requirement and at regularly scheduled intervals throughout the life of the system to determine the pattern of inhibitor depletion.

The complexity of water/glycol solution condition problems and the variations of required treatment programs make it extremely important to obtain the advice of a competent and experienced water treatment specialist and follow a regularly scheduled coolant fluid system maintenance program.

Water chemistry varies greatly by location, as do the required additives, called inhibitors, that reduce the corrosive effect of the fluids on the piping systems and components. The chemistry of the water used must be considered, because water from some sources may contain corrosive elements that reduce the effectiveness of the inhibited formulation. Sediment deposits prevent the formation of a protective oxide layer on the inside of the coolant system components and piping. The water/coolant fluid must be treated and circulating through the system continuously to prevent the buildup of sediment deposits and or growth of sulfate reducing bacteria.

Proper inhibitor maintenance must be performed in order to prevent corrosion of the system. Consult glycol manufacturer for testing and maintenance of inhibitors. Commercial ethylene glycol, when pure, is generally less corrosive to the common metals of construction than water itself. It will, however, assume the corrosivity of the water from which it is prepared and may become increasingly corrosive with use if not properly inhibited. We recommend installing a monitored fluid detection system that is wired to activate the automatic closure of field-installed coolant-fluid supply and return shut-off valves to reduce the amount of coolant-fluid leakage and consequential equipment and building damage. The shut-off valves must be sized to close-off against the maximum coolant-fluid system pressure in case of a catastrophic fluid leak.

**NOTICE**

Risk of frozen pipes and corrosion from improper coolant mixture. Can cause water leaks resulting in equipment and building damage.

When piping or the cooling unit may be exposed to freezing temperatures, charge the system with the proper percentage of glycol and water for the coldest design ambient temperature. Automotive antifreeze is unacceptable and must NOT be used in any glycol fluid system. Use only HVAC glycol solution that meets the requirements of recommended industry practices.

**NOTICE**

Risk of no-flow condition. Can cause equipment damage. Do not leave the water/coolant fluid supply circuit in a no-flow condition. Idle fluids allow the collection of sediment that prevents the formation of a protective oxide layer on the inside of tubes. Keep unit switched On and water/coolant fluid-supply circuit system operating continuously.

**NOTICE**

Risk of improper water supply. Can reduce humidifier efficiency or obstruct humidifier plumbing. Do not use a hot water source. It will cause deposits that will eventually block the fill-valve opening.

**NOTICE**

Risk of water backing up in the drain line. Leaking and overflowing water can cause equipment and building damage.

Do not install an external trap in the drain line. This line already has a factory trap installed inside the cabinet. Installation of a second trap will prevent drain water flow and will cause the water to overflow the drain pan.

Sagging condensate drain lines may inadvertently create an external trap.

**NOTICE**

Risk of doorway/hallway interference. Can cause unit and/or structure damage. The unit may be too large to fit through a doorway or hallway while on the skid. Measure the unit and passageway dimensions and refer to the installation plans prior to moving the unit to verify clearances.

**NOTICE**

Risk of damage from forklift. Can cause unit damage. Keep tines of the forklift level and at a height suitable to fit below the skid and/or unit to prevent exterior and/or underside damage.

**NOTICE**

Risk of improper storage. Can cause unit damage.

Keep the unit upright, indoors and protected from dampness, freezing temperatures and contact damage.

**Agency Listed**

Standard 60-Hz units are Intertek listed under the harmonized U.S. and Canadian product safety standard CSA C22.2 No. 60335-1 and UL 60335-1 for “Household and Similar Electrical Appliances - Part 1: General Requirements” and CSA C22.2 No. 60335-2-40 and UL 6033-2-40 for “Household and Similar Electrical Appliances - Part 2: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers.” ” and are marked with the Intertek cETLus logo.

T his appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

This appliance is designed to be installed in areas where maximum altitude is 2,000 m (6,562 ft).

For installation only in locations not accessible to the general public.

The appliance shall be installed according to national wiring regulations. For USA and Canada follow NFPA 70 National Electrical code and Canadian Electrical Code for the proper electrical installation.

**CAUTION: In order to avoid a hazard due to inadvertent resetting of the thermal cut-off, this appliance must not be supplied through and external switching device, such as a timer, or connected to a circuit that is regularly switched on and off by the utility.**

**WARNING! Air outlet of the appliance must be clear of obstruction all time**

R-32 Refrigerant
Safety Group A2L

**WARNING! Unventilated area where the appliance using flammable refrigerant is installed shall be so constructed that any refrigerant leak will not stagnate so as to create a fire or explosion hazard.**

**WARNING! Do not pierce or burn.**

**WARNING! Be aware that refrigerants may not contain odour.**

**NOTICE**

Servicing must be performed only as recommended by this manual.

Vertiv™ CoolPhase Ceiling units must be paired only with CoolPhase Condensing Unit

## 1.1 Pipe-work

Pipe-work shall be kept to a minimum.

Pipe-work shall be protected from physical damage and shall not be installed in an unventilated space.

Compliance with national gas regulations shall be observed.

Mechanical connections shall be accessible for maintenance purposes.

Pipe-work including piping material, pipe routing, and installation shall include protection from physical damage in operation and service and be in compliance with national and local codes and standards, such as ASHRAE 15, ASHRAE 15.2, IAPMO Uniform Mechanical Code, ICC International Mechanical Code, or CSA B52. All field joints shall be accessible for inspection prior to being covered or enclosed.

After completion of field piping for split systems, the field pipework shall be pressure tested with an inert gas and then vacuum tested prior to refrigerant charging.

Field-made refrigerant joints indoors shall be tightness tested. The test method shall have a sensitivity of 5 grams per year of refrigerant or better under a pressure of at least 0.25 times the maximum allowable pressure. No leak shall be detected.

## 1.2 Refrigerant Leak Detection System

In case of leakage, the following actions will be taken:

- The compressor will shut down
- The evaporator fan will be set to provide the minimum airflow depending on the unit, please see Table 1.1.
- The EEV will be closed completely
- Safety Shut-Off Valve, if installed, activates and will close completely, preventing additional refrigerant flow.

**Table 1.1 Minimum ventilation airflow for refrigerant leaks**

| | MMI12 | MMI24 | MMI36 | MMI48 | MMI60 | MMI96 |
|---|---|---|---|---|---|---|
| Airflow CFM (m3/h) | 219 (371) | 405 (688) | 588 (998) | 940 (1,598) | 1,355 (2,303) | 1,826 (3,102) |

**NOTE: In case of leakage, the unit will start mitigation actions and will send an alarm**

**NOTE: For the alarm to be reset, the sensor reading must be a minimum of 2.5% below the alarm setpoint (threshold): from 1% to 25%.**

**NOTE: The mitigation actions will continue 5 minutes after the problem has been solved.**

**NOTE: After the equipment is rebooted, the Leak Detector Sensor verifies that there's no leakage**

**NOTE: The alarm will disappear from the smart display once the sensor doesn't detect the concentration of R-32 refrigerant and the LSR Relay located in the eBox has been restarted by authorized personnel. It is imperative to verify physically if the leakage was mitigated before restarting the relay.**

**NOTE: : In case of leak of refrigerant, the unit will show an alarm in the display which cannot be deactivated until the leak has been repaired. Please follow the instructions provided to deactivate the alarm. After the equipment is rebooted, the Refrigerant Detection System will verify that there is no leakage. The alarm will be active until a manual verification has been done to confirm there is no refrigerant leakage and the unit has been reestablished by the operator.**

**NOTE: If replacement of the refrigerant detection system is required, it shall be replaced only with Danfoss DST GR32-AB-12 component, replacement must be performed only by trained personnel.**

## 1.3 Qualification of workers

Every working procedure that affects safety means shall only be carried out by competent personnel.

Information of procedures additional to usual information for refrigerating appliance installation, repair, maintenance and decommission procedures is required when an appliance with flammable refrigerants is affected.

The training of these procedures is carried out by national training organizations or manufacturers that are accredited to teach the relevant national competency standards that may be set in legislation. The achieved competence should be documented by a certificate.

### 1.3.1 Safety concepts

Unventilated. Safety of the appliance does not depend on ventilation of the housing. Switching off the appliance or opening of the housing has no significant effect on safety. Nevertheless, it is possible that leaking refrigerant may accumulate inside the enclosure and flammable atmosphere will be released when the enclosure is opened.

Ventilated enclosure. Safety of the appliance depends on ventilation of the housing. Switching off the appliance or opening of the enclosure has a significant effect on safety. Care should be taken to ensure sufficient ventilation before.

Ventilated room. Safety of the appliance depends on the ventilation of the room. Switching off the appliance or opening of the housing has no significant effect on safety. The ventilation of the room shall not be switched off during repair procedures.

### 1.3.2 Correct working procedures

#### 1.3.2.1 Commissioning

Ensure that the floor area is sufficient for the refrigerant charge or that the ventilation duct is assembled in a correct manner.

Connect the pipes and carry out a leak test before charging with refrigerant.

Check safety equipment before putting it into service.

#### 1.3.2.2 Maintenance

Ensure sufficient ventilation at the repair place.

Be aware that malfunction of the equipment may be caused by refrigerant loss and a refrigerant leak is possible.

Discharge capacitors in a way that won't cause any spark. The standard procedure to short circuit the capacitor terminals usually creates sparks.

Reassemble sealed enclosures accurately. If seals are worn, replace them.

Check safety equipment before putting into service.

#### 1.3.2.3 Repair

Ensure sufficient ventilation at the repair place.

Be aware that malfunction of the equipment may be caused by refrigerant loss and a refrigerant leak is possible.

Discharge capacitors in a way that won't cause any spark.

When brazing is required, the following procedures shall be carried out in the right order:

- Safely remove the refrigerant following local and national regulations. If the recovery is not required by national regulations, drain the refrigerant to the outside. Take care that the drained refrigerant will not cause any danger. In doubt, one person should guard the outlet. Take special care that drained refrigerant will not float back into the building.
- Purge the refrigerant circuit with oxygen free nitrogen.
- Evacuate the refrigerant circuit.
- Purge the refrigerant circuit with nitrogen for 5 min (not required for A2L refrigerants).
- Evacuate again (not required for A2L refrigerants).
- Remove parts to be replaced by cutting, not by flame.
- Purge the braze point with nitrogen during the brazing procedure.
- Carry out a leak test before charging with refrigerant.

Reassemble sealed enclosures accurately. If seals are worn, replace them.

Check safety equipment before putting into service.

#### 1.3.2.4 Decommissioning

If the safety is affected when the equipment is putted out of service, the refrigerant charge shall be removed before decommissioning.

Ensure sufficient ventilation at the equipment location.

Be aware that malfunction of the equipment may be caused by refrigerant loss and a refrigerant leak is possible.

Discharge capacitors in a way that won't cause any spark.

Remove the refrigerant. If the recovery is not required by national regulations, drain the refrigerant to the outside. Take care that the drained refrigerant will not cause any danger. In doubt, one person should guard the outlet. Take special care that drained refrigerant will not float back into the building.

When flammable refrigerants except A2L refrigerants are used:

- Evacuate the refrigerant circuit.
- Purge the refrigerant circuit with nitrogen for 5 min.
- Evacuate again.
- Fill with nitrogen up to atmospheric pressure.
- Put a label on the equipment that the refrigerant is removed.

#### 1.3.2.5 Disposal

Ensure sufficient ventilation at the working place.

Remove the refrigerant. If the recovery is not required by national regulations, drain the refrigerant to the outside. Take care that the drained refrigerant will not cause any danger. In doubt, one person should guard the outlet. Take special care that drained refrigerant will not float back into the building.

When flammable refrigerants are used:

- Evacuate the refrigerant circuit.
- Purge the refrigerant circuit with oxygen free nitrogen for 5 min.
- Evacuate again, (not required for A2L refrigerants).
- Cut out the compressor and drain the oil.

## 1.4 Installation, Maintenance, Repair, and Decommissioning

### 1.4.1 Checks to the area

Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized. For repair to the refrigerating system, servicing procedure shall be completed prior to conducting work on the system.

### 1.4.2 Work procedure

Work shall be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapour being present while the work is being performed.

### 1.4.3 General work area

All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided.

### 1.4.4 Checking for presence of refrigerant

The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed or intrinsically safe.

### 1.4.5 Presence of fire extinguisher

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. Have a dry powder or CO2 fire extinguisher adjacent to the charging area.

### 1.4.6 No ignition sources

No person carrying out work in relation to a refrigerant system which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. “No Smoking” signs shall be displayed.

### 1.4.7 Ventilated area

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

### 1.4.8 Checks to the refrigerant equipment

Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times Vertiv maintenance and service guidelines shall be followed. If in doubt, consult the technical department for assistance.

The following checks shall be applied to installations using flammable refrigerants:

- The actual refrigerant charge is in accordance with the room size within which the refrigerant containing parts are installed.
- The ventilation machinery and outlets are operating adequately and are not obstructed.
- If an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant.
- Marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected.
- Refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

### 1.4.9 Checks to electrical devices

Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment, so all parties are advised.

Initial safety checks shall include:

- That capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking.
- That no live electrical components and wiring are exposed while charging, recovering or purging the system.
- That there is continuity of earth bonding.

### 1.4.10 Repair to sealed components and intrinsically safe components

Sealed electrical components shall be replaced.

Intrinsically safe components must be replaced.

### 1.4.11 Cabling

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.

### 1.4.12 Detection of flammable refrigerants

Under no circumstances shall potentially sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

Electronic leak detectors may be used to detect refrigerant leaks, in the case of flammable refrigerants the sensitivity may not be adequate or may need re-calibration. Detection equipment shall be calibrated in a refrigerant-free area. Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25 % maximum) is confirmed.

Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work. Examples of leak detection fluids are bubble method and fluorescent method agents.

If a leak is suspected, all naked flames shall be removed/extinguished.

If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak. Removal of refrigerant shall be according to Removal and evacuation procedures.

### 1.4.13 Removal and evacuation

When breaking into the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration. The following procedure shall be adhered to:

- Safely remove refrigerant following local and national regulations.
- Evacuate.
- Purge the circuit with inert gas.

- Evacuate.
- continuously flush or purge with inert gas when using flame to open circuit.
- Open the circuit.

The refrigerant charge shall be recovered into the correct recovery cylinders. For appliances containing flammable refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

For appliances containing flammable refrigerants, refrigerants purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the maximum allowable pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process shall be repeated until no refrigerant is within the system. When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place. This operation is absolutely vital if brazing operations on the pipe-work are to take place.

The outlet for the vacuum pump is not close to any potential ignition sources and ventilation shall be available.

### 1.4.14 Charging procedures

In addition to conventional charging procedures, the following requirements shall be followed:

- Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
- Cylinders shall be kept in an appropriate position according to the instructions.
- Ensure that the refrigerating system is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- Extreme care shall be taken not to overfill the refrigerating system.

Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

### 1.4.15 Decommissioning

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.

- Become familiar with the equipment and its operation.
- Isolate system electrically.
- Before attempting the procedure, ensure that:
  - Mechanical handling equipment is available, if required, for handling refrigerant cylinders;
  - All personal protective equipment is available and being used correctly;
  - The recovery process is supervised at all times by a competent person;
  - Recovery equipment and cylinders conform to the appropriate standards.
- Pump down refrigerant system, if possible.
- If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.

- Make sure that cylinder is situated on the scales before recovery takes place.
- Start the recovery machine and operate in accordance with instructions.
- Do not overfill cylinders (no more than 80 % volume liquid charge).
- Do not exceed the maximum working pressure of the cylinder, even temporarily.
- When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
- Recovered refrigerant shall not be charged into another refrigerating system unless it has been cleaned and checked.

### 1.4.16 Labeling

Equipment shall be labelled stating that it has been de-commissioned and emptied of refrigerant. The label shall be dated and signed. For appliances containing flammable refrigerants, ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.

### 1.4.17 Recovery

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labelled for that refrigerant (i.e. Special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of all appropriate refrigerants including, when applicable, flammable refrigerants. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition. Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release. Consult manufacturer if in doubt.

The recovered refrigerant shall be returned to the refrigerant supplier in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

USA and Canada. The recovered refrigerant shall be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

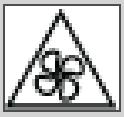
If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The evacuation process shall be carried out prior to returning the compressor to the suppliers. Only electric heating to the compressor body shall be employed to accelerate this process. When oil is drained from a system, it shall be carried out safely.

USA and Canada. If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

## 1.5 Symbol Description

The unit is marked with symbols for different purposes. To avoid risks, read these carefully and follow the instructions.

**Table 1.2 User manual symbology**

| Symbology | Description | |
|---|---|---|
|  | This symbol is displayed to indicate matters and operations that can cause risk | |
| | | Risk in terms of matters and operations |
| | WARNING | Risk of death or severe injury if instructions are not followed |
| | CAUTION | Risk of minor or moderate injury if instructions are not followed |
|  | Protective earthing. Permanent earthing shall always remain connected other than for small periods of maintenance | |
|  | Matters related to the appliance's operation | |
|  | Appliance servicing. The information in the manual is for use by qualified service technicians who are familiar with the safety procedures and equipped with the correct tools and test instruments | |
|  | Flammable refrigerants | |
|  | Flammable refrigerants | |
|  | Moving fan blades during regular operation | |
|  | Hazardous voltage or the risk of electric shock. To indicate the level of risk, it might include the wording ´CAUTION´ or ´WARNING´ | |
|  | Potential hot surface(s) | |

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# 2 Product Overview

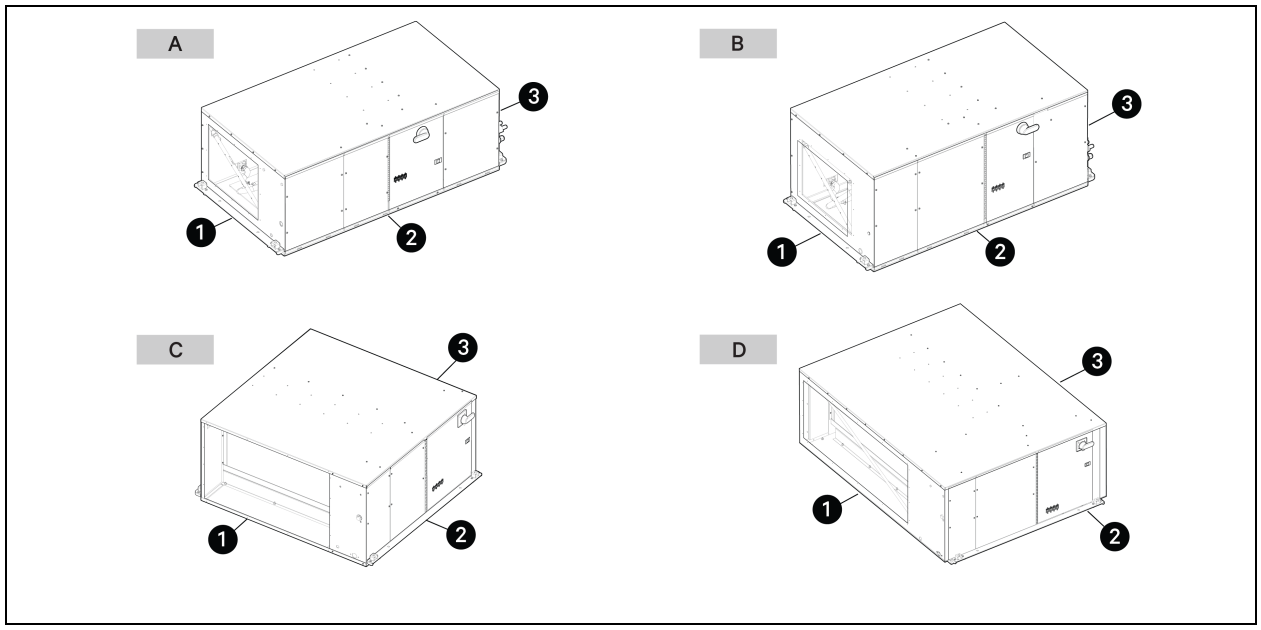
The Vertiv™ CoolPhase Ceiling is a ceiling mounted fully featured cooling system for Small IT rooms, which occupies zero floor space. It comes in 6 different capacities, 1, 2, 3, 4, 5 and 8 ton. The CoolPhase Ceiling offers multiple heat rejection and power supply options.

Standard features include EC fan, inverter compressor, Microchannel HEX to minimize refrigerant charge, wall mounted display and Remote monitoring through SNMP, HTTP, and Modbus.

The main features of the CoolPhase Ceiling are: it has more than 10,000 possible configurations, it works with digital scroll compressors, it has humidity control and three reheat types, a free cooling option to save operating costs, and remote monitoring.

This section describes the model numbers for CoolPhase Ceilingunits and components.

**Figure 2.1 Vertiv™ CoolPhase Ceiling models**




| Item | Description | Item | Description |
|---|---|---|---|
| A | MMI12 (1 Ton) | 1 | Return Air side of the unit |
| B | MMI24/36 (2 & 3 Tons) | 2 | Front of the unit |
| C | MMI48/60 (4 & 6 Tons) | 3 | Supply Air side of the unit |
| D | MMI96 (8 Tons) | | |

## 2.1 Vertiv™ CoolPhase Ceiling Model Nomenclature

The tables below describe each digit of the 25-digit configuration number. The 14-digit model/number consists of the first 10 digits and last 4 digits of the configuration number. Table 2.2 below describes each digit of the model number.

**Table 2.1 Vertiv™ CoolPhase Ceiling 14-Digit Configuration Number**

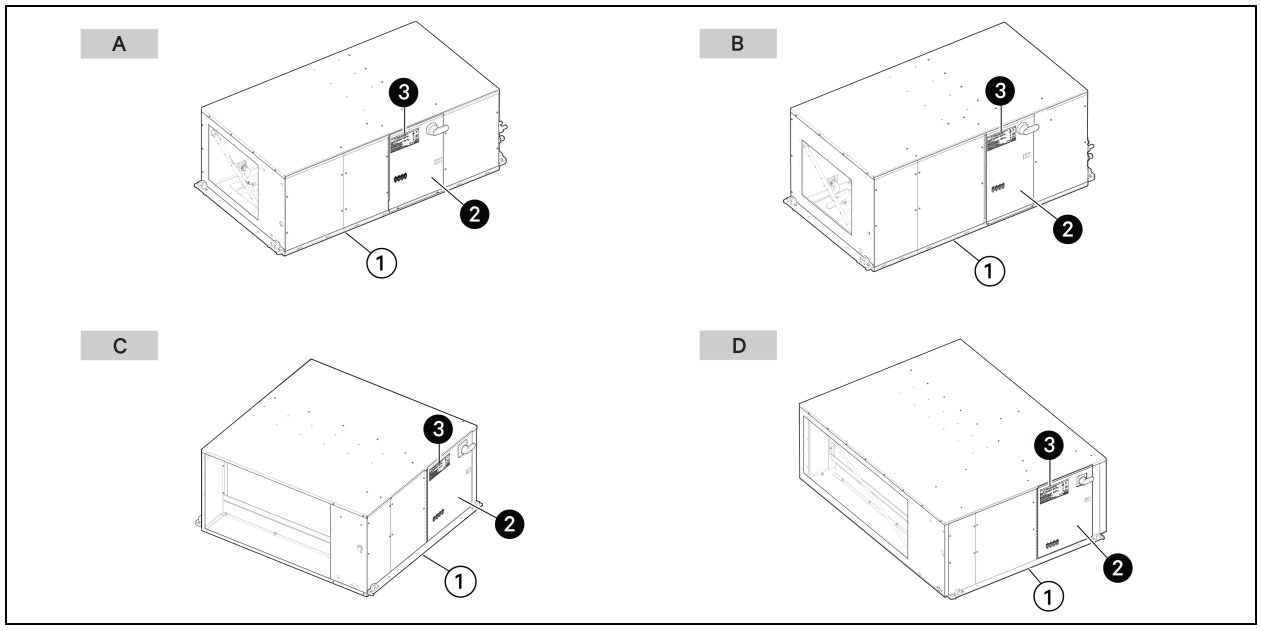
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M | M | I | 1 | 2 | E | 0 | 0 | R | 0 | 0 | N | 0 | A | 0 | N | 0 | 0 |

**Table 2.2 Model Number Digit Definitions**

| Digit | Description | |
|---|---|---|
| Digits 1 and 2 | Unit Family | MM = Vertiv™ CoolPhase Ceiling |
| Digits 3 | Inverter | I |
| Digits 4 and 5 | Nominal Cooling Capacity (Sizes) | 12 - 1 Ton (12 kBtuh)<br>24 - 2 Tons (24 kBtuh)<br>36 - 3 Tons (36 kBtuh)<br>48 - 4 Ton (48 kBtuh)<br>60 - 5 Ton (60 kBtuh)<br>96 - 8 Ton (96 kBtuh) |
| Digit 6 | Unit type | E - Air Cooled<br>K - Air Cooled w/Free Cooling |
| Digit 7 | Free | |
| Digit 8 | Supply Power | 0 = 208/230 V, 1 Ph, 50/60 Hz<br>1 = 208/230 V, 3 Ph, 60 Hz<br>4 = 460 V, 3 Ph, 60 Hz |
| Digit 9 | Humidifier | R = Remote Contact<br>J = Steam Humidifier |
| Digit 10 | Reheat | 0 = No reheat<br>S = Modulating Reheat |
| Digit 11 | Disconnect (high-voltage) | 2 = Locking, 65 k SCCR |
| Digit 12 | Sensors | N = Base Package (with Filter Clog, High Temp Sensor, and Unity Card)<br>2 = Base Package and Smoke Sensor |
| Digit 13 | Free | |
| Digit 14 | Version | A - Standard<br>S - ETO |
| Digits 15 to 18 | Factory Configuration Number | 0000 = Standard<br>4 digits other than 0= Engineering To Order designated number |

## 2.2 Nameplate Label

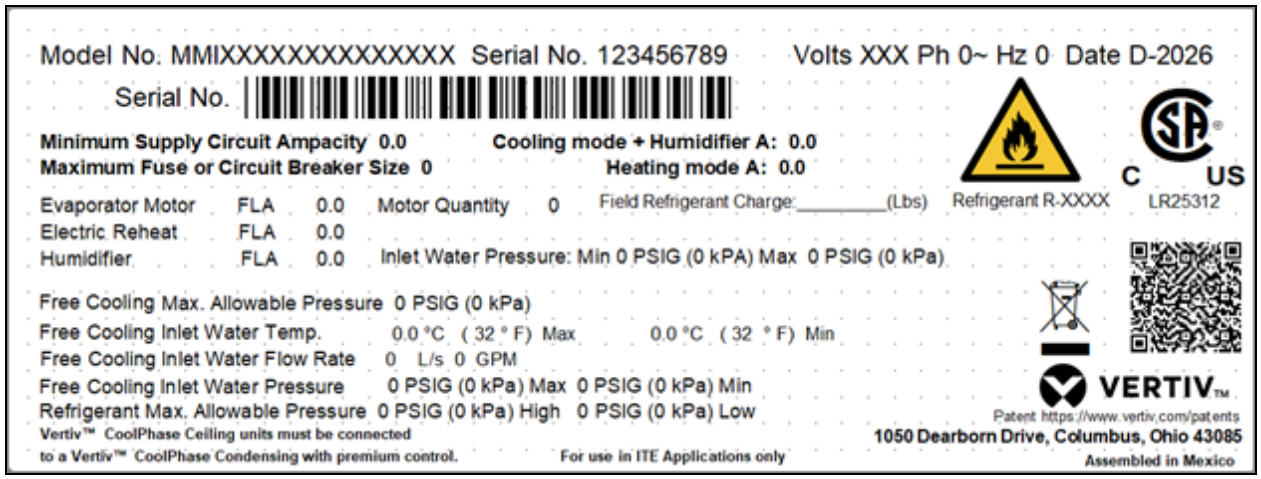
**Figure 2.2 Nameplate Label Location on CoolPhase Ceiling Units**




| Item | Description | Item | Description |
|---|---|---|---|
| A | MMI12 (1 Ton) | 1 | Front of the Indoor Unit |
| B | MMI24/36 (2 & 3 Ton) | 2 | Cover of the electrical box (E-Box) |
| C | MMI48/60 (4 & 6 Ton) | 3 | Nameplate |
| D | MMI96 (8 Ton) | | |

NOTE: NOTE: The side panel of the electrical box may be labeled with warnings, cautions, and relevant notices. To identify the nameplate label, refer to Figure 2.3 below.

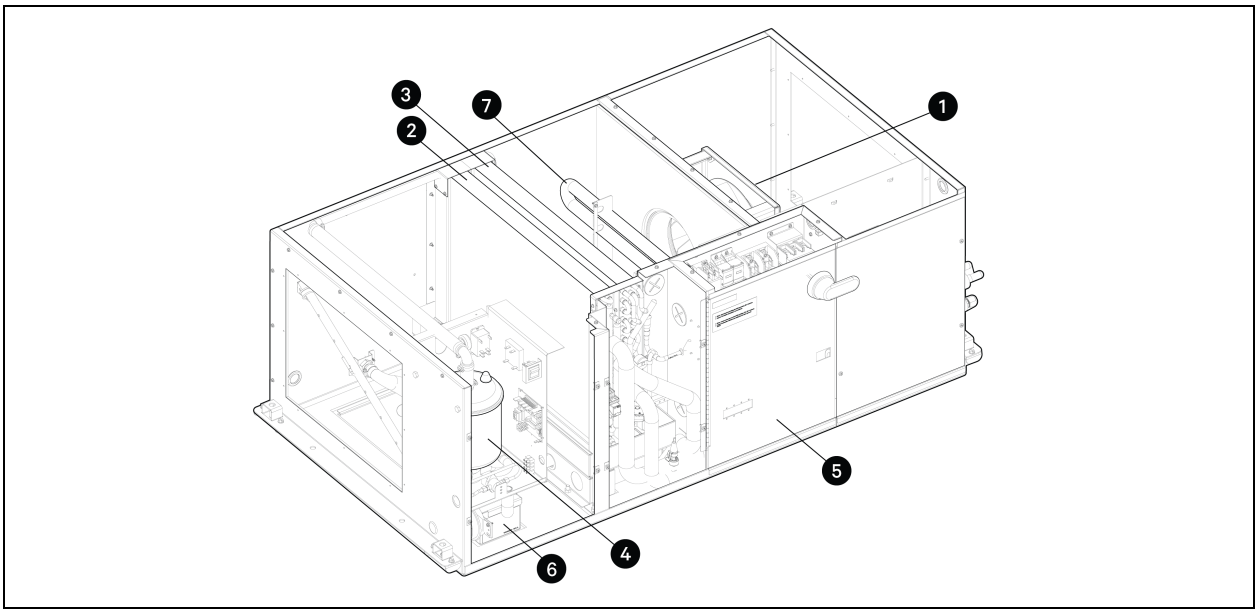
**Figure 2.3 CoolPhase Ceiling Nameplate Information**



## 2.3 Component Location

The unit component locations are described in the submittal documents included in the SL-80138 CoolPhase Ceiling System Design Catalog. The following image lists the main components.

**Figure 2.4 Component Location - MMI12 (1 Ton) unit as reference**



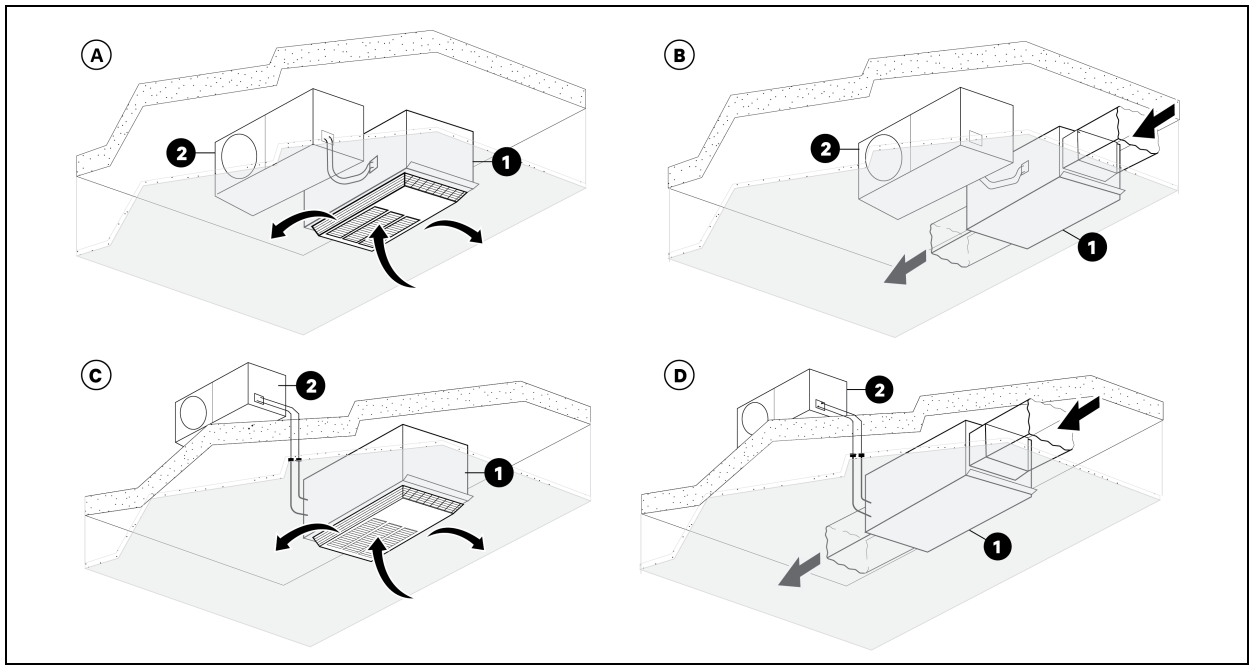

| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Direct Drive Fan with Variable Speed EC Motor | 5 | Electric Box |
| 2 | Evaporator Coil DX | 6 | Smoke Sensor (optional) |
| 3 | Evaporator Coil Free Cooling (Optional) | 7 | Electric Reheat (optional) |
| 4 | Humidifier (optional) | | |

**NOTE: Some components' location may vary depending of the model.**

## 2.4 System Configurations

To know the different parts of the system configurations, refer to section Component Location above

**Figure 2.5 Air Cooled units**




| Item | Description |
|---|---|
| A | Split system with condensing unit ceiling-mounted and supply/return air plenum (1, 2, and 3 Ton systems only) |
| B | Split system with condensing unit ceiling-mounted and ducted evaporator (1, 2, and 3 Ton systems only) |
| C | Split system with condensing unit installed outdoors and supply/return air plenum (1, 2 and 3 Ton systems only) |
| D | Split system with condensing unit installed outdoors and ducted supply/return air (all models) |
| 1 | Evaporator unit |
| 2 | Condensing unit |

## 2.5 Accessories

The optional accessories available for the indoor unit are listed below.

**Table 2.3 Accessories for Vertiv™ CoolPhase Ceiling units**

| SKU | Item Accessory | Description |
|---|---|---|
| CEILFILTB-XS | Filter box with duct flanges | Ceiling Filter Box, 1 Ton |
| CEILFILTB-S | | Ceiling Filter Box, 2 and 3 Ton |
| CEILFILTB-M | | Ceiling Filter Box, 4 and 6 Ton |
| CEILFILTB-L | | Ceiling Filter Box, 8 Ton |

**Table 2.3 Accessories for Vertiv™ CoolPhase Ceiling units (continued)**

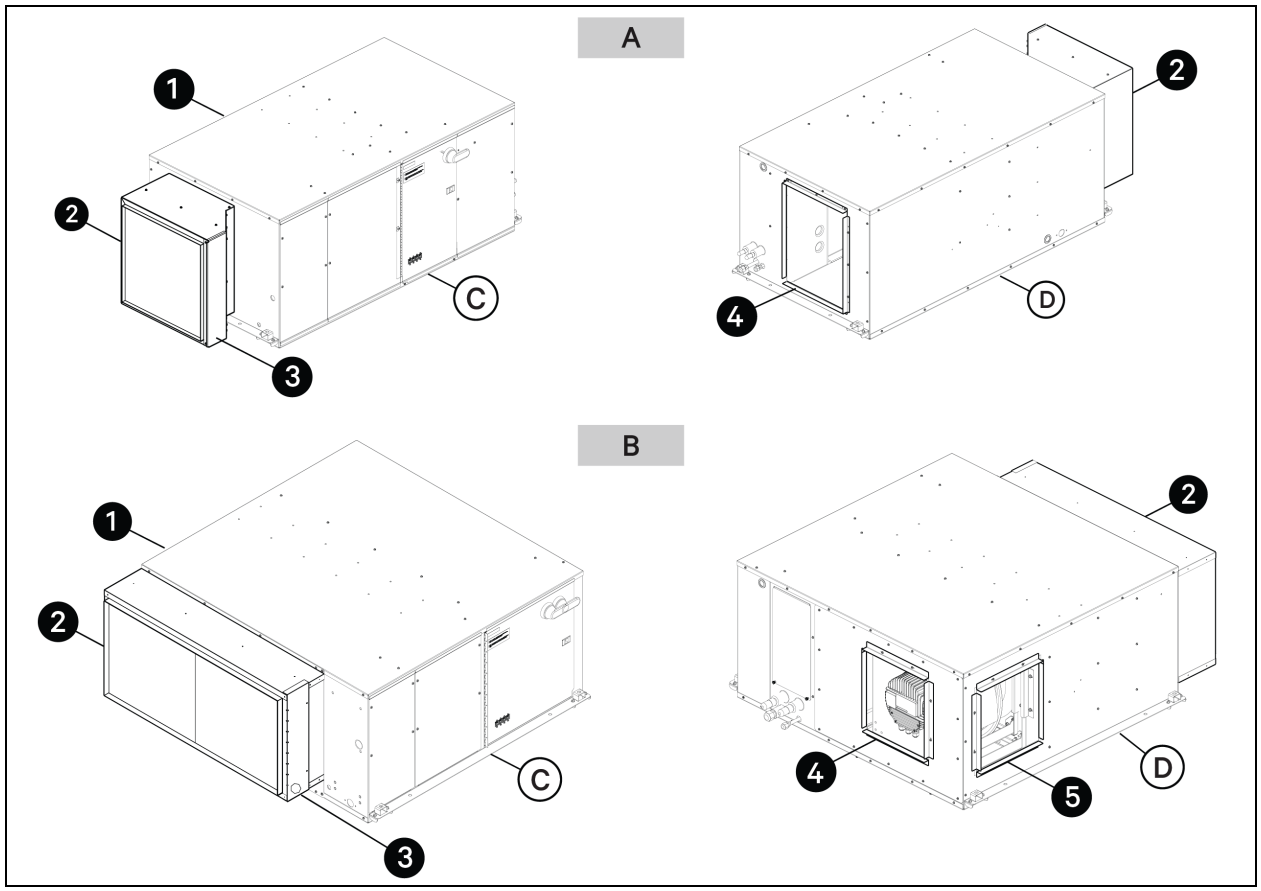
| SKU | Item Accessory | Description |
|---|---|---|
| CEILDUCTKIT-XS | Duct Flange Kit | Indoor Duct Flange Kit, 1 Ton |
| CEILDUCTKIT-S | | Indoor Duct Flange Kit, 2 and 3 Ton |
| CEILDUCTKIT-M | | Indoor Duct Flange Kit, 4 and 6 Ton |
| CEILDUCTKIT-L | | Indoor Duct Flange Kit, 8 ton |
| CEILAIRPLEN-XS | Air Plenum | Ceiling Air Plenum, 1 Ton |
| CEILAIRPLEN-S | | Ceiling Air Plenum, 2 and 3 Ton |
| CEILGRILLE-XS | Supply & Return Grille | Ceiling Supply & Return Grille, 1 Ton |
| CEILGRILLE-S | | Ceiling Supply & Return Grille, 2 and 3 Ton |
| CEILPMPKIT-L | Condensate Pump Kit | Ceiling Condensate Pump Kit 230/1 & 230/3 |
| CEILPMPKIT-H | | Ceiling Condensate Pump Kit 460/3 |
| CEILSENS | Remote Sensors | Ceiling Remote Sensors |
| LT410 | Liqui-Tect™ 410 Point Leak Detection Sensor | Single-point detection for leaks |
| LT460 | Liqui-Tect™ 460 Zone Leak Detection Sensor | Zone detection for leaks |

### 2.5.1 Filter Box with Duct Flanges

For detailed information on installing the Filter Box Kit for 1 Ton, 2 & 3 Ton, 4 & 5 Ton, and 8 Ton, please refer to the SL-80134 Vertiv™ CoolPhase Ceiling Filter Box Kit Quick Installation Guide.

The kit includes a MERV 8 filter and duct flanges for air supply connection.

**Figure 2.6 Filter box with duct flanges**




| Item | Description | Item | Description |
|---|---|---|---|
| A | 1-, 2- & 3-Tons models | 1 | Evaporator |
| B | 4-, 5- & 8-Tons models | 2 | Filter box assembly |
| C | Front of unit | 3 | Filter access door |
| D | Rear of Unit | 4 | Air Supply Duct Flange |
| | | 5 | Alternate location of Air Supply Duct Flange (on 4-, 5- & 8-Ton models) |

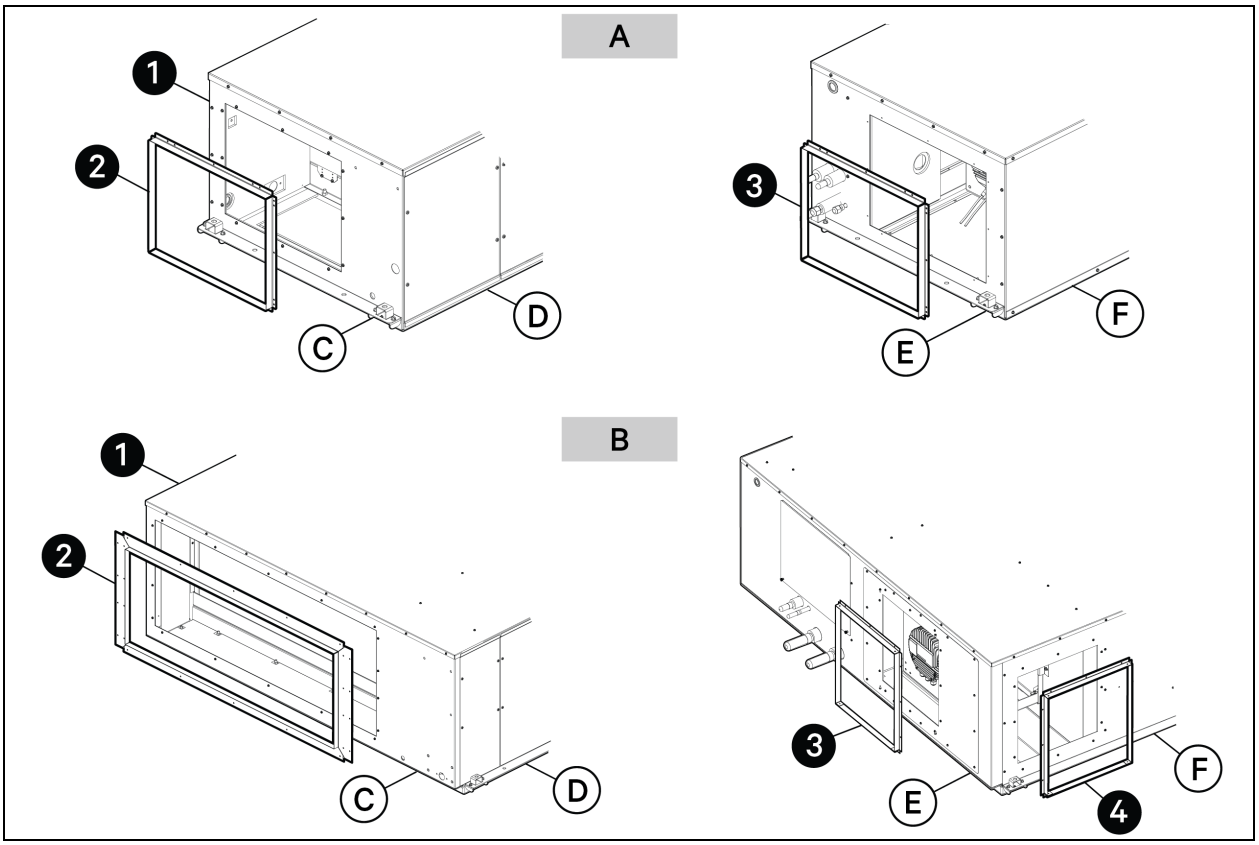
**NOTE: For the filter access door, a recommended clearance of 30 in (762 mm) should be provided for component access and removal.**

**NOTE: For 4, 5, and 8 Ton models, duct flanges may be installed either on the rear side of the unit or on the side as an alternate location. Remove panel and cover rear discharge opening before attaching duct flanges.**

## 2.5.2 Duct Flanges

For detailed information on installing the Duct Flange Kit, please refer to the SL-80136 Vertiv™ CoolPhase Ceiling Duct Flange Kit Quick Installation Guide.

**Figure 2.7 Duct flange**

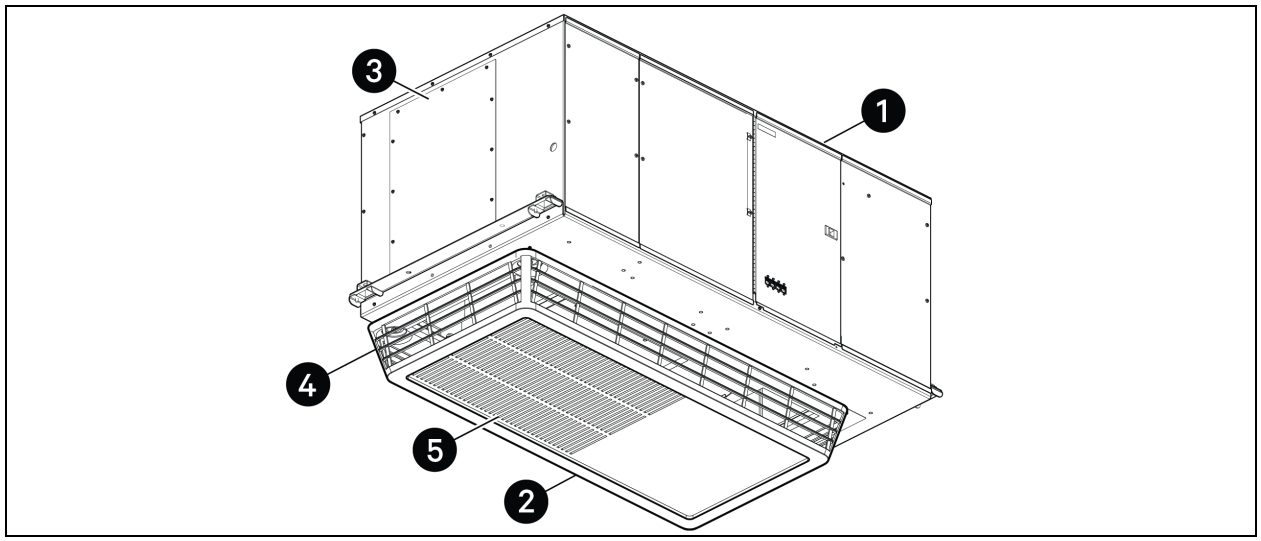



| Item | Description | Item | Description |
|---|---|---|---|
| A | 1-, 2- & 3-Tons models | F | Rear of Unit |
| B | 4-, 5- & 8-Tons models | 1 | Evaporator |
| C | Return side of the unit | 2 | Air Return Duct Flange |
| D | Front of unit | 3 | Air Supply Duct Flange 1 (for all models) |
| E | Discharge side of unit | 4 | Air Supply Duct Flange 2 (for 4-, 5- & 8-Ton models only) |

### 2.5.3 Air Distribution Plenum

For detailed information on installing the Air Distribution Plenum, part number - CEILAIRPLEN-XS and CEILAIRPLEN-S, please refer to the SL-80137 Vertiv™ CoolPhase Ceiling Air Distribution Plenum Quick Installation Guide.

**Figure 2.8 Air distribution plenum for MMI 1, 2 and 3 Ton**

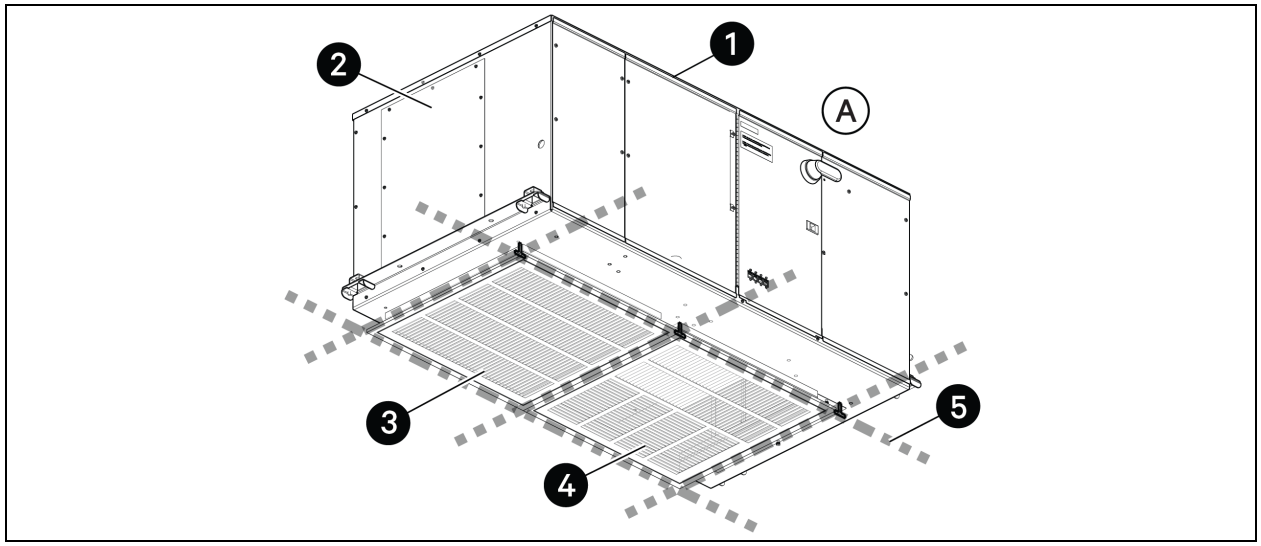



| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Evaporator | 4 | Air distribution return inlet |
| 2 | Air distribution plenum | 5 | Air distribution supply outlet |
| 3 | Air return cover | | |

## 2.5.4 Downflow Grille

For detailed information on installing the Supply and Return Grille for 1-, 2- and 3-Ton models, please refer to the SL-80135 Vertiv™ CoolPhase Ceiling Supply and Return Grille Quick Installation Guide.

**Figure 2.9 Downflow Grille for MMI1, 2 and 3 Ton**



| Item | Description | Item | Description |
|---|---|---|---|
| A | Front of indoor unit | 3 | One-way Return Grille |
| 1 | Evaporator | 4 | Three-way Supply Grille |
| 2 | Air return cover | 5 | 24"x24" Drop ceiling T-bars (Not included) |

## 2.5.5 Condensate Pump Kit

These are different models of the Condensate Pump kits:

- CEILPMPKIT-L: Ceiling Condensate Pump Kit 230/1 & 230/3
- CEILPMPKIT-H: Condensate Pump Kit 460/3

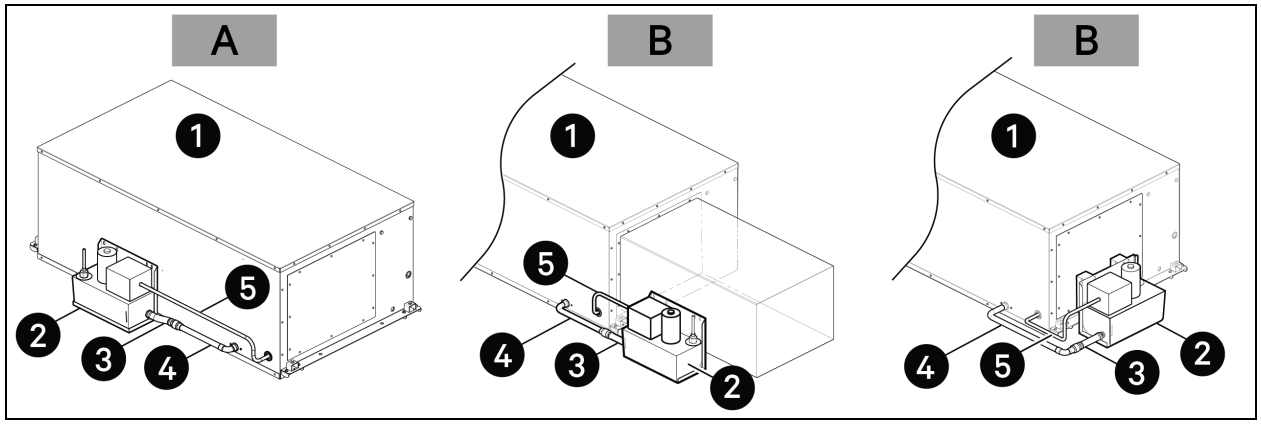
The Condensate Pump can be installed in one of the following 3 ways which may apply to different models. Refer to the document SL-80133 as mentioned above.

Mounting Option 1 - The condensate pump is to be mounted to the back of the unit, or on the air inlet end.

Mounting Option 2 - For ducted air, mount the condensate pump to the air duct with the support bracket.

Mounting Option 3 - For non-ducted air, mount the condensate pump to the discharge end using two standoff brackets and the support bracket.

**Figure 2.10 Condensate Pump Kit**




| Item | Description | Item | Description |
|---|---|---|---|
| A | Option 1 | 3 | Flexible Tubing |
| B | Option 2 | 4 | Field supplied Rigid tubing |
| C | Option 3 | 5 | Field supplied Flexible electrical conduit |
| 1 | Evaporator | 6 | Field supplied Drain line |
| 2 | Condensate Pump | 7 | Condensate pump support bracket |

For detailed information on installing the Vertiv™ CoolPhase Ceiling Condensate Pump Kit (part numbers CEILPMPKIT-L and CEILPMPKIT-H), please refer to the SL-80133 Vertiv™ CoolPhase Ceiling Condensate Pump Kit Quick Installation Guide.

### 2.5.6 Leak Detection Accessories

The system supports compatibility with Liebert® Liqui-Tect™ LT410 point leak detection sensors and LT460 zone leak detection modules, providing leak detection monitoring when used as part of the overall system installation.

Liebert® Liqui Tect™ 410 (LT410) is a solid state point leak detection sensor for remote mounting that monitors a specific location for water leaks, internal faults, and power loss, and provides dual outputs for alarm and monitoring connections.

The Liebert® Liqui Tect™ 460 KIT provides reliable leak detection with up to 100 feet of cable, selectable alarm modes, LED status indicators, and dual outputs for integration with alarms or management systems. It continuously monitors leaks, faults, and power failures, making it ideal for protecting sensitive equipment in critical environments.

For more information about specifications and installation, refer to SL-31050 Liebert® Liqui-Tect™ 410 Point Leak Detection Sensor and SL-31052 Liebert® Liqui-Tect™ 460 Zone Leak Detection Sensor Product Specification and Installation Guides.

## 2.6 System Data

**Table 2.4 Vertiv™ CoolPhase Ceiling technical description**

| Models | | MMI12 (1 Ton) | MMI24 (2 Ton) | MMI36 (3 Ton) | MMI48 (4 Ton) | MMI60 (6 Ton) | MMI96 (8 Ton) |
|---|---|---|---|---|---|---|---|
| Region | | NAM | | | | | |
| Certification marks | | cCSAus | | | | | |
| Piping Connections | | Flare Connection | | | | | |
| Condenser Fan | | EC Motor | | | | | |
| External Static Pressure | | 0.20 in H2O (50 Pa) | | | | | |
| Sensible Cooling Capacity (kW) @ 26.7° C (80° F) RAT, 38% RH, 35° C (95° F) outdoor temp | | 1 (3.5) | 2 (7) | 3 (11) | 4 (15) | 6 (21) | 8 (28) |
| Power Supply Evaporator | | 208/230 V, 1-Ph, 50/60 Hz | | 208/230 V, 1-Ph, 50/60 Hz<br>208/230 V, 3-Ph, 60 Hz<br>460 V, 3-Ph, 60 Hz | 208/230 V, 3-Ph, 60 Hz<br>460 V, 3-Ph, 60 Hz | | |
| Refrigerant | | R-32 | | | | | |
| Max Equivalent Length of Pipe between Indoor Unit and Condensing Unit | | 196.85 ft (60 m) | | | 295.27 ft (90 m) | | |
| Maximum refrigerant charge in the complete system (indoor and outdoor), lb (kg) | | 18.5 (8.4) | 34.2 (15.5) | 49.7 (22.5) | 79.5 (36.0) | 114.5 (51.9) | 154.3 (70.0) |
| Height between Indoor and Condensing Unit | Condensing unit placed higher than indoor unit | 98.43 ft (30 m) | | | 60 ft (18.3 m) | 98.43 ft (30 m) | |
| | Condensing unit placed lower than indoor unit | -26.25 ft (-8 m) | | | -15 ft (4.6 m) | -26.25 ft (-8 m) | |

1. Certified in accordance with the AHRI Datacom Cooling Certification Program at AHRI Standard 1360 (I-P) Standard Rating Conditions. Certified units may be found in the AHRI Directory at www.ahridirectory.org.
2. Some options or combinations of options may result in reduced air flow. Consult factory for recommendations.

3. Data rated at 100% fan speed and with Standard Feature filter.
4. Net capacity data has fan motor heat factored in for all ratings.
5. Performance data generated in GRS (Global Rating System).

**Table 2.5 Storage Environment of the CoolPhase Condensing Unit**

| Item | Requirements |
|---|---|
| Storage environment | Store the unit in its original factory packaging in a clean indoor environment with good ventilation and no dust. |
| Ambient temperature | -40 °C ~+70 °C (-40 ~ +158 °F) |
| Ambient humidity | Less than 95% RH @ 30 °C (86 °F) |

**Table 2.6 Operating limits—Air Cooled Systems**

| Parameter | | Design Condition | |
|---|---|---|---|
| | | Minimum | Maximum |
| nit Entering Air Conditions | Temperature | 64.4° F (18° C) | 113 °F (45° C) |
| | Relative Humidity | 17% | 60% |
| Storage Conditions | Temperature | -4° F (-20° C) | 118° F (48° C) |
| | | NOTE: Unit remains operational up to 125.6 °F (52 °C) with reduced capacity | |
| Power Supply Tolerances | | Voltage ± 10% | |
| | | Frequency ±2 Hz | |

The sound data is without the Low Sound Package compressor jacket and sound deadening panel insulation installed.

Sound power is an absolute measurement that can be used for comparisons when all sound measurement parameters match exactly.

**Table 2.7 Sound Data – MMI12 (1 Ton models)**

| Model Type | | | MMI12 | | |
|---|---|---|---|---|---|
| Sound Power Level (PWL, dB(A)) | Airflow | SCFM | 816 | 579 | 426 |
| | | m3/h | 1386 | 984 | 724 |
| | External Static Pressure, in w.g. | | 0.2 | 0.2 | 0.2 |
| | Filter | | MERV 8 | MERV 8 | MERV 8 |
| | Free Cooling Coil | | NO | NO | NO |
| | Octave Band Frequency (Hz) | 63 | 38 | 35 | 39 |
| | | 125 | 52 | 52 | 41 |
| | | 250 | 51 | 51 | 42 |
| | | 500 | 55 | 54 | 45 |
| | | 1000 | 55 | 53 | 44 |
| | | 2000 | 54 | 52 | 44 |
| | | 4000 | 53 | 52 | 42 |
| | | 8000 | 47 | 47 | 30 |
| | A-Scale Weighted, dB(A) | | 63 | 55 | 52 |
| | At Discharge Side, 2 m Distance, 1.5 m Above Ground, Free Field Conditions (2 m, f.f, dBA) | | 52 | 45 | 40 |

**Table 2.8 Sound Data – MMI24 (2 Ton models)**

| Model Type | | | MMI24 | | |
|---|---|---|---|---|---|
| Sound Power Level (PWL, dB(A)) | Airflow | SCFM | 1451 | 952 | 725 |
| | | m3/h | 2465 | 1617 | 1232 |
| | External Static Pressure, in w.g. | | 0.2 | 0.2 | 0.2 |
| | Filter | | MERV 8 | MERV 8 | MERV 8 |
| | Free Cooling Coil | | NO | NO | NO |
| | Octave Band Frequency (Hz) | 63 | 34 | 29 | 34 |
| | | 125 | 50 | 52 | 49 |
| | | 250 | 52 | 47 | 45 |
| | | 500 | 61 | 56 | 53 |
| | | 1000 | 59 | 53 | 52 |
| | | 2000 | 56 | 51 | 47 |
| | | 4000 | 53 | 46 | 42 |
| | | 8000 | 49 | 41 | 34 |
| | A-Scale Weighted, dB(A) | | 63 | 61 | 56 |
| | At Discharge Side, 2 m Distance, 1.5 m Above Ground, Free Field Conditions (2 m, f.f, dBA) | | 52 | 50 | 46 |

**Table 2.9 Sound Data – MMI36 (3 Ton models)**

| Model Type | | | MMI36 | | |
|---|---|---|---|---|---|
| Sound Power Level (PWL, dB(A)) | Airflow | SCFM | 1533 | 1296 | 1130 |
| | | m3/h | 2605 | 2202 | 1920 |
| | External Static Pressure, in w.g. | | 0.2 | 0.2 | 0.2 |
| | Filter | | MERV 8 | MERV 8 | MERV 8 |
| | Free Cooling Coil | | NO | NO | NO |
| | Octave Band Frequency (Hz) | 63 | 32 | 32 | 36 |
| | | 125 | 51 | 49 | 45 |
| | | 250 | 50 | 48 | 47 |
| | | 500 | 56 | 54 | 51 |
| | | 1000 | 55 | 53 | 51 |
| | | 2000 | 53 | 50 | 48 |
| | | 4000 | 49 | 46 | 44 |
| | | 8000 | 45 | 41 | 36 |
| | A-Scale Weighted, dB(A) | | 61 | 58 | 56 |
| | At Discharge Side, 2 m Distance, 1.5 m Above Ground, Free Field Conditions (2 m, f.f, dBA) | | 50 | 47 | 45 |

**Table 2.10 Sound Data – MMI48 (4 Ton models)**

| Model Type | | | MMI48 | | |
|---|---|---|---|---|---|
| Sound Power Level (PWL, dB(A)) | Airflow | SCFM | 2710 | 2097 | 1735 |
| | | m3/h | 4604 | 3563 | 2948 |
| | External Static Pressure, in w.g. | | 0.2 | 0.2 | 0.2 |
| | Filter | | MERV 8 | MERV 8 | MERV 8 |
| | Free Cooling Coil | | NO | NO | NO |
| | Octave Band Frequency (Hz) | 63 | 49 | 44 | 39 |
| | | 125 | 56 | 55 | 50 |
| | | 250 | 63 | 58 | 52 |
| | | 500 | 68 | 60 | 56 |
| | | 1000 | 65 | 59 | 54 |
| | | 2000 | 63 | 57 | 53 |
| | | 4000 | 60 | 55 | 52 |
| | | 8000 | 60 | 52 | 46 |
| | A-Scale Weighted, dB(A) | | 73 | 66 | 61 |
| | At Discharge Side, 2 m Distance, 1.5 m Above Ground, Free Field Conditions (2 m, f.f, dBA) | | 61 | 55 | 50 |

**Table 2.11 Sound Data – MMI60 (5 Ton models)**

| Model Type | | | MM60 | | |
|---|---|---|---|---|---|
| Sound Power Level (PWL, dB(A)) | Airflow | SCFM | 2746 | 2279 | 1888 |
| | | m3/h | 4665 | 3872 | 3208 |
| | External Static Pressure, in w.g. | | 0.2 | 0.2 | 0.2 |
| | Filter | | MERV 8 | MERV 8 | MERV 8 |
| | Free Cooling Coil | | NO | NO | NO |
| | Octave Band Frequency (Hz) | 63 | 48 | 45 | 42 |
| | | 125 | 59 | 57 | 52 |
| | | 250 | 64 | 59 | 53 |
| | | 500 | 68 | 62 | 57 |
| | | 1000 | 64 | 59 | 55 |
| | | 2000 | 62 | 58 | 54 |
| | | 4000 | 60 | 56 | 54 |
| | | 8000 | 61 | 55 | 49 |
| | A-Scale Weighted, dB(A) | | 72 | 67 | 62 |
| | At Discharge Side, 2 m Distance, 1.5 m Above Ground, Free Field Conditions (2 m, f.f, dBA) | | 60 | 56 | 51 |

**Table 2.12 Sound Data – MMI96 (8 Ton models)**

| Model Type | | | MMI96 | | |
|---|---|---|---|---|---|
| Sound Power Level (PWL, dB(A)) | Airflow | SCFM | 3759 | 3061 | 2601 |
| | | m3/h | 6387 | 5201 | 4419 |
| | External Static Pressure, in w.g. | | 0.2 | 0.2 | 0.2 |
| | Filter | | MERV 8 | MERV 8 | MERV 8 |
| | Free Cooling Coil | | NO | NO | NO |
| | Octave Band Frequency (Hz) | 63 | 52 | 48 | 45 |
| | | 125 | 62 | 60 | 58 |
| | | 250 | 68 | 63 | 60 |
| | | 500 | 71 | 65 | 61 |
| | | 1000 | 68 | 63 | 60 |
| | | 2000 | 69 | 64 | 61 |
| | | 4000 | 66 | 62 | 60 |
| | | 8000 | 67 | 60 | 52 |
| | A-Scale Weighted, dB(A) | | 77 | 72 | 69 |
| | At Discharge Side, 2 m Distance, 1.5 m Above Ground, Free Field Conditions (2 m, f.f, dBA) | | 67 | 63 | 59 |

## 2.7 R-32 Refrigerant

R-32 is a refrigerant of next generation that carries heat efficiently. Also known as difluoromethane and belongs to the HFC family of refrigerant, has a lower GWP (675) and lower impact on the environment in comparison with R-410A and R22. This refrigerant is easier to recycle and use much less amount versus R-410A, therefore, is more efficient with less operating and maintenance costs.

List of characteristics and benefits versus R-410A:

- Zero ODP (Ozone Depletion Potential)
- Can be charged from either the liquid or vapor phase.
- Gas refrigerant cylinders have dual port valves, making liquid offtake easier.
- Mildly flammable, non-toxic with a safety classification of A2L
- One third of R-410A GWP.
- Required less charge as it has a 20% higher volumetric capacity.
- Similar saturated pressure hence development is easier.
- Higher critical temperature, consequently higher COP.
- Lower density, therefore, the amount of charge required is smaller.
- Single component of gas, therefore it is easier to be produced and managed.

**WARNING! Risk of piping ruptures and refrigerant leaks. Can cause equipment damage, illness, severe injury and death from suffocation. Do not use piping that is not approved for use in high-pressure refrigerant systems. Refrigerant leaks in non-ventilated spaces could cause oxygen depletion levels that are dangerous to discharging and charging.**

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# 3 Pre-installation Preparation and Guidelines

**NOTE: Before installing the unit, determine whether any building alterations are required to run piping, wiring and duct work. Follow unit dimensional drawing for proper clearances as referred on Vertiv™ CoolPhase Ceiling Vertiv™ CoolPhase Ceiling clearance requirements on page 43 below. Refer toSystem Configurations on page 24 to determine the type of system being installed, and anticipate building alterations, piping and ductwork needed as described on Chapter 3.**

Refer to Planning Dimensions & Weights on the next page for the unit dimensions. Pipe connection locations and piping schematics are described in Piping and Refrigerant Requirements on page 57 .

- Confirm that the room is properly insulated and has a sealed vapor barrier.
- For proper humidity control, keep outside or fresh air to an absolute minimum (less than 5% of total air circulated in the room).
- Install the units as close as possible to the largest heat load.
- Allow at least the minimum recommended clearances for maintenance and service. Refer to Clearance Requirements on page 43 .
- We recommend installing a water detection system. Contact your Vertiv representative for information.

## 3.1 Tools Required

The tools required are listed in Table 3.1 . These tools are not provided with the unit.

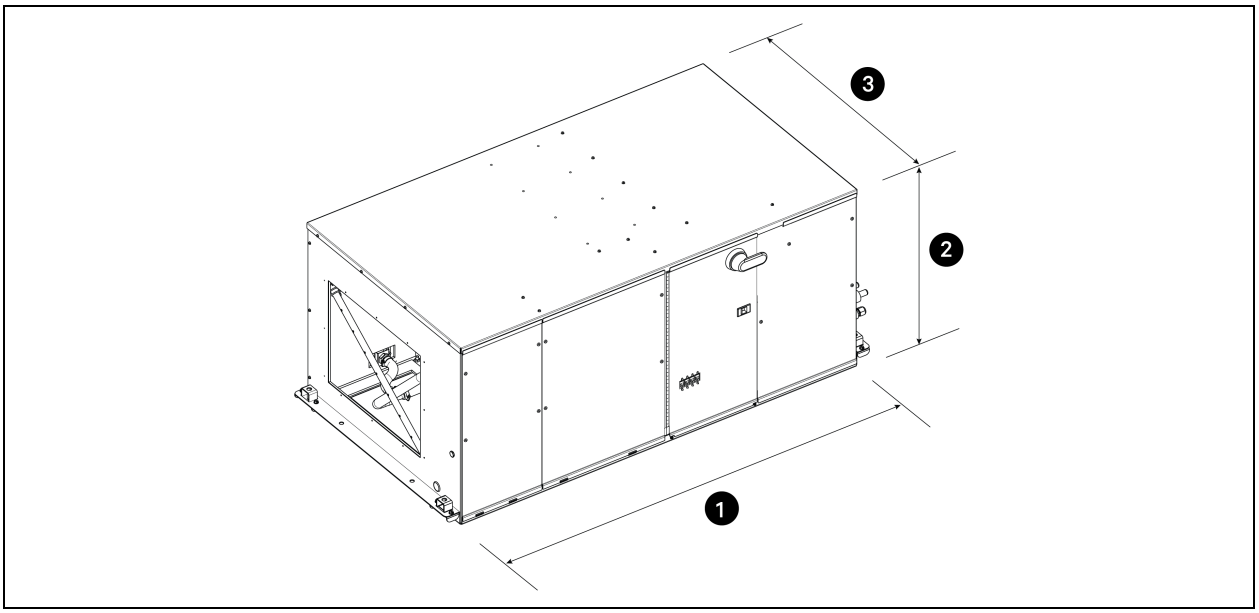
**Table 3.1 Tools required**

| Name of Tools | |
|---|---|
| Electric hand drill | Adjustable wrench |
| Slotted screwdriver | Cross-head screwdriver |
| Stepladder | Forklift |
| Level wire | Cutting pliers |
| Claw hammer | Diagonal cutting pliers |
| Insulating shoes | Antistatic gloves |
| Electrician knife | Cable ties |
| Insulating tape | Insulating gloves |
| Crimping pliers | Heat-shrinkable tube |
| Insulated torque wrench | Torque screwdriver |
| Multimeter | Clip-on ammeter |

## 3.2 Planning Dimensions & Weights

For a detailed view of the unit dimensions refer to the submittal documents included in the SL-80138 CoolPhase Ceiling System Design Catalog.

**Figure 3.1 Cabinet dimensions**




| Model | Unit Dimensions in (mm) | | | Shipping Dimensions in (mm) | | |
|---|---|---|---|---|---|---|
| | Width (1) | Height (2) | Depth (3) | Width (1) | Height (2) | Depth (3) |
| MMI12 (1 Ton) | 54.0 (1372) | 20.3 (515) | 30.0 (762) | 67.0 (1700) | 38.3 (972) | 20.7 (525) |
| MMI24 (2 Ton) | 53.8 (1367) | 24.1 (611) | 30.0 (762) | 67.0 (1700) | 38.3 (972) | 20.7 (525) |
| MMI36 (3 Ton) | | | | | | |
| MMI48 (4 Ton) | 46.4 (1178) | 24.1 (611) | 50.8 (1290) | 59.1 (1500) | 56 (1420) | 31.0 (787) |
| MMI60 (6 Ton) | | | | | | |
| MMI96 (8 Ton) | 54.2 (1377) | 26.5 (673) | 69.9 (1775) | 79 (2000) | 65.5 (1660) | 33.0 (838) |

**NOTE: Taking the front view as reference for the width.**

**Table 3.2 CoolPhase Ceiling unit weights**

| Model | | Weights lb (kg) | |
|---|---|---|---|
| | | Net Product Weight | Total Shipping Weight |
| MMI12 (1 Ton) | Minimum (DX only) | 269 (122.2) | 425 (192.8) |
| | Maximum (DX + FC) | 292 (132.6) | 447 (203.2) |
| MMI36 (3 Ton) | Minimum (DX only) | 295 (134.0) | 451 (204.6) |
| | Maximum (DX + FC) | 325 (147.6) | 481 (218.2) |
| MMI60 (6 Ton) | Minimum (DX only) | 299 (136.0) | 456 (206.6) |
| | Maximum (DX + FC) | 329 (149.6) | 486 (220.2) |
| MMI12 (1 Ton) | Minimum (DX only) | 416 (187.5) | 623 (281.6) |
| | Maximum (DX + FC) | 484 (219.5) | 691 (313.6) |
| MMI36 (3 Ton) | Minimum (DX only) | 484 (219.5) | 691 (313.6) |
| | Maximum (DX + FC) | 504 (228.5) | 711 (322.6) |
| MMI60 (6 Ton) | Minimum (DX only) | 673 (305.4) | 898 (407.4) |
| | Maximum (DX + FC) | 752 (341.4) | 977 (443.4) |

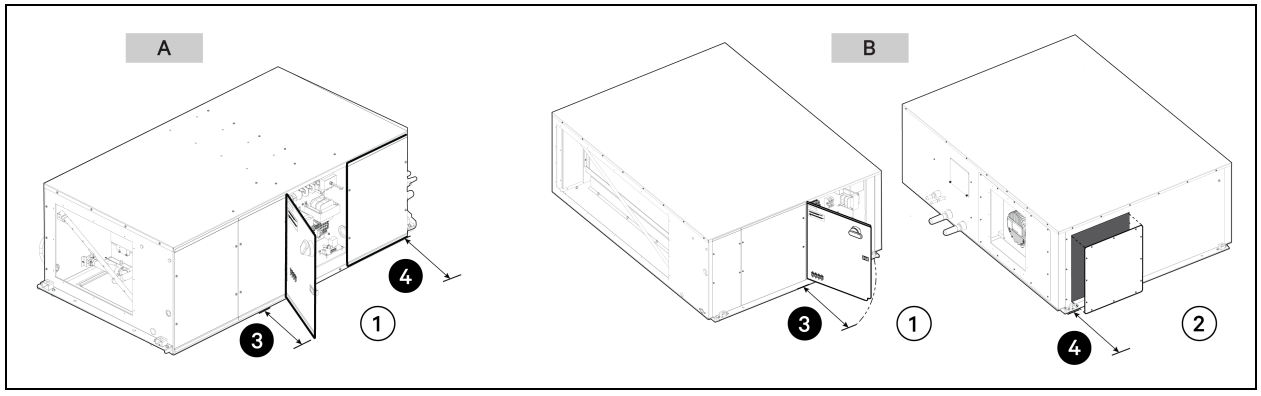
## 3.3 Clearance Requirements

Follow recommended practices when choosing an indoor location for the ceiling-mounted indoor unit.

- Keep unit away from any indoor steam or excessive heat.
- No obstacles should be placed around the unit.
- Condensation drain (leakage piping) should be routed away from the unit.
- Do not install near a doorway.

When planning the position and location of the equipment, refer to Figure 3.2 below, for the required clearances for installation and service of the installed equipment.

**Figure 3.2 Vertiv™ CoolPhase Ceiling clearance requirements**




**NOTE: The minimal distance between two or more indoor units should be 3.28 ft (1 m) from side to side.**

**NOTE: The minimum clearance for eBox and the Service Access door should be 25 in (635 mm).**

**NOTE: For the minimal installation area, refer to the tables on Amount of Refrigerant and Lubricating Oil for Air Cooled systems on page 100 .**

## 3.4 Location Considerations

When determining installation locations, consider that these units contain water and that water leaks can cause damage to sensitive equipment and furniture below.

The evaporator is usually mounted above the dropped ceiling and must be securely mounted to the roof structure. See Guidelines for Ducted Systems on page 55 for additional guidelines. For a split system with an air cooled, outdoor condensing unit, the condensing unit may be mounted on the roof or remotely in an outdoor area. See SL-71937 CoolPhase Condensing Unit user manual for additional guidelines.

Refer to Vertiv™ CoolPhase Ceiling recommended refrigerant line sizes, O.D. CU for Vertiv™ CoolPhase Condensing Unit on page 76 for maximum refrigerant line lengths.

The ceiling and the ceiling supports of existing buildings may require reinforcement. See Planning Dimensions & Weights on page 42 for measurements and sizes of the CoolPhase Ceiling models. Be sure to follow all applicable national and local codes.

Install the ceiling mounted unit over an unobstructed floor space if possible. This will allow easy access for routine maintenance or service. Do not attach additional devices (such as smoke detectors, etc.) to the housing, as they could interfere with the maintenance or service.

Do not install units in areas where normal unit operating sound may disturb the working environment.

## 3.5 Equipment Inspection and Handling

**WARNING! Risk of improper moving, lifting, or handling of the unit. Can cause equipment damage, injury or death. Read all the following instructions and verify that all lifting and moving equipment is rated for the weight of the unit before attempting to move, lift, remove packaging from or prepare the unit for installation. Unit weights are specified in section 3.1 Planning Dimensions & Weights.**

**CAUTION: Risk of contact with sharp edges, splinters, and exposed fasteners. Can cause injury. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should attempt to move, lift, remove packaging from or prepare the unit for installation.**

**NOTICE**

Risk of doorway/hallway interference. Can cause unit and/or structure damage. The unit may be too large to fit through a doorway or hallway while on the skid. Measure the unit and passageway dimensions and refer to the installation plans prior to moving the unit to verify clearances.

**NOTICE**

Risk of damage from forklift. Can cause unit damage. Keep tines of the forklift level and at a height suitable to fit below the skid and/or unit to prevent exterior and/or underside damage.

**NOTICE**

Risk of improper storage. Keep the unit upright, indoors and protected from dampness, freezing temperatures and contact damage.

Upon arrival of the unit and before unpacking:

- Verify that the labeled equipment matches the bill of lading.
- Carefully inspect all items for visible or concealed damage.
- Report damage immediately to the carrier and file a damage claim with a copy sent to Vertivor to your sales representative.

Equipment recommended for Handling the Unit:

- Forklift
- Pallet jack

### 3.5.1 Handling the unit while package

Transport packaged unit using a forklift or pallet jack.

- When using a forklift or pallet jack, make sure forks (if adjustable) are spread to widest allowable distance to still fit under pallet. Make sure fork length is suitable for pallet length.
- Packaged unit shall not be lifted any higher than 2-4 in (51-102 mm) off ground when handled. All by-standing personnel shall be no closer than 12 ft (3.7 m) to handled packaged unit.
- If circumstances require unit to be lifted higher than 4 in (102 mm) great care shall be exercised and all by-standing personnel are to be no closer than 20 ft (5 m) to lift point of unit.

For detailed information about Unpacking instructions of the unit, refer to SL-10548 Handling Instructions CoolPhase Ceiling document.

## 3.6 Unpacking the Unit

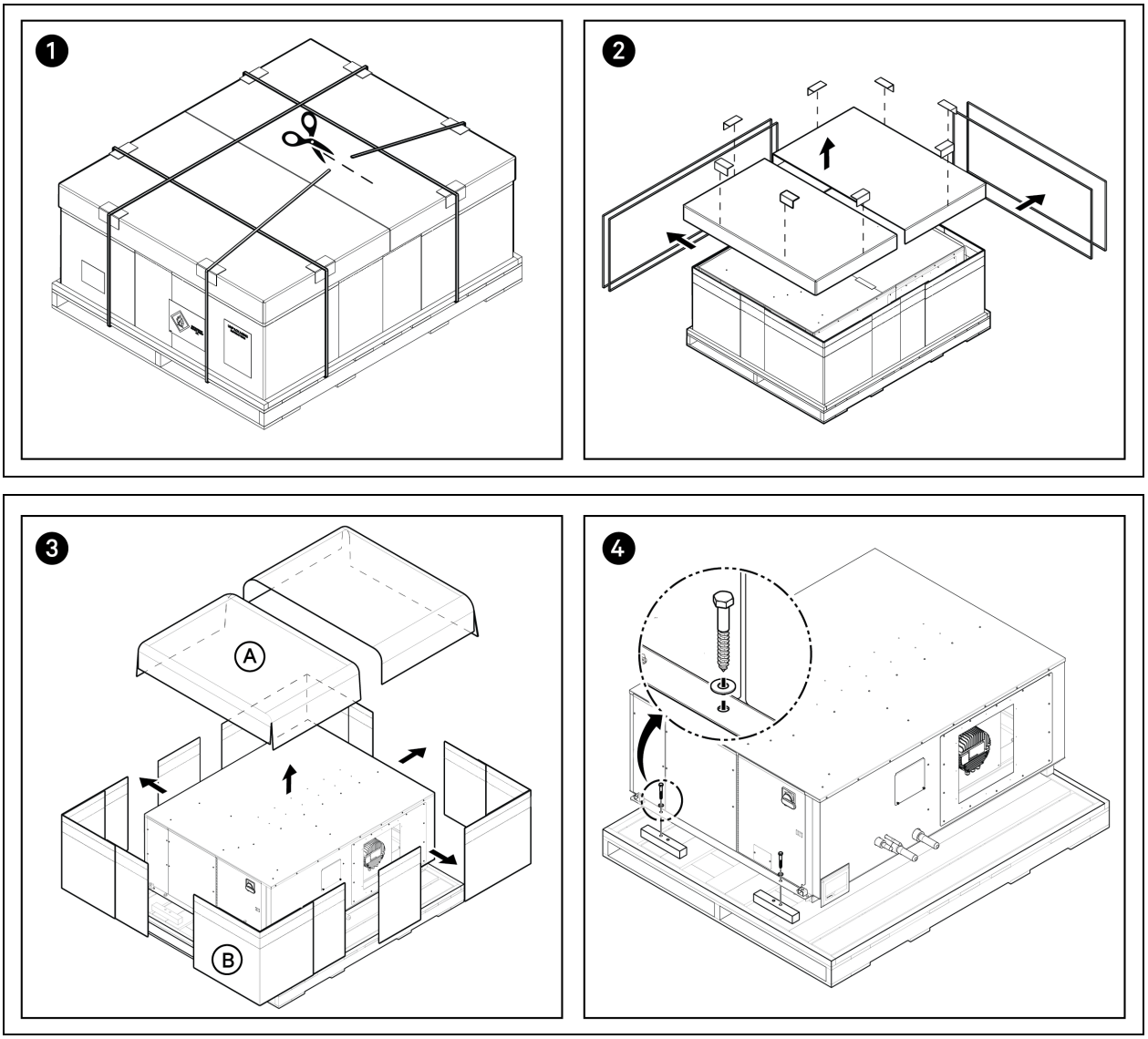
For detailed information about Unpacking instructions of the unit, refer to SL-10547 Unpacking guide CoolPhase Ceiling document.

Follow these instructions to unpack the Unit:

1. Place the package on a flat surface, then trim the poly straps to release the unit from the pallet.
2. Remove all cardboard protector edges and covers.
3. 3. Remove the poly roll foil (A) and the corrugated pads (B). Remove the documentation and hardware bag and set them aside.

4. Remove the hex-head screws and washers, then take the unit out of the pallet.

**Figure 3.3 Unpacking steps for the Indoor Unit (Isometrics)**




## 3.7 Operating Conditions

The Vertiv™ CoolPhase Ceiling must be operated in a conditioned space within the operating envelope that ASHRAE recommends for data centers. Operating the CoolPhase Ceiling outside of this envelope can decrease equipment reliability. Refer to ASHRAE's publication, "Thermal Guidelines for Data Processing Environments."

### 3.7.1 Cooling, Humidification, and Dehumidification

For operation in the Cooling, Humidification, or Dehumidification modes, the CoolPhase Ceilingunit's return air requirements for proper unit operation are:

- Maximum dew point of 59° F (15° C)
- Minimum 65° F (20° C) DB
- Maximum 85° F (29.4° C) DB

### 3.7.2 Heating

For operation in the Heating mode, the CoolPhase Ceiling unit's return air requirements for proper unit operation are:

- Maximum humidity: less than 80% RH and less than 64° F (17.8° C) dew point.
- Maximum dry bulb of 80° F (27° C) .

## 3.8 Connections and System Setup

- The unit requires a drain, which must comply with all applicable codes. This drain line may contain boiling water. See Drain Line Installation Requirements on page 69 section 5.3.2, for details.
- Electrical service is required for all models. Electrical service must conform to national and local electrical codes. See equipment nameplate for details.
- Plan the routing of wiring, piping, and duct work to the unit. Refer to the appropriate piping connection location, piping schematics, and electrical connection for your system in Chapters 5 and 7.

**NOTE: Seal openings around piping and electrical connection to prevent air leakage. Failure to do so could reduce the unit's cooling performance.**

# 4 Installation

**WARNING! Before breaking into the system or conducting any hot work ensure that the working area is open or it is adequately ventilated. Ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.**

**WARNING! Under no circumstances potential sources of ignition shall be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.**

**WARNING! If a leakage of refrigerant is found which requires brazing, all the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak. Removal of refrigerant shall be performed following manufacturer instructions.**

**WARNING! Electronic leak detectors with the appropriate sensitivity must be used, equipment shall be calibrated to the refrigerant employed. Electronic leak detectors shall not be potential ignition sources and shall be suitable for the refrigerant used. Leak detection equipment shall be set to an appropriate percentage of the Lower Flammability Limit of the refrigerant not exceeding the 25% of the LFL.**

**WARNING! Keep ventilation of the unit clear of any obstruction.**

### SAFETY INSTRUCTIONS

- Installation of pipework shall be kept at minimum.
- Pipe-work including piping material, pipe routing, and installation always shall be protected from physical damage.
- Pipe-work must not be located in unventilated areas.
- Pipe-work including piping material, pipe routing, and installation shall be in compliance with national gas regulations and local codes and standards, such as ASHRAE 15, ASHRAE 15.2, IAPMO Uniform Mechanical Code, ICC International Mechanical Code, or CSA B52. All field joints shall be accessible for inspection prior to being covered or enclosed.
- Mechanical filed joints shall remain accessible after installation for maintenance and servicing purposes.
- After completion of field piping, pipework must be pressure tested looking for leaks. An inert gas with a pressure not less than 300 PSI (2,000 kPa) must be used for the test.
- Field-made refrigerant joints indoors shall be tightness tested with a method having a sensitivity of 5 grams per year of refrigerant or better under a pressure of at least 162.5 PSI, (1,120 kPa). No leak shall be detected.
- An unventilated area where the appliance is installed shall be so constructed that should any refrigerant leak, it will not stagnate to create a fire or explosion hazard.
- Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

- When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labelled for that refrigerant. Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.
- The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of the flammable refrigerant. If in doubt, the manufacturer should be consulted. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition.
- Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release. Consult manufacturer if in doubt.
- The recovered refrigerant shall be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.
- If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

**NOTICE**

The length of the piping shall be considered when filling the system with refrigerant. Refer to the tables on Amount of Refrigerant and Lubricating Oil for Air Cooled systems on page 100 for more details regarding the pipe length, total refrigerant charge.

**NOTICE**

Every working procedure that affects safety means shall only be carried out by competent people.

**NOTICE**

When removing refrigerant from a system it is recommended good practice that all refrigerants are removed safely.

In addition to conventional charging procedures, the following requirements shall be followed:

- Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
- Cylinders shall be kept in an appropriate position according to the instructions.
- Ensure that the refrigerant system is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete. Indoor and outdoor units are provided with locations to write the total refrigerant charge.
- Extreme care shall be taken not to overfill the refrigerant system.

Refer to the appropriate installation procedures depending on the size and type of your Vertiv™ CoolPhase CeilingSystem.

**Table 4.1 Maximum airflow**

| Parameter | MMI12 | MMI24 | MMI36 | MMI48 | MMI60 | MMI96 |
|---|---|---|---|---|---|---|
| Maximum airflow CFM (m3/h) | 816 (1,386) | 1,451 (2,465) | 1,533 (2,605) | 2,710 (4,604) | 2,746 (4,665) | 3,759 (6,387) |

The following procedure must be followed when breaking into the refrigerant circuit to make repairs or for any other purpose:

- Safely remove refrigerant following local and national regulations
- Evacuate
- Purge the circuit with inert gas (optional for A2L)
- Evacuate (optional for A2L)
- Continuously flush or purge with inert gas when using flame to open circuit
- Open the circuit by cutting or brazing

**SAFETY INSTRUCTION**

- Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.
- Detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipework.
    - Specify the leak detection method such as bubble method or fluorescent method agents.
- The refrigerant charge shall be recovered into the correct recovery cylinders.
- System shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.
- Refrigerant purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process shall be repeated until no refrigerant is within the system. When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place. This operation is absolutely vital if brazing operations on the pipework are to take place.
- The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.

**NOTE: Ensure that the lowest part of the indoor unit is installed at the minimum installation height.**

## 4.1 Installing Ceiling Mounted Units

**WARNING! Risk of ceiling collapse and heavy unit falling. Can cause building and equipment damage, serious injury or death. Verify that the supporting roof structure is capable of supporting the weight of the unit(s) and the accessories, CoolPhase Ceiling unit weights on page 43 on section 3.2 Planning Dimensions & Weights. Be sure to securely anchor the top ends of the suspension rods. Make sure all nuts are tight.**

**NOTICE**

Risk of leaking water. Can cause equipment and building damage.

Improper installation, application, and service practices can result in water leakage from the unit. Do not mount this unit over equipment and furniture that can be damaged by leaking water. Install a water-tight drain pan with a drain connection under the cooling unit. We recommend installing monitored leak detection equipment for the unit and supply lines. Check drain lines periodically for leaks, sediment buildup, obstructions, kinks and/or damage and verify that they are free running.

### 4.1.1 Installing Suspension Rods

Refer toLocation Considerations on page 44 before beginning installation.

**NOTE: Follow all national and local building, electrical and plumbing codes.**

- The ceiling and ceiling supports of existing buildings may require reinforcements.
- Recommended clearance between ceiling grids and building structural members is the unit's height plus 3 in (76 mm).
- Four ½ in. 13 TPI threaded suspension rods are required and field supplied.
- The factory supplied ½ in 13 TPI hardware kit includes the remaining installation hardware for rod to unit.

To install the suspension rods:

1. Install the four-field supplied 1/2 in 13 TPI threaded rods by suspending them from suitable building structural members so that they will align with the four mounting locations on the unit base.
2. Securely anchor the top ends of the suspension rods with field supplied nuts.
3. Make sure all nuts are tight.

To lift and install the unit on the rods:

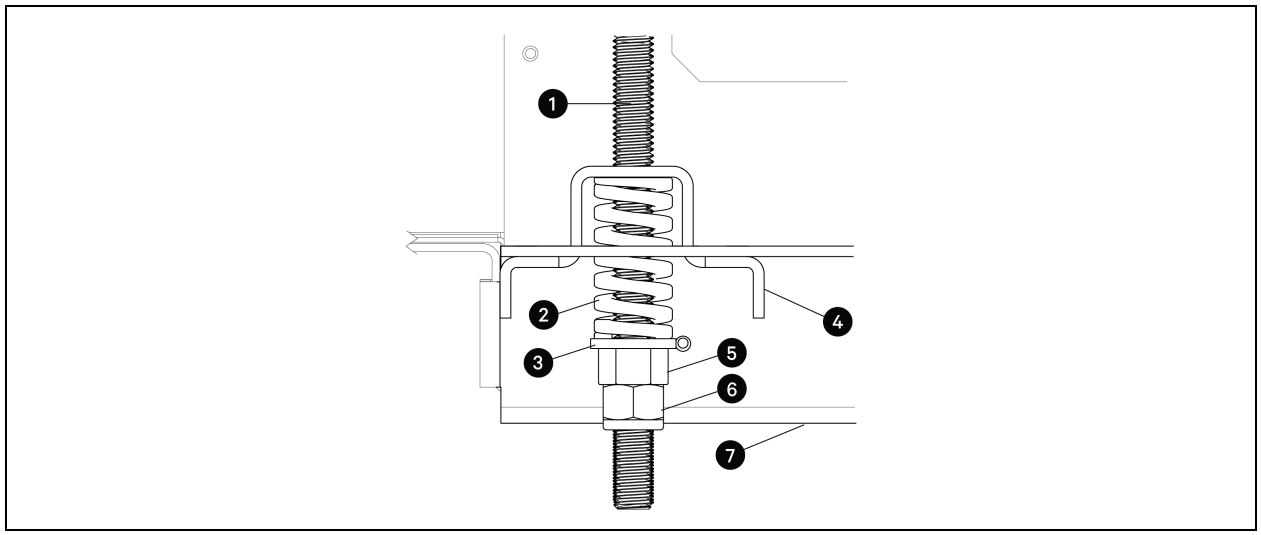
1. Using a suitable lifting device that is rated for the weight of the unit (see section 3.2 Planning Dimensions & Weights), raise the unit and pass the threaded rods through the four hanging brackets in the unit base.
2. Insert the coil spring completely into the hanging bracket, add washer and then thread the plain nut onto the rod as shown in Figure 4.1 below .
3. Slowly lower the lifting device, making sure that the rods securely hold the weight of the unit.
4. Adjust the plain nuts to distribute the weight of the unit evenly by the rods, making sure that the unit does not rest on the ceiling grid and that the unit is level.

**NOTE: Make sure that none of the spring nuts are compressed to solid height. Also, note that the coil side of the unit is heavier, so the springs on that side will be more compressed.**

**NOTE: The evaporator must be level to properly drain condensate.**

5. Use the Nylock nuts to jam the plain nuts in place as shown in Figure 4.1 below .

**Figure 4.1 Installing Threaded Rods and Hardware of Ceiling Mounted Units**




| Item | Description | Item | Description |
|---|---|---|---|
| 1 | 1/2-in. threaded rod, field supplied | 5 | 1/2-in. hex nut |
| 2 | 1-in. O.D. spring | 6 | 1/2-in. Nylock locking nut |
| 3 | 1/2-in. flat washer | 7 | Unit-based pan (reference) |
| 4 | Hanging bracket | | |

## 4.2 Installing Air Distribution Components for Evaporators

Your indoor units may include filters, ducting, plenums, and grilles. Refer to the appropriate installation procedures included with each optional kit.

### 4.2.1 Installing a Filter Box for 1, 2 and 3 Ton Models (Optional)

The optional filter box attaches directly to the return air opening of the evaporator.

- The filter box includes one MERV 8 filter (per ASHRAE 52.2-2007), 20 in x 20 in x 4 in (508 mm x 508 mm x 102 mm).

**NOTE: Do not operate the unit without filters installed in return air system.**

### 4.2.2 Installing a Filter Box for 4, 5 and 8 Ton Models

The optional filter box attaches directly to the return air opening of the evaporator.

- For return air opening, the filter box includes a duct flange connection with two MERV 8 filters (per ASHRAE 52.2-2007), 20 in x 20 in x 4 in (508 mm x 508 mm x 102 mm).

- For the air supply opening, a duct flange is included for ducted air supply.

**NOTE: Do not operate the unit without filters installed in return air system.**

## 4.2.3 Installing an Air Distribution Plenum for 1, 2 and 3 Ton Models

The optional plenum fastens to the bottom of the evaporator and provides three-way air distribution. The plenum includes a MERV 8 filter (per ASHRAE 52.2-2007), 16 in x 25 in x 4 in (406 mm x 635 mm x 102 mm).

- When using the plenum, mount the evaporator above the bottom of the T-bar supports with at least 30-in. (762 mm) clearance from return air end to wall (for replacing filter).
- Follow the installation instructions included with the plenum kit.

## 4.2.4 Installing a Bottom Discharge Grille for 1, 2 and 3 Ton Models

The optional, bottom discharge grille is a three-way louvered air grille, painted white, and added to a T-bar grid assembly for air discharge directly into room from the bottom of the unit. Use a separate filter box kit for filtration and connection to field provided room-air return duct work.

Your indoor units may include a filter box, ducting, plenums, and grilles. Refer to the appropriate installation procedures for each.

### 4.1.4.1 Installing a Filter Box

The optional filter box attaches directly to the return air opening of the evaporator. The filter box includes one filter, 16 in x 20 in x 4 in (406 mm x 508 mm x 102 mm).

**NOTE: Do not operate the unit without filters installed in return air system.**

### 4.2.4.1 Grille Installation

**CAUTION: Risk of the grille falling. Can cause equipment damage or injury. Do not allow the weight of the unit to rest on the grilles.**

**NOTICE**

Risk of improper filter installation. Can cause filter collapse and airflow reduction.

The airflow grilles are directional devices and MUST be installed with the louvers properly aligned for the unit to operate properly.

An air baffle is included with the grille kit and must be installed to ensure proper air distribution.

To install the grilles:

1. Refer to the instructions included with the kit and locate the return and discharge grilles.

2. Lower the grilles into place with the louvers in the proper direction. If required, grilles may be screwed directly to the sub-base.
3. Install a field supplied T-bar between the two grilles.
4. Install the disposable filter (20 in x 20 in x 1 in) in the return grille.
5. Lower the evaporator unit until the gasket material is compressed 1/4 in (6 mm).

**NOTE: Do not operate the unit without the filter installed in the return air grille.**

### 4.2.5 Guidelines for Ducted Systems

Observe the following for all duct work.

- Ductwork should be fabricated and installed in accordance with local and national codes.
- Use flexible duct work or non-flammable cloth collars to attach duct work to the unit and to control vibration transmission to the building.
- Attach the duct work to the unit using the flanges provided. Locate the unit and duct work so that the discharge air does not short circuit to the return air inlet.
- Ductwork that runs through a conditioned space or is exposed to areas where condensation may occur must be insulated. Insulation of duct work is vital to prevent condensation during the cooling cycle.
- The use of a vapor barrier is required to prevent absorption of moisture from the surrounding air into the insulation.
- If the return air duct is short or if noise is likely to be a problem, sound absorbing insulation should be used inside the duct.
- Ductwork should be suspended using flexible hangers. Ductwork should not be fastened directly to the building structure.

## 4.3 Checklist for Completed Installation

Checklist for Completed Installation

### 4.3.1 Moving and Placing Equipment

1. Proper clearance for service access has been maintained around the equipment.
2. Equipment is level and mounting fasteners are tight.

### 4.3.2 Piping Installation Checks

- Piping completed to refrigerant or coolant loop (if required).
- Piping has been leak-checked, evacuated and charged (if required).
- For additional oil, refer to table 8.1 on Amount of Refrigerant and Lubricating Oil for Air Cooled systems on page 100 . See Additional Oil Requirements for Digital Scroll Compressors in the condensing unit manual.
- Piping is properly sized, sloped and trapped as shown in the piping schematics.
- Check piping inside and outside of equipment for proper support and adequate spacing to prevent rub-through.
- Ensure that factory clamps have been reinstalled.
- Drain line connected, not obstructed, and pitched by local code.
- Water supply line connected to humidifier and not leaking and routed to allow filter removal.
- Condensate pump, if applicable, is operational.
- Condensate drain line piping has no leaks or visible damage.
- Shut-Off valve has been added for systems charges over 33 lb (15 kg).

### 4.3.3 Other Installation Checks

- Ducting complete (if required), maintain access to filters.
- Return air filter box and supply air duct collar installed.
- Filters installed.
- Check fasteners that secure reheats, humidifier and motors—some may have become loose during shipment.
- Control parameters are set based on customer requirements. Verify water detection is properly installed (recommended).
- All fans are free of debris.
- Seal openings around piping and electrical connections.
- Installation materials and tools have been removed from equipment (literature, shipping materials, construction materials, tools, etc.).
- Field provided, water-tight, secondary drain pan with drain is installed under all cooling units and ceiling-mounted water/glycol condensing units.
- Drain from secondary drain pan is routed to a frequently used maintenance sink with signs posted to alert people to report water/glycol flowing from drain pan.
- Rubber band is removed from the evaporator condensate pan float switch.

# 5 Piping and Refrigerant Requirements

**SAFETY INSTRUCTIONS**

Pipework must be installed so that it is protected from physical damage and must not be in located in

unventilated areas.

- Pipework shall be done following national and local codes such as ASHRAE 15, ASHRAE 15.2, IAPMO Uniform
- Mechanical Code, ICC International Mechanical Code, or CSA B52.
- All field joints shall be accessible for inspection prior to being covered or enclosed.
- Mechanical field joints shall remain accessible after installation for maintenance and servicing purposes.
- Precautions must be taken to avoid excessive vibration or pulsation to refrigerating piping.
- Protection devices, piping and fittings must be protected as far as possible against adverse environmental
- effects, for example, the danger of water collecting and freezing in relief pipes or the accumulation of dirt and
- debris.
- After the completion of field piping, pipework must be pressure tested with an inert gas and then vacuum tested prior to refrigerant charging, testing shall be done as follow:
    - The system shall be tested according to the low-side maximum allowable pressure.
    - Field-made refrigerant joints indoors shall be tightly tested with a method having a sensitivity of 5 grams per year of refrigerant or better under a pressure of at least 0.25 times the maximum allowable pressure. No leak shall be detected.

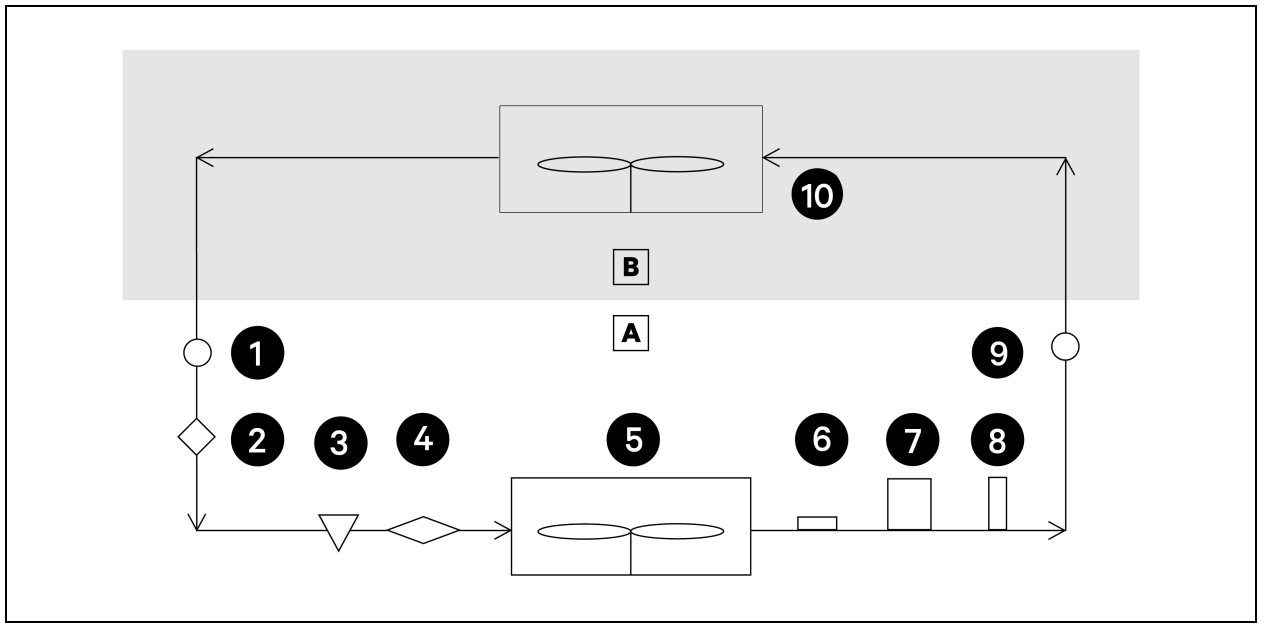
All fluid and refrigeration connections to the unit, with the exception of the condensate drain and humidifier supply line, are sweat copper. Factory installed piping brackets must not be removed. Field installed piping must be installed in accordance with local codes and must be properly assembled, supported, isolated, and insulated. Avoid piping runs through noise sensitive areas, such as office walls and conference rooms.

Refer to specific text and detailed diagrams in this manual for other unit specific piping requirements. The following pipe connections are required:

- Refrigerant piping connections between the evaporator unit and the condensing unit.
- A drain line from the unit or a drain line from the optional condensate pump (if applicable).
- A drain line from the secondary drain pan (if applicable).
- A water supply line to the optional humidifier (if applicable).
- Free cooling coil piping for free cool option.

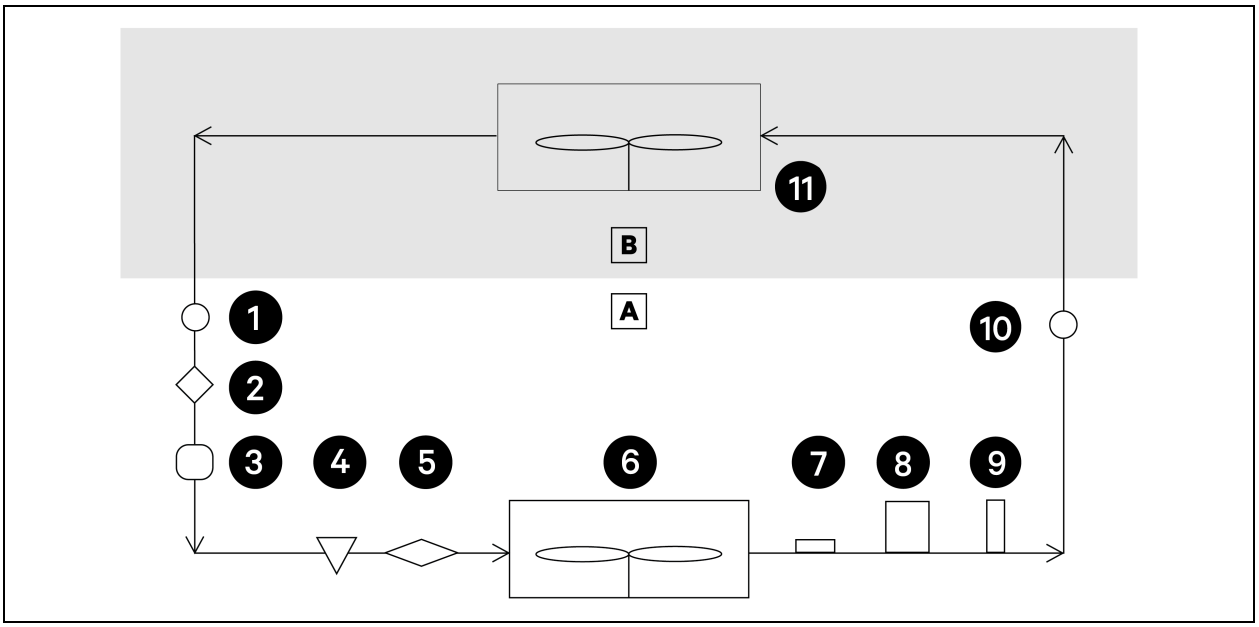
## 5.1 General Arrangements

**Figure 5.1 Piping general arrangement diagram drawings for DX (Direct Expansion) for MMI12 and MM24 models**



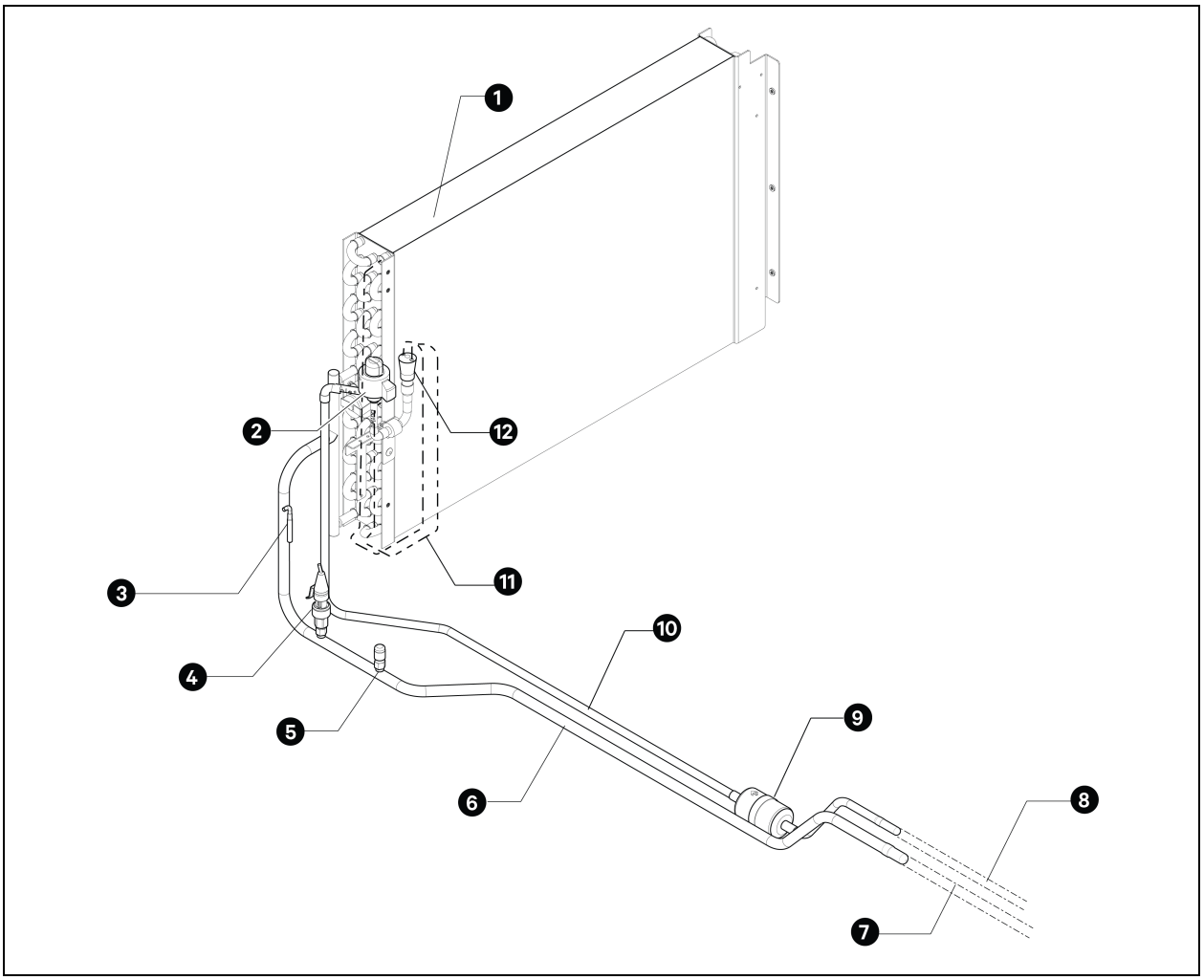

| Item | Description | Item | Description |
|---|---|---|---|
| A | Indoor | 5 | Evaporator unit |
| B | Outdoor / Plenum | 6 | Suction Temperature Sensor (at Evaporator outlet) |
| 1 | Brazed Pipe Union, Liquid Line | 7 | Suction Pressure Transducer (at Suction valve) |
| 2 | Filter Drier | 8 | Schrader Service Valve w/Core |
| 3 | Electronic Expansion Valve | 9 | Brazed Pipe Union, Suction Line |
| 4 | Distributor | 10 | Condensing unit |

**Figure 5.2 Piping general arrangement diagram drawings for DX (Direct Expansion) for MMI36, 48, 60 and 96 Models**



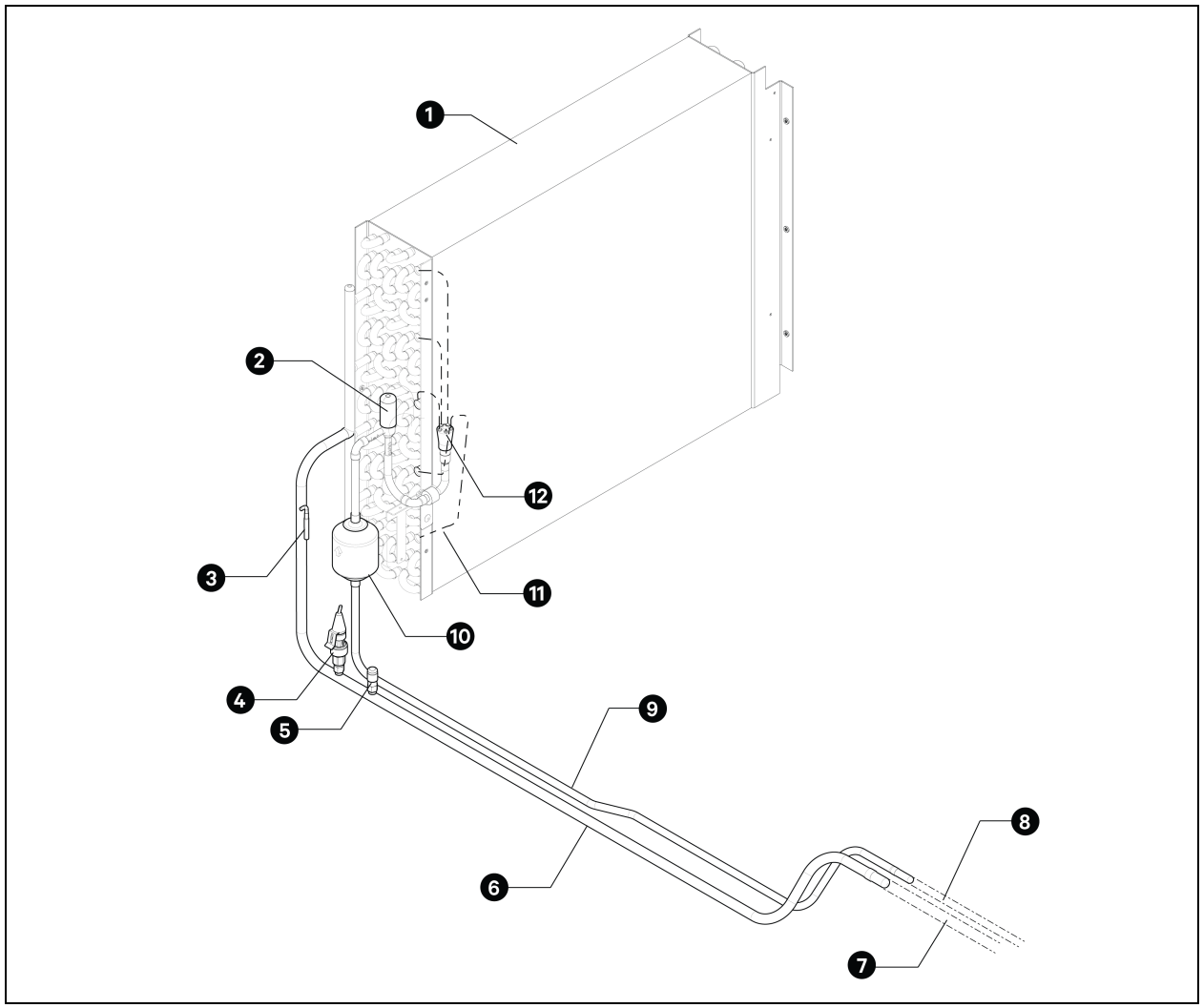

| Item | Description | Item | Description |
|---|---|---|---|
| A | Indoor | 6 | Evaporator unit |
| B | Outdoor / Plenum | 7 | Suction Temperature Sensor (at Evaporator outlet) |
| 1 | Brazed Pipe Union, Liquid Line | 8 | Suction Pressure Transducer (at Suction valve) |
| 2 | Filter Drier | 9 | Schrader Service Valve w/Core |
| 3 | Shutt-Off Valve | 10 | 9. Brazed Pipe Union, Suction Line |
| 4 | Electronic Expansion Valve | 11 | Condenser unit |
| 5 | Distributor | | |

**Figure 5.3 Piping schematic 1 Ton Split System Air-Cooled**



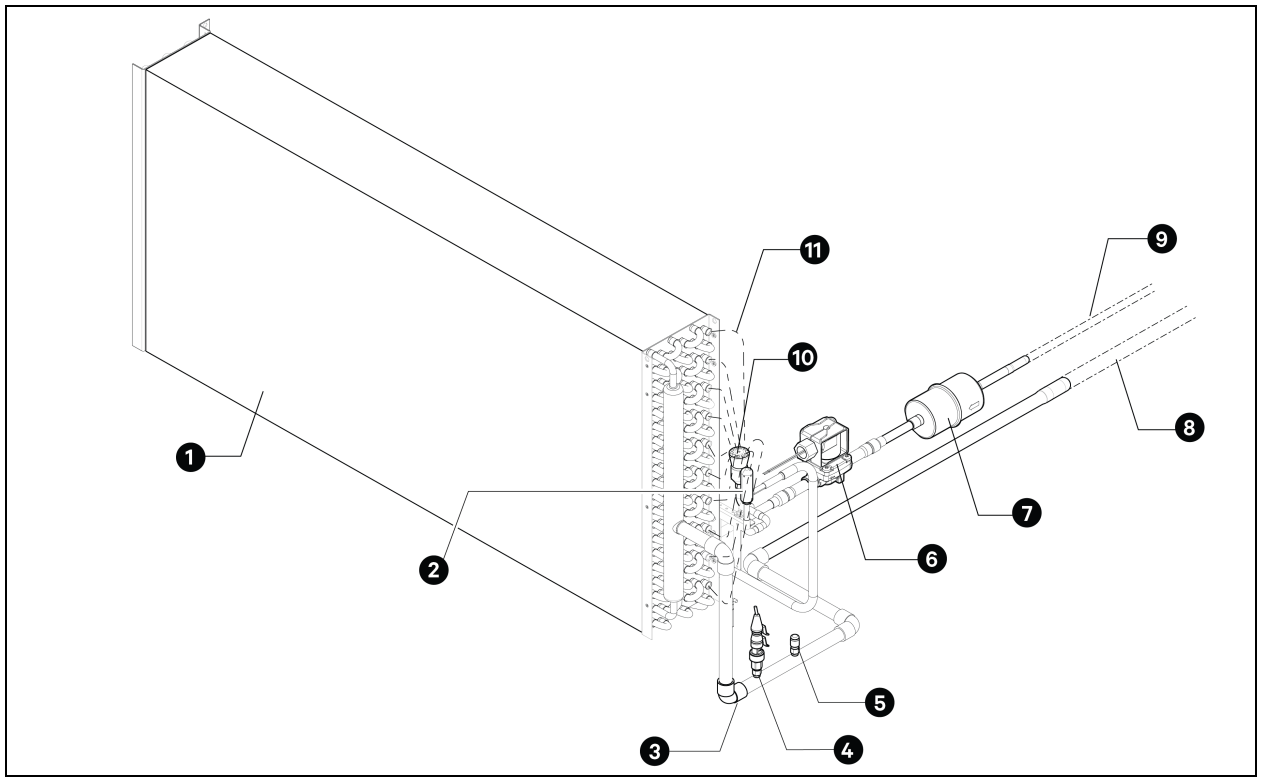

| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Evaporator Coil | 7 | To OHE Condensing Unit |
| 2 | Electronic Expansion Valve | 8 | From OHE Condensing Unit |
| 3 | Temperature Sensor Probe | 9 | Filter Drier |
| 4 | Pressure Transducer | 10 | Liquid Pipe |
| 5 | Service/Charge Port | 11 | Distributor Feeders |
| 6 | Suction Pipe | 12 | Distributor |

**Figure 5.4 Piping schematic 2 and 3 Ton Split System Air-Cooled**



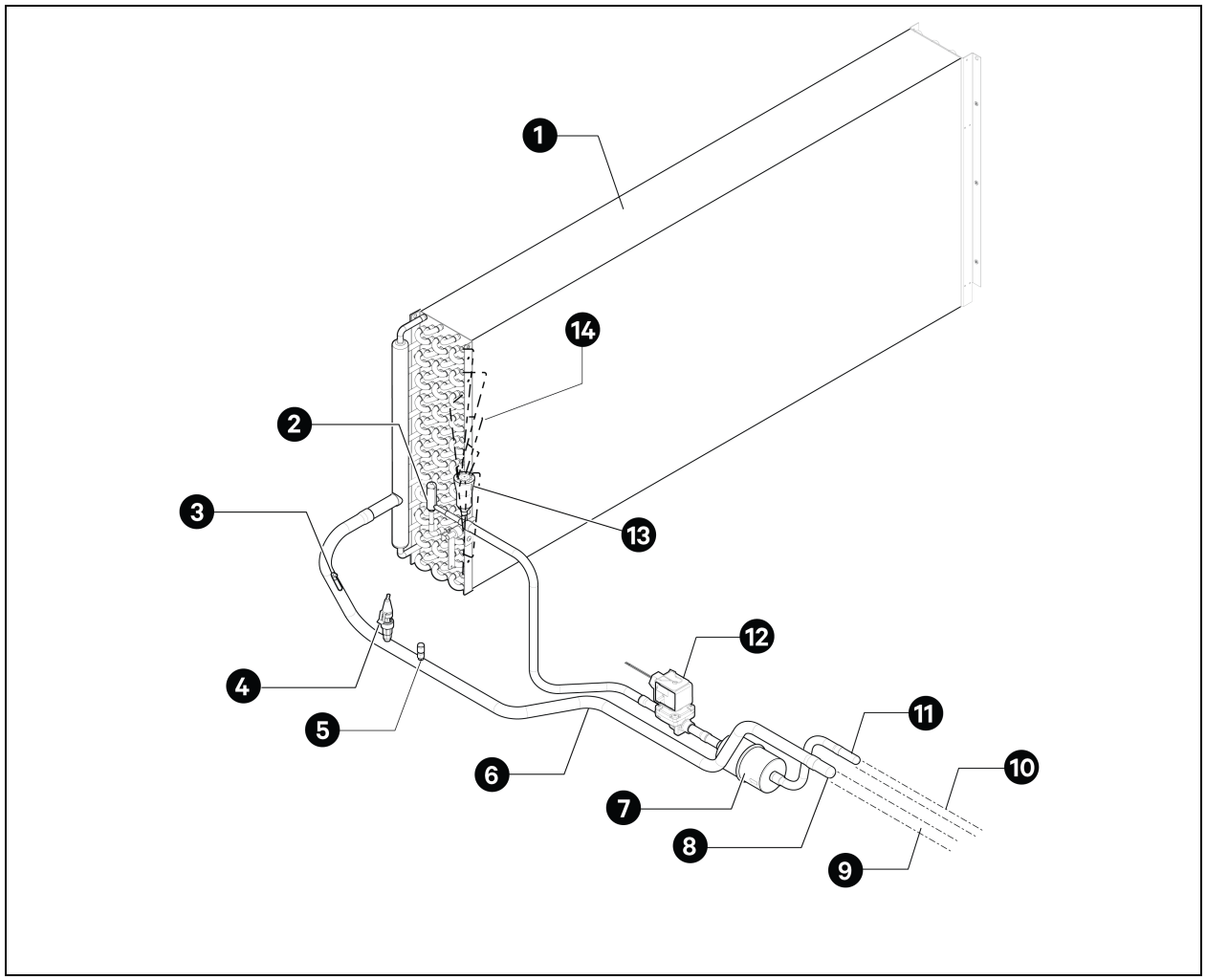

| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Evaporator Coil | 7 | To OHE Condensing Unit |
| 2 | Electronic Expansion Valve | 8 | From OHE Condensing Unit |
| 3 | Temperature Sensor Probe | 9 | Liquid Pipe |
| 4 | Pressure Transducer | 10 | Filter Drier |
| 5 | Service/Charge Port | 11 | Distributor Feeders |
| 6 | Suction Pipe | 12 | Distributor |

**Figure 5.5 Piping schematic 4 and 5 Ton Split System Air-Cooled**



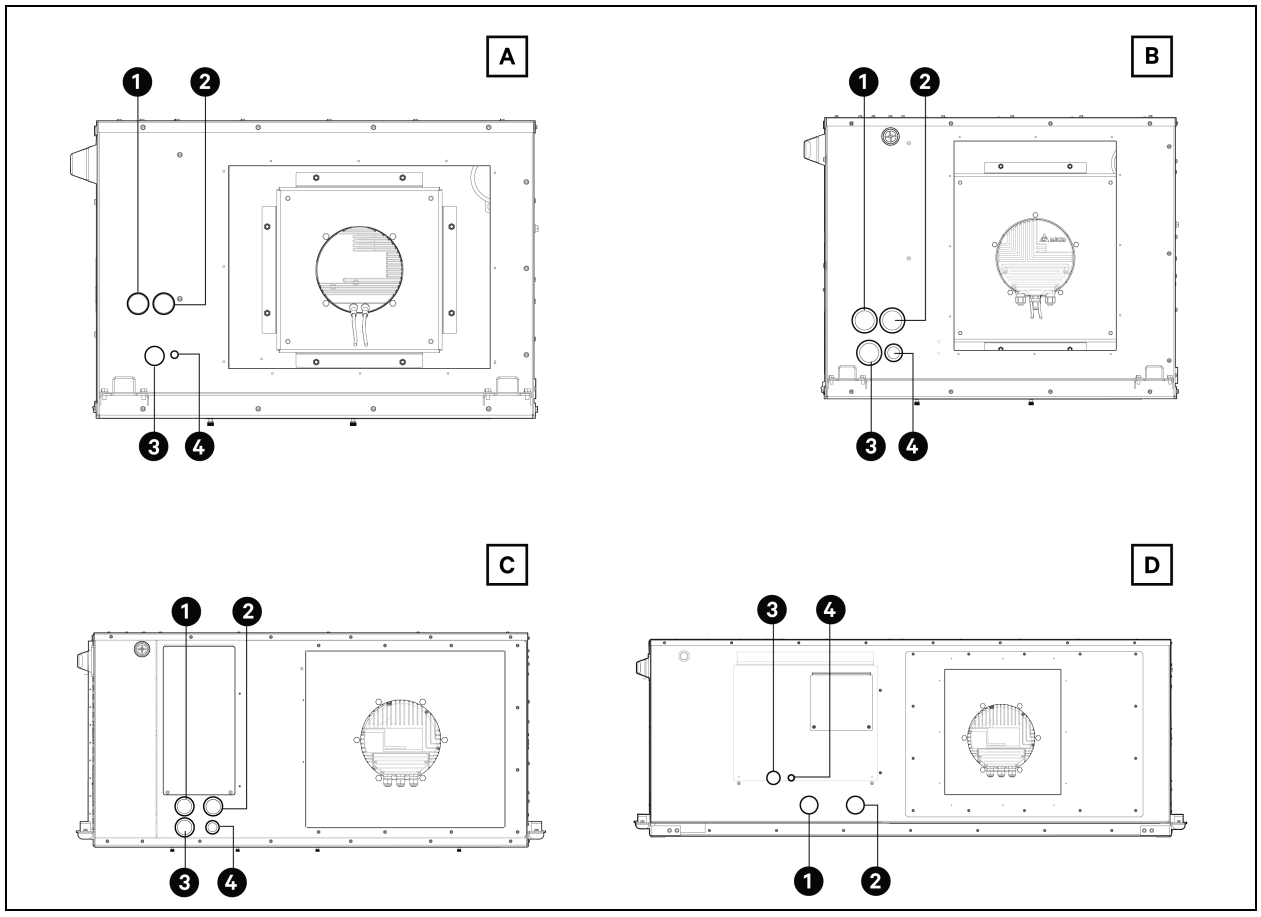

| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Evaporator Coil | 7 | Filter Drier |
| 2 | Electronic Expansion Valve | 8 | To OHE Condensing Unit |
| 3 | Suction Pipe | 9 | From OHE Condensing Unit |
| 4 | Pressure Transducer | 10 | Distributor |
| 5 | Schrader Port with Valve Core | 11 | Distributor Feeders[SJ1] |
| 6 | Shut-off (Solenoid Valve) | | |

**Figure 5.6 Piping schematic 8 Ton Split System Air-Cooled**




| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Evaporator Coil | 8 | To OHE Condensing Unit |
| 2 | Electronic Expansion Valve | 9 | Suction Line |
| 3 | Temperature Sensor Probe | 10 | Liquid Line |
| 4 | Pressure Transducer | 11 | From OHE Condensing Unit |
| 5 | Schrader Port with Valve Core | 12 | Sutt-off Valve |
| 6 | Suction Pipe | 13 | Refrigerant Distributor |
| 7 | Filter Drier | 14 | Refrigerant Distributor Feeders |

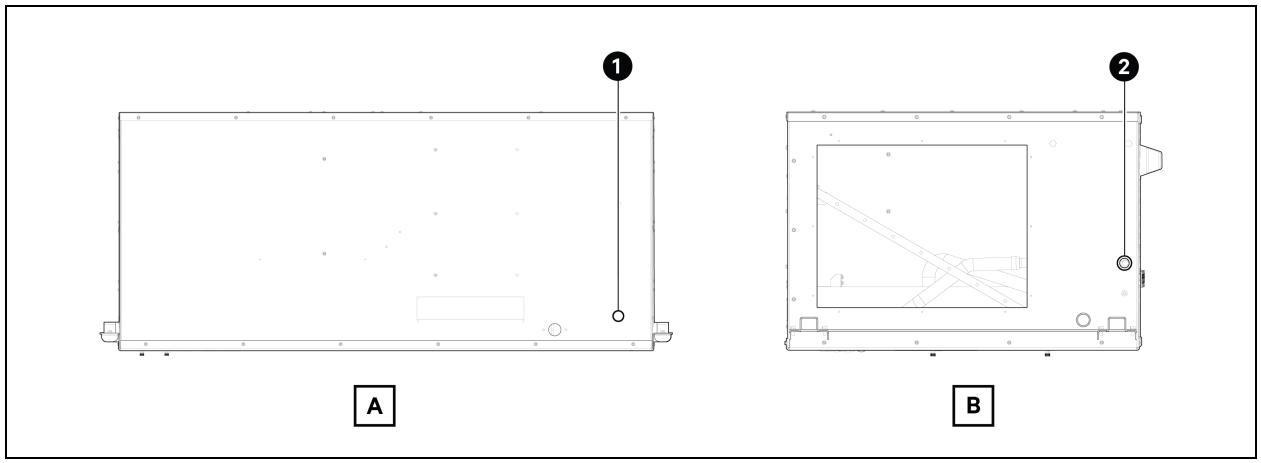
**Figure 5.7 Connection drawings for Refrigerant and Free Cooling piping outlets**




| Model | | Description | | | |
|---|---|---|---|---|---|
| | | 1<br>Free Cooling Return Line (outlet) | 2<br>Free Cooling Fluid Supply (inlet) | 3<br>Suction Refrigerant Line (outlet) | 3<br>Suction Refrigerant Line (outlet) |
| A | MMI12 (1 Ton) | 5/8 in (15.875 mm) O.D. | 5/8 in (15.875 mm) O.D. | 1/2 in (12.7 mm) O.D. | 3/8 in (9.525 mm) O.D. |
| B | MMI24/36 (2 and 3 Ton) | 5/8 in (15.875 mm) O.D. | 5/8 in (15.875 mm) O.D. | 1/2 in (12.7 mm) O.D. | 3/8 in (9.525 mm) O.D. |
| C | MMI48/60 (4 and 6 Ton) | 7/8 in (22.225 mm) O.D. | 7/8 in (22.225 mm) O.D. | 3/4 in (19.05 mm) O.D. | 3/8 in (9.525 mm) O.D. |
| D | MMI96 (8 Ton) | 1-3/8 in (34.925 mm) O.D. | 1-3/8in (34.925 mm) O.D. | 7/8 in (22.225 mm) O.D. | 5/8 in (15.875 mm) O.D. |

**NOTE: For more detailed information, refer to the submittals in the System Design manual or contact a Vertiv representative.**

**Figure 5.8 Connection Drawings for Condensate Pump and Humidifier Piping Outlets**




| Item | Description | Item | Description |
|---|---|---|---|
| A | Back of the unit | 1 | Condensate Drain Connector 3/4 in FPT |
| B | Return of the air side of the unit | 2 | Humidifier water supply connection 1/4 FPT x 1 in HEX |

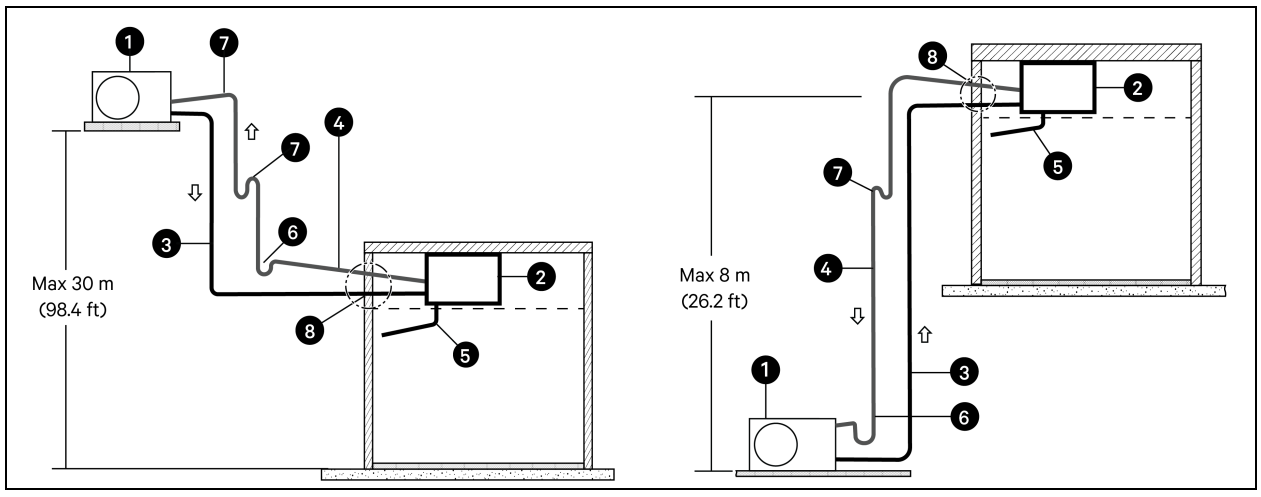
## 5.1.1 Piping When Condensing Unit is Above or Below Evaporator

Refer to General Arrangements on page 58 for the maximum vertical rise/fall between condensing unit and evaporator.

When installing remote condensing units above the evaporator, trap the suction gas line at the evaporator as shown in Figure 5.9. Traps recommended at the base of riser exceeding 5 ft (1.5 m) and every 20 ft (6 m) of vertical rise. This trap will retain refrigerant oil during the "Off" cycle. When the unit starts, oil in the trap is carried up the vertical riser and returns to the compressor.

When installing remote condensing units below the evaporator, trap the suction gas line with an inverted trap the height of the evaporator as shown in the following figure. This prevents refrigerant migration to the compressor during "Off" cycles.

**Figure 5.9 Refrigerant Piping Diagram When Condenser is Above or Below the Evaporator**



| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Condenser (outdoor unit) | 5 | Condensate pipe |
| 2 | Evaporator (indoor unit) | 6 | Oil trap (*) |
| 3 | Liquid pipe (high pressure) | 7 | Inverted oil trap (**) |
| 4 | Suction pipe (low pressure) | 8 | The gap between the pipe and the wall needs to be sealed |

**NOTE: Any horizontal pipe must be pitched down toward the condensing unit at a minimum rate of 1/2 in (13 mm) per 10 ft (3 m) to assure oil return to the compressor.**

**Table 5.1 Pipe length and condensing unit elevation relative to evaporator**

| Model | Maximum Condensing Unit Level Above Evaporator, ft (m) | Maximum Condensing Unit Level Below Evaporator, ft (m) |
|---|---|---|
| MMI12 | 49.2 (15) | 16.4 (5) |
| MMI24 | 49.2 (15) | 16.4 (5) |
| MMI36 | 49.2 (15) | 16.4 (5) |
| MMI48 | 49.2 (15) | 16.4 (5) |
| MMI60 | 98.4 (30) | 26.2 (8) |
| MMI96 | 98.4 (30) | 26.2 (8) |

## 5.2 Refrigerant Piping and Charging

**WARNING! Risk of over-pressurization of the refrigeration system. Can cause explosive discharge of high-pressure refrigerant, loss of refrigerant, environmental pollution, equipment damage, injury, or death. This unit contains fluids and gasses under high pressure. Use extreme caution when charging the refrigerant system. Do not pressurize the system higher than the design pressure marked on the unit's nameplate. Consult local building and plumbing codes for installation requirements of additional pressure relief devices when isolation valves are field installed. Do not isolate any refrigerant circuits from over-pressurization protection.**

**NOTICE**

Vertiv™ CoolPhase Ceiling systems require the use of PVE (FW68S). Oil absorbs water at a much faster rate when exposed to air than previously used oils. Because water is the enemy of a reliable refrigeration system, extreme care must be used when opening systems during installation or service. If water is absorbed into the oil, it will not be easily removed and will not be removed through the normal evacuation process. If the oil is too wet, it may require an oil change. Oils also have a property that makes them act as a solvent in a refrigeration system. Maintaining system cleanliness is extremely important because the oil will tend to bring any foreign matter back to the compressor.

### 5.2.1 Refrigerant Piping Guidelines for Air Cooled Systems

- Evaporators and condensing units ship with an inert gas holding charge. Do not vent the evaporator and condensing unit until all refrigerant piping is in place, ready for connection to the unit and condensing unit.
- Use copper piping with a brazing alloy with a minimum temperature of 1350° F (732° C), such as Sil-Fos. Avoid soft solders, such as 50/50 or 95/5.
- Use a flow of dry nitrogen through the piping during brazing to prevent formation of copper oxide scale inside the piping. When copper is heated in the presence of air, copper oxide forms. PVE oils will dissolve these oxides from inside the copper pipes and deposit them throughout the system, clogging filter driers and affecting other system components.
- A pure dry nitrogen flow of 1-3 $ft^3$/min (0.5-1.5 l/s) inside the pipe during brazing is sufficient to displace the air. Control the flow using a suitable measuring device.
- Ensure that the tubing surfaces to be brazed are clean and that all burrs have been removed from the ends of the tubes.
- Ensure that all loose material has been cleaned from inside the tubing before brazing.
- Protect all refrigerant line components within 18 in (460 mm) of the brazing site by wrapping them with a wet cloth or with a suitable heat sink compound.
- Isolate piping from building using vibration isolating supports.
- When sealing openings in walls and to reduce vibration transmission, use a soft, flexible material to pack around the tubes to prevent tube damage.
- When installing remote condensing units above the evaporator, the suction gas lines should be trapped at the evaporator. These traps will retain refrigerant oil in the off cycle. When the unit starts, oil in the traps is carried up the vertical risers and returns to the compressors. For rises over 25 ft (7.6 m), trap every 20 ft (6 m) or evenly-divided.
- Consult factory if piping run exceeds 150 ft (46 m) equivalent length.
- Keep piping clean and dry, especially on units with R-32 refrigerant.
- Avoid piping runs through noise sensitive areas.
- Do not run piping directly in front of discharge air stream.
- Refrigerant oil – do not mix oil types.
- Refer to ASHRAE Refrigeration Handbook for general, good practice refrigeration piping.

**NOTE: All indoor and outdoor suction line piping must have 1/2 in minimum of insulation. All outdoor insulation must be UV and ozone resistant.**

**NOTE: Proper safety equipment and proper refrigeration tools are required when working with R-32 refrigerant. Check unit serial tag for correct refrigerant type before topping off or recharging a system.**

**NOTE: Refrigerant R-32 compressors use a PVE (Polyvinyl Ether) lubricant. The refrigerant must be introduced and charged from the cylinder only as a liquid.**

**NOTE: When installing field piping, you must take care to protect all refrigerant lines from the atmosphere especially when using refrigerants with PVE oils. Do not allow the piping to stand open to air for more than 15 minutes. Units designed for R-32 have a compressor that contains PVE oil, which quickly absorbs water from the air. The longer that the refrigerant piping is left open to air, the harder it will be to fully evacuate the system. If left open too long, the PVE oil may require replacement to achieve the required vacuum level.**

- Refer to Table 5.3 Vertiv™ CoolPhase Ceiling recommended refrigerant line sizeson Vertiv™ CoolPhase Ceiling recommended refrigerant line sizes, O.D. CU for Vertiv™ CoolPhase Condensing Unit on page 76 , for recommended refrigerant piping sizes based on equivalent pipe lengths.

- Refer to the condensing unit's Installer/User Guide for the complete charging procedure of the system.

## 5.3 Connecting Drainage Pipes

The following pipe connections are required:

- Water supply line to the optional humidifier (if applicable).
- Drain line from unit drain connection.

**NOTICE**

Risk of clogged or leaking drain lines and leaking water supply lines. Can cause equipment and building damage.

This unit requires a water drain connection. Drain lines must be inspected at start-up and periodically, and maintenance must be performed to ensure that drain water runs freely through the drain system and that lines are clear and free of obstructions and in good condition with no visible sign of damage or leaks.

Improper installation, application and service practices can result in water leakage from the unit. Water leakage can result in catastrophic and expensive building and equipment damage and loss of critical data center equipment.

Do not locate unit directly above any equipment that could sustain water damage.

We recommend installing a monitored fluid detection system to immediately discover and report coolant fluid system and condensate drain line leaks.

### 5.3.1 Connecting Water Supply Line to Humidifier

**NOTE: The connections must be sealed to prevent water leakage.**

The following is required for units with the optional steam generating humidifier package:

- 1/4 in. (6.4 mm) copper compression fitting connection for water inlet.
- The supply pressure range is 10 psig to 150 psig (69 to 1034 kPa) at 1 gpm (3.8 lpm).
- A shut-off valve in the supply line to isolate the humidifier for maintenance.
- Do not supply steam generating humidifier with softened water.
- Do not use hot water source.
- Water conductivity must be in the range of 330 - 750 micro siemens.

To install the water supply:

1. Cut the tube square and remove any burrs.
2. Slide nut, then sleeve on tube. The threaded end of the nut faces the end of the tube.
3. Insert the tube into the fitting, seating it against the stop shoulder and tighten the nut hand tight to the body.
4. Use a wrench to tighten the nut 1-1/4 to 2-1/4 turns.

**NOTICE**

Risk of improper tightening of the piping fittings. Can damage fittings and cause leaks. Use caution not to overtighten or under tighten the piping fittings.

Do not route the humidifier supply line in front of the filter box access panel.

## 5.3.2 Drain Line Installation Requirements

**NOTICE**

Risk of water backing up in the drain line. Leaking and overflowing water can cause equipment and building damage.

Do not install an external trap in the drain line. This line already has a factory installed trap inside the cabinet. Installation of a second trap will prevent drain water flow and will cause the water to overflow the drain pan.

Sagging condensate drain lines may inadvertently create an external trap.

A 3/4 in. (19.1 mm) NPT female connection is provided for the evaporator unit condensate drain. The evaporator drain pan includes a float switch to prevent operation if the drain line becomes blocked. This line also drains the humidifier, if applicable.

Observe the following requirements and refer to Correct and Incorrect Gravity Drains on Figure 5.10, when installing and routing the drain line:

- The drain line must be sized for 2 gpm (7.6 l/m) flow.
- The drain line must be located so it will not be exposed to freezing temperatures.
- The drain should be the full size of the drain connection.
- The drain line must slope continuously away from the unit.
- Do not externally trap the drain line.
- The drain line must be rigid enough that it does not sag between supports, which unintentionally creates traps.
- Use copper or other material suitable for draining water that can reach temperatures up to 212° F (100° C).
- When the evaporator is installed below the level of the gravity fed drain line, the optional condensate pump kit is required. See Condensate Drain Pump Kit on the next page.

**NOTE: Remove the shipping band from the float switch in the evaporator pan before operating the unit.**

**Figure 5.10 Correct and incorrect gravity drains**

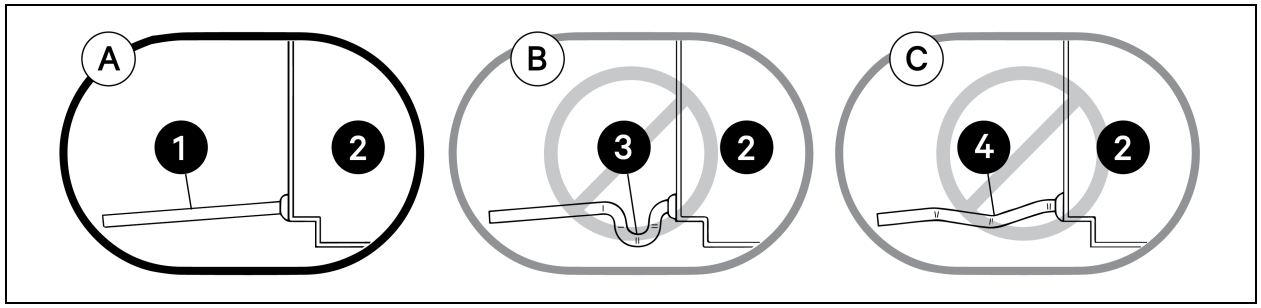


**Table 5.2 Gravity-fed drain line figure descriptions**

| Item | Description | Item | Description |
|---|---|---|---|
| A | Correct drain installation. | 2 | Evaporator Unit |
| B | Incorrect. Do not trap externally. | 3 | External trap |
| C | Incorrect. Sagging between supports and bowed line causes unintentional external traps. | 4 | Unintentional traps from bowing line. Lines must be rigid enough not to bow or sag between supports, creating a trap. |
| 1 | Continuous downward slope away from the unit. | | |

### 5.3.3 Condensate Drain Pump Kit (Optional Accessory)

**WARNING! Risk of electric shock. Can cause equipment damage, injury or death. Open all local and remote electric power supply disconnect switches and verify with a voltmeter that power is off before working within any electric connection enclosures. Service and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.**

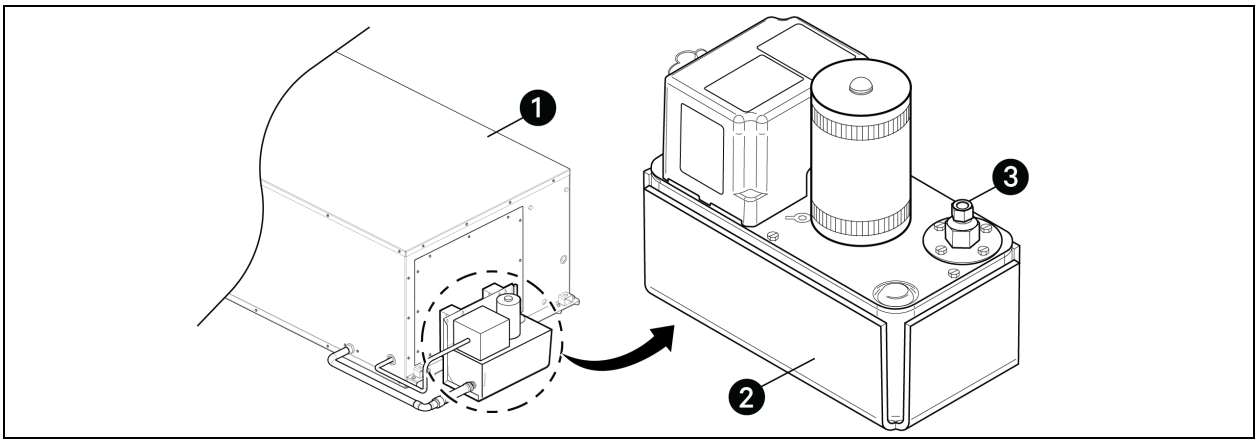
The optional condensate pump kit is required when the evaporator is installed below the level of the gravity fed drain line. The condensate pump is field installed alongside the evaporator unit.

A 3/4 in NPT female connection is provided for the evaporator unit condensate drain.

- The drain is trapped internally, do not trap external to unit.
- Size the discharge piping based on the available condensate head.

The installation of the condensate drain pump is described in the SL-80133 Condensate Pump Kit Quick Installation Guide.

**Figure 5.11 Condensate pump piping connection locations (MMI96 / 8Ton as reference)**



| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Vertiv™ CoolPhase Ceiling | 3 | Outlet |
| 2 | Condensate Pump | | |

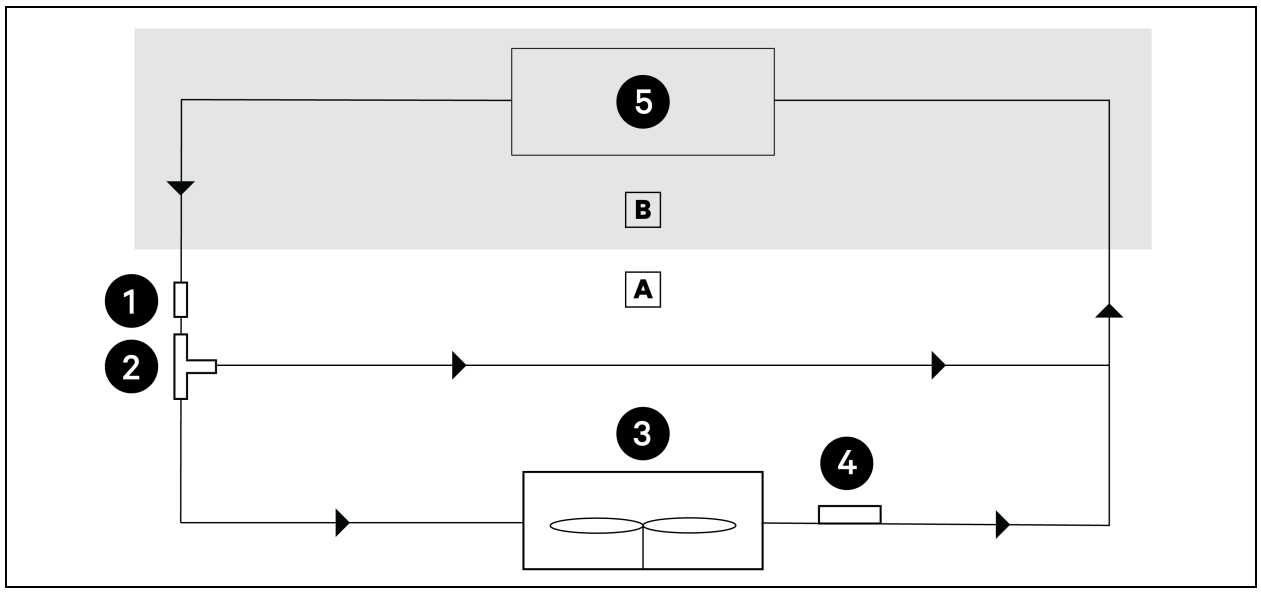
**NOTE: For detailed information refer to the SL-80133 Vertiv™ CoolPhase Ceiling Condensate Pump Kit Quick Installation Guide.**

## 5.4 Free Cooling Coil Piping

Refer to the applicable piping general arrangement schematics for your system for detailed free-cooling coil installation information. See Piping and Refrigerant Requirements on page 57 .

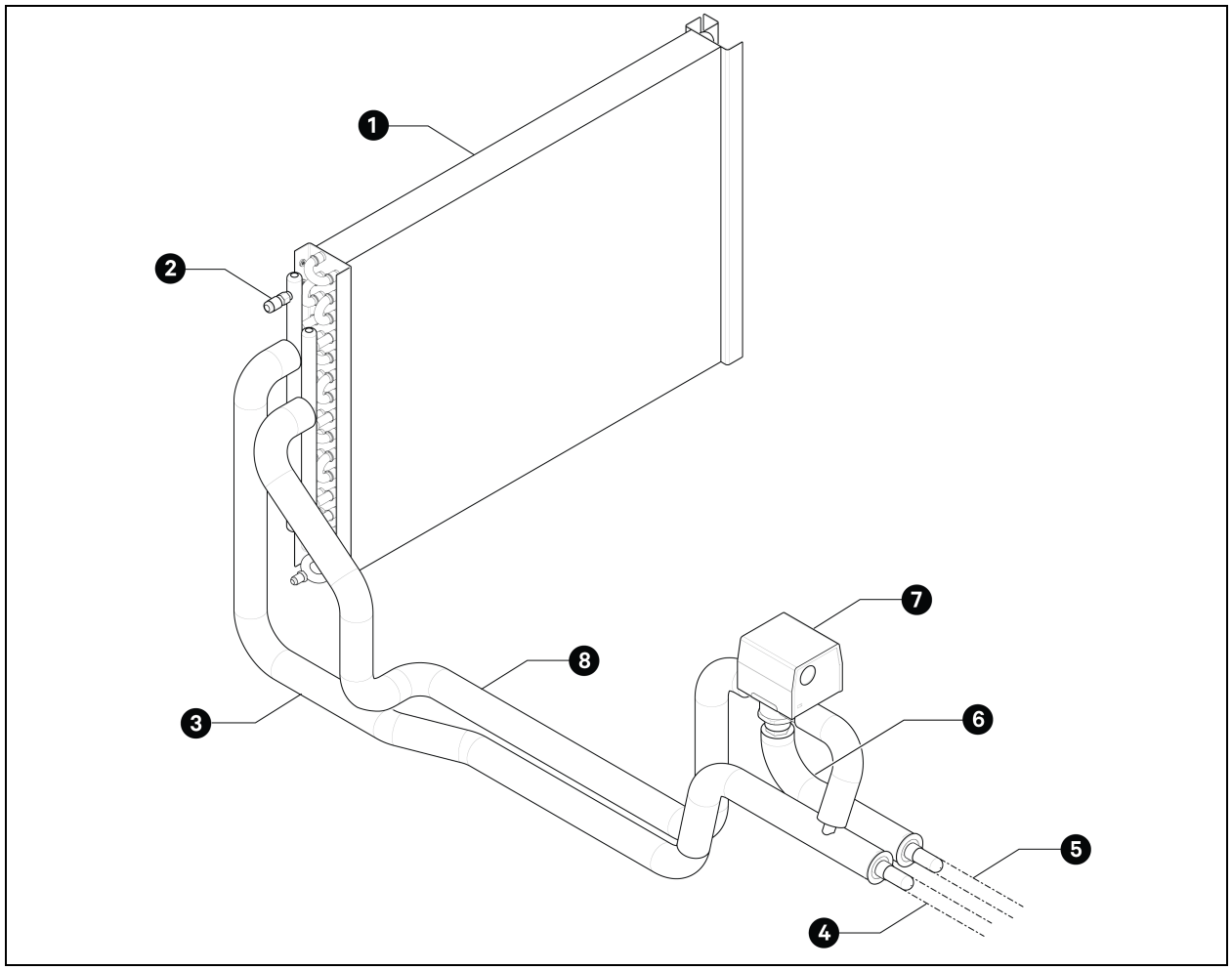
**NOTE: If the free cooling coil is piped to an open water tower, a CU/NI (copper/nickel) type coil must be ordered to prevent corrosion of the copper tubes, or a heat exchanger must separate the tower water from the free cooling loop.**

**Figure 5.12 Piping general arrangement diagram drawings for Free Cooling models (when applicable)**



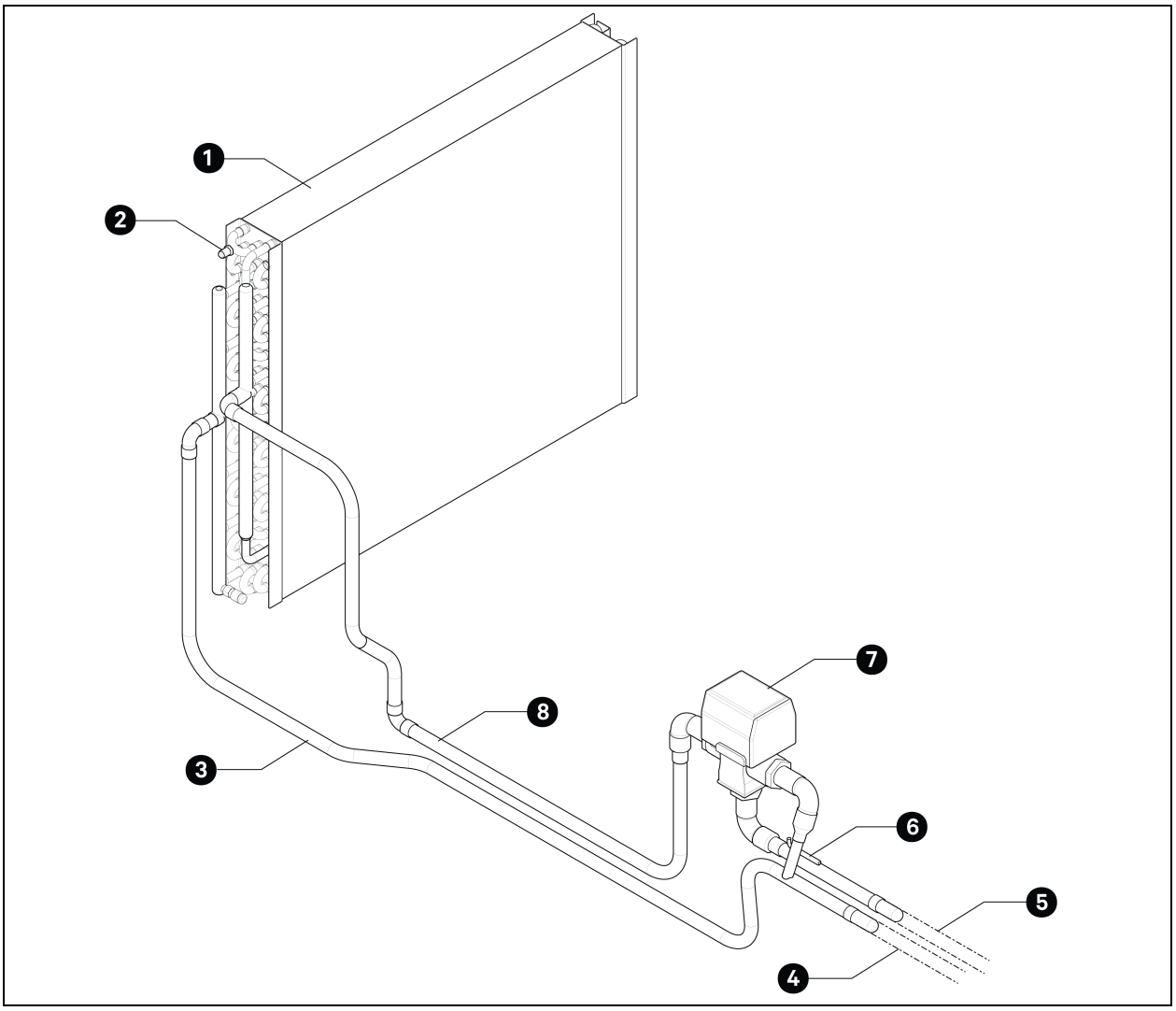

| Item | Description | Item | Description |
|---|---|---|---|
| A | Indoor | 3 | Free Cooling Coil |
| B | Outdoor / Plenum | 4 | Bleed Valve |
| 1 | Temperature Sensor | 5 | Fluid Supply Unit |
| 2 | 3-way Valve | | |

**Figure 5.13 Piping general arrangement for 1 Ton Split System Free Cooling**



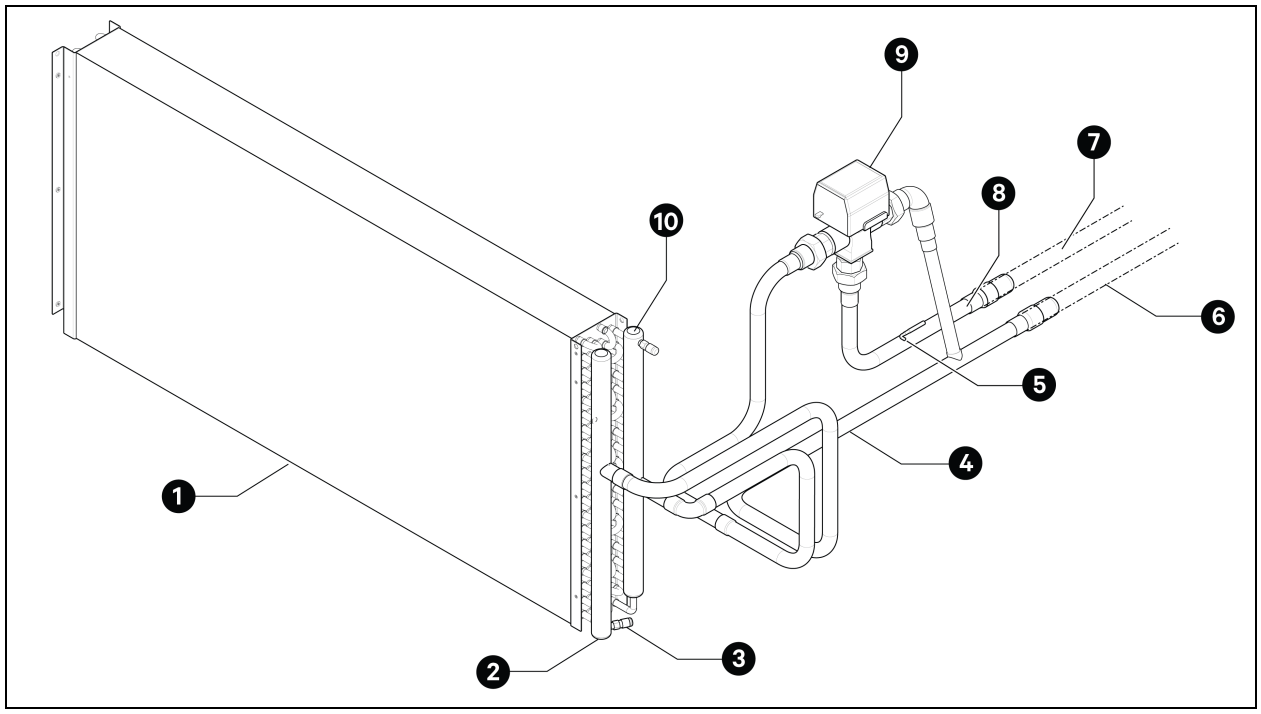

| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Free Cooling Coil | 5 | Water supply |
| 2 | Bleeding valve | 6 | Temperature sensor probe<br>**NOTE: NOTE: Not shown, located below the insulation foam** |
| 3 | Fluid Return Pipe | 7 | Free Cooling 3-Way Valve |
| 4 | Water Return | 8 | Fluid Supply Pipe |

**Figure 5.14 Piping general arrangement for 2 & 3 Ton Split System Free Cooling**



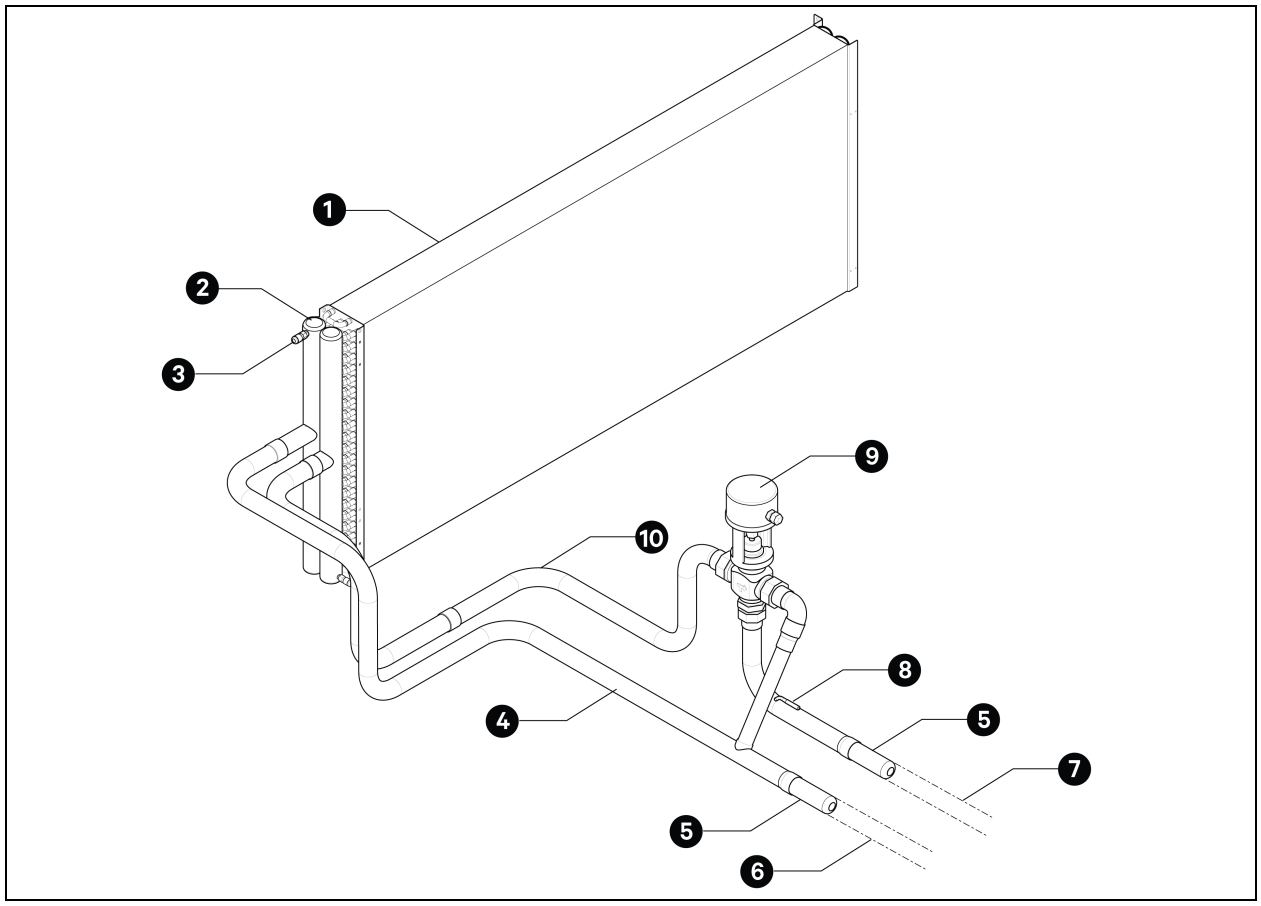

| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Free Cooling Coil | 5 | Water Supply |
| 2 | Bleeding Valve | 6 | Temperature Sensor Probe |
| 3 | Fluid Return Pipe | 7 | Free Cooling 3-Way Valve |
| 4 | Water Return | 8 | Fluid Supply Pipe |

**Figure 5.15 Piping general arrangement for 4 & 5 Ton Split System Free Cooling**




| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Free Cooling Coil | 5 | Water Supply |
| 2 | Bleeding Valve | 6 | Temperature Sensor Probe |
| 3 | Fluid Return Pipe | 7 | Free Cooling 3-Way Valve |
| 4 | Water Return | 8 | Fluid Supply Pipe |

**Figure 5.16 Piping general arrangement for 8 Ton Split System Free Cooling**




| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Free Cooling Coil | 5 | Water Supply |
| 2 | Bleeding Valve | 6 | Temperature Sensor Probe |
| 3 | Fluid Return Pipe | 7 | Free Cooling 3-Way Valve |
| 4 | Water Return | 8 | Fluid Supply Pipe |

## 5.5 Connecting Gas Pipe and Liquid Pipe

**Table 5.3 Vertiv™ CoolPhase Ceiling recommended refrigerant line sizes, O.D. CU for Vertiv™ CoolPhase Condensing Unit**

| CoolPhase Ceiling | Total Equivalent Length ft (m) | Suction Line, in (mm) | Liquid Line in. (mm) |
|---|---|---|---|
| MMI12 (1 Ton) + CU03A | 0 to 32.80 (0 to 10) | ½ (12.70) | ¼ (6.35) |
| | 32.80 to 196.90 (10 to 60) | ½ (12.70) | 5/16 (7.93) |
| MMI24 (2 Ton) + CU07A | 0 to 16.40 (0 to 5) | ½ (12.70) | 3/8 (9.52) |
| | 16.40 to 65.60 (5 to 20) | 5/8 (15.87) | 3/8 (9.52) |
| | 65.60 to 196.85 (20 to 60) | ¾ (19.05) | 3/8 (9.52) |
| MMI3 (36 Ton) + CU11A | 0 to 16.40 (0 to 5) | ½ (12.70) | 3/8 (9.52) |
| | 16.40 to 49.20 (5 to 15) | 5/8 (15.87) | 3/8 (9.52) |
| | 49.20 to 65.60 (15 to 20) | 5/8 (15.87) | ½ (12.70) |
| | 65.60 to 131.20 (20 to 40) | ¾ (19.05) | ½ (12.70) |
| | 131.20 to 196.85 (40 to 60) | 7/8 (22.22) | ½ (12.70) |
| MMI48 (4 Ton) + CU15A | 0 to 32.80 (0 to 10) | ¾ (19.05) | ½ (12.70) |
| | 32.80 to 295.30 (10 to 90) | 7/8 (22.22) | ½ (12.70) |
| MMI60 (6 Ton) + CU21A | 0 to 49.20 (0 to 15) | 7/8 (22.22) | 5/8 (15.87) |
| | 49.20 to 295.30 (15 to 90) | 1-1/8 (28.58) | 5/8 (15.87) |
| MMI96 (8 Ton) + CU28A | 0 to 16.40 (0 to 5) | 7/8 (22.22) | 5/8 (15.87) |
| | 16.40 to 98.40 (5 to 30) | 1-1/8 (28.58) | 5/8 (15.87) |
| | 98.40 to 295.30 (30 to 90) | 1-3/8 (34.93) | ¾ (19.05) |

**NOTE: Must downsize vertical riser one trade size (1-1/8” to 7/8”, 7/8” to 3/4”, 3/4” to 5/8”, 5/8” to 1/2”).**

**NOTE: If the condensing unit is installed indoors, the total system refrigerant charge (Indoor unit+ Condensing unit + Piping) can’t exceed 4 lbs.**

**NOTE: Contact your representative for line sizing for runs longer than 295.30 ft (90 m) equivalent length.**

**Table 5.4 Equivalent Length of Components**

| Liquid Pipe, External Diameter in (mm) | Equivalent Length ft (m) | | |
|---|---|---|---|
| | 90° Bend 45° Bend T Type Three-Way | 90° Bend 45° Bend T Type Three-Way | 90° Bend 45° Bend T Type Three-Way |
| ½ (12.70) | 1.31 (0.40) | 0.65 (0.20) | 2.49 (0.76) |
| 5/8 (15.87) | 1.80 (0.55) | 0.88 (0.27) | 2.49 (0.76) |
| ¾ (19.05) | 1.96 (0.60) | 0.98 (0.30) | 2.49 (0.76) |
| 7/8 (22.22) | 2.29 (0.70) | 1.14 (0.35) | 3.60 (1.10) |

**Table 5.4 Equivalent Length of Components (continued)**

| Liquid Pipe, External Diameter in (mm) | Equivalent Length ft (m) | | |
|---|---|---|---|
| | 90° Bend 45° Bend T Type Three-Way | 90° Bend 45° Bend T Type Three-Way | 90° Bend 45° Bend T Type Three-Way |
| 1 1/8 (28.58) | 2.85 (0.87) | 1.44 (0.44) | 4.60 (1.04) |
| 1 3/8 (34.93) | 3.45 (1.05) | 1.72 (0.53) | 5.30 (1.60) |
| 1-5/8 (41.00) | 4.10 (1.25) | 2.05 (0.63) | 5.30 (1.60) |

**NOTE: Suitable piping thickness must be used to support the pressure of the CoolPhase Ceiling Units**

### Installing Pipelines

1. Release the pre-charged nitrogen. Open all the Schrader valves in the system to release nitrogen.
2. Cut the liquid pipe and gas pipe connectors on the evaporator and condenser.
3. Lay the pipes between the evaporator and condenser.
4. Connect a nitrogen cylinder to the Schrader valve. Purge the pipe with nitrogen to flow through the pipe while welding the pipe.

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# 6 Leak Detection System

**WARNING! Refrigerant sensors for refrigerant detection systems shall only be replaced with sensors specified by Vertiv™ and the installation needs to be performed by Vertiv™ personnel only.**

**CAUTION: Only authorized and qualified technicians must reset and confirm there's no sign of leakage, before restarting the unit.**

## 6.1 Refrigerant Leak Detector

**WARNING! Refrigerant sensors for refrigerant detection systems shall only be replaced with sensors specified by Vertiv™ and the installation needs to be performed by Vertiv™ personnel only.**

**CAUTION: Whenever main power is cycled at the unit the RLS latching relay needs to be manually reset.**

Due to the slightly flammable nature of Refrigerant R-32, a refrigerant leak detector is installed into the unit, which will allow to install and pipe the unit up to 295.28 ft (90 m) of equivalent length depending on the evaporator model. Refer to Table 8.1 Indoor Evaporator Approximate R-32 Refrigerant Charge on Amount of Refrigerant and Lubricating Oil for Air Cooled systems on page 100 .

**Operation**

When the sensor is powered up, a LED will indicate the sensor status. The LED is located on the reverse side of the sensor near the sensor membrane. While the sensor is mounted, the LED will backlight the sensor and be visible by reflection from the mounting surface

**Table 6.1 LED color description**

| Item | Description |
|---|---|
| Solid green | Sensor power-up and self-test |
| Blinking green | Normal operation (heartbeat) |
| Solid red | Alarm state – gas detected |
| Blinking red | Sensor fault |

### 6.1.1 Leak Mitigation Actions

In case of leakage, the following actions will be taken:

**Step 1**

- Detect leak
- Shut down compressor.
- Close EEV valve.
- CoolPhase Ceiling evaporator fan runs at 100%
- CoolPhase Condensing unit fan runs at 100%
- Alarms on the HMI:
  - REFRIGERANT LEAK C1
  - HIGH LFL MITIGATION

**NOTE: These actions will remain until the unit is de-energized or 5 minutes after the detection of gas is no longer present**

**Step 2**

If, after the power cycle of the unit, the sensor continues to send readings to the iCOM™ controller, and if high gas concentrations are detected, the actions in Step 1 will continue.

If the RLS device does not detect high gas concentrations after the power cycle, the following actions will take place until the unit is reset by the RLS Clear push button in the electrical box:

- Compressor is kept OFF
- EEV is Closed
- SSOV is Closed
- CoolPhase Ceiling Evaporator Fan is turned OFF
- OHE Condenser Fan is turned OFF
- The following alarms are removed from the HMI alarm list:
  - REFRIGERANT LEAK C1
  - HIGH LFL MITIGATION
- The following alarms are shown on HMI alarm list:
  - RLS COMP LOCKOUT
  - LOSS OF COOLING

**Step 3**

The RLS Clear push button must be pressed for ~10s to reset the unit to normal operation. Refer to Figure 6.1 for the ebox location of the push button.

If the unit was actively cooling (UNIT ON) before the leak was detected, it will resume cooling automatically after the RLS Clear procedure.

If the unit was in DISPLAY OFF before the leak was detected, the unit will remain in an OFF state (no active cooling).

**NOTE: In case of leakage, the unit will start mitigation actions and will send an alarm**

**NOTE: For the alarm to be reset, the sensor reading must be a minimum of 2.5% below the alarm setpoint (threshold): from 1% to 25%.**

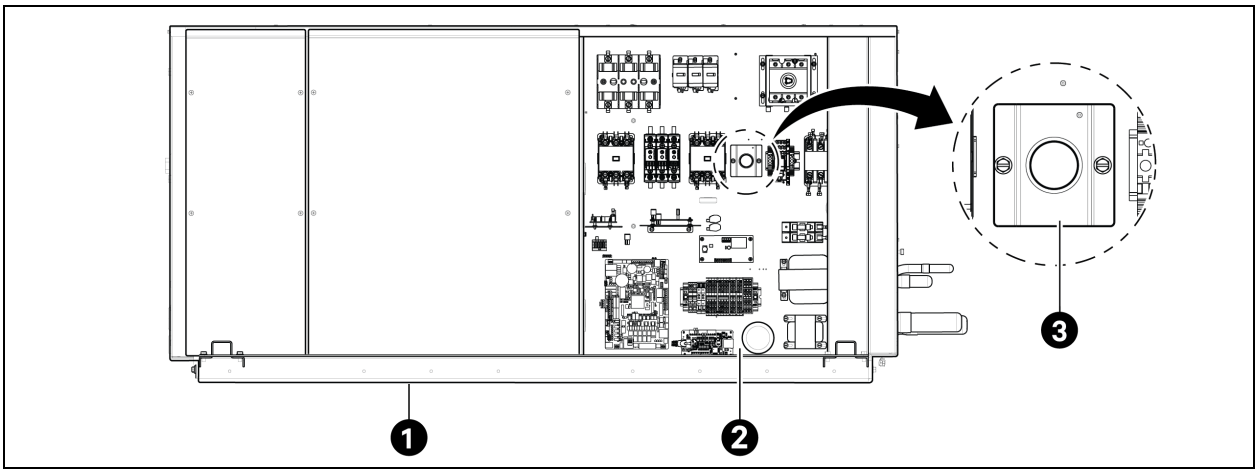
**NOTE: The mitigation actions will continue 5 minutes after the problem has been solved.**

**NOTE: After the equipment is rebooted, the Leak Detector Sensor verifies that there's no leakage**

**NOTE: The alarm will disappear from the smart display once the sensor doesn't detect the concentration of R-32 refrigerant and the LSR Relay located in the eBox has been restarted by authorized personnel. It is imperative to verify physically if the leakage was mitigated before restarting the relay.**

**NOTE: In case of leak of refrigerant, the unit will show an alarm in the display which cannot be deactivated until the leak has been repaired. Please follow the instructions provided to deactivate the alarm. After the equipment is rebooted, the Refrigerant Detection System will verify that there is no leakage. The alarm will be active until a manual verification has been done to confirm there is no refrigerant leakage and the unit has been reestablished by the operator.**

**Figure 6.1 Location of the push button at the eBox**

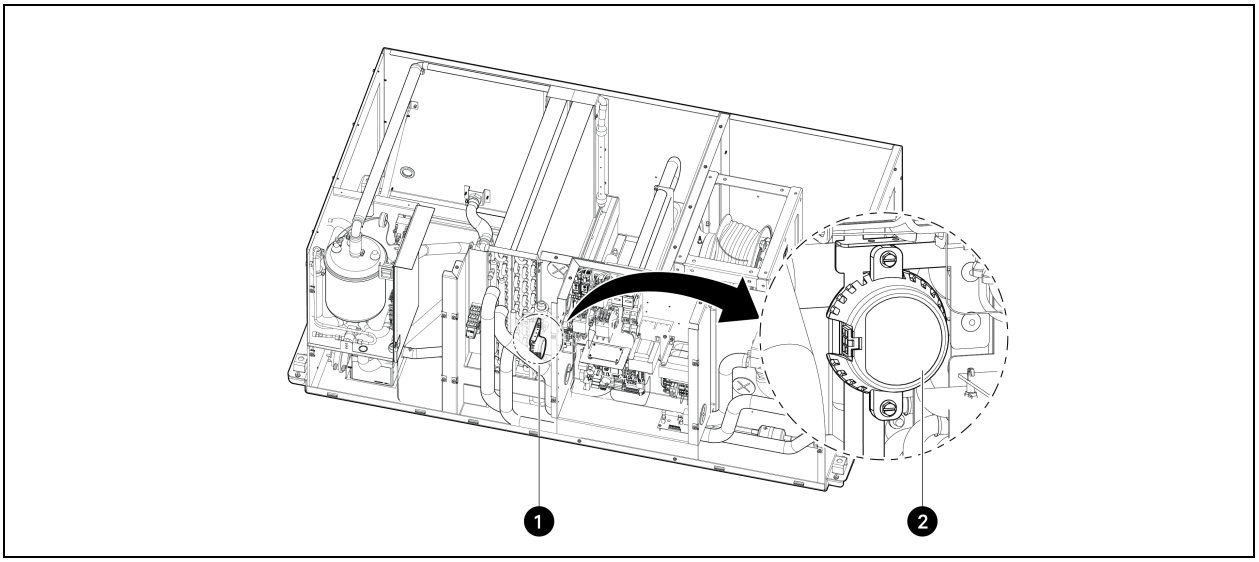



| Item | Description | Item | |
|---|---|---|---|
| 1 | Front side of the evaporating unit | 3 | Push button |
| 2 | Electrical Box (eBox) | | |

**Table 6.2 Maximum airflow**

| Parameter | MMI12 | MMI24 | MMI36 | MMI48 | MMI60 | MMI96 |
|---|---|---|---|---|---|---|
| Maximum airflow CFM (m3/h) | 816 (1,386) | 1,451 (2,465) | 1,533 (2,605) | 2,710 (4,604) | 2,746 (4,665) | 3,759 (6,387) |

**Figure 6.2 Refrigerant Leak Detector location**




| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Leak Detector location | 2 | Leak Detector |

**NOTE: Precise location of the Refrigerant Leak detector may vary depending on the indoor unit model.**

NOTE: Avoid covering the sensing area of the leak detector.

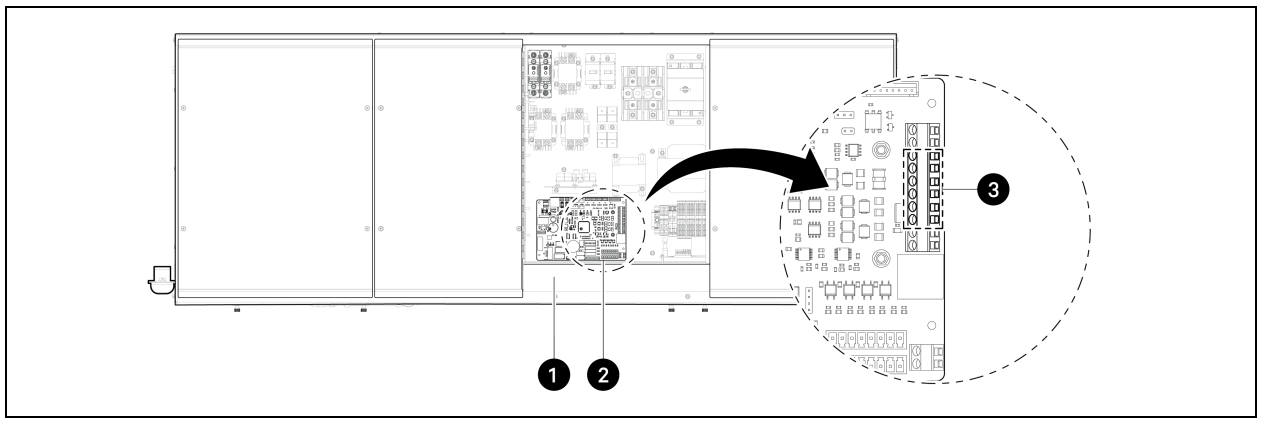
NOTE: The refrigerant leak detector is designed to sense 306 g/m³ with an accuracy of +- 2.5% of R-32 refrigerant under the specified test conditions at 73.4 °F (23.0 °C) and 101.3 kPa.

NOTE: The maximum default value is 12% (36.7 g/m³); the alarm will be activated if the concentration surpasses this value.

NOTE: Provide the corresponding maintenance and replacement of the air filters in order to avoid dust obstructions on the leak detector. See Maintenance Checklist and Schedule on page 113 and Air Filters on page 117 .

NOTE: The equipment is designed to function normally without needing additional maintenance or calibration over a planned 15-year equipment life.

**Figure 6.3 Connection between the relay and the Vertiv™ iCOM™**




| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Electrical Box (eBox) | 3 | RS485 |
| 2 | Vertiv™ iCOM™ | | |

NOTE: Each one has a relay and dry contact.

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# 7 Electrical Connection

**WARNING! Arc flash and electric shock hazard. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to the unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Vertiv™ iCOM™ does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "Unit Off" mode of the iCOM™. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.**

**WARNING! Risk of improper wire sizing/rating and loose electrical connections. Can cause overheated wire and electrical connection terminals resulting in smoke, fire, equipment and building damage, injury or death. Use correctly sized copper wire only and verify that all electrical connections are tight before turning power On. Check all electrical connections periodically and tighten as necessary.**

**NOTE: Seal openings around piping and electrical connections to prevent air leakage. Failure to do so could reduce the unit's cooling performance.**

**NOTICE**

Risk of improper power supply connection. Can cause equipment damage and loss of warranty coverage.

Prior to connecting any equipment to a main or alternate power source (for example: back-up generator systems) for start-up, commissioning, testing, or normal operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. In general, power source voltages should be stabilized and regulated to within ±10% of the load nameplate nominal voltage. Also, ensure that no three-phase sources are single phased at any time.

See transformer label for primary tap connections. Installer will need to change transformer primary taps if applied unit voltage is other than pre-wired tap voltage.

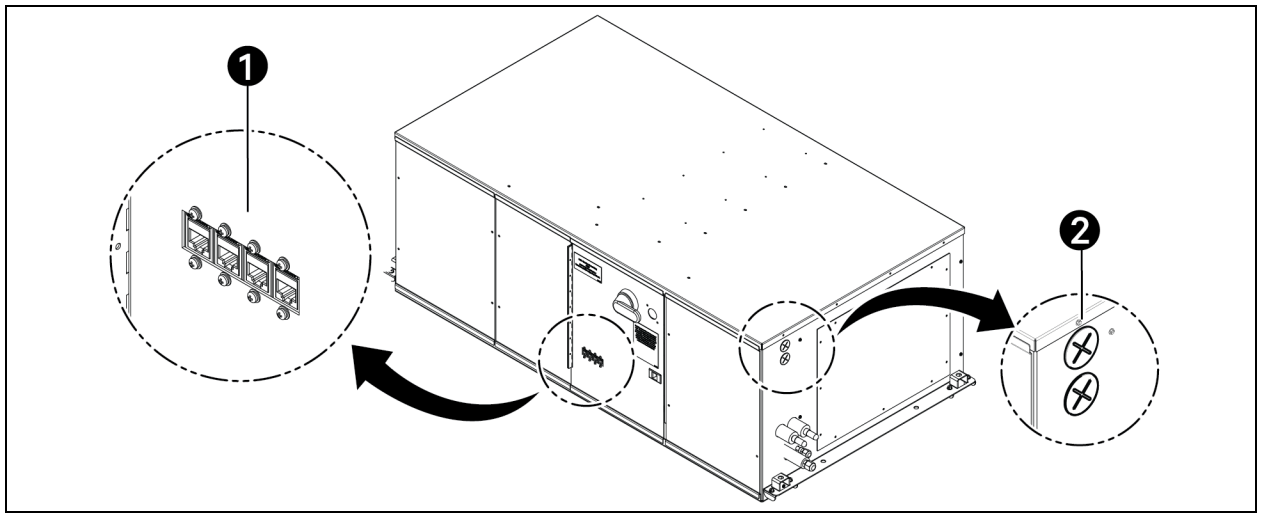
**NOTE: Check the control voltage transformer tap has the correct voltage position. Refer to the electrical schematic.**

All power and control wiring and ground connections must be in accordance with the National Electrical Code and local codes. Refer to the equipment serial tag data for electrical requirements.

A manual electrical disconnect switch should be installed in accordance with local codes and distribution system. Consult local codes for external disconnect requirements.

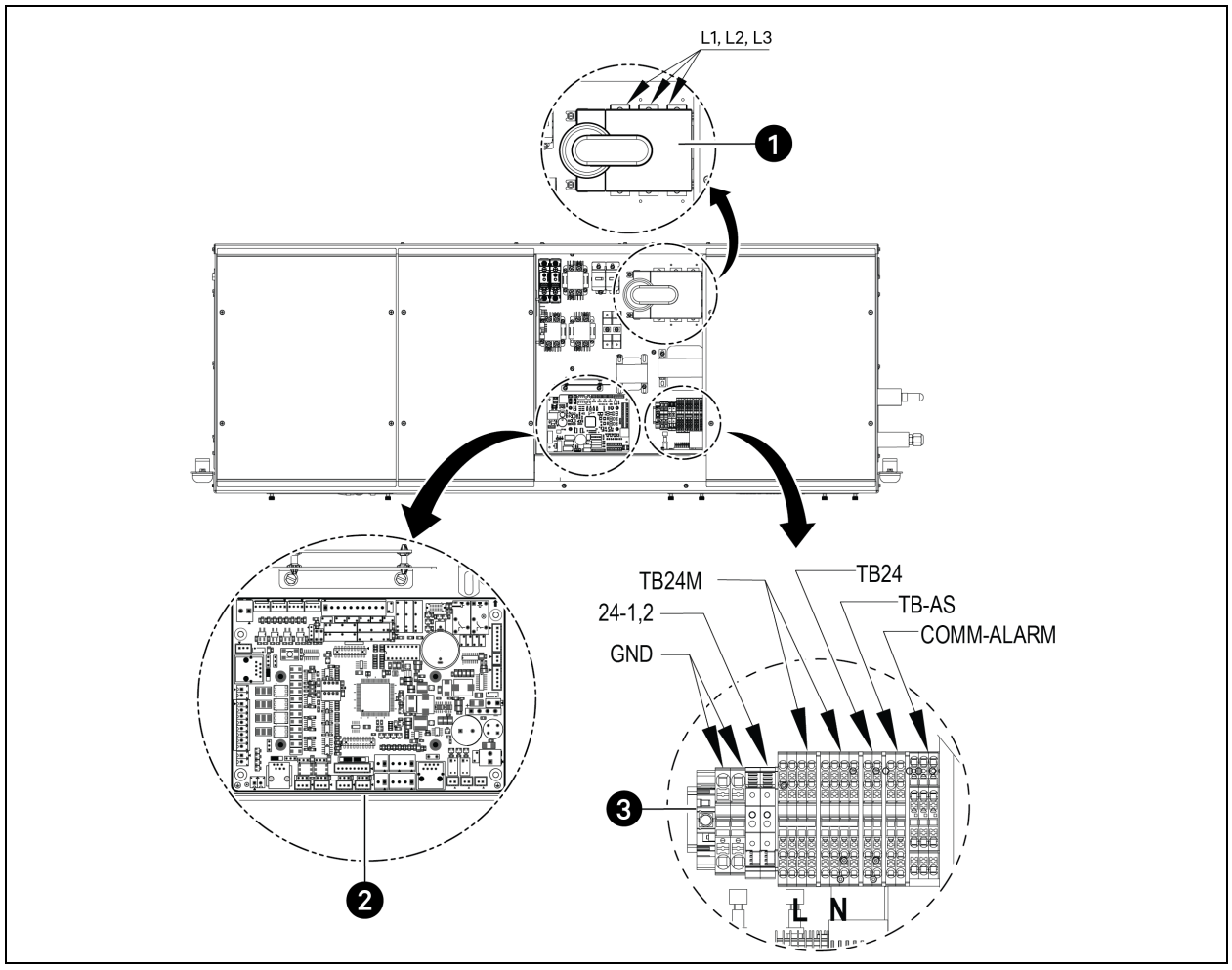
**NOTE: Input power requirements: For 3 phase units, only 3 power wires and an earth ground are required.**

**Figure 7.1 Electrical connections - Exterior**




| Item | Description | |
|---|---|---|
| 1 | Communication ports (from left to right) | - P64A: U2U-A Unit-to-Unit Communication<br>- P64B: U2U-B Unit-to-Unit Communication<br>- VFD: Condenser Modbus (RS485) Communication<br>- P74: BMS Connectivity / Embedded Unity |
| 2 | Input power supply wires, Unit-to-Unit connections - 1.37 in (35 mm) dia. concentric knockout | |

**Figure 7.2 Electrical connections - Interior**




| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Input main power supply from customer site | 2 | Vertiv™ iCOM™ |
| | | 3 | Terminal blocks |

**HIGH VOLTAGE FEATURES:**

- High Voltage Entrance: Located on top and left side of unit.
- Single and three-phase electric service and Earth Ground: Field-supplied power and service.
- Single and three-phase connection: Electric service connection terminals on disconnect.
- Disconnect Switch: Locking type standard.
- Earth ground connection: Connection terminals for field supplied earth grounding wire.

**CONTROL FEATURES:**

- 7" HMI Display communication: Vertiv Display connects with the DVI connector through DVI cable.

- Remote Temperature/Humidity Sensor: The Remote sensor connects with the Temperature and Humidity sensors that are installed in the unit.
- 7" HMI Display Power: Field connection between indoor display port and PWR connector on 7" display.
- Low Voltage and Control Wiring connections: Unit to unit, BMS and outdoor connections located on the front side of the unit.

**COMMUNICATION CONNECTIONS:**

- Customer supplies ethernet wire: connection to OHE thermal board and port ethernet port "VFD" on evaporator unit.

**STANDARD LOW VOLTAGE FEATURES:**

- Remote Alarm Device (RAD): Remote Alarm Device connect field connection wires on the 10DI board DI2 and GND see schematic for connections.

**OPTIONAL LOW VOLTAGE TERMINAL PACKAGE:**

- Optional Condensate pump switch: Customer must wire the condensate pump status wires between CP-WS-FBK1 and CP-WS-FBK2. Refer to schematic for connections.

## 7.1 Connecting Power Supply Cables

**NOTICE**

Fans must be connected only to the specified supply voltage and phase for the applicable model, either 208–230 VAC 1-phase or 3-phase or 460 VAC 3-phase.

**NOTICE**

Connection to an incorrect voltage or phase may result in overheating, abnormal operation, or permanent damage to the fan motor and associated components.

**Table 7.1 Electrical data for Vertiv™ CoolPhase Ceiling**

| Model | Power Supply | Feature | FLA (A) | MCA (A) | MOP (A) |
|---|---|---|---|---|---|
| MMI12 | 230 V / 1-Ph | Reheat | 28.0 | 35.0 | 35 |
| | | Reheat + Humidifier | 28.0 | 35.0 | 45 |
| | | Humidifier | 10.6 | 16.5 | 15 |
| | | Air Cooling | 6.2 | 7.0 | 15 |
| MMI24 | 230 V / 1-Ph | Reheat | 41.0 | 51.3 | 60 |
| | | Reheat + Humidifier | 41.0 | 51.3 | 60 |
| | | Humidifier | 14.4 | 18.0 | 15 |
| | | Air Cooling | 7.4 | 8.0 | 15 |

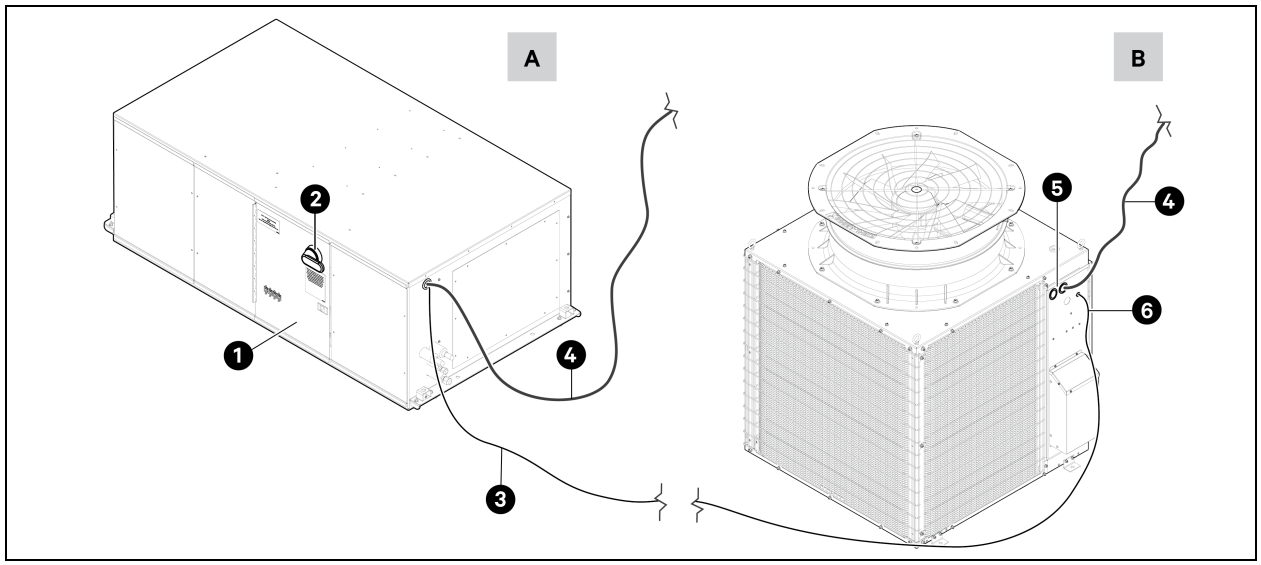
**Table 7.1 Electrical data for Vertiv™ CoolPhase Ceiling (continued)**

| Model | Power Supply | Feature | FLA (A) | MCA (A) | MOP (A) |
|---|---|---|---|---|---|
| MMI36 | 230 V / 1-Ph | Reheat | 39.2 | 48.9 | 50 |
| | | Reheat + Humidifier | 39.2 | 48.9 | 50 |
| | | Humidifier | 17.4 | 22.0 | 25 |
| | | Air Cooling | 10.3 | 12.0 | 15 |
| | 230 V / 3-Ph | Reheat | 30.5 | 38.0 | 35 |
| | | Reheat + Humidifier | 30.5 | 47.0 | 50 |
| | | Humidifier | 18.1 | 23.0 | 25 |
| | | Air Cooling | 11.0 | 13.0 | 20 |
| | 460 V / 3-Ph | Reheat | 15.0 | 21.0 | 20 |
| | | Reheat + Humidifier | 15.0 | 19.0 | 20 |
| | | Humidifier | 8.4 | 10.0 | 15 |
| | | Air Cooling | 6.2 | 7.0 | 15 |
| MI48 | 230 V / 3-Ph | Reheat | 38.6 | 48.0 | 50 |
| | | Reheat + Humidifier | 38.6 | 61.0 | 70 |
| | | Humidifier | 20.7 | 26.0 | 25 |
| | | Air Cooling | 10.9 | 13.0 | 15 |
| | 460 V / 3-Ph | Reheat | 18.4 | 23.0 | 20 |
| | | Reheat + Humidifier | 18.4 | 29.0 | 30 |
| | | Humidifier | 10.8 | 13.0 | 15 |
| | | Air Cooling | 5.8 | 7.0 | 15 |
| MMI60 | 230 V / 3-Ph | Reheat | 52.5 | 66.0 | 70 |
| | | Reheat + Humidifier | 52.5 | 78.0 | 80 |
| | | Humidifier | 20.7 | 26.0 | 25 |
| | | Air Cooling | 10.9 | 13.0 | 15 |
| | 460 V / 3-Ph | Reheat | 18.4 | 29.0 | 30 |
| | | Reheat + Humidifier | 18.4 | 23.0 | 20 |
| | | Humidifier | 10.8 | 13.0 | 15 |
| | | Air Cooling | 5.8 | 7.0 | 15 |

**Table 7.1 Electrical data for Vertiv™ CoolPhase Ceiling (continued)**

| Model | Power Supply | Feature | FLA (A) | MCA (A) | MOP (A) |
|---|---|---|---|---|---|
| MMI96 | 230 V / 3-Ph | Reheat | 40.0 | 50.0 | 50 |
| | | Reheat + Humidifier | 40.0 | 50.0 | 70 |
| | | Humidifier | 24.5 | 30.6 | 35 |
| | | Air Cooling | 12.3 | 15.3 | 20 |
| | 460 V / 3-Ph | Reheat | 20.8 | 26.0 | 25 |
| | | Reheat + Humidifier | 20.8 | 34.0 | 35 |
| | | Humidifier | 14.4 | 18.0 | 20 |
| | | Air Cooling | 8.2 | 10.0 | 15 |

**Figure 7.3 Typical electrical field connection external overview**



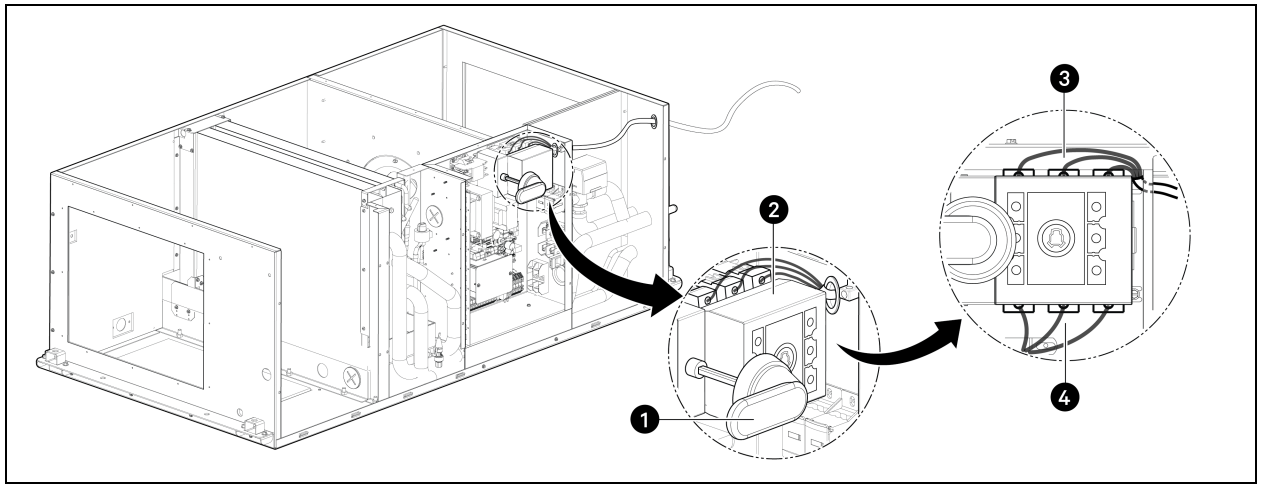

| Item | Description | Item | Description |
|---|---|---|---|
| A | Vertiv™ CoolPhase Ceiling | 3 | Low Voltage Cable (for communication) |
| B | Condensing Unit | 4 | Customer-provided high-voltage cable (for power supply) |
| 1 | Electrical Box | 5 | Knockout for Power Cable Input |
| 2 | Power supply connection (disconnect 65 kA) | 6 | Knockout for Communication Cable Input |

**NOTE: For communication between indoor and outdoor units, it's recommended to use ethernet cable CAT5e or CAT6a, or similar.**

**NOTE: For power supply connection cables between indoor and outdoor units, it's recommended to use 3-wire multi conductor cable (L1, L2 + GND) for 1-phase units and 4-wire multi conductor cable (L1, L2, L3 + GND) for 3-phase units.**

**NOTE: For gauge cable, check the related values according to each model configuration as shown in Appendix B:AWG ratings table on page 134 .**

**Figure 7.4 65kA disconnector**




| Item | Description | Item | Description |
|---|---|---|---|
| 1 | 65kA disconnector | 3 | Input (high voltage cable) |
| 2 | Internal Fuse Block | 4 | Output |

**NOTE: For 1-Phase units are 2 power distribution blocks (L1 and L2) and for 3-Phase units are 3 power distribution blocks (L1, L2 and L3).**

**NOTE: 1 and 2 Tons models are monophasic, 3 Ton models may be monophasic or triphasic, and 4 to 8 Tons models are triphasic.**

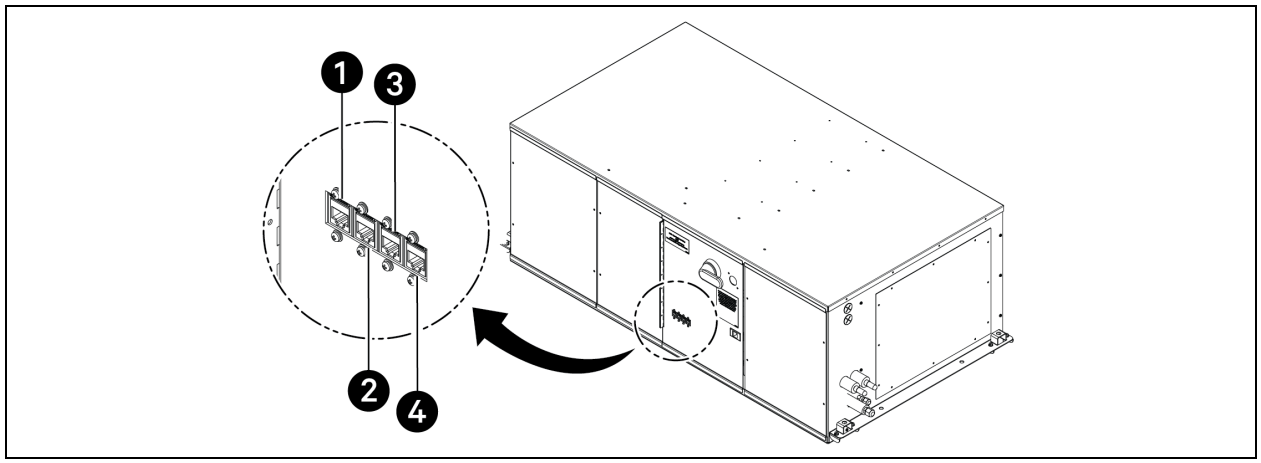
## 7.2 Connecting Communications Cable

The 50 ft (15.24 m) communication cable is provided with the unit.

The connection between the evaporator and condenser is made through an ethernet cable (Cat5E) going from the evaporator unit RS485 port to condensing unit RS485 port located in the connection panel.

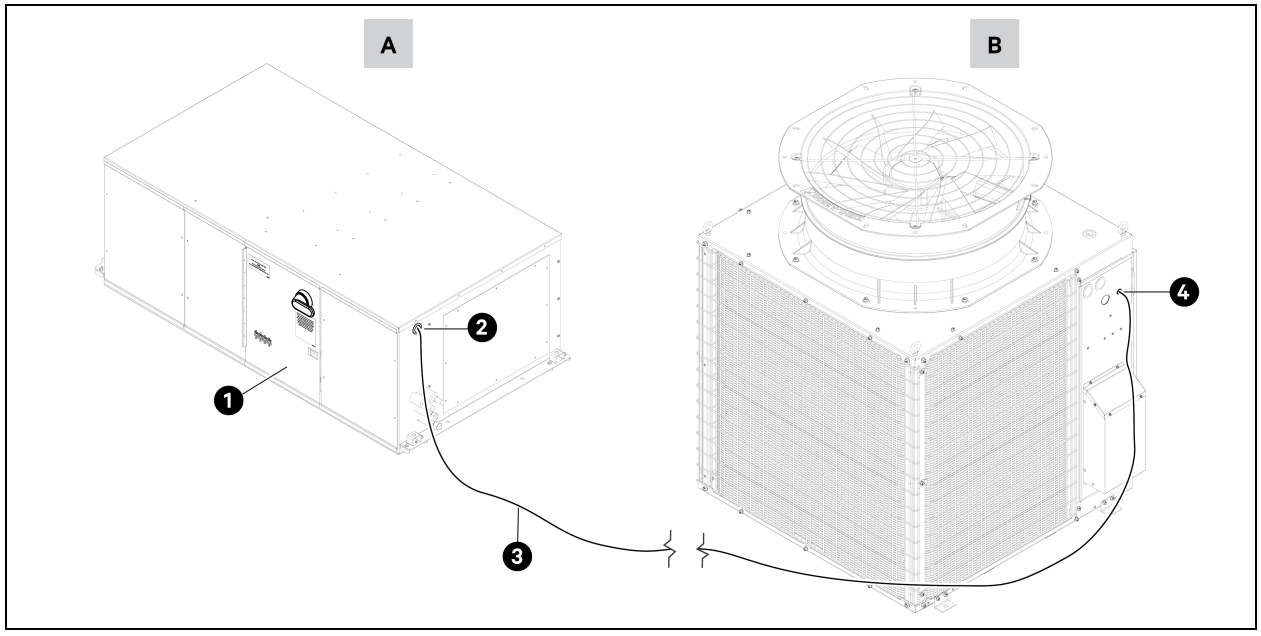
The iCOM™ board controls the operation of condenser fans through the communications cable.

**Figure 7.5 Electrical communication ports**




| Item | Description |
|---|---|
| 1 | UA Can Communication 1 |
| 2 | UB Can Communication 2 |
| 3 | VFD Remote Temperature Sensor connection |
| 4 | BMS Modbus (RS485) Communication for outdoor unit |

**Figure 7.6 Evaporator, Condenser and Communication Cable**



| Item | Description Item | | Description |
|---|---|---|---|
| A | Vertiv™ CoolPhase Ceiling | 2 | Knockout for Communication Cable output |
| B | Condensing Unit | 3 | Low Voltage Cable (communication cable) |
| 1 | Electrical Box | 4 | Knockout for Communication Cable Input |

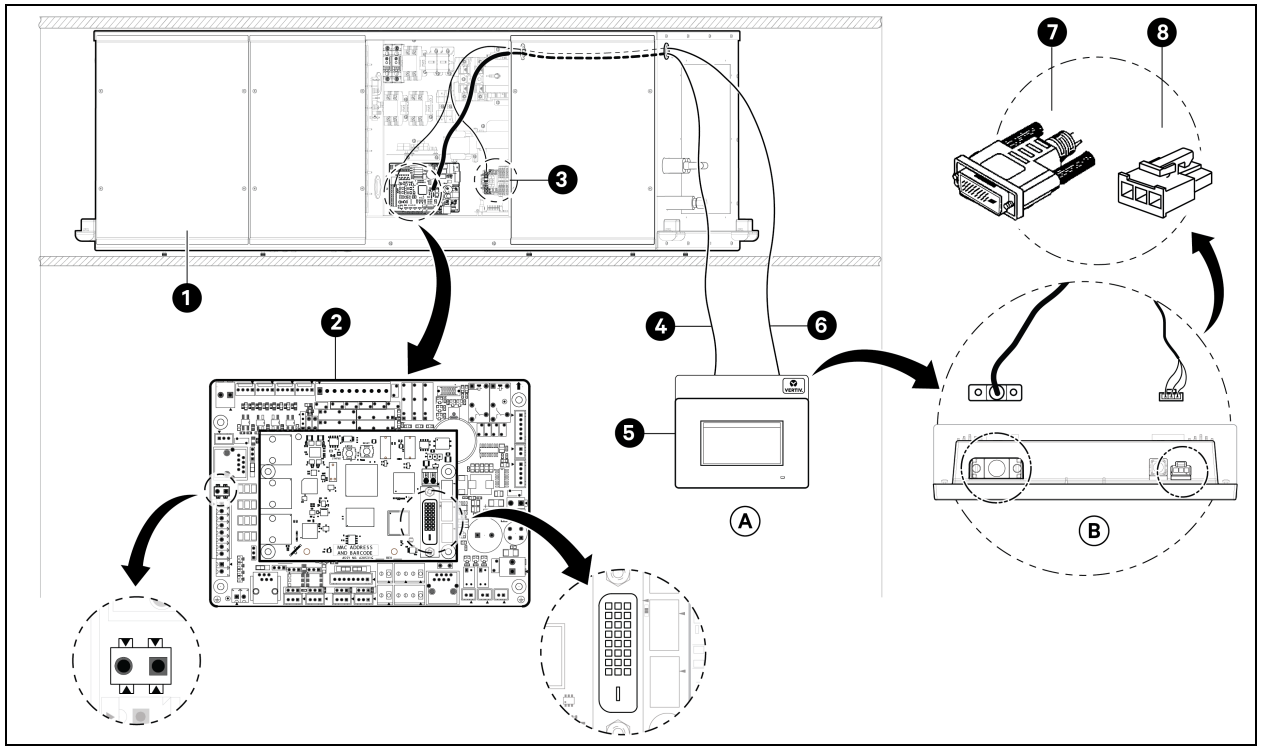
## 7.2.1 Installing and Connecting the HMI display

This section describes the procedure for installing the HMI display and connecting the communications cable between the evaporator and the HMI display.

### 7.2.1.1 Connecting Communications Cable between Evaporator and LCD display

The display board is connected to the unit with a power cable (included), as shown in the following Figure.

**Figure 7.7 Display, Power and Monitoring cable connections**




| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Indoor unit | 6 | Power Supply wiring (included) |
| 2 | Controller | 7 | Display DVI connector |
| 3 | Terminal Blocks | 8 | Power Supply 3-pin connector |

| Item | Description | Item | Description |
|---|---|---|---|
| 4 | Monitoring wiring (included) | A | Display Front View |
| 5 | Smart display | B | Display Top View |

**NOTICE**

Risk of improper smart display installation. Can cause unit malfunction.

- Installation work must be performed in accordance with the national wiring standards and local code by authorized personnel only.
- If local electric and building code requires plenum (CMP) cable, use an enclosed, non-combustible conduit (metal raceway) or FT-6 rated or above cable.
- The connectors, terminals and cable are included with the display.
- AWG#22, 4 core shielded twisted pair cable is recommended.

**NOTE: The HMI is equipped with an LCD display and should be installed at the recommended height for proper view of the display.**

**Steps to connect the display:**

**NOTE: Identify the position of the harness connectors with the counterpart of the indoor unit and HMI.**

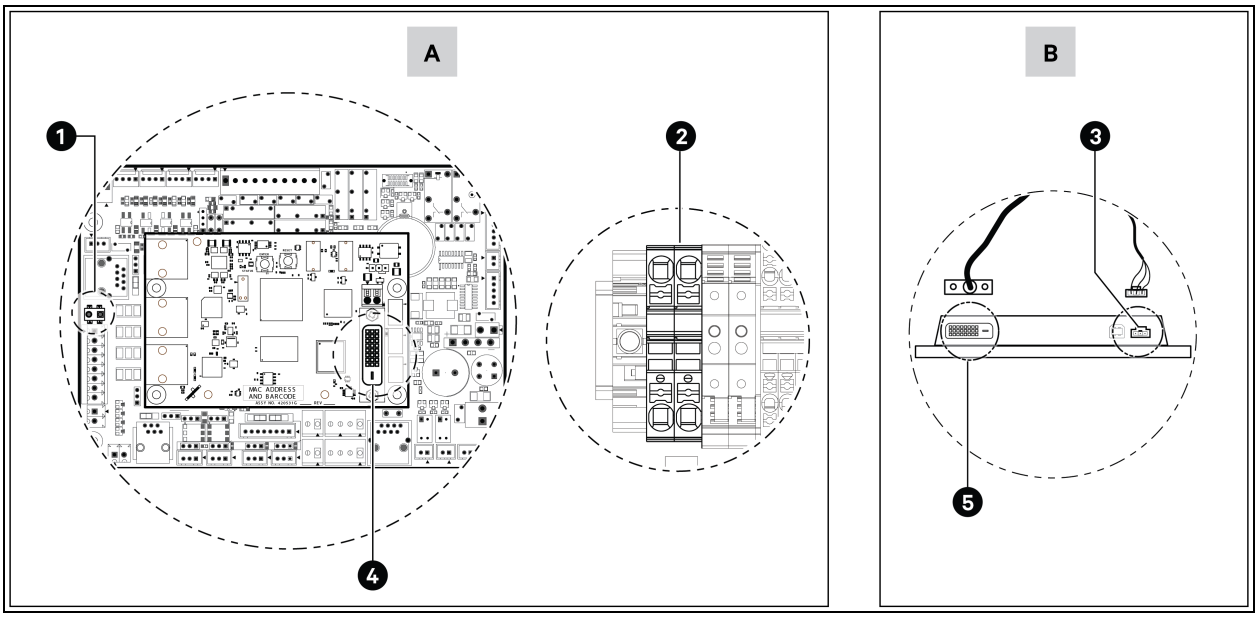
1. Open the door of the electrical box.
   - Identify the controller and the terminal blocks on the indoor unit. Refer to items 2 and 3 as shown on Figure 7.2 Electrical connections - Interior on page 87
   - Pay attention to the power supply and monitoring cables routing, as shown in Figure 7.9 Display, Power and Monitoring cable connections on the previous page above.
2. To connect the smart display to the indoor unit, first plug the 3-pin Molex connector (power supply cable) into the outlet on the indoor unit iCOM™ controller. Refer to #6 on Figure 7.9.
3. Then, plug the third power supply wire on the ground terminal block. Refer to #2 on Figure 7.9.
4. On the top side of the smart display, look for the 3-pin outlet and plug the other end of the power supply cable. Refer to #8 on Figure 7.9.
5. On the controller located at the electrical box, connect one end of the DVI cable. Refer to items 2 and 4 on Figure 7.9.
6. Then, on the top side of the display, insert the other end of the DVI cable as shown in #7 of Figure 7.9.
7. Close the door of the electrical box.

**NOTE: Make sure connectors are properly connected.**

**NOTE: For more information, refer to the electric diagrams in Appendix C of the SL-80138 Vertiv™ CoolPhase Ceiling System Design Catalog.**

Refer to Figure below to connect the indoor unit to the display.

**Figure 7.8 How to connect the indoor unit to the display**




| Item | Description | Item | Description |
|---|---|---|---|
| A | Controller in electrical box | 3 | Connect power cable to display outlet |
| B | Smart Display | 4 | Connect monitoring cable into Vertiv™ iCOM™ DVI outlet |
| 1 | Connect power cable to Vertiv™ iCOM™ outlet | 5 | Connect monitoring cable into display DVI outlet |
| 2 | Connect earth cable to terminal block outlet | | |

For a general connection overview, refer to Figure 7.13 Display installation overview on page 97 below.

### 7.2.1.2 Installation of the HMI display

**Steps to install the display:**

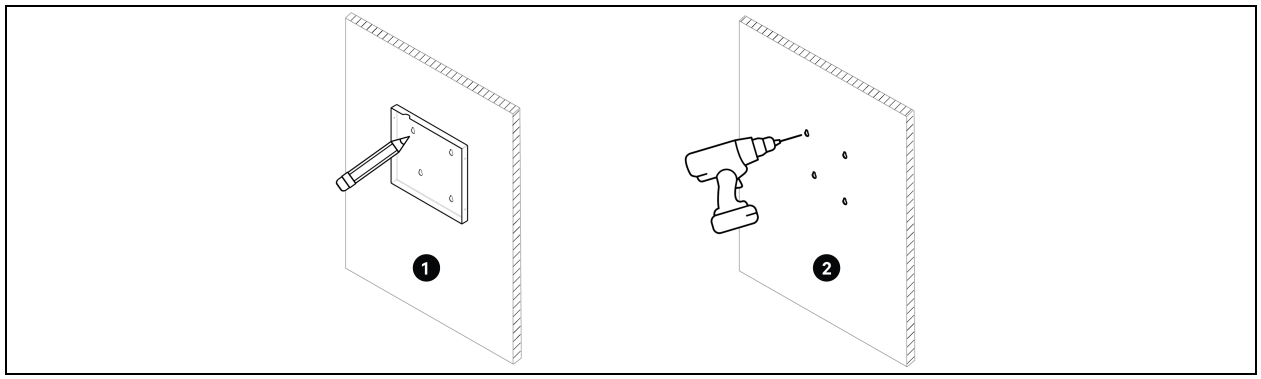
1. Locate the place on the wall where the Display will be mounted.

**NOTE: It is recommended to place the Sensor near the Display. Refer to items 2 and 3 in Figure 7.13 below.**

2. Remove the back cover of the display case and mark the holes on the wall.
3. Drill the four holes. Then, mount the back cover using four screws.

**NOTE: To mount the back of the metallic case onto the wall, #10-24 / #10-32 or M4 / M5 panhead screws are recommended (not included).**

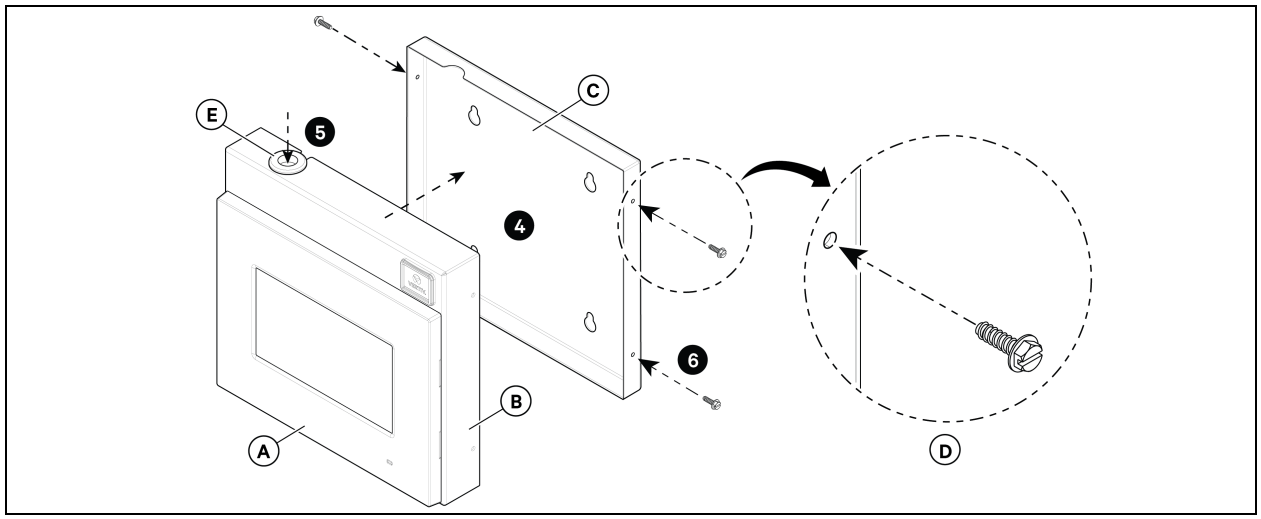
**Figure 7.9 Installation of the back cover of the display case**




| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Mark the four holes on the wall. | 2 | Drill the holes to mount the back cover. |

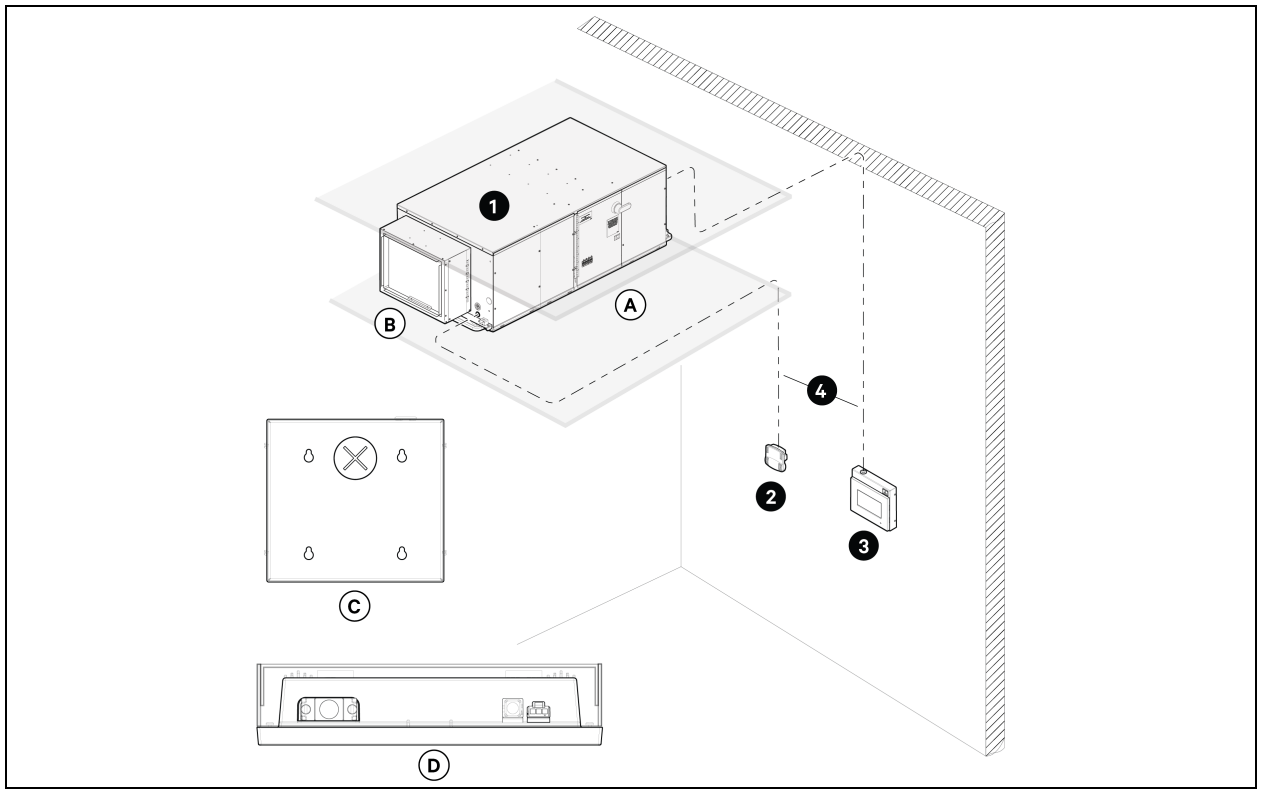
4. Connect the cables at the rear of the display.
5. Cut the grommet located at the top of the enclosure to route the cables through it, with the help of an utility knife.
6. Close the display case by installing the back cover and secure it using the four Hex #8-18 x .5 screws (included).

**Figure 7.10 Installation of display case**




| Item | Description | Item | Description |
|---|---|---|---|
| A | Display | E | Grommet |
| B | Metallic case | 4 | Place the display into back cover |
| C | Back cover of the metallic case | 5 | Cut the grommet with scissors or screwdriver |
| D | Four Hex #8-18 x .5 screws (included) | 6 | Fix case with screws (x4) |

**Figure 7.11 Display installation overview**




| Item | Description | Item | Description |
|---|---|---|---|
| A | Front of the evaporating unit | 1 | Evaporating unit |
| B | Left side of the unit | 2 | Remote Temperature and Humidity Sensor |
| C | Back of display case | 3 | Display |
| D | Top view of display | 4 | Wiring |

## 7.3 Electrical Installation Checks

After the system electrical installation is completed, make sure to perform the following checks:

1. Supply voltage and phase matches equipment nameplate.
2. Power wiring connections completed to the disconnect switch or terminal blocks depending on the selected model / when applies.
3. Power line circuit breakers or fuses have proper ratings for equipment installed.
4. Control wiring connections completed between indoor evaporator and heat-rejection equipment.
5. Wiring connection is completed between the evaporator unit and the wall mount display and remote T/H sensor.
6. All internal and external high and low voltage wiring connections are tight.
7. Confirm that unit is properly grounded to an earth ground.
8. Control transformer setting matches incoming power.
9. Electrical service conforms to national and local codes.
10. Check blowers and compressors for proper rotation.

# 8 Warranty Inspection

This section refers to the initial start-up checks and commissioning procedure for warranty inspection.

**WARNING! Arc flash and electric shock hazard. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Vertiv™ iCOM™ does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "Unit Off" mode of the unit controller. The only way to ensure that there is NO voltage inside the unit is to install and open a remote dis8connect switch. Refer to unit electrical schematic. Follow all local codes.**

**WARNING! Risk of improper wiring, piping, moving, lifting and handling. Can cause equipment damage, serious injury or death. Installation and service of this equipment should be done only by qualified personnel who have been specially trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE.**

**CAUTION: Risk of smoke generation. Can cause fire suppression and alarm system activation, resulting in injury during building evacuation and mobilization of emergency fire and rescue services. Start-up operation of optional electric reheat elements can create smoke or fumes that can activate the facility alarm and fire suppression system. Prepare and take appropriate steps to manage this possibility. Activating reheat during initial start-up may burn off particulates from electric reheat elements. Check the steam generating humidifier electrode plugs to ensure that they are pressed firmly onto the pins. Loose connections will cause the cylinder and plugs to overheat. Before beginning initial start-up checks, make certain that unit was installed according to the instructions in this manual. All exterior panels must be in place.**

- Confirm that all items on Section 7 Checklist for Completed Installation have been done.
- Locate "Vertiv™ CoolPhase Ceiling Warranty Inspection Check Sheet" in the unit's electric panel. (PSWI-8542-437RE)
- Complete "Vertiv™ CoolPhase Ceiling Warranty Inspection Check Sheet" during start-up. (PSWI-8542-437RE)
- Forward the completed "Vertiv™ CoolPhase Ceiling Warranty Inspection Check Sheet" to your local sales office. This information must be completed and forwarded to validate warranty.
- Contact your local sales representative or technical support if you have any questions or problems during unit start-up and commissioning. Visit https://www.Vertiv.com/en-us/support/ or call 1-800-543-2778 for contacts.
- Local sales offices and product support contacts can be found at https://www.Vertiv.com/en-us/support/ or 1-800-543-2778.

## 8.1 Charging Refrigerant and Lubricating Oil

**WARNING! Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.**

**WARNING! Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.**

**WARNING! Ensure that the refrigerating system is earthed prior to charging the system with refrigerant.**

**WARNING! Extreme care shall be taken not to overfill the refrigerating system.**

**NOTICE**

Cylinders shall be kept in an appropriate position according to the instructions.

**NOTICE**

Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow-up leak test shall be carried out prior to leaving the site.

**NOTICE**

Label the system when charging is complete (if not already).

### 8.1.1 Amount of Refrigerant and Lubricating Oil for Air Cooled systems

**CAUTION: Do not use refrigerant and lubricating oil of poor quality or wrong type, as they can damage the system.**

The following tables list the information required to field install the refrigerant piping for the system.

To define the total charge of the units, use the table shown below, considering the model number, the length and the diameter of the piping.

**NOTE: Consult factory for proper line sizing for runs longer than maximum equivalent length or when the value is not shown in tables below.**

**NOTE: Field installed interconnecting piping must be properly selected and installed based on local and national codes, the user manual, and the unit serial tag.**

**NOTE: If the condensing unit is installed indoors, the total system refrigerant charge (Indoor unit+ Condensing unit + Piping) can't exceed 4 lbs.**

If the pipework length is between any of the table values, the unit must be filled with the refrigerant charge stated in the immediately largest value. For example, if the pipework is 59 ft (18 m) long, the refrigerant charge for the unit should be the one stated for 65.6 ft (20 m).

**Table 8.1 Indoor evaporator approximate R-32 refrigerant charge**

| Model | Refrigerant charge lb (kg) |
|---|---|
| MMI12 | 0.50 (0.20) |
| MMI24 | 1.00 (0.50) |
| MMI36 | 1.80 (0.80) |
| MMI48 | 2.80 (1.30) |
| MMI60 | 3.30 (1.50) |
| MMI96 | 3.70 (1.70) |

**Table 8.2 Outdoor condenser approximate R-32 refrigerant charge for standard units**

| Model | Refrigerant charge lb kg) |
|---|---|
| CUD03 | 1.3 (0.6) |
| CUD07 | 1.5 (0.7) |
| CUD11 | 1.8 (0.8) |
| CUD15 | 2.9 (1.3) |
| CUD21 | 3.0 (1.4) |
| CUD28 | 5.0 (2.3) |

**Table 8.3 Outdoor condenser approximate R-32 refrigerant charge for units with Low Ambient Kit**

| Model | Refrigerant charge lb kg) |
|---|---|
| CUL03 | 2.0 (1.0) |
| CUL07 | 2.9 (1.3) |
| CUL11 | 5.3 (2.4) |
| CUL15 | 5.7 (2.6) |
| CUL21 | 5.7 (2.6) |
| CUL28 | 9.3 (4.2) |

**Table 8.4 Interconnecting piping refrigerant charge for R-32 for type L Tube**

| Line Size O.D. | Liquid Line, lb /100 ft (kg/30 m) | Suction Line, lb /100 ft (kg/30 m) |
|---|---|---|
| 3/8 | 2.9 (1.3) | 0.15 (0.07) |
| 1/2 | 5.5 (2.5) | 0.2 (0.1) |
| 5/8 | 9.0 (4.0) | 0.4 (0.2) |
| 3/4 | 13.5 (6.0) | 0.7 (0.3) |
| 7/8 | 18.5 (8.4) | 1.1 (0.5) |
| 1 1/8 | 31.7 (14.4) | 1.8 (0.8) |
| 1 3/8 | 48.3 (21.9) | 2.6 (1.2) |

**NOTE: If the condensing unit is installed indoors, the total system refrigerant charge (Indoor unit + Condensing unit + Piping) can't exceed 4 lbs.**

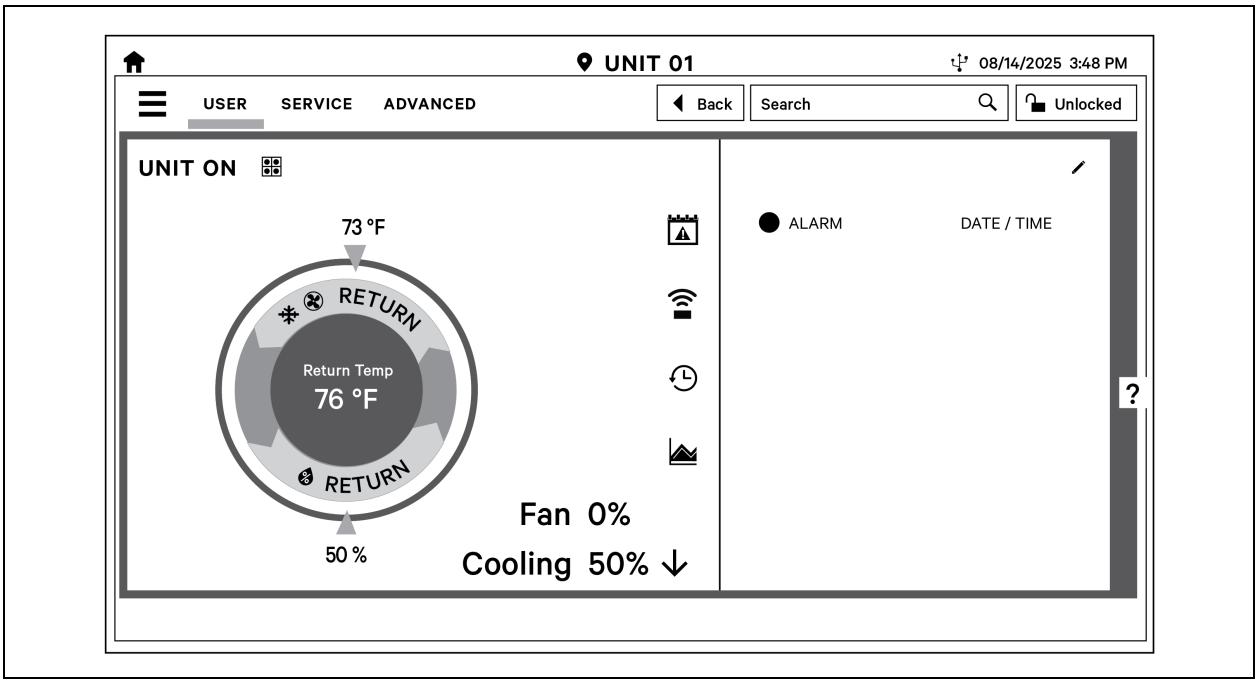
# 9 Controls Instructions

**NOTE: For detailed information on operating instructions, interface, communication, control and monitoring of the units, refer to the SL-80472 iCOM User Manual.**

## 9.1 Display appearance

The HMI display is a 7-inch touch-screen color display.

**Figure 9.1 HMI display**




## 9.2 Main Functions

### 9.2.1 Home Page

After the HMI display is powered on for one minute, press Locked, input password 1490, and press Enter. The home page will be displayed. You can power on or off the unit by pressing and holding the ON/OFF button for three seconds.

**NOTE: If no password is entered, you can only view the menu settings.**

**Figure 9.2 Entering password**

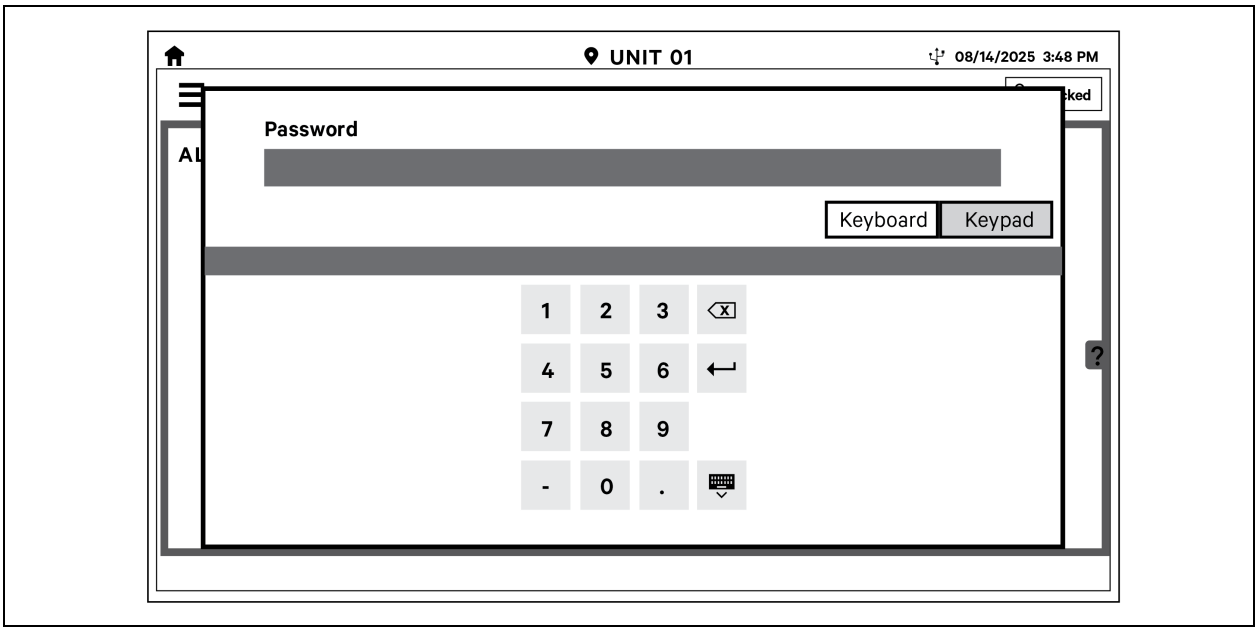
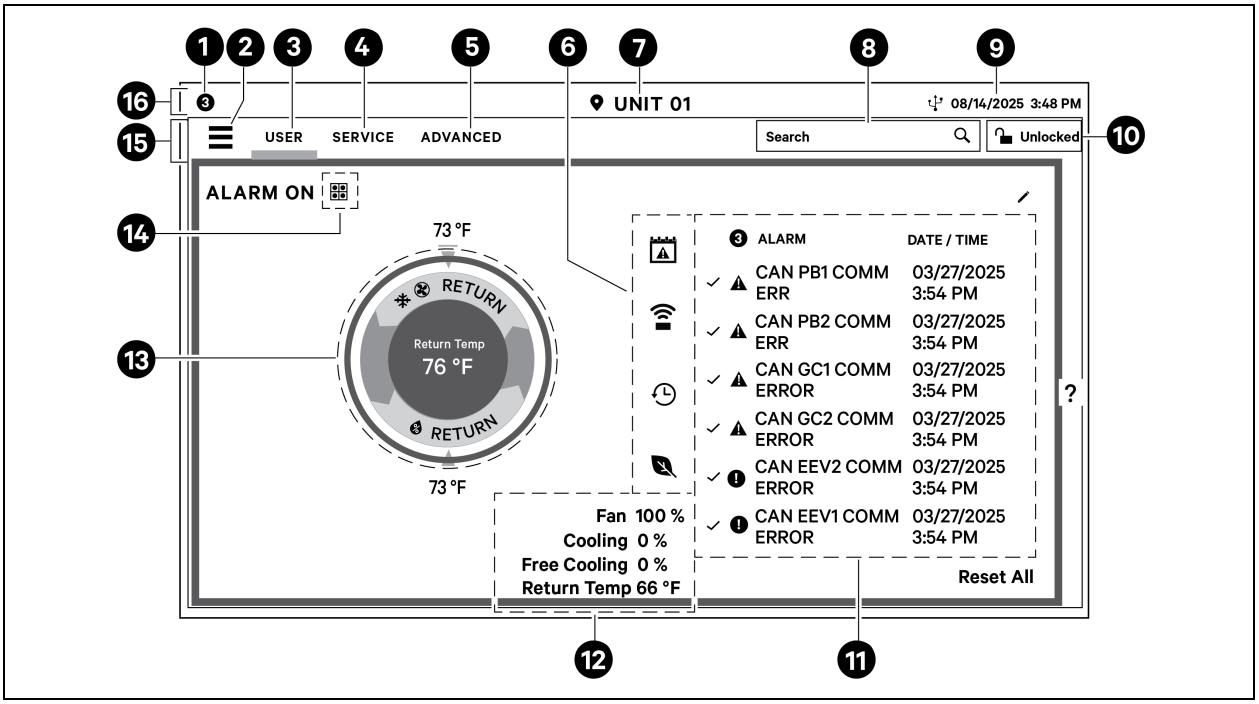



**Figure 9.3 Color display screen - Unlock & Functional keys**

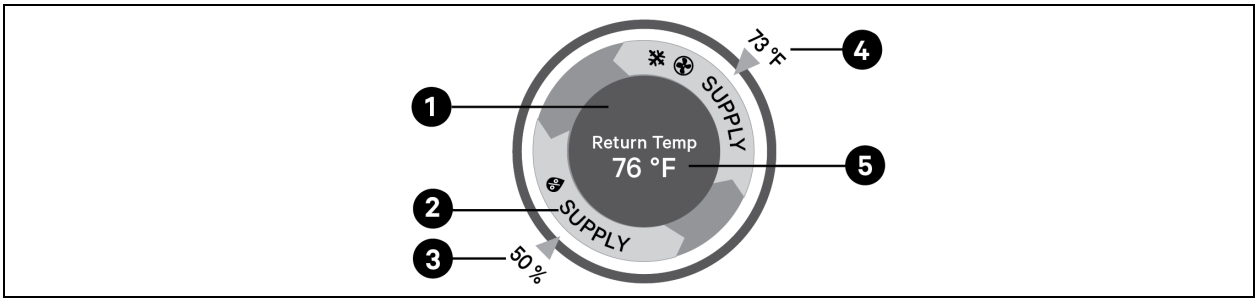


| Item | Keys | Description |
|---|---|---|
| 1 | Alarms present | Displays the number of active alarms. |
| 2 | Menu icon | When unlocked, displays a menu for user or service options depending on which icon is selected. |
| 3 | User icon | When selected, the user options are available on the main display and menu. |
| 4 | Service icon | When selected, the service options are available on the main display and menu. |
| 5 | Advanced icon | When selected, the advanced options are available on the main display and menu. |
| 6 | Cooling unit parameters | Status display of selected system parameter settings. |
| 7 | Unit Identification | Specify a unit name using up to six alphanumeric characters. |
| 8 | Search icon | Opens the keyboard to search for controls and setting locations. |
| 9 | Date/Time | — |
| 10 | Lock/Unlock icon | Indicates whether or not the user and service options are accessible. |
| 11 | Secondary content panel | When accessing settings/configuration via the menus, the settings display in the right, secondary panel. |
| 12 | Summary of current unit function | Configure the display to show fan speed, cooling, percentages from any installed device, and any physical (sensor) values. |
| 13 | Status Dial | Circular display of setpoints and environmental conditions of the unit. |
| 14 | Teamwork mode icon | In a panel with “Status” content, the Teamwork Mode icon indicates the mode selected. |
| 15 | Control header | Controls to access the user and service menus. |
| 16 | Status Header | Displays the alarm status, unit identification, and the current date and time. |

## 9.2.2 Control Mode

The compressor and fan are controlled according to temperature (supply air temperature, return air temperature, and remote temperature) and humidity (supply air humidity, return air humidity, and remote humidity).

**Figure 9.4 Control mode diagram**



| Item | Description |
|---|---|
| 1 | Each color of this area indicates different status:<br>• Green: The unit is On and the temperature within normal range.<br>• Red: The unit is On and the temperature is not within normal range.<br>• Grey: The unit is Off. |
| 3 | Desired humidity set by user. |
| 2 | Control mode: compressor is controlled according to supply air humidity. |
| 5 | Control mode: compressor is controlled according to supply air temperature, return air temperature |
| 4 | Desired supply air temperature, return air temperature, or remote temperature set by user. |
| 6 | Supply air temperature, return air temperature, or remote temperature, depending on the control |

## 9.3 Menu Structure and Parameters

For menu structure and parameters, refer to the SL-80132 iCOM™ Manual which contains the relevant information about software and controls.

## 9.4 Alarm Information

Press the menu button and choose Alarm Information to check active alarms and historical alarms.

- Active Alarms show the active alarms and the time they are generated.
- Historical Alarms show active alarms and historical alarms, and the time they are generated and closed (if the alarm has been resolved).

The Alarm Table section in Appendix C lists all the alarms.

**NOTE: Alarms are displayed in time sequence, starting with the latest one.**

**NOTE: Some active alarms records will be cleared when the unit is powered off.**

**NOTE: Up to 500 historical alarms can be stored. They will not be cleared when the unit is powered off.**

## 9.5 Teamwork Control

Press the menu button and choose Parameter Settings > Teamwork Settings to set teamwork control. Teamwork Mode includes Teamwork 0, Teamwork 1, Teamwork 2, and Teamwork 3. Teamwork 0 indicates standby and rotation control.

Teamwork 1 indicates standby, rotation, and cooling/heating cascade control. Teamwork 2 indicates standby, rotation, and avoid fighting control. Teamwork 3 indicates standby, rotation, and fan cascade control.

#### Standby function

One or several units can be defined as standby unit. The standby unit fan runs at the speed of 0% by default. If the Back Draft

Control (BDR) mode is enabled, the standby unit fan will run at 20%. If a critical alarm or normal alarm is generated on the master unit, a standby unit will start to run.

- Critical fault alarms: high pressure lock, low pressure lock, high discharge temperature lock, low discharge superheat lock, low pressure sensor fail lock, compressor drive fail lock, fan fail alarm (when its alarm handling is set to shut down), water underfloor alarm (when its alarm handling is set to shut down), power fail alarm.
- Normal alarms: high discharge temperature alarm, air flow temperature sensor failure, air flow loss alarm, discharge temperature sensor failure, suction temperature sensor failure, low pressure sensor failure, EEV drive communication failure, compressor drive communication failure, compressor temperature control sensors failure, fan temperature control sensors failure, high supply temperature alarm, high return temperature alarm, and high remote temperature alarm.

#### Rotation function

This function ensures that all the units have equal runtime. The unit can rotate according to days. User can set:

Rotate Days: (Every week, every day and no rotation)

Rotate Timer Hour: (0-23) and rotate the standby units each time.

#### Avoid fighting function

This function prevents the units from performing conflicting operations, such as cooling and heating, humidifying and dehumidifying. The master unit will calculate the number of cooling units and heating units (or humidifying units and dehumidifying units). If cooling units (or humidifying units) are more than heating units (or dehumidifying units), the heating units (or humidifying units) will stop working.

#### Cascade function

If an alarm is generated on the master unit, a standby unit will start to run.

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# 10 Maintenance

**WARNING! Arc flash and electric shock hazard. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Vertiv™ iCOM™ does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "Unit Off" mode of the Vertiv™ iCOM™. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.**

**WARNING! Risk of electric shock. Can cause equipment damage, injury or death. Open all local and remote electric power supply disconnect switches and verify with a voltmeter that power is off before working within any electric connection enclosures. Service and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.**

**WARNING! Risk of improper wiring, piping, moving, lifting and handling. Can cause equipment damage, serious injury or death. Installation and service of this equipment should be done only by qualified personnel who have been specially trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE.**

**WARNING! Risk of electric shock. Can cause serious injury or death. The Vertiv™ iCOM™ does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "unit off" mode of the Vertiv™ iCOM™. Open all local and remote electric power disconnect switches and verify with a voltmeter that power is Off before working on any component of the system.**

**Good maintenance practices are essential to minimizing operation costs and maximizing product life.**

**Read and follow monthly and semi-annual maintenance schedules included in this manual. These MINIMUM maintenance intervals may need to be more frequent based on site-specific conditions.**

**It is recommended the use of trained and authorized service personnel, extended service contracts and factory-specified replacement parts. Contact your Vertiv™ sales representative.**

### SAFETY INSTRUCTIONS

- Installation of pipework shall be kept at minimum.
- Pipe-work including piping material, pipe routing, and installation always shall be protected from physical damage.

- Pipe-work must not be located in unventilated areas.
- Pipe-work including piping material, pipe routing, and installation shall be in compliance with national gas regulations and local codes and standards, such as ASHRAE 15, ASHRAE 15.2, IAPMO Uniform Mechanical Code, ICC International Mechanical Code, or CSA B52. All field joints shall be accessible for inspection prior to being covered or enclosed.
- Mechanical field joints shall remain accessible after installation for maintenance and servicing purposes.
- After completion of field piping, pipework must be pressure tested looking for leaks. An inert gas with a pressure not less than 300 PSI (2,000 kPa) must be used for the test.
- Field-made refrigerant joints indoors shall be tightly tested with a method having a sensitivity of 5 grams per year of refrigerant or better under a pressure of at least 162.5 PSI, (1,120 kPa). No leak shall be detected.
- An unventilated area where the appliance is installed shall be so constructed that should any refrigerant leak, it will not stagnate to create a fire or explosion hazard.

**NOTICE**

The length of the piping shall be considered when filling the system with refrigerant. Refer to the tables on Amount of Refrigerant and Lubricating Oil for Air Cooled systems on page 100 , for more details regarding the pipe length, total refrigerant charge.

**Table 10.1 Maximum airflow**

| Parameter | MMI12 | MMI24 | MMI36 | MMI48 | MMI60 | MMI96 |
|---|---|---|---|---|---|---|
| Maximum airflow CFM (m3/h) | 816 (1,386) | 1,451 (2,465) | 1,533 (2,605) | 2,710 (4,604) | 2,746 (4,665) | 3,759 (6,387) |

**WARNING! Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized.**

**CAUTION: Work shall be undertaken under a controlled procedure to minimize the risk of a flammable gas or vapor being present while the work is being performed.**

**CAUTION: All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out.**

**WARNING! Work in confined spaces shall be avoided.**

**CAUTION: The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants.**

WARNING! Hot work conducted on the refrigerating equipment, or any associated parts must be performed with the appropriate fire extinguishing equipment available to hand. Have a dry powder or CO2 fire extinguisher adjacent to the charging area.

WARNING! No person carrying out work in relation to the refrigerating system which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion.

All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space.

Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. “No Smoking” signs shall be displayed.

WARNING! Before breaking into the system or conducting any hot work ensure that the working area is open or it is adequately ventilated. Ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

WARNING! Electrical components shall be changed only for manufacturer approved replacements, so they fit for the purpose and to the correct specification. At all times the manufacturer’s maintenance and service guidelines shall be followed. If in doubt, consult the manufacturer’s technical department for assistance.

WARNING! If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment, so all parties are advised.

WARNING! Sealed electrical components shall be replaced.

WARNING! Intrinsically safe components must be replaced.

WARNING! Under no circumstances potential sources of ignition shall be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

WARNING! If a leakage of refrigerant is found which requires brazing, all the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak. Removal of refrigerant shall be performed following manufacturer instructions.

**WARNING! Electronic leak detectors with the appropriate sensitivity must be used, equipment shall be calibrated to the refrigerant employed. Electronic leak detectors shall not be potential ignition sources and shall be suitable for the refrigerant used. Leak detection equipment shall be set to an appropriate percentage of the Lower Flammability Limit of the refrigerant not exceeding the 25% of the LFL.**

**NOTICE**

Every working procedure that affects safety means shall only be carried out by competent people.

**NOTICE**

When removing refrigerant from a system it is recommended good practice that all refrigerants are removed safely.

**SAFETY INSTRUCTIONS**

- Repair and maintenance to electrical components shall include initial safety checks and component inspection. Initial safety checks shall include
  - Verify that capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking.
  - No live electrical components and wiring are exposed while charging, recovering or purging the system.
  - Continuity of earth bonding shall be verified.
- Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.
- Detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipework.
  - Specify the leak detection method such as bubble method or fluorescent method agents.
- Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.
- When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labelled for that refrigerant. Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.
- The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of the flammable refrigerant. If in doubt, the manufacturer should be consulted. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition.
- Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release. Consult manufacturer if in doubt.
- The recovered refrigerant shall be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

- If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

In addition to conventional charging procedures, the following requirements shall be followed:

- Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
- Cylinders shall be kept in an appropriate position according to the instructions.
- Ensure that the refrigerant system is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete. Indoor and outdoor units are provided with locations to write the total refrigerant charge.
- Extreme care shall be taken not to overfill the refrigerant system.

For Refrigerant Detection System (RDS) the following instructions are required:

- Function and operation of the RDS.
- Servicing measures for the RDS.
- A statement advising that refrigerant sensors for the RDS shall be replaced with sensors specified by the manufacturer.
- Instructions to verify the actuation of the mitigation actions in case of a leak of refrigerant.

**NOTE: Ensure that the lowest part of the indoor unit is installed at the minimum installation height.**

## 10.1 Maintenance Checklist and Schedule

After installation, the following checks shall be applied to installations:

- The actual refrigerant charge is in accordance with the room size within which the refrigerant containing parts are installed _____
- The ventilation machinery and outlets are operating adequately and are not obstructed _____
- Marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected _____
- Refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded ___

Refer to the source: DPN002953

| | | | |
|---|---|---|---|
| Inspection Date | | Job Name | |
| Indoor Unit Model # | | Indoor Unit Serial Number # | |
| Condensing Unit Model # | | Condensing Unit Serial # | |
| Room Temperature / Humidity | ° % | Ambient Temperature | ° |

Not all units will have all components. To determine your unit's configuration, compare the Indoor Unit Model # above and the information in the Components and Nomenclature section.

Good maintenance practices are essential to minimizing operation cost and maximizing product life. Read and follow all applicable maintenance checks listed below. At a minimum, these checks should be performed semi-annually. However, maintenance intervals may need to be more frequent based on-site specific conditions. Review the unit user manual for further information on unit operation. We recommend the use of trained and authorized service personnel, extended service contracts, and factory-certified replacement parts. Contact your local sales representative for more details.

Check all that apply:

**Evaporator/Filters**

1. Check/replace filters
2. Make sure grille area unrestricted
3. Wipe section clean
4. Check coil is clean
5. Clean condensate pan
6. Clean trap in condensate drain
7. Drain connection/lines open, leak free and in good condition
8. Check/test filter clog switch operation
9. Check/test condensate drain pan float switch operation (if equipped)

**Blower Section (EC fan)**

1. Make sure mounting bolts tight
2. Check fan guard bolts tight
3. Make sure Impeller free of debris and spins freely
4. Check/test air sail switch (if equipped)
5. Check motor amp draw

- Compare to nameplate amps

#1 _____ L1_____ L2_____ L3_____

**Reheat (If equipped)**

1. Inspect elements and check for corrosion.
2. Check/re-torque wire connections (inside reheat box).
3. Check reheat amp draw.

L1_____ L2_____ L3_____

**Steam Generating Humidifier (If equipped)**

1. Check drain valve/drain lines/trap for clogs.
2. Check water fill valve and all hoses for leaks.
3. Check condition of steam hose.
4. Check canister for mineral deposits.
5. Check condition of the electrodes.

6. Clean strainer.
7. Replace humidifier bottle, if necessary.
8. Check operation of humidifier.
9. Check humidifier amp draw.

L1_____ L2_____ L3_____

**Condensate Pump (If equipped)**

1. Check for debris in sump.
2. Check operation of float(s) (free movement).
3. Check/clean discharge check valve.
4. Check drain connection/lines for leaks.

**Overflow Drain Pan (Ducted Units - If equipped)**

1. Drain connection and lines open and free of debris.
2. Drain line empties into a maintenance sink or condensate pump.
3. Check water detection device/system installed and monitored. Check operation (If installed).

**Electrical Panel**

1. Check fuses.
2. Check contactors for pitting. (Replace if pitted).
3. Check/re-torque wire connections.

**Controls**

1. Check/test the correct version of the model is selected.
2. Check/verify control operation (sequence).
3. Check/test water detection device(s) (if equipped).
4. Check/Test Leak Detector device.

**Refrigeration Piping**

1. Check refrigerant lines (clamps secure/no rubbing/no leaks).
2. Check for restriction temperature drop across filter drier.

**Air Cooled Condensing Unit (If equipped)**

1. Check coil clean/free of debris.
2. Make sure motor mounts tight.
3. Check bearings in good condition.
4. Check refrigerant lines properly supported.
5. Check motor amp draw.

L1_____ L2_____ L3_____

(L1 and L2 on single-phase units)

**Free Cooling kit Water/Glycol Cooled Condensing Unit (If equipped)**

1. Check water regulating valve operation.
2. Verify water flow/continuous flow is maintained.
3. Clean screen on Y strainer (if equipped).
4. Check cap tubes (not rubbing).
5. Check for water/glycol leaks.
6. Entering water temperature _____ °
7. Leaving water temperature _____ °

## MAINTENANCE NOTES

| | | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| Name | | | |
| Signature | | | |
| Company | | | |

Make photocopies for your records. Compare readings/information to previous maintenance worksheet.

To locate your local Vertiv representative for Vertiv-engineered parts, check https://www.Vertiv.com/en-us/support/ or Call 1-800-543-2778.

**Table 10.2 Maintenance schedule**

| Component | Check Items | Maintenance Period | | | |
|---|---|---|---|---|---|
| | | Monthly by user | 3 months | 6 months | 1 year |
| General | Check unit/remote display for clogged-filter warning | x | | | |
| | Check for irregular noise from unit fans | x | | | |
| | Check for irregular noise from compressor | x | | | |
| | Check for irregular noise from remote condenser fans (if applicable) | x | | | |
| Filters | Check the state of filters | | x | | |
| | Clean or replace air filters if necessary | | x | | |
| Fan | Verify that impellers move freely | | x | | |
| | Check bearings | | | x | |
| | Check that motor supports are fixed securely | | | x | |

**Table 10.2 Maintenance schedule (continued)**

| Component | Check Items | Maintenance Period | | | |
|---|---|---|---|---|---|
| | | Monthly by user | 3 months | 6 months | 1 year |
| Electronics | Check the condition of contactors | | | x | |
| | Check electrical connections | | | | x |
| | Check the operation of Vertiv™ iCOM™ | | | x | |
| | Check unit operation sequence | | | x | |
| Humidifier | Check steam hoses conditions | | | x | |
| | Check cylinder conditions | | | | x |
| Refrigerant Circuit | Check compressor noise or vibrations | | x | | |
| | Check sight glass for problems | | x | | |
| | Check main refrigerant circuit pressure | | x | | |
| | Check compressor suction superheat | | x | | |
| | Check discharge temperature | | x | | |

## 10.2 Air Filters

**NOTICE**

Risk of improper filter installation, can cause filter collapse and airflow reduction.

To maximize the performance and reliability of the equipment, use only Vertiv filters. Contact your Vertiv representative to order replacement filters.

Verify that filters are installed and positioned so the air flow direction marked on the filter is the same direction as unit air flow.

**Table 10.3 MERV 8, 11 and 13 (disposable type) filter quantity by unit option**

| Unit Model | Unit Option | Filter Nominal Size, in. (mm) | Number of Filters |
|---|---|---|---|
| MMI 12 | Filter box | 4 x 16 x 20 (102 x 406 x 508) | 1 |
| MMI 24, 36 | Filter box | 4 x 20 x 20 (102 x 508 x 508) | 1 |
| MMI 12, 24, 36 | Air-distribution plenum | 4 x 16 x 25 (102 x 406 x 635) | 1 |
| MMI 48, 60 | Filter box | 4 x 20 x 20 (102 x 508 x 508) | 2 |
| MMI 96 | Filter box | 4 x 25 x 20 (102 x 635 x 508) | 2 |

### 10.2.1 Filter Replacement

1. Disconnect power from the unit.
2. Locate the filter in the filter box or air distribution plenum and remove the old filter(s).

3. Replace with new filter(s). If there are two filters, always replace both.
4. Test the operation of the filter clog switch, adjustable from the unit exterior. The unit panels must be in place and closed to find this point.
5. Start the blower and turn the switch counterclockwise until the alarm is energized.
6. Turn the adjusting knob one turn clockwise or to the desired filter change point.

## 10.3 Blower Drive System—EC Fans

**WARNING! Risk of electric shock. Can cause serious injury or death. Open all local and remote electric power supply disconnect switches and verify with a voltmeter that power is off before working within the fan-motor electric-connection enclosures. Fan-motor controls can maintain an electric charge for 10 minutes after power is disconnected. Wait 10 minutes after power is verified as off before working within the electric control/connection enclosures. Use only fully trained and qualified HVAC technicians to perform maintenance on the fans.**

**CAUTION: Risk of contact with high-speed rotating fan blades. Can cause serious injury or death. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is off, and verify that all fan blades have stopped rotating before working in the unit cabinet or on the fan assembly. If control voltage is applied, the fan motor can restart without warning after a power failure. Do not operate the unit with any or all cabinet panels removed. Do not operate upflowed units without installing a plenum, ductwork of guard over the blower opening(s) on the top surface of the unit cabinet. Ductwork must be connected to the blower(s) or a plenum must be installed on the blower deck for protection from rotating blower wheel(s) on upflowed units.**

**CAUTION: Risk of improper moving, lifting and handling. Can cause equipment damage or injury. Only properly trained and qualified personnel should work on this equipment. Evaporator fan modules are heavy load. Use proper lifting techniques and wear appropriate, OSHA-approved PPE to avoid injury and dropping the fan module during removal. Equipment used in handling/lifting, and/or installing the fan assembly must meet OSHA requirements. Use handling/lifting equipment rated for the weight of the fan assembly. Use ladders rated for the weight of the fan assembly and technicians if used during installation. Refer to handling/lifting, and/or installation equipment operating manual for manufacturer's safety requirements and operating procedures.**

**NOTICE**

Risk of improper power supply connection. Can cause equipment damage and loss of warranty coverage.

Prior to connecting any equipment to a main or alternate power source (for example: back-up generator systems) for start-up, commissioning, testing, or normal operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. In general, power source voltages should be stabilized and regulated to within ±10% of the load nameplate nominal voltage. Also, ensure that no three-phase sources are single phased at any time.

**NOTICE**

Risk of improper installation. Can cause equipment damage.

Only a properly trained and qualified technician should install or open this motor.

Use 90/105° C Class 1 copper wire only.

### 10.3.1 EC Fan Motor – Monitoring and Protection Functions

The evaporator EC fan motor is equipped with integrated electronic monitoring and protection functions to prevent damage to the motor and its internal electronics.

The EC fan motor provides protection against:

- Electronics over temperature
- Motor overtemperature
- Incorrect rotor position detection

If any of these fault conditions are detected:

- An alarm is displayed on the HMI.
- The EC fan motor is stopped electronically.
- Automatic restart is not permitted.

To reset the fault condition, the power supply to the EC fan motor must be switched OFF for a minimum of 20 seconds, ensuring that the motor has come to a complete standstill before re-energizing.

In addition, the EC fan motor includes:

- Locked rotor protection
- Undervoltage and phase failure detection
- Motor current limitation

These conditions are also indicated by corresponding alarms on the HMI display.

### 10.3.2 Fan Assembly Troubleshooting

Any safety hazards stemming from the device must be re-evaluated once it is installed in the end device. Do not make any modifications, additions or conversions to the fan assembly without the approval of Vertiv.

**WARNING! Risk of electric shock. Can cause serious injury or death. Open all local and remote electric power-supply disconnect switches and verify with a voltmeter that power is off before opening the fan motor electric-connection enclosure. Use only fully-trained and qualified HVAC technicians to replace or perform maintenance on the EC fans.**

**WARNING! Risk of contact with high-speed rotating fan blades. Can cause serious injury or death. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is off, and verify that all fan blades have stopped rotating before working in the unit cabinet or on the fan assembly. If control voltage is applied, the fan motor can restart without warning after a power failure. Do not operate the unit with any or all cabinet panels removed.**

**CAUTION: Risk of exposure to harmful noise levels. Can cause hearing injury or loss. Depending on the installation and operating conditions, a sound pressure level greater than 70 dB(A) may arise. Take appropriate technical safety measures. Operating personnel must wear appropriate, OSHA-approved PPE and observe all appropriate hearing-protection safety requirements.**

**CAUTION: Risk of contact with hot surfaces. Can cause injury. The fan motor, and some electrical components are extremely hot during unit operation. Allow sufficient time for them to cool to a touch-safe temperature before working within the unit cabinet. Use extreme caution and wear appropriate, OSHA-approved PPE when working on or near hot components.**

**NOTICE**

Risk of improper power supply connection. Can cause equipment damage and loss of warranty coverage.

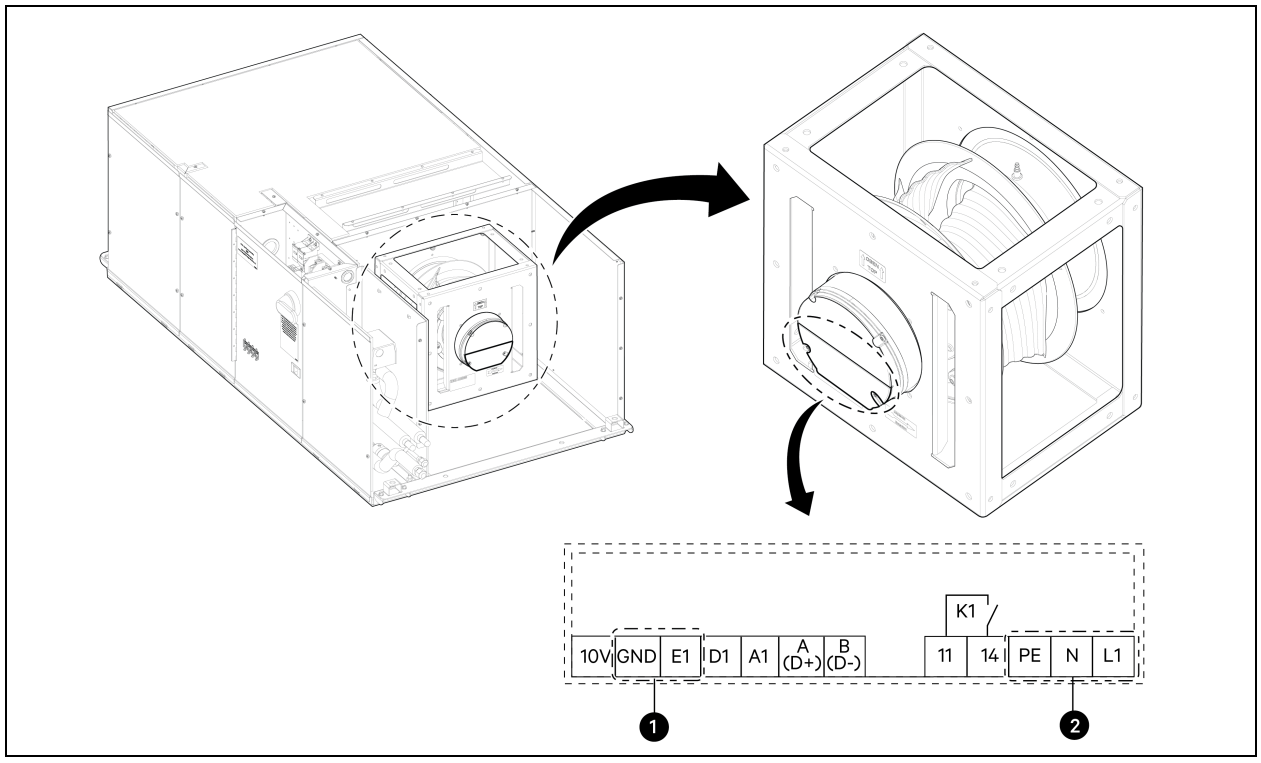
Prior to connecting any equipment to a main or alternate power source (for example: back-up generator systems) for start-up, commissioning, testing, or normal operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. In general, power source voltages should be stabilized and regulated to within ±10% of the load nameplate nominal voltage. Also, ensure that no three-phase sources are single phased at any time.

**NOTE: Do not assume that the fan blades will not start to spin. If the motor is in fault condition, it will safely shut down. Once the fault condition is cleared, there are certain conditions in which the motor will automatically resume operation.**

### EC Fan High Voltage Tests

- Check all connections. See EC Fan Connections on the schematic diagram.
- Make sure connections are on the wire strand and not on the wire insulation.
- Cycle power. Disconnect mains voltage to power down the motor and then re-apply power.
- Check mains voltage at each phase (phase to ground) at the Mains connector. Confirm phase failure not present.
- Check that the voltage is within the acceptable voltage range at the Mains connector. Confirm line under-voltage is not present.
- Check mains voltage at each phase (phase to ground) at the Mains connector. Confirm phase failure not present.
- Check that the voltage is within the acceptable voltage range at the Mains connector. Confirms line under-voltage is not present.

**Figure 10.1 EC Fan connections**




| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Control Signal | 2 | Power Supply |

### EC Fan Low Voltage Tests

- Check control input at the control system connection (for 1-phase fans L1 and L2) (for 3-phase fans L1, L2 and L3). Confirm that there is a control voltage present at the connection.
- Check 0-10 V output on control system connection (between 0-10V/PWM and GND).

### EC Fan Alarm Contact Tests

Check the alarm contact at the alarm relay connection to determine if there are any fault conditions present.

**Table 10.4 EC Fan Fault Condition**

| Condition | No Fault Condition | Fault Condition |
|---|---|---|
| NC - COM | Closed | Open |

**NOTE: The table refers to conditions while the motor is actively energized. When the motor is de-energized, it will be in fault condition.**

- Check EC Control to determine the fault condition.

## 10.4 Direct Drive Blower System

Monthly inspection of the blower package includes: motor mounts, fan bearings, and impellers.

### 10.4.1 Fan Impellers and Bearings Maintenance

Fan impellers should be periodically inspected and any debris removed. Check to ensure that the impellers can rotate freely and that the fan guards are still properly mounted for sufficient protection against accidentally contacting the impeller.

Bearings used on the units are maintenance free. Consult the factory for more information.

## 10.5 Steam Generating Humidifier Maintenance

The humidifier drains and refills to maintain a current setpoint and alert the operator when the humidifier canister needs to be replaced.

**WARNING! Arc flash and electric shock hazard. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to the unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Vertiv™ iCOM™ does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "Unit Off" mode of the unit controller. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.**

**WARNING! Risk of improper wiring, piping, moving, lifting and handling. Can cause equipment damage, serious injury or death. Installation and service of this equipment should be done only by qualified personnel who have been specially trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE.**

**WARNING! Risk of improper humidifier-canister maintenance. Can cause smoke and fire, activation of fire suppression systems, building evacuation, dispatching of fire/rescue equipment and personnel, and catastrophic canister failure resulting in water leaks, equipment damage, injury, or death. Using a humidifier canister that has reached the end of its service life can be extremely hazardous. If the canister cannot be replaced immediately at the end-of-life condition, turn Off the power and water supply to the humidifier and remove the canister until a replacement canister can be installed. Do not ignore humidifier problem alarms. Resetting humidifier without addressing the cause may result in fire or damage due to leaking water.**

**CAUTION: Risk of contact with hot surfaces. Can cause burn injury. The humidifier canister and steam discharge lines are extremely hot during operation. Allow sufficient time for them to cool to a touch-safe temperature before handling. Use extreme caution and wear appropriate, OSHA-approved PPE when performing maintenance on the humidifier.**

**CAUTION: After an extended period of operation, in accordance with life expectancy information, the cylinder is completely used as indicated by the amber high water sensor light illuminated on the cabinet. Then this condition is reached, a new replacement cylinder must be installed.**

**NOTE: The amber high water sensor light may come on during initial start-up, but this instance does not indicate that the cylinder should be replaced.**

**NOTE: The steam cylinder is disposable and must be replaced at the end of the cylinder's life. Cylinder life will vary according to water supply conditions and humidifier use.**

### 10.5.1 Operating the Humidifier

1. During start-up, when the humidity control calls for humidification, the fill valve opens and allows water to enter the canister. When the water level reaches the electrodes, current flows and the water begins to warm. The canister fills until the amperage reaches the setpoint and the fill valve closes. As the water warms, its conductivity increases and the current flow, in turn, rises. If the current reaches 115% of the normal operating current, the drain valve opens and drains some of the water out of the canister. This reduces electrode contact with the water and lowers the current flow to the amperage setpoint. Boiling soon commences, and the canister operates normally.
2. If the conductivity of the water is low, the canister fills and the water level reaches the canister full electrode before the current setpoint is reached. The humidifier stops filling to prevent overflow. Boiling should commence in time. As water is boiled off, the mineral concentration in the canister increases and current flow also increases. The canister eventually reaches full output and goes to normal operation. No drain is permitted until then.
3. When full output is reached the circuit board starts a time cycle which is factory set at 60 seconds. During this repeating time cycle, the fill valve will open periodically to replenish the water being boiled off and maintain a “steady state” output at the setpoint. The amperage variance depends on the conductivity of the water.
4. After many cycles, the mineral concentration in the canister becomes too high. When this occurs, the water boils too quickly. As the water quickly boils off and less of the electrode is exposed, the current flow decreases. When the current crosses the low threshold point before the end of the time cycle, the drain valve opens, draining the mineral-laden water out and replacing it with fresh water. This lowers the mineral concentration and returns the canister to “steady state” operation and prolongs canister life. The frequency of drains depends on water conductivity.
5. Over a period of time, the electrode surface becomes coated with a layer of insulating material, which causes a drop in current flow. As this happens, the water level in the canister will slowly rise exposing new electrode surface to the water to maintain normal output. Eventually, the steady state water level will reach the canister full electrode and indicate so by activating the canister full alarm and opening the humidifier contactor. At this point, all of the electrode surface has been used up and the canister must be replaced.
6. After the entire electrode surface has been coated, the output will slowly begin to fall off. This usually occurs in the last several hours of electrode life and should allow enough time to schedule maintenance. During these last hours, the mineral concentration can increase. If the mineral concentration is too high, arcing can occur. If the electrodes start to arc, turn off the humidifier immediately and replace the canister with the identical part.

### 10.5.2 Replacing the Canister

The humidifier RUN/DRAIN switch is located in the humidifier assembly. This switch should be in the RUN position when the humidifier is in normal operation. It should be in the DRAIN position when a manual drain for service is required. The electronic control board for the humidifier is located in the same area as the humidifier assembly. When the unit is energized, power is available to the humidifier circuits.

1. Turn off the humidifier by lowering the humidity setpoint below the ambient humidity level. Record the original setpoint.
2. Place the RUN/DRAIN switch in the DRAIN position to drain the water from the canister.
3. Return the RUN/DRAIN switch to the RUN position after the canister has drained.
4. Turn Off the power at the main unit and make sure that the unit is completely de-energized.
5. Remove the cover from the humidifier cabinet.
6. Locate the power wires to the steam canister. They are connected to the canister with 1/4-in quick connections. Make note of the wiring configuration before removing any wires. Refer to the schematic on the unit. Slide the rubber boot back to expose the connections. Remove the two power wires and the canister wire. Do not loosen the screws that secure the electrodes.
7. Loosen the steam outlet hose clamps and slide the steam hose away from the canister fitting.
8. Release the canister clamp along the base of the canister. The canister is now ready to be removed.
9. Remove the canister.
10. Reverse these steps to replace the canister, taking special note of the following:
    - When replacing wiring, connect the red wire from terminal #1 on the interface to the red tip terminal on the canister. Reconnect the power wires as they were formerly connected (#2 on the left and #1 on the right).
    - Always check the fill and drain solenoids for proper operation after replacing the canister.

### 10.5.3 Circuit Board Adjustments

Humidifier operation is governed by the humidifier control board. There are three potentiometers mounted on the board. These pots can be used to adjust for extreme water conductivity conditions and capacity.

POT2 controls the amperage at which the drain will energize. The pot is clearly marked in percentages. This adjustment is factory set at 85%, which indicates that the unit will drain when the amperage falls off to 85% of the capacity setpoint. Raising the value increases the frequency of drain cycles. Lowering the value decreases the frequency of drain cycles. The frequency should be increased for highly conductive water and decreased for less conductive water. If adjustment is necessary and a change of three to four percent in either direction does not permit normal operation of the unit, consult your Vertiv supplier.

POT1 controls the duration of the drain cycle. The pot is clearly marked in seconds. This adjustment is factory set at 60 seconds and should not be readjusted without consulting your Vertiv™ supplier.

POT3 is factory set at 100% for units from 1 to 3 TON and 80% for units from 4 to 8 TON. The maximum capacity of the system is not field-adjustable.

**WARNING! Risk of electric shock. Can cause injury or death. The DIP switches must be set exactly as indicated in Circuit Board Adjustments. Failure to correctly set the DIP switches may result in an electrical or water hazard.**

The DIP switch sets the capacity of the humidifier. If you replace the humidifier, set the DIP switches on the circuit board based on the voltage and capacity of your unit shown in DIP Switch Settings for Humidifier Control Board below.

**Table 10.5 DIP Switch settings for humidifier control board**

| Models | Voltage | SW1 | SW2 | SW3 | SW4 | Amps |
|---|---|---|---|---|---|---|
| 1, 2, 3 Ton | 208/230 | ON | OFF | ON | OFF | 4 Amps |
| 4, 5 & 8 Ton | 208 | ON | ON | ON | OFF | 8.9 Amps |
| | 240 | OFF | ON | ON | OFF | 8.5 Amps |
| 4, 5, 8 Ton | 460 | ON | ON | ON | OFF | 4.5 Amps |

## 10.5.4 Humidifier Troubleshooting

**Table 10.6 Steam generating humidifier troubleshooting guide**

| Symptom | Possible Cause | Check or Remedy |
|---|---|---|
| Humidifier does not operate | DIP switch not set to enable humidifier option | See DIP switch settings in DIP Switch Settings for Humidifier Control Board above . |
| | Display does not show humidification mode | Increase humidity control setpoint |
| | Defective board | Check the voltage at TBAS-1 and TBAS-2 on the EBox and P-2 and P-4 on the humidifier terminal board for 24 VAC ±2 VAC. If no voltage is detected, check wiring and/or replace board. Check the wiring from the Vertiv™ iCOM™ board to the humidifier interface board. |
| | Failed humidity sensor | Display shows "RET sensor invalid" warning. Check wiring from the temperature/humidity board to the control board. Replace temperature/humidity sensor if defective. |
| | No water flow | Make sure that the switch is in "RUN" position. Check the humidifier water (including filter screen) and check the nylon overflow line if the canister is full. |
| | Canister fill rate does not keep up with steam output | Check the fill valve screen opening and capillary tube for obstructions. Check the water supply pressure (minimum 10 psig). |

# 10.6 Condensate Drain and Condensate Pump System Maintenance

## 10.6.1 Condensate Drain

Check for and clear obstructions in tubing during routine maintenance.

### 10.6.2 Condensate Pump

**WARNING! Risk of electric shock. Can cause injury or death. Open all local and remote electric power-supply disconnect switches and verify that power is Off with a voltmeter before working within the condensate pump electrical connection enclosure. The iCOM™ does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "Unit Off" mode of the unit controller.**

To maintain the condensate pump:

1. Disconnect power to the unit using the disconnect switch.
2. Check for and clear obstructions in gravity lines leading to the condensate pump.
3. Remove the sump, clean with a stiff nylon brush and flush with water.
4. Inspect and clear clogs in the discharge check valve and float mechanism.
5. Reassemble and check for leaks.

For more information about the Condensate Pump Kit, refer to the SL-80133 Vertiv™ CoolPhase Ceiling Condensate Pump Kit Quick Installation Guide.

## 10.7 Refrigeration Circuit

**WARNING! Refrigerant sensors for refrigerant detection systems shall only be replaced with sensors specified by Vertiv and the installation needs to be performed by Vertiv™personnel only.**

The following procedure must be followed when breaking into the refrigerant circuit to make repairs or for any other purpose:

- Safely remove refrigerant following local and national regulations
- Evacuate
- Purge the circuit with inert gas (optional for A2L)
- Evacuate (optional for A2L)
- Continuously flush or purge with inert gas when using flame to open circuit
- Open the circuit by cutting or brazing

#### SAFETY INSTRUCTION

The refrigerant charge shall be recovered into the correct recovery cylinders.

System shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

Refrigerant purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process shall be repeated until no refrigerant is within the system. When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place. This operation is absolutely vital if brazing operations on the pipework are to take place.

The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.

Note the following when maintaining the refrigerant circuit:

- Piping (cleaning all the piping
- Evaporator coil (depending on operating environment and adherence to return air filter changes)

**NOTICE**

The refrigerant charge shall be recovered into the correct recovery cylinders. For appliances containing

flammable refrigerants other than A2L refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process may need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems. Ensure that the outlet for the vacuum pump is not close to any potential ignition sources and that ventilation is available.

## 10.8 Electric Reheat Maintenance

- Inspect and clean reheat elements.
- Inspect and tighten support hardware.
- Check connections and wirings don't have any burned marks.

## 10.9 Electronic Expansion Valve (EEV) Maintenance

The EEV performs one function: It keeps the evaporator supplied with enough refrigerant to satisfy load conditions. It does not affect compressor operation.

Proper valve operation can be determined by measuring superheat. The correct superheat setting is between 10 and 15° F (5.6 and 8.3° C). If too little refrigerant is being fed to the evaporator, the superheat will be high. If too much refrigerant is being supplied, the superheat will be low.

## 10.10 Decommissioning of the Unit

WARNING! Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized.

CAUTION: Work shall be undertaken under a controlled procedure to minimize the risk of a flammable gas or vapour being present while the work is being performed.

CAUTION: All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out.

WARNING! Work in confined spaces shall be avoided.

CAUTION: The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants.

WARNING! Hot work conducted on the refrigerating equipment, or any associated parts must be performed with the appropriate fire extinguishing equipment available to hand. Have a dry powder or CO2 fire extinguisher adjacent to the charging area.

WARNING! No person carrying out work in relation to the refrigerating system which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion.

All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space.

Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. “No Smoking” signs shall be displayed.

WARNING! Under no circumstances potential sources of ignition shall be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

WARNING! If a leakage of refrigerant is found which requires brazing, all the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak. Removal of refrigerant shall be performed following manufacturer instructions.

**WARNING! Electronic leak detectors with the appropriate sensitivity must be used, equipment shall be calibrated to the refrigerant employed. Electronic leak detectors shall not be potential ignition sources and shall be suitable for the refrigerant used. Leak detection equipment shall be set to an appropriate percentage of the Lower Flammability Limit of the refrigerant not exceeding the 25% of the LFL.**

**WARNING! Decommissioning procedure must be performed by trained personnel completely familiar with the equipment and all its detail.**

**WARNING! Do not overfill cylinders (no more than 80 % volume liquid charge).**

**Do not exceed the maximum working pressure of the cylinder, even temporarily.**

**NOTICE**

Every working procedure that affects safety means shall only be carried out by competent people.

**NOTICE**

It is recommended good practice that all refrigerants are recovered safely.

**NOTICE**

Prior to the decommissioning being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant.

**NOTICE**

It is essential that electrical power is available before the task commences.

**NOTICE**

When removing refrigerant from a system it is recommended good practice that all refrigerants are removed safely.

**SAFETY INSTRUCTIONS**

- Detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipework.
    - Specify the leak detection method such as bubble method or fluorescent method agents.
- The refrigerant charge shall be recovered into the correct recovery cylinders.
- System shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

- Refrigerant purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process shall be repeated until no refrigerant is within the system. When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place. This operation is vital if brazing operations on the pipework are to take place.
- The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.
- Isolate system electrically.
- Before attesting the decommissioning procedure, ensure that:
    - Mechanical handling equipment is available, if required, for handling refrigerant cylinders
    - All personal protective equipment is available and being used correctly
    - Recovery process is always supervised by a competent person
    - Recovery equipment and cylinders conform to the appropriate standards
- Whenever possible, pump down refrigerant system.
- If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
- Make sure that cylinder is situated on the scales before recovery takes place.
- Start the recovery machine and operate in accordance with instructions.
- When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
- Recovered refrigerant shall not be charged into another REFRIGERATING SYSTEM unless it has been cleaned and checked.
- When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labelled for that refrigerant. Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.
- The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of the flammable refrigerant. If in doubt, the manufacturer should be consulted. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition.
- Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release. Consult manufacturer if in doubt.
- The recovered refrigerant shall be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.
- If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

**NOTE: De-commissioned equipment shall be labelled stating that it has been de-commissioned and emptied of refrigerant. The label shall be dated and signed. Appliances shall maintain all labels on the equipment stating the equipment contains flammable refrigerant.**

# 11 Troubleshooting

The table below lists possible issues and their cause and corrective steps.

**Table 11.1 Troubleshooting**

| Problem | Possible Cause | Corrective Action |
|---|---|---|
| Rack temperature is too high | Dirty filters | Replace filters |
| | Filter clog sensor | Call Vertiv Technical Support |
| | Incorrect position of remote temperature sensors | Verify that remote temperature sensors are correctly positioned |
| | Remote temperature sensor issue | Call Vertiv Technical Support |
| | Condensation pressure too high | Verify remote condenser fans are running |
| | Refrigerating circuit charge issue | Call Vertiv Technical Support |
| | Cold air short-cycling issues | Verify unit positioning/room configuration |
| | | Verify unit air-baffles set-up |
| | | Verify cold aisle containment seals (if applicable) |
| | Insufficient room cooling capacity | Reduce rack heat load or add cooling units |
| | Unit safety device intervention | Contact your local Vertiv representative |
| Unit fan fail to start | The fan is faulty | Call Vertiv Technical Support |
| Water drops carried by airflow | Room humidity is over acceptable limit | Check room condition |
| | Condensate pan drain is clogged | Call Vertiv Technical Support |
| | Problem to humidifier control | |
| Water on the floor around the unit | Unit is not properly levelled | Adjust the levelling feet |
| | Unit condensate drain pipe is clogged | Remove pipe obstruction |
| | Piping insulation broken/damaged | Restore insulation integrity |
| | Leak in the draining circuit | Call Vertiv Technical Support |
| | Condensate pump is faulty | |
| | Leak in the humidifier filling hose | |
| Cooling Unit noise level is too high than expected | Incorrect positioning of remote temperature sensors | Verify that remote temperature sensors are correctly positioned |
| | Unbalanced heat load distribution | Enhance racks heat load distribution |
| | Remote temperature sensor/s issue | Call Vertiv Technical Support |
| Unsteady air delivery temperature | Faulty temperature sensor | Call Vertiv Technical Support |
| | Unit Vertiv™ iCOM™ issue. | |

**Table 11.1 Troubleshooting (continued)**

| Problem | Possible Cause | Corrective Action |
|---|---|---|
| Local display not operational but unit operates | Local display cable disconnected | Connect the cable |
| | Local display cable damaged | Replace the cable |
| | Local display configuration lost | Call Vertiv Technical Support |
| HMI display does not operate and the unit does not operate | Unit electrical supply is off | Restore electrical supply |
| | Unit main switch is off | Switch on the unit |
| | Control board supply issue | Call Vertiv Technical Support |
| | Control board issue | |

# Appendices

## Appendix A: Technical Support and Contacts

### A.1 Technical Support/Service in the United States

Vertiv Group Corporation

24x7 dispatch of technicians for all products.

1-800-543-2378

Liebert® Thermal Management Products

1-800-543-2778

Liebert® Channel Products

1-800-222-5877

Liebert® AC and DC Power Products

1-800-543-2378

### A.2 Locations

United States

Vertiv Headquarters

505 N Cleveland Ave

Westerville, OH, 43082, USA

Europe

Via Leonardo Da Vinci 8 Zona Industriale Tognana

35028 Piove Di Sacco (PD) Italy

Asia

7/F, Dah Sing Financial Centre

3108 Gloucester Road, Wanchai

Hong Kong

*

# Appendix B: AWG ratings table

The following tables show the gauge cable according to each model configuration.

| MMI12 SERIES | | | | | |
|---|---|---|---|---|---|
| Model | Voltage (V) | Phases | Frequency (Hz) | Current (A) | AWG According NEC 230.42 90 - 105 °C |
| MMI12*00R0++++ | 208/230 | 1 | 50/60 | 6.22 | 12 |
| MMI12*00J0++++ | 208/230 | 1 | 50/60 | 10.62 | 12 |
| MMI12*00RS++++ | 208/230 | 1 | 50/60 | 27.86 | 10 |
| MMI12*00JS++++ | 208/230 | 1 | 50/60 | 27.86 | 10 |

* Represents the 4-digit of the configurator; features do not affect the current consumption.

++++ Represents digit 9 to 12 of the model configuration; features do not affect the current consumption.

| MMI24 SERIES | | | | | |
|---|---|---|---|---|---|
| Model | Voltage (V) | Phases | Frequency (Hz) | Current (A) | AWG According NEC 230.42 90 - 105 °C |
| MMI24*00R0++++ | 208/230 | 1 | 50/60 | 7.38 | 12 |
| MMI24*00J0++++ | 208/230 | 1 | 50/60 | 14.42 | 12 |
| MMI24*00RS++++ | 208/230 | 1 | 50/60 | 29.81 | 8 |
| MMI24*00JS++++ | 208/230 | 1 | 50/60 | 29.81 | 8 |

* Represents the 4-digit of the configurator; features do not affect the current consumption.

++++ Represents digit 9 to 12 of the model configuration; features do not affect the current consumption.

| MMI36 SERIES | | | | | |
|---|---|---|---|---|---|
| Model | Voltage (V) | Phases | Frequency (Hz) | Current (A) | AWG According NEC 230.42 90 - 105 °C |
| MMI36*00R0++++ | 208-230 | 1 | 50-60 | 8.5 | 18 |
| MMI36*00J0++++ | 208-230 | 1 | 50-60 | 16.3 | 16* |
| MMI36*00RS++++ | 208-230 | 1 | 50-60 | 29.9 | 12* |
| MMI36*00JS++++ | 208-230 | 1 | 50-60 | 29.9 | 12* |
| MMI36*01R0++++ | 208/203 | 3 | 60 | 4.9 | 18 |
| MMI36*01J0++++ | 208/230 | 3 | 60 | 9.4 | 18 |
| MMI36*01RS++++ | 208/230 | 3 | 60 | 26.5 | 12* |

| MMI36 SERIES | | | | | |
|---|---|---|---|---|---|
| Model | Voltage (V) | Phases | Frequency (Hz) | Current (A) | AWG According NEC 230.42 90 - 105 °C |
| MMI36*01JS++++ | 208/230 | 3 | 60 | 26.5 | 12* |
| MMI36*0AR0++++ | 460 | 3 | 60 | 2.6 | 18 |
| MMI36*0AJ0++++ | 460 | 3 | 60 | 5 | 18 |
| MMI36*0ARS++++ | 460 | 3 | 60 | 12.4 | 18 |
| MMI36*0AJS++++ | 460 | 3 | 60 | 12.4 | 18 |

* Represents the 4-digit of the configurator; features do not affect the current consumption.

++++ Represents digit 9 to 12 of the model configuration; features do not affect the current consumption.

| MMI48 SERIES | | | | | |
|---|---|---|---|---|---|
| Model | Voltage (V) | Phases | Frequency (Hz) | Current (A) | AWG According NEC 230.42 90 - 105 °C |
| MMI48*01R0++++ | 208/230 | 3 | 60 | 4.9 | 18 |
| MMI48*01J0++++ | 208/230 | 3 | 60 | 11.2 | 18 |
| MMI48*01RS++++ | 208/230 | 3 | 60 | 35.8 | 10* |
| MMI48*01JS++++ | 208/230 | 3 | 60 | 35.8 | 10* |
| MMI48*04R0++++ | 460 | 3 | 60 | 2.6 | 18 |
| MMI48*04J0++++ | 460 | 3 | 60 | 5.8 | 18 |
| MMI48*04RS++++ | 460 | 3 | 60 | 16.5 | 16* |
| MMI48*04JS++++ | 460 | 3 | 60 | 16.5 | 16* |

* Represents the 4-digit of the configurator; features do not affect the current consumption.

++++ Represents digit 9 to 12 of the model configuration; features do not affect the current consumption.

| MMI60 SERIES | | | | | |
|---|---|---|---|---|---|
| Model | Voltage (V) | Phases | Frequency (Hz) | Current (A) | AWG According NEC 230.42 90 - 105 °C |
| MMI60*01R0++++ | 208/230 | 3 | 60 | 12 | 18 |
| MMI60*01J0++++ | 208/230 | 3 | 60 | 18.3 | 14* |
| MMI60*01RS++++ | 208/230 | 3 | 60 | 58.3 | 6 |
| MMI60*01JS++++ | 208/230 | 3 | 60 | 58.3 | 6 |

| MMI60 SERIES | | | | | |
|---|---|---|---|---|---|
| Model | Voltage (V) | Phases | Frequency (Hz) | Current (A) | AWG According NEC 230.42 90 - 105 °C |
| MMI60*04R0++++ | 460 | 3 | 60 | 2.6 | 18 |
| MMI60*04J0++++ | 460 | 3 | 60 | 5.8 | 18 |
| MMI60*04RS++++ | 460 | 3 | 60 | 16.5 | 16* |
| MMI60*04JS++++ | 460 | 3 | 60 | 16.5 | 16* |

* Represents the 4-digit of the configurator; features do not affect the current consumption.

++++ Represents digit 9 to 12 of the model configuration; features do not affect the current consumption.

| MMI90 SERIES | | | | | |
|---|---|---|---|---|---|
| Model | Voltage (V) | Phases | Frequency (Hz) | Current (A) | AWG According NEC 230.42 90 - 105 °C |
| MMI96*01R0++++ | 208/230 | 3 | 60 | 12 | 18 |
| MMI96*01J0++++ | 208/230 | 3 | 60 | 19.9 | 14* |
| MMI96*01RS++++ | 208/230 | 3 | 60 | 42.8 | 8 |
| MMI96*01JS++++ | 208/230 | 3 | 60 | 42.8 | 8 |
| MMI96*04R0++++ | 460 | 3 | 60 | 2.6 | 18 |
| MMI96*04J0++++ | 460 | 3 | 60 | 6.6 | 18 |
| MMI96*04RS++++ | 460 | 3 | 60 | 16.5 | 16* |
| MMI96*04JS++++ | 460 | 3 | 60 | 16.5 | 16* |

* Represents the 4-digit of the configurator; features do not affect the current consumption.

++++ Represents digit 9 to 12 of the model configuration; features do not affect the current consumption.

# Appendix C: Alarms Table

The following table shows the alarm conditions and effects.

| Alarm | Alarm Conditions | Effect | Condition to clear the Alarm |
|---|---|---|---|
| High pressure alarm | When the compressor contactor is closed, the alarm occurs when any of the following conditions is met:<br>1. The auxiliary normally opened contact point is opened. The alarm detection delay expires.<br>2. When the compressor is running, the high-pressure sensor is effective, and the detected value is larger than “high pressure alarm value”.<br>The alarm detection delay expires. | The alarm occurs. The compressor stops immediately | When the compressor contactor is closed, the alarm is cleared when all the following conditions are met:<br>1. The auxiliary normally opened contact point is closed. The alarm detection delay expires.<br>2. The high-pressure sensor is ineffective, or the detected value is smaller than “high pressure alarm value - offset”. The alarm detection delay expires. |
| Low pressure alarm | The alarm occurs when all the following conditions are met:<br>1. The compressor is running<br>2. The compressor is not in soft stop state<br>3. Low pressure is smaller than ”low pressure alarm value”. The alarm detection delay expires (the 2nd phase of soft start has completed. The alarm detection delay expires.) | The alarm occurs. The compressor stops immediately | The alarm is cleared when any of the following conditions is met:<br>1. Low pressure sensor is ineffective<br>2. Low pressure is smaller than ”low pressure alarm value + offset”. The alarm detection delay expires. |
| Discharge high temperature alarm | The alarm occurs when all the following conditions are met:<br>1. The compressor is running<br>2. Discharge temperature is higher than “discharge high temperature alarm value”. The alarm detection delay expires. | The alarm occurs. The compressor stops immediately | The alarm is cleared when any of the following conditions is met:<br>1. Discharge temperature sensor is ineffective<br>2. Discharge temperature is smaller than “discharge high temperature alarm value”-offset”. The alarm detection delay expires. |
| Low discharge superheat | The alarm occurs when all the following conditions are met:<br>1. The compressor is running. The compressor is not in soft stop state.<br>2. High pressure sensor and discharge temperature sensor are effective. The discharge superheat is smaller than alarm value. The alarm detection delay expires (the 2nd phase of soft start has completed. The “low discharge superheat alarm start delay” expires) | The alarm occurs. The compressor stops immediately | The alarm is cleared 60s after the compressor stops |
| High pressure lock | The alarm occurs when the high-pressure alarm occurs 3 times within 1 hour or the alarm occurs for 10 min | The alarm occurs. The compressor is locked and stops working | The alarm is cleared when the unit is powered on again or user clears the alarm on the HMI |
| Low pressure lock | The alarm occurs when the low-pressure alarm occurs 3 times within 1 hour or the alarm occurs for 10 min | The alarm occurs. The compressor is locked and stops working | The alarm is cleared when the unit is powered on again or user clears the alarm on the HMI |
| Discharge high temperature lock alarm | The alarm occurs when the high temperature alarm occurs 3 times within 24 hours. | The alarm occurs. The compressor is locked and stops working | The alarm is cleared when the unit is powered on again or user clears the alarm on the HMI |

| Alarm | Alarm Conditions | Effect | Condition to clear the Alarm |
|---|---|---|---|
| Discharge low super heat lock alarm | The alarm occurs when the discharge low super heat alarm occurs 3 times within 1 hour. | The alarm occurs. The compressor is locked and stops working | The alarm is cleared when the unit is powered on again or user clears the alarm on the HMI |
| Return air high temperature alarm | The alarm occurs when, 5 min after the fan starts, the return air temperature is effective, and the detected value is higher than the alarm value. The alarm detection delay expires. | The alarm occurs | The alarm is cleared when: the return air temperature is invalid, or the return air temperature is smaller than “the alarm value – offset” and the alarm detection delay expires |
| Return air low temperature alarm | The alarm occurs when, 5 min after the fan starts, the return air temperature is effective, and the detected value is lower than the alarm value. The alarm detection delay expires. | The alarm occurs | The alarm is cleared when: the return air temperature is invalid, or the return air temperature is higher than “the current high temperature alarm value + offset” and the alarm detection delay expires |
| Supply air low temperature alarm | The alarm occurs when, 5 min after the fan starts, the supply air temperature is effective, and the detected value is higher than the alarm value. The alarm detection delay expires. | The alarm occurs. The compressor stops immediately | The alarm is cleared when: the supply air temperature is invalid, or the supply air temperature is higher than “the alarm value + offset” and the alarm detection delay expires |
| Supply air high temperature alarm | The alarm occurs when, 5 min after the fan starts, the supply air temperature is effective, and the detected value is lower than the alarm value. The alarm detection delay expires. | The alarm occurs | The alarm is cleared when: the supply air temperature is invalid, or the supply air temperature is smaller than “the alarm value - offset” and the alarm detection delay expires |
| Remote air high temperature alarm | The alarm occurs when, 15 min after the fan starts, the remote air temperature is effective, and the detected value is higher than the alarm value. The alarm detection delay expires. | The alarm occurs | The alarm is cleared when: the remote air temperature is invalid, or the remote air temperature is smaller than “the alarm value - offset” and the alarm detection delay expires. |
| Remote air low temperature alarm | The alarm occurs when, 15 min after the fan starts, the remote air temperature is effective, and the detected value is lower than the alarm value. The alarm detection delay expires. | The alarm occurs | The alarm is cleared when: the remote air temperature is invalid, or the remote air temperature is higher than “the alarm value + offset” and the alarm detection delay expires |
| Filter clogged alarm | The alarm occurs when the filter switch is closed. The alarm detection delay expires. | The alarm occurs | The alarm is cleared when: the filter switch is opened, and the alarm detection delay expires |
| Remote powering off alarm | The alarm occurs when the remote power on/off switch is different from the set value. The alarm detection delay expires. | The alarm occurs. The unit is stopped by remote powering off. The compressor performs soft stop | The alarm is cleared when: the remote power on/off switch is the same as the set value, and the alarm detection delay expires |
| Return air temperature sensor {n} failure | The alarm occurs when the return air temperature sensor {n} exceeds the detectable range. The alarm detection delay expires. | The alarm occurs | The alarm is cleared when: the return air temperature sensor {n} reaches the detectable range, and the alarm detection delay expires |

| Alarm | Alarm Conditions | Effect | Condition to clear the Alarm |
|---|---|---|---|
| Return air humidity sensor failure alarm | The alarm occurs when the return air humidity sensor {n} exceeds the detectable range. The alarm detection delay expires. | The alarm occurs | The alarm is cleared when: the return air humidity sensor {n} reaches the detectable range, and the alarm detection delay expires |
| Supply air temperature sensor {n} failure | The alarm occurs when the supply air temperature sensor {n} exceeds the detectable range. The alarm detection delay expires. | The alarm occurs | The alarm is cleared when: the supply air temperature sensor {n} reaches the detectable range, and the alarm detection delay expires |
| Remote air temperature sensor {n} failure | The alarm occurs when the remote air temperature sensor {n} exceeds the detectable range. The alarm detection delay expires. | The alarm occurs | The alarm is cleared when: the remote air temperature sensor {n} reaches the detectable range, and the alarm detection delay expires |
| High pressure sensor failure | The alarm occurs when the main control board can communicate with the VFD and reads this alarm, or the high pressure exceeds the normal range. | The alarm occurs. The compressor immediately stops. The indoor fan runs at minimum speed. The outdoor fan runs at full speed | The alarm is cleared when: the high-pressure sensor {n} reaches the detectable range, and the alarm detection delay expires |
| Low pressure sensor failure | The alarm occurs when the main control board can communicate with the EEV, the compressor is not in soft start, soft stop, or evacuation state, the main control board reads this alarm, or the detected pressure exceeds the normal range. | The alarm occurs. The compressor immediately stops. The fan runs at minimum speed | The alarm is cleared when: the main board cannot communicate with the EEV, the main board does not read this alarm, or the detected pressure is within the normal range |
| Suction temperature sensor failure | The alarm occurs when the main control board can communicate with the EEV and reads this alarm, or the suction temperature exceeds the normal range. | The alarm occurs. The compressor immediately stops. The fan runs at minimum speed | The alarm is cleared when: the main board cannot communicate with the EEV, or the main board receives that the EEV failure is recovered |
| Discharge temperature sensor failure | The alarm occurs when the main control board can communicate with the VFD and reads this alarm, or the discharge temperature exceeds the normal range. | The alarm occurs. The compressor immediately stops. The fan runs at minimum speed | The alarm is cleared when the discharge temperature is within the detectable range and the alarm detection delay expires |
| EEV communication failure | The alarm occurs when the main control board cannot communicate with the EEV for 20s. | The alarm occurs. The compressor stops immediately | The alarm is cleared when the main control board can communicate with the EEV |
| Compressor driver communication failure | The alarm occurs when the compressor contactor is closed, the auxiliary normally closed contact point is closed, and the main control board cannot communicate with the compressor driver board for 30s. | The alarm occurs. The compressor maintains the current output. he fans runs at rated speed | The alarm is cleared when the auxiliary normally closed contact point is closed, the main control board can communicate with the compressor driver board, and the alarm detection delay expires |
| Electric heater failure | The alarm occurs when the electric heater faulty dry point has an alarm event, and the alarm detection delay expires. | The alarm occurs. The electric heater stops | The alarm is cleared when the electric heater stops, or the electric heater is powered on again |

| Alarm | Alarm Conditions | Effect | Condition to clear the Alarm |
|---|---|---|---|
| Water leakage alarm | The alarm occurs when the water leakage switch is closed, and the alarm detection delay expires. | The alarm occurs. The way to manage it: 0: alarm only; 1: stops the humidification and dehumidification; 2: stops the unit (except the pump). User can set. The default way is 1: stops the humidification and dehumidification. When the unit stops, the compressor stops immediately. | The alarm is cleared when the water leakage switch is opened, and the alarm detection delay expires |
| Return air high humidity alarm | The alarm occurs when the fan has started for 5 min, the return air humidity is higher than the alarm value, and the alarm detection delay expires. | The alarm occurs | The alarm is cleared when the return air humidity is ineffective or the return air humidity is smaller than “alarm value – offset”, and the alarm detection delay expires |
| Return air low humidity alarm | The alarm occurs when the fan has started for 5 min, the return air humidity is effective and smaller than the alarm value, and the alarm detection delay expires. | The alarm occurs | The alarm is cleared when the return air humidity is ineffective or the return air humidity is higher than “alarm value + offset”, and the alarm detection delay expires |
| Air flow loss alarm | Switch feedback type<br>The alarm occurs when the fan has started for 10 min, the fan detection board communicates normally, all the fan speed is larger than 20%, all the fan failure alarm switch is different from the set value, and the alarm detection delay expires (standard value = 10 * fan curve gradient + fan frequency correction), and the alarm detection delay expires.<br>The default is the speed mode. | The alarm occurs. All the components stop except the fan and pump. The compressor stops immediately | Switch mode<br>The alarm is cleared when the fan stops, the fan detection board communicates normally, any fan failure alarm switch is the same as the set value, and the alarm detection delay expires.<br>Speed mode<br>The alarm is cleared when the fan stops, the fan detection board communicates normally, any of the fan speed feedback > 20%, and the alarm detection delay expires |
| Fan detection board communication failure | The alarm occurs when the main control board cannot communicate with the 10DI board for 20s. | The alarm occurs. The humidification, dehumidification, and heating stop. The fan runs according to rated speed when in high temperature, cooling, humidification, and dehumidification mode. The compressor runs according to demand output and the compressor demand speed ≤ compressor rated speed | The alarm is cleared when the main control board receives data from the 10DI |
| Fan {n} failure alarm | Switch feedback type<br>The alarm occurs when, after the fan start delay, the fan speed ≥ 20%, fan {n} failure switch is different from the set value, and the alarm detection delay expires.<br>Frequency feedback type | The alarm occurs. The way to manage it: 0: cooling only (stops humidification, dehumidification, and heating). Fan runs according to “demand output + faulty fan quantity x 5%”; 1: stops the unit (except the pump). The default way is 0. When the unit stops, the compressor stops immediately | Switch feedback type<br>The alarm is cleared when: fan<br>{n} failure switch is the same as the set value and the alarm detection delay expires, or fan speed < 20% (if the way to handle it is to stop the fan, the alarm is not cleared; if the way to handle it is to provide cooling, the alarm is cleared)<br>Frequency feedback type |

| Alarm | Alarm Conditions | Effect | Condition to clear the Alarm |
|---|---|---|---|
| | The alarm occurs when, after the fan start delay, the fan speed ≥ 20%, fan {n} feedback frequency < 50% standard value (standard value = given value × fan curve gradient + fan frequency correction), and the alarm detection delay expires. | | The alarm occurs when: fan speed > 20% and fan {n} feedback frequency > 70% standard value, or fan speed < 20% (if the way to manage it is to stop the fan, the alarm is not cleared; if the way to manage it is to provide cooling, the alarm is cleared). |
| Power loss alarm | The alarm occurs, when the unit is running, the power supply is disconnected and then resumes. | The alarm occurs | The alarm is cleared after 10s |
| Power over voltage alarm | The alarm occurs when the power input voltage is higher than over voltage alarm value and the alarm detection delay expires. | The alarm occurs. All the components are stopped | The alarm is cleared when the power input voltage is lower than the over voltage alarm value and the alarm detection delay expires |
| Power under voltage alarm | The alarm occurs when the power input voltage is lower than the under-voltage alarm value and the alarm detection delay expires. | The alarm occurs. All the components are stopped | The alarm is cleared when the power input voltage is higher than the under-voltage alarm value and the alarm detection delay expires |
| Power frequency offset alarm | The alarm occurs when the power frequency offset exceeds ±3 Hz and the alarm detection delay expires. | The alarm occurs. All the components are stopped | The alarm is cleared when the power frequency offset does not exceed ±1.5 Hz and the alarm detection delay expires |
| High condensate water alarm | The alarm occurs when the high condensate water level detection board switch is closed, and the alarm detection delay expires. | The alarm occurs. The compressor stops immediately | The alarm is cleared when the high condensate water level detection board switch is opened, and the alarm detection delay expires |
| Teamwork addresses duplicated | The alarm occurs when the unit receives the data frame that has the same address as itself. | The alarm occurs | The alarm is cleared when the unit does not receive the data frame that has the same address as itself within 60s |
| Teamwork primary unit loss | The alarm occurs when the secondary unit does not receive data from the primary unit within 60s in teamwork mode. | The alarm occurs. The secondary unit runs according to single unit mode | The alarm occurs when the secondary unit receives data from the primary unit |
| Teamwork secondary unit loss | The alarm occurs when the primary unit does not receive data from the secondary unit within 60s in teamwork mode. | The alarm occurs. The primary unit does not calculate the data of the secondary unit | The alarm occurs when the primary unit receives data from the secondary unit |
| Smoke alarm | The alarm occurs when the smoke sensor switch is different from the set value and the alarm detection delay expires. | The alarm occurs | The alarm occurs when the smoke sensor switch is the same as the set value and the alarm detection delay expires |
| Fire alarm | The alarm occurs when the fire sensor switch is different from the set value and the alarm detection delay expires. | The alarm occurs. All the components are stopped | The alarm occurs when the fire sensor switch is the same as the set value and the alarm detection delay expires |

| Alarm | Alarm Conditions | Effect | Condition to clear the Alarm |
|---|---|---|---|
| Customized alarm | The alarm occurs when the customized switch is different from the set value and the alarm detection delay expires. | The alarm occurs | The alarm is cleared when the customized switch is the same as the set value and the alarm detection delay expires |
| Humidifier failure alarm | The alarm occurs when the humidifier failure switch is closed, and the alarm detection delay expires. | The alarm occurs | The alarm is cleared when the humidifier stops, the humidifier failure switch is opened, and the alarm detection delay expires |
| EEV driver abnormal | The alarm occurs when all the following conditions are met:<br>1. The compressor is running, and the compressor is not in EEV balanced state<br>2. EEV communicates normally<br>3. EEV actual opening degree is smaller than 8%. | The alarm occurs. The compressor stops immediately. The fan runs at minimum speed | The alarm is cleared when the compressor stops for 3s |
| Humidifier maintenance | The alarm occurs when the humidifier running time reaches the humidifier maintenance notification value. | The alarm occurs | The alarm is cleared when user clears the humidifier running time |
| Air pressure sensor failure | The alarm occurs when the air pressure exceeds the detectable range. The alarm detection delay expires. | The alarm occurs. The fan runs according to rated speed in single unit mode, and the fan runs according to the allocated speed in teamwork unit mode | The alarm is cleared when the fan sensor quantity is set to 0 or the air pressure value is within the detectable range and the alarm detection delay expires |
| Power meter communication failure | The alarm occurs when the main control board cannot communicate with the power meter for 10s. | The alarm occurs | The alarm is cleared when the main control board can communicate with the power meter |
| Filter maintenance | The alarm occurs when the filter running time reaches the filter maintenance notification value. | The alarm occurs | The alarm is cleared when user clears the filter running time |
| Compressor OVERCURRENT | Communication reads that the compressor driver overcurrent alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor OVERVOLTAGE | Communication reads that the compressor driver overvoltage alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor PRECHARGE_ FAULT | Communication reads that the compressor driver precharge_fault alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor UNDERVOLTAGE | Communication reads that the compressor driver undervoltage alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor AC_ DRIVE_OVERLOAD | Communication reads that the compressor ac_ drive_overload alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |

| Alarm | Alarm Conditions | Effect | Condition to clear the Alarm |
|---|---|---|---|
| Compressor MOTOR OVERLOAD | Communication reads that the compressor motor overload alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor INPUT_ PH_LOSS | Communication reads that the Compressor input phase loss alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor OUTPUT_ PH_LOSS | Communication reads that the Compressor output phase loss alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor OVERHEAT | Communication reads that the Compressor overheat alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor EXT_ FAULT | Communication reads that the Compressor external fault alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor PRECHRG_CIRC_ EXC | Communication reads that the Compressor PRECHRG_CIRC_EXC alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor CURR_ SAMPLING_EXC | Communication reads that the Compressor current sampling abnormal alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor AUTOTUNE_EXC | Communication reads that the Compressor autotune abnormal alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor ENCODER_EXC | Communication reads that the Compressor encoder abnormal alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor EEPROM_ FAULT | Communication reads that the Compressor EEPROM fault alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor ENCODER_NOT_ ACT | Communication reads that the Compressor encoder not active alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor OUTPUT_ SHORT_ GROUND | Communication reads that the Compressor output short ground alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor ACCUM_ RUN_ REACH | Communication reads that the Compressor accum run reach alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor USER_ DEF_FAULT | Communication reads that the Compressor user define fault reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor USER_ DEF_ALARM | Communication reads that the Compressor user define alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |

| Alarm | Alarm Conditions | Effect | Condition to clear the Alarm |
|---|---|---|---|
| Compressor ACCUM_ POW_ON_ REACH | Communication reads that the Compressor accum power on reach alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor OUTPUT_ LD_LOSS | Communication reads that the Compressor output all three phases loss alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor PID_ FDBK_LOSS | Communication reads that the Compressor PID feedback loss alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor PARAM_ EXC | Communication reads that the Compressor parameter abnormal alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor PULSE_ CURR_LIM_FAULT | Communication reads that the Compressor pulse current limit fault alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor SPEED_ DEVIATON | Communication reads that the Compressor speed overdeviation alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor MOTOR_ OVERSPEED | Communication reads that the Compressor motor overspeed alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor MOTOR_ OVERTEMP | Communication reads that the Compressor motor over temperature alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor STO_ FAULT | Communication reads that the Compressor STO fault alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor POLE_ POS_ERROR | Communication reads that the Compressor pole position error alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor MSTR_ SLV_CTRL_FAULT | Communication reads that the Compressor master slave control fault alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor SELF_ CHECK_FAULT1 | Communication reads that the Compressor self-check fault1 alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor SELF_ CHECK_FAULT2 | Communication reads that the Compressor self-check fault2 alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor SELF_ CHECK_FAULT3 | Communication reads that the Compressor self-check fault3 alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor SELF_ CHECK_FAULT4 | Communication reads that the Compressor self-check fault4 alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |

| Alarm | Alarm Conditions | Effect | Condition to clear the Alarm |
|---|---|---|---|
| Compressor BRAKING_ OVERLOAD | Communication reads that the Compressor breaking overload alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor BRAKING_ TRANS_ FAULT | Communication reads that the Compressor breaking trans fault alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor EXTERNAL_ ALARMS | Communication reads that the Compressor external alarms reach the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor PRECHRG_CONT_ FAULT | Communication reads that the Compressor prechrg contactor alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor TIMING_ FAULT | Communication reads that the Compressor timing fault alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor MOTOR_ CTRL_ EXC1 | Communication reads that the Compressor motor control abnormal alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor MOTOR_ CTRL_ EXC2 | Communication reads that the Compressor motor control abnormal alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor AUTO_ RST_FAIL | Communication reads that the Compressor auto reset fail alarm reaches the alarm detective delay time | The alarm is triggered, the compressor shuts down, and the indoor fan runs at standard speed | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor MODBUS_ TO | Communication reads that the Compressor modbus timeout alarm reaches the alarm detective delay time | The alarm is triggered. | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor CANOPEN_FAULT | Communication reads that the Compressor canopen fault alarm reaches the alarm detective delay time | The alarm is triggered. | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor CANLINK_ FAULT | Communication reads that the Compressor canlink fault alarm reaches the alarm detective delay time | The alarm is triggered. | The compressor communication fails or the communication reads that the fault has been cleared |

| Alarm | Alarm Conditions | Effect | Condition to clear the Alarm |
|---|---|---|---|
| Compressor EXP_ CARD_FAULT | Communication reads that the Compressor expansion card fault alarm reaches the alarm detective delay time | The alarm is triggered. | The compressor communication fails or the communication reads that the fault has been cleared |
| Compressor INPUT_ EXC_PROTECTION | Communication reads that the Compressor input abnormal protection alarm reaches the alarm detective delay time | The alarm is triggered. | The compressor communication fails or the communication reads that the fault has been cleared |
| Cooling Lockout | The alarm occurs when the FreezeStat Status (FZS) is configured on DI3. DI3 = “1” (Open) Indicating risk of freezing (~32° F / 0° C) | - The alarm “COOLING LOCKOUT” occurs.<br>- FreeCooling functionality is disabled.<br>- FreeCooling Valves are OFF.<br>- Compressor functionality is OFF.<br>- EEV is Closed.<br>- CFAN functionality is OFF.<br>- EFANs are set to 50% speed to help warm the evaporator. | The “COOLING LOCKOUT” event is cleared when DI3 = “0” (Closed). Then Normal cooling operation is restored |

# Appendix D: DX Products with R-32

See next page for submittal: A2L Refrigerant Dispersal Volume Calculation R-32 for DX Products

# DX PRODUCTS WITH R32

## A2L REFRIGERANT DISPERSAL VOLUME CALCULATION R32

Engineer of record to determine the Refrigerant Charge $m_c$ and required minimum Effective Dispersal Volume $V_{ED}$ of the space to which the appliance can be utilized for the cooling of ITE AREAS.

The required minimum EFFECTIVE DISPERSAL VOLUME $V_{ED}$ is a function of the refrigerant charge, $m_c$ and is represented by the following equation:

$V_{ED} = m_c / 0.5 \times LFL$

$V_{ED}$ = the minimum Effective Dispersal Volume in $ft^3$ ($m^3$)

$m_c$ = the refrigerant charge of the largest single circuit of a unit in lbs (kg)

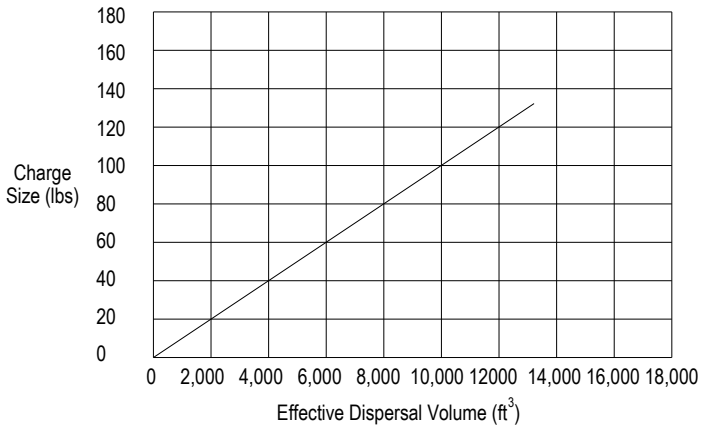
0.5 = the concentration factor

LFL = the Lower Flammability Limit in lbs/1000 $ft^3$ ($kg/m^3$)

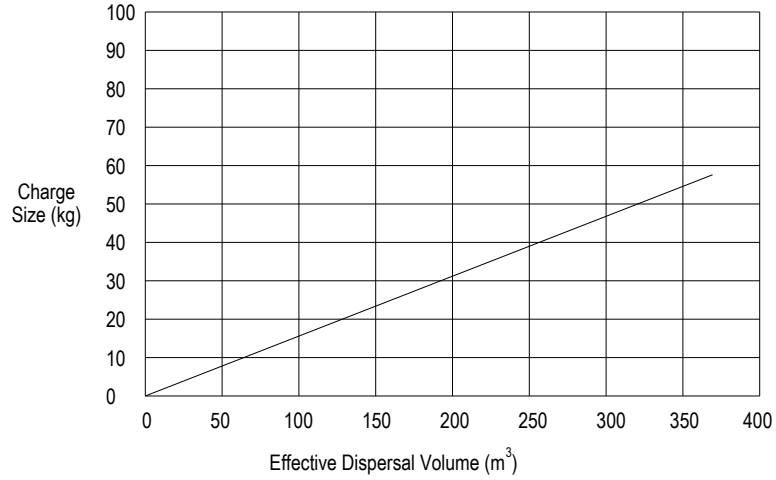
Note: The LFL of R32 is 19.2 lbs/1000 $ft^3$ (307.0 $g/m^3$) according to ASHRAE 34-2022.

Minimum Effective Dispersal Volume $V_{ED}$ of the space shall be based on altitude of the installation location. For locations above sea level, the engineer of record will need to adjust the value of LFL in accordance with ANSI/ASHRAE 34 before applying it to the equation for determining the required minimum Effective Dispersal Volume $V_{ED}$.

Charge Size vs. Effective Dispersal Volume




Charge Size vs. Effective Dispersal Volume



# A2L REFRIGERANT DISPERSAL VOLUME CALCULATION R32

**How to Determine the Effective Dispersal Volume of an ITE Area**

Volume Calculations shall be based on the overall volume of space available to which the refrigerant disperses within the CIRCULATION AIRFLOW in the event of a refrigerant leak. This overall volume shall be modified with the appropriate deductions. For the purposes of determining the EFFECTIVE DISPERSAL VOLUME of an ITE AREA the following shall apply:

a) The EFFECTIVE DISPERSAL VOLUME shall only include the circulated airflow of the system.
b) The EFFECTIVE DISPERSAL VOLUME shall initially include the ITE AREA enclosed by the floor, walls, and ceiling of that space.
c) When the CIRCULATION AIRFLOW includes underfloor spaces, suspended ceiling spaces, or other partitioned spaces, such as equipment galleries, the volume of those spaces may be included.

In general, the volume of equipment, piping, wiring, or other apparatus that consume space within and are isolated from the CIRCULATION AIRFLOW shall be deducted from the EFFECTIVE DISPERSAL VOLUME. The following deductions shall be applied:

a) When the CIRCULATION AIRFLOW has been fully contained on both hot and cold sides of the aisle, via ducts or other apparatus, any room volume outside of that containment shall not be included when calculating the EFFECTIVE DISPERSAL VOLUME.
b) When the overall volume of space available, or a partitioned portion of that volume includes ducted openings from partially ducted systems, some volume of that space may require a deduction. No volume greater than 4 feet away in height from the upper most supply or return duct opening in the space may be included when calculating the EFFECTIVE DISPERSAL VOLUME, unless an analysis of the airflow has been conducted to show that the volume of air has effective movement for the mixing of a leaked refrigerant.
c) Obstructions of tubing, piping, wiring, etc., consuming more than 0.0071 $m^3$ (0.25 $ft^3$) of space shall be included in the deductions from the overall volume.
d) The ITE within the circulated airflow shall be evaluated for their deduction from the EFFECTIVE DISPERSAL VOLUME. The deducted volume of the ITE shall be based on the designed maximum capacity or fill of the servers.
e) As a maximum value, no more than 75 % of the ITE's volume shall be included as circulating air space in the EFFECTIVE DISPERSAL VOLUME. The total volume of the ITE shall be defined by the overall dimensions of its ITE ENCLOSURE. Small gaps in between individual server racks shall not be included in the EFFECTIVE DISPERSAL VOLUME.
f) Any other volume within the circulation airflow that is otherwise enclosed or partitioned off from the airflow shall be deducted in the calculation of the EFFECTIVE DISPERSAL VOLUME.

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