Vertiv™ CoolPhase Condensing Unit

Installer/User Guide

3.5, 7, 11, 15, 21, and 28 kW

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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.

TABLE OF CONTENTS

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1 Important Safety Instructions

This manual contains important safety instructions that should be followed during the installation and maintenance of the Vertiv™ CoolPhase Condensing Unit. 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, 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.

Any operation that requires the removal of equipment panels must be carried out only by adequately trained and qualified personnel.

For assistance or spare parts, look for the model and serial number on the nameplate located on the service access panel.

Warning labels on the Vertiv™ CoolPhase Condensing Unit remind users that:

- The unit restarts automatically in case of a blackout.
- All power sources must be disconnected before accessing the internal compartment for any operation.

The following safety guidelines are intended to prevent unforeseen risks or damage from unsafe or incorrect operation.

Vertiv™ CoolPhase Condensing Unit must be paired only withVertiv™ CoolPhase products.

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

This appliance is designed to be installed in areas with a maximum altitude of 9,843 ft (2000 m).

This is for installation only in locations not accessible to the general public.

The appliance shall be installed in accordance with national wiring regulations. For the USA and Canada, follow NFPA 70, National Electrical Code, and Canadian Electrical Code for the proper electrical installation.

De-commissioned equipment shall be labeled, stating that it has been de-commissioned and emptied of refrigerant. The label shall be dated and signed, stating that the equipment contains flammable refrigerant.

Refrigerant
Safety
Group A2L

WARNING! Air outlet of the appliance must always be clear of obstruction.

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

WARNING! Disconnect all electric power supplies, verify with a voltmeter that the power is Off, and wear approved personal protective equipment (PPE) before working within the electric control enclosure. Failure to comply can cause severe injury or death. The customer must provide earth ground to the unit, per national and local codes. Before proceeding with the installation, read all instructions carefully, verify that all parts are included, and check the nameplate to ensure the voltage matches the available utility power. TheVertiv™ CoolPhase Condensing Unit controller 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 controller. The only way to ensure NO voltage inside the unit is to install and disconnect all power-supply sources. Refer to the unit electrical schematic. Follow all national and local codes.

WARNING! Power down the unit for 10 minutes before removing any cover.

WARNING! Risk of over-pressurization of the refrigeration system. It 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 maximum allowable pressure marked on the unit's nameplate.

WARNING! Risk of contact with high-speed rotating fan blades. It can cause severe injury or death. Disconnect all electrical power supply sources, verify with a voltmeter that the power is off, and confirm that all fan blades have stopped rotating before working on the unit cabinet or the fan assembly. Fan motor and compressor controls can maintain an electric charge for up to 10 minutes after the power is disconnected. If the control voltage is applied, the fan motor can restart without warning after a power failure has occurred.

WARNING! Risk of hair, clothing, and jewelry entanglement with high-speed rotating fan blades. It can cause equipment damage, serious injury, or death. Keep hair, jewelry, and loose clothing secure and away from rotating fan blades during unit operation.

WARNING! Risk of heavy unit falling over. Improper handling can cause equipment damage, injury, or death. Read all the following instructions and verify that all lifting and moving equipment is rated for the unit's weight before attempting to move, lift, remove packaging from, or prepare the unit for installation. Unit weights are specified in section 2.5, "Dimensions and Weights".

WARNING! Risk of contact with extremely hot and/or cold surfaces. It can cause injury. Verify that all components have reached a safe temperature for human contact or wear appropriate PPE before working within the electric connection enclosures or unit cabinet. Perform maintenance only when the system is de-energized and component temperatures are safe for human contact.

WARNING! Risk of improper wiring, piping, moving, lifting, and handling. It 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 are wearing appropriate PPE.

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

WARNING! Do not pierce or burn. Be aware that refrigerants may not contain an odour.

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

CAUTION: Risk of improper moving, lifting, and handling. It can cause equipment damage or injury. Only properly trained and qualified personnel should work on this equipment. Condenser fan modules are heavy objects. Use proper lifting techniques and wear appropriate PPE to avoid injury and dropping the fan module during removal. Equipment used in handling/lifting and/or installing the fan assembly must meet Health and Safety national and local requirements. Handling/lifting equipment should be 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 the operating manual for handling/lifting and/or installing equipment for the manufacturer's safety requirements and operating procedures.

CAUTION: Risk of exposure to harmful noise levels. It can cause hearing injury or loss. A sound pressure level greater than 70 dB(A) may arise depending on the installation and operating conditions. Take appropriate technical safety measures. Operating personnel must wear proper PPE and observe all appropriate hearing protection safety requirements.

CAUTION: Risk of excessive refrigerant line pressure. It can cause tubing and component rupture, damage to equipment, and personal injury. Do not close off the refrigerant line isolation valve for repairs unless a pressure relief valve is installed in the field between the isolation valve and the check valve. The pressure relief valve must be rated 5% to 10% higher than the system's maximum allowable pressure. An increase in ambient temperature can cause the pressure of the isolated refrigerant to rise and exceed the system's maximum allowable pressure rating marked on the unit nameplate.

CAUTION: A high-touch current and earth connection is essential before connecting the supply.

NOTICE

Servicing must be performed only as recommended by this manual.

NOTICE

Risk of improper power supply connection. It can cause equipment damage and loss of warranty coverage. Before connecting any equipment to a main or alternate power source (for example, backup generator systems) for startup, commissioning, testing, or regular operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. Power source voltages should generally be stabilized and regulated to within ±10% of the load nameplate nominal voltage. Also, ensure that no three-phase sources are single-phase at any time.

NOTICE

Risk of oil contamination with water. It can cause equipment damage.

Vertiv™ CoolPhase Condensing Unit systems require polyvinyl ether (FW68S) oil. PVE oil absorbs water much faster 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, an oil change may be required. 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 return any foreign matter to the compressor.

NOTICE

Risk of improper refrigerant charging. It can cause equipment damage.

Refrigerant charges must be weighed into air-cooled compressorized systems before they are started. Starting rotary 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 20 psig (138 kPa). Operation for extended periods at less than 20 psig (138 kPa) can cause premature compressor failure.

NOTICE

Risk of doorway/hallway interference. It 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 before moving the unit to verify clearances.

NOTICE

Risk of damage from the forklift. It can cause unit damage. Keep tines of the forklift level 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 and indoors, protecting it from dampness, freezing temperatures, and contact damage.

NOTICE

Risk of release of hazardous substances into the environment. It can cause environmental pollution and violation of environmental regulations.

The Vertiv™ CoolPhase Condensing Unitcontains substances and components hazardous to the environment (electronic components, refrigerating gases, and oils). At the end of its useful life, specialized refrigerating technicians must dismantle it. The unit must then be delivered to suitable centers specializing in collecting and disposing of equipment containing hazardous substances.

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 comply 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.

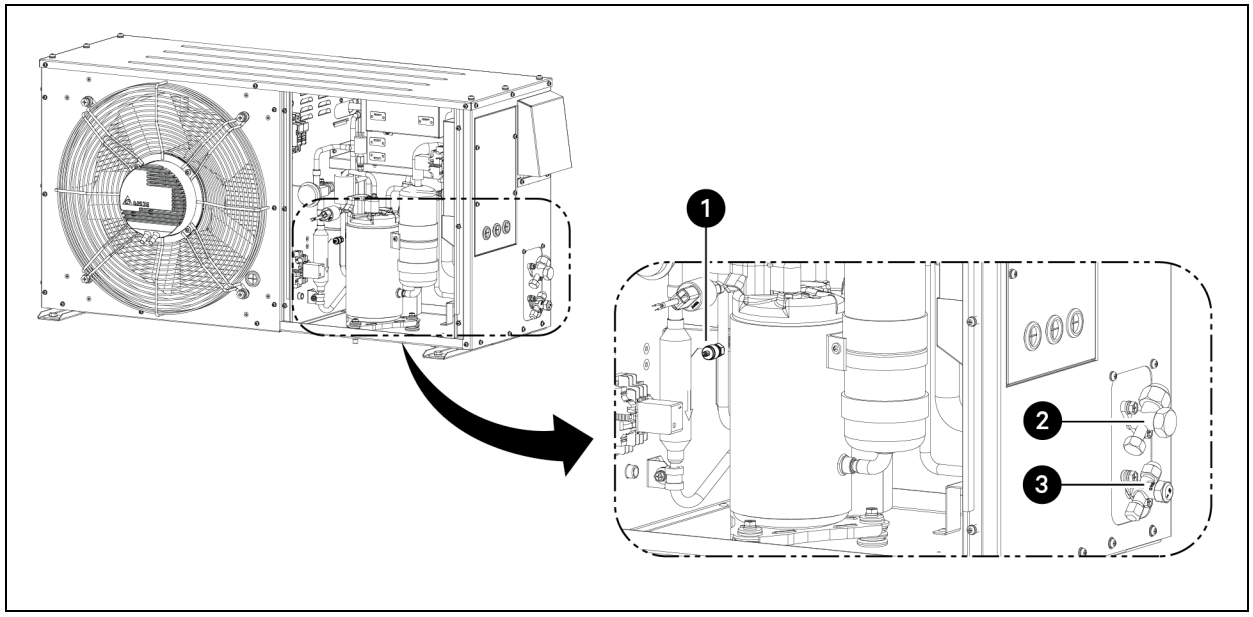
After completion of field piping for split systems, the field pipework shall be pressure tested with an inert gas and then vacuum tested prior to refrigerant charging.

For proper vacuum, ensure that the hoses are connected to the suction and liquid service valves located in the Condensing Units.

Additionally, connect a hose to the Schrader valve on the compressor discharge line. Refer to the Figures below to locate it on each Condenser model.

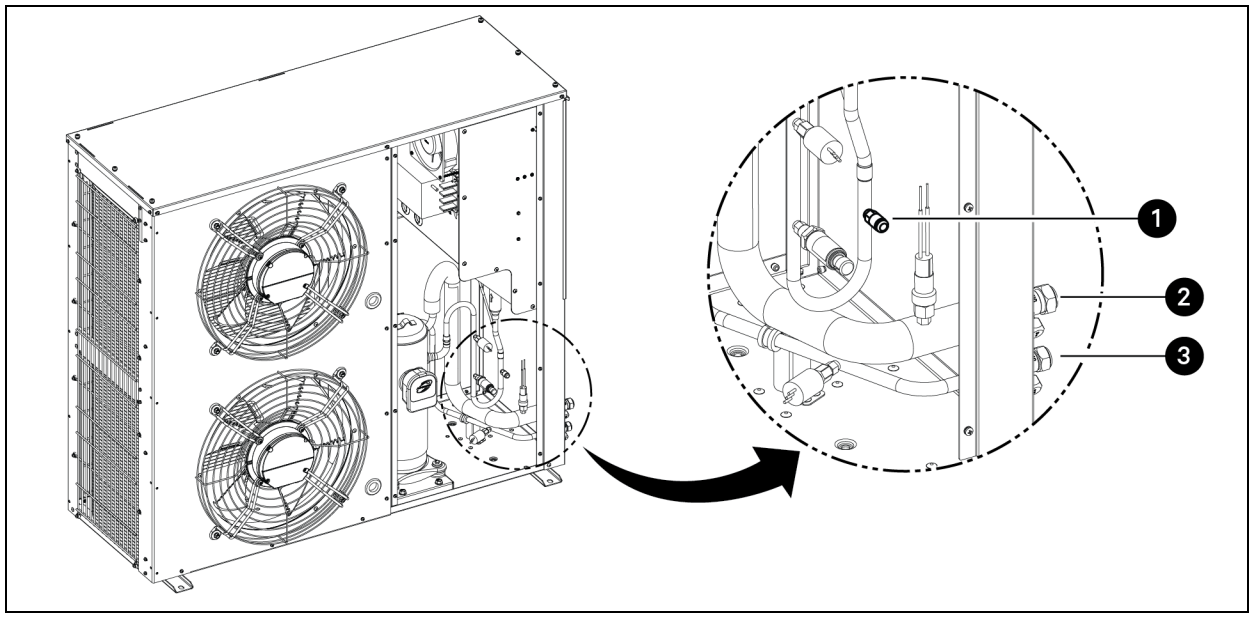
Field-made refrigerant joints installed indoors must undergo tightness testing. The test method shall have a sensitivity of 5 grams per year of refrigerant or better under a pressure of at least 0.25 times the maximum allowable pressure. No leak shall be detected.

Figure 1.1 Schrader Valve Location, 3.5-11 kW units.



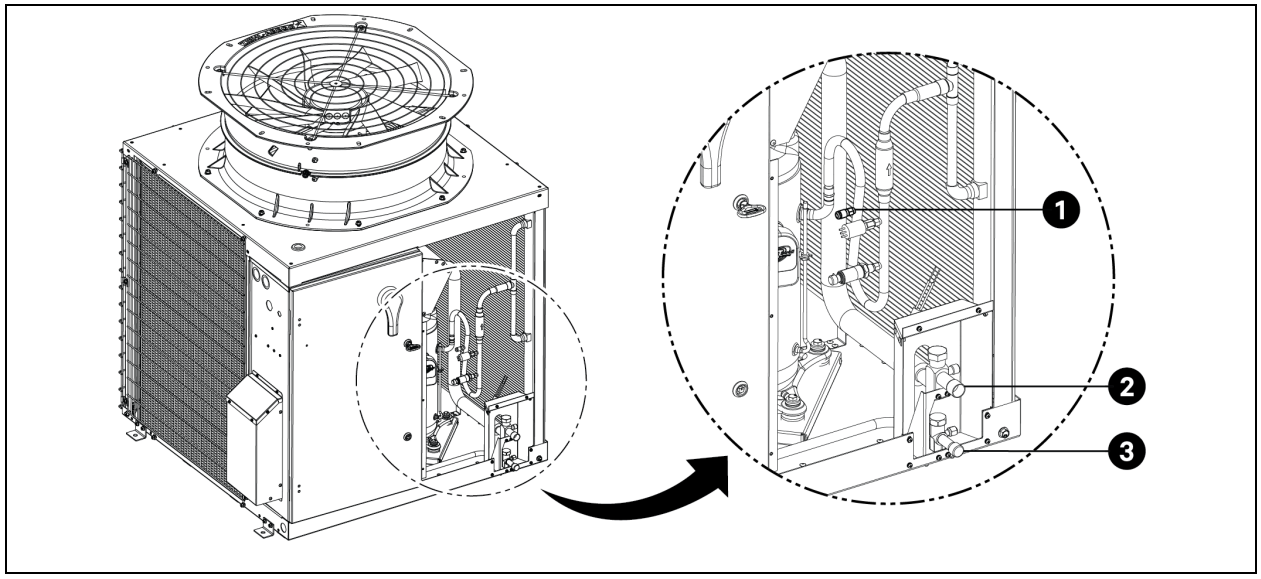
Item	Description	Item	Description
1	Schrader Valve	3	Liquid line
2	Suction line		

Figure 1.2 Schrader Valve Location, 15 kW units.



Item	Description	Item	Description
1	Schrader Valve	3	Liquid line
2	Suction line		

Figure 1.3 Schrader Valve Location, 21 and 28 kW units.



Item	Description	Item	Description
1	Schrader Valve	3	Liquid line
2	Suction line		

1.2 Qualification of workers

Competent personnel shall only carry out every working procedure that affects safety means.

Information on procedures, in addition to the 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. A certificate should document the achieved competence.

1.2.1 Safety concepts

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

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

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

1.2.2 Correct working procedures

1.2.2.1 Commissioning

Ensure that the floor area is sufficient for the refrigerant charge or that the ventilation duct is assembled correctly.

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

Check safety equipment before putting it into service.

1.2.2.2 Maintenance

Ensure sufficient ventilation at the repair place.

Be aware that equipment malfunction 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 it into service.

1.2.2.3 Repair

Ensure sufficient ventilation at the repair place.

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

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

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 national regulations do not require the recovery, drain the refrigerant to the outside. Take care that the drained refrigerant will not cause any danger. In doubt, one person should be assigned to guard the outlet. Take special care that the drained refrigerant will not float back into the building.
- Evacuate the refrigerant circuit.
- Purge the refrigerant circuit with nitrogen for 5 minutes (recommended).
- Evacuate again (recommended).
- 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 it into service.

1.2.2.4 Decommissioning

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

Ensure sufficient ventilation at the equipment location.

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

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

Remove the refrigerant. If national regulations do not require the recovery, drain the refrigerant to the outside. Take care that the drained refrigerant will not cause any danger. In doubt, one person should be assigned to guard the outlet. Take special care to ensure that the drained refrigerant does 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 minutes.
- Evacuate again.
- Fill with nitrogen up to atmospheric pressure.
- Put a label on the equipment so that the refrigerant has been removed.

1.2.2.5 Disposal

Ensure sufficient ventilation at the working place.

When flammable refrigerants are used:

- Evacuate the refrigerant circuit.
- Purge the refrigerant circuit with oxygen-free nitrogen for 5 minutes.
- Evacuate again (recommended).
- Cut out the compressor and drain the oil.

1.3 Installation, Maintenance, Repair and Decommissioning

1.3.1 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 procedures shall be completed before conducting work on the system.

1.3.2 Work procedure

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

1.3.3 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.

1.3.4 Checking for the 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 A2L refrigerants, i.e., non-sparking, adequately sealed, or intrinsically safe.

1.3.5 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 CO_2 fire extinguisher adjacent to the charging area.

1.3.6 No ignition sources

No person carrying out work in relation to a refrigerant system that involves exposing any pipe work shall use any ignition sources 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 installation site, repair, removal, and disposal, during which refrigerant can possibly be released into the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to ensure there are no flammable hazards or ignition risks. “No Smoking” signs shall be displayed.

1.3.7 Ventilated area

Ensure the area is open or adequately ventilated before breaking into the system or conducting 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.

1.3.8 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, the 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.
- Markings to the equipment continue to be visible and legible. Markings and signs that are illegible shall be corrected.
- Refrigerating pipes or components are installed in a position where they are unlikely to be exposed to any substance that may corrode refrigerant-containing components unless the components are constructed of materials that are inherently resistant to being corroded or are suitably protected against being so corroded.

1.3.9 Checks to electrical devices

Repair and maintenance of 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 safely to avoid sparking.
- That no live electrical components and wiring are exposed while charging, recovering or purging the system.
- That there is continuity of earth bonding.

1.3.9.1 Repair to sealed components and intrinsically safe components.

- Sealed electrical components shall be replaced.
- Intrinsically safe components must be replaced.

1.3.10 Cabling

Check that cabling is not 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.

1.3.11 Detection of flammable refrigerants

Under no circumstances shall potential ignition sources be used to search for or detect 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 recalibration. Detection equipment shall be calibrated in a refrigerant-free area. Ensure that the detector is not a potential ignition source and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the refrigerant's Lower Flammable Limit (LFL). It 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. Still, chlorine-containing detergents shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipework. Examples of leak detection fluids are the bubble method and fluorescent method agents.

All naked flames shall be removed/extinguished if a leak is suspected.

If refrigerant leakage 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 done according to the removal and evacuation procedures.

1.3.12 Removal and evacuation

Conventional procedures shall be used when breaking into the refrigerant circuit to make repairs or for any other purpose. However, for flammable refrigerants, best practices must 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 the 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, refrigerant 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 the 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 is not close to any potential ignition sources, and ventilation shall be available.

1.3.13 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.

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

1.3.14 Decommissioning

Before carrying out this procedure, the technician must be completely familiar with the equipment and all its details. It is recommended good practice that all refrigerants be recovered safely. Before the task is carried out, an oil and refrigerant sample shall be taken in case analysis is required before reusing the recovered refrigerant. Electrical power must be available before the task is commenced.

a. Become familiar with the equipment and its operation.
b. Isolate the system electrically.
c. 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.
d. Pump down the refrigerant system, if possible.
e. If a vacuum is not possible, make a manifold so refrigerant can be removed from various system parts.
f. Make sure the cylinder is situated on the scales before recovery occurs.
g. Start the recovery machine and operate it following the instructions.
h. Do not overfill cylinders (no more than 80 % volume liquid charge).
i. Do not exceed the maximum working pressure of the cylinder, even temporarily.
j. 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.
k. Recovered refrigerant shall not be charged to another refrigerating system unless it has been cleaned and checked.

1.3.15 Labeling

Equipment shall be labeled stating that it has been decommissioned 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 that the equipment contains flammable refrigerant.

1.3.16 Recovery

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants be 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 labeled for that refrigerant (i.e., Special cylinders for the recovery of refrigerant). Cylinders shall be complete with a 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 the 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 prevent flammable refrigerant from remaining 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.

1.4 Symbol Description

The unit is marked with various symbols for different purposes; read the part with the symbol(s) carefully and follow the instructions to avoid any risk.

Table 1.1 Symbol Description

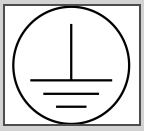
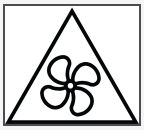
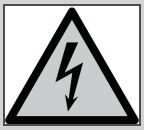
Symbology	Description	
	This symbol is displayed to indicate matters and operations that can cause risk.	
	**WARNING**	This symbol means that if the warning is not heeded, it can cause death or severe injury.
	**WARNING**	This symbol means that if the precaution is not taken, it may cause minor or moderate injury.
	This symbol is displayed to indicate protective earthing. Permanent earthing shall always remain connected other than for small periods of maintenance.	
	These symbols are displayed to indicate matters related to the appliance's operation.	
	This symbol is displayed to indicate matters related to the servicing of the appliance. The information in the manual is intended for use by a qualified service technician familiar with the safety procedures and equipped with the proper tools and test instruments.	
 	These symbols are displayed to indicate matters related to flammable refrigerants.	

Table 1.1 Symbol Description (continued)

Symbology	Description
	This symbol is displayed to indicate moving fan blades during regular operation.
	This symbol is displayed to indicate hazardous voltage involved or risk of electric shock. This symbol might be followed by ´CAUTION´ or ´WARNING´ wording to indicate the level of risk.
	This symbol is displayed to indicate potential hot surfaces.

2 Product Introduction

2.1 Product Overview

2.1.1 Condensing Unit Overview

The Vertiv™ CoolPhase Condensing Unit is an air-cooled condenser featuring a compressor that rejects the heat removed from the IT space into ambient air, utilizing low-GWP R-32 refrigerant. This unit is always used in conjunction with an Evaporator unit and is controlled and operated through it.

CoolPhase Condensing Units are classified by size, as displayed in Table 2.2 below. Some of these units are compatible for plenum installation, specifically the 3.5, 7, and 11 kW models, which are vertically constructed. The ones that are not plenum-compatible are the units with larger capacities: 15, 21, and 28 kW. For condensers with a capacity of 3.5 kW to 15 kW, the end-user must provide overcurrent and overvoltage protective devices, as well as main connections, in accordance with the installation instructions.

2.2 Model Nomenclature

2.2.1 Model Number Nomenclature Detail

The following tables describe each digit of the model number Nomenclature displayed:

Table 2.1 Model Number Nomenclature

1	2	3	4	5	6	-	7	8	9	10	11	12	13	14	15
C	U	D	2	8	1	-	E	0	0	0	A	0	0	0	0

Table 2.2 Condensing Unit Model-number Digit Description

Digit	Description
Digits 1 - 2	Unit Family: CU - Vertiv™ CoolPhase Condensing Unit
Digit 3	Version: D - Air-Cooled Standard Ambient L - Air-Cooled Low Ambient
Digit 4 - 5	Size: 03 – 3.5 kW 07 – 7.0 kW 11 – 11 kW 15 -15 kW 21 = 21 kW 28 = 28 kW
Digit 6	Voltage:

Table 2.2 Condensing Unit Model-number Digit Description (continued)

Digit	Description
	0 = 208/230 V, 1 PH, 50-60 Hz 1 = 208/230 V; 60 Hz; 3 PH (NAM) 4 = 460 V; 60 Hz; 3 PH (NAM)
Digit 7	Protection: 0- No coating E - E-coating (Aggressive environments)
Digit 8	Power Supply feature: 0 = Single power supply configuration
Digit 9	Free
Digit 10	Free
Digit 11	Revision: A - Revision A
Digit 12-15	Factory Configuration number: 0000 = Standard 4 digits other than 0= Engineering To Order designated number

2.2.2 Technical Description

Table 2.3 Vertiv™ CoolPhase Condensing Unit Technical Description.

		CUD030 CUL030	CUD070 CUL070	CUD111 CUL111	CUD114 CUL114
Region		Global		NAM	
Certification Marks		cETLus, CE & UKCA		cETLus	
Piping Connections		Flare Connection			
Operating Temperature range		Low Ambient Condensing Unit: -31°F (-35°C) ~118°F(48°C) Standard Ambient Condensing Unit: 23°F (-5°C) ~118°F (48°C) Standard Ambient Condensing Unit with Wind Baffle Accessory: -4°F (-20°C) ~118°F (48°C)			
Compressor		Variable speed rotary compressor			
Condenser Fan		EC Motor			
External Static Pressure		0.20 inH2O (50pa)	0.12 inH2O (30pa)		
Noise Data		68 dB		71 dB	
Noise Data of night mode		58 dB		56 dB	
Power Supply		208/230V, 1PH, 50/60Hz (-10%/+10%)		208/230V, 3PH, 50/60Hz (-10%/+10%)	460V, 3PH, 60Hz (-10%/+10%)
Refrigerant		R32			
Max Equivalent Length of Pipe between Indoor Unit and Condensing Unit		196.85 ft (60m)			
Height between Indoor and Condensing Unit	Condensing unit placed higher than indoor unit	98.43 ft (30m)			
	Condensing unit placed lower than indoor unit	26.25 ft (8m)			

NOTE: When the ambient temperature is below -4°F (-20 °C) up to -31°F (-35 °C), the low-ambient version must be used. Low Ambient versions of the units do not require a Wind Baffle accessory.

NOTE: The Low Ambient version of the Condensing Unit can not be installed in plenum areas, only the standard version is plenum rated.

Table 2.4 Vertiv™ CoolPhase Condensing Unit Technical Description for 15 kW Units.

		CUD151 CUL151	CUD154 CUL154
Certification marks		cCSAus (UL 60335-2-40 and CSA C22.2 No. 60335-2-40)	
Piping Connections		Flare Connection	
Operatin Temperature range		Low ambient condensing unit: -31°F (-35°C) ~118°F(48°C) Standard ambient condensing Unit with wind baffle: -4°F (-20°C) ~118°F (48°C) Standard ambient condensing unit without wind baffle 23°F (-5°C) ~118°F (48°C)	
Compressor		Variable speed Inverter-driven	
Condenser Fan		EC Motor	
Noise Data		72 dB	
Noise Data of Night Mode		64 dB	
Power Supply		208/230V, 3Ph, 50/60 Hz (±10%)	460/3PH, 50/60Hz (±10%)
Refrigerant		R32	
Max Equivalent Length of Pipe between Indoor Unit and Condensing Unit		295.27 ft (90 m)	
Height between Indoor and Condensing Unit	Condensing unit placed higher than indoor unit	98.4 ft (30 m)	
	Condensing unit placed lower than indoor unit	26.3 ft (8 m)	

NOTE: When the ambient temperature is below -4°F (-20 °C) up to -31°F (-35 °C), the low-ambient version must be used. Low Ambient versions of the units do not require a Wind Baffle accessory.

NOTE: All CUD15 and CUL15 Condensing Unit models on the table above are not plenum-rated.

Table 2.5 Vertiv™ CoolPhase Condensing Unit Technical Description for 21-28 kW Units.

		CUD211 CUL211	CUD281 CUL281	CUD214 CUL214	CUD284 CUL284
Certification marks		cCSAus (UL 60335-2-40 and CSA C22.2 No. 60335-2-40)			
Piping Connections		Sweat Connection			
Operating Temperature range		Standard ambient condensing Unit: -4°F (-20°C) ~118°F (48°C) Low ambient condensing unit: -31°F (-35°C) ~118°F (48°C)			
Compressor		Variable speed Inverter-driven			
Condenser Fan		EC Motor			
Noise Data		88 dB			
Noise Data of night mode		79 dB			
Power Supply		208/230V, 3PH, 50-60Hz (±10%)		460, 3PH, 60Hz (±10%)	
Refrigerant		R32			
Max Equivalent Length of Pipe between Indoor Unit and Condensing Unit		295.27 ft (90 m)			
Height between Indoor and Condensing Unit	Condensing unit placed lower than indoor unit	98.43 ft (30 m)			
	Condensing unit placed higher than indoor unit	26.2 ft (8 m)			

NOTE: All CUD21, CUL21, CUD28, and CUL28 Condensing Unit models on the table above are not plenum-rated.

Figure 2.1 Vertiv™ CoolPhase Condensing Unit Name Plate Information for 3.5-11 Kw Units.

Model No.: Volts: Ph: Hz: Date:
Serial No.:

IP Number: Weight Net:
Full Load Current (FLA):

Refrigerant: R32 GWP: 675 CO_2 :___
Refrigerant Charge: On-site

Conforms to UL Std.60335-1
Cert. to CSA Std.C22.2#60335-1
Conforms to UL Std.60335-2-40
Cert. to CSA Std.C22.2#60335-2-40

Intertek 5033496

VERTIV.

Inverter Rated Input Current:
EC Fan Maximum Operating Current (MOC):
High-side Maximum Allowable Pressure:
Low-side Maximum Allowable Pressure:
Branch Circuit Selection Current (BCSC):
Maximum Overcurrent Protective Device (MOP):
Minimum Supply Circuit Ampacity (MCA):

Vertiv Corporation
505 N. Cleveland Ave.,
Westerville, Ohio,43082,
USA.
www.vertiv.com

For installation only in locations not accessible to the general public

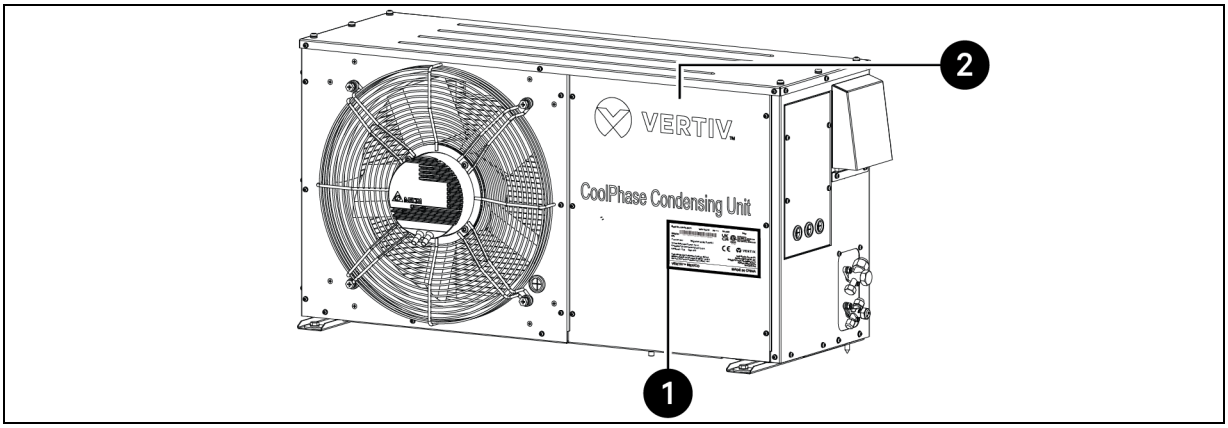
VERTIV ™ **MADE IN CHINA**

Name Plate Information	Description
Power Supply	
Model	Model defined by 11 digits
Serial Number	Serial number defined by 20 digits

NOTE: The values may vary for different SKUs. Please refer to the nameplate on the unit.

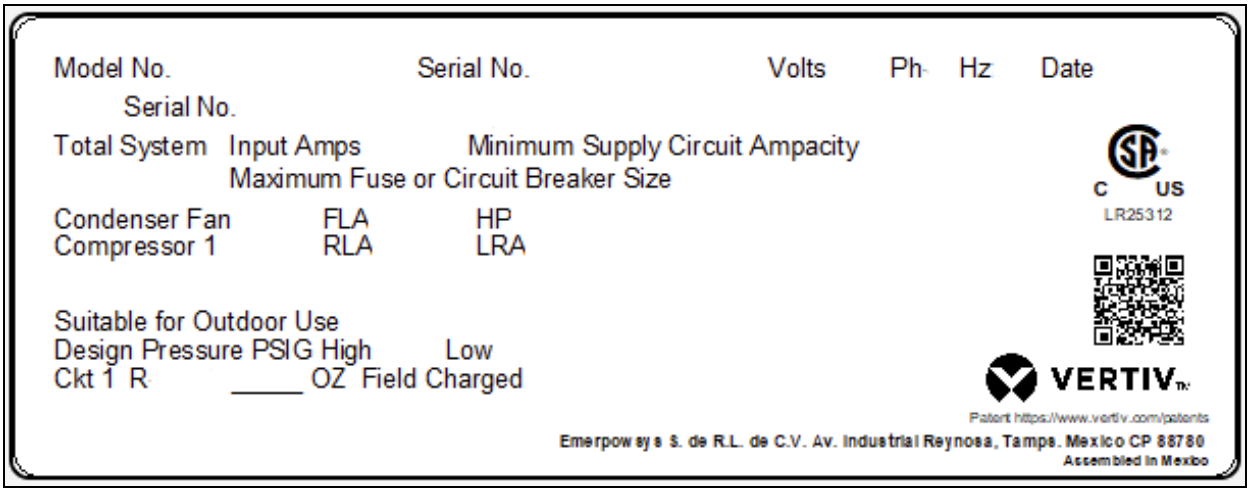
NOTE: The certification label varies by region; please refer to the unit's nameplate for details.

Figure 2.2 Nameplate Location, 3.5, 7 and 11-kW Units.



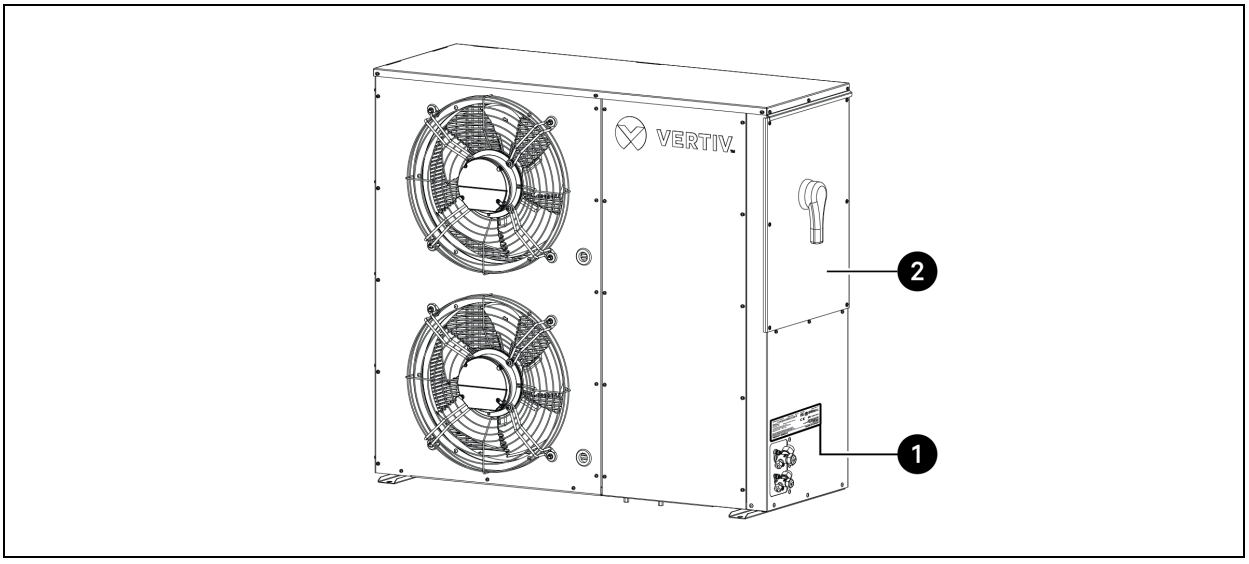
Item	Description
1	Service Access Panel
2	Nameplate

Figure 2.3 Vertiv™ CoolPhase Condensing Unit, Name Plate Information for 15-, 21-, and 28-kW Units.



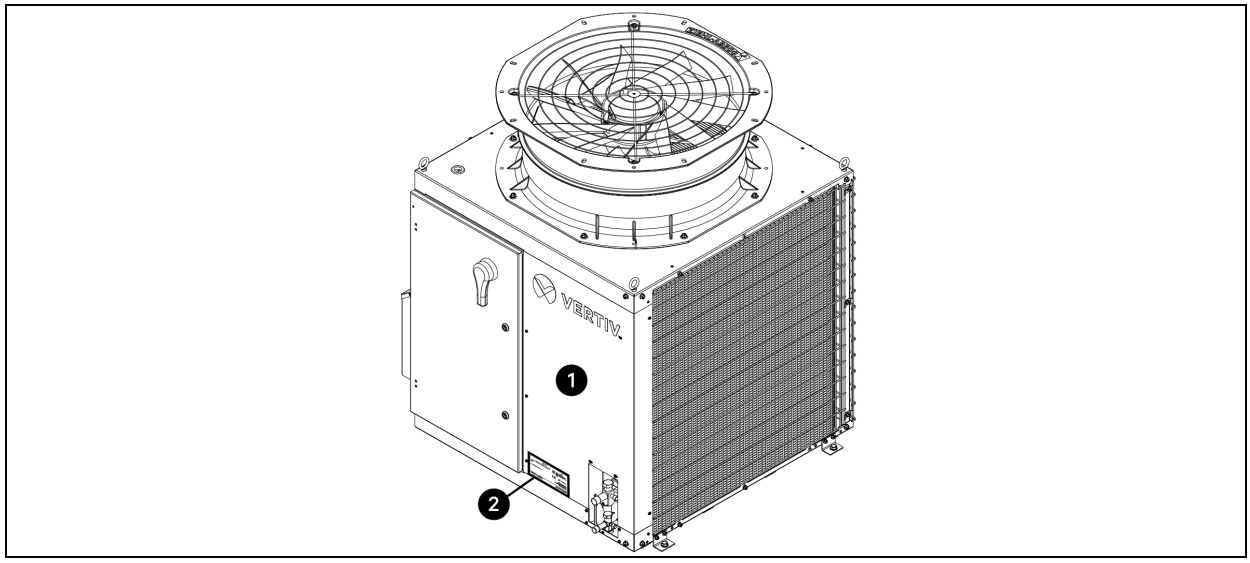
Name Plate Information	Description
Power Supply	
Model	Model defined by 15 digits
Serial Number	Serial number defined by 10 digits

Figure 2.4 Nameplate Location, 15 kW Units.



Item	Description
1	Service Access Panel
2	Nameplate

Figure 2.5 Nameplate Location, 21 and 28-kW Units.

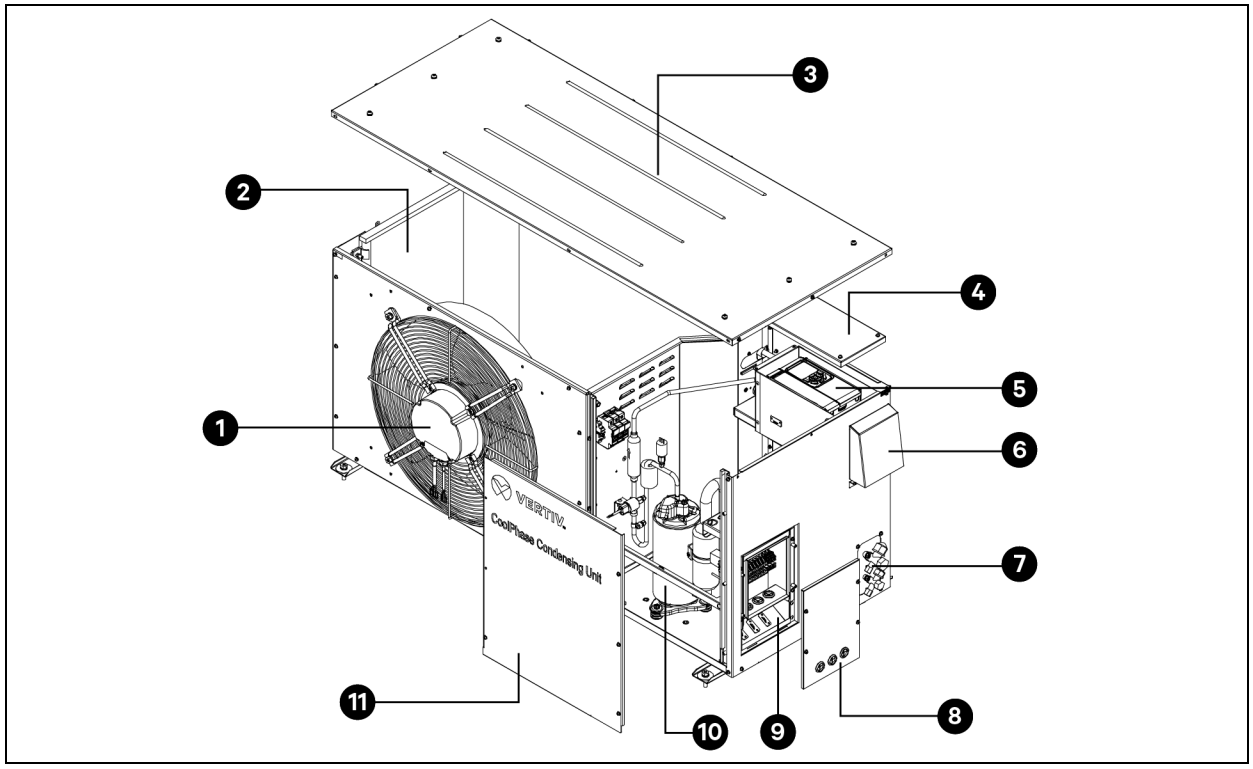


Item	Description
1	Service Access Panel
2	Nameplate

2.3 Components

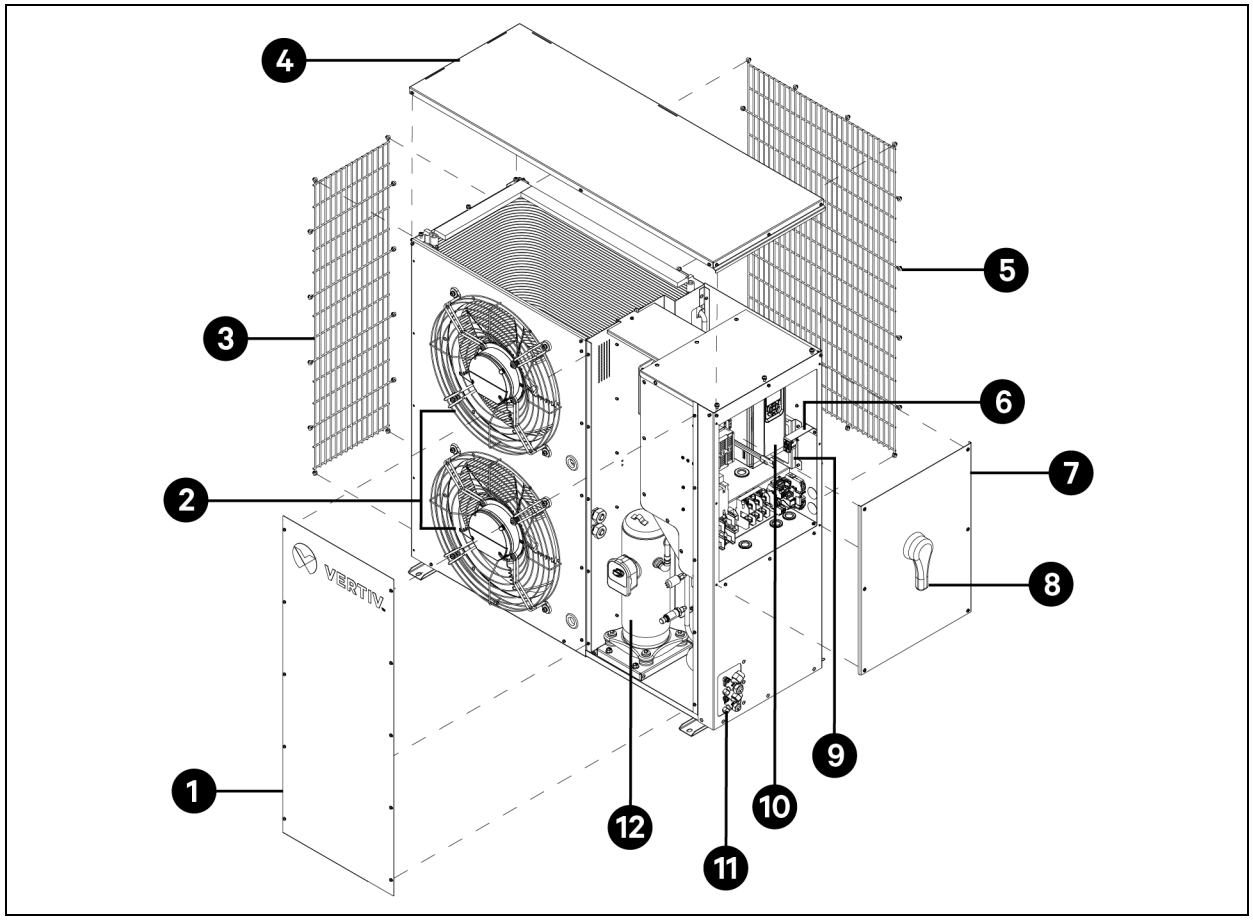
2.3.1 Component Location

Figure 2.6 Vertiv™ CoolPhase Condensing Unit (3.5-11 kW) Component Location.



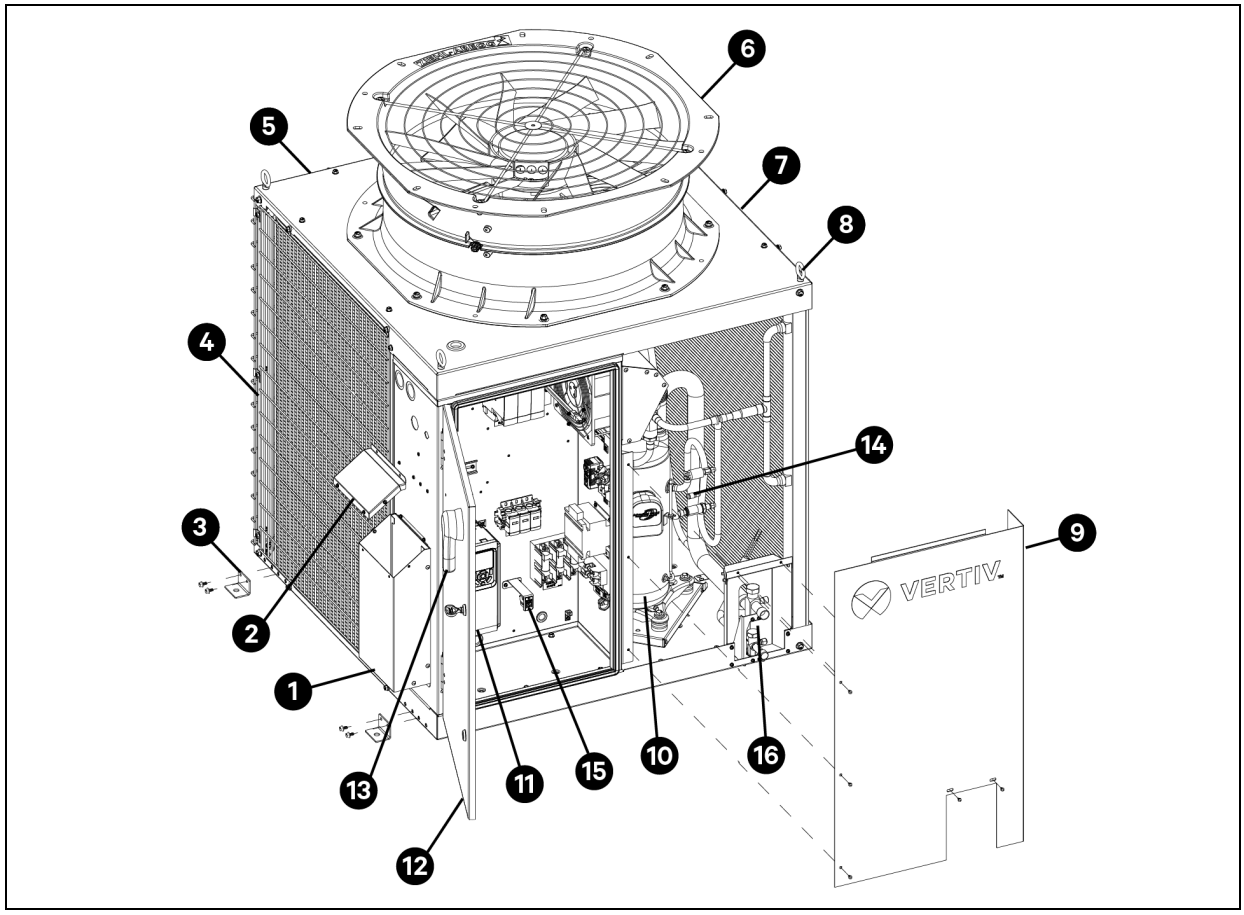
Item	Description	Item	Description
1	Condenser Fan	7	Piping Valves
2	Condenser Coil	8	Electrical Box Panel
3	Top Cover	9	Electrical Box
4	VFD Access Panel	10	Compressor
5	Variable Frequency Driver	11	Service Access Panel
6	VFD Air Filter Box Panel		

Figure 2.7 Vertiv™ CoolPhase Condensing Unit(15 kW) Component Location.



Item	Description	Item	Description
1	Service Access Panel	7	Electrical Connections Access Panel
2	EC Axial Fans	8	Fuse Switch Handle
3	Side Guard Mesh	9	Air Filter
4	Top Access Panel	10	Inverter
5	Back Guard Mesh	11	Valves
6	Evaporator Communication Port	12	Compressor

Figure 2.8 Vertiv™ CoolPhase Condensing Unit (21-28 kW) Component Location



Item	Description	Item	Description
1	Air Filter	9	Service Access Panel
2	Air Filter cover	10	Compressor
3	Base brackets (4)	11	Inverter
4	Left Side Grill	12	Electrical box cover
5	Center Side Grill	13	Fuse Switch Handle
6	EC Axial Fan	14	Schrader Valve
7	Right Side Grill	15	Evaporator Communication Port
8	Lifting Eyebolts (4)	16	Valves

2.3.2 Main Components (Standard version)

The standard version of the unit mainly consists of a compressor, fan, and heat exchanger, and it is designed to maintain proper operating pressure in outdoor temperatures of -4~118°F (-20~+48 °C).

NOTE: For 1–4-ton units (refer to the table on section Electrical Data on page 46), a Wind Baffle is required to enable operation down to -4°F.

NOTE: When equipped with the Wind Baffle kit, the maximum ambient air temperature is 118.4°F (48°C); however, cooling capacity will be reduced by approximately 1.5% in high ambient temperatures.

NOTE: With the Hail Guard kit installed, the maximum ambient air temperature is 118.4°F (48°C), but cooling capacity will be reduced by 2%.

NOTE: If both the Hail Guard and Wind Baffle kit are installed, the maximum ambient air temperature is 118.4°F (48°C); however, the cooling capacity will decrease by approximately 3.5% in high ambient temperatures.

NOTE: 21-kW and 28 kW models do not require a Wind Baffle accessory. Refer to section 2.4 for further details.

Figure 2.9 Standard Condensing Unit components diagram.

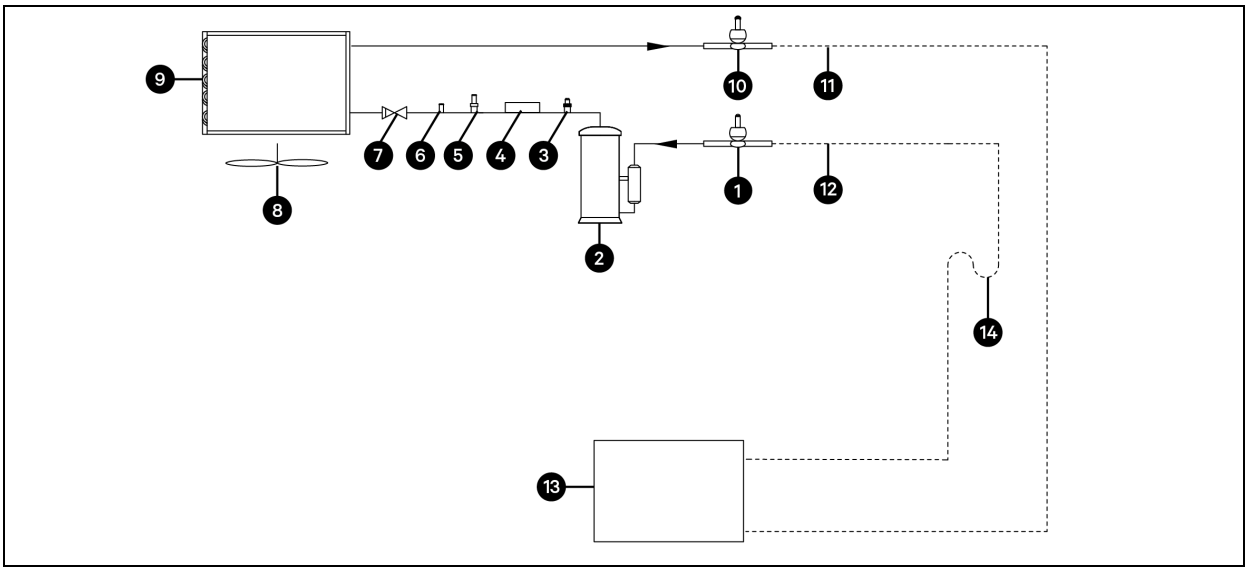


Table 2.6 Standard Condensing Unit components

Item	Description	Item	Description
1	Suction Valve	8	Condenser fan
2	Compressor	9	Condenser Coil
3	High-pressure switch	10	Liquid valve
4	Discharge temperature sensor	11	Liquid line
5	High-pressure transducer	12	Suction line
6	Schrader valve	13	Indoor unit
7	Check valve	14	Oil trap

Main Components of this version:

Fan

The EC axial fan uses low-noise fan blades and a high-performance three-phase motor.

Heat Exchanger

The microchannel heat exchanger provides high heat-dissipating efficiency and is convenient for maintenance.

2.3.3 Main Components (Low Ambient Version)

The low ambient version of the unit has additional components for its system, such as a receiver with a heater belt, a head pressure valve, a safety valve, a check valve, and a pressure switch. This version is designed to maintain proper operating pressure in outdoor temperatures lower than the standard version; the lowest operating temperature for these models is -31°F (-35 °C).

The low ambient version is a factory-made installed option that can be selected at the time of the purchase.

NOTE: Low Ambient versions of the units do not require a Wind Baffle accessory.

Figure 2.10 Low Ambient Condensing Unit Components Diagram.

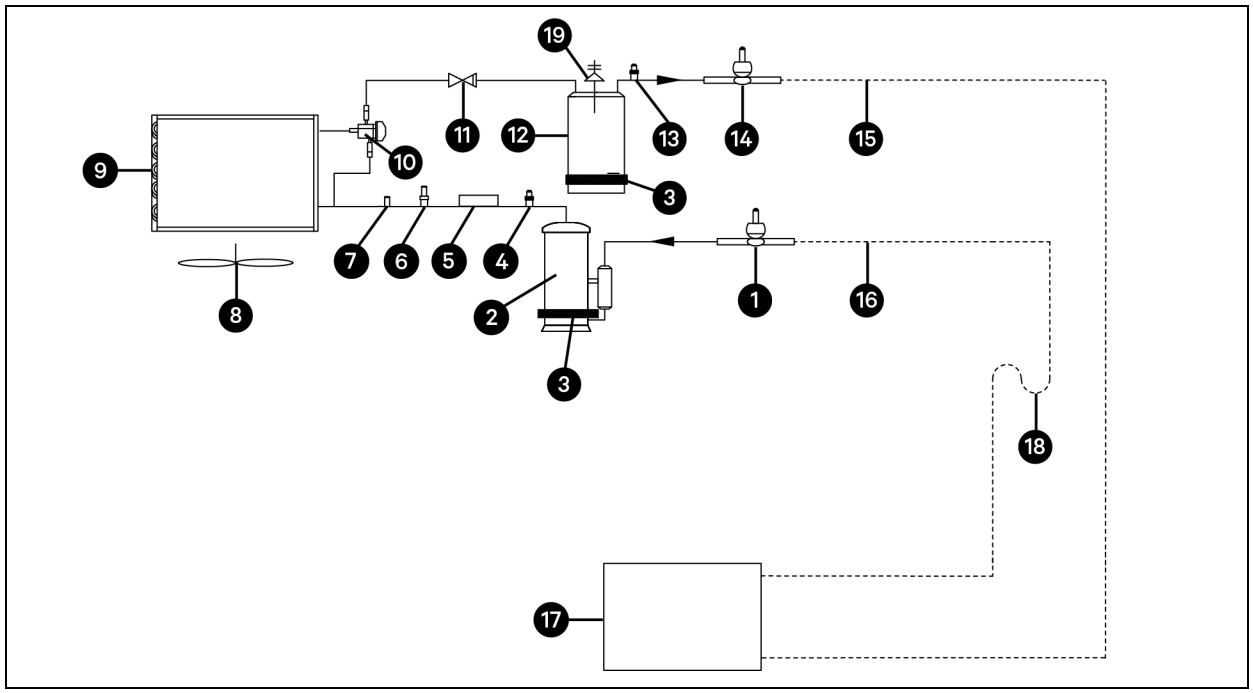


Table 2.7 Low Ambient Condensing Unit Components.

Item	Description	Item	Description
1	Suction Valve	11	Check valve
2	Compressor	12	Liquid receiver
3	Electric heating belt	13	Low-pressure switch
4	High-pressure switch	14	Liquid valve
5	Discharge temperature sensor	15	Liquid line
6	High-pressure transducer	16	Suction line
7	Schrader valve	17	Indoor unit
8	Condenser fan	18	Oil trap
9	Condenser Coil	19	Relief Valve
10	Head pressure control valve		

Main Components of this version:

Liquid Receiver Tank

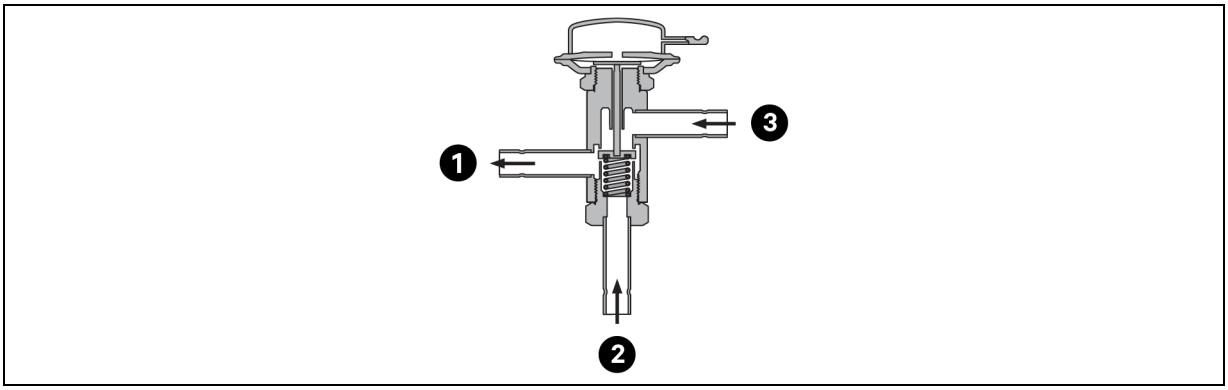
The receiver stores refrigerant to help fulfill the needs for low-temperature loads in winter and high-temperature loads in summer. The receiver has three connection ports to connect the refrigerant inlet pipe, refrigerant outlet pipe, and safety valve.

Head Pressure Valve

The head pressure valve is a three-way modulating valve that responds to discharge pressure. When the system head pressure falls below the setting of the Head pressure valve, flow from the condenser coil outlet is reduced by mixing both valve inlets (Discharge Gas, Liquid from Condenser coil) to the valve outlet (Receiver Inlet), causing the liquid refrigerant to stack within the condenser coil reducing its heat of rejection capacity. Steady system pressure is achieved when enough refrigerant has flooded the condenser coil to reduce the heat exchange capacity, maintaining the minimum system head pressure. The receiver size is based on the liquid refrigerant holding capacity of the condenser coil while maintaining a liquid column of refrigerant to the expansion valve. See Figure 2.11 below for reference.

During the soldering process, care must be taken not to overheat and damage the valve.

Figure 2.11 Structure Diagram of Head Pressure Valve



Item	Description
1	Connected with Receiver
2	Connected with Condenser
3	Connected with Discharge pipe

Heater Belt

The receiver is equipped with four heater belts, which consume a total power of 300 Watts. The heater belt is controlled by the pressure of refrigerant in the receiver. The heater belt will heat when the pressure exceeds 1.4 MPa (203.1 psig). The heater belt will stop heating when the pressure exceeds 1.9 MPa (275.6 psig).

Check Valve

The check valve is installed between the head pressure valve and the receiver on the liquid line to prevent the refrigerant from flowing back to the condenser. The arrow on the valve indicates the direction of the flow, and it should point toward the receiver.

2.4 Accessories

The accessories for the Coolphase Condensing Unit are listed below. These items are sold separately. For further mounting information, refer to the Quick Installation Guide for each accessory.

2.4.1 Hail Guard

Hail Guards protect the coil against hail produced during storms. This accessory should be added when the unit is located in an area with extreme weather conditions.

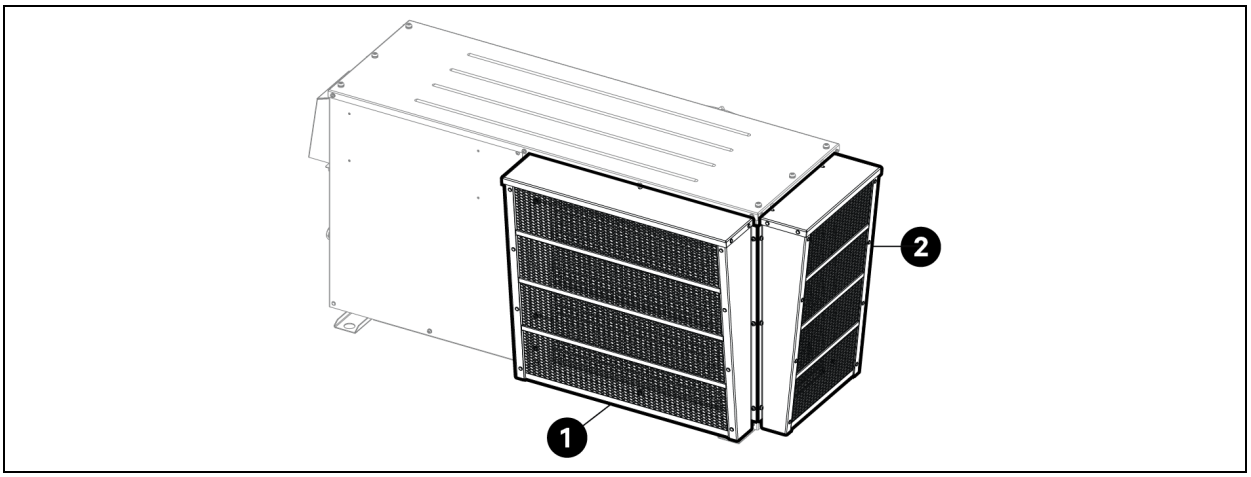
NOTE: With the Hail Guard kit installed, the maximum ambient air temperature is 118.4°F (48°C), but cooling capacity will be reduced by 2%.

NOTE: When both the Hail Guard and Wind Baffle kits are installed, the maximum ambient air temperature is 118.4°F (48°C); however, the cooling capacity decreases by approximately 3.5%.

Table 2.8 Hail Guard SKUs.

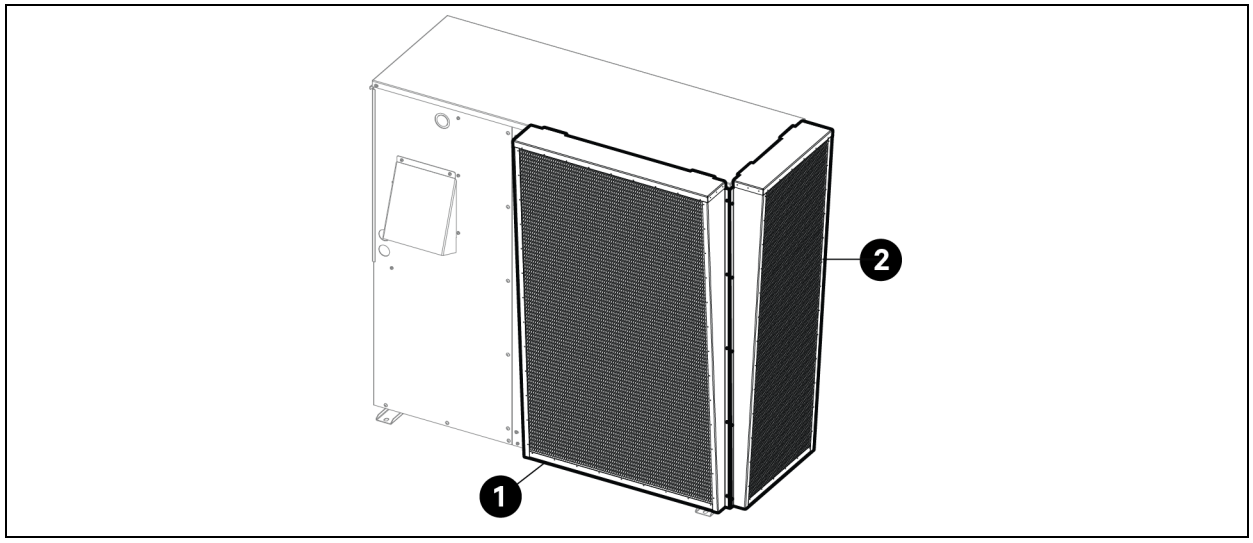
SKU	Item Description	Applicable Models
CUHAILGRD-03	Hail Guard for 3.5 kW Units	CUD03, CUL03
CUHAILGRD-07	Hail Guard for 7 kW Units	CUD07, CUL07
CUHAILGRD-11	Hail Guard for 11 kW Units	CUD11, CUL11
CUHAILGRD-15	Hail Guard for 15 kW Units	CUD15, CUL15
CUHAILGRD-21/28	Hail Guard for 28 kW Units	CUD21, CUL21 CUD28, CUL28

Figure 2.12 Hail Guards (CUHAILGRD-03, CUHAILGRD-07, CUHAILGRD-11) mounted on the 3.5-11 kW unit.



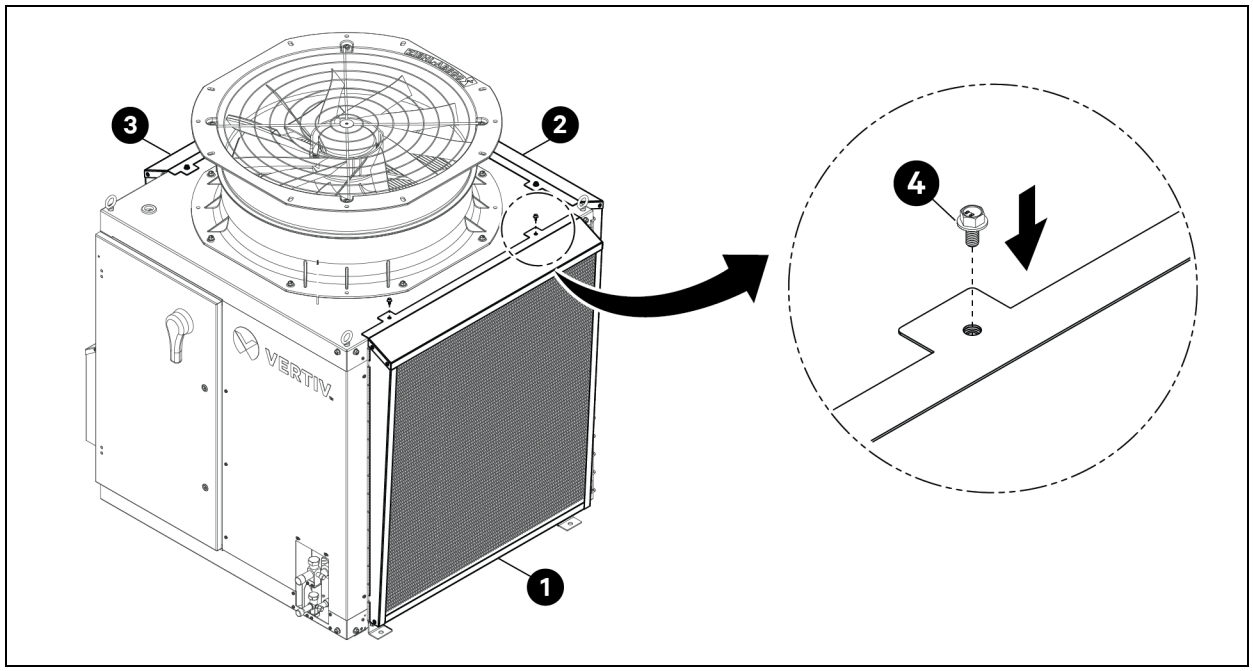
Item	Description
1	Back Guard Mesh Hail Guard
2	Side Guard Mesh Hail Guard

Figure 2.13 Hail Guards (CUHAILGRD-15) mounted on the 15-kW unit.



Item	Description
1	Back Guard Mesh Hail Guard
2	Side Guard Mesh Hail Guard

Figure 2.14 Hail Guards (CUHAILGRD-21/28) mounted on the 21-kW and 28-kW unit.



Item	Description	Item	Description
1	Right Hail Guard	3	Left Hail Guard
2	Back Hail Guard	4	M6 bolts attachment detail

2.4.2 Wind Baffle

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

NOTE: The Wind Baffle should be installed when the standard condensing unit is installed outdoors, and the temperature is 23°F (-5°C) or below. The Wind Baffle can help ensure the stability and reliability of the standard condensing unit running in a low-temperature environment.

NOTE: When equipped with the wind baffle kit, the maximum ambient air temperature is 118.4°F (48°C); however, cooling capacity will be reduced by approximately 1.5% in high ambient temperatures.

NOTE: If both the hail guard and wind baffle kit are installed, the maximum ambient air temperature is 118.4°F (48°C); however, the cooling capacity will decrease by approximately 3.5% in high ambient temperatures.

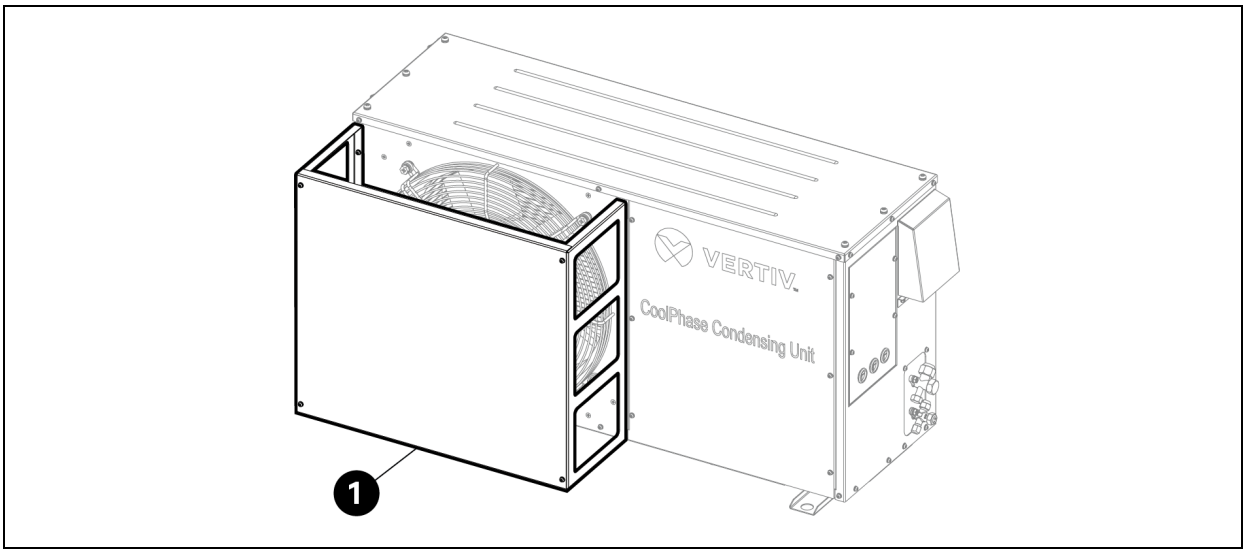
NOTE: When the ambient temperature is lower than -4°F (-20 °C) up to -31°F (-35°C), the low ambient version must be used.

NOTE: Low Ambient versions of the units do not require a Wind Baffle accessory.

Table 2.9 Wind Baffle SKUs.

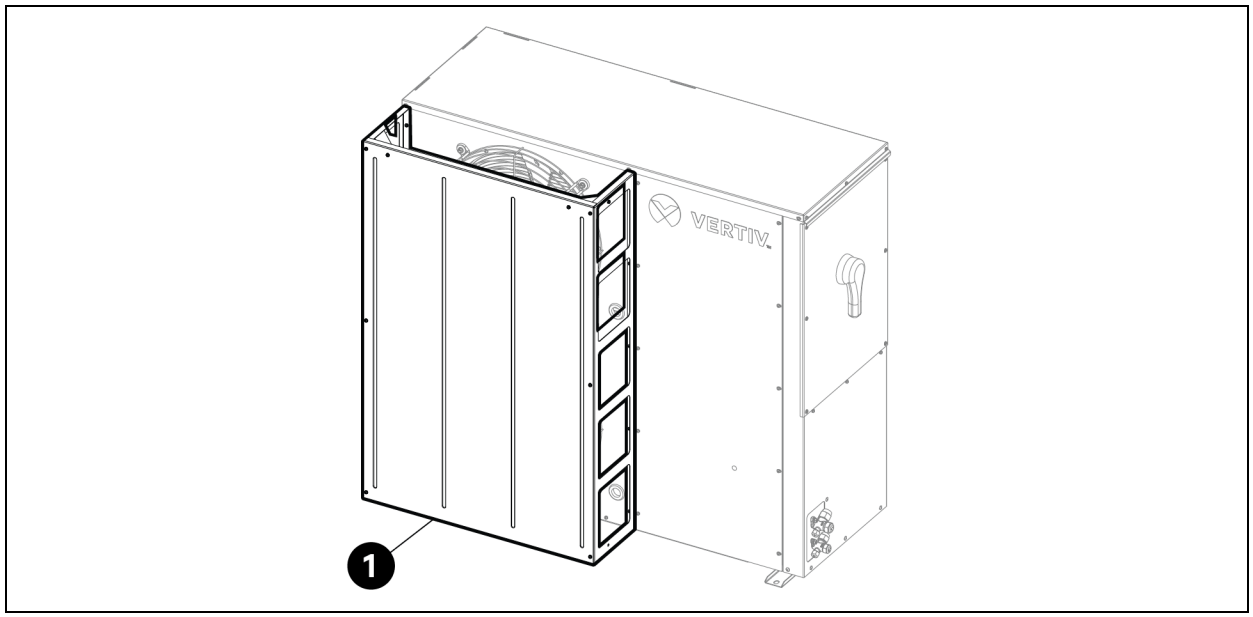
SKU	Item Description	Applicable Models
CUWINDKIT-03	Wind Baffle for 3.5 kW Standard Ambient Condensing Units	CUD03
CUWINDKIT-07	Wind Baffle for 7 kW Standard Ambient Condensing Units	CUD07
CUWINDKIT-11	Wind Baffle for 11 kW Standard Ambient Condensing Units	CUD11
CUWINDKIT-15	Wind Baffle for 15 kW Standard Ambient Condensing Units	CUD15

Figure 2.15 Wind Baffle (CUWINDKIT-03, CUWINDKIT-07, CUWINDKIT-11) mounted on the 3.5-11 kW unit.



Item	Description
1	Wind Baffle for Condensing Unit

Figure 2.16 Wind Baffle (CUWINDKIT-15) mounted on the 15-kW unit.



Item	Description
1	Wind Baffle for Condensing Unit

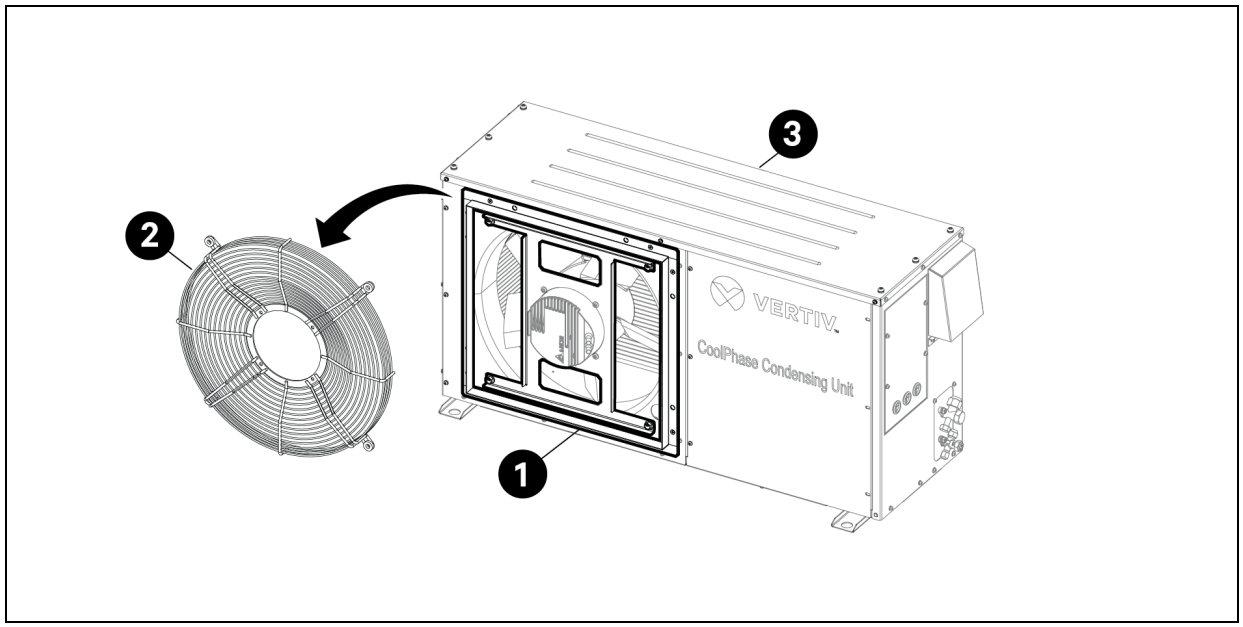
2.4.3 Duct Kit

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

Table 2.10 Duct Kit SKUs.

SKU	Item Description	Applicable Models
CUDUCTKIT-07	Duct Kit for 3.5- and 7-kW Units	CUD03, CUL03 CUD07, CUL07
CUDUCTKIT-11	Duct Kit for 11 kW Units	CUD11, CUL11

Figure 2.17 Duct Kit mounted on the unit.



Item	Description	Item	Description
1	Duct Kit	3	Condensing Unit
2	Fan cover		

2.5 Dimensions and weights

Figure 2.18 Condensing Unit Dimensions (3.5-11 kW).

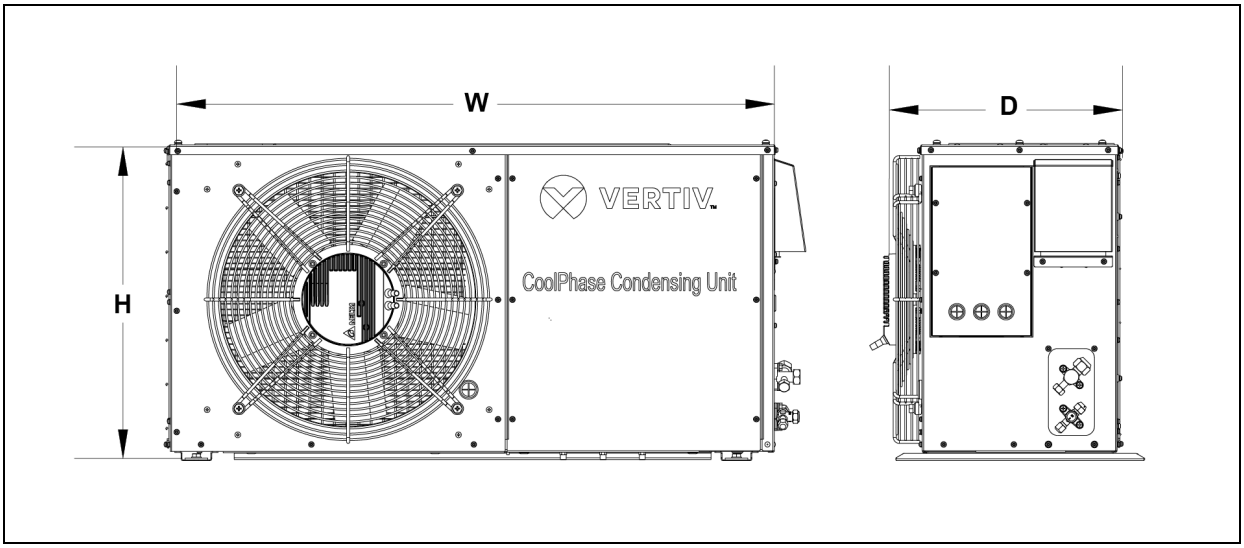


Table 2.11 Dimensions and Weights of 3.5-11 kW Units.

Model	Unit Dimensions (Width x Depth x Height) in (mm)	Shipping Dimensions (Width x Depth x Height) in (mm)	Net Weight lb (kg)	Shipping Weight lb (kg)
CUD03	38.77 x 12.55 x 20.31 (985 x 319 x 516)	45.24 x 22.01 x 28.82 (1149 x 559 x 732)	110 (50)	170 (77)
CUL03			117 (53)	176 (80)
CUD07	44.40 x 16.49 x 20.31 (1128 x 419 x 516)	50.75 x 25.94 x 28.82 (1289 x 659 x 732)	118 (54)	189 (86)
CUL07			130 (59)	201 (91)
CUD111	51.29 x 20.47 x 22.83 (1303 x 520 x 580)	57.64 x 30.08 x 31.30 (1464 x 764 x 795)	175 (80)	259 (118)
CUL111			184 (84)	272 (124)
CUD114			165 (75)	255 (116)
CUL114			176 (80)	263 (120)

Figure 2.19 Condensing Unit Dimensions (15 kW-230V).

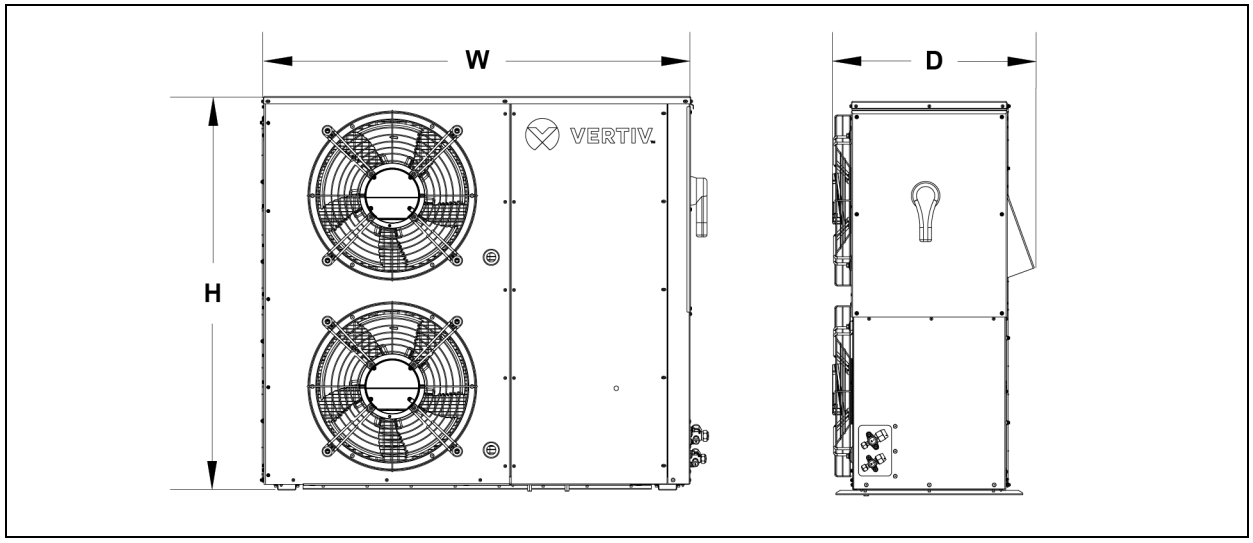


Figure 2.20 Condensing Unit Dimensions (15 kW-460V).

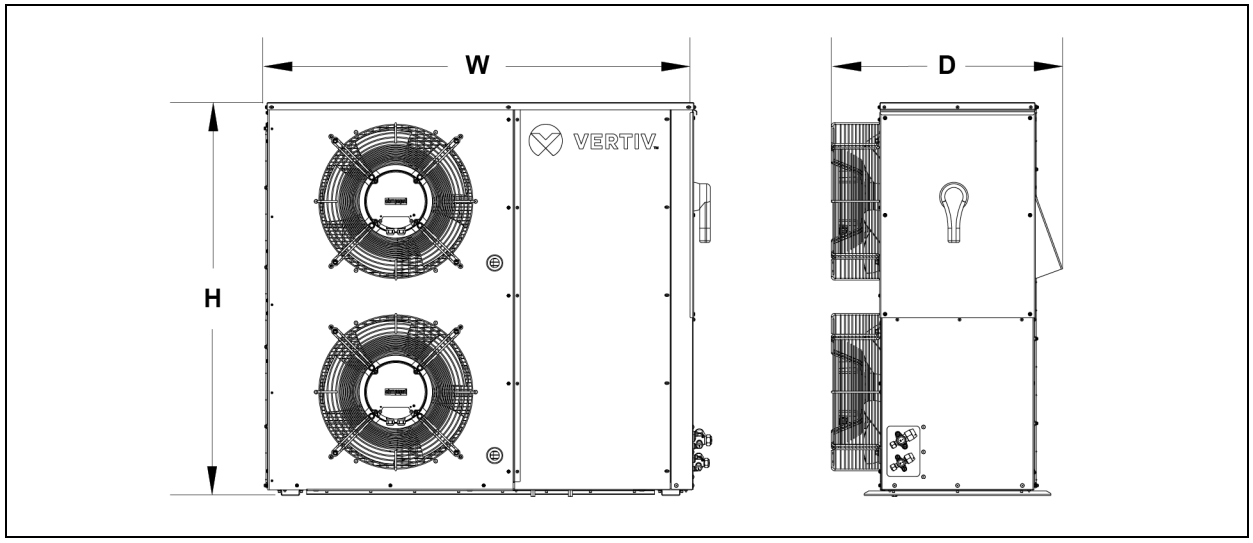


Table 2.12 Dimensions and Weights of 15 kW Units

Model	Unit Dimensions (Width x Depth x Height) in (mm)	Shipping Dimensions (Width x Depth x Height) in (mm)	Net Weight lb (kg)	Shipping Weight lb (kg)
CUD15	45.7 x 21.5 x 42.2 (1162 x 550 x 1072)	57.5 x 39.4 x 50.2 (1460 x 1000 x 1276)	268 (121)	325 (147)
CUL151			277 (125)	334 (151)
CUD154	45.7 x 24.8 x 42.2 (1162 x 632 x 1072)		268 (121)	325 (147)
CUL154			277 (125)	334 (151)

Figure 2.21 Condensing Unit Dimensions (21 and 28 kW).

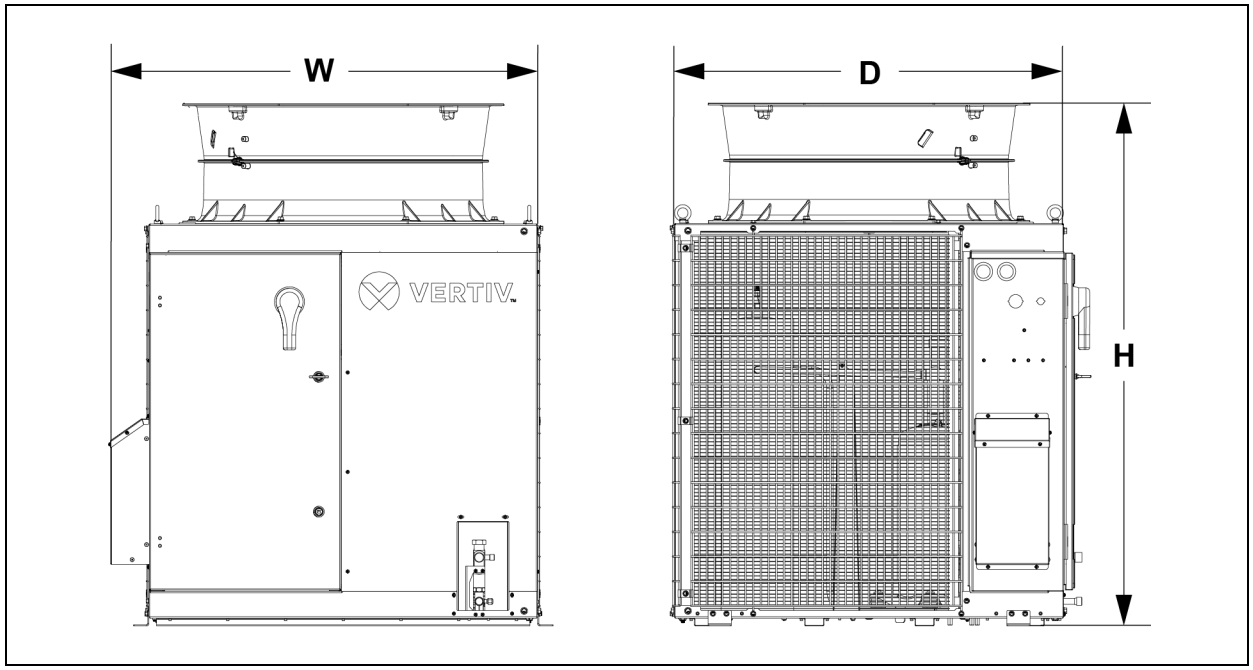


Table 2.13 Dimensions and Weights of 21 and 28 kW units.

Model	Unit Dimensions (Width x Depth x Height) in (mm)	Shipping Dimensions (Width x Depth x Height) in (mm)	Net Weight. lb (kg)	Shipping Weight. lb (kg)
CUD21 CUL21	39.76 x 42.40 x 53.37 (1010 x 1010 x 1355.7)	48 x 48 x 61.01 (1219.2 x 1219.2 x 1549.6)	425 (193)	546 (248)
CUD28 CUL28			458 (208)	579 (263)

2.6 Storage environment

Table 2.14 Storage Environment

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 °F to 122 °F (-40 °C to +50 °C)
Ambient humidity	Less than 95% RH @ 86°F (30°C)

2.7 Electrical Data

Table 2.15 Condensing Unit Electrical Data

Models	Nom. Tons	Volts / Phases	Compressor Qty.	Compressor Inverter (A)	Fan Qty.	Fan 1 (A)	Fan 2 (A)	Exhaust fan (A)	Crank Case + Heating belt (A)	FLA (A)	MCA (A)	MOP (A)
CUD03 CUL03	1	208/230 1Ph	1	14	1	3	0	N/A	0/0.40	17	21	35
CUD07 CUL07	2	208/230 1Ph	1	20	1	3	0	N/A	0/0.40	23	28	50
CUD111 CUL111	3	208/230 3Ph	1	16.7	1	4	0	N/A	0/0.40	21	25	40
CUD114 CUL114	3	460 3Ph	1	11.4	1	4	0	N/A	0/0.40	15	18	30
CUD151	4	208/230 3Ph	1	14.3	2	2.4	2.4	0.5	0/32.2	19.6	23	35
CUL151	4	208/230 3Ph	1	14.3	2	2.4	2.4	0.5	0.5/32.2	20.1	24	35
CUD154	4	460 3Ph	1	9	2	0.8	0.8	0.25	0/21.9	10.9	13	20
CUL154	4	460 3Ph	1	9	2	0.8	0.8	0.25	0.25/21.9	11.1	13	20
CUD211	6	208/230 3Ph	1	22.2	1	8.2	0	0.5	0/41.3	30.9	36	50
CUL211	6	208/230 3Ph	1	22.2	1	8.2	0	0.5	0.5/41.3	31.4	37	50
CUD214	6	460 3Ph	1	19	1	3	0	0.25	0/32.9	22.3	27	45
CUL214	6	460 3Ph	1	19	1	3	0	0.25	0.25/32.9	22.5	27	45
CUD281	8	208/230 3Ph	1	39.8	1	8.2	0	0.5	0/51.3	48.5	58	90
CUL281	8	208/230 3Ph	1	39.8	1	8.2	0	0.5	0.5/51.3	49	59	90
CUD284	8	460 3Ph	1	30	1	2.5	0	0.25	0/39.7	32.8	40	70
CUL284	8	460 3Ph	1	30	1	2.5	0	0.25	0.25/39.7	33	41	70

NOTE: The values in the table above apply only to the Condensing Unit; for the Condenser + Evaporator system, please refer to the corresponding Indoor Unit User Manual.

3 Pre-Installation Preparation

WARNING! Competent persons shall only carry out every working procedure that affects safety means.

WARNING! Risk of a top-heavy unit falling over. Improper handling can cause equipment damage, injury, or death. Read all the following instructions and verify that all lifting and moving equipment is rated for the unit's weight before attempting to move, lift, remove packaging from, or prepare the unit for installation.

WARNING! Before breaking into the system or conducting any hot work, ensure the working area is open or 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 refrigerant leakage is found that 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. Refrigerant removal shall be performed following manufacturer instructions.

WARNING! Risk of heavy unit falling over. Improper handling can cause equipment damage, injury, or death. Read all the following instructions and verify that all lifting and moving equipment is rated for the unit's weight before attempting to move, lift, remove packaging from, or prepare the unit for installation. Unit weights are specified in section 2.5, “Dimensions and Weights”.

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

NOTICE

Risk of damage from forklift. It can cause unit damage. Keep tines of the forklift level 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 in its original package, upright, indoors, and protected from dampness, freezing temperatures, and contact damage.

3.1 Inspecting the Unit

Upon the unit's arrival and before unpacking:

- Verify that the labeled equipment matches the contents listed on the bill of lading.
- Inspect the package for any visible or concealed damage.
- Additional unit inspection is warranted to ensure no exterior or internal damage.

Report any damage immediately to the carrier and file a damage claim, sending a copy to Vertiv™ or your sales representative.

3.2 Handling and Unpacking Indications for 3.5, 7, and 11 kW Condensers

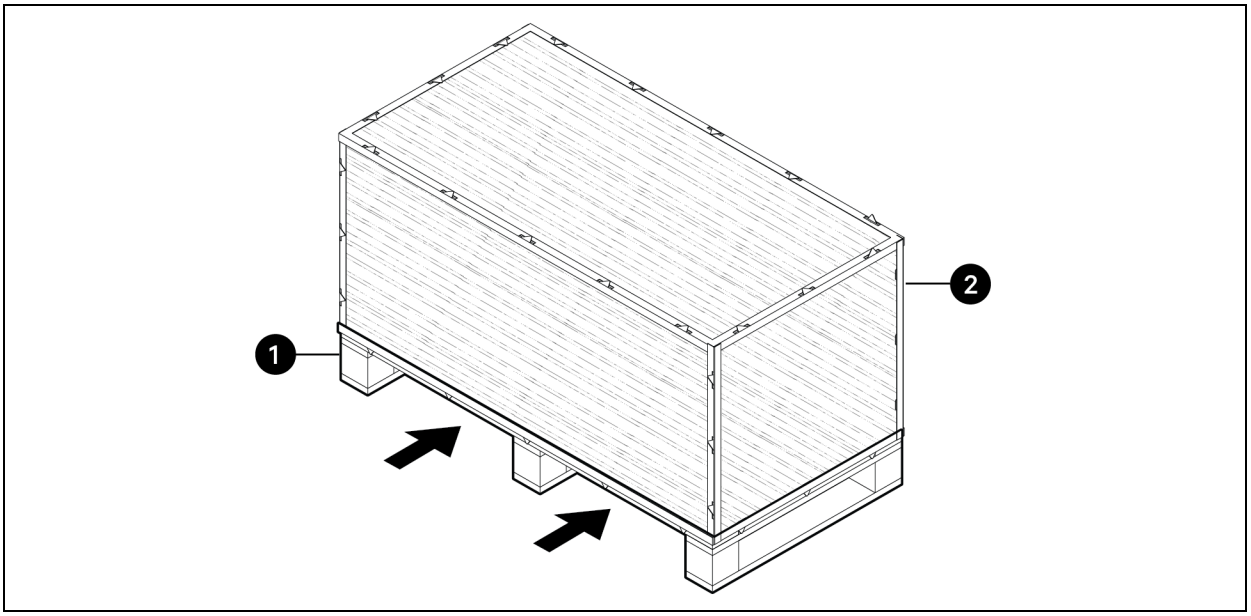
3.2.1 Moving the Packaged Unit

NOTE: Before moving, installing, or servicing this unit, please read the Safety Instructions sheet provided as a separate document shipped with the unit.

Mechanical transport equipment, such as a forklift or crane, is recommended when unloading and transferring the condenser closest to the installation site.

When using a forklift, insert the tines in the direction indicated in the figure below.

Figure 3.1 Inserting the Forklift in this direction.



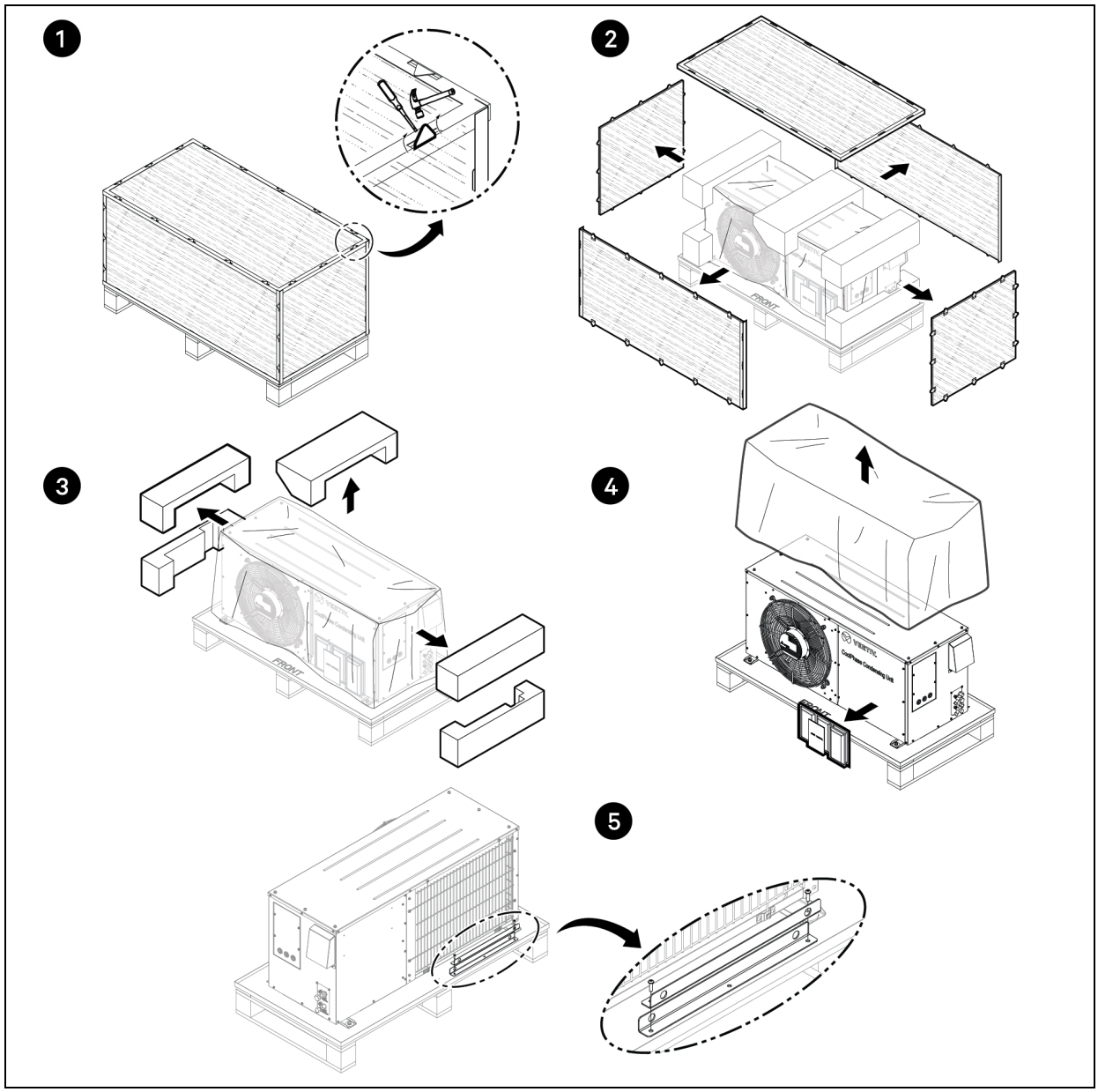
Item	Description
1	Pallet
2	Packaged Unit

3.2.2 Unpacking the Unit

To unpack the Vertiv™ CoolPhase Condensing Unit from the wooden box:

1. Place the package on a level surface, then unfold the mild steel tabs on the wood box edges with the help of a flat screwdriver and a hammer.
2. After all tabs are flattened, remove the wood panels to release the unit.
3. Remove all foam pads.
4. Lift the plastic bag protecting the unit, then remove the desiccant and documentation bags.
5. With a screwdriver, detach the lifting brackets on the pallet's backside and keep them for plenum installation.

Figure 3.2 Unpacking the unit.



3.2.3 Removing the Unit from the Pallet

WARNING! Two or more adequately trained and qualified personnel are required to move the unit to its installation location.

To remove the unit from the pallet:

1. Remove the shipping brackets from the pallet by removing four M8 hex screws and washers for each bracket (Figure 3.3).
2. If the unit needs to be lifted, attach the lifting brackets to the top of the unit (Figure 3.4), reusing the six screws on the top panel to secure them.
3. Hoist the Unit to its designated installation location with the help of a crane anchoring the slings to the lifting brackets.

Figure 3.3 Removing Unit from pallet, step 1.

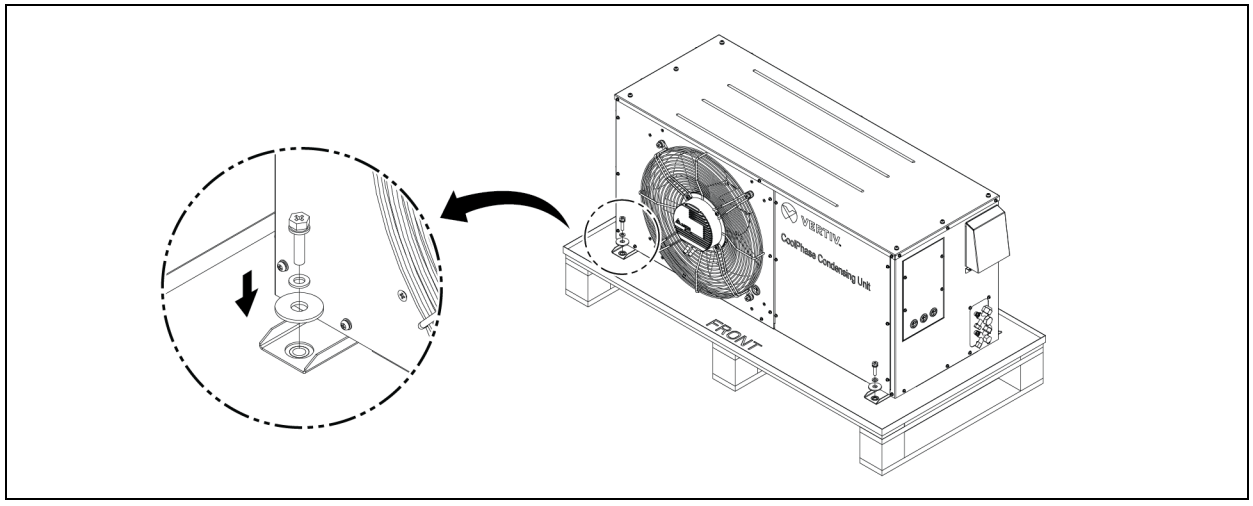
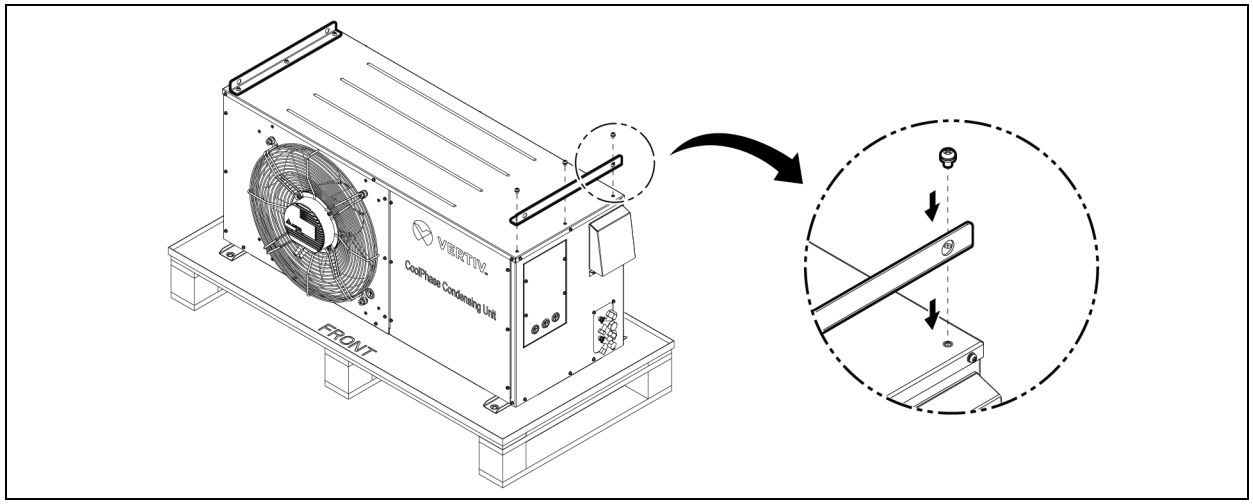


Figure 3.4 Removing Unit from pallet, step 2.



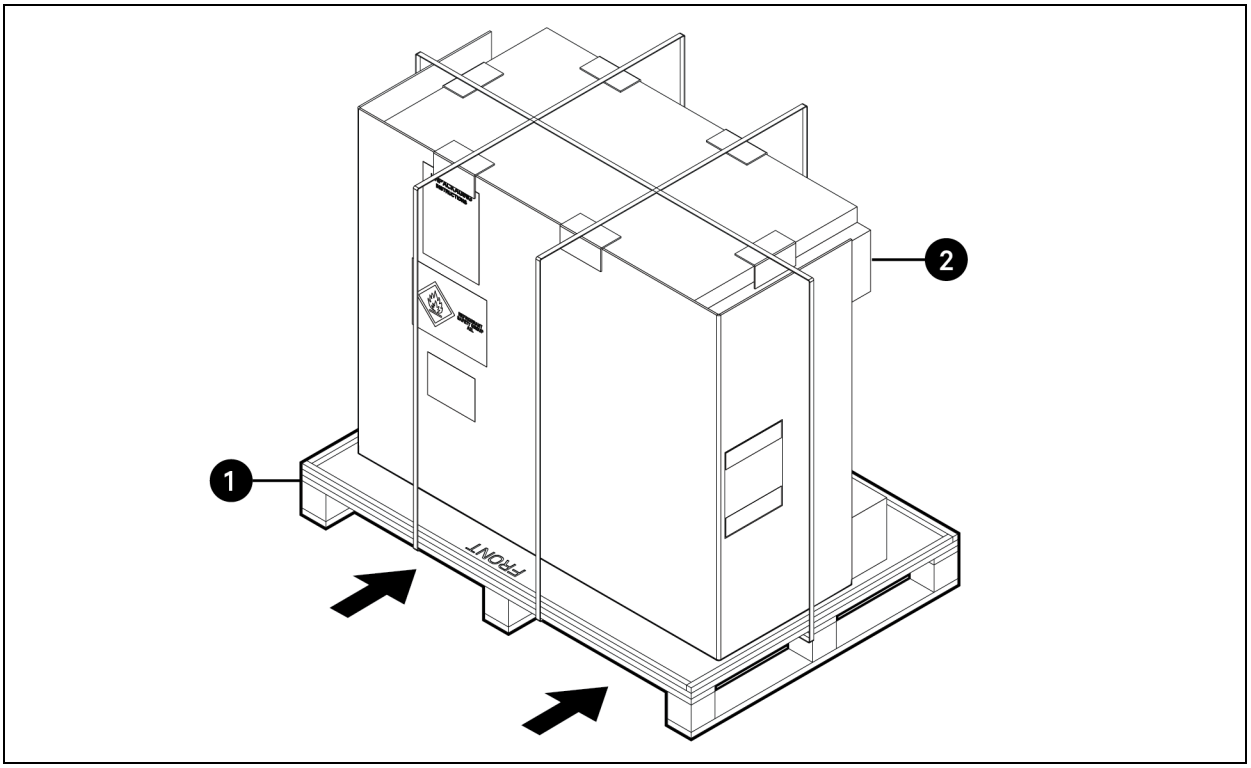
3.3 Handling and Unpacking Indications for 15 kW Condensers

3.3.1 Moving the packaged Unit

NOTE: Before moving, installing, or servicing this unit, please read the Safety Instructions sheet provided as a separate document shipped with the unit.

Mechanical transport equipment, such as a forklift or crane, must be used when unloading and transferring the condenser closest to the installation site. When using a forklift, insert the tines in the direction indicated in the figure below.

Figure 3.5 Inserting the Forklift in this direction.

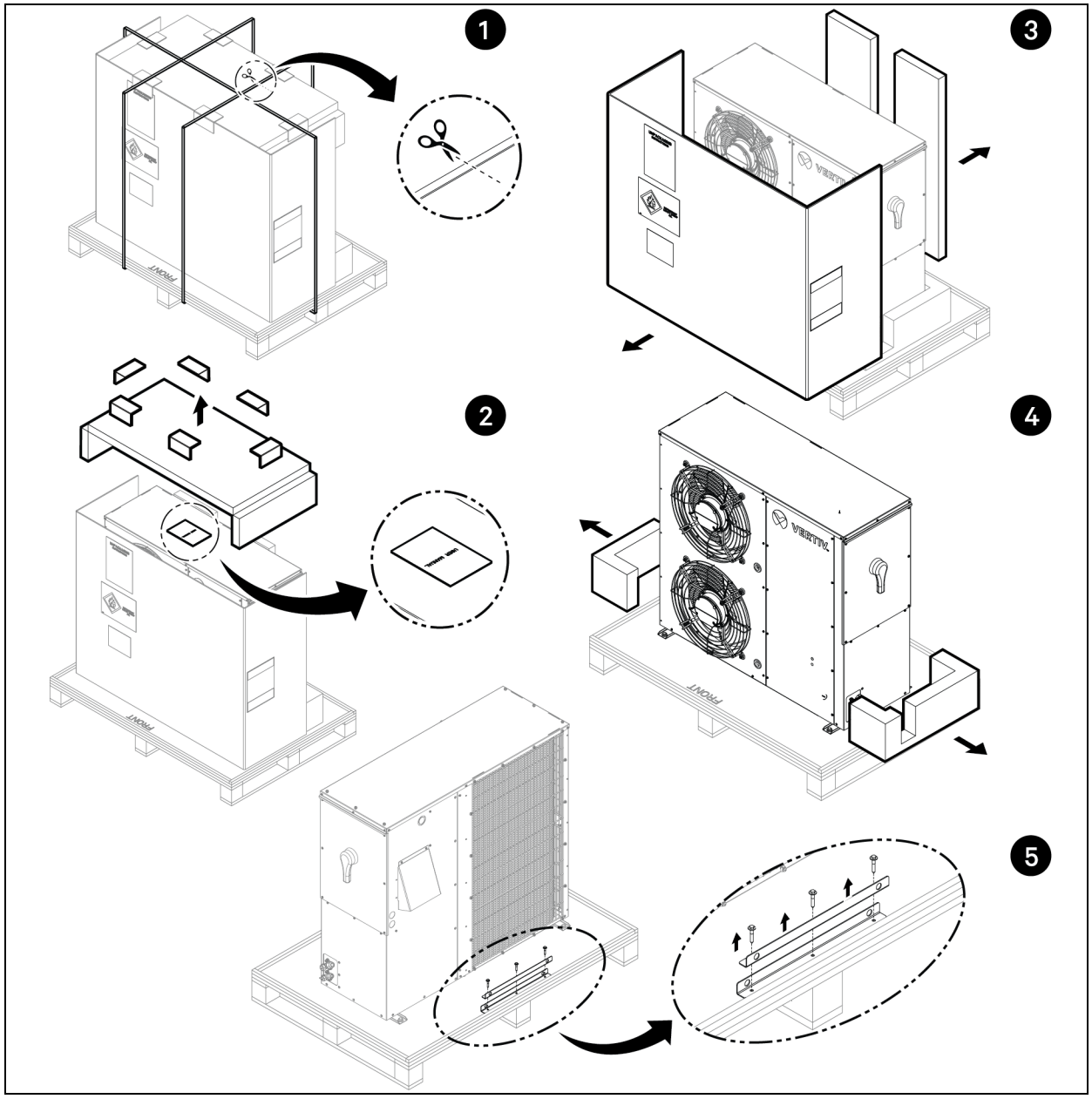


Item	Description
1	Pallet
2	Packaged Unit

To unpack the Vertiv™ CoolPhase Condensing Unit from the cardboard box:

1. Place the package on a flat surface, then trim the plastic wrap and the polystraps to release the unit.
2. Remove the protector corners and the honeycomb, then take off the user manual from the top.
3. Step aside the cardboard and the corrugated packaging material that protects the unit on the front of the package.
4. Remove the foam pads on the base of the unit to access the anchoring base brackets.
5. Lastly, detach the lifting brackets from the pallet by removing the 3 screws attached to them, then proceed to detach the condenser from the pallet as established in the following section.

Figure 3.6 Unpacking the unit.



3.3.2 Removing the Unit from the Pallet

1. Remove the shipping brackets from the pallet by removing four 3/8” hex screws and washers for each bracket.
2. If the unit needs to be lifted, attach the lifting brackets to the top of the unit, reusing the six screws on the top panel to secure them.
3. Hoist the Unit to its designated installation location with the help of a crane, anchoring the slings to the lifting brackets.

NOTE: A minimum height span of 19.68 in (50cm) is required to lift the unit off the shipping pallet safely.

Figure 3.7 Removing Unit from pallet, step 1.

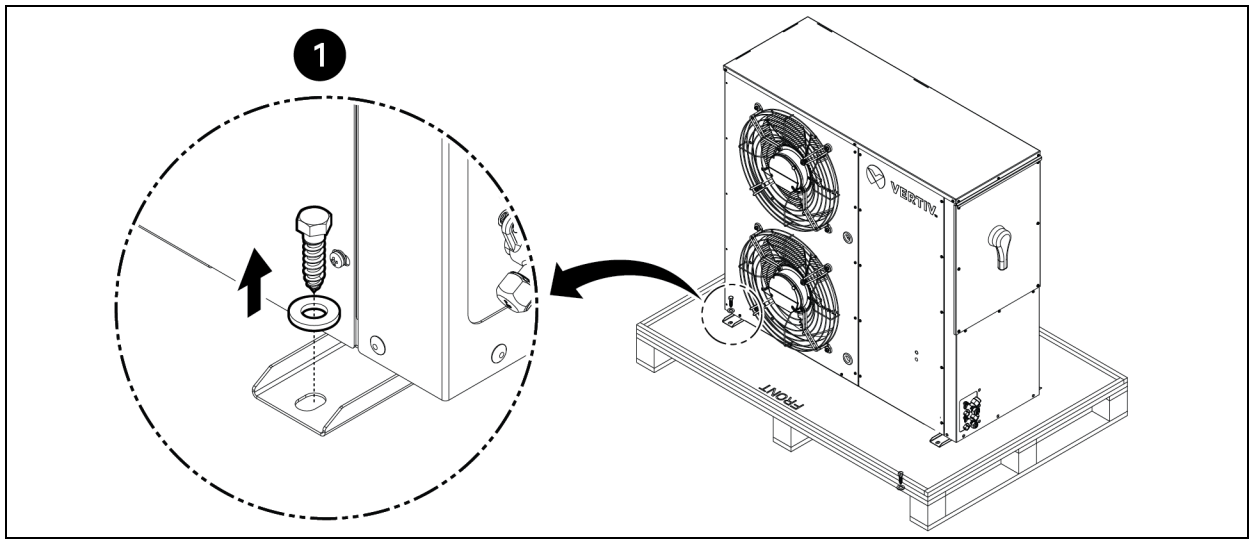
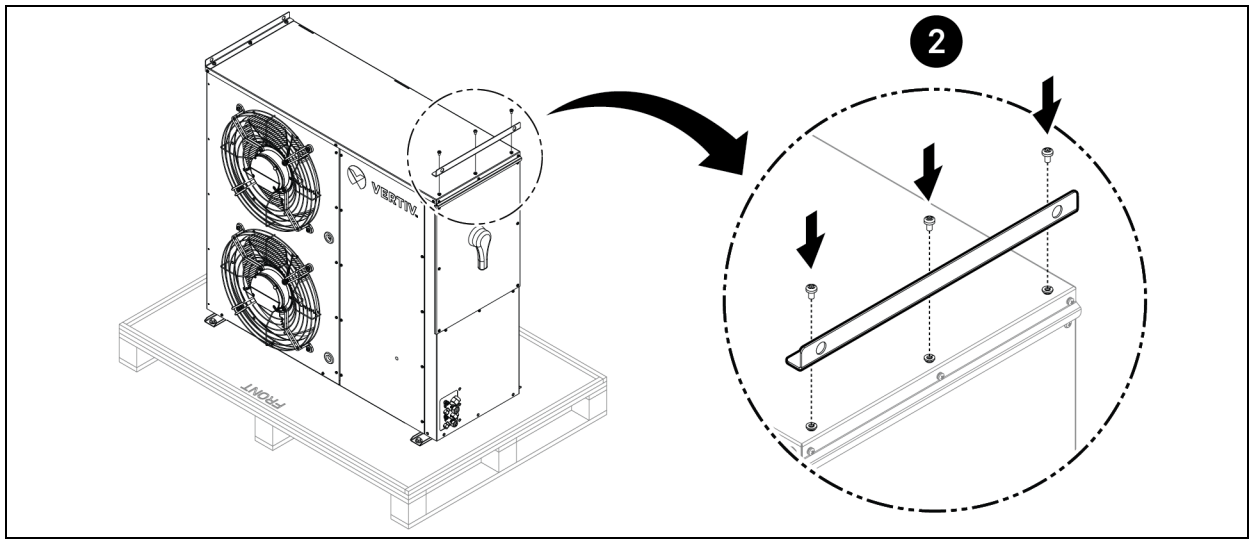


Figure 3.8 Removing Unit from pallet, step 2.



3.4 Handling and Unpacking indications of 21- and 28-kW Condensers

3.4.1 Moving the packaged Unit

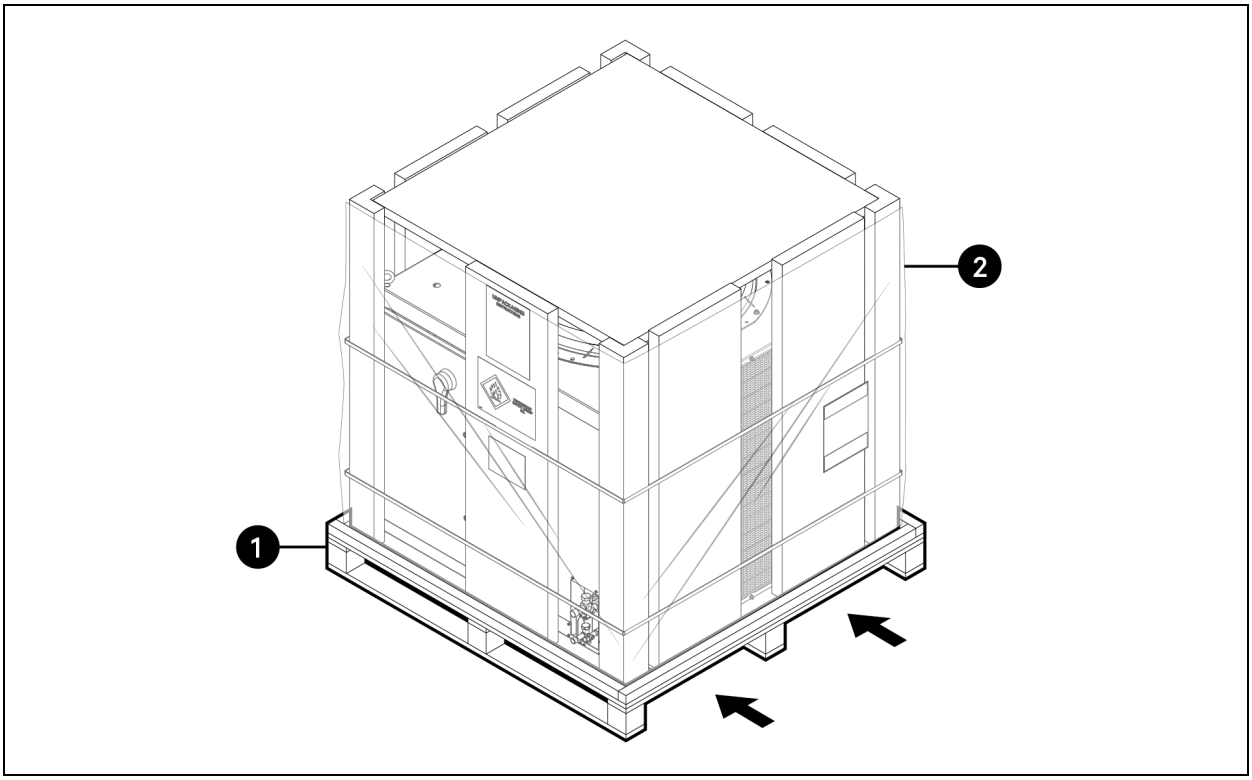
WARNING! Risk of heavy unit falling over. Improper handling can cause equipment damage, injury, or death. Read all the following instructions and verify that all lifting and moving equipment is rated for the unit's weight before attempting to move, lift, remove packaging from, or prepare the unit for installation. Unit weights are specified in section 2.5, "Dimensions and Weights".

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

Mechanical transport equipment, such as a forklift or crane, must be used when unloading and transferring the condenser closest to the installation site.

When a forklift is used, insert the tines in the direction shown in the figure below.

Figure 3.9 Inserting the Forklift in this direction.



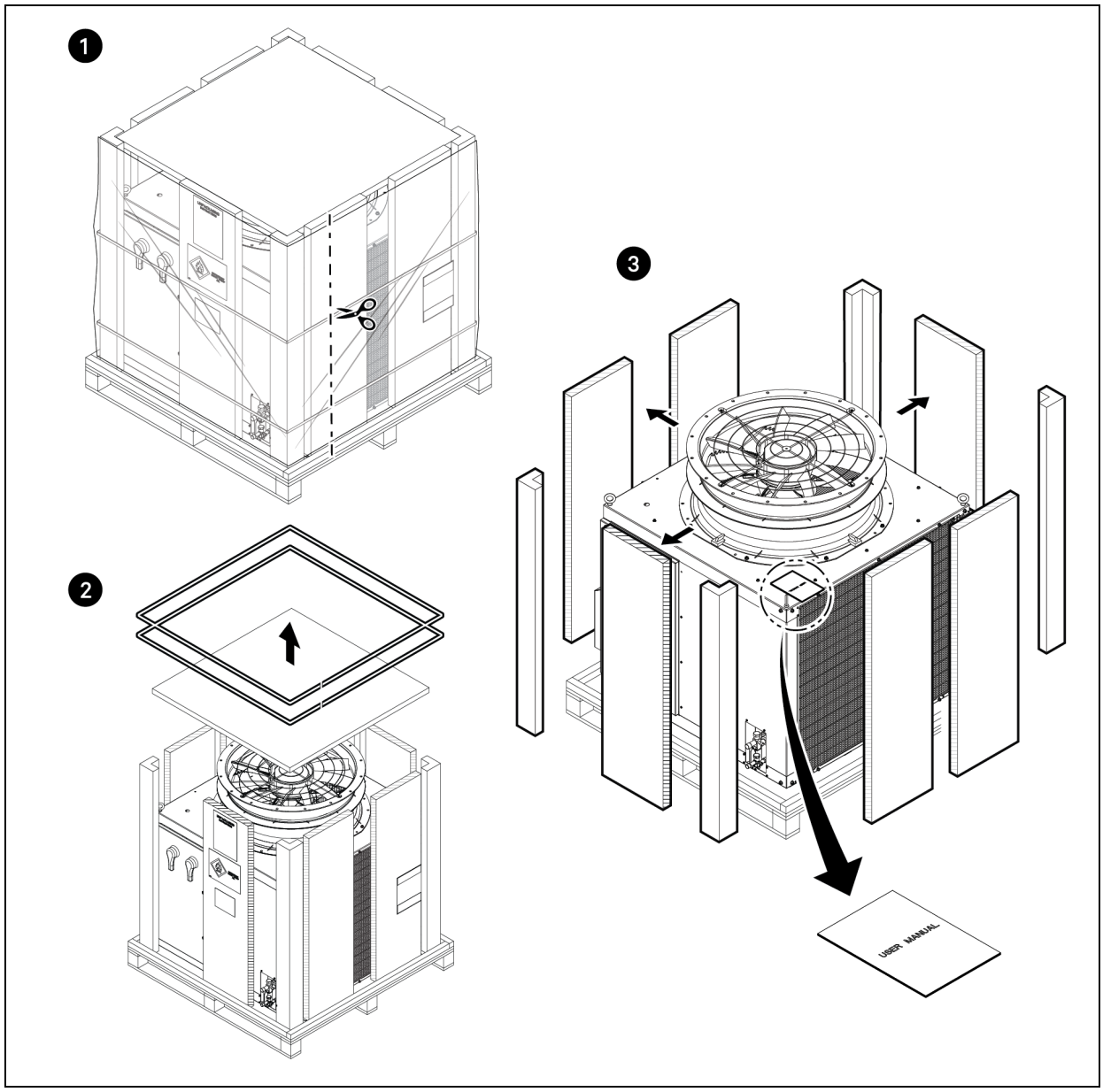
Item	Description
1	Pallet
2	Packaged Unit

3.4.2 Unpacking the Unit

To unpack the Vertiv™ CoolPhase Condensing Unit from the cardboard box:

1. Place the package on a flat surface, then trim the plastic wrap and the polystraps to release the unit.
2. Remove the top honeycomb piece.
3. Step aside the honeycomb placed in the sides of the unit, including the foam of the corners, then take out the user manual for Installation.

Figure 3.10 Unpacking the unit.



3.4.3 Removing Unit from the Pallet

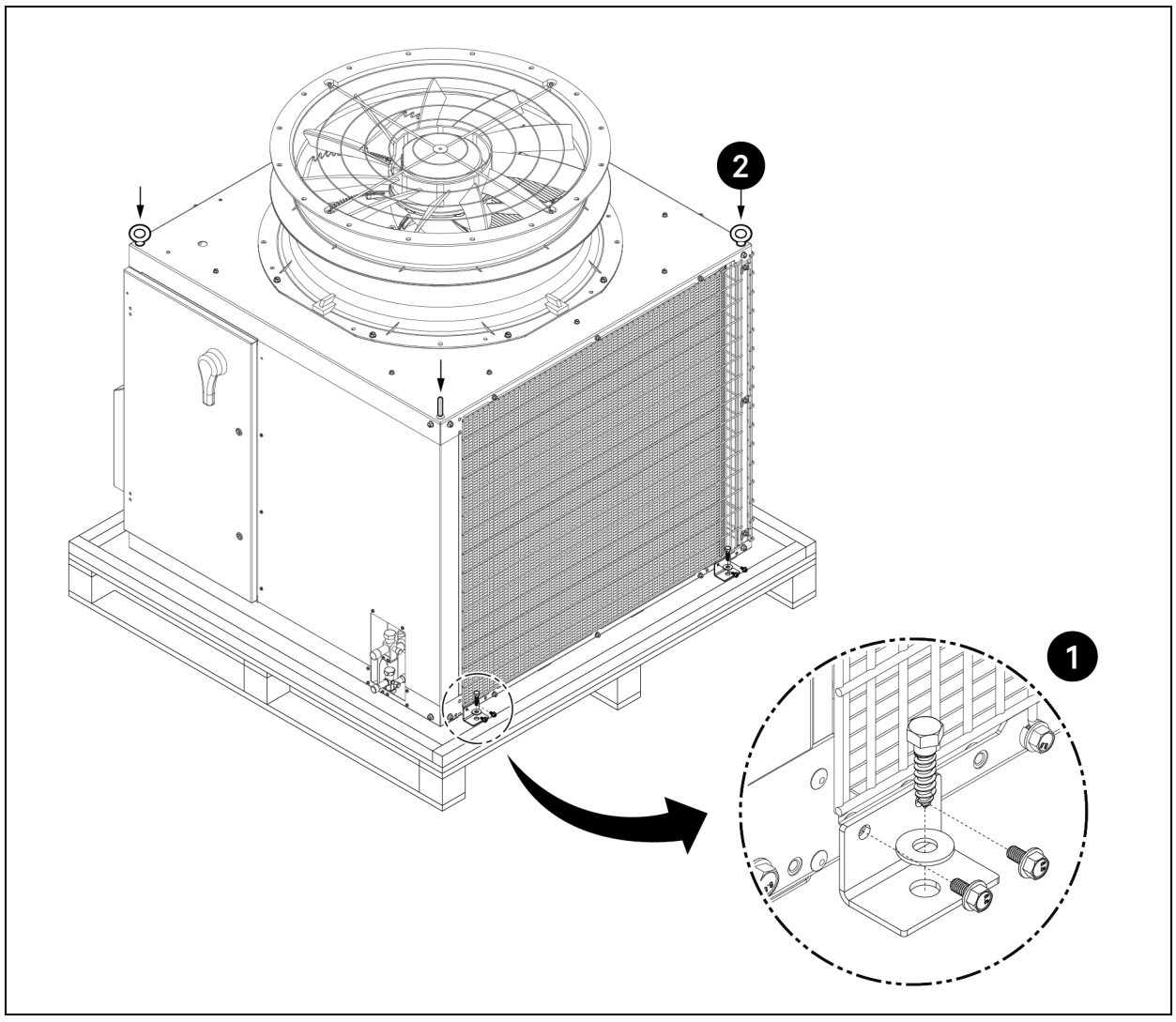
To remove the unit from the pallet:

1. Take off the shipping brackets from the pallet by detaching the four 3/8” hex screws and washers of each bracket.
2. Lift the unit with the help of a crane anchoring the slings to the four eyebolt lifts located on the corners of the top of the unit.

NOTE: Do not throw away the shipping brackets; they are necessary for installing the unit.

NOTE: A minimum height span of 19.68 in (50cm) is required to lift the unit off the shipping pallet safely.

Figure 3.11 Removing Unit from pallet.



4 Unit Installation

4.1 Installation Notes

- Vertiv™ CoolPhase Condensing Unit is always used with Vertiv™ CoolPhase Evaporator Unit. Read the Evaporator User Manual before installing and using this Condensing Unit.
- Do not install the unit in an environment with noise restrictions.
- Do not place the unit near vapors, hot surfaces, and waste gases.
- Install the unit in a clean place and keep it away from dust and foreign objects.
- When the Standard Condensing Unit is installed in an outdoor environment where the ambient temperature can fall below 23°F (-5 °C), the Wind Baffle accessory shall be installed for 1–4-ton units only. For these units, the Wind Baffle is required to ensure stable, reliable low-temperature operation and extend the minimum operating temperature down to -4°F.
- When the ambient temperature is lower than -4°F(- 20 °C) up to -31 °F (-35 °C), the low ambient version must be used.

4.2 Placing the Unit

WARNING! Risk of heavy unit falling over. Improper handling can cause equipment damage, injury, or death. Read all the following instructions and verify that all lifting and moving equipment is rated for the unit's weight before attempting to move, lift, remove packaging from, or prepare the unit for installation. Unit weights are specified in section 2.5, "Dimensions and Weights".

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

CAUTION: Do not tilt the Unit more than 5 degrees to prevent compressor damage.

CAUTION: To prevent Unit malfunction, power on the unit within 6 hours after all installations are completed, but don't turn it on yet.

The Condensing Unit needs to be placed on a leveled horizontal surface, rooftop, or floor; otherwise, place the unit on a flat and leveled base. Move the unit closest to the final location.

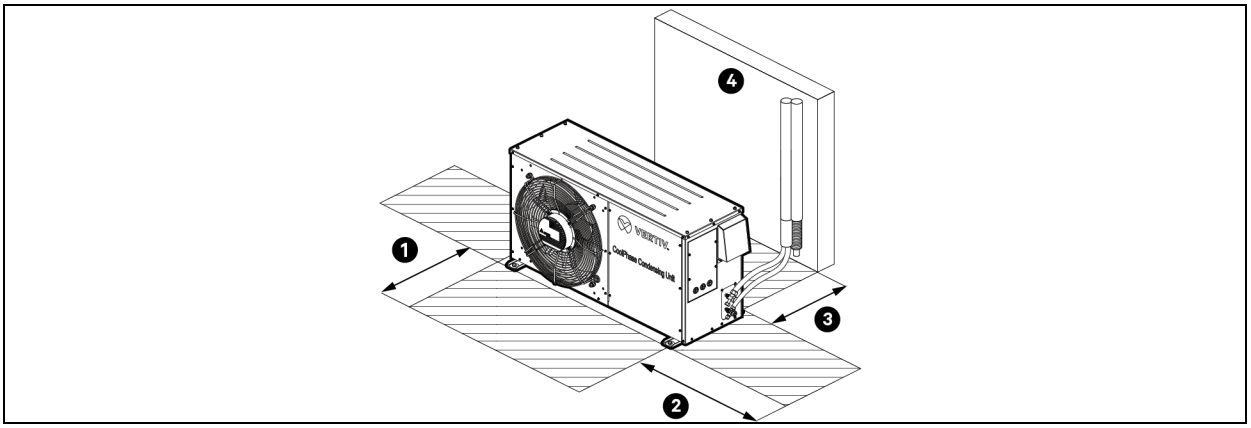
For 21- and 28-kW units that will be installed on a rooftop, use the eyebolt lifts on the top cover, shown in Figure 3.11 on section 3.4 on page 54 , and attach the hardware equipment to them to lift the unit securely. A minimum height span of 50 cm is required to safely lift the unit off the shipping pallet.

4.3 Clearance Requirements

4.3.1 Condensing Units of 3.5 to 15 kW

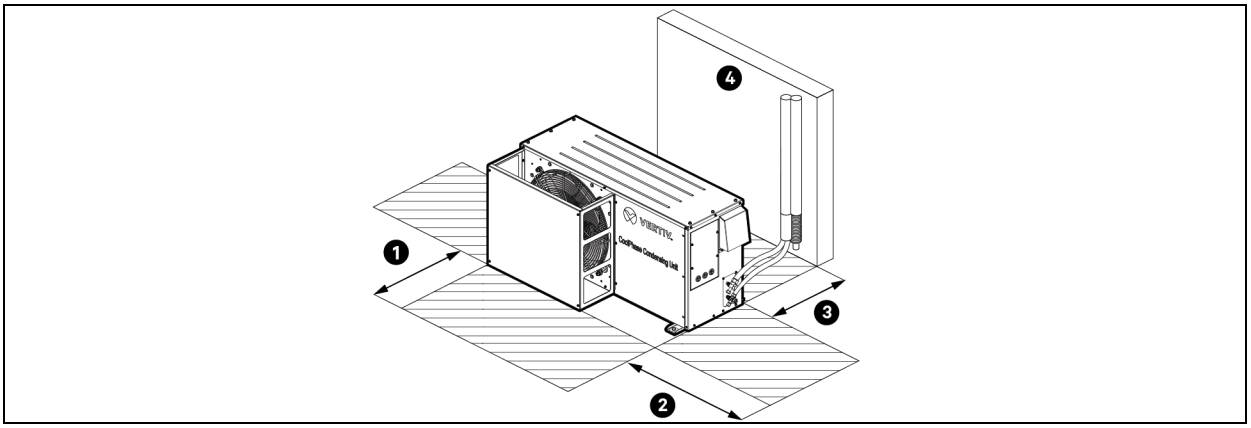
Proper airflow through the Condensing unit coil is critical for correct unit operation. When installing, consider service, inlet, outlet, and minimum allowable space requirements as illustrated below.

Figure 4.1 Condensing unit clearances



Item	Description	Item	Description
1	23.6 in (600 mm) Minimum distance	3	11.8 in (300 mm) Minimum distance
2	23.6 in (600 mm) Minimum distance	4	Wall

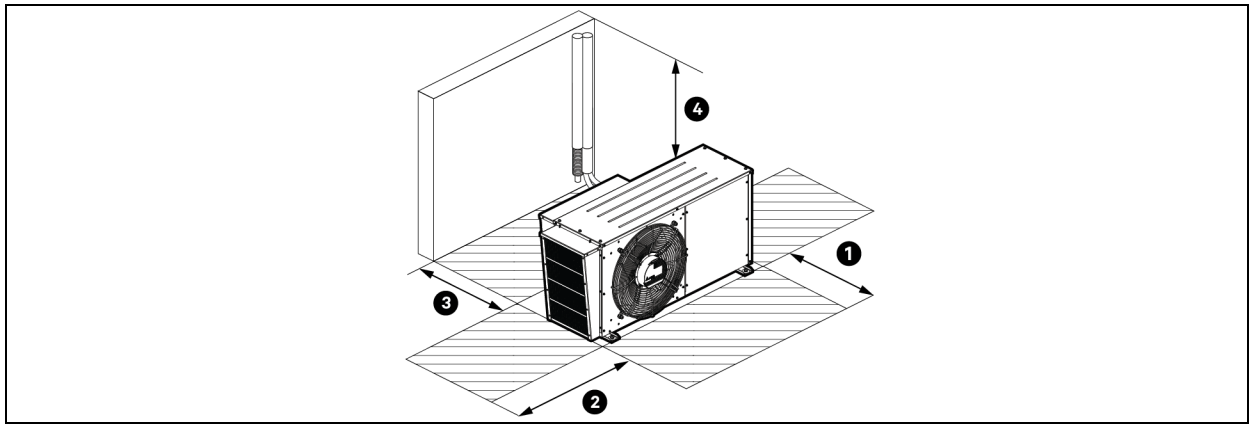
Figure 4.2 Condensing unit clearances with Wind Baffle installed.



Item	Description	Item	Description
1	23.6 in (600 mm) Minimum distance	3	11.8 in (300 mm) Maximum distance
2	23.6 in (600 mm) Minimum distance	4	Wall

NOTE: When installing the wind baffle, there must be a wall behind the unit, and the maximum clearance is 11.8 in (300 mm)

Figure 4.3 Condensing unit clearances with Hail Guard installed.



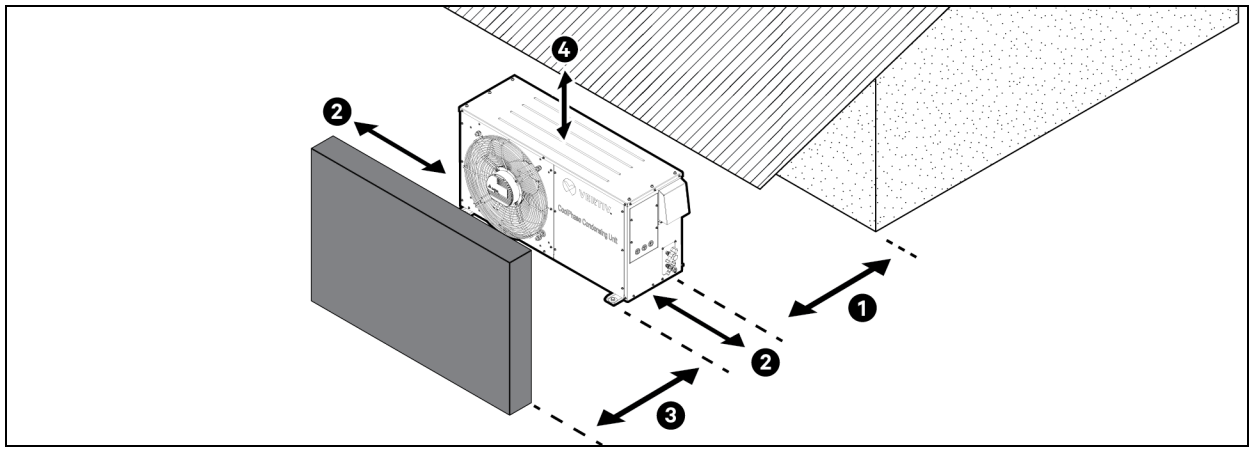
Item	Description	Item	Description
1	11.8 in (300 mm) Minimum distance	3	11.8 in (300 mm) Minimum distance
2	23.6 in (600 mm) Minimum distance	4	11.8 in (300 mm) Minimum distance

When placing the Condensing unit under an overhang, awning, sunroof, or other “roof-like” structure, observe the clearance requirements for height in relation to the unit. This clearance ensures that heat radiation from the condenser is not restricted around the unit. See figures below for recommendations for other obstacles.

If installing the unit on a roof, adhere to all clearance requirements. Level the unit and ensure that it is adequately anchored. Consult local codes for rooftop mounting requirements.

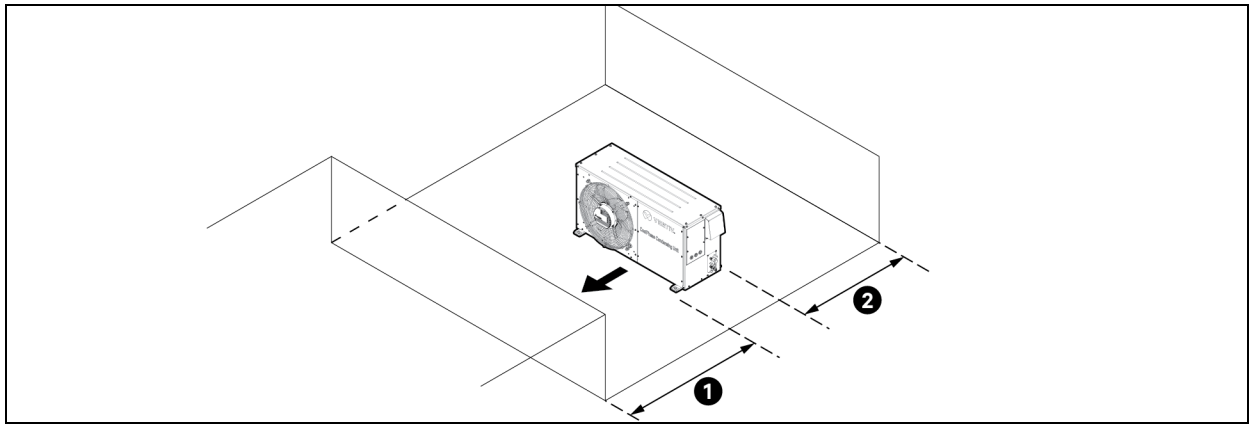
NOTE: Do not place the unit where animals and/or plants will be on the warm air path or where the warm air and/or noise will disturb neighbors.

Figure 4.4 Condensing Unit sunroof/awning clearances



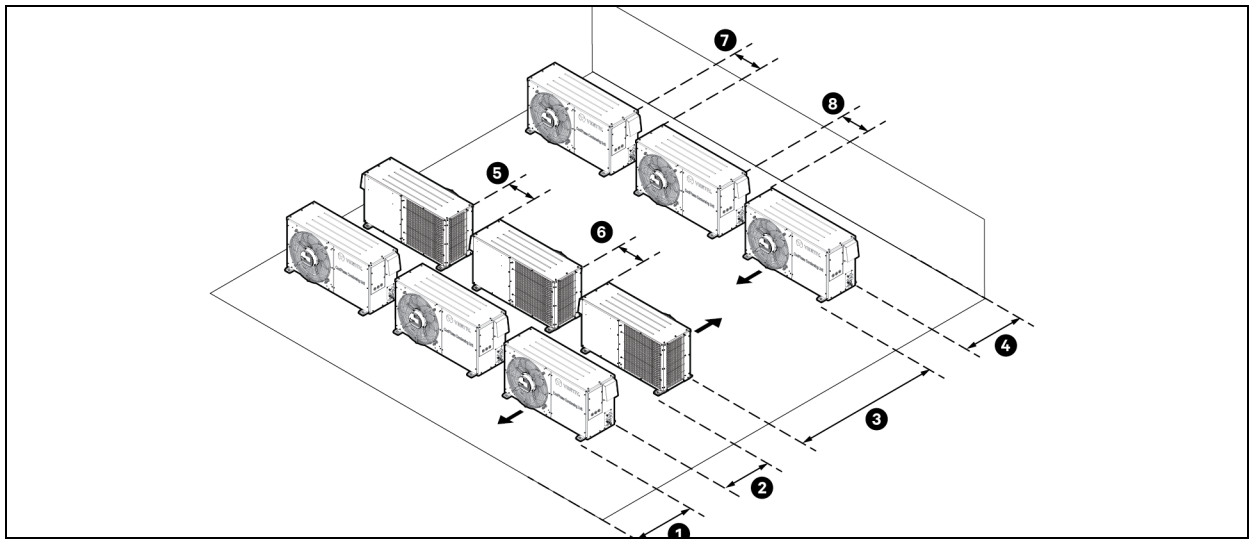
Item	Description	Item	Description
1	11.8 in (300 mm) Minimum distance	3	23.6 in (600 mm) Minimum distance
2	23.6 in (600 mm) Minimum distance	4	11.8 in (300 mm) Minimum distance

Figure 4.5 Clearances when there are obstacles on both air inlet and air outlet sides.



Item	Description
1	23.6 in (600 mm) Minimum distance
2	11.8 in (300 mm) Minimum distance

Figure 4.6 Clearances when several units are mounted side by side.

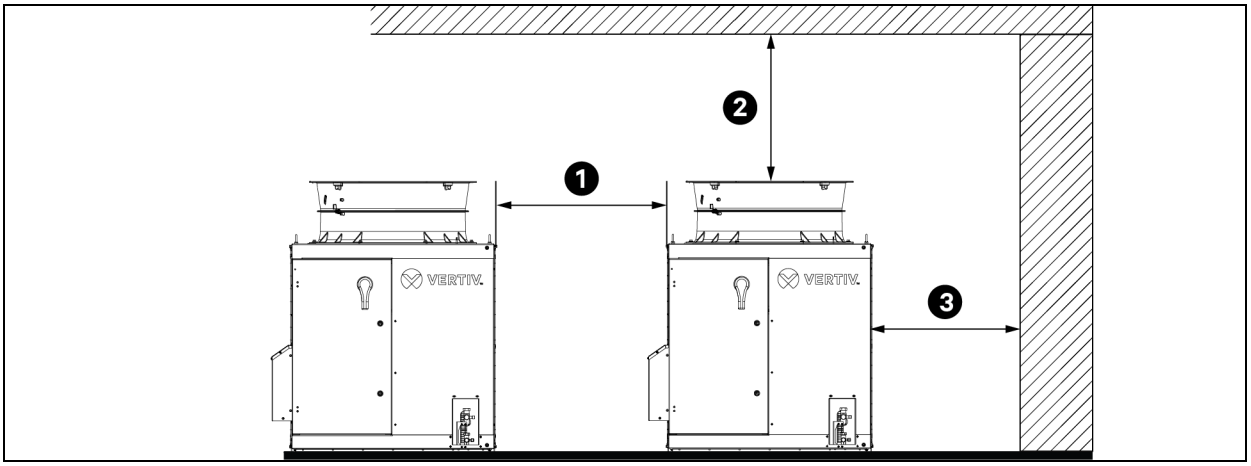


Item	Description	Item	Description
1	59 in (1500 mm) Minimum distance	5	11.8 in (300 mm) Minimum distance
2	23.6 in (600 mm) Minimum distance	6	11.8 in (300 mm) Minimum distance
3	118.1 in (3000 mm) Minimum distance	7	11.8 in (300 mm) Minimum distance
4	11.8 in (300 mm) Minimum distance	8	11.8 in (300 mm) Minimum distance

4.3.2 Condensing Units of 21 kW and 28 kW

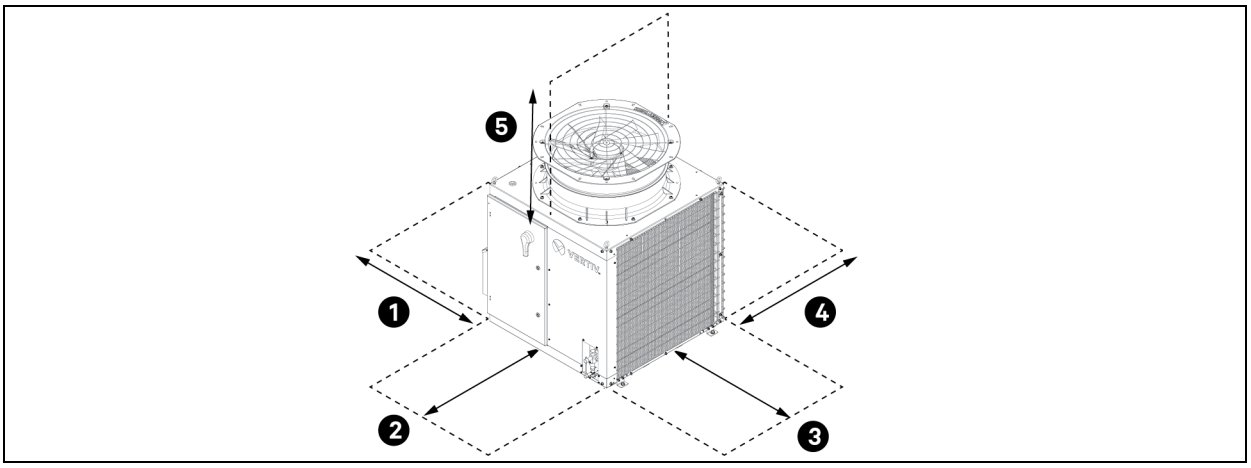
Proper airflow through the Condensing unit coil is critical for correct unit operation. When installing, consider the service, inlet, and outlet, and minimum allowable space requirements as illustrated below.

Figure 4.7 Condensing unit clearances, airflow considerations.



Item	Description	Item	Description
1	39 in (100 cm) Minimum distance	3	39 in (100 cm) Minimum distance
2	39 in (100 cm) Minimum distance		

Figure 4.8 Condensing unit clear space required for service access.

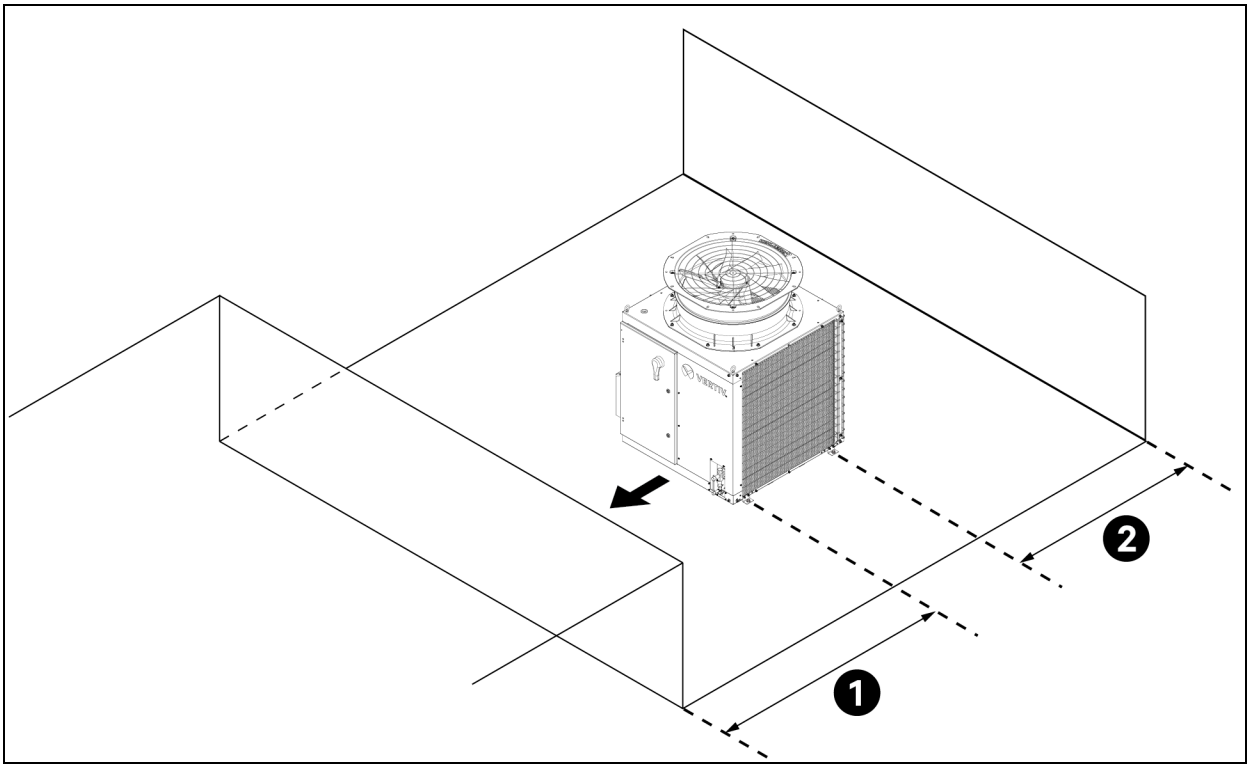


Item	Description	Item	Description
1	39 in (100 cm) Minimum distance	4	39 in (100 cm) Minimum distance
2	39 in (100 cm) Minimum distance	5	39 in (100 cm) Minimum distance
3	39 in (100 cm) Minimum distance		

When placing the Condensing unit under an overhang, awning, sunroof, or other “roof-like” structure, observe the clearance requirements (as shown in Figure 4.8) for height in relation to the unit. This clearance ensures that heat radiation from the condenser is not restricted around the unit. See Figure 4.9 for recommendations when other obstacles are present.

Adhere to all clearance requirements if installing the unit on a roof. Be sure to level the unit and ensure that the unit is adequately anchored. Consult local codes for rooftop mounting requirements.

Figure 4.9 Clearances when there are obstacles on both air-inlet and air-outlet sides.



Item	Description
1	39 in (100 cm) Minimum distance
2	39 in (100 cm) Minimum distance

NOTE: In the fugure above, the obstacle on the outlet side is lower than the Condensing Unit.

4.4 Installation

4.4.1 Condensing Units of 3.5, 7, and 11 kW

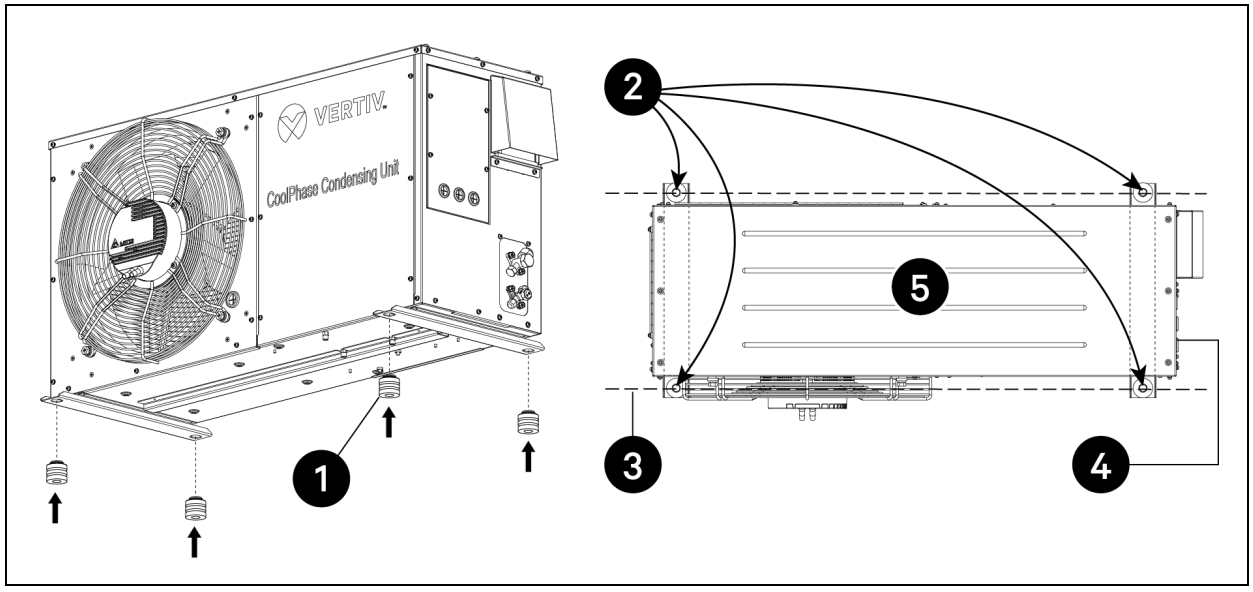
Roof Mounting the Condensing Unit

The Vertiv™ CoolPhase Condensing Unit should be placed in a well-ventilated area over a flat, leveled surface, with enough room to install the connecting pipes and cables and access them for maintenance.

Before installation, place four field supplied vibration isolation pads on the unit's base, as indicated in Figure 4.10 . Securely attach the Condensing Unit to the roof, a condenser pad, base rails, or another mounting platform securely anchored to the ground or building structure with M10 anchor bolts. See Figure 4.11 below.

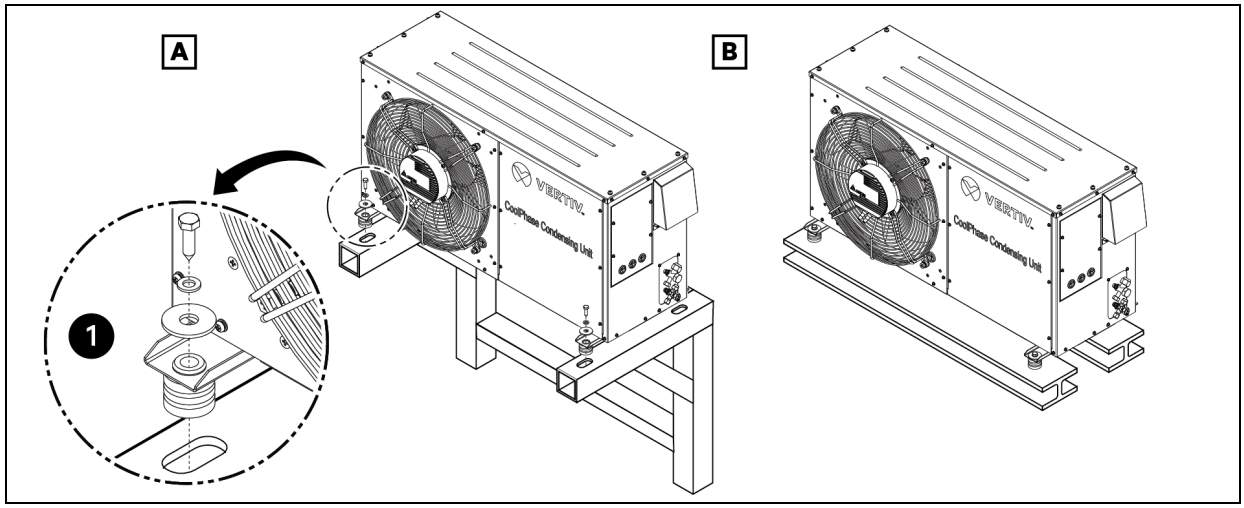
Follow local codes for clearance, mounting, anchoring, and vibration attenuation requirements.

Figure 4.10 Condensing unit vibration isolation pads placement.



Item	Description	Item	Description
1	Vibration isolation pad	3	Piping connection
2	Vibration isolation pads placement	4	Top of unit
2	Base reference		

Figure 4.11 Condensing unit mounting methods.



Item	Description	Item	Description
A	Platform mounting	B	Base rails mounting
1	Bolt placement		

4.4.2 Plenum Mounting of the Unit

WARNING! Risk of ceiling collapse and heavy unit falling. It can cause building and equipment damage, serious injury, or death. Verify that the supporting roof structure can support the weight of the unit(s) and the accessories. See Dimensions and Weights in section 2.5 for the unit weights. Securely anchor the top ends of the suspension rods and verify that all nuts are tight.

WARNING! When installing the unit within a plenum, the refrigerant charge shall not exceed 3.9 lbs (1.8 kg); if the system exceeds this charge, this condensing unit shall be located outdoors.

Location Considerations

Refer to Refrigerant and Lubricating Oil Charges section on the corresponding indoor unit User Manual for maximum refrigerant line lengths.

The ceilings and ceiling support of existing buildings may require reinforcement. Follow all applicable national and local codes.

If possible, install the ceiling mounting over an unobstructed floor space. 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 a typical unit operating sound may disturb the working environment.

When installing an air-cooled or water-cooled unit inside a space, ensure that national and local codes are met for refrigerant concentration limits that might vary with building type and use.

Installing Suspension Rods and Ceiling Mounting

NOTE: The Low ambient version of the Condensing Unit cannot be installed in plenum areas, only the standard version is plenum rated.

NOTE: To lift the unit closer to its final location, use the lifting brackets contained in the package (see section 3.2 Handling and Unpacking Indications for 3.5, 7, and 11 kW Condensers on page 48 for further indications).

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

NOTE: The unit must be leveled to work correctly.

NOTE: The duct kit is needed when the unit is adapted to a Plenum Mounting. Before mounting the unit to the ceiling, it must be attached for proper component access and installation. Please refer to the Duct Kit Quick Installation Guide for more installation details.

NOTE: Four 3/8-inch 16 TPI threaded suspension rods are required and field supplied.

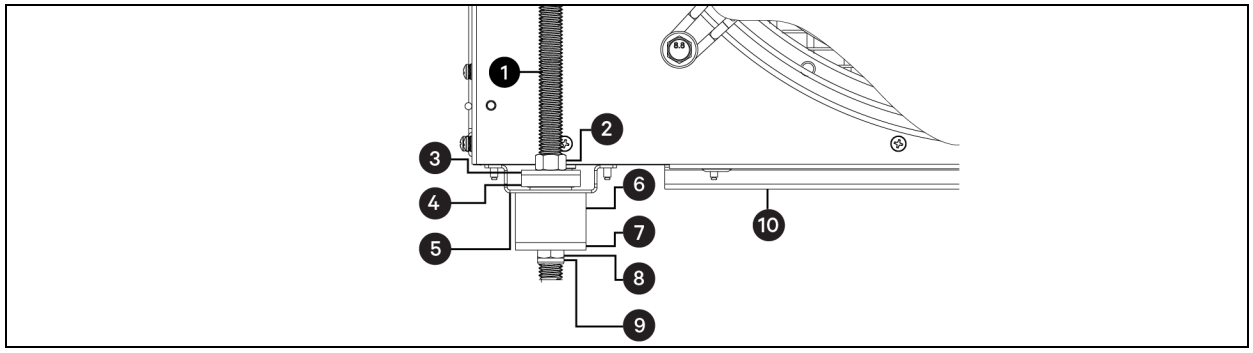
To install the suspension rods:

1. Install the four field-supplied 3/8-inch 16 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 (see Figure 4.13)
2. Securely anchor the top ends of the suspension rods with field-supplied nuts.
3. Make sure all nuts are tight and locked.

To lift and install the unit on the rods:

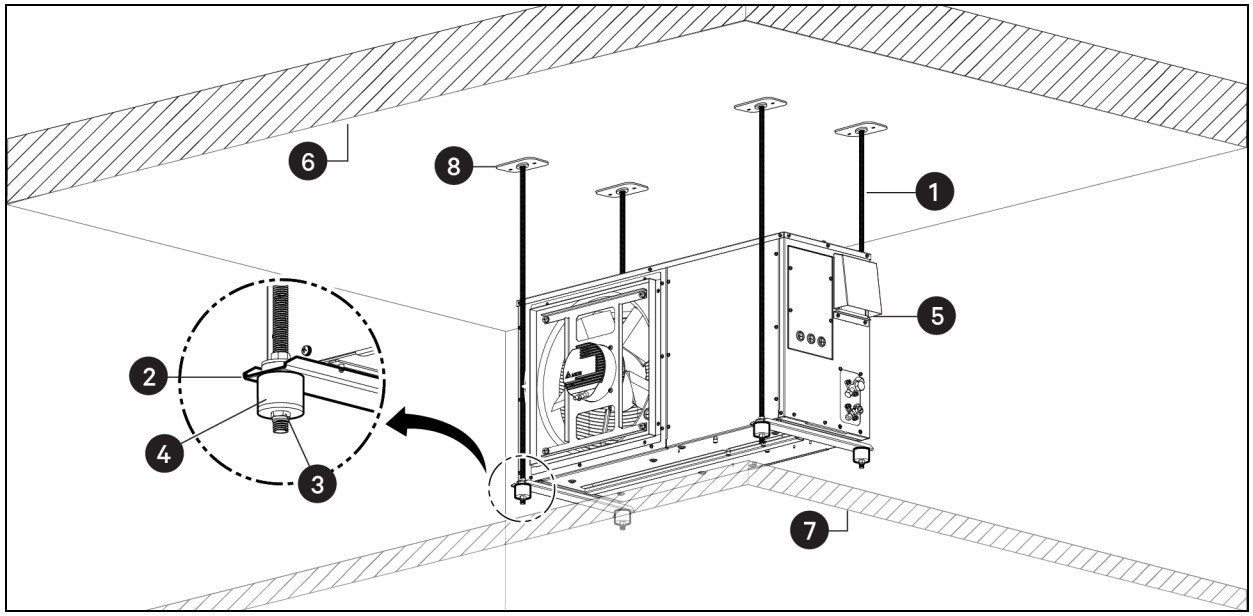
1. Referring to Figure 4.12 below, place the hex nuts (Item 2) on the threaded rods and add the washer, sleeve, and isolator (Items 3, 4, and 6) to the bracket holes on the unit.
2. Using the lifting brackets included in the package (refer to section 3.2, Handling and Unpacking Indications for 3.5, 7, and 11 kW Condensers on page 48), raise the unit and pass the threaded rods through the four mounting locations in the unit base.
3. Attach the threaded rods to the flanges using the washer and plain nut (Items 7 and 8) to hold the unit in place, as shown in Figure 4.13 .
4. Adjust the plain nuts to distribute the unit's weight evenly by the rods, ensuring that the unit does not rest on the ceiling grid and is level.
5. Use the Nylock nuts to "jam" the plain nuts into place.

Figure 4.12 Installing threaded rods and hardware of ceiling-mounted Condensing units.



Item	Description	Item	Description
1	3/8-in. threaded rod, field supplied	6	Field provided Isolator
2	3/8-in. hex nut	7	3/8-in. fender washer
3	3/8-in. washer	8	3/8-in. hex nut
4	Sleeve	9	3/8-in. Nylock locking nut
5	Bracket on unit	10	Unit base pan (reference)

Figure 4.13 Plenum-Installed Unit.



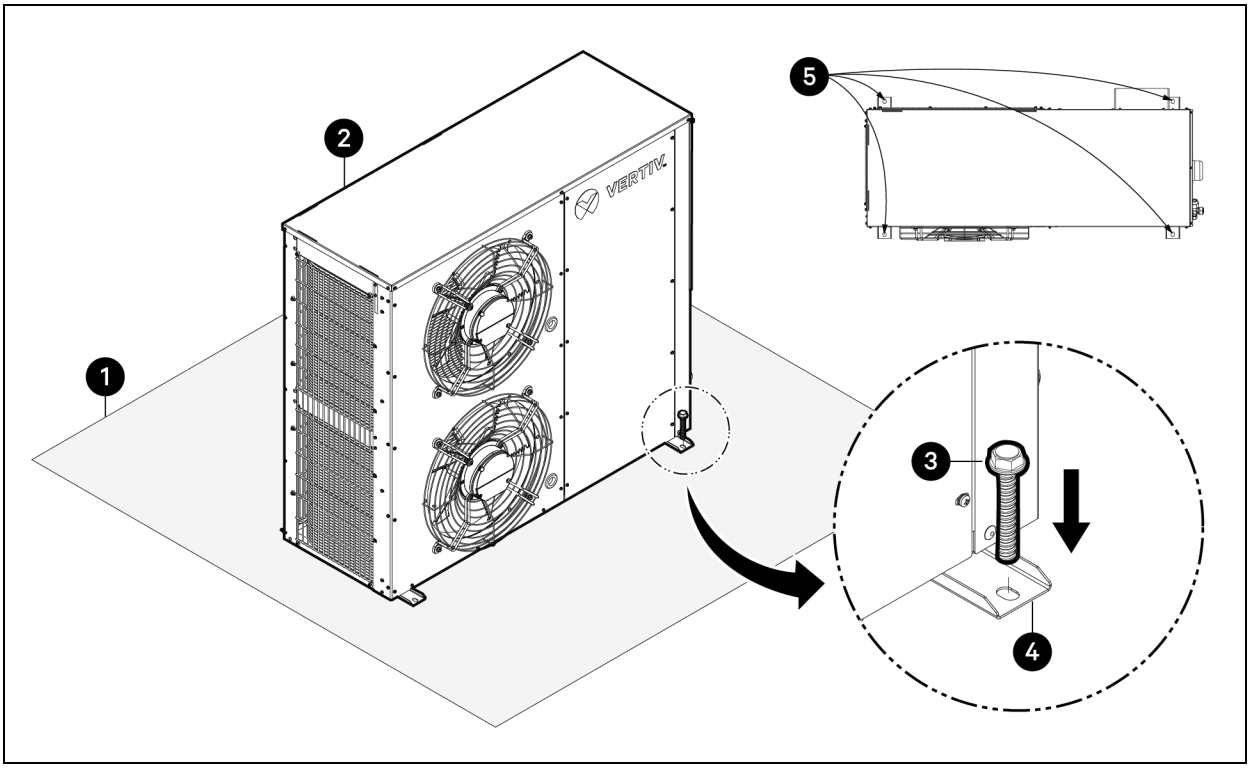
Item	Description	Item	Description
1	Threaded rods	5	Condensing Unit
2	Unit base bracket	6	Roof
3	Nylock locking nut	7	Ceiling
4	Suspension rod grommet	8	Supports

4.4.3 Condensing Units of 15 kW

The Vertiv™ CoolPhase Condensing Unit should be placed in a well-ventilated area, over a flat, level rooftop or floor, with sufficient room to install the connecting pipes and cables for easy access during maintenance.

The proper hardware size to securely attach the Condensing Unit to the surface is field-supplied 1/2" -13 UNC concrete anchors, as shown below. Follow local codes for clearance, mounting, anchoring, and vibration attenuation requirements.

Figure 4.14 Installation of the unit.



Item	Description	Item	Description
1	Flat surface (Roof or Floor)	4	Unit Base Bracket
2	Condensing Unit	5	Concrete anchor distribution on the unit
3	Concrete anchor placement detail		

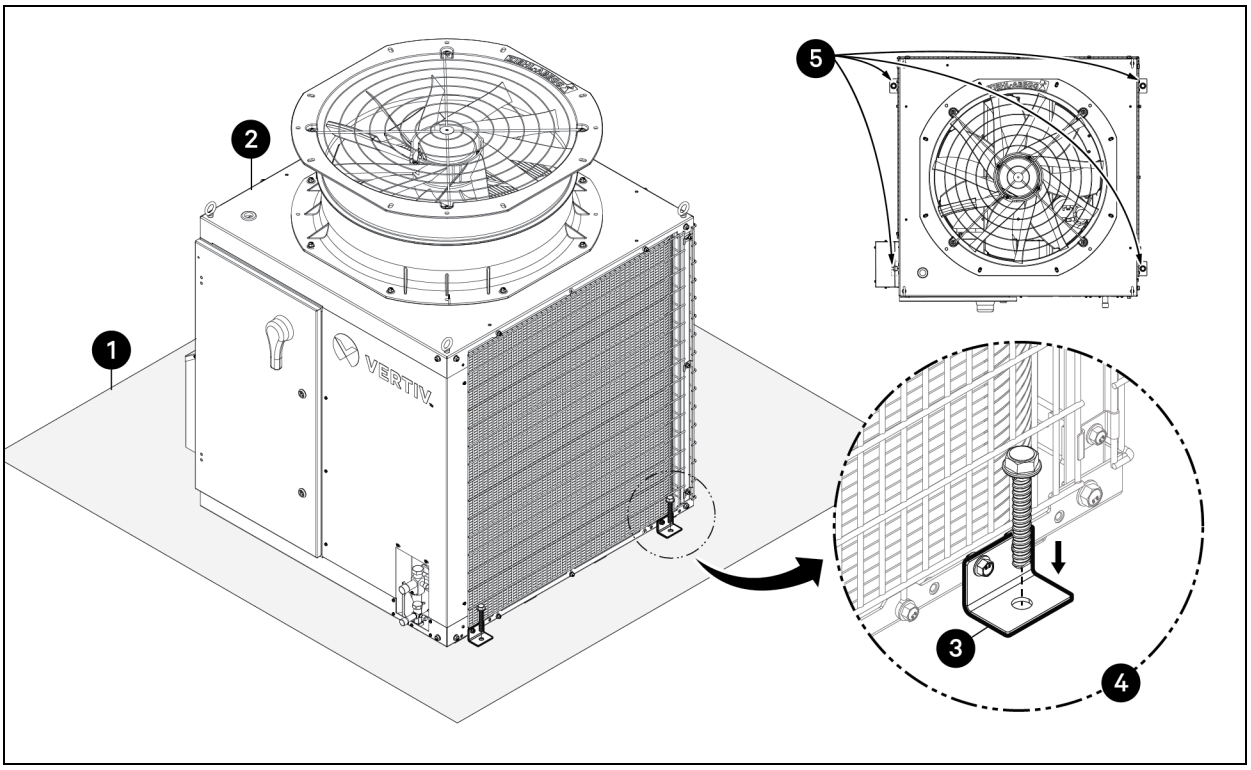
4.4.4 Condensing Units of 21 and 28 kW

The Vertiv™ CoolPhase Condensing Unit should be placed in a well-ventilated area, over a flat, leveled rooftop or floor, with enough room to install the connecting pipes and cables to access them for maintenance.

The proper hardware size to securely attach the Condensing Unit to the surface is field-supplied 1/2" -13 UNC concrete anchors, as shown below. Follow local codes for clearance, mounting, anchoring, and vibration attenuation requirements.

NOTE: For the installation, shipping brackets must be reused as base brackets to attach the unit to the surface.

Figure 4.15 Installation of the unit.



Item	Description	Item	Description
1	Flat surface (Roof or Floor)	4	Concrete anchor placement detail
2	Condensing Unit	5	Concrete anchor distribution on the unit
3	Base Brackets		

4.5 Installation Considerations for all Units

4.5.1 Mounting-Platform Guidelines

The underlying structure or foundation must be able to support the unit's weight. Avoid placing the unit in a low-lying area where water may accumulate. When installing the Condensing Unit on the wall or rooftop, anchor the mounting base securely to account for wind, earthquake, or vibration.

4.5.2 Tie-down and Wind-restraint Guidelines

The strength of the Condensing Unit frame is adequate for use with field-provided wind restraint tie-downs. A local, professional engineer must approve the overall tie-down configuration.

NOTE: Always refer to local code when designing a wind-restraint system.

4.5.3 Considerations for Snow and Ice Conditions

In climates that experience snow build-up, place the unit on a raised platform to ensure condenser airflow. The raised support platform must be high enough to keep the unit above possible snow drifts. Mount the unit on a field-provided snow stand at a minimum height equal to the average annual snowfall plus 20 in (51 cm). Design the mount base to prevent snow accumulation on the platform in front of or behind the unit case. Provide a field-fabricated hood to avoid snow, ice, and/or drifting snow from accumulating on the coil surfaces if necessary. Use inlets and discharge ducts or hoods to prevent snow or rain from collecting on the fan inlet and outlet guards. The best practice is to prevent snow from accumulating on top of the unit. Consider the tie-down requirements in the event of high winds or as required by local codes.

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5 Piping Connections

Prior to starting with the piping connection, please read the Important Safety Instructions section of this Manual.

5.1 General Connections

WARNING! Do not allow the refrigerant to leak during brazing. If the refrigerant is combusted, it generates a toxic gas that can cause physical injury or death. Do not braze in an enclosed location, and always test for gas leaks before/after brazing. After brazing, check for refrigerant gas leaks.

WARNING! Do not allow the refrigerant to leak during brazing. The threat of suffocation exists due to air displacement from refrigerant gas being heavier than air, especially in small, confined spaces.

WARNING! Competent persons shall only carry out every working procedure that affects safety means.

Pipework, 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.

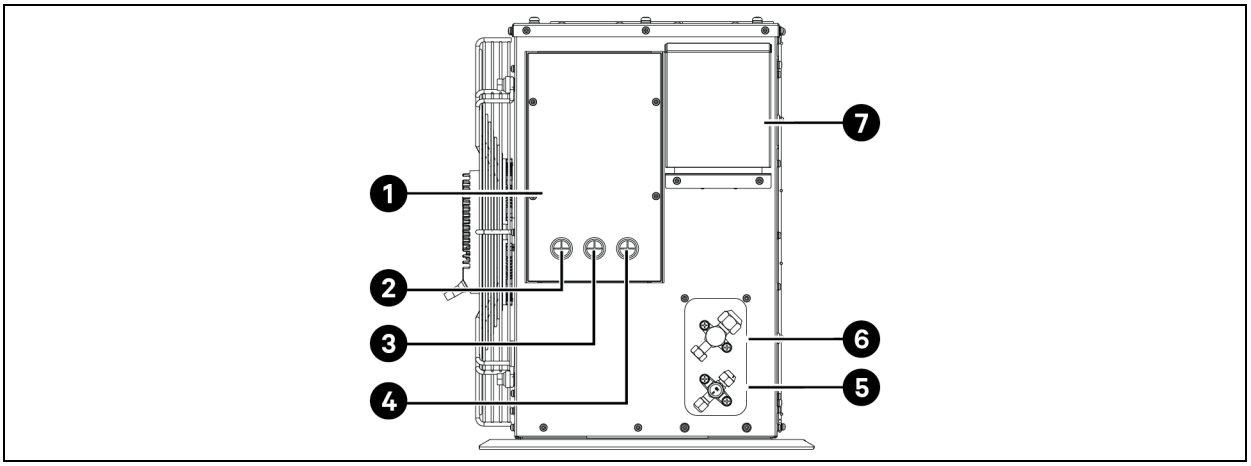
The following indications must be considered:

- Do not use kinked pipe caused by excessive bending in one specific area on its length.
- Braze the pipes to the service-valve pipe stem of the Condensing Unit.
- Pipe-work shall not be installed in unventilated areas.
- Mechanical connections shall be accessible for maintenance purposes.

5.1.1 General Arrangement

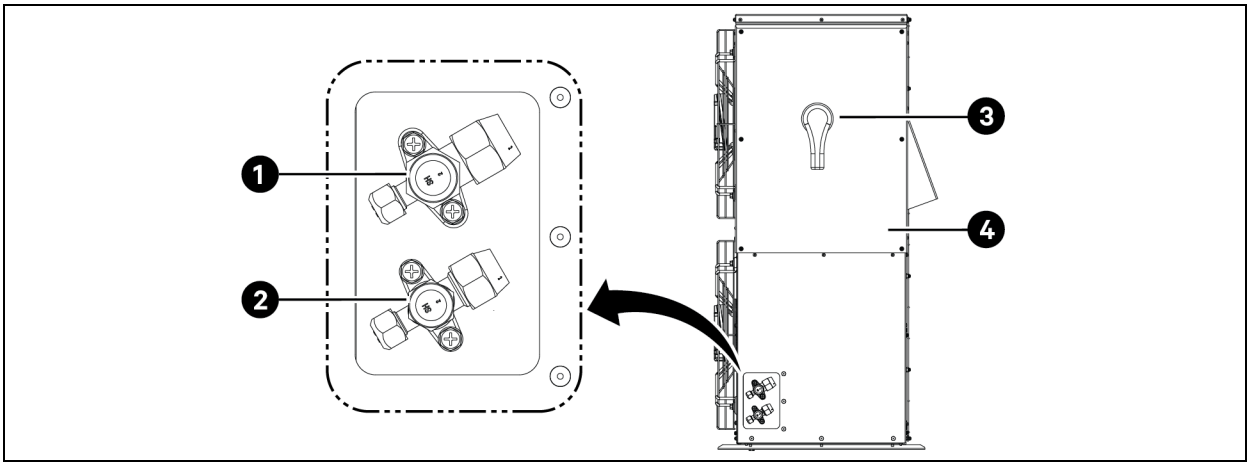
Refer to the section Components on page 31 for more information regarding the internal components of both versions of the condensing unit system (Standard and Low Ambient).

Figure 5.1 Location of Pipe and Cable Outlets, 3.5, 7-, and 11-kW units



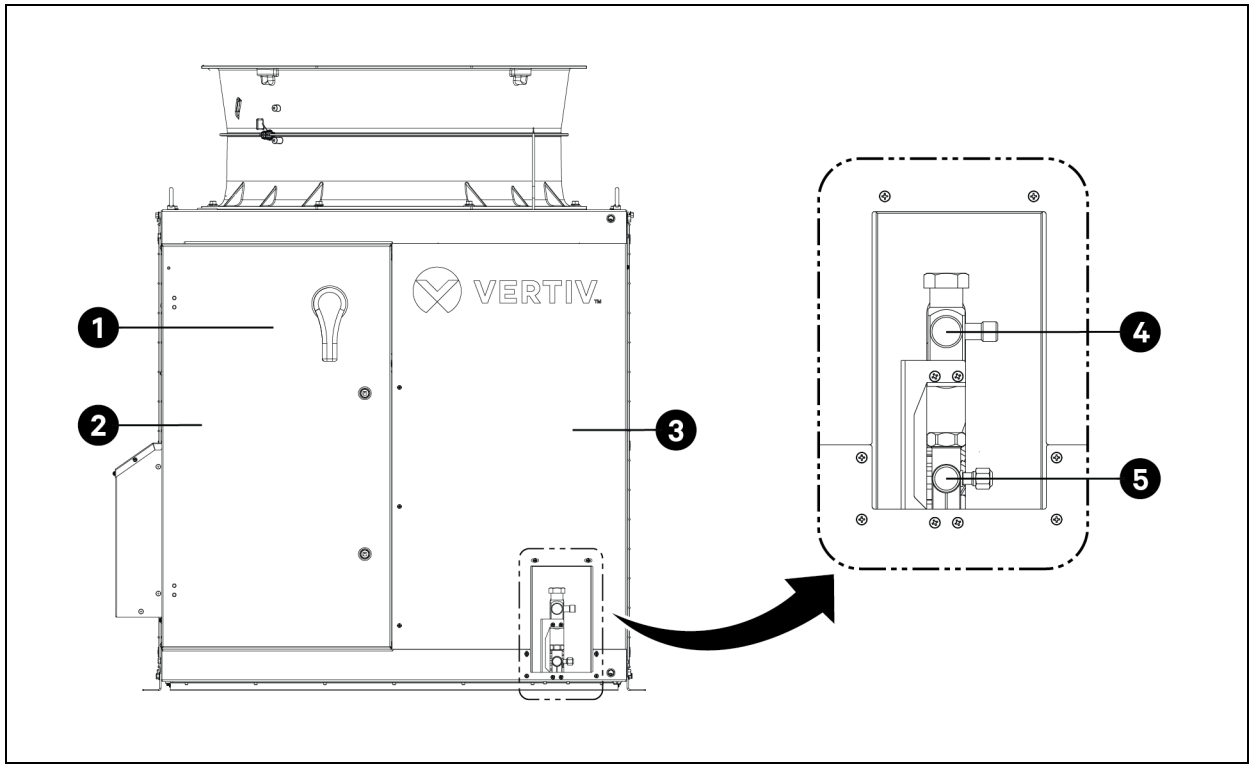
Item	Description	Item	Description
1	Electrical Box Panel	5	Liquid Line Valve
2	Communications Cable Input	6	Suction Line Valve
3	Condensing Unit Power Supply Input	7	VFD Box Air Filter Cover
4	Indoor Unit Power Supply Output		

Figure 5.2 Location of Pipe and Cable Outlets of 15 kW Units



Item	Description	Item	Description
1	Suction Line Valve	3	Fuse Switch Handle
2	Liquid Line Valve	4	Electrical Box Panel

Figure 5.3 Location of Piping Valves in the Unit



Item	Description	Item	Description
1	Power source Fuse Switch Handle	4	Suction Line Valve
2	Electrical box cover	5	Liquid Line Valve
3	Service Access Panel		

5.2 Connection of Condensing Unit to Indoor Unit

5.2.1 Connection Limitations

These systems always consist of one outdoor/condensing unit and one indoor/evaporator unit. One of the most critical elements of a system is the refrigerant piping. See figures 5.4 and 5.5 for the maximum length and elevation of the piping reference.

NOTE: For more installation requirements and connection limitations between indoor units and condensing units, refer to the corresponding indoor unit manual.

Table 5.1 Refrigerant-piping limitations of the Condensing Unit.

Specifications	Limitations	Distance		
		3.5-11 kW	15 kW	21-28 kW
Pipe Length, ft (m)	Max Equivalent Length of Pipe	196.85 (60)	295.27 (90)	295.27 (90)
Height between indoor unit and condensing unit, ft (m)	The condensing unit is placed higher than the indoor unit.	98.4 (30)	98.4 (30)	98.4 (30)
	The condensing unit is placed lower than the indoor unit.	26.2 (8)	26.2 (8)	26.2(8)

Table 5.2 Equivalent Length for Bends and Valves

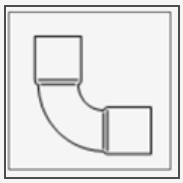
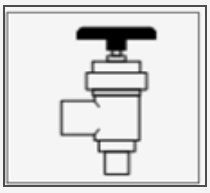
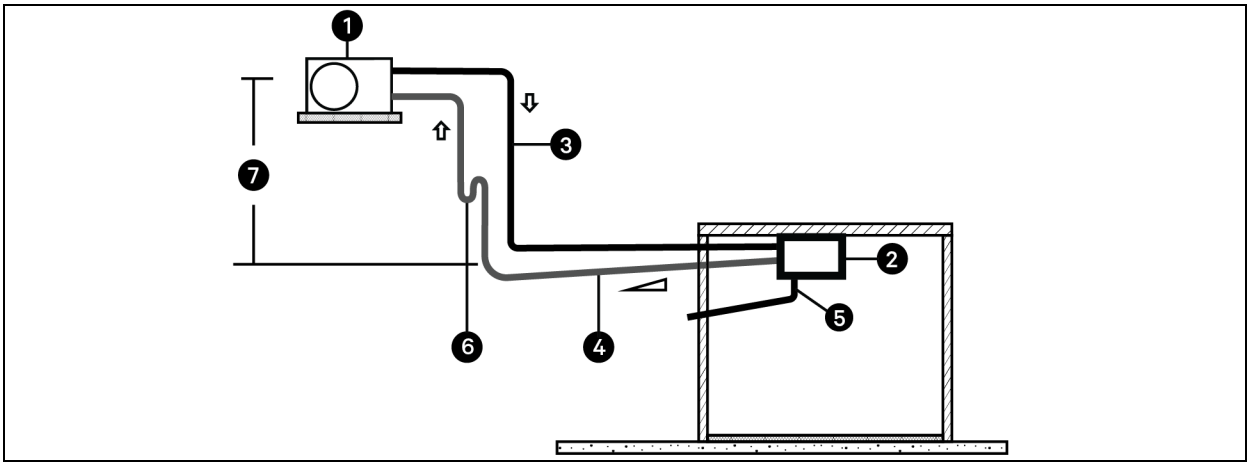
Liquid pipe outer diameter in (mm)	Equivalent length ft (m)			
	90° bend 	45° bend 	180° U bend 	90° shut off valve 
1/4 (6.35)	1.28 (0.39)	0.66 (0.20)	1.94 (0.59)	4.92 (0.15)
3/8 (9.52)	1.44 (0.44)	0.72 (0.22)	2.13 (0.65)	5.91 (1.80)
1/2 (12.7)	1.64 (0.50)	0.82 (0.25)	2.46 (0.75)	6.90 (2.10)
5/8 (16)	1.80 (0.55)	0.88 (0.27)	2.79 (0.85)	7.87 (2..40)
3/4 (19.05)	2.2 (0.67)	1.1 (0.34)	4.5 (1.37)	17 (5.18)
7/8 (22.23)	2.91 (0.89)	2.75 (0.83)	4.0 (1.23)	10.1 (3.10)

Figure 5.4 Condensing Unit Placed Higher than the Indoor Unit.

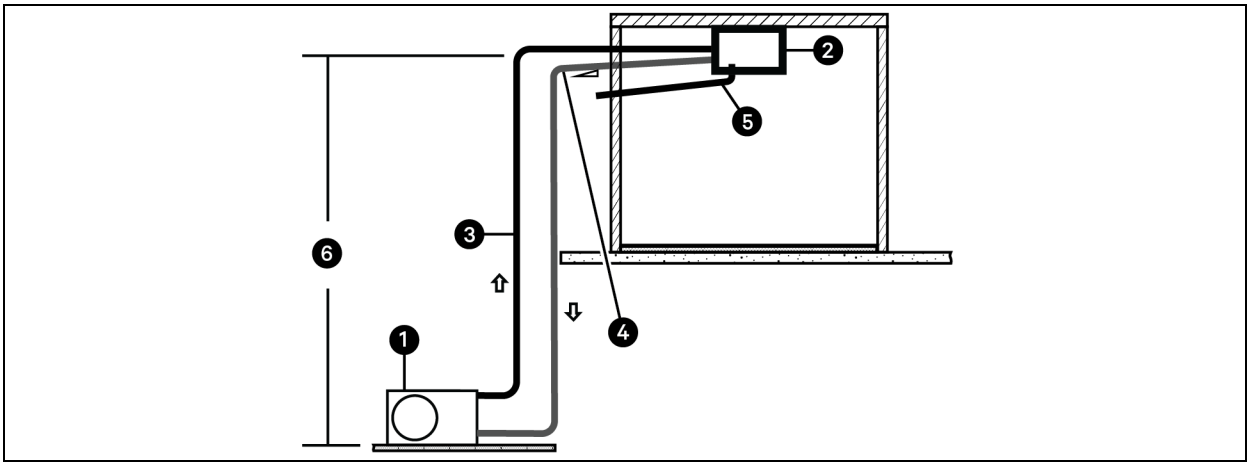


Item	Description	Item	Description
1	Condensing Unit	5	Condensate Pipe
2	Indoor Unit	6	Oil Trap
3	Liquid Line	7	Maximum distance (refer to Table 5.1)
4	Suction Line		

NOTE: The Suction line in the figure above is represented with a 1% lower gradient, whose arrow direction is pointing upwards.

NOTE: Install an oil trap every 24.6 ft (7.5 m) of the vertical suction/gas pipe.

Figure 5.5 Condensing Unit is lower than the evaporator.



Item	Description	Item	Description
1	Condensing Unit	4	Suction Line
2	Indoor Unit	5	Condensate Pipe
3	Liquid Line	6	Maximum distance (refer to Table 5.1)

NOTE: Suction line in the figure above is represented with a 1% lower gradient, whose arrow direction is pointing downwards.

5.2.2 Connection Size

Refer to the following tables to see the required distances for the pipe-length limits that must be followed under different Indoor units and their compatible outdoor unit models.

Table 5.3 Connection size

Condensing Unit	Item	Pipe Size in (mm)	Coupling Size	Torque Value lb-ft
CUD03, CUL03	Liquid pipe	1/4" (6.35 mm)	7/16"-20UNF	13.9 – 18
	Suction pipe	1/2" (12.7 mm)	3/4"-16UNF	39.7-47.7
CUD07, CUL07	Liquid pipe	3/8" (9.52 mm)	5/8"-18UNF	24.5-30.3
	Suction pipe	1/2" (12.7 mm)	3/4"-16UNF	39.7-47.7
CUD11, CUL11	Liquid pipe	3/8" (9.52 mm)	5/8"-18UNF	24.5-30.3
	Suction pipe	5/8" (16 mm)	7/8"-14UNF	45.5-59.2
CUD15, CUL15	Liquid pipe	1/2" (12.7 mm)	3/4"-16UNF	24.05-30.3
	Suction pipe	3/4" (19.05 mm)	17/16" -14UNS	45.5-59.2
CUD21, CUL21	Liquid pipe	5/8" (15.875 mm)	5/8" (15.875 mm) SLD	n/a
	Suction pipe	7/8" (22.23 mm)	7/8" (22.23 mm) SLD	n/a
CUD28, CUL28	Liquid pipe	5/8" (15.875 mm)	5/8" (15.875 mm) SLD	n/a
	Suction pipe	7/8" (22.23 mm)	7/8" (22.23 mm) SLD	n/a

5.2.3 Pipe Connection

Condensing Units of 3.5 to 15 kW

The unit is equipped with nitrogen, the pressure of which is 29.01 psi (200 kPa).

To connect the piping to the Condenser, please follow the instructions below:

1. Remove the service valve caps.
2. Align the center of the refrigerant pipe and the corresponding connection, as shown in Figure 5.6 below.
3. Refer to Figure 5.7 below for the correct liquid and gas pipe attachment to the Condensing unit.
4. Before assembling, place a couple of drops of refrigerant oil on the flare's opening rim to prevent contaminants from entering, and tighten the flare nut by hand.
5. Following the torque guidelines in table 5.3, finish tightening the flare nut with a torque wrench until the wrench clicks; refer to Figure 5.7 below for correct connection points.
6. Use as short refrigeration pipelines as possible to minimize the refrigerant's total charge and pressure drops.
7. Reduce the number of bends to a minimum. The bend must have a large radius, at least equal to the diameter of the pipe.
8. Insulate all piping to avoid heat loss from piping or scalding of cables.
9. Install an oil trap every 24.6 ft (7.5m) of the vertical suction/gas line.
10. If brazing is required, use a brazing alloy at a minimum temperature of 1350°F (732°C), such as Sil-Fos. Avoid soft solders, such as 50/50 or 95/5, or Stay Brite.

NOTE: Consult Vertiv Technical Support if the piping run exceeds the maximum equivalent length specified in Table 5.2 “Refrigerant-piping limitation of the Condensing Unit”.

NOTE: Nitrogen gas must be used during brazing to prevent oxidation of the interior piping, fouling of the refrigerant system, and plugging of the system filter dryer.

NOTE: When tightening the flare nut with a torque wrench, ensure the direction for tightening follows the arrow on the wrench.

Figure 5.6 Align the center of the piping connection.

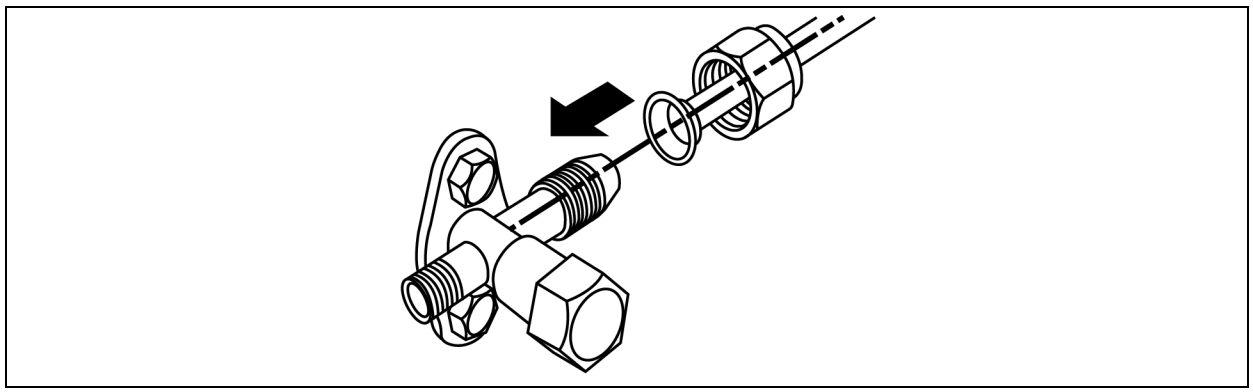
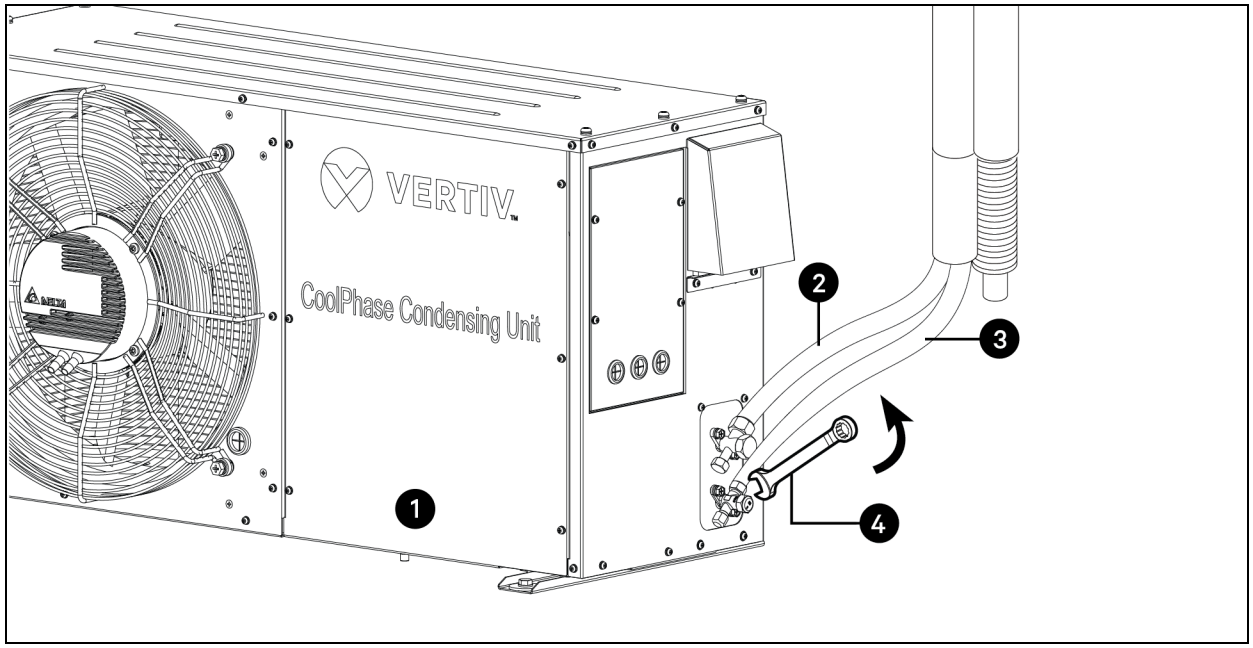


Figure 5.7 Correct piping attachment for Condensing Unit.



Item	Description	Item	Description
1	Condensing Unit	3	Liquid line
2	Suction line	4	Torque wrench

Condensing Units of 21 kW and 28 kW

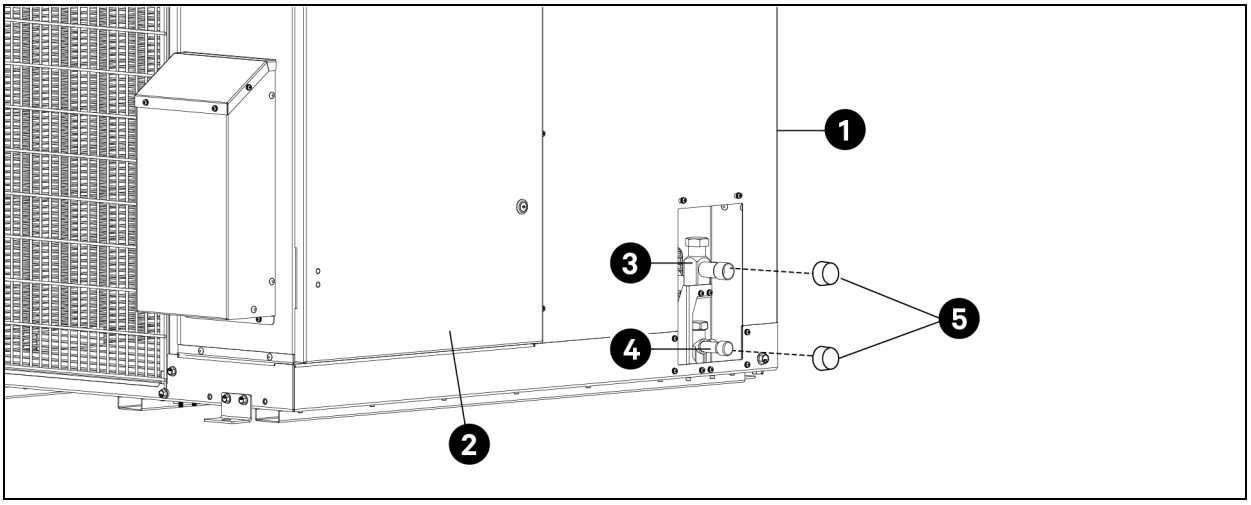
To connect the piping to the Condenser, please follow the indications below:

11. Remove the service valve caps.
12. Use as short refrigeration pipelines as possible to minimize the refrigerant's total charge and pressure drops.
13. Reduce the amount of bends to a minimum. The bend must be of a large radius, at least equal to the pipe diameter.
14. Insulate the piping to avoid cable damage if the pipes are next to electrical cables.
15. When the condenser is installed higher than the compressor, install an inverted trap to the discharge line of the evaporator and the liquid line of the condenser. The inverted trap prevents the liquid refrigerant from flowing back when the condenser stops working. The top end of the inverted trap must be higher than the height of the copper pipes of the condenser. Refer to the Evaporator Unit User manual for the minimum required height difference.
16. Install an oil trap every 24.6 ft (7.5 m) of the vertical discharge line.
17. Weld the connections using copper piping with a brazing alloy minimum temperature of 1350°F (732°C), such as Sil-Fos. Avoid soft solders, such as 50/50 or 95/5.

NOTE: Consult Vertiv Technical Support if the piping run exceeds the maximum equivalent length specified in Table 5.2 “Refrigerant-piping limitation of the Condensing Unit”.

NOTE: Nitrogen gas must be used during brazing to prevent interior piping oxidation, fouling of the refrigerant system, and plugging the system filter dryer.

Figure 5.8 Removing service-valve caps from the Condensing Unit



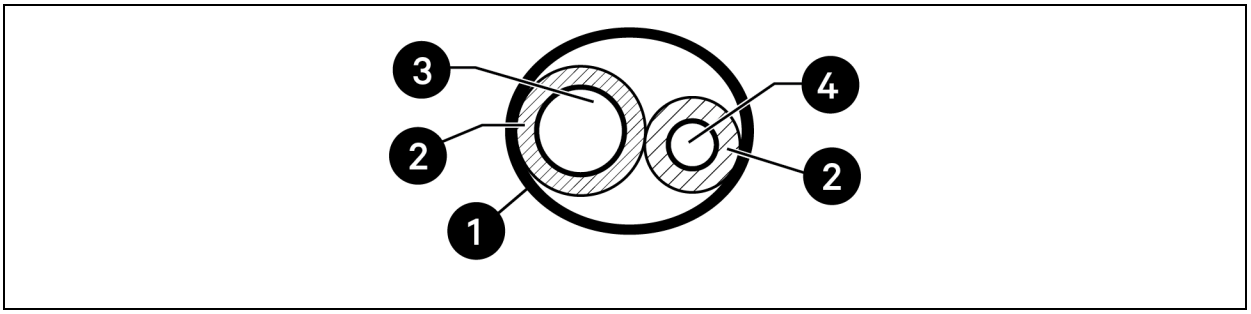
Item	Description	Item	Description
1	Condensing unit	4	2-way Valve for Liquid line
2	Electrical box cover	5	Valve caps
3	2-way Valve for Suction line		

5.2.4 Piping Insulation

To prevent heat loss or heat gain through the refrigerant piping, all refrigerant piping, including both liquid and vapor lines, must be insulated separately. Insulation must be a minimum of 1/2 in. Thickness may need to be increased based on ambient conditions and local codes.

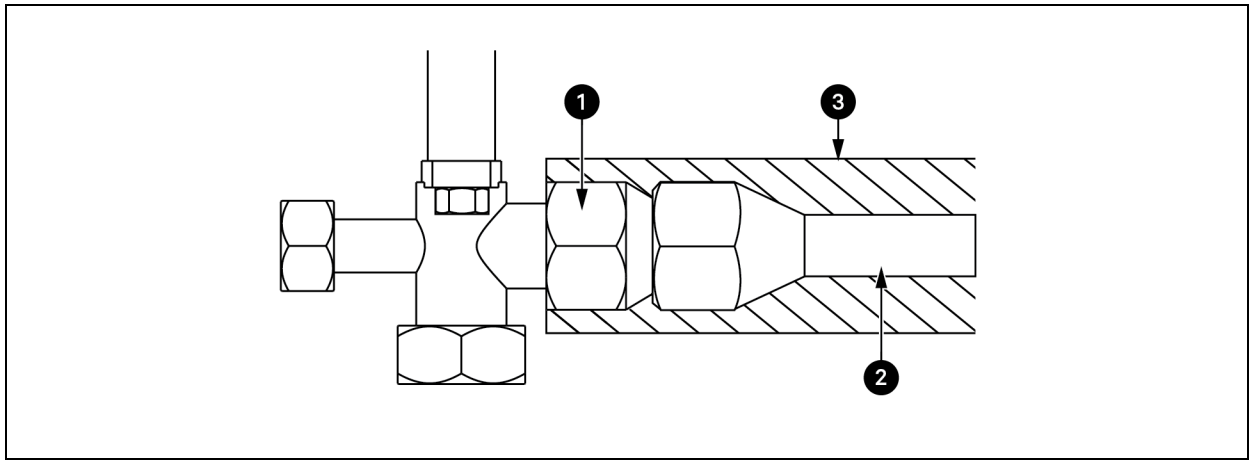
NOTE: Do not insulate gas and liquid pipes together, as this can result in pipe leakage and malfunction due to extreme temperature fluctuations. Ensure that the piping connections are fully insulated.

Figure 5.9 Typical pipe-insulation arrangement



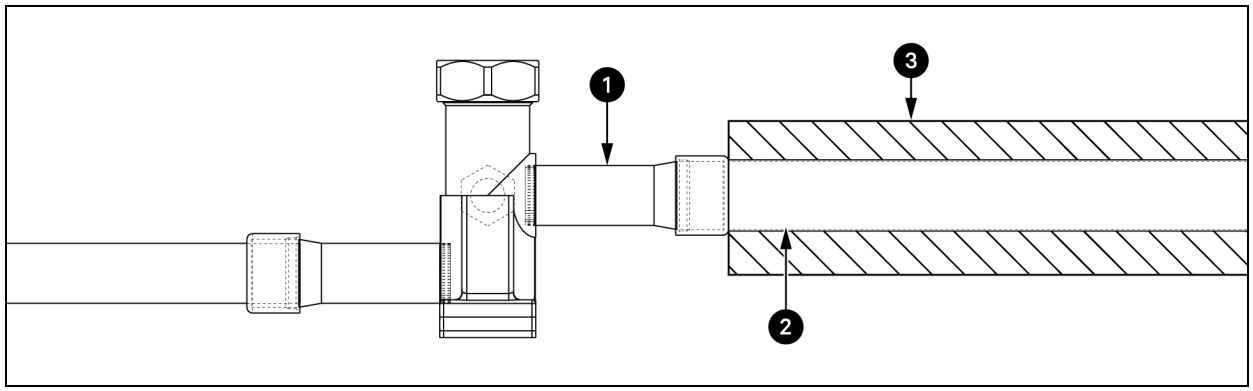
Item	Description	Item	Description
1	Pipe sleeve	3	Suction Line
2	Insulation material	4	Liquid Line

Figure 5.10 Typical butt-joint insulation at outdoor unit 3.5-15 kW.



Item	Description	Item	Description
1	Valve	3	Field-supplied pipe insulation
2	Field-supplied pipe		

Figure 5.11 Typical butt-joint insulation at outdoor unit 21-28 kW



Item	Description	Item	Description
1	Valve	3	Field-supplied pipe insulation
2	Field-supplied pipe		

5.2.5 Piping Leak Test

For the correct Piping leak procedure, please refer to topic 1.3.11, "Detections of Flammable Refrigerants" in section Installation, Maintenance, Repair and Decommissioning on page 16 of the Important Safety Instructions of this manual.

5.2.6 Evacuation

Before starting the evacuation of the appliance, please read the Important Safety Instructions in this manual and follow the instructions in topic 1.3.12, Removal and Evacuation, in section Installation, Maintenance, Repair and Decommissioning on page 16 .

6 Electrical Connections

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, approved personal protective equipment (PPE) before working within the electric control enclosure. Failure to comply can cause severe injury or death. The customer must provide earth ground to the unit, per local codes. Before proceeding with the installation, read all instructions carefully, verify that all parts are included, and check the nameplate to ensure the voltage matches the available utility power. The iCOM 4 controller 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 controller. The only way to ensure NO voltage inside the unit is to install and open a remote disconnect switch. Refer to the unit electrical schematic. Follow all local codes.

NOTICE

Risk of electrical phase reversal. It can cause equipment damage, unit malfunction, and loss of cooling operation. If reversed phase, phase loss, momentary blackout, or power going on and off while the system operates is possible, install a field-supplied phase-loss protection circuit.

Do not connect the ground cable to the refrigerant, gas, water piping, lightning rods, telephone ground wiring, or building plumbing system.

To protect the operator from the hazards noted, immediately after working on the unit, replace and securely fasten all control boxes and panel covers.

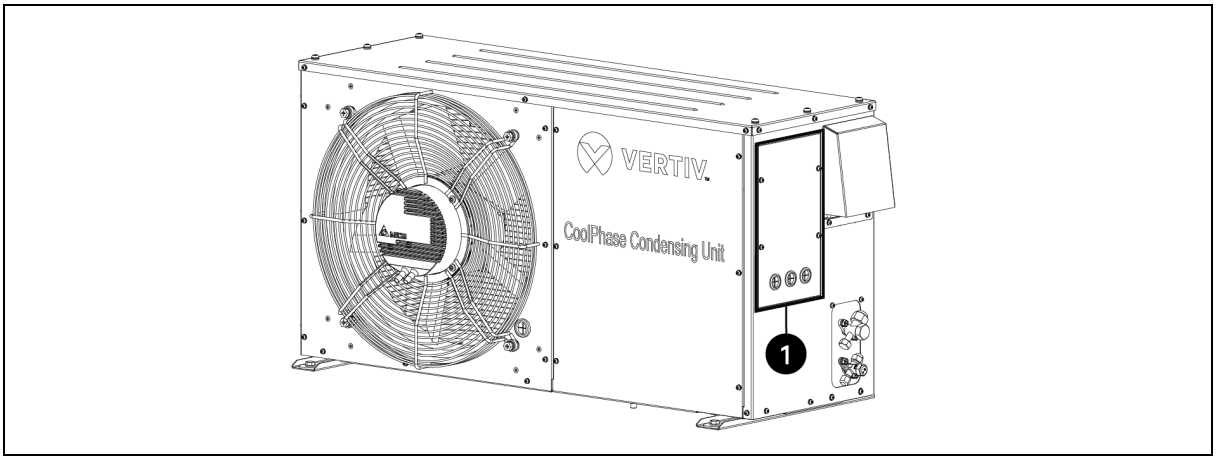
NOTE: Consider ambient conditions (temperature, direct sunlight, inclement weather, etc.) when selecting, installing, and connecting the power wiring.

6.1 Connecting Power Supply

6.1.1 Power Connection of 3.5, 7, and 11 kW Condensers

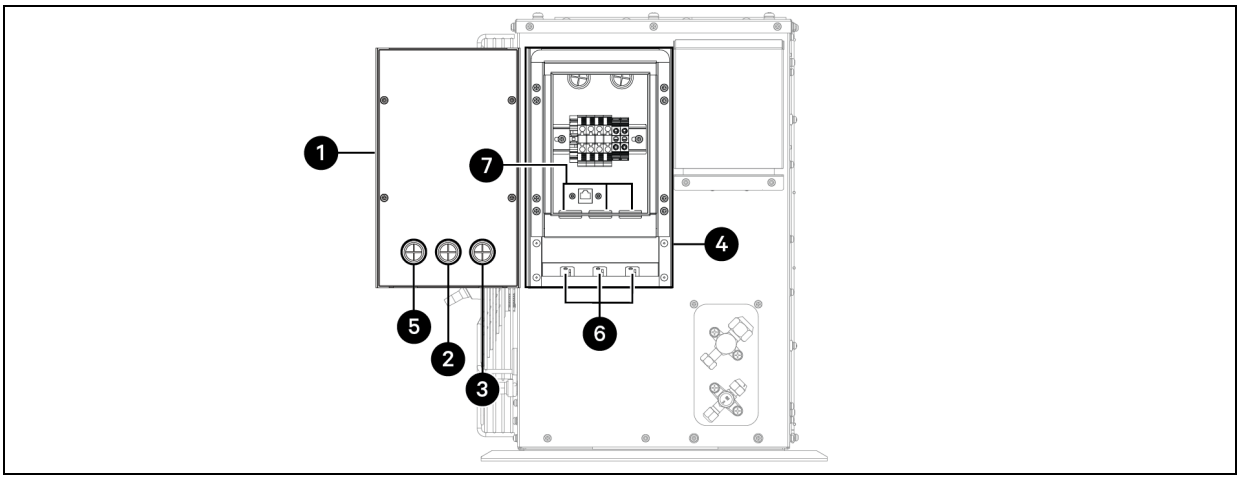
The size of the power cable must support the full load current. Do not fit the supply cable in the raceways inside the electrical panel. Use multipolar cables with sheath (CEI20-22) only.

Figure 6.1 Location of the Electrical Connections Panel in Condensing Units



Item	Description
1	Electrical Box Panel

Figure 6.2 The Electrical Box Structure



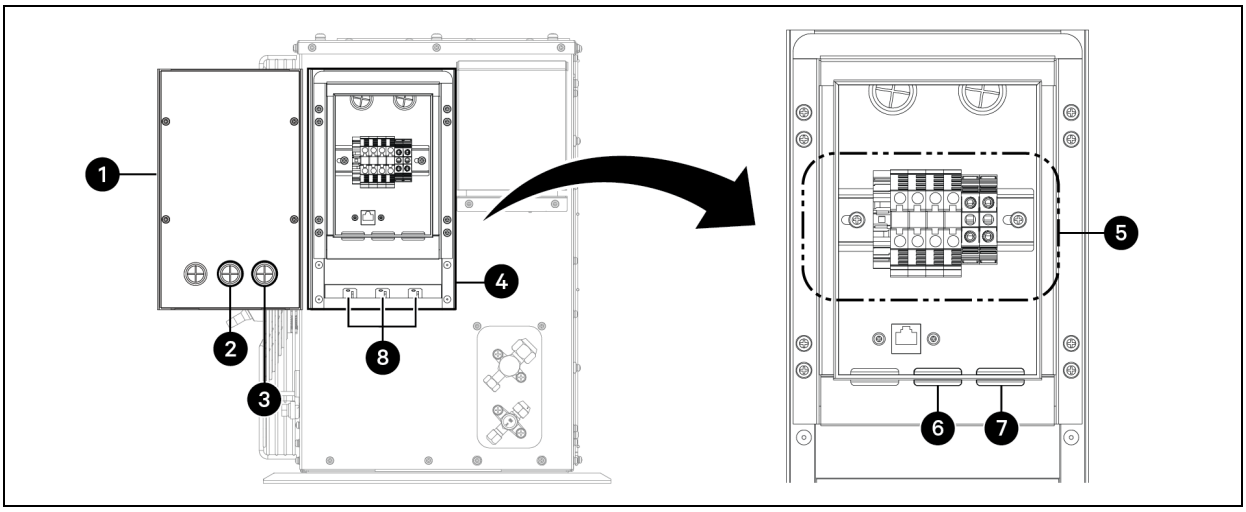
Item	Description	Item	Description
1	Electrical Box Panel	2	Condensing Unit Power Supply Cable inlet
3	Indoor Unit Power Supply Cable Outlet	4	Electrical Box (E-Box)
5	Communication Cable inlet	6	Wire Saddle
7	Cable Hose		

NOTE: Before connecting the Condensing Unit power cable, indoor unit power cable, and communication cable, please insert all cables into the cable inlet of the E-box panel in advance. Then, insert all of them into the cable clamp. Fix them with a wire tie at the cable clamp of the E-box, as shown in Figure 6.2. Lastly, insert all the cables into the cable hose of the E-box.

To connect the power supply cables:

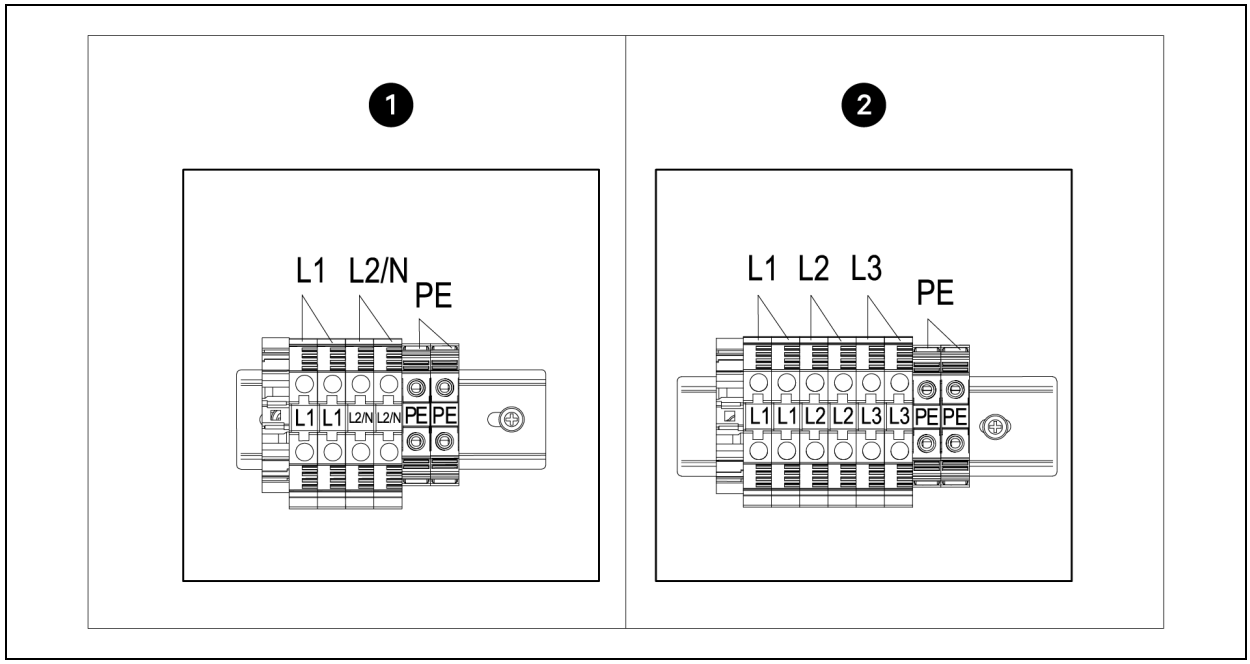
1. Viewing the unit from the right side, the electrical connection panel is located on the left upper corner.
2. Remove the cover plate from the electrical box panel by removing four M4X12 Phillips-head screws.
3. Open the terminal block's cover to reveal the screws for the connection. Route the power supply cables into the unit through the grommet on the bottom of the E-box.
4. Connect the Power cables as follows, please refer to Figure 6.4 for more details:
    a. Connect the power cables to the L1, L2, and PE terminal blocks of the single-phase 3.5 kW and 7kW Condensing units.
    b. Connect the power cables to the L1, L2, L3, and PE terminal blocks of the 3 phase CUD111, CUL111 condensing units.
    c. Connect the power cables to the L1, L2, L3, N, and PE terminal blocks of the 3 phase CUD115, CUL115 condensing units.
5. Insert the wire lug into the wiring terminal. Fix the cable with a wire tie at the cable clamp, as shown in Figure 6.3.

Figure 6.3 Structure of the power supply connection of the E-Box



Item	Description	Item	Description
1	Electrical Box Panel	5	Terminal Blocks
2	Condensing Unit Power Supply Input	6	Condensing Unit Power Supply grommet
3	Evaporator Unit Power Supply Outlet	7	Indoor Unit Power Supply Grommet
4	Electrical box (E-Box)	8	Wire Saddle

Figure 6.4 Power supply connection for Condensing Unit models.

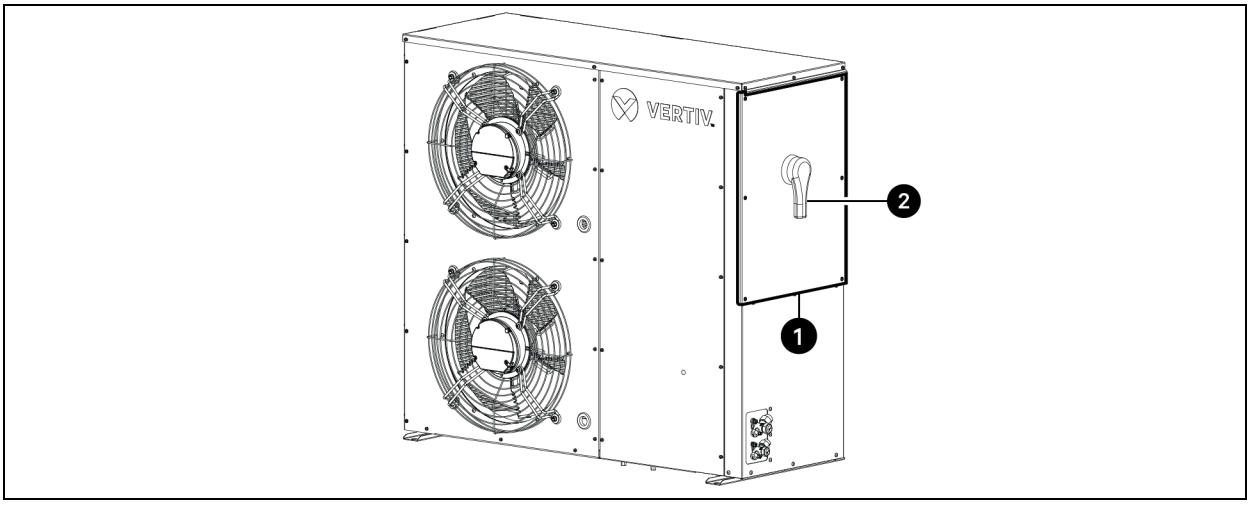


Item	Description	Item	Description
1	Models: CUD030, CUL030, CUD070, CUL070	2	Models: CUD111, CUL111 CUD114, CUL114

6.1.2 Power Connection of 15 kW Condensers

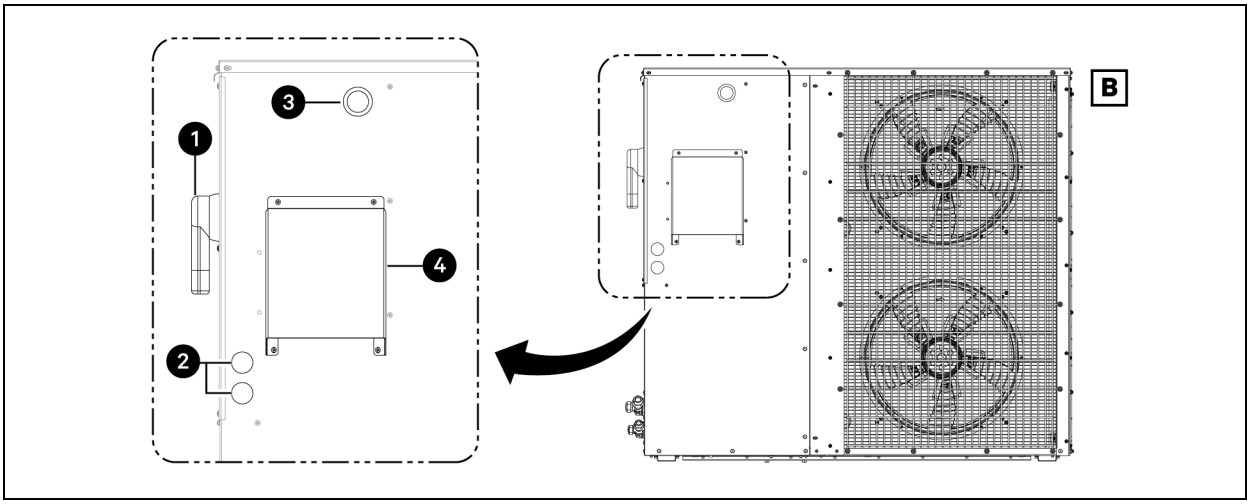
The size of the power cable must support the full load current. Do not fit the supply cable in the raceways inside the electrical panel. Use multipolar cables with sheath (CEI20-22) only.

Figure 6.5 Location of the Electrical Connections Panel in Condensing Units



Item	Description	Item	Description
1	Electrical Box Panel	2	Fuse Switch Handle

Figure 6.6 Location of Power Cable Inlets/Outlets.



Item	Description	Item	Description
B	Back of the Condensing Unit	3	Power Cable input
1	Fuse Switch Handle	4	Filter Rain Cover
2	Control / Communication Cable Input		

NOTE: Either of the knockouts marked in item 2 can be used to insert the Communication Cable into the Unit.

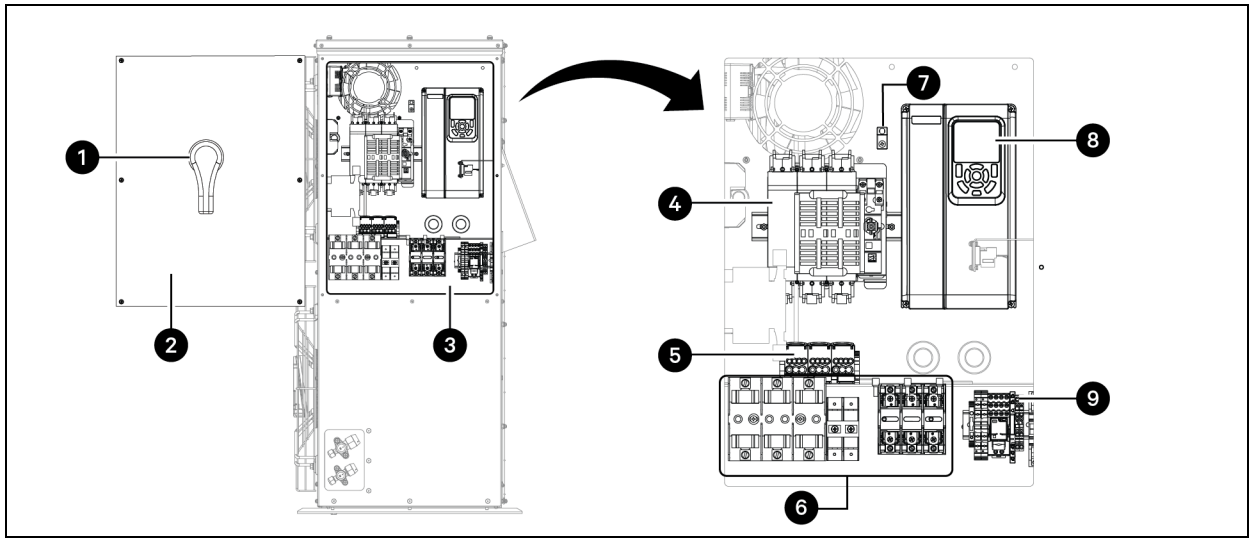
NOTE: Before connecting the Condensing Unit power cable, indoor unit power cable, and communication cable, please insert all cables into the cable inlet of the E-box panel in advance.

To connect the power supply cables:

1. Remove the cover plate from the electrical box panel by removing the six M4X12 Phillips-head screws.
2. Route the power supply cables into the unit through the grommet on the bottom of the E-box.
3. Connect the Power cables as follows, refer to Figure 6.7 for more details:
    a. Connect the power cables to the L1, L2, and PE terminal blocks of the single-phase Condensing units.
    b. Connect the power cables to the L1, L2, L3, and PE terminal blocks of the 3-phase condensing units.
4. Insert the wire lug into the wiring terminal. Fix the cable with a wire tie at the cable clamp.

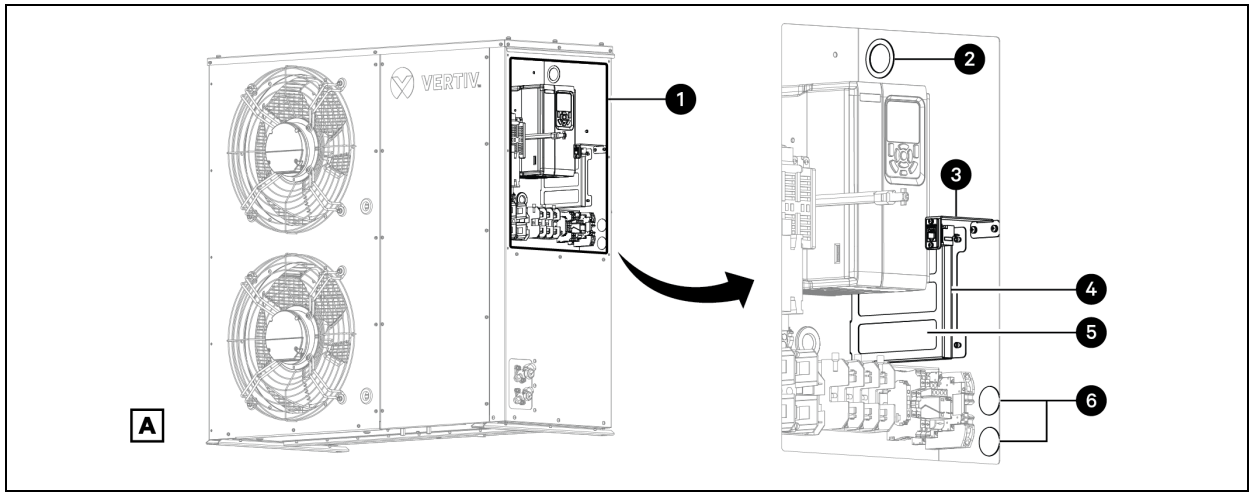
NOTE: Verify against the electrical diagram to ensure proper connection.

Figure 6.7 Inside Electrical Box. Part one.



Item	Description	Item	Description
1	Fuse Switch Handle	6	Fuse Blocks
2	Electrical Box Panel	7	Ground lug
3	Electrical Box (E-Box)	8	Inverter
4	Disconnect Switch	9	Control Terminal Blocks
5	Distribution Blocks		

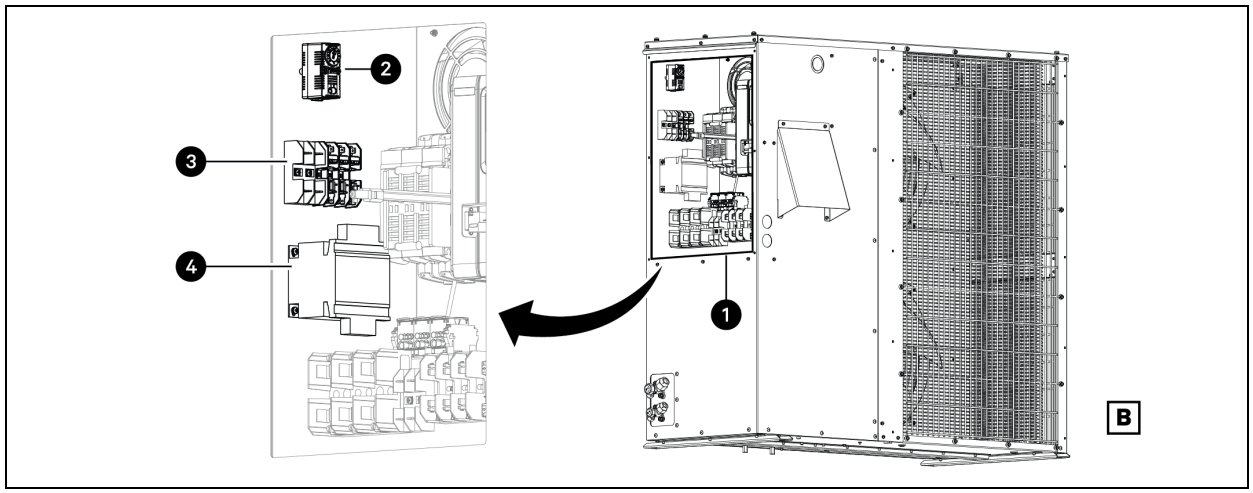
Figure 6.8 Inside Electrical Box. Part two.



Item	Description	Item	Description
A	Condensing Unit Front Side	4	Filter Holder Bracket
1	Electrical Box (E-Box)	5	Air Filter
2	Power Supply Input	6	Control / Communication Cable Input
3	Evaporator Communication Port		

NOTE: Either of the knockouts marked in item 2 can be used to insert the Communication Cable into the Unit.

Figure 6.9 Inside Electrical Box. Part three.



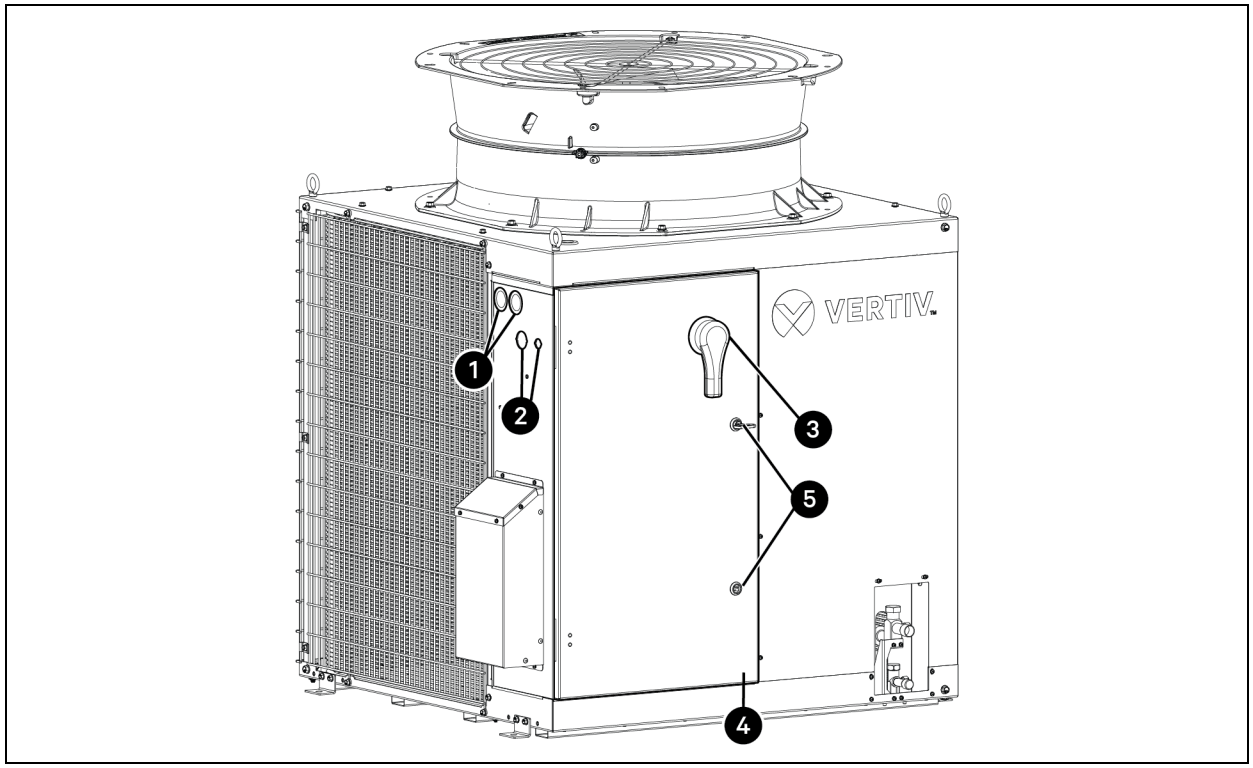
Item	Description	Item	Description
B	Condensing Unit Rear Side	3	Fuse Blocks
1	Electrical Box (E-Box)	4	460:230V Transformer
2	Temperature Control Relay		

6.1.3 Power Connection of 21 and 28 kW Condensers

Power is supplied to the evaporator from the condenser. Connect one end of the power supply cable to the switch disconnect on the evaporator side and the other to the feeder circuit breaker output inside the electrical panel on the condenser side.

NOTE: Some units have dual power supply included. It works as a secondary power supply in case of current interruption in the main one. When power supply 1 fails, power supply 2 automatically takes over. When power supply 1 is restored, it automatically resumes its function as the primary power feed.

Figure 6.10 Location of the Electrical Connections Panel on Single Power Supply Condenser Units



Item	Description	Item	Description
1	Knockout for Power Cable Input	4	Electrical box cover
2	Knockout for Communication Cable Input	5	Cover Locks
3	Fuse Switch Handle		

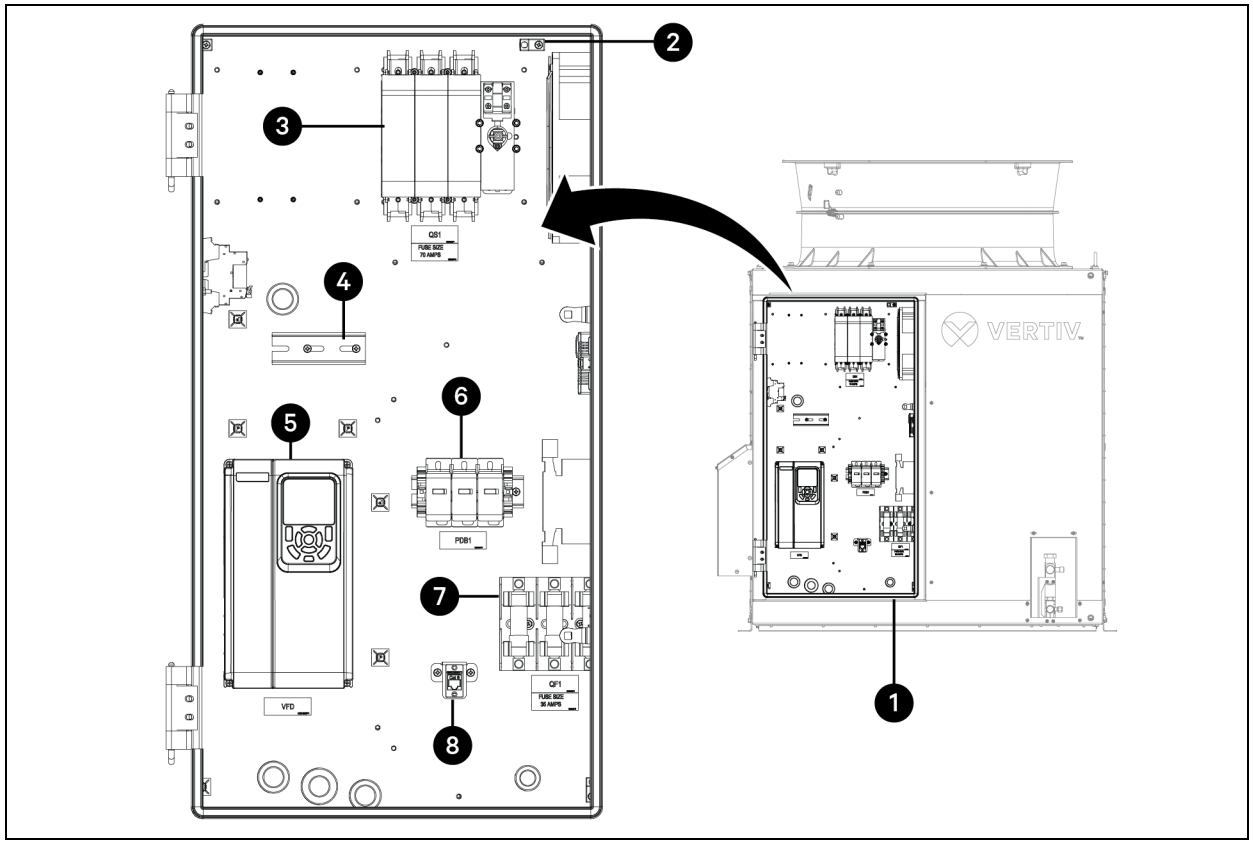
NOTE: Either of the knockouts marked in item 1 can be used to insert the Power Cable into the Unit.

NOTE: Either of the knockouts marked in item 2 can be used to insert the Communication Cable into the Unit.

To connect the power supply cables:

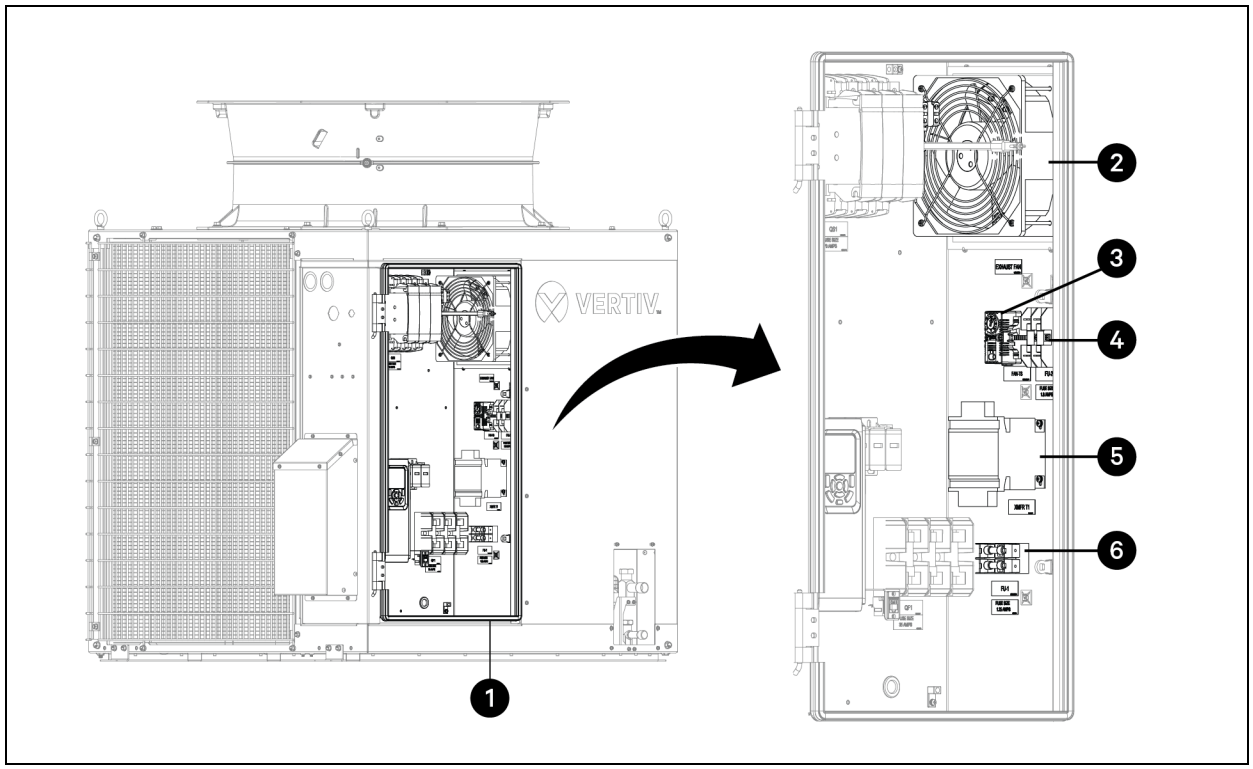
1. The power supply cables must enter the electrical box from the top left side of it. The electrical box includes two knockouts, one for the power cable input.
2. Viewing the unit from the front of the electrical box, the primary source connection is located at the top of the left side (Power Supply Disconnect Switch). Open the electrical box cover and connect it to the main disconnect line fuse switch lugs. The phase connection should be from left to right: L1, L2, and L3.
3. Make the PE connection to the ground lug at the side of the fuse switch disconnect (As shown in image 6.7).

Figure 6.11 Inside Electrical box, part one



Item	Description	Item	Description
1	Electrical Box (E-box)	5	Inverter
2	PE Terminal	6	Power distribution block
3	Power Supply Disconnect Switch	7	Inverter Fuse
4	Rail for Power Meter Accessory	8	Evaporator Communication Port

Figure 6.12 Inside Electrical Box of the Condensing Units, part two.

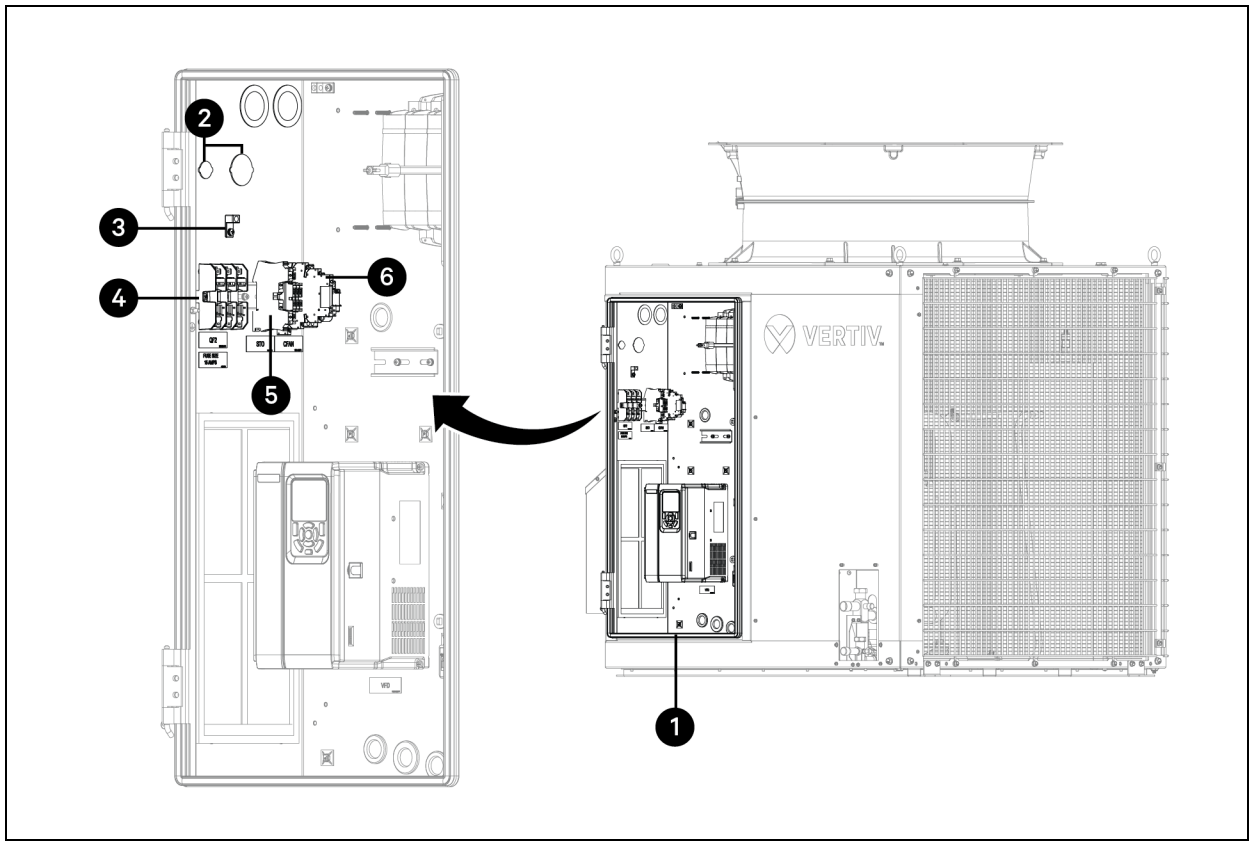


Item	Description	Item	Description
1	Electrical Box (E-box)	4	Exhaust fan / Low Ambient Version fuse block
2	Exhaust fan	5	460:230V Transformer
3	Exhaust fan thermostat	6	Indoor Unit fuse block

NOTE: The 460:230V Transformer is only available in the electrical box of the following Condensing Unit models: CUD214, CUL214, CUD284, and CUL284.

NOTE: The factory setting of the Exhaust Fan Thermostat (item 3 above) is 95°F (35°C).

Figure 6.13 Inside Electrical Box of the Condensing Units, part three.



Item	Description	Item	Description
1	Electrical Box (E-box)	4	Fan Motor Fuse
2	Knockout for Communication Cable Input	5	Communication terminal blocks
3	PE Terminal (Ground Lug)	6	Leak detection routine relay

NOTE: Either of the knockouts marked in item 2 can be used to insert the Communication Cable into the Unit.

6.2 Connecting Communications Cable

6.2.1 Connection of 3.5, 7-, and 11-kW Condensers

The unit does not include a communications cable. To connect it, connect one side of the communication wire to the COMM terminal of the indoor unit and the other side to the communication terminal in the E-box of the condensing unit. The Vertiv™ iCOM 4 Controller controls the operation of the condenser fan and compressor through the communications cable.

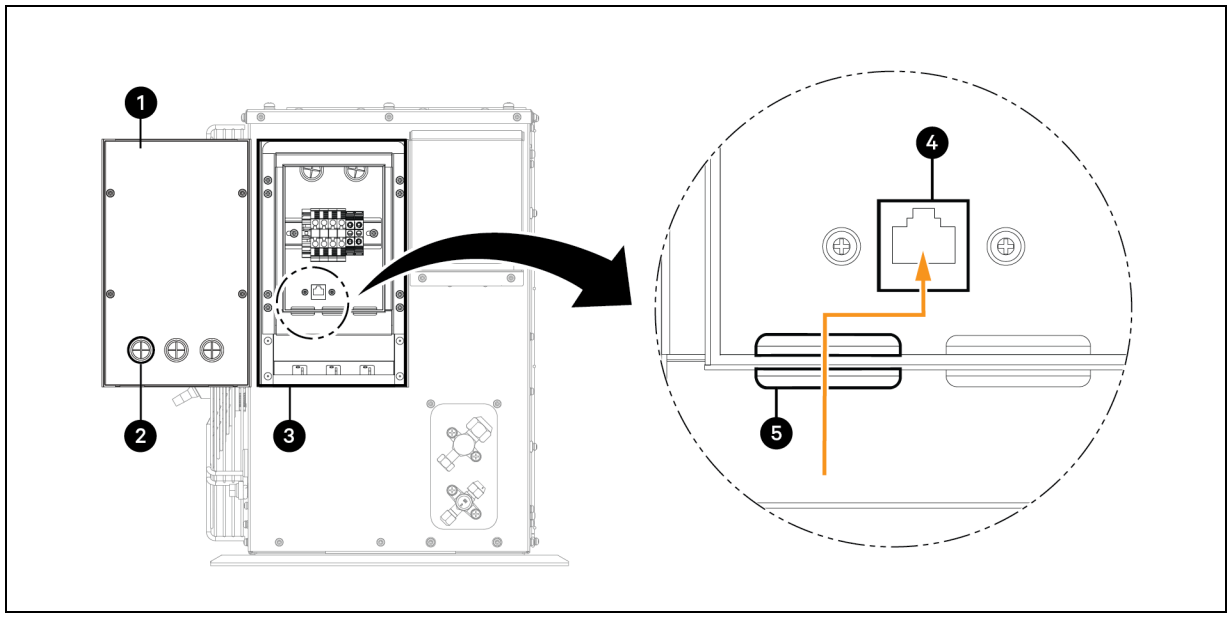
Detach the M4X12 Phillips-head screws of the electrical control box cover and remove the cover. Connect one cable to the COMM port in the electrical box. The communications terminal of the unit is shown in Figure 6.14 .

NOTE: The communication cable used must have shielding. The communication line should have a shielded grounding wire connected to the PE terminal.

NOTE: The cable size should be 24AWG, and the length should be shorter than 295.27 ft (90 m).

NOTE: Use standard Ethernet (K5E) as communication cables.

Figure 6.14 Communications Port location.



Item	Description	Item	Description
1	Electrical Box Panel	4	COMM Port
2	Communications Cable Input	5	Communications Cable Grommet
3	Electrical box (E-Box)		

6.2.2 Connection of 15 kW Condensers

The communications cable is not provided with the unit. To connect the communications cable, connect one end of the cable to the RJ45 terminal of the evaporator and connect the other end to the RJ45 terminal provided on the electrical box. This cable contains both communication wires and the 24V wires used for the leak detection mitigation routine. The iCOM 4 board controls the operation of the condenser fans through the communications cable.

To make this connection, follow the next steps:

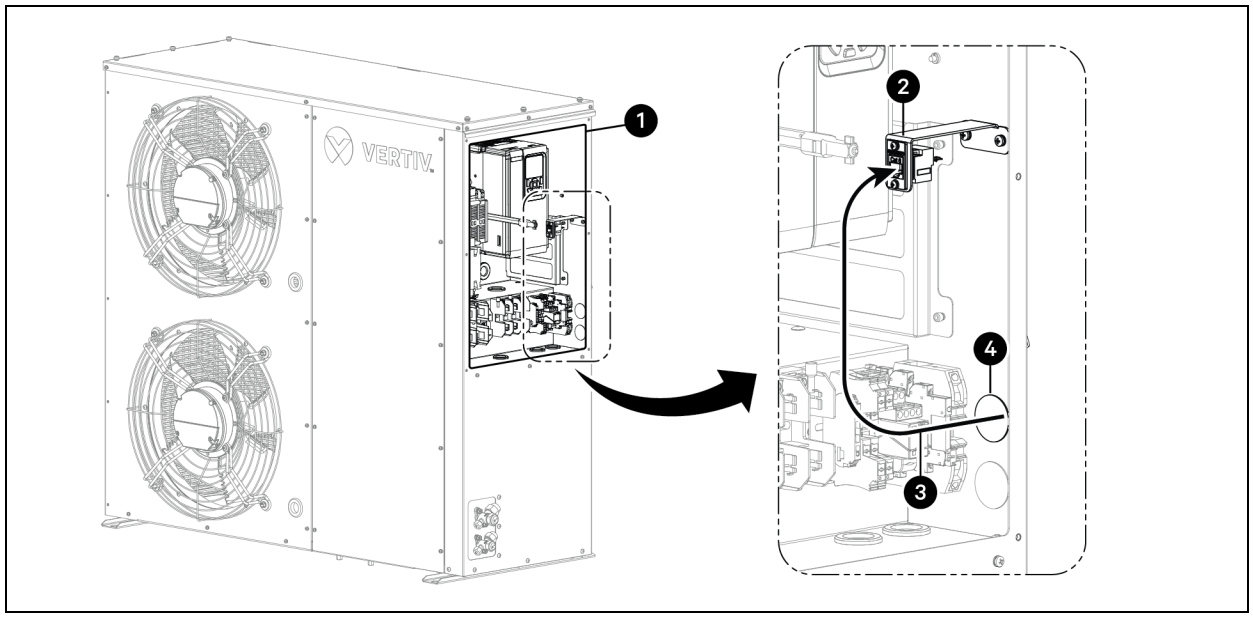
1. Open the electrical box cover, ensure the communication cable is routed, and enter through the knockout on the right side of the electrical box.
2. Connect the RJ45 terminal into the Evaporator Communication Port located in the unit shown in the Figure below.

NOTE: The communication cable used must have shielding. The communication line should have a shielded grounding wire connected to the PE terminal.

NOTE: The communication cables are planned to be routed at least 12 in (300 mm) from any power cable.

NOTE: Verify against the electrical diagram to ensure proper connection.

Figure 6.15 Communications Port location.



Item	Description	Item	Description
1	Electrical box (E-Box)	3	Cable route
2	Evaporator Communication Port	4	Control / Communication Cable Input

6.2.3 Connection of 21 and 28 kW Condensers

The communications cable is not provided with the unit. To connect the communications cable, connect one end of the cable to the RJ45 terminal of the evaporator and connect the other end to the RJ45 terminal provided on the electrical box. This cable contains both communication wires and the 24V wires used for the leak detection mitigation routine. The iCOM 4 board controls the operation of the condenser fans through the communications cable.

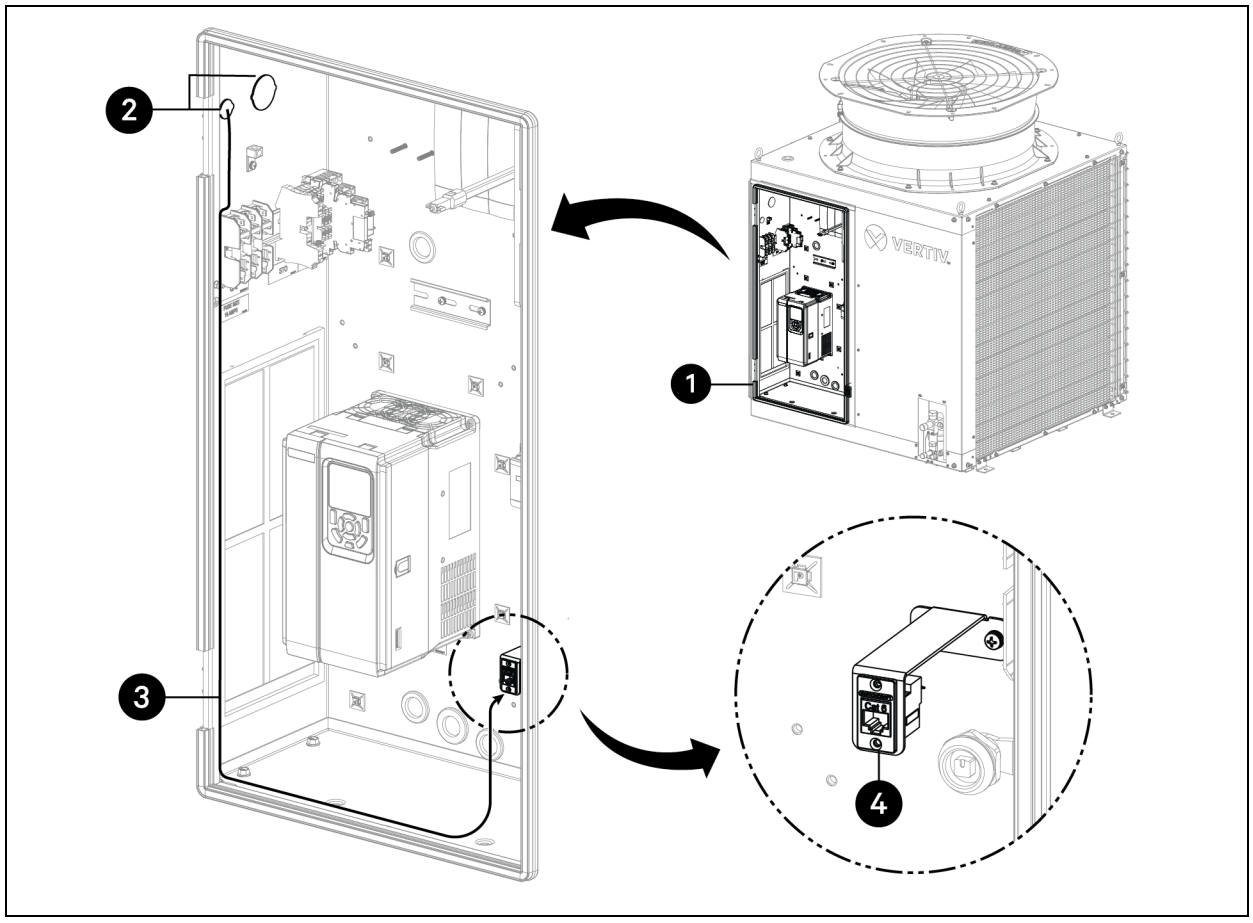
To make this connection, follow the next steps:

1. Open the electrical box cover, ensure the communication cable is routed, and enter through the knockout on the right side of the electrical box.
2. Connect the RJ45 terminal into the Evaporator Communication Port located in the unit shown in Figure 6.16

NOTE: The communication cables are planned to be routed at least 12 in (300 mm) from any power cable.

NOTE: Verify against the electrical diagram to ensure proper connection.

Figure 6.16 Communications Port location.



Item	Description	Item	Description
1	Electrical Box (E-box)	3	Cable route
2	Knockout for Communication Cable	4	Evaporator Communication Port

NOTE: Either of the knockouts marked in item 2 can be used to insert the Communication Cable into the Unit.

6.3 Connecting Indoor Unit Electrical Wiring

NOTE: This information only applies when the Indoor Unit is powered from the Condensing Unit. For more details, please refer to the connected Indoor Unit.

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 severe injury or death. As applicable, the customer must provide earth ground to the unit, per NEC, CEC, and local codes. Before proceeding with installation, read all instructions, verify that all the parts are included, and check the nameplate to be sure the voltage matches the available utility power. The iCOM 2 controller 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 controller. The only way to ensure NO voltage inside the unit is to install and open a remote disconnect switch. Refer to the unit electrical schematic. Follow all local codes.

The general guidelines for connecting electrical and communication cables to the indoor unit are the same for each system. However, the actual connections on the terminal block will differ. Refer to the manual that you are wiring for the correct connection from the load side of the circuit breaker evaporator feeder. Depending on your indoor unit, the feeder circuit breaker's location and circuit breaker capacity may vary.

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7 Checklists

7.1 Piping Checklist

7.1.1 Piping Checklist for 3.5 to 15 kW Units

Major Component Rough-in

1. The unit was connected properly according to the local code and the product installation procedures.
2. All literature and bagged accessories have been removed from the unit.
3. The Condensing Unit was installed, adequately supported, and located in a non-corrosive environment.
4. Copper piping connections:
    a. Over 5/8 in (15.9 mm)—Rigid ACR only
    b. 5/8 in (15.9 mm) and under—can use soft ACR.
5. 15% silver brazing material only.
6. All refrigerant pipes and valves were insulated separately. Insulation butts up against the walls of the condensing units. No gaps or cracks. Insulation was not compressed at the clamps and hangers.

Brazing Practices

Dry nitrogen was used for purging during brazing (constant three psi (21 kPa) while brazing).

Installation

Refer to the details in the Installation section for more information on any procedure.

Refrigerant Piping

1. All pipe materials were stored correctly, capped, and cleaned. All burrs were removed after cutting, and pipe ends were reamed before brazing.
2. During refrigerant pipe installation, each pipe segment was recorded, along with its length (including expansion loops, offsets, and double-back sections), sizes, and the quantity and type of elbows used.
3. All long runs of straight pipe were provided with expansion loops.
4. A torque wrench and backup wrench were used to tighten all flare connections.
5. Before tightening flare fittings, the back side of all flares was lubricated with a small drop of PVE refrigeration oil.
6. Ensure all field-made flares are 45°. Used factory-supplied flare nuts only.
7. Pipe segments were properly supported, and all wall penetrations were sleeved.
8. Pipe insulation was not compressed at any point.
9. No oil traps, solenoid valves, sight glasses, filter driers, or other unauthorized refrigerant specialties were present.
10. Best practice included installing a minimum of 20-in (508 mm) straight pipe between each elbow.
11. The actual refrigerant charge is in accordance with the room size within which the refrigerant-containing parts are installed.
12. The ventilation machinery and outlets operate adequately and are not obstructed.

13. If an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant.
14. The markings on the equipment continue to be visible and legible. Illegible markings and signs shall be corrected.
15. Refrigerating pipes or components are installed in a position where they are unlikely to be exposed to any substance that may corrode refrigerant-containing components unless the components are constructed of materials that are inherently resistant to corrosion or are suitably protected against corrosion.

7.1.2 Piping Checklist for 21 and 28 kW Units

Major Component Rough-in

1. The unit was connected properly following local codes and the product installation procedures.
2. All literature and bagged accessories have been removed from the unit.
3. The indoor unit was installed, adequately supported, and located indoors in a noncorrosive environment.
4. The unit's gravity condensate drain line was connected and routed to drain away properly, or, if installed in a mechanical room, it was connected and properly routed to a drain terminal.

Piping and Insulation

1. Copper piping connections.
2. Over 5/8 in. (15.9 mm)—Rigid ACR only
3. 5/8 in. (15.9 mm) and under—can use soft ACR.
4. 15% silver brazing material only.
5. All refrigerant pipes and valves were insulated separately. Insulation butts up against the walls of the indoor units. No gaps or cracks. Insulation was not compressed at the clamps and hangers.

Brazing Practices

Dry nitrogen was used for purging during brazing (constant 3 psi (21 kPa) while brazing).

Installation

Refer to the details in the Installation section for more information on any procedure.

Refrigerant Piping

1. All pipe materials were properly stored, capped, and cleaned. All burrs were removed after cutting, and pipe ends were reamed before brazing.
2. During refrigerant pipe installation, each pipe segment was recorded, along with its length (including expansion loops, offsets, and double-back sections), sizes, and the quantity and type of elbows used.
3. All long runs of straight pipe were provided with expansion loops.
4. A torque wrench and backup wrench were used to tighten all flare connections.
5. Before tightening flare fittings, the back side of all flares was lubricated with a small drop of PVE refrigeration oil.
6. Ensure all field-made flares are 45°. Used factory-supplied flare nuts only.
7. Pipe segments were properly supported, and all wall penetrations were sleeved.
8. Pipe insulation was not compressed at any point.
9. No oil traps, solenoid valves, sight glasses, filter driers, or other unauthorized refrigerant specialties were present.
10. Best practice included installing a minimum of 20-in. (51 cm) straight pipe between each elbow.
11. The actual refrigerant charge is in accordance with the room size within which the refrigerant-containing parts are installed.

7.2 Electrical Checklist

After the system's electrical installation is completed, the following requirements should be met.

Power Wire and Communication Cables

1. Power wiring was connected to a power supply corresponding to the unit's nameplate.
2. Ground wire was installed and properly terminated at the unit.
3. The power supplied was clean with voltage fluctuations within specifications. (±10% of nameplate).
4. Power wiring to the Condensing Unit was installed per all local electrical code requirements.
5. Power wiring to the indoor unit was installed per all local electrical code requirements.
6. Communication type RS-485-BUS type.
7. Straight-through Ethernet cables (RJ45) were used for communication connections.
8. Used appropriate crimping tools to attach ring, spade, or ferrule terminals to all power wiring and control cable terminations.
9. During wiring, the distance between power and control wires should be kept above 6 in (15 cm). At least two inches (51 mm) must separate the power wire from the communication/ground wire.

Table 7.1 Electrical Inspection Checklist

Particulars	Results
The system's electrical loop has no open-circuit or short-circuit in the electrical connection.	
The power supply voltage meets the rated voltage on the unit's nameplate.	
Verify that the power wire sizing matches the recommended gauge for the unit that is being installed.	
The power and ground cables are connected to the breaker switches, the indoor unit, and the Condensing Unit correctly per the norms.	
The ratings and fuses of the Miniature Circuit Breakers (MCBs) are correct.	
The control cables are configured and subsequently fixed in place.	
All cables and connections, including the fixing blocks, are securely and properly fixed.	

Following the completion of the electrical inspection, the system must not be started until vacuuming and refrigerant charging have been fully carried out.

8 Comission

8.1 Charging the refrigerant

Prior to starting with the piping connection, please read the Important Safety Instructions section of this Manual.

WARNING! This Condensing Unit shall be connected only to an Evaporator Unit suitable for R32 refrigerant.

WARNING! Every working procedure that affects safety means shall only be carried out by competent persons.

WARNING! When installing the unit within a plenum, the refrigerant charge shall not exceed 3.9 lbs (1.8 kg); if the system exceeds this charge, this condensing unit shall be located outdoors.

NOTE: The unit is not charged with refrigerant from the factory. You need to charge refrigerant on site. The refrigerant for the unit is R32.

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

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 where the total refrigerant charge can be written.
- Extreme care shall be taken not to overfill the refrigerant system.

NOTE: Please refer to the user manual of the corresponding indoor unit for detailed information on the amounts of refrigerant and lubricant oil to charge.

8.2 Adding Lubricating Oil

After evacuating the unit, as indicated in section Pipe Work on page 12 , connect the lubricating oil tank to the Schrader valve of the unit.

NOTE: Ensure the “Hi” knob and “Lo” knob of the manifold valve and the service valves of the condensing unit are open.

NOTE: Exhaust the air from the tube and oil tank before the tube enters the oil tank, making sure that no air is absorbed into the system. As an optional approach, the lubricating oil can be charged by pouring the oil into the suction pipe when connecting the suction pipes.

8.3 Charging Refrigerant

NOTICE

Vertiv™ CoolPhase Condensing Unit is designed to be connected with different families of Vertiv™ evaporator units. The refrigerant charge will be determined in the field during the installation of the whole system; nevertheless, these units require a minimum refrigerant charge to work correctly without damage.

8.3.1 Refrigerant Charges

Table 8.1 Condensing Unit R32 Refrigerant Charge, Standard Units

Model	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 8.2 Condensing Unit R32 Refrigerant Charge, Low Ambient Units

Model	Charge lb (kg)
CUL03	2.4 (1.1)
CUL07	2.9 (1.3)
CUL11	5.3 (2.4)
CUL15	5.7 (2.6)
CUL21	10.1 (4.6)
CUL28	17.2 (7.8)

Table 8.3 Piping Connection Length between Indoor Unit and Outdoor Unit

Line Size O.D. in	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)

8.4 Automatic Restart

The unit will automatically restart when power is restored after a power interruption.

9 Maintenance

Prior to starting with the piping connection, please read the Important Safety Instructions on page 7 section of this Manual.

WARNING! Competent persons shall only carry out every working procedure that affects safety means.

WARNING! All maintenance operations must be carried out strictly by observing the European and National accident prevention regulations, especially those concerning electrical systems, refrigerators, and manufacturing resources. Only authorized and qualified technicians may maintain air conditioning equipment. The maintenance must adhere to the manufacturer's instructions to keep all warranties valid.

WARNING! The work shall be performed when the system is de-energized. Stop the system by disconnecting all power supplies and powering the air conditioner. Check that the device's electrical components are off and not receiving a power supply.

WARNING! Power down the unit for 10 minutes before removing any cover.

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

WARNING! Work in confined spaces shall be avoided.

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! 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. Do not attempt to repair those components.

WARNING! Intrinsically safe components must be replaced. Do not attempt to repair those components.

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 refrigerant leakage 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. Refrigerant removal shall be performed following manufacturer instructions.

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

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

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.

NOTICE

Risk of release of hazardous substances into the environment. It can cause environmental pollution and violation of environmental regulations.

9.1 Maintenance Schedule

Conduct monthly, quarterly, biannual, and annual checks according to the following guidelines.

Table 9.1 Maintenance Schedule.

Component	Check Items	Maintenance Period			
		Monthly	3 months	6 months	1 year
General	Irregular noises from the condenser fan	X			
	Irregular noises from the compressor	X			
VFD Air Filter	The filter is out of debris or obstructions	X			
	Cleaning or replacement of the air filter, if necessary		X		
Condenser coil	Cleanliness of the condenser coil fins		X		
Fan	Impellers can freely move		X		
	Motor and bearings			X	
	The fan is securely fixed			X	
Electronics	The electrical box is out of water leaks.			X	
	Electrical connections stability				X
Refrigerant system	Main refrigerant circuit, and if there are any signs of oil leakage				X
	Compressor suction superheat is normal				X
	Compressor discharge temperature is normal				X

NOTE: The Electrical box air filter must be checked monthly when the unit is installed in dirty conditions.

NOTE: When the Indoor unit's display reports “Cond Filter Run Hours Exceeded,” check the filter and perform the proper maintenance routine.

Only original spare parts made by Vertiv™ may be used. Using third-party material can invalidate the warranty. When the spare parts must be brazed, be careful not to damage the internal parts (gaskets, seals, O-rings, etc.).

9.2 Condensing Unit Maintenance

9.2.1 Condenser

To maintain the condenser:

- Clear the air-cooled condenser coil of all debris that will inhibit airflow. This can be done with compressed air, water from a garden hose, or a commercial coil cleaner.
- Check that there are no bent or damaged coil fins.
- Do not permit snow to accumulate around the Condensing Unit.
- Periodically clean coil surface with dedicated degreasing products.
- Inspect fans, motors, and controls for proper operation.
- Check all piping for proper support.
- Inspect for leaks.

9.2.2 Fan

Check that the fan operates normally and inspect it for potential issues, such as abnormal noise, vibration, or bearing failure.

9.2.3 Refrigeration System

Perform the following steps for refrigeration system maintenance:

1. Check that the refrigeration pipes are firmly fixed. The refrigeration pipes shall not vibrate in response to vibrations from the wall, earth, or equipment frame. Otherwise, reinforce the refrigeration piping with pipe hangers for vibration isolation.
2. Look for signs of oil in or around the evaporator/condenser and interconnecting piping. If found, check for leaks with an electronic leak detector or soap bubbles.

9.2.4 Refrigeration Circuit

Note the following when maintaining the refrigerant circuit:

- When repairing the refrigeration circuit, collect all refrigerant in a container and do not allow the refrigerant to escape.
- When either removing (for repairs) or charging refrigerant, this must be performed on both the compressor's high- and low-pressure sides simultaneously.
- The compressor copper-plated steel connections should be brazed with a SIL-FOS material containing a minimum of 5% silver.

9.2.5 Variable Frequency Driver (VFD) Box Air Filter

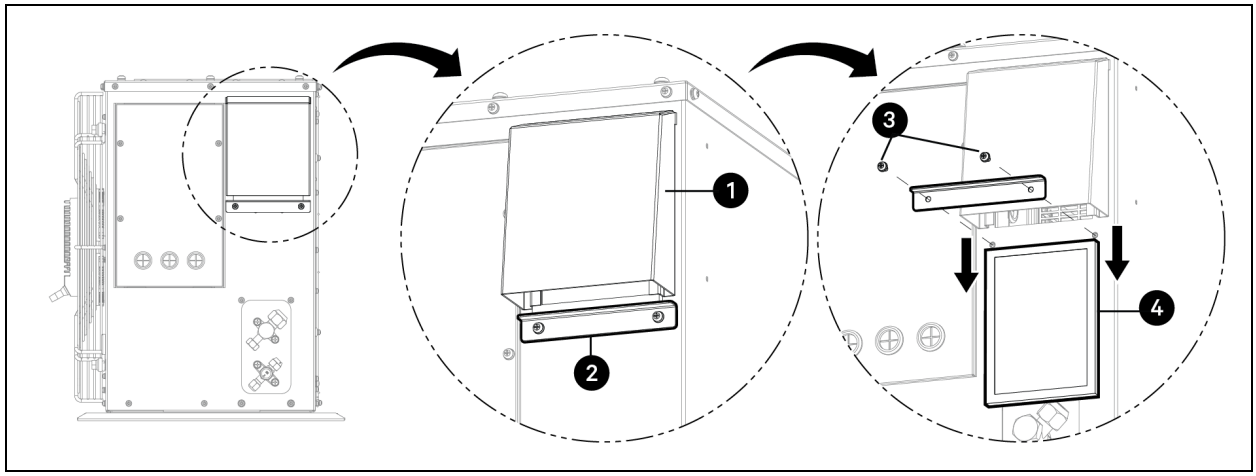
Please follow these steps to clean or replace the VFD box air filter:

1. Remove the filter by untightening the screws of the bracket or cover that protects it (see the figures below to see the corresponding location of each type of Condensing Unit).
2. Take out the filter.
3. Rinse the filter with clean water to remove debris.

4. Air-dry the filter completely, then reattach it to the unit.

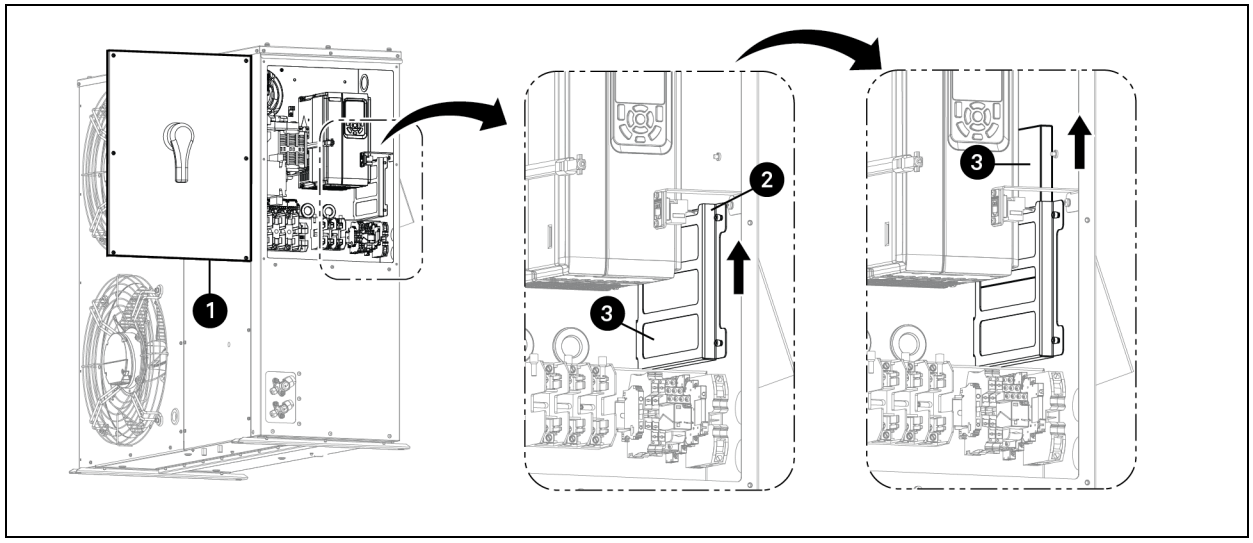
NOTE: Each unit model has a different method for removing the filter; refer to the figures below to view the corresponding filter removal indications.

Figure 9.1 Air Filter removal of 3.5, 7-, and 11-kW units.



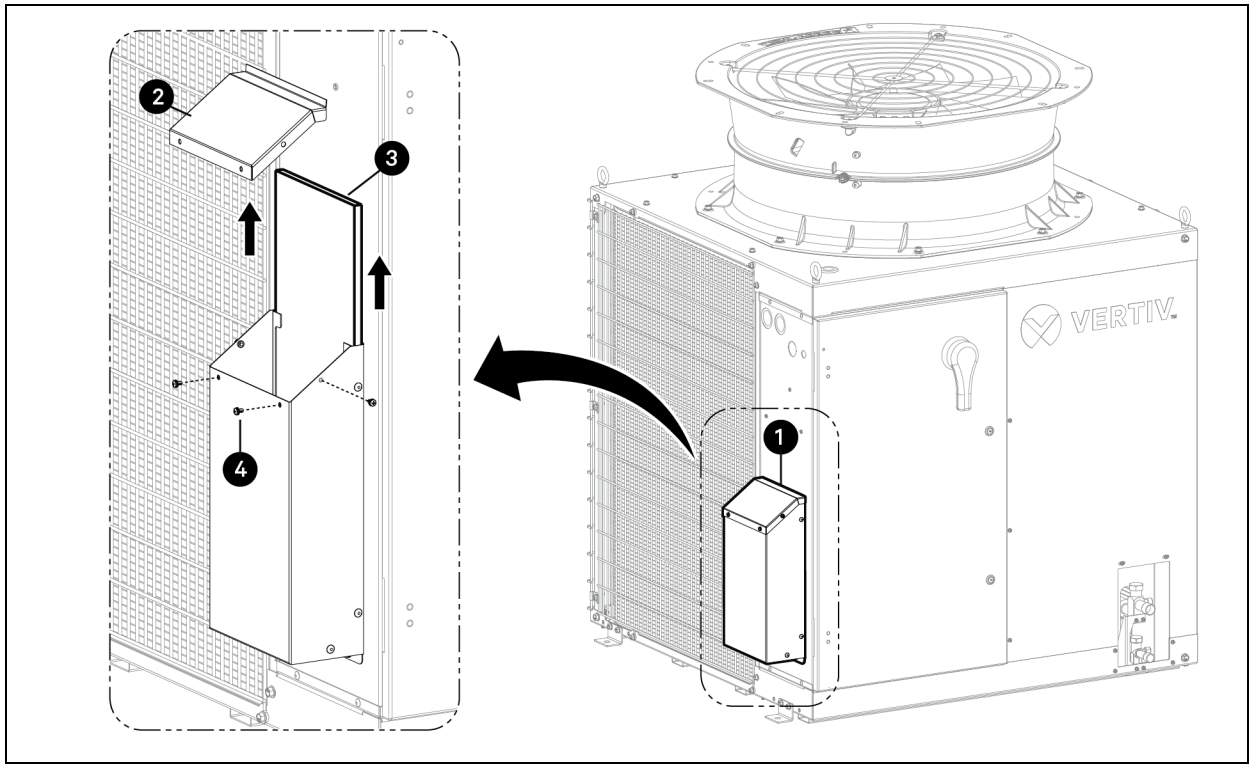
Item	Description	Item	Description
1	Filter cover	3	Screws
2	Filter Bracket	4	Air Filter

Figure 9.2 Air Filter removal of 15 kW units.



Item	Description	Item	Description
1	Electrical box cover	3	Air Filter
2	Air filter guard		

Figure 9.3 Air Filter Removal of 21-28 kW Units.



Item	Description	Item	Description
1	VFD Box	3	Air filter
2	Box Cover	4	Screws

10 Troubleshooting

Please check Table 10.1 below before contacting the service. If the problem persists after corrective action, contact Vertiv technical support (refer to Appendix D, Technical Support and Contacts).

Table 10.1 Self-Service Troubleshooting

Problem	Possible Cause	Corrective Action
The unit does not work.	The indoor air temperature is too low.	No operation is required; the unit will start automatically when it meets the indoor air temperature demand.
	A burning smell and strange sounds are coming from the unit.	Power off the unit, check all electrical components, and the power supply cable connection.
	The power cable is damaged, or it is generating excessive heat.	Revise and replace it with a new power cable if needed, according to the electrical parameters.
	The communication cable between the indoor and condensing units is damaged or disconnected.	Check that the indoor and Condensing Units' communication cable is correctly connected.
	No power to the unit.	Check that the air breakers are closed and that all the power supply connections are correctly connected.
	A switch, circuit breaker (safety, ground), or fuse is malfunctioning.	Replace the fuse or check if the circuit breaker is tripped.
	Power supply voltage is too high or too low.	Power off the unit, and the voltage will return to the value required by the nameplate before the power supply is restored.
	There is a serious alarm on the unit(display).	Troubleshoot and resolve the alarm.
High-pressure alarm	Insufficient condenser airflow	Clear up alien objects from the condenser coil surface or near the air inlet.
	The condenser fan does not run.	Check if the condenser fan cable connection is loose. Check if the condenser fan is damaged.

10.1 Refrigerant Leaks

CAUTION: This unit is equipped with electrically powered safety measures. To be effective, it must be electrically powered at all times after installation, except when servicing.

CAUTION: Risk of exposure to excessive refrigerant concentration and oxygen depletion. It can cause illness or injury. The unit must be installed as indicated. If additional ventilation is needed, follow local or federal codes and take necessary measures to prevent refrigerant concentration from exceeding safety limits in case of a refrigerant leak. Verify that the maximum refrigerant concentration level in the space where the indoor unit will be mounted meets the concentration limit for the application.

NOTE: At the end of HVAC equipment life, take appropriate actions to recover, recycle, reclaim, or destroy R32 refrigerant according to applicable NATIONAL rules.

ASHRAE Standards 15-2010 and 34-2010, as well as ISO 817, offer guidelines that address refrigerant safety and the maximum allowable refrigerant concentration in occupied spaces. Refrigerant will dissipate into the atmosphere, but a specific air volume is required to occur safely. For R32 refrigerant, the maximum allowable concentration is 4.8 pounds per 1,000 cubic feet of air in an occupied space. Buildings with 24-hour occupancy allow half of that concentration.

ASHRAE Standards 15 and 34 assume that if a system develops a leak, its entire refrigerant charge will dump into the area where the leak occurs. To meet ASHRAE Standards 15 and 34, calculate the refrigerant concentration that may occur in the smallest room volume on the system and compare the result to the maximum allowable concentration.1 Also consult state and local codes about refrigerant safety.

The system is designed to execute mitigation actions to prevent hazardous refrigerant concentrations in the event of a leak. Do not turn off the unit; this may cause the refrigerant to stagnate, creating a hazardous atmosphere.

Do not attempt to repair the unit yourself; instead, contact service personnel to address this issue.

After the leak has been repaired, the mitigation actions will remain operable for 5 minutes after the unit has been reset to dissipate the remaining refrigerant; otherwise, the unit will not be operational.

Once the mitigation actions have ended, you can use the appliance normally.

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: Electrical Diagrams

For a more detailed view of the electric diagrams of the 3 evaporator units, refer to the online Submittals Addendum on vertiv.com.

Drawing No.	Title
29044991	Electrical Schematic for 3.5 kW and 7 kW 208/230V, 1 Phase, 50/60Hz, CoolPhase Condensing Unit
29044993	Electrical Schematic for 11 kW 208/230V, 3 Phase, CoolPhase Condensing Units
29045791	Electrical Schematic for 11 kW 460V, 3 Phase, CoolPhase Condensing Units
10068508P9	Electrical Schematic for 15 kW 208/230V 3 Phase, CoolPhase Condensing Unit
10068508P10	Electrical Schematic for 15 kW 460V, CoolPhase Condensing Unit
10068508P11	Electrical Schematic for 21 kW 208/230V 3 Phase, CoolPhase Condensing Unit
10068508P12	Electrical Schematic for 21 kW 460V 3 Phase, CoolPhase Condensing Unit
10068508P1	Electrical Schematic for 28 kW 208/230V 3 Phase, CoolPhase Condensing Unit
10068508P2	Electrical Schematic for 28 kW 460V 3 Phase, CoolPhase Condensing Unit

Figure 11.1 Electrical Schematic for 3.5 kW and 7 kW 208/230V, 1 Phase, 50/60Hz, CoolPhase Condensing Unit

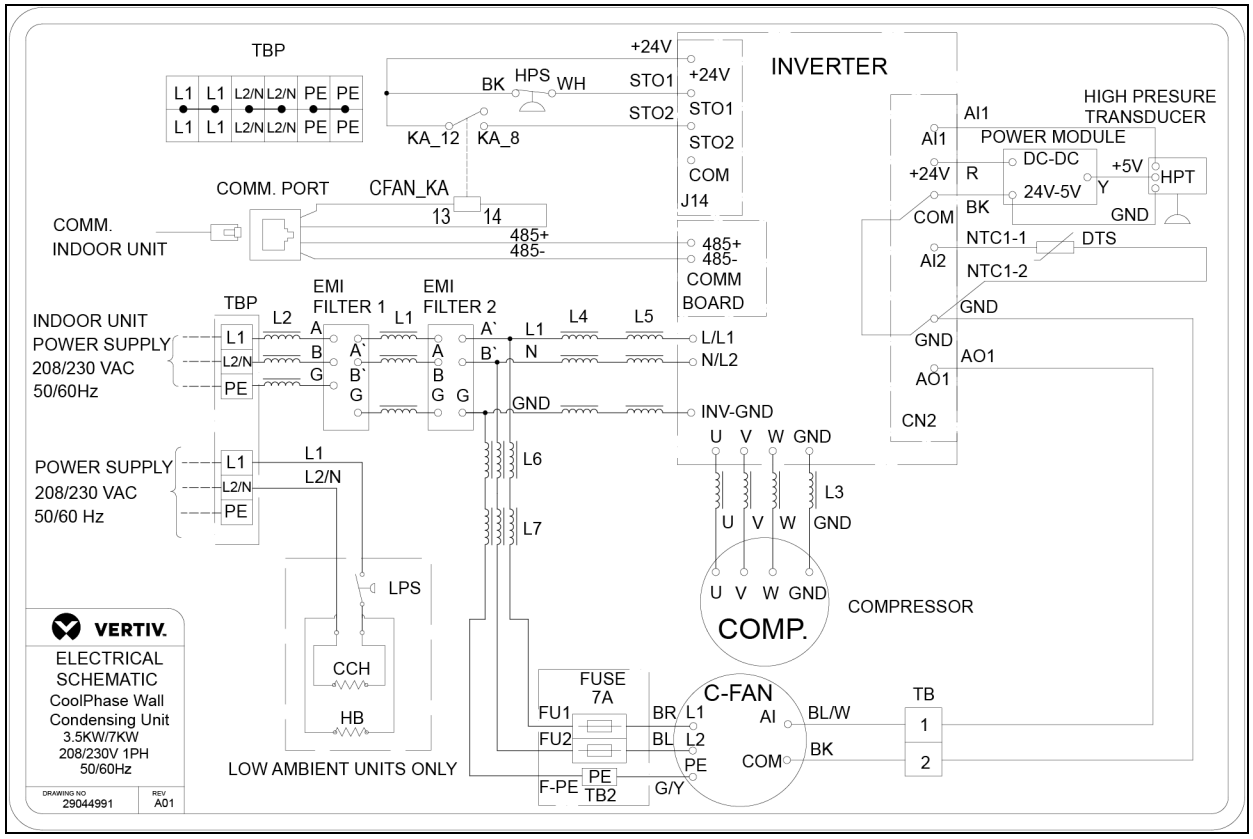


Figure 11.2 Electrical Schematic for 11 kW 208/230V, 3 Phase, CoolPhase Condensing Units

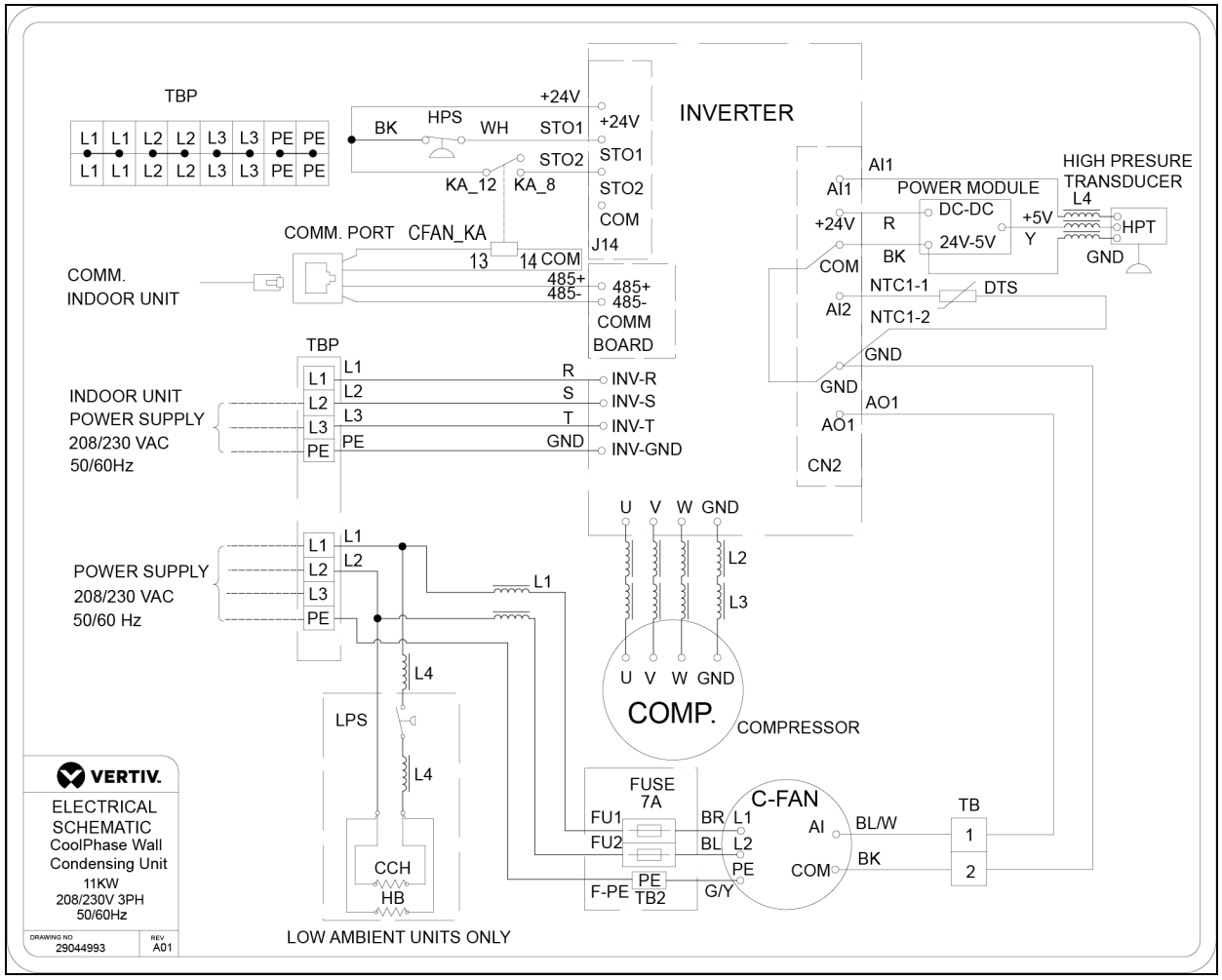


Figure 11.3 Electrical Schematic for 11 kW 460V, 3 Phase, CoolPhase Condensing Units.

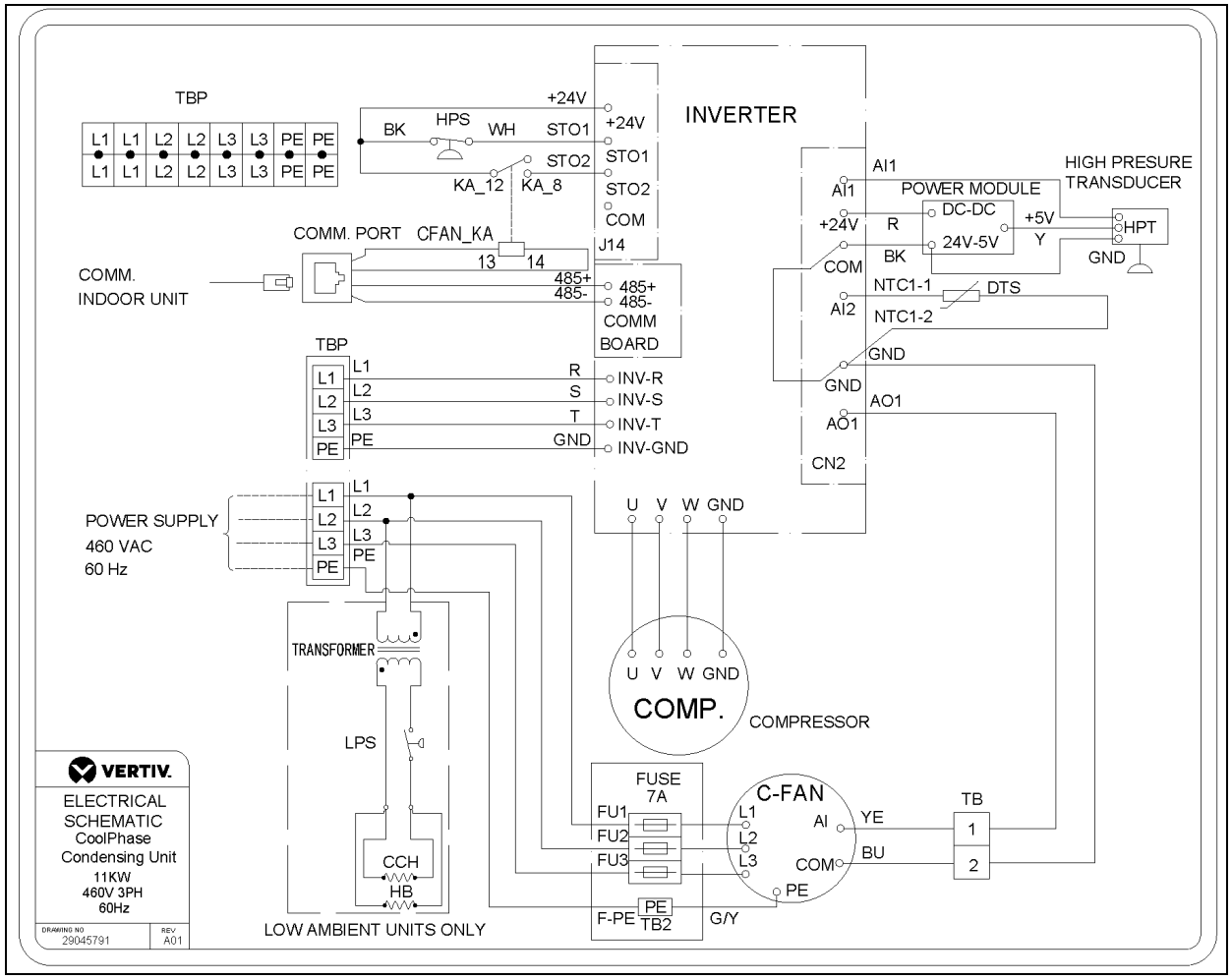


Figure 11.4 Electrical Schematic for 15 kW 208/230V, 3 Phase, 50/60 Hz, CoolPhase Condensing Units (Standard and Low Ambient) Page 1.

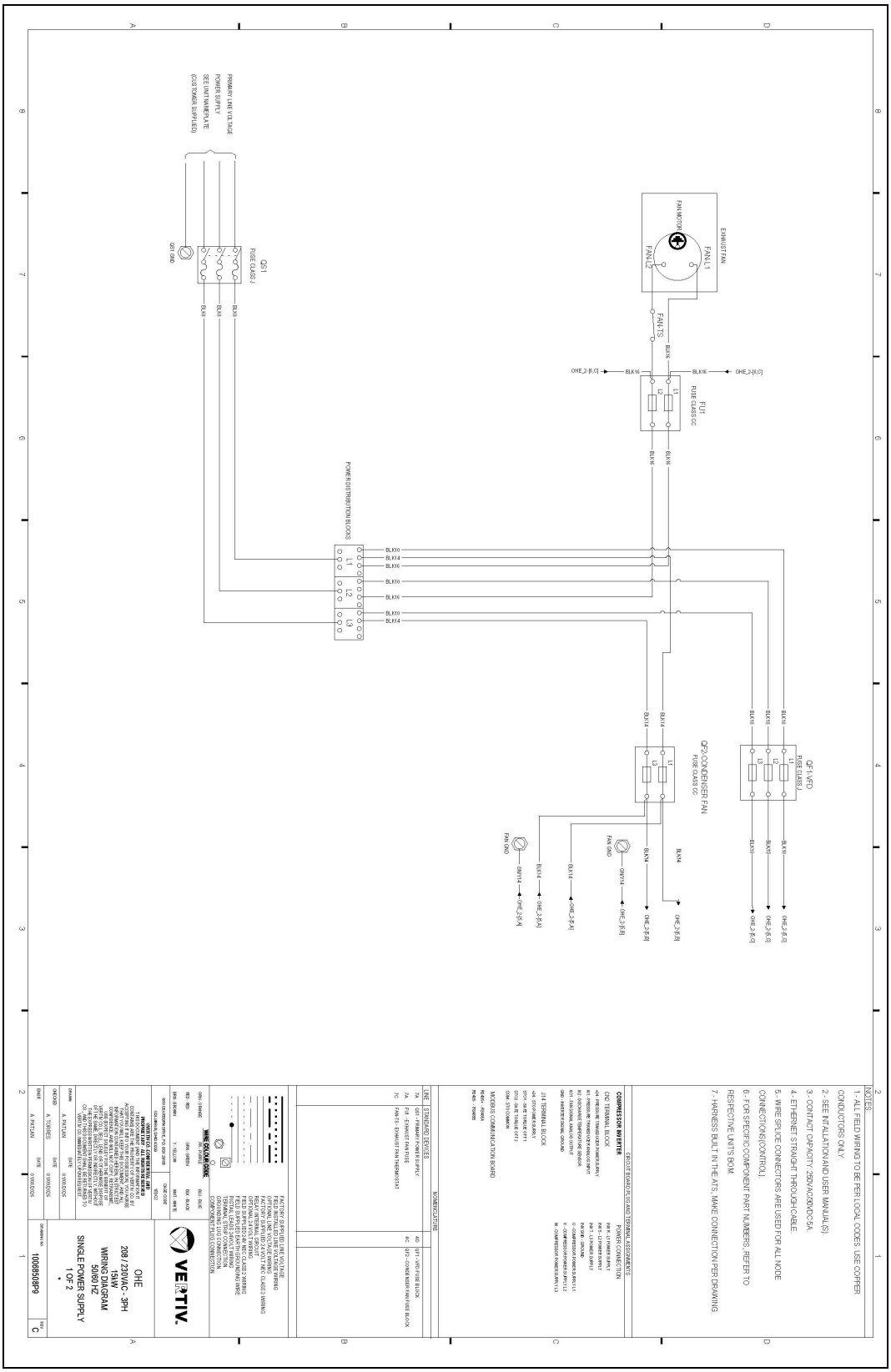


Figure 11.5 Electrical Schematic for 15 kW 208/230V, 3 Phase, 50/60 Hz, CoolPhase Condensing Units (Standard and Low Ambient) Page 2.

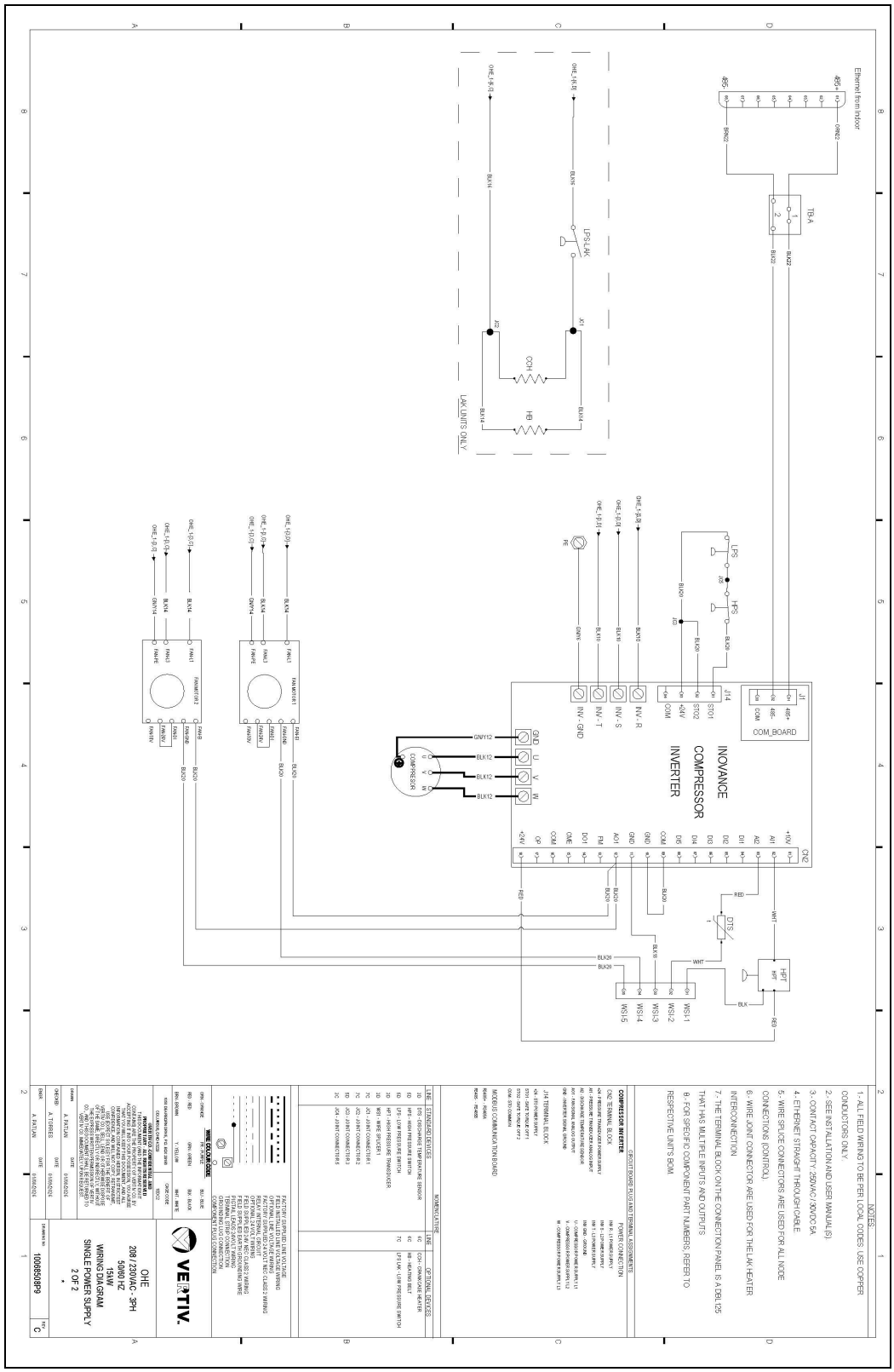


Figure 11.6 Electrical Schematic for 15 kW 460V, 3 Phase, 60 Hz, CoolPhase Condensing Units (Standard and Low Ambient) Page 1.

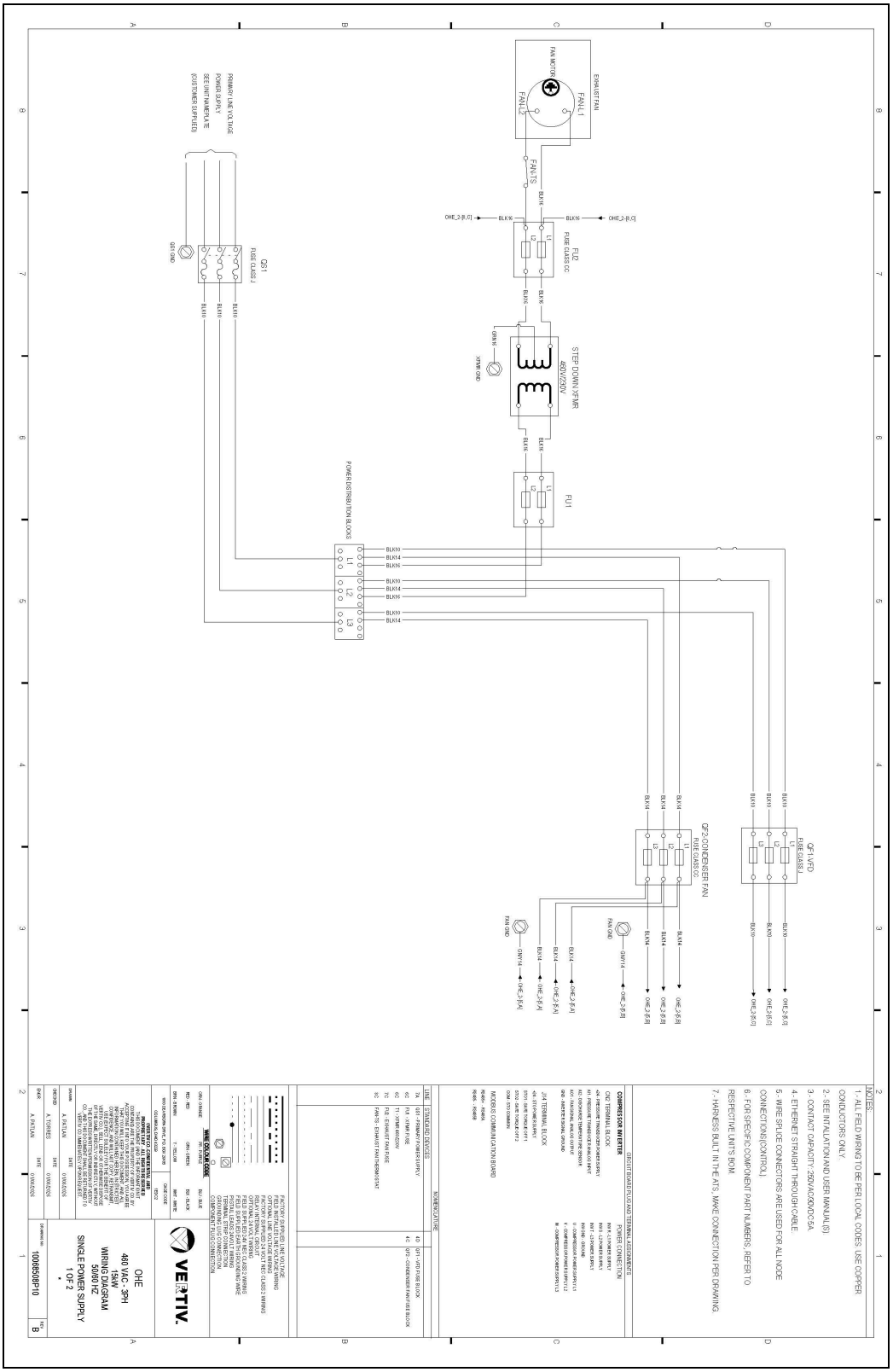


Figure 11.7 Electrical Schematic for 15 kW 460V, 3 Phase, 60 Hz, CoolPhase Condensing Units (Standard and Low Ambient) Page 2.

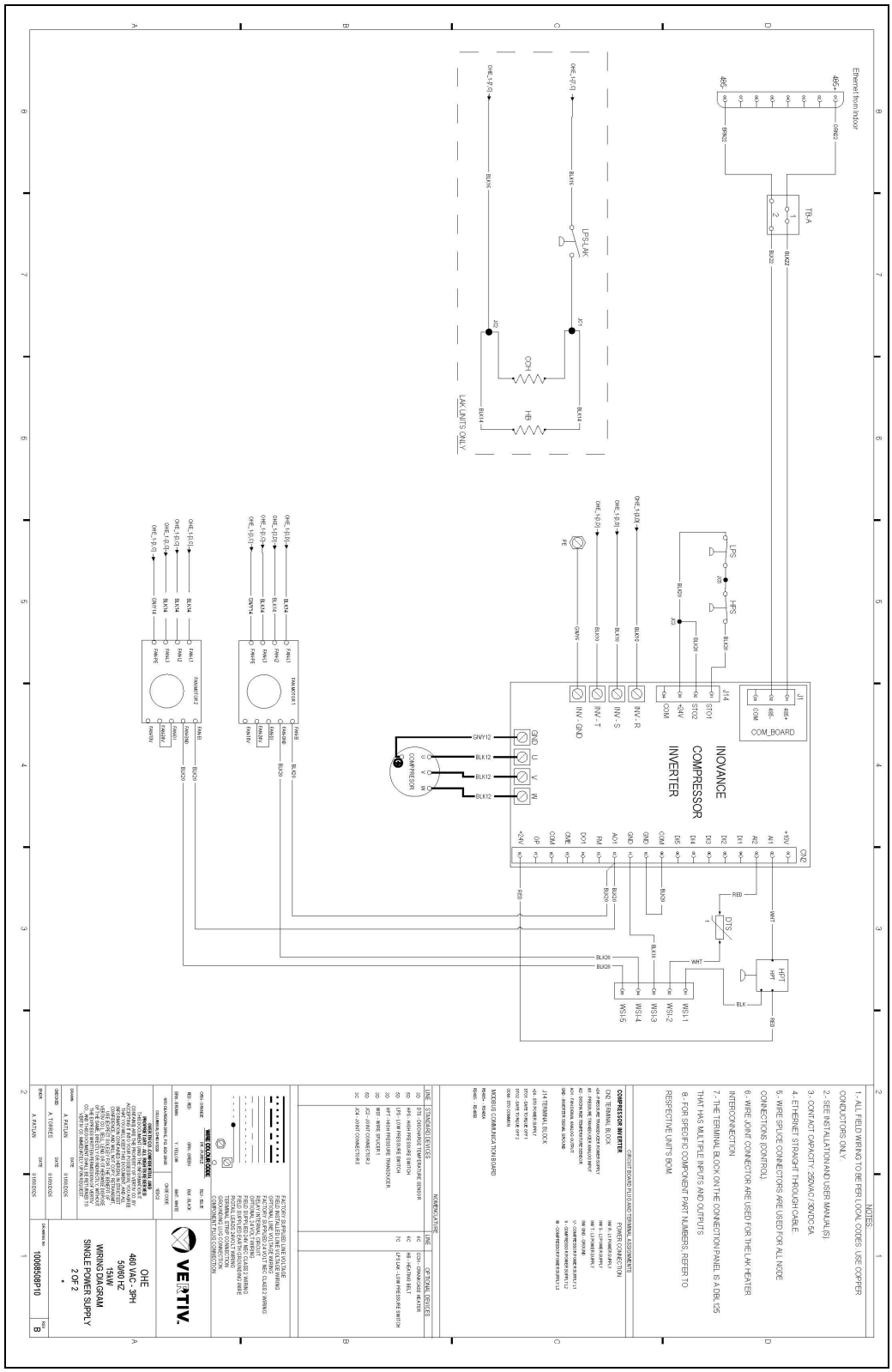


Figure 11.8 Electrical Schematic for 21 kW 208/230V, 3 Phase, 50/60 Hz, CoolPhase Condensing Units (Standard and Low Ambient) Page 1.

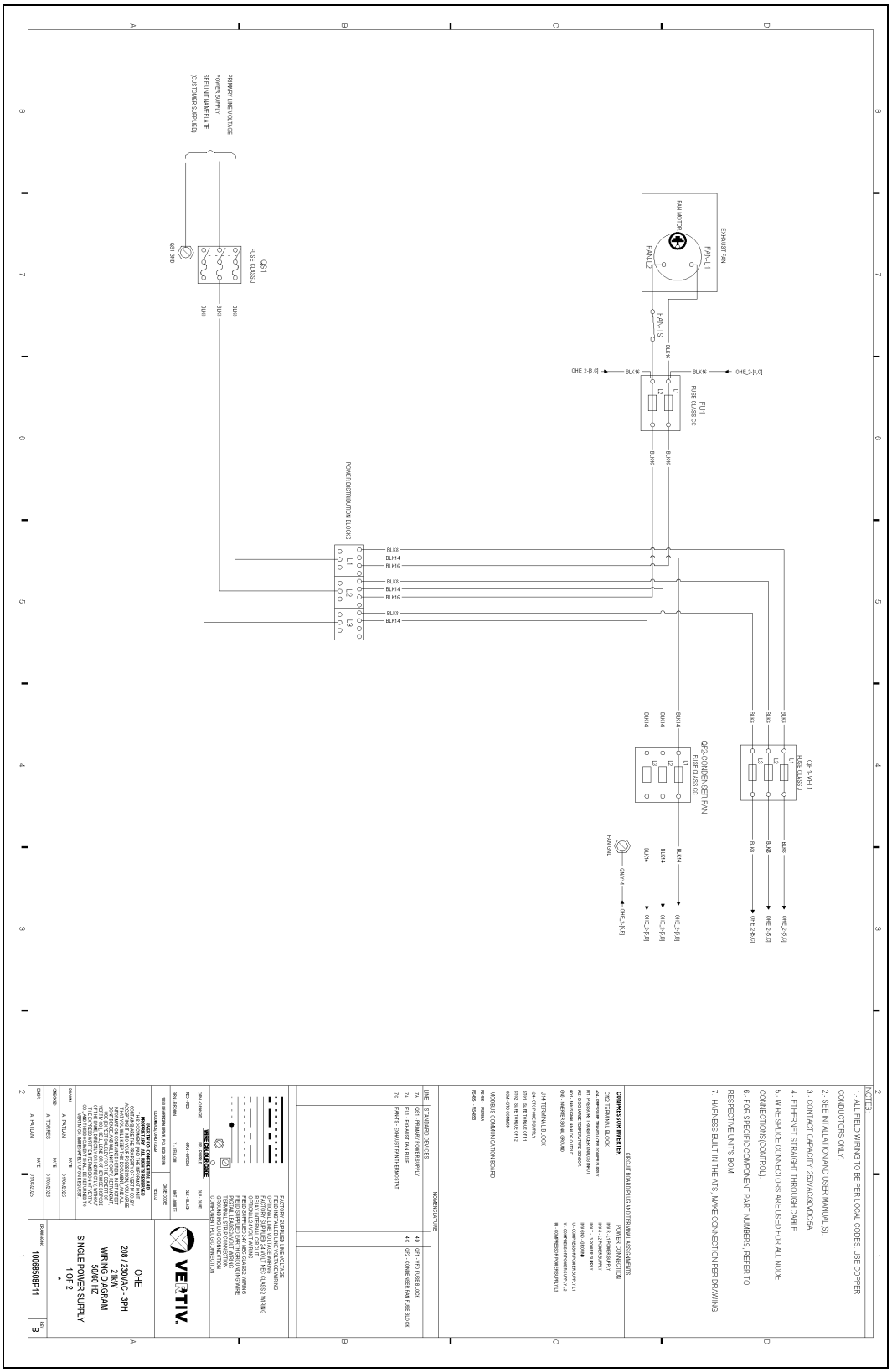


Figure 11.9 Electrical Schematic for 21 kW 208/230V, 3 Phase, 50/60 Hz, CoolPhase Condensing Units (Standard and Low Ambient) Page 2.

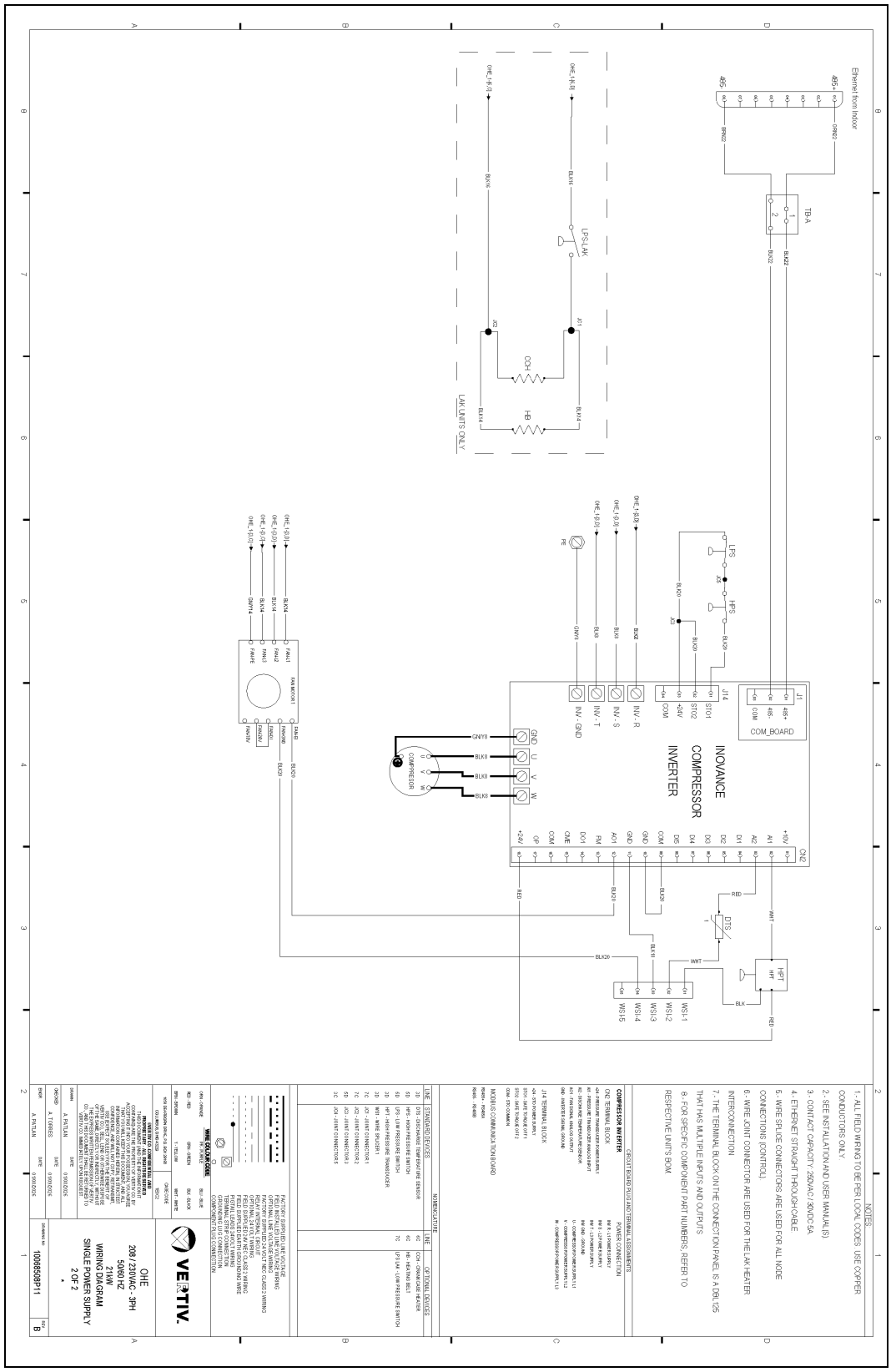


Figure 11.10 Electrical Schematic for 21 kW 460V, 3 Phase, 60 Hz, CoolPhase Condensing Units (Standard and Low Ambient) Page 1.

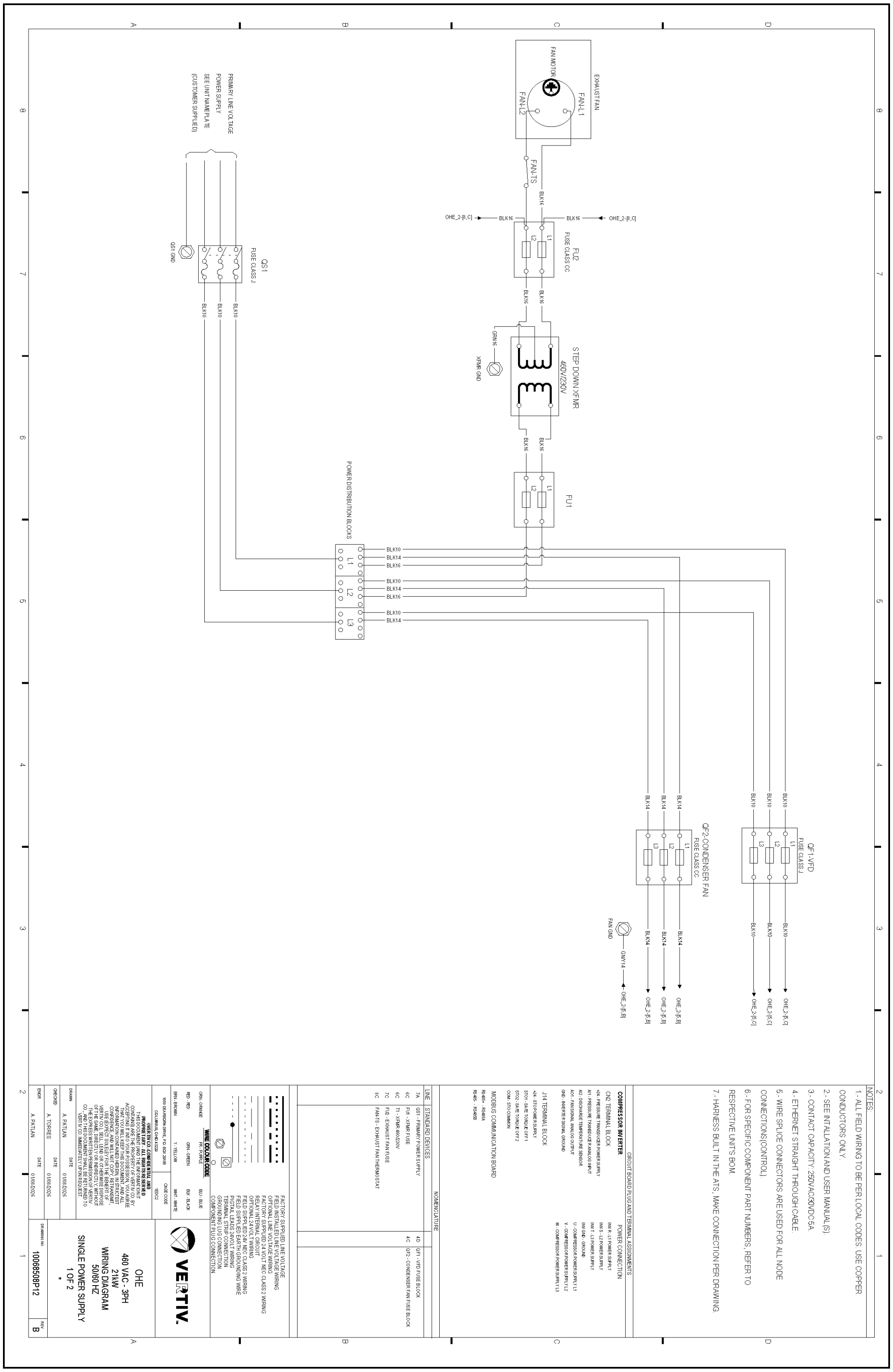


Figure 11.11 Electrical Schematic for 21 kW 460V, 3 Phase, 60 Hz, CoolPhase Condensing Units (Standard and Low Ambient) Page 2.

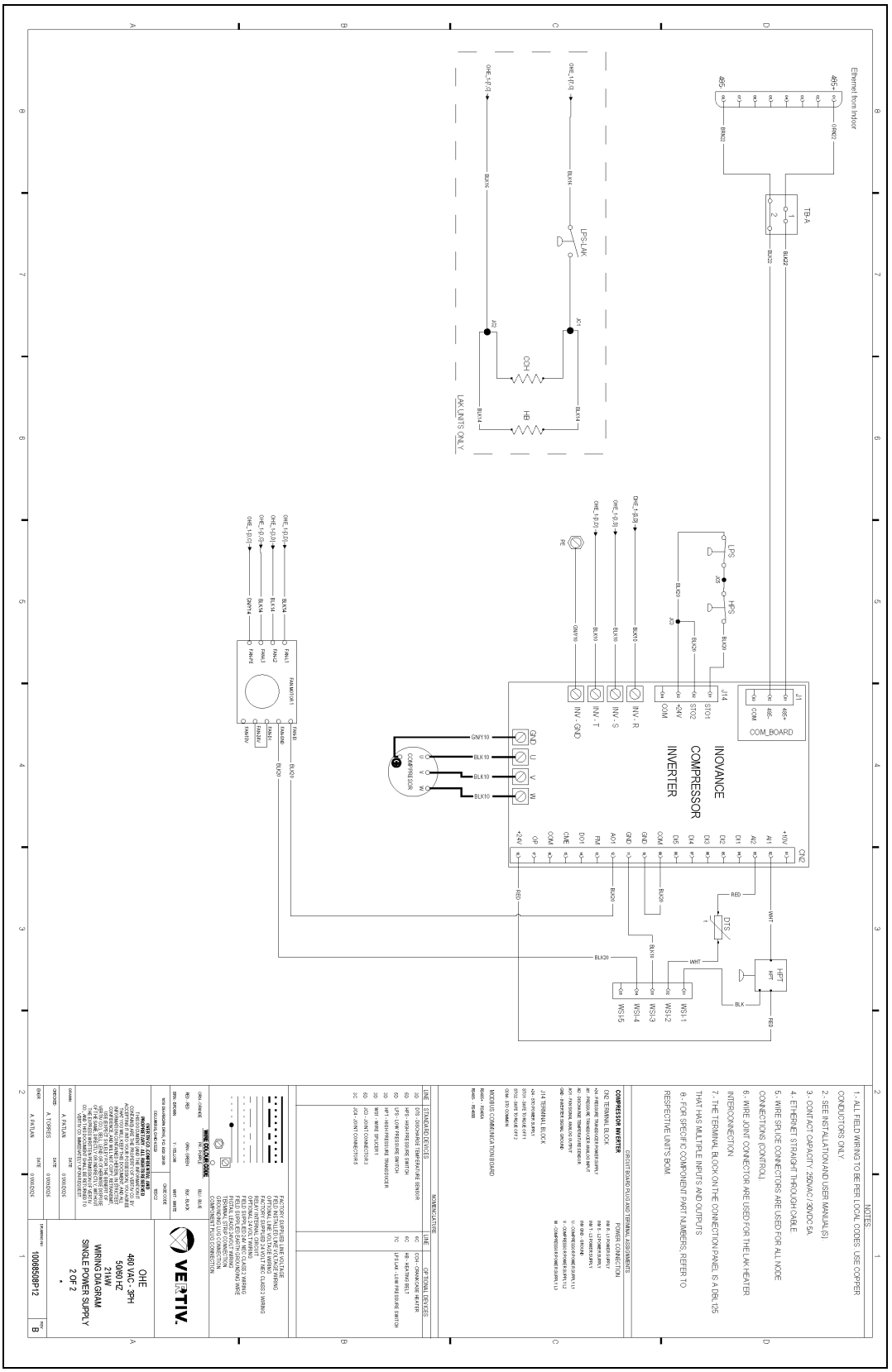


Figure 11.12 Electrical Schematic for 28 kW 208/230V, 3 Phase, 50/60 Hz, CoolPhase Condensing Units (Standard and Low Ambient) Page 1.

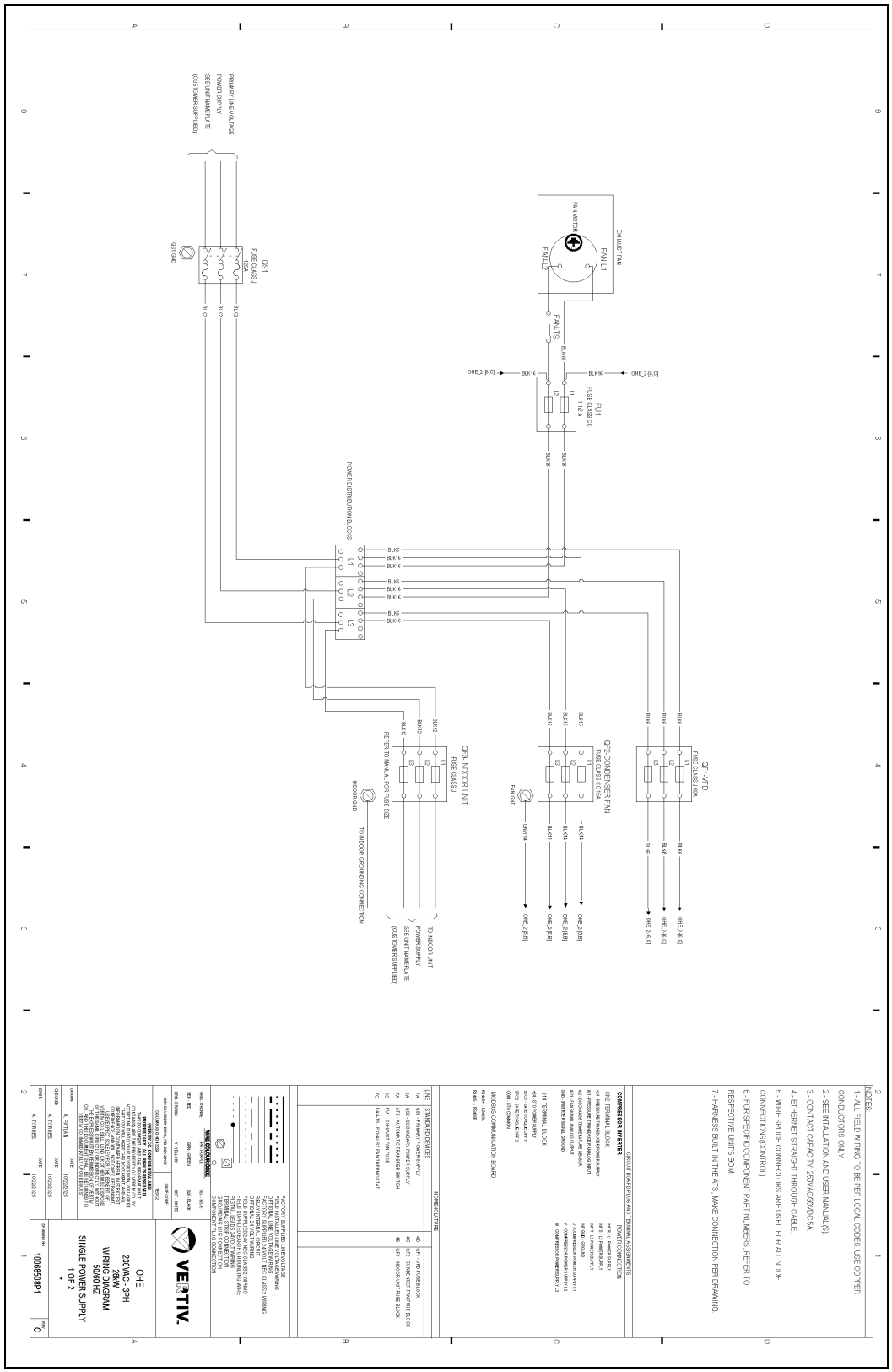


Figure 11.13 Electrical Schematic for 28 kW 208/230V, 3 Phase, 50/60 Hz, CoolPhase Condensing Units (Standard and Low Ambient) Page 2.

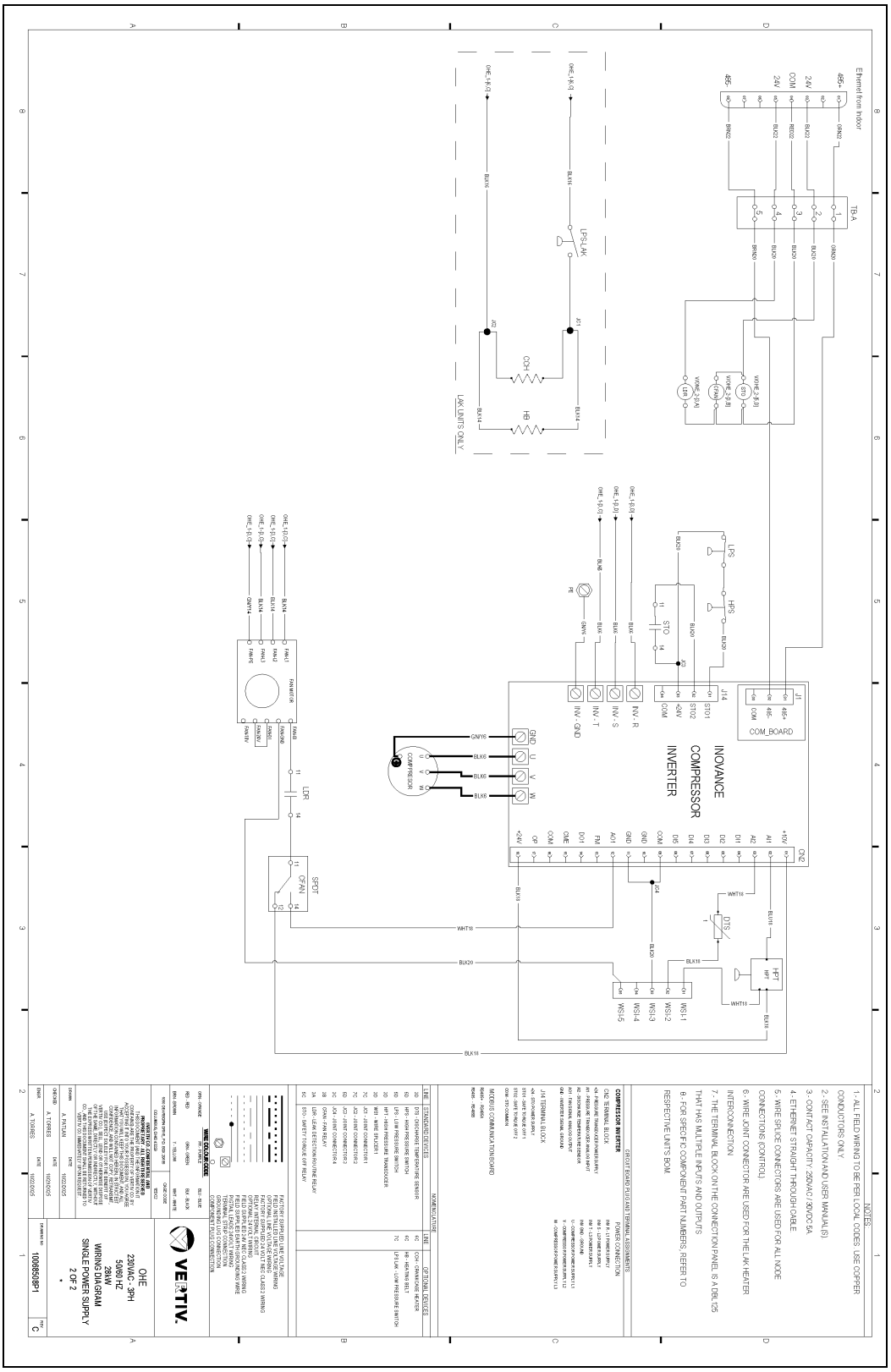


Figure 11.14 Electrical Schematic for 28 kW 460V, 3 Phase, 60 Hz, Single Supply, CoolPhase Condensing Units (Standard and Low Ambient) Page 1.

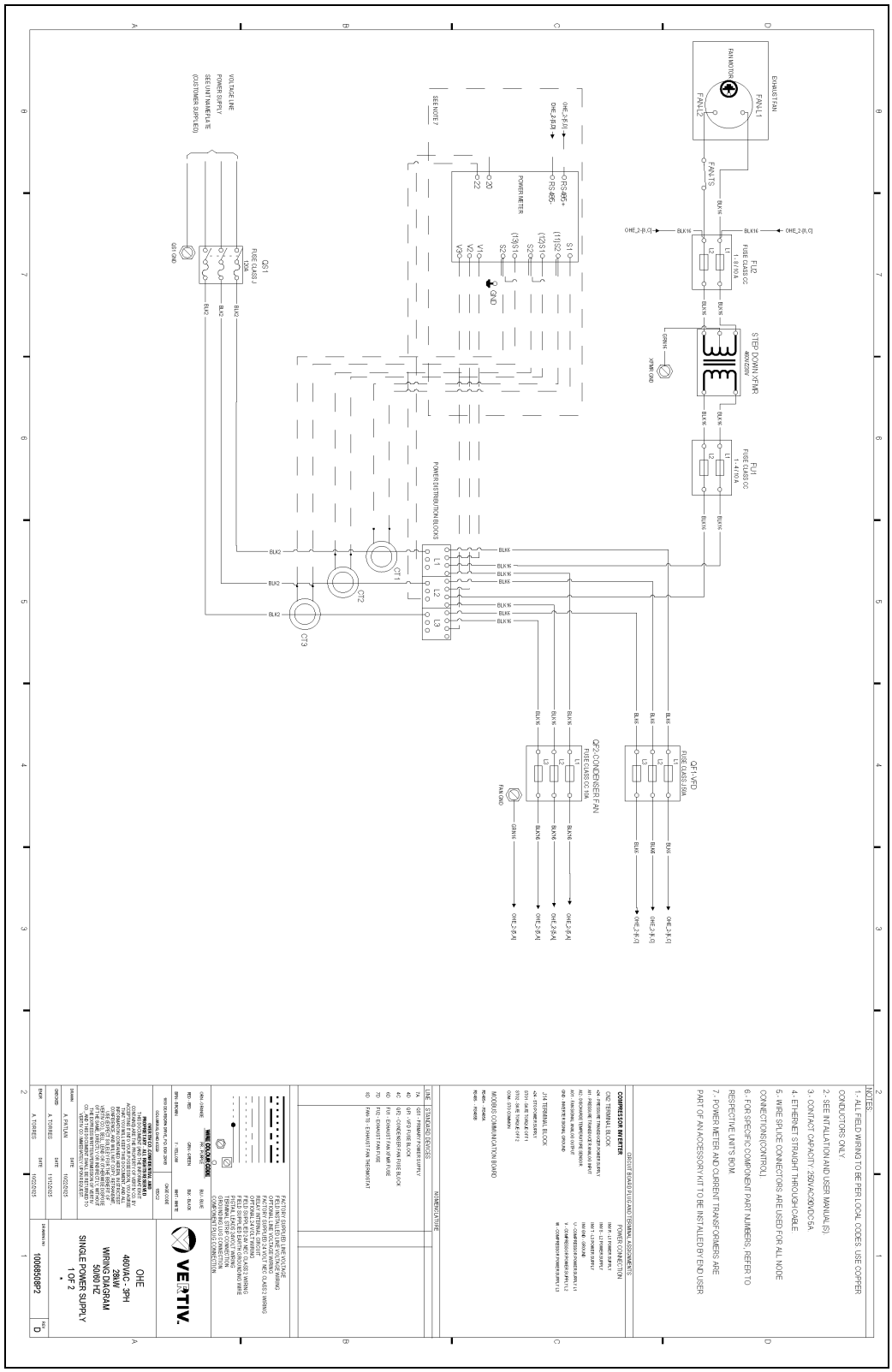
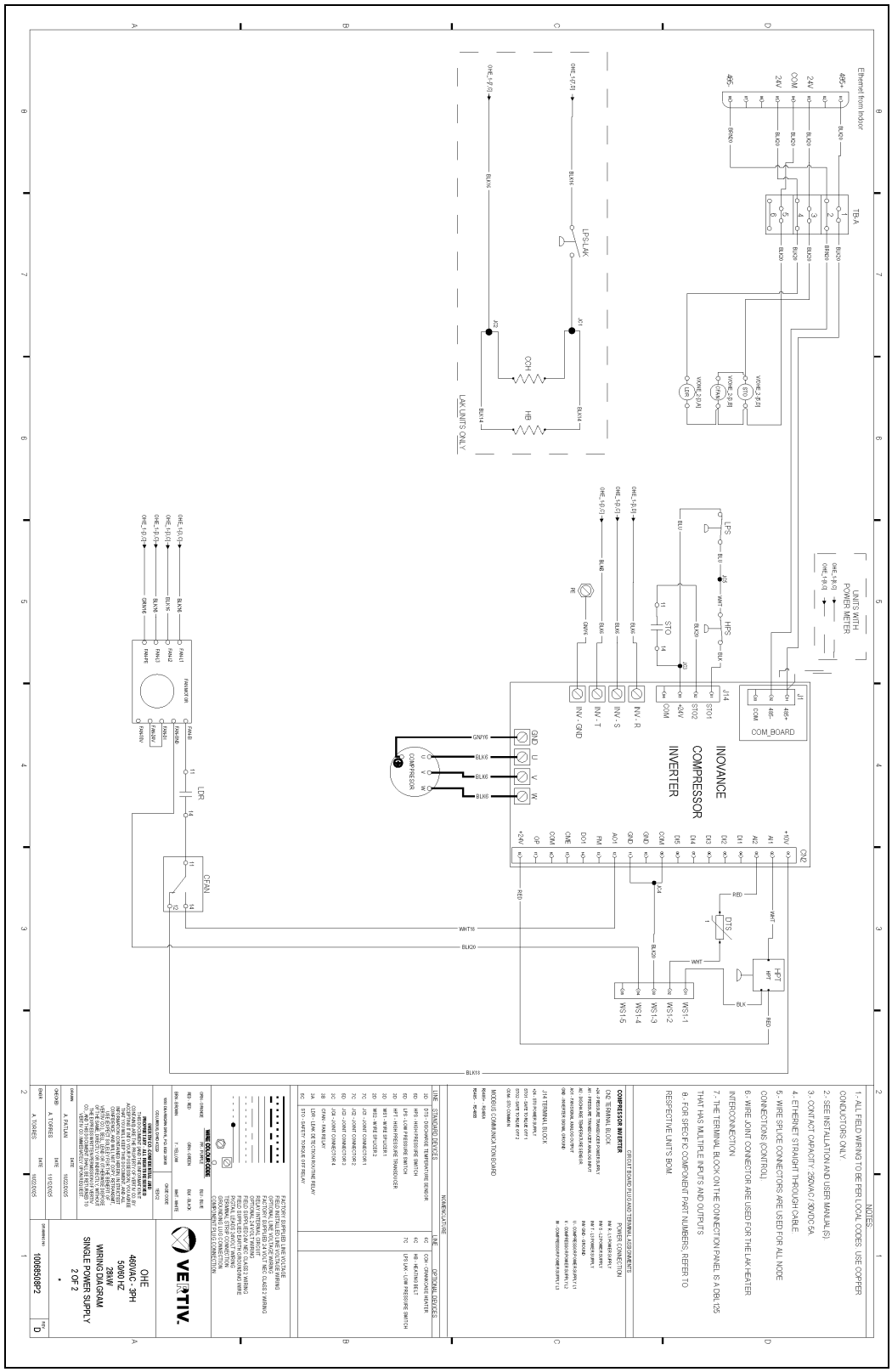


Figure 11.15 Electrical Schematic for 28 kW 460V, 3 Phase, 60 Hz, CoolPhase Condensing Units (Standard and Low Ambient) Page 2.



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