



Liebert®

Mini-Mate™ Variable Capacity
Thermal Management Systems

Installer/User Guide

3, 4 and 5 Ton (10.5, 14 and 17.5 kW) Capacity, Ceiling Mounted, 60 Hz

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Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures. Visit <https://www.Vertiv.com/en-us/support/> for additional assistance.

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1 IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important safety instructions that should be followed during the installation and maintenance of the Liebert® Mini-Mate. Read this manual thoroughly before attempting to install or operate this unit.

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

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



WARNING! Arc flash and electric shock hazard. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Liebert® 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 that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.



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



WARNING! Risk of electric shock. Can cause serious injury or death. The Liebert® iCOM microprocessor 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 Liebert® iCOM control. Open all local and remote electric power disconnect switches and verify with a voltmeter that power is Off before working on any component of the system.



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



WARNING! Risk of over-pressurization of the refrigeration system. Can cause explosive discharge of high-pressure refrigerant, loss of refrigerant, environmental pollution, equipment damage, injury, or death. This unit contains fluids and gases under high pressure. Use extreme caution when charging the refrigerant system. Do not pressurize the system higher than the design pressure marked on the unit's nameplate. Relieve pressure before cutting into or making connections/disconnections to the piping system. Local building or plumbing codes may require installing a pressure-relief device in the system. Consult local building and plumbing codes for installation requirements of additional pressure-relief devices when isolation valves are field installed. Do not isolate any refrigerant circuit from over-pressurization protection. Do not close off any field-installed, refrigerant-line isolation valves for repairs unless a pressure-relief valve is field-installed in the line between the isolation valve and the check valve. The pressure-relief valve must be rated 5% to 10% higher than the system-design pressure. An increase in ambient temperature can cause the pressure of the isolated refrigerant to rise and exceed the system-design pressure rating (marked on the unit nameplate).



WARNING! Risk of improper moving. Can cause equipment damage, injury or death. Use only lifting equipment that is rated for the unit weight by an OSHA-certified rating organization. The center of gravity varies depending on the unit size and selected options. The slings must be equally spaced on either side of the center of gravity indicator. Unit weights are listed in [Table 3.2](#) on page 13.



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



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



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



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



CAUTION: Risk of improper moving, lifting and handling. Can cause equipment damage or injury. Only properly trained and qualified personnel should work on this equipment. Evaporator fan modules weigh in excess of 37 lb (17 kg). Use proper lifting techniques and wear appropriate, OSHA-approved PPE to avoid injury and dropping the fan module during removal. Equipment used in handling/lifting, and/or installing the fan assembly must meet OSHA requirements. Use handling/lifting equipment rated for the weight of the fan assembly. Use ladders rated for the weight of the fan assembly and technicians if used during installation. Refer to handling/lifting, and/or installation equipment operating manual for manufacturer's safety requirements and operating procedures.



CAUTION: Risk of improper moving, lifting and handling. Can cause equipment damage or injury. Only properly trained and qualified personnel should work on this equipment. Condenser fan modules weigh in excess of 37 lb (17 kg). Use proper lifting techniques and wear appropriate, OSHA-approved PPE to avoid injury and dropping the fan module during removal. Equipment used in handling/lifting, and/or installing the fan assembly must meet OSHA requirements. Use handling/lifting equipment rated for the weight of the fan assembly. Use ladders rated for the weight of the fan assembly and technicians if used during installation. Refer to handling/lifting, and/or installation equipment operating manual for manufacturer's safety requirements and operating procedures.



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



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



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

NOTICE

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

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

NOTICE

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

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

NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

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

NOTICE

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

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

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

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

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

NOTICE

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

NOTICE

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

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

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

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

NOTICE

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

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

NOTICE

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

NOTICE

Risk of improper water supply. Can reduce humidifier efficiency or obstruct humidifier plumbing.

Do not use a hot water source. It will cause deposits that will eventually block the fill-valve opening.

NOTICE

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

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

Sagging condensate drain lines may inadvertently create an external trap.

NOTICE

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

NOTICE

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

NOTICE

Risk of improper storage. Can cause unit damage.

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

Agency Listed

Standard 60-Hz units are CSA Certified to the harmonized U.S. and Canadian product safety standard CSA C22.2 No 236/UL 1995 for "Heating and Cooling Equipment" and are marked with the CSA c-us logo.



2 NOMENCLATURE AND COMPONENTS

This section describes the model number for Liebert® Mini-Mate units and components.

2.1 Mini-Mate Model Number Nomenclature

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

[Model Number Digit Definitions](#) below describes each digit of the model number.

Table 2.1 Mini-Mate 25-Digit Configuration Number

Model Number Digits 1 to 10										Model Details											Model Number Digits 11 to 14			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
M	T	O	6	O	H	E	1	A	O	S	H	2	O	D	O	U	O	P	O	O	A	#	#	#

Table 2.2 Model Number Digit Definitions

Digit and Description
Digits 1 and 2 = Unit Family MT = Mini-Mate Ceiling System
Digits 3, 4, 5 = Nominal Cooling Capacity 036 = 36 kBTuh 048 = 48 kBTuh 060 = 60 kBTuh
Digit 6 = Air Direction and Discharge H = Horizontal air flow
Digit 7 = System type E = Split System evaporator
Digit 8 = Fan type 1 = Direct Drive EC motor (variable-speed)
Digit 9 = Supply power A = 460 V / 3 ph / 60 Hz B = 575 V / 3 ph / 60 Hz (048 and 060 models only) C = 208 V / 3 ph / 60 Hz (048 and 060 models only) D = 230 V / 3 ph / 60 Hz (048 and 060 models only) P = 208-230/1ph/60Hz (036 model only) Y = 208-230/3ph/60Hz (036 model only)
Digit 10 = Evaporator Type O = Split System evaporator
Digit 11 = Humidifier O = No humidifier S = Steam-gen canister humidifier

Table 2.2 Model Number Digit Definitions (continued)

Digit and Description
Digit 12 = Display type H = 9-in. remote display, IntelliSlot-based monitoring (048 and 060 models only) 1 = 9-in. remote display, iCOM-based monitoring (036 model only)
Digit 13 = Reheat 0 = No reheat 2 = Electric reheat 5 = SCR reheat (048 and 060 models only)
Digit 14 = Coil, Valve, Pressure 0 = Split System evaporator
Digit 15 = High-voltage options D = Non-locking disconnect, 5k SCCR (048 and 060 models only) L = Locking disconnect, 5kA SCCR (036 model only) M = Locking disconnect, 65k SCCR (048 and 060 models only)
Digit 16 = Low-voltage options 0 = None L = Low voltage terminal package (LVTP)
Digit 17 = Monitoring Cards 0 = No card, IntelliSlot only (048 and 060 models only) U = IS-UNITY-DP card, factory-installed (048 and 060 models only) B = BACnet, Modbus, SNMP using iCOM board (036 model only)
Digit 18 = Sensors 0 = None S = Smoke sensor H = High Temperature sensor F = Smoke and high temperature sensor
Digit 19 = Packaging P = Domestic C = Wood crate export
Digits 20, 21 = Future use
Digit 22 = Factory configuration code A = No SFA's (Any Alpha letter except S) S = SFA
Digit 23-25 = Factory Configuration Number

2.2 Component Location

The unit component locations are described in the submittal documents included in the [Submittal Drawings](#) on page 63.

The following tables list the relevant documents by number and title.

Table 2.3 Component Location Drawings

Document Number	Title
DPN004808	Evaporator Unit, 3 Ton
DPN004179	Evaporator Unit, 4 Ton and 5 Ton

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3 PRE-INSTALLATION PREPARATION AND GUIDELINES

NOTE: Before installing unit, determine whether any building alterations are required to run piping, wiring and duct work. Follow all unit dimensional drawings and refer to the submittal engineering dimensional drawings of individual units for proper clearances.

Refer to [Model Number Digit Definitions](#) on page 7, and submittal drawings to determine the type of system being installed and anticipate building alterations, piping and duct work needed.

The unit dimensions, pipe connection locations, and piping schematics are described in the submittal documents included in the [Submittal Drawings](#) on page 63.

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

3.1 Planning Dimensions

The unit dimensions described in the submittal documents included in the [Submittal Drawings](#) on page 63.

The following table lists the relevant documents by number and title.

Table 3.1 Dimension Planning Drawings

Document Number	Title
DPN004800	Cabinet dimensions, 3 ton DX module
DPN004055	Cabinet dimensions, 4 ton and 5 ton DX module
Filter and Ducting Options	
DPN004805	Dimensional data, filter box and duct flange, 3 ton
DPN004807	Dimensional data, air distribution plenum 3 ton
DPN004166	Dimensional data, filter box and duct flange, 4 and 5 ton
DPN004842	Dimensional data, bottom discharge grille, 4 and 5 ton

3.2 Location Considerations

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

The evaporator is usually mounted above the dropped ceiling and must be securely mounted to the roof structure. For ducted systems, the evaporator may be located in a different room. See [Guidelines for Ducted Systems](#) on page 37 for additional guidelines. For a split system with an air cooled, outdoor condensing unit, the condensing unit may be mounted on the roof or remotely in an outdoor area. See [Location Considerations for Outdoor Condensing Unit](#) on the next page for additional guidelines.

Refer to [Refrigerant Line Sizes and Equivalent Lengths](#) on page 18 for maximum refrigerant line lengths.

The ceiling and ceiling supports of existing buildings may require reinforcement. See [Mini-Mate Unit Weights](#) on the facing page. Be sure to follow all applicable national and local codes.

For a split system with an indoor condensing unit, the condensing unit may be:

- Installed above the suspended ceiling near the evaporator.
- In any remote indoor area, subject to the requirements detailed in **Table 4.3** on page 17.

Refer to [Refrigerant Line Sizes and Equivalent Lengths](#) on page 18 for maximum refrigerant line lengths.

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

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

3.2.1 Location Considerations for Outdoor Condensing Unit

Observe the following when planning the installation of the outdoor unit:

- To ensure a satisfactory air supply, locate air cooled condensing units in an environment with clear air, away from loose dirt and foreign matter that may clog the coil.
- Condensing units must not be located in the vicinity of steam, hot air, or fume exhausts or closer than 18 inches from a wall, obstruction or adjacent unit.
- Avoid areas where heavy snow will accumulate at air inlet and discharge locations.
- The condensing unit should be located for maximum security and maintenance accessibility. Avoid ground-level sites with public access. Install a solid base, capable of supporting the weight of the condensing unit.
- The base should be at least 2 in. (51 mm) higher than the surrounding grade and 2 in. (51 mm) larger than the dimensions of the condensing unit base. For snowy areas, a base of sufficient height to clear snow accumulation must be installed.

Before beginning, refer to [Piping and Refrigerant Requirements](#) on page 15 for unit placement, piping guidelines, and refrigerant charge requirements for your system.

3.3 Connections and System Setup

- The unit requires a drain, which must comply with all applicable codes. This drain line may contain boiling water. See [Drain Line Installation Requirements](#) on page 28, for details.
- Electrical service is required for all models. Electrical service must conform to national and local electrical codes. See equipment nameplate for details.
- Plan the routing of wiring, piping, and duct work to the unit. Refer to the appropriate piping connection location drawings, piping schematics, and electrical connection drawings for your system in .

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

3.4 Operating Conditions

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

3.4.1 Cooling, Humidification, and Dehumidification

For operation in the Cooling, Humidification, or Dehumidification modes, the Liebert® Mini-Mate unit's return air requirements for proper unit operation are:

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

3.4.2 Heating

For operation in the Heating mode, the Liebert® Mini-Mate unit's return air requirements for proper unit operation are:

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

3.5 Mini-Mate Unit Weights

Table 3.2 Mini-Mate Unit Weights

Model #	Weight, lb (kg)
MT036	328 (149)
MT048*	498 (226)
MT060*	498 (226)
* for 575-V units, add 32 lb (14.5 kg)	

3.6 Equipment Inspection and Handling

SAFETY INFORMATION



WARNING! Risk of improper moving, lifting, or handling of the unit. Can cause equipment damage, injury or death. Read all of the following instructions and verify that all lifting and moving equipment is rated for the weight of the unit before attempting to move, lift, remove packaging from or prepare the unit for installation. Unit weights are specified in section [Mini-Mate Unit Weights](#) above.



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

NOTICE

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

NOTICE

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

NOTICE

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

Upon arrival of the unit and before unpacking:

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

Equipment Recommended for Handling the Unit:

- Forklift
- Pallet jack

4 PIPING AND REFRIGERANT REQUIREMENTS

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

Refer to specific text and detailed diagrams in this manual for other unit specific piping requirements.

The following pipe connections are required:

- Refrigerant piping connections between the evaporator unit and the condensing unit.
- A drain line from the unit or a drain line from the optional condensate pump (if applicable).
- A drain line from the secondary drain pan (if applicable).
- A water supply line to the optional humidifier (if applicable).
- On water/glycol systems: connections to a water or glycol loop. See [Water/Glycol Loop Piping Guidelines](#) on page 21, for additional requirements.

The pipe connection locations, piping general arrangement, and schematics are described in the submittal documents included in the [Submittal Drawings](#) on page 63.

The following tables list the relevant documents by number and title.

Table 4.1 Piping General Arrangement Drawings

Document Number	Title
Air Cooled System	
DPN004060	Piping arrangement, 3, 4 and 5 ton split system
Water/Glycol Cooled System	
DPN004893	Piping arrangement, 3, 4 and 5 ton split system

Table 4.2 Piping Connection Drawings

Document Number	Title
DPN004801	Primary connection locations, 3 ton DX module
DPN004806	Condensate pump connection locations, 3 ton
DPN004056	Primary connection locations, 4 ton and 5 ton DX module
DPN004077	Condensate pump connection locations, 4 ton and 5 ton

4.1 Refrigerant Piping and Charging



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

Consult local building and plumbing codes for installation requirements of additional pressure relief devices when isolation valves are field installed. Do not isolate any refrigerant circuits from over-pressurization protection.

NOTICE

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

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

4.1.1 Refrigerant Piping Guidelines for Air Cooled Systems

- Evaporators and condensing units ship with an inert gas holding charge. Do not vent the evaporator and condensing unit until all refrigerant piping is in place, ready for connection to the unit and condensing unit.
- Use copper piping with a brazing alloy with a minimum temperature of 1350°F (732°C), such as Sil-Fos. Avoid soft solders, such as 50/50 or 95/5.
- Use a flow of dry nitrogen through the piping during brazing to prevent formation of copper oxide scale inside the piping. When copper is heated in the presence of air, copper oxide forms. POE oils will dissolve these oxides from inside the copper pipes and deposit them throughout the system, clogging filter driers and affecting other system components.
- A pure dry nitrogen flow of 1-3 ft³/min (0.5-1.5 l/s) inside the pipe during brazing is sufficient to displace the air. Control the flow using a suitable measuring device.
- Ensure that the tubing surfaces to be brazed are clean and that all burrs have been removed from the ends of the tubes.
- Ensure that all loose material has been cleaned from inside the tubing before brazing.
- Protect all refrigerant line components within 18 in. (460 mm) of the brazing site by wrapping them with a wet cloth or with a suitable heat sink compound.
- Isolate piping from building using vibration isolating supports.
- When sealing openings in walls and to reduce vibration transmission, use a soft, flexible material to pack around the tubes to prevent tube damage.
- When installing remote condensing units above the evaporator, the suction gas lines should be trapped at the evaporator. These traps will retain refrigerant oil in the off cycle. When the unit starts, oil in the traps is carried up the vertical risers and returns to the compressors. For rises over 25 ft (7.6 m), trap every 20 ft (6 m) or evenly-divided.
- Consult factory if piping run exceeds 150 ft (46 m) equivalent length.
- Keep piping clean and dry, especially on units with R-410A refrigerant.
- Avoid piping runs through noise sensitive areas.
- Do not run piping directly in front of discharge air stream.
- Refrigerant oil – do not mix oil types.

Refer to ASHRAE Refrigeration Handbook for general, good practice refrigeration piping.

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

NOTE: Proper safety equipment and proper refrigeration tools are required when working with R-410A refrigerant. Check unit serial tag for correct refrigerant type before topping off or recharging a system.

NOTE: Refrigerant R-410A uses a POE (polyolester) lubricant. The refrigerant must be introduced and charged from the cylinder only as a liquid.

NOTE: When installing field piping, you must take care to protect all refrigerant lines from the atmosphere especially when using refrigerants with POE oils. Do not allow the piping to stand open to air for more than 15 minutes. Units designed for R-410A have a compressor that contains POE oil, which quickly absorbs water from the air. The longer that the refrigerant piping is left open to air, the harder it will be to fully evacuate the system. If left open too long, the POE oil may require replacement to achieve the required vacuum level.

- Refer to [Refrigerant Line Sizes and Equivalent Lengths](#) on the next page, for recommended refrigerant piping sizes based on equivalent pipe lengths.
- Refer to the condensing unit's Installer/User Guide for the complete charging procedure of the system.

4.1.2 Piping when Condensing Unit is Above or Below Evaporator

Refer to **Table 4.3** below for the maximum vertical rise/fall between condensing unit and evaporator.

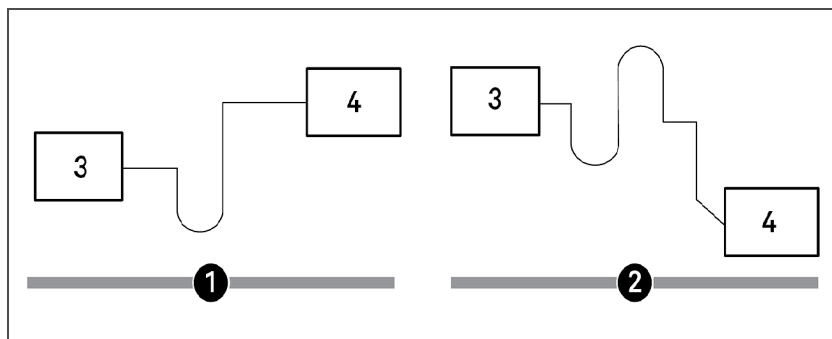
When installing remote condensing units above the evaporator, trap the suction gas line at the evaporator as shown in **Figure 4.1** below. Traps recommended at the base of riser exceeding 5 ft. (1.5 m) and every 20 ft. (6 m) of vertical rise. This trap will retain refrigerant oil during the "Off" cycle. When the unit starts, oil in the trap is carried up the vertical riser and returns to the compressor.

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

Table 4.3 Pipe Length and Condensing Unit Elevation Relative to Evaporator

Maximum Equivalent Pipe Length, ft. (m)	Maximum Condensing Unit Level Above Evaporator, ft. (m)	Maximum Condensing Unit Level Below Evaporator, ft. (m)
150 (45)	50 (15)	15 (4.6)

Figure 4.1 Refrigerant Piping Diagram When Condenser is Above or Below Evaporator



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

4.2 Refrigerant Line Sizes and Equivalent Lengths

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

Table 4.4 Recommended Refrigerant Line Sizes, O.D. cu by Equivalent Length

Equivalent Length, ft (m)	3 Ton		4 Ton		5 Ton	
	Suction	Liquid	Suction	Liquid	Suction	Liquid
50 (15)	7/8	1/2	7/8	1/2	1-1/8	1/2
75 (23)	7/8	1/2	1-1/8	1/2	1-1/8	5/8
100 (30)	7/8	1/2	1-1/8	5/8	1-1/8	5/8
125 (38)	7/8	1/2	1-1/8 ¹	5/8	1-1/8	5/8
150 (45)	7/8	1/2	1-1/8	5/8	1-1/8	5/8

Consult factory for proper line sizing for runs longer than maximum equivalent length shown.

1. Use one line size smaller on suction lines for vertical risers.

Source: DPN000788 Rev. 13

4.2.1 Refrigerant Charge Requirements for Air Cooled Systems

To calculate the charge requirements:

1. Determine the charge for your units by model number from the following tables.
2. Determine the charge for the piping by line size and length.
3. Add these all together to obtain the total refrigerant charge for your system.

Table 4.5 Indoor Evaporator Approximate R-410A Refrigerant Charge

Model #	Charge, lb (kg)
MT036HE	1 (0.45)
MT048HE	2.2 (1.0)
MT060HE	2.2 (1.0)

Table 4.6 Interconnecting Piping Refrigerant Charge for R-410A using Type L Copper Tube

Line Size, O.D., in.	Liquid Line, lb/100 ft (kg/30 m)	Suction Line, lb/100 ft (kg/30 m)
3/8	3.2 (1.4)	—
1/2	5.9 (2.7)	0.2 (0.1)
5/8	9.6 (4.3)	0.4 (0.2)
3/4	14.3 (6.4)	0.6 (0.3)
7/8	19.8 (8.8)	0.8 (0.4)
1-1/8	33.8 (15.1)	1.4 (0.6)
1-3/8	51.5 (23.0)	2.1 (1.0)

Source: DPN003099 Rev. 1

Table 4.7 PFD Condensing Unit R-410A Refrigerant Charge

Model #	Charge, lb (kg)
PFD037A-*L1	13.4 (6.1)
PFD037A-*H1	27 (12.2)
PFD054A-*L1	27 (12.2)
PFD067A-*L1	27 (12.2)
PFDZ67A-*L1	57 (25.8)
PFD067A-*H1	57 (25.8)

4.2.2 Additional Oil Requirements for Digital Scroll Compressors

NOTICE

Risk of improper compressor lubrication. Can cause compressor and refrigerant system damage.

Failure to use oil types, viscosities and quantities recommended by the compressor manufacturer may reduce compressor life and void the compressor warranty.

- Do not mix polyolester (POE) and mineral-based oils.
- Do not mix oils of different viscosities.
- Consult your Vertiv sales representative, visit <https://www.Vertiv.com/en-us/support/>, or contact the compressor manufacturer if questions arise.

System charges may require additional oil charge to be added. See **Table 4.8** below, for the amount required for various system charge levels.

After the system has been fully charged with refrigerant, use a hand pump to add the additional oil at the suction side of the system while the system is running.

On the tag marked "Oil Added Field Service Record," attached to each compressor, record the date the oil was added and the amount of oil added.

Table 4.8 Additional Oil Required per Refrigerant Charge

	3 Ton	4 Ton	5 Ton
Refrigerant System Charge per Circuit, lb (kg) *	Additional Oil Required Per Circuit, oz (ml)		
< 40 (18.1)	0	0	0
40 (18.1)	4 (120)	4 (120)	6 (180)
50 (22.7)	6 (180)	6 (180)	9 (270)
60 (27.2)	8 (240)	8 (240)	12 (350)
70 (31.8)	10 (300)	10 (300)	15 (440)
80 (36.3)	12 (350)	12 (350)	18 (530)
* System Charge = indoor unit + condensing unit + refrigerant lines. For system charges over 80lb. (36.3 kg), consult your Vertiv representative. Source: DPN003950 Rev 5.			

Table 4.9 Compressor Oil types for R-410A Refrigerant

Compressor Type	Oil Type
Copeland Digital Scroll	POE Oil - ISO 32 Centistoke Viscosity ¹
1. Use Copeland POE Oil ULTRA 32-3MAF or other Copeland approved oils. Source: DPN003950, Rev. 5	

4.3 Water/Glycol Loop Piping Guidelines



WARNING! Risk of improper piping installation, leak checking, fluid chemistry and fluid maintenance can cause equipment damage and personal injury. Installation and service of this equipment should be done only by qualified personnel who have been specially trained in the installation of air conditioning equipment and who are wearing appropriate, OSHA approved PPE.

NOTICE

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

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

NOTICE

Risk of piping system corrosion and freezing fluids. Can cause leaks resulting in equipment and expensive building damage. Cooling coils and piping systems are at high risk of freezing and premature corrosion. Fluids in these systems must contain an inhibitor to prevent premature corrosion.

The system coolant fluid must be analyzed by a competent fluid treatment specialist before start up to establish the inhibitor level and evaluated at regularly scheduled intervals throughout the life of the system to determine the pattern of inhibitor depletion. The fluid complexity and variations of required treatment programs make it extremely important to obtain the advice of a competent and experienced fluid treatment specialist and follow a regularly scheduled coolant fluid system maintenance program.

Fluid chemistry varies greatly as do the required additives, called inhibitors, that reduce the corrosive effect of the fluids on the piping systems and components.

The chemistry of the coolant fluid used must be considered, because some sources may contain corrosive elements that reduce the effectiveness of the inhibited formulation. Sediment deposits prevent the formation of a protective oxide layer on the inside of the coolant system components and piping. The coolant fluid must be treated and circulating through the system continuously to prevent the buildup of deposits and/or growth of bacteria. Proper inhibitor maintenance must be performed to prevent corrosion of the system.

Consult fluid manufacturer for testing and maintenance of inhibitors.

Commercial grade coolant fluid is generally less corrosive to the common metals of construction than water itself. It will, however, assume the corrosivity of the coolant fluid from which it is prepared and may become increasingly corrosive with use if not properly inhibited.

Vertiv recommends installing a monitored fluid detection system that is wired to activate the automatic closure of field installed coolant fluid supply and return shut-off valves to reduce the amount of coolant fluid leakage and consequential equipment and building damage. The shut-off valves must be sized to close off against the maximum coolant fluid system pressure in case of a catastrophic fluid leak.

NOTICE

Risk of no-flow condition. Can cause equipment damage.

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

- Use copper piping with a brazing alloy with a minimum temperature of 1350°F (732°C), such as Sil-Fos. Avoid soft solders, such as 50/50 or 95/5.
- Follow local piping codes and safety codes.
- Qualified personnel must install and inspect system piping.
- The water/glycol cooled system will operate in conjunction with a cooling tower, city water or drycooler.
- Contact a local water consultant regarding water quality, corrosion protection and freeze protection requirements.
- Install manual shut-off valves at the supply and return line to each unit to permit routine service and emergency isolation of the unit.
- When the fluid quality is poor, we recommend installing a 16-20# mesh Y-strainer filter in the supply line to extend the service life of the coaxial condensers. These filters must be easily replaced or cleaned.
- Install a monitored, fluid-detection system that is wired to activate the automatic closure of field installed coolant fluid supply and return shut-off valves to reduce the amount of coolant fluid leakage and consequential equipment and building damage. The shut-off valves must be sized to close off against the maximum coolant fluid system pressure in case of a catastrophic fluid leak.

Coolant Regulating Valve Requires No Adjustment

Water/glycol cooled units include a coolant flow regulating valve that is factory adjusted and should not need field adjustment.

Contact Vertiv technical support before making any adjustments.

4.3.1 Refrigerant Charge Requirements for Water/Glycol Cooled Systems

To calculate the charge requirements:

1. Determine the charge for your units by model number from the following tables.
2. Determine the charge for the piping by line size and length.
3. Add these all together to obtain the total refrigerant charge for your system.

Table 4.10 Water/Glycol, Indoor Condenser R-410A Refrigerant Charge

Model #	Charge, lb (kg)
MTC38W	4.2 (1.9)
MTC55W	4.2 (1.9)
MTC69W	4.2 (1.9)

Table 4.11 Indoor Evaporator Approximate R-410A Refrigerant Charge

Model #	Charge, lb (kg)
MT036HE	1 (0.45)
MT048HE	2.2 (1.0)
MT060HE	2.2 (1.0)

Table 4.12 Interconnecting Piping Refrigerant Charge for R-410A Using Type L Copper Tube

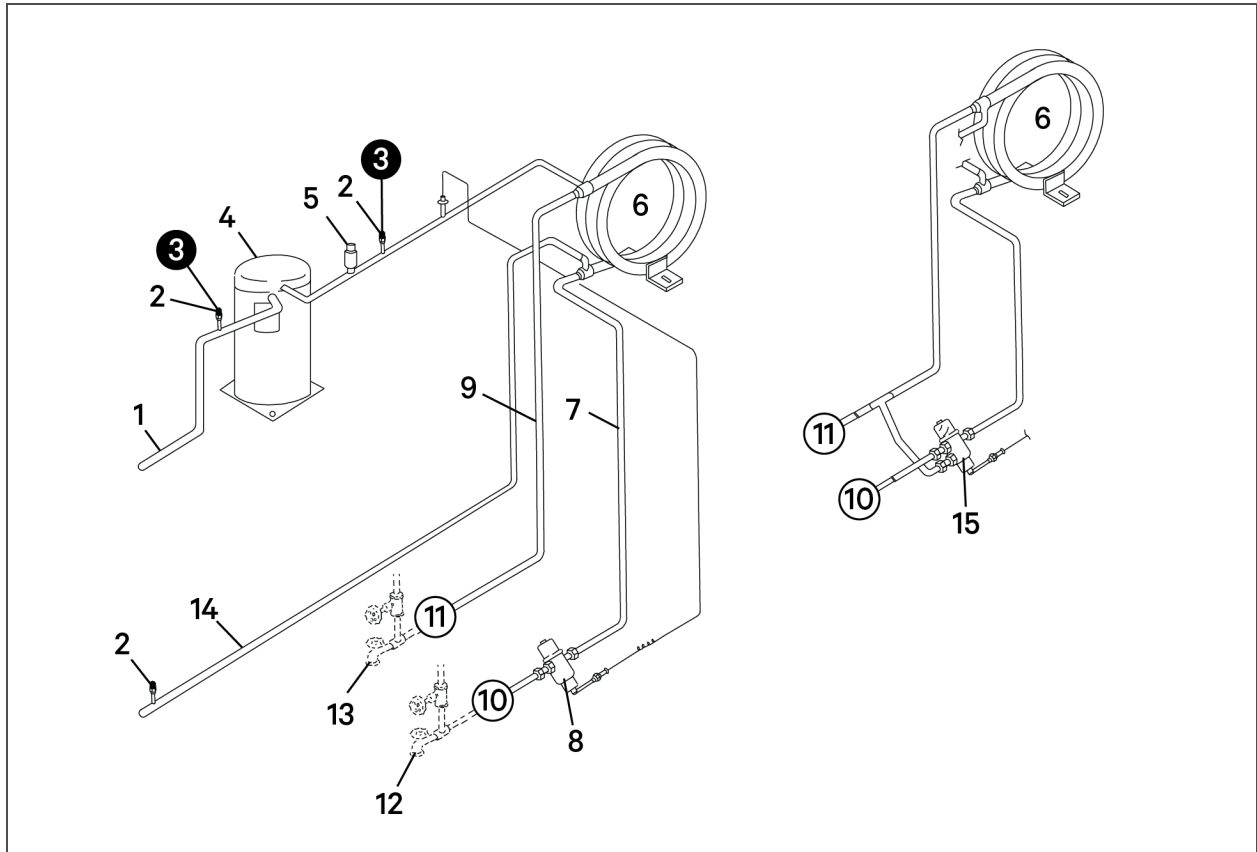
Line Size, O.D., in.	Liquid Line, lb/100 ft (kg/30 m)	Suction Line, lb/100 ft (kg/30 m)
3/8	3.2 (1.4)	—
1/2	5.9 (2.7)	0.2 (0.1)
5/8	9.6 (4.3)	0.4 (0.2)
3/4	14.3 (6.4)	0.6 (0.3)
7/8	19.8 (8.8)	0.8 (0.4)
1-1/8	33.8 (15.1)	1.4 (0.6)
1-3/8	51.5 (23.0)	2.1 (1.0)

Source: DPN003099 Rev. 1

4.3.2 Evacuation and Leak Testing Water/Glycol Cooled Systems

For proper leak check and evacuation, you must open all system valves and account for all check valves, see **Figure 4.2** on the next page.

Figure 4.2 Valves and Connections for Water/Glycol Condensing Unit



Item	Description
1	Suction line
2	Schrader port with valve core
3	Apply a manifold gauge hose on the suction line and discharge line Schrader port.
4	2-stage scroll compressor
5	High-pressure switch
6	Tube-in-tube condenser
7	Water/Glycol supply line
8	2-way water regulating valve
9	Water/Glycol return line
10	Fluid supply to unit
11	Fluid return from unit
12	Hose bibs (required, field supplied)
13	Shut-off valves (required, field supplied)
14	Liquid line

Item	Description
15	3-way water regulating valve (optional)

To evacuate and leak test the system:

1. Connect a manifold gauge hose on the discharge and suction line Schrader ports, open the service valve, and place a 150 Psig (1034 kPa) charge of dry nitrogen with a tracer of refrigerant, then check the system for leaks with a suitable leak detector.
2. After completion of leak testing, release the test pressure, (observe local code) and pull an initial deep vacuum of 500 microns on the system with a suitable pump.
3. After four hours, check the pressure readings and, if they have not changed, break vacuum with dry nitrogen. Pull a second and third vacuum to 500 microns or less. Re-check the pressure after two hours. When the three checks are complete, proceed to [Charging Water/Glycol Cooled Systems](#) on the next page.

4.3.3 Charging Water/Glycol Cooled Systems



WARNING! Risk of over-pressurization of the refrigeration system. Can cause explosive discharge of high-pressure refrigerant, loss of refrigerant, environmental pollution, equipment damage, injury, or death. This unit contains fluids and gases under high pressure. Use extreme caution when charging the refrigerant system. Do not pressurize the system higher than the design pressure marked on the unit's nameplate. Relieve pressure before cutting into or making connections/disconnections to the piping system. Local building or plumbing codes may require installing a pressure-relief device in the system. Consult local building and plumbing codes for installation requirements of additional pressure-relief devices when isolation valves are field installed. Do not isolate any refrigerant circuit from over-pressurization protection.



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



CAUTION: Risk of contacting caustic substances. Can cause injury. Avoid touching or contacting the gas and oils with exposed skin. Severe burns will result. Wear appropriate, OSHA-approved PPE when handling contaminated parts.

NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

R-410A is a blended refrigerant and must be introduced and charged from the cylinder only as a liquid.

When adding liquid refrigerant to an operating system, it may be necessary to add the refrigerant through the valve in the compressor suction line. Care must be exercised to avoid damage to the compressor. We recommend connecting a sight glass between the charging hose and the compressor suction service valve.

This will permit adjustment of the cylinder hand valve so that liquid can leave the cylinder while allowing vapor to enter the compressor.

To calculate the charge for the system:

1. Check the nameplate on the indoor unit for refrigerant type to use.
2. Refer to [Refrigerant Charge Requirements for Water/Glycol Cooled Systems](#) on page 22, and calculate the amount of charge for the system including the evaporator, condensing unit, and interconnecting piping.
3. Accurately weigh-in as much of the system charge as possible before starting the unit.

4.3.4 Optimizing Refrigerant Charge on Water/Glycol Units

1. Operate the unit at full heat load, normal room conditions and normal water/glycol fluid temperatures for a minimum of 30 minutes before measuring stable unit superheat and sub-cooling temperatures and adjusting charge levels.
 - Condensing temperatures should be in range of 100 to 130°F (38 to 54°C) depending on fluid type and fluid temperature.
 - Full heat load is required to stabilize the system.
2. Attach pressure and temperature instruments to the liquid line of the condensing unit. Measure the initial sub-cooling.

NOTE: To determine sub-cooling measurement, a liquid line pressure reading (at the factory installed Schrader tap) must be measured along with the temperature reading on the liquid line. Convert the liquid line pressure reading into a liquid temperature by utilizing a pressure temperature guide. Subtract the measured temperature from the liquid saturation temperature. The difference is sub-cooling.

3. Adjust refrigerant charge levels as needed to achieve sub-cooling range of 8 to 10°F (4.4 to 5.5°C) while maintaining full load conditions.

4.3.5 Documenting Refrigerant Charge on Water/Glycol Cooled Units

When the unit is charged, you must record the total system charge value on the condensing unit's serial tag. The total system charge includes the evaporator, condensing unit, and interconnecting lines.

4.4 Drain and Humidifier Piping

The following pipe connections are required:

- A drain line from the evaporator unit drain connection.
- A drain line from the secondary drain pan (if applicable).
- A water supply line to the optional humidifier (if applicable).

NOTICE

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

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

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

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

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

4.4.1 Water Supply Line to the Humidifier

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

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

To install the water supply:

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

NOTICE

Risk of improper tightening of the piping fittings. Can damage fittings and cause leaks.

Use caution not to over tighten or under tighten the piping fittings.

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

4.4.2 Drain Line Installation Requirements

NOTICE

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

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

Sagging condensate drain lines may inadvertently create an external trap.

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

Observe the following requirements and refer to [Correct and Incorrect Gravity Drains](#) below, when installing and routing the drain line:

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

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

Figure 4.3 Correct and Incorrect Gravity Drains

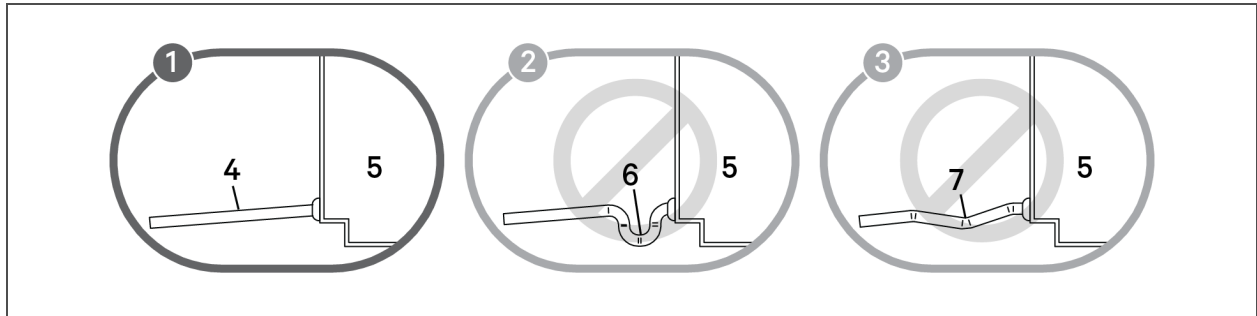


Table 4.13 Gravity Fed Drain Line Figure Descriptions

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

4.4.3 Condensate Drain Pump Kit



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

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

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

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

The installation of the condensate drain pump is described in the submittal documents included in the [Submittal Drawings](#) on page 63.

The following tables list the relevant documents by number and title.

Table 4.14 Condensate Drain Pump Drawings

Document Number	Title
DPN004806	Condensate pump connection locations, 3 ton models
DPN004077	Condensate pump connection locations, 4 and 5 ton models

5 ELECTRICAL CONNECTION REQUIREMENTS



WARNING! Arc flash and electric shock hazard. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Liebert® 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 that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.



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

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

NOTICE

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

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

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

NOTE: For 208 VAC, 3 ton applications, the low voltage transformer tap must be changed. Refer to the electrical schematic.

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

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

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

The electrical connections are described in the submittal documents included in the [Submittal Drawings](#) on page 63.

The following table lists the relevant documents by number and title.

Table 5.1 Electrical Field Connection Drawings

Document Number	Title
DPN004802	Electrical Field Connections, 3 Ton DX Module
DPN004057	Electrical Field Connections, 4 Ton and 5 Ton DX Module
DPN004803	3 ton iCOM Wall Mount Field Connection
DPN004238	4 and 5 Ton iCOM Wall Mount Field Connection
Unit-to-Unit Networking	
DPN004840	3 Ton Model iCOM Unit-to-unit Field Connection
DPN004841	4 and 5 Ton Models iCOM Unit-to-unit Field Connection

5.1 Low Voltage Electrical Field Connections

[Typical Electrical Field Connection Overview](#) on the facing page, shows an overview of the low voltage wiring connections between the Mini-Mate module and the condensing unit (on DX systems only), and the wiring and cabling between the wall mounted iCOM display for all system types. Detailed connection information is included in the submittal drawings listed in [Electrical Field Connection Drawings](#) above.

Connect field supplied, shielded, Class 1 wiring from the condensing unit to the indicated terminal strip locations.

Evaporator to outdoor air cooled condensing units require six conductors. Evaporator to indoor water/glycol condensing units require five conductors. Two additional terminals are available in water/glycol units for activating heat rejection devices. Follow unit schematics.

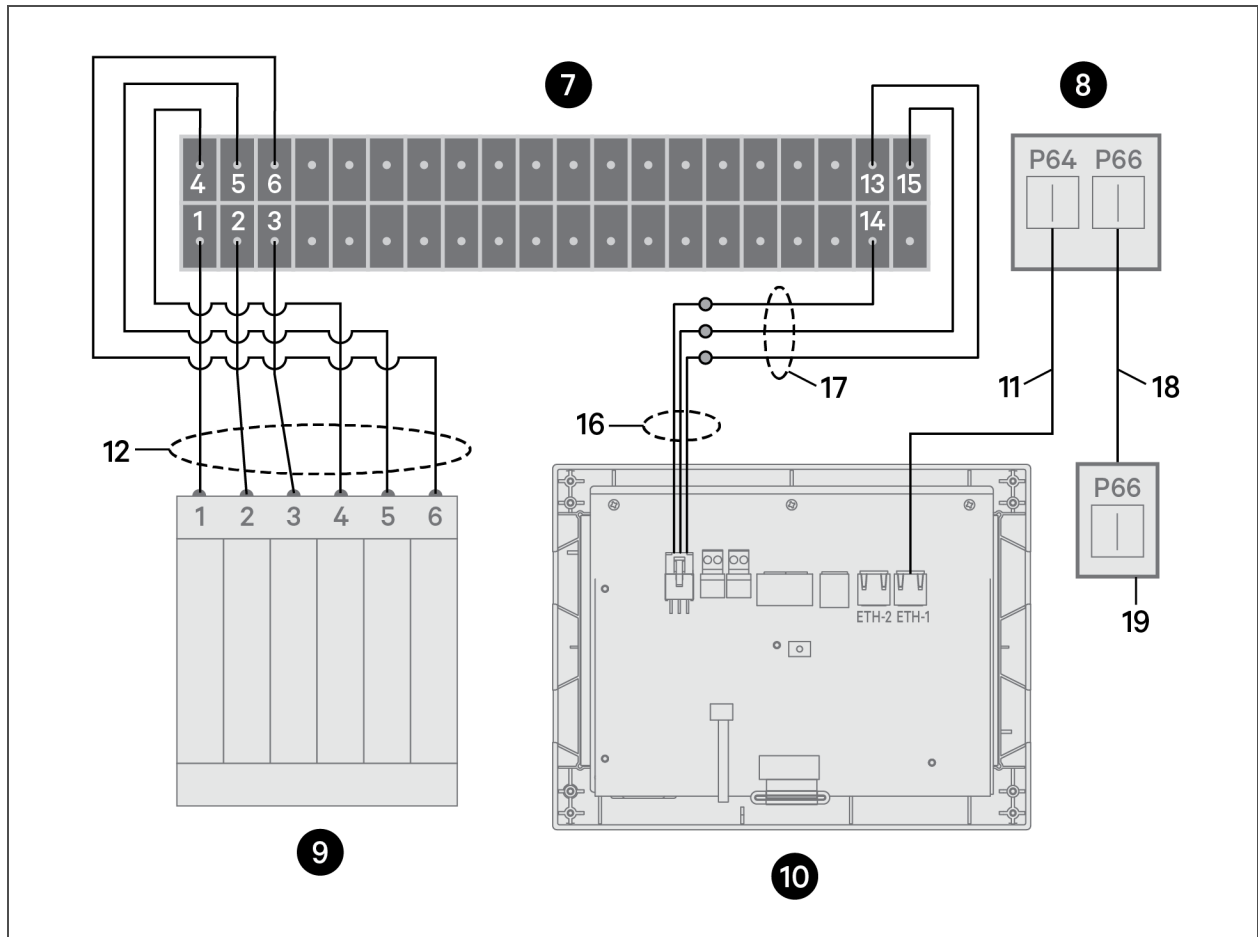
For the wall mounted iCOM-controller display:

- Connect a field supplied, CAT5 Crossover Ethernet cable between P64 on the iCOM-control board in the Mini-Mate module and ETH-1 on the wall mount iCOM display.
- Locate the wire harness inside the wall mount display, and connect field supplied, Class 1 wiring between the harness and landing on the terminal strip 13, 14, and 15 in the Mini-Mate module to provide power for the display.

For the wall mounted temperature/humidity sensor:

- Plug the factory supplied, CANbus cable into P66 on the iCOM-control board in the Mini-Mate module and into P66, Ethernet connection on the temperature/humidity sensor.

Figure 5.1 Typical Electrical Field Connection Overview



Item	Description
1 to 6	Terminal connections between the evaporator module and the condensing unit
7	Terminal strip in the evaporator module
8	iCOM control board in the evaporator module
9	Condensing unit
10	iCOM display, field mounted
11	Field supplied CAT5 cable
12	Field supplied, shielded class 1 wiring
13 to 15	Terminal strip connections on evaporator module for wiring connected to the harness wires from the wall mount display.
16	Factory supplied wiring harness with plug. Wires are identified as TS-13, TS-14, and TS-15 and are 8 in. (203-mm) long.
17	Field supplied, shielded class 1 wiring
18	Factory supplied CAT5 cable, 30 ft (9 m)
19	Temperature/Humidity sensor, field mounted

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6 INSTALLATION

Refer to the appropriate installation procedures depending on the size and type of your Mini-Mate System

6.1 Installing Ceiling Mounted Units



WARNING! Risk of ceiling collapse and heavy unit falling. Can cause building and equipment damage, serious injury or death. Verify that the supporting roof structure is capable of supporting the weight of the unit(s) and the accessories, see [Mini-Mate Unit Weights](#) on page 13. Be sure to securely anchor the top ends of the suspension rods. Make sure all nuts are tight.

NOTICE

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

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

6.1.1 Installing Suspension Rods and Mounting Ceiling Units

Refer to the [Location Considerations](#) on page 11 before beginning installation.

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

- The ceiling and ceiling supports of existing buildings may require reinforcements.
- Recommended clearance between ceiling grids and building structural members is the unit's height plus 3 in. (76 mm).
- Four 3/8-in. 16 TPI threaded suspension rods are required and field supplied. The factory supplied 3/8-in. 16 TPI hardware kit includes the remaining installation hardware for rod to unit.

To install the suspension rods:

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

To lift and install the unit on the rods:

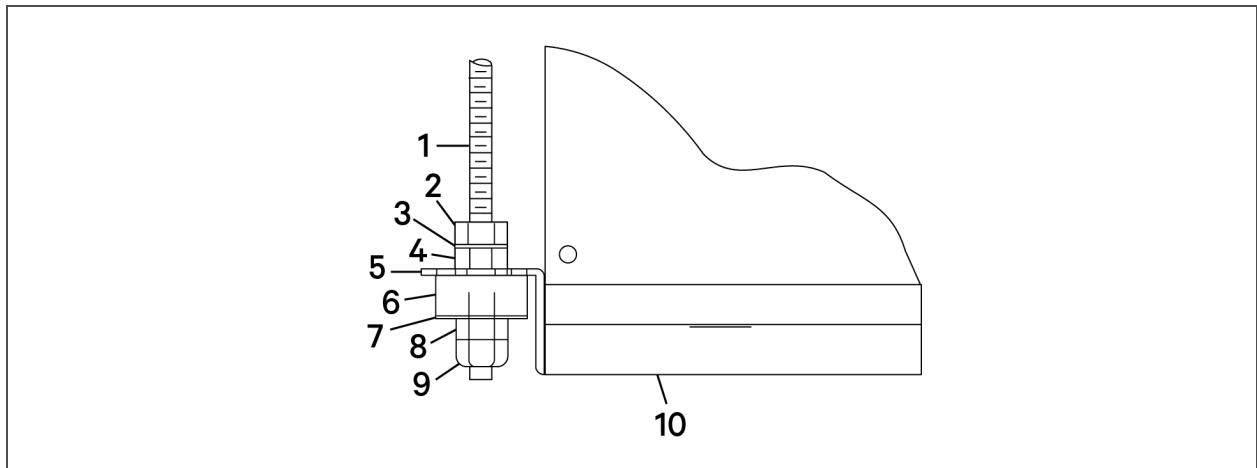
1. Referring to **Figure 6.1** on the next page, place the hex nuts (Item 2) on the threaded rods, and add the washer, sleeve, and isolator (Items 3, 4, and 6) to the bracket holes on the unit.
2. Using a suitable lifting device that is rated for the weight of the unit (see [Mini-Mate Unit Weights](#) on page 13), 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) from the hardware kit to hold the unit in place as shown in **Figure 6.1** on the next page.

- Adjust the plain nuts to distribute the weight of the unit evenly by the rods, making sure that the unit does not rest on the ceiling grid and that the unit is level.

NOTE: The unit must be level to properly drain condensate.

- Use the Nylock nuts to jam the plain nuts in place as shown in **Figure 6.1** below.

Figure 6.1 Installing Threaded Rods and Hardware of Ceiling Mounted Units



Item	Description	Item	Description
1	3/8 in. threaded rod, field supplied	6	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)

6.2 Installing Air Distribution Components for Evaporators

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

6.2.1 Installing a Filter Box for 3 Ton Models

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

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

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

6.2.2 Installing an Air Distribution Plenum for 3 Ton Models

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

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

6.2.3 Installing a Filter Box for 4 Ton and 5 Ton Models

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

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

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

6.2.4 Installing a Bottom Discharge Grille for 4 Ton and 5 Ton Models

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

6.2.5 Guidelines for Ducted Systems

Observe the following for all duct work.

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

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7 CHECKLIST FOR COMPLETED INSTALLATION

7.1 Moving and Placing Equipment

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

7.2 Electrical Installation Checks

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

7.3 Piping Installation Checks

1. Piping completed to refrigerant or coolant loop (if required).
2. Piping has been leak-checked, evacuated and charged (if required).
3. Additional oil has been added for system charges over 40 pounds (18.1kg) per circuit. See [Additional Oil Requirements for Digital Scroll Compressors](#) on page 20.
4. Piping is properly sized, sloped and trapped as shown in the piping schematics.
5. Check piping inside and outside of equipment for proper support and adequate spacing to prevent rub-through.
6. Ensure that factory clamps have been reinstalled.
7. Drain line connected, not obstructed, and pitched per local code.
8. Water supply line connected to humidifier and not leaking, and routed to allow filter removal.
9. Condensate pump, if applicable, is operational.
10. Condensate drain line piping has no leaks or visible damage.

7.4 Other Installation Checks

1. Ducting complete (if required), maintain access to filters.
2. Return air filter box and supply air duct collar installed.
3. Filters installed.
4. Check fasteners that secure reheats, humidifier and motors—some may have become loose during shipment.
5. Control panel DIP switches are set based on customer requirements. Verify water detection is properly installed (recommended).
6. All fans are free of debris.

7. Seal openings around piping and electrical connections.
8. Installation materials and tools have been removed from equipment (literature, shipping materials, construction materials, tools, etc.).
9. Field provided, water-tight, secondary drain pan with drain is installed under all cooling units and ceiling-mounted water/glycol condensing units.
10. Drain from secondary drain pan is routed to a frequently used maintenance sink with signs posted to alert people to report water/glycol flowing from drain pan.

8 INITIAL START-UP CHECKS AND COMMISSIONING PROCEDURE FOR WARRANTY INSPECTION



WARNING! Arc flash and electric shock hazard. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Liebert® 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 that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.



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



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

- Confirm that all items on [Checklist for Completed Installation](#) on page 39 have been done.
- Locate “Liebert® Mini-Mate Warranty Inspection Check Sheet” in the unit’s electric panel. (PSWI-8542-437RE)
- Complete “Liebert® Mini-Mate Warranty Inspection Check Sheet” during start-up. (PSWI-8542-437RE)
- Forward the completed “Liebert® Mini-Mate Warranty Inspection Check Sheet” to your local sales office. **This information must be completed and forwarded to validate warranty.**
- Contact your local sales representative or technical support if you have any questions or problems during unit start-up and commissioning. Visit <https://www.Vertiv.com/en-us/support/> or call 1-800-543-2778 for contacts.

Local sales offices and product support contacts can be found at <https://www.Vertiv.com/en-us/support/> or 1-800-543-2778.

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9 MAINTENANCE



WARNING! Arc flash and electric shock hazard. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Liebert® 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 that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.



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



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



WARNING! Risk of electric shock. Can cause serious injury or death. The Liebert® iCOM microprocessor 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 Liebert® iCOM control. Open all local and remote electric power disconnect switches and verify with a voltmeter that power is Off before working on any component of the system.

- Good maintenance practices are essential to minimizing operation costs and maximizing product life.
- Read and follow monthly and semi-annual maintenance schedules included in this manual. These MINIMUM maintenance intervals may need to be more frequent based on site-specific conditions.
- We recommend the use of trained and authorized service personnel, extended service contracts and factory specified replacement parts. Contact your Vertiv sales representative.

9.1 Filters

NOTICE

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

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

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

Table 9.1 MERV 8 (Disposable Type) Filter Quantity by Unit Option

Unit Model	Unit Option	Filter Nominal Size, in. (mm)	Number of Filters
MT036 (3 ton)	Filter box	4 x 20 x 20 (102 x 508 x 508)	1
MT036 (3 ton)	Air-distribution plenum	4 x 16 x 25 (102 x 406 x 635)	1
MT048 (4 ton)	Filter box	4 x 20 x 20 (102 x 508 x 508)	2
MT060 (5 ton)	Filter box	4 x 20 x 20 (102 x 508 x 508)	2

9.1.1 Filter Replacement

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

9.2 Blower Drive System—EC Fans



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



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



CAUTION: Risk of improper moving, lifting and handling. Can cause equipment damage or injury. Only properly trained and qualified personnel should work on this equipment. Evaporator fan modules weigh in excess of 37 lb (17 kg). Use proper lifting techniques and wear appropriate, OSHA-approved PPE to avoid injury and dropping the fan module during removal. Equipment used in handling/lifting, and/or installing the fan assembly must meet OSHA requirements. Use handling/lifting equipment rated for the weight of the fan assembly. Use ladders rated for the weight of the fan assembly and technicians if used during installation. Refer to handling/lifting, and/or installation equipment operating manual for manufacturer's safety requirements and operating procedures.

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

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

NOTICE

Risk of improper installation. Can cause equipment damage.

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

Use 60/75°C Class 1 copper wire only.

9.2.1 Fan Impellers and Bearings Maintenance

Fan impellers should be periodically inspected and any debris removed. Check to ensure that the impellers can rotate freely and that the fan guards are still properly mounted for sufficient protection against accidentally contacting the impeller. Bearings used on the units are maintenance free. Consult the factory for more information.

9.2.2 Protective Features

Monitoring functions protect the motor against overtemperature of electronics, overtemperature of motor and incorrect rotor position detection. With any of these failures, an alarm will display through the Liebert® iCOM controller and the motor stops electronically. There is no automatic restart. The power must be switched off for a minimum of 20 seconds once the motor is at a standstill.

The motor also provides locked rotor protection, undervoltage/phase failure detection and motor current limitation. These conditions will display an alarm through the Liebert® iCOM.

9.2.3 Fan Assembly Troubleshooting

Any safety hazards stemming from the device must be re-evaluated once it is installed in the end device.

Do not make any modifications, additions or conversions to the fan assembly without the approval of Vertiv.



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



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



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



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

NOTICE

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

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

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

EC Fan Fault Conditions

Table 9.2 EC Fan Fault Conditions

Fault Condition	Reset Trigger	Description
Hall-IC error	Power reset/Manual	The Hall Effect Sensor is used to monitor fan speed. If there is a communication error from the Hall-ICs, the motor is switched off and automatically restarted if no faults are recognized.
Line failure	Automatic	The motor will come to a stop in the event of mains interruption (failure of a fuse or mains phase). A start-up attempt will be made every 15 sec until all three phases are available.
Blocked motor	Automatic/Manual (Power/Software)	The motor is blocked if after 8 sec of sending a speed command by communication no speed (= 0 RPM) is measured. Attempt to start is made after 2.5 sec. After 4 failed attempts (i.e. the motor is still blocked), the fan is finally shut down and will require manual restart (either with the mains power or software).
IGBT failure	Automatic/Manual (Power)	If there is a short circuit to earth or to the motor winding, then the motor is turned off. An attempt to re-start is made after 60s. If a second fault is detected within a period of 60 seconds, then the motor is finally shut down. In this case, there has to be a manual restart (either with the mains power or software).
Intermediate circuit undervoltage	Automatic/Manual (Mains/Software)	If the DC-link voltage rises above the limit within 75 seconds, then the controller will attempt to start. Should the DC-link voltage stay below the limit for more than 75 seconds, the device will switch off with a fault message. In this case, there has to be a manual restart (either with the mains power or software).
Intermediate circuit overvoltage	Automatic/Manual (Mains/Software)	If the DC-link voltage drops below the limit within 75 seconds, then the controller will attempt to start. Should the DC-link voltage stay above the limit for more than 75 seconds, the device will switch off with a fault message. In this case, there has to be a manual restart (either with the mains power or software).
Line voltage too low	Automatic/Manual (Mains/Software)	If the line voltage rises above a specified limit within 75 seconds, then the controller will attempt to start. Should the line voltage stay below the specified limit for more than 75 seconds, the device will switch off with an error message. In this case, there has to be a manual restart (either with the mains power or software).
Line voltage too high	Automatic/Manual (Mains/Software)	If the line voltage drops below the specified limit within 75 seconds, then the controller will attempt to start. Should the line voltage stay above the specified limit for more than 75 seconds, the device will switch off with an error message. In this case, there has to be a manual restart (either with the mains power or software).
Error Peak current	Automatic/Manual (Mains/Software)	If the motor current increases above the specified limit (even in a short time frame) the device will switch off. The controller will attempt a restart after 5 seconds. If within next 60s, 5 further disconnections arise, the motor will switch off and indicate a fault. If none happen for 60 seconds, the counter resets and it continues operating.
Temperature alarm	Automatic	If the internal temperature exceeds the max. permissible limit, then the controller switches off the motor. The motor is automatically restarted after the temperature has cooled down below the max. limit. Note in this case the derating was starting already and was reducing the fan speed to close to 0 (active temperature management was already active).

EC Fan High Voltage Tests

1. Check fuses. If fuses are okay, perform the following:
 - Check all connections. See [EC Fan Connections](#) on the facing page.
 - Make sure connections are on the wire strand and not on the wire insulation.
 - Cycle power. Disconnect mains voltage to power down the motor and then re-apply power.
 - Check mains voltage at each phase (phase to ground) at the Mains connector. Confirm phase failure not present.
 - Check that the voltage is within the acceptable voltage range at the Mains connector. Confirm line under-voltage is not present.
2. Check fuses. If fuses are blown, perform the following:
 - Check resistances across the phases at the Mains connector and note them in the following table.

NOTE: Power wires must be removed from the motor for resistance test.

L1 - L2		Ohm
L2 - L3		Ohm
L1 - L3		Ohm

- Resistances should be similar for all three readings.
- Resistance readings should be greater than 100 kOhm.
 - Check all connections. Make sure connections are on the wire strand and not on the wire insulation.
 - Replace fuses.
 - Check mains voltage at each phase (phase to ground) at the Mains connector. Confirm phase failure not present.
 - Check that the voltage is within the acceptable voltage range at the Mains connector. Confirms line under-voltage is not present.

Figure 9.1 EC Fan Connections



Item	Description	Item	Description
1	Cover of controller housing	5	Alarm-relay connection
2	Cable glands and seal insert for two cables (if needed) <ul style="list-style-type: none"> Motor size "D": 3 x M16 and 1 x seal insert with two 5-mm holes. Motor size "G": 3 x M20 and 1 x seal insert with two 6-mm holes. 	6	Control-system connection
3	Cable-entry points with plastic fastener	7	Slot for add-on module
4	Mains connection		

EC Fan Low Voltage Tests

- Check control input at the control system connection (E1 and GND). Confirm that there is a control voltage present at the connection.

NOTE: Use the GND in the connector. Do not connect the control ground to the PE in Main connector!

- Check +10 V output on control system connection (between +10 V and GND).

EC Fan Alarm Contact Tests

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

Condition	No Fault Condition	Fault Condition
NC - COM	Closed	Open

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

- Check EC Control to determine the fault condition.

9.3 Direct Drive Blower System

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

9.3.1 Fan Impellers and Motor Bearings Maintenance

Fan impellers should be periodically inspected and any debris removed. Check to see if they are tightly-mounted on the fan shaft. Rotate the impellers and make sure they do not rub against the fan housing.

Although the motor bearings are permanently-sealed and self-lubricating, inspect the bearings monthly for signs of wear.

9.4 Steam Generating Humidifier Maintenance

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



WARNING! Arc flash and electric shock hazard. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Liebert® 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 that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.



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



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



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

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

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

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

9.4.1 Operating the Humidifier

1. During start-up, when the humidity control calls for humidification, the fill valve opens and allows water to enter the canister. When the water level reaches the electrodes, current flows and the water begins to warm. The canister fills until the amperage reaches the setpoint and the fill valve closes. As the water warms, its conductivity increases and the current flow, in turn, rises. If the current reaches 115% of the normal operating current, the drain valve opens and drains some of the water out of the canister. This reduces electrode contact with the water and lowers the current flow to the amperage setpoint. Boiling soon commences, and the canister operates normally.
2. If the conductivity of the water is low, the canister fills and the water level reaches the canister full electrode before the current setpoint is reached. The humidifier stops filling to prevent overflow. Boiling should commence in time. As water is boiled off, the mineral concentration in the canister increases and current flow also increases. The canister eventually reaches full output and goes to normal operation. No drain is permitted until then.
3. When full output is reached the circuit board starts a time cycle which is factory set at 60 seconds. During this repeating time cycle, the fill valve will open periodically to replenish the water being boiled off and maintain a "steady state" output at the setpoint. The amperage variance depends on the conductivity of the water.
4. After many cycles, the mineral concentration in the canister becomes too high. When this occurs, the water boils too quickly. As the water quickly boils off and less of the electrode is exposed, the current flow decreases. When the current crosses the low threshold point before the end of the time cycle, the drain valve opens, draining the mineral-laden water out and replacing it with fresh water. This lowers the mineral concentration and returns the canister to "steady state" operation and prolongs canister life. The frequency of drains depends on water conductivity.

5. Over a period of time, the electrode surface becomes coated with a layer of insulating material, which causes a drop in current flow. As this happens, the water level in the canister will slowly rise exposing new electrode surface to the water to maintain normal output. Eventually, the steady state water level will reach the canister full electrode and indicate so by activating the canister full alarm and opening the humidifier contactor. At this point, all of the electrode surface has been used up and the canister must be replaced.
6. After the entire electrode surface has been coated, the output will slowly begin to fall off. This usually occurs in the last several hours of electrode life and should allow enough time to schedule maintenance. During these last hours, the mineral concentration can increase. If the mineral concentration is too high, arcing can occur. If the electrodes start to arc, turn off the humidifier immediately and replace the canister with the identical part.

9.4.2 Replacing the Canister

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

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

9.4.3 Circuit Board Adjustments

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

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

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

POT3 is factory set at 100%. The maximum capacity of the system is not field adjustable.



WARNING! Risk of electric shock. Can cause injury or death. The DIP switches must be set exactly as indicated in [Circuit Board Adjustments](#) on the previous page. Failure to correctly set the DIP switches may result in an electrical or water hazard.

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

Table 9.3 DIP Switch Settings for Humidifier Control Board

Voltage	SW1	SW2	SW3	SW4	Amps
3 Ton Units					
208/230	Off	On	Off	On	6.4
460	On	On	Off	Off	3.4
4 Ton and 5 Ton Units					
208	On	On	On	Off	8.9
240	Off	On	On	Off	8.5
460	On	On	On	Off	4.5
575	On	On	Off	Off	3.4

9.4.4 Humidifier Troubleshooting

Table 9.4 Steam Generating Humidifier Troubleshooting Guide

Symptom	Possible Cause	Check or Remedy
Humidifier does not operate	DIP switch not set to enable humidifier option	See DIP switch settings in DIP Switch Settings for Humidifier Control Board above.
	Display does not show humidification mode	Increase humidity control setpoint
	Defective board	Check the voltage at P35-1 on the unit's iCOM board, and P1-9 and P1-7 on the humidifier interface board for 24 VAC ± 2 VAC. If no voltage is detected, check wiring and/or replace board. Check the wiring from the iCOM board to the humidifier interface board.
	Failed humidity sensor	Display shows "RET sensor invalid" warning. Check wiring from the temperature/humidity board to the control board. Replace temperature/humidity sensor if defective.
	No water flow	Make sure that the switch is in "RUN" position. Check the humidifier water (including filter screen) and check the nylon overflow line if the canister is full.
	Canister fill rate does not keep up with steam output	Check the fill valve screen opening and capillary tube for obstructions. Check the water supply pressure (minimum 10 psig).

9.5 Condensate Drain and Condensate Pump System Maintenance

9.5.1 Condensate Drain

Check for and clear obstructions in tubing during routine maintenance.

9.5.2 Condensate Pump



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

To maintain the condensate pump:

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

9.6 Electric Reheat Maintenance

- Inspect and clean reheat elements.
- Inspect and tighten support hardware.

9.7 Thermostatic Expansion Valve (TXV) Maintenance

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

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

9.7.1 Determining Suction Superheat

To determine superheat:

1. Measure the temperature of the suction line at the point the TXV bulb is clamped.
2. Obtain the gauge pressure at the compressor suction valve.
3. Add the estimated pressure drop between the bulb's location and the suction valve.
4. Convert the sum of the two pressures to the equivalent temperature.
5. Subtract this temperature from the actual suction line temperature. The difference is superheat.

9.7.2 Adjusting Superheat Setting with the TXV

To adjust the superheat setting:

1. Remove the valve cap at the bottom of the valve.
2. Turn the adjusting stem counterclockwise to lower the superheat.
3. Turn the adjusting stem clockwise to increase the superheat.

NOTE: Make no more than one turn of the stem at a time. Allow up to 15 minutes of fully loaded compressor operation before checking superheat or making additional stem adjustments.

9.7.3 Coaxial Condenser Maintenance (Water/Glycol Cooled Condensers Only)

Each water or glycol cooled module has a coaxial condenser consisting of an exterior steel tube and an interior copper tube. Clean the screen on the field installed Y-strainer (if installed). If the water supply is clean, coaxial condensers do not normally require maintenance or replacement. If your system begins to operate at high head pressure with reduced capacity and all other causes have been eliminated, the condenser may be obstructed or fouled and should be cleaned or replaced.

9.7.4 Regulating Valve Maintenance (Water Glycol Cooled Condensers Only)

The water regulating valve automatically regulates the amount of fluid necessary to remove the heat from the refrigeration system, permitting more fluid to flow when load conditions are high and less fluid to flow when load conditions are low. The valve consists of a brass body, balance spring, valve seat, valve disc holders, capillary tube to discharge pressure and adjusting screw.

The water regulating valve begins opening at 180 psig (1240 kPag) and is fully opened at 240 psig (1655 kPag). The valve is factory set and should not need adjustment. There is significant difference in the way standard pressure and high pressure valves are adjusted. Consult Vertiv technical support.

9.7.5 Glycol Solution Maintenance

It is difficult to establish a specific schedule of inhibitor maintenance because the rate of inhibitor depletion depends upon local water conditions. Analysis of water samples at the time of installation and through a maintenance program should help to establish a pattern of depletion. A visual inspection of the solution and filter residue is often helpful in judging whether active corrosion is occurring.

The complexity of water/glycol solution condition problems and the variations of required treatment programs make it extremely important to obtain the advice of a competent and experienced water treatment specialist and follow a regularly scheduled coolant fluid system maintenance program. It is important to note that improper use of water treatment chemicals can cause problems more serious than using none. Proper inhibitor maintenance must be performed in order to prevent corrosion of the glycol system. Consult the glycol manufacturer for testing and maintenance of inhibitors. Do not mix products from different manufacturers.

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10 PREVENTIVE MAINTENANCE CHECKLIST

Source: DPN002953, Rev 2

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

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

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

Check all that apply:

Evaporator/Filters

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

Blower Section (Direct Drive)

1. Make sure impellers free of debris
2. Check bearings in good condition

Blower Section (EC fan)

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

#1	L1	L2	L3
----	----	----	----

Reheat (If Equipped)

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

L1

L2

L3

Steam Generating Humidifier (If Equipped)

1. Check drain valve/drain lines/trap for clogs.
2. Check water fill valve and all hoses for leaks.
3. Check condition of steam hose.
4. Check canister for mineral deposits.
5. Check condition of the electrodes.
6. Clean strainer.
7. Replace humidifier bottle, if necessary.
8. Check operation of humidifier .
9. Check humidifier amp draw .

L1

L2

L3

Condensate Pump (If Equipped)

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

Overflow Drain Pan (Ducted Units - If Equipped)

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

Electrical Panel

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

Controls

1. Check/verify control operation (sequence).
2. Check/test changeover device(s) (if equipped).
3. Check/test water detection device(s) (if equipped).

Refrigeration Piping

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

Air Cooler Condensing Unit (If Equipped)

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

L1 _____ L2 _____ L3 _____

(L1 and L2 on single-phase units)

Water/Glycol Cooled Condenser (If Equipped)

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

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

1050 Dearborn Drive

Columbus, OH, 43085, 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

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Appendix B: Submittal Drawings

Table B.1 Submittal Drawings Contents

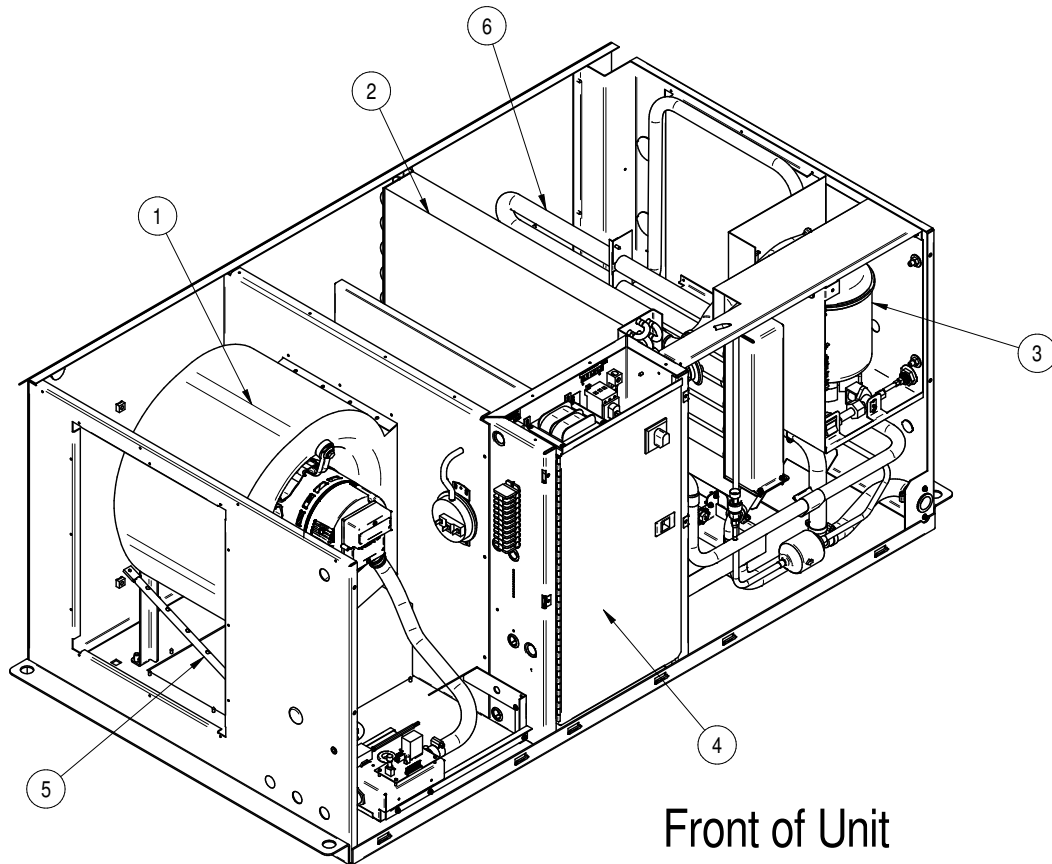
Document Number	Title
Mini-Mate Component Location	
DPN004808	Evaporator Unit, 3 Ton
DPN004179	Evaporator Unit, 4 Ton and 5 Ton
Mini-Mate Planning Dimensions - Split System Evaporators	
DPN004800	Cabinet Dimensions 3 Ton DX Module
DPN004055	Cabinet Dimensions 4 Ton and 5 Ton DX Module
Mini-Mate Planning Dimensions - Filter and Ducting Options	
DPN004805	Dimensional, Data Filter Box, and Duct Flange, 3 Ton
DPN004807	Dimensional Data, Air Distribution Plenum 3 Ton
DPN004166	Dimensional Data, Filter Box, and Duct Flange, 4 and 5 Ton
DPN004842	Dimensional Data, Bottom Discharge Grille, 4 and 5 Ton
Mini-Mate Piping Schematics	
DPN004060	Piping Arrangement, 3, 4, and 5 Ton Split System, Air Cooled
Mini-Mate Piping Connections	
DPN004801	Primary Connection Locations, 3 Ton DX Module
DPN004806	Condensate Pump Connection Locations, 3 Ton
DPN004056	Primary Connection Locations, 4 Ton and 5 Ton DX Module
DPN004077	Condensate Pump Connection Locations, 4 Ton and 5 Ton
Mini-Mate Electrical Connections	
DPN004802	Electrical Field Connections, 3 Ton DX Module
DPN004057	Electrical Field Connections, 4 Ton and 5 Ton DX Module
DPN004238	General Arrangement Unit, iCOM Display and Temperature Humidity Sensor
DPN004803	3 Ton iCOM Wall Mount Field Connection
Unit-to-Unit Networking	
DPN004840	3 Ton Model iCOM Unit-to-unit Field Connection
DPN004841	4 and 5 Ton Models iCOM Unit-to-unit Field Connection

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LIEBERT MINI-MATE VARIABLE CAPACITY

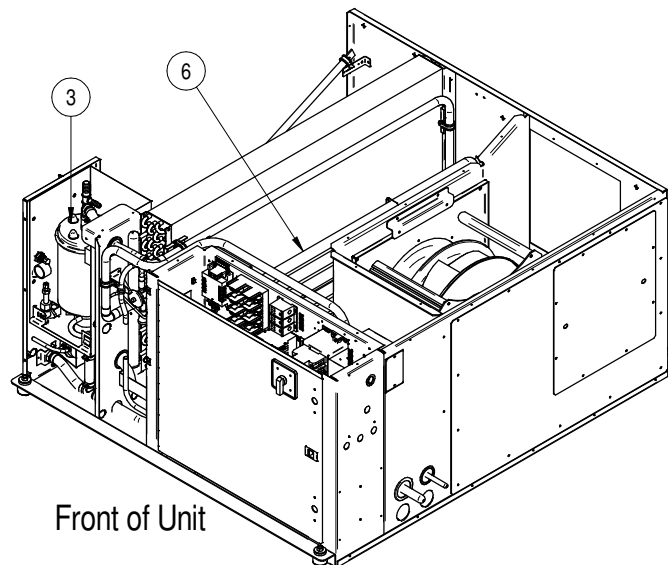
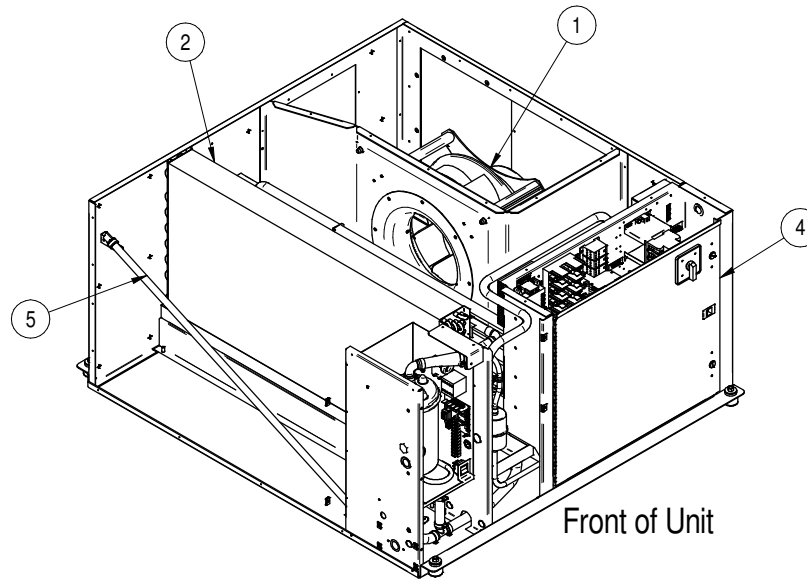
COMPONENT LOCATION DIAGRAM 3 TON EVAPORATOR UNIT



- 1 Direct Drive Fan with Variable Speed EC Motor
- 2 Evaporator Coil
- 3 Humidifier (optional)
- 4 Electric Box
- 5 Smoke Sensor (optional)
- 6 Electric Reheat (optional)

LIEBERT MINI-MATE VARIABLE CAPACITY

COMPONENT LOCATION DIAGRAM 4&5 TON EVAPORATOR UNIT

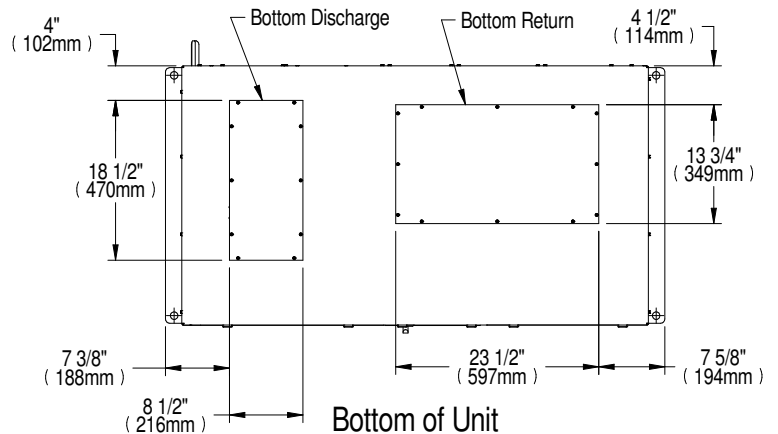
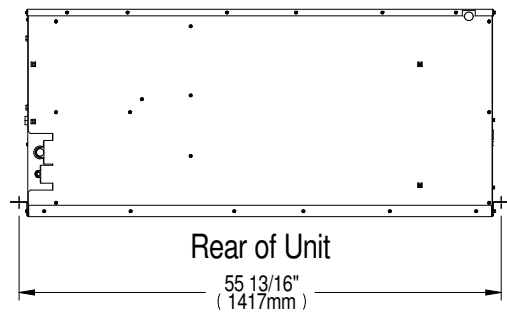
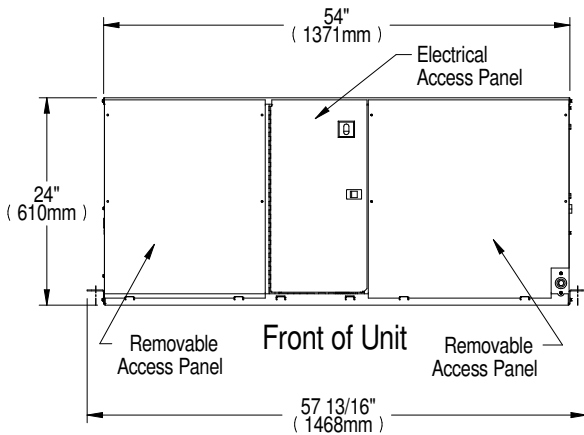
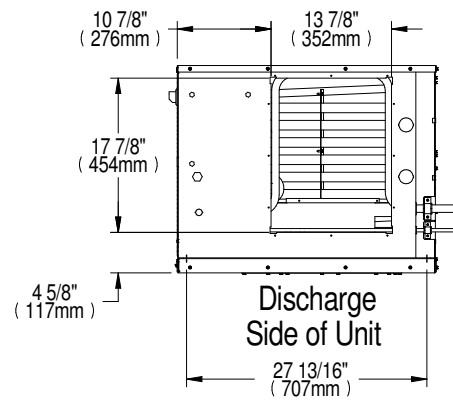
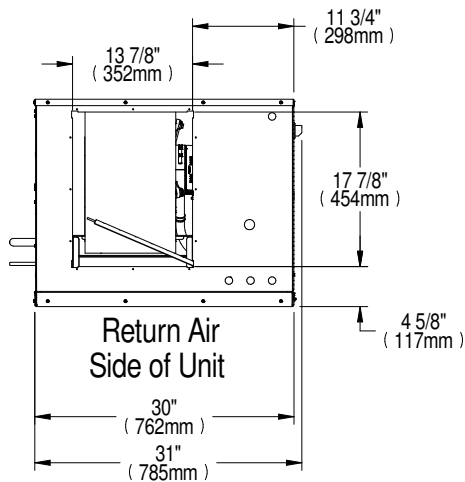
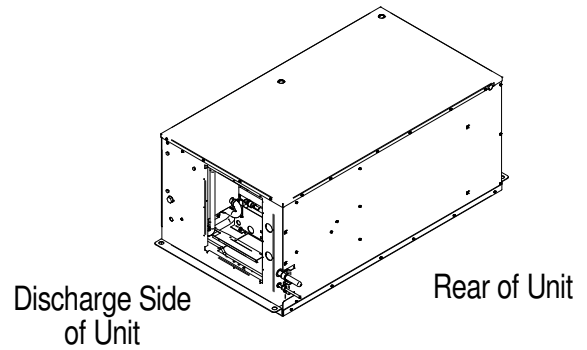
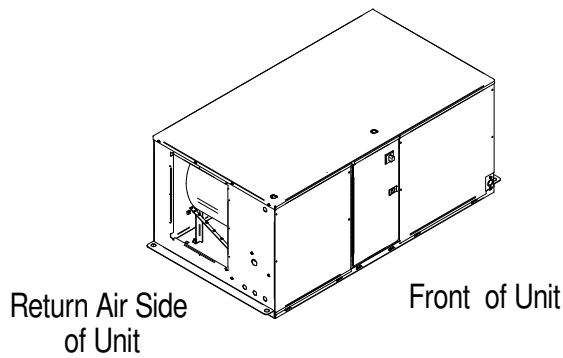


- 1 Variable Speed Direct Drive Fan with EC Motor
- 2 Evaporator Coil
- 3 Humidifier (optional)
- 4 Electric Box
- 5 Smoke Sensor (optional)
- 6 Electric Reheat (optional)



LIEBERT MINI-MATE VARIABLE CAPACITY

CABINET DIMENSIONAL DATA 3 TON DIRECT EXPANSION FAN/COIL MODULE

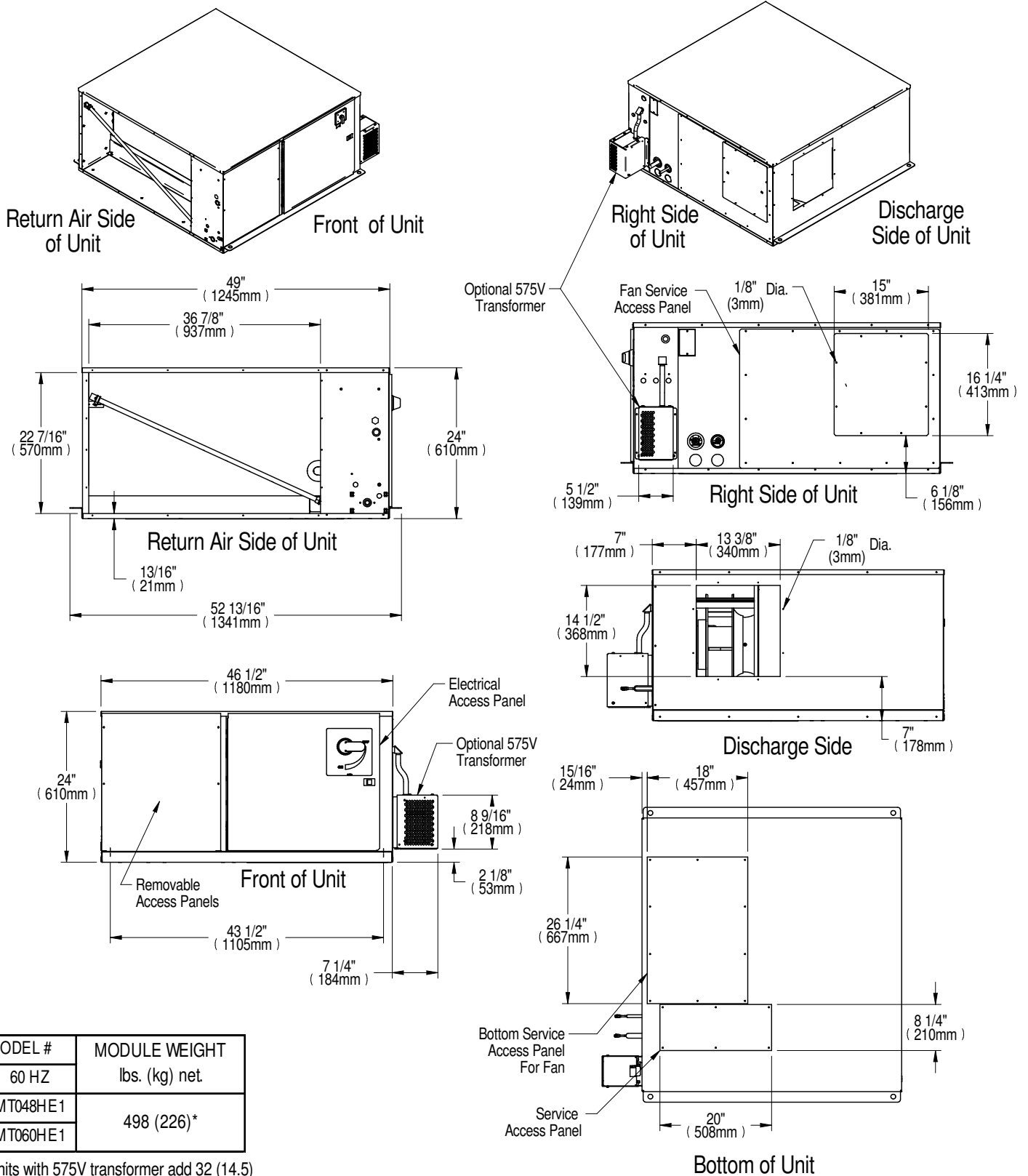


MODEL NUMBER	UNIT NET WEIGHT lbs. (kg)
MT036HE1	328 (149)



LIEBERT MINI-MATE VARIABLE CAPACITY

CABINET DIMENSIONAL DATA 4 & 5 TON DIRECT EXPANSION FAN/COIL MODULE

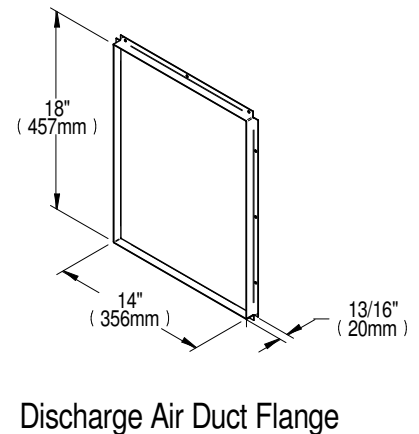
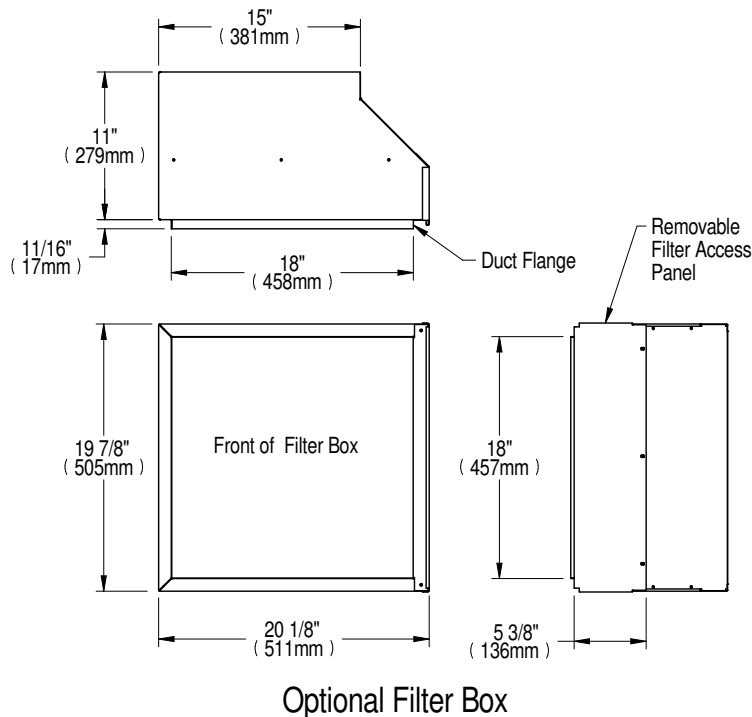
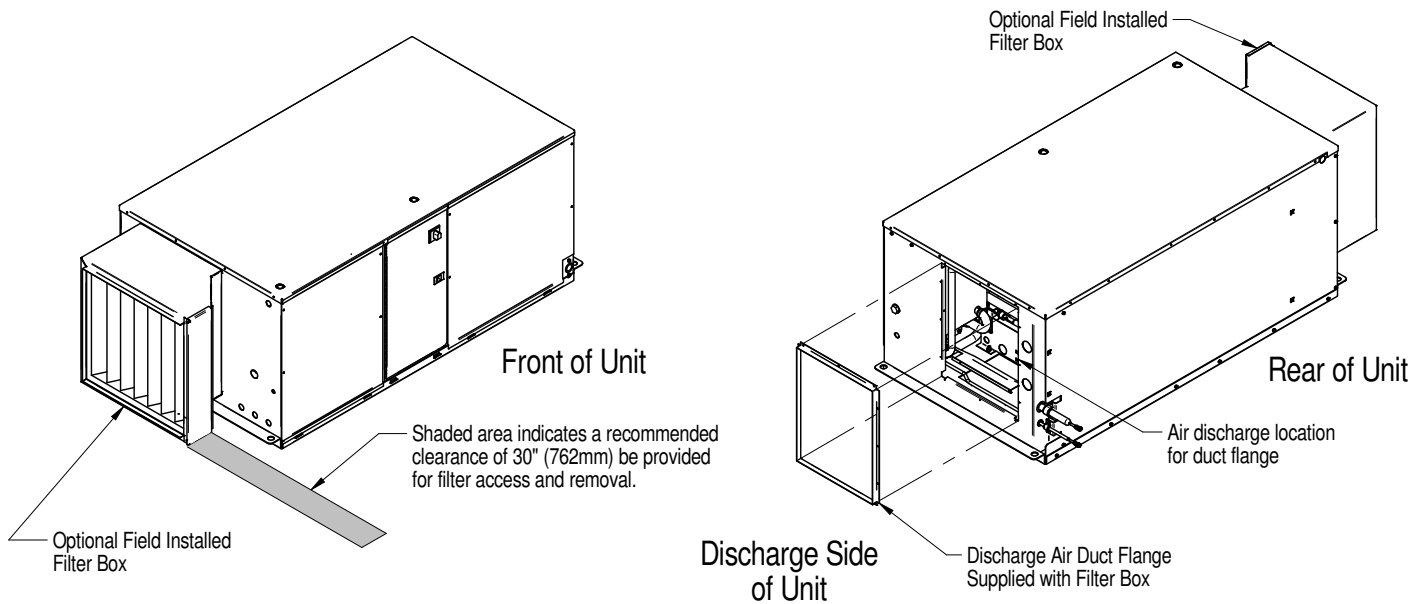


MODEL #	MODULE WEIGHT
60 HZ	lbs. (kg) net.
MT048HE1	498 (226)*
MT060HE1	

*Units with 575V transformer add 32 (14.5)

LIEBERT MINI-MATE VARIABLE CAPACITY

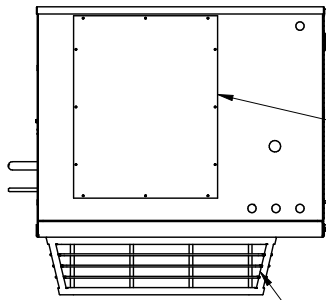
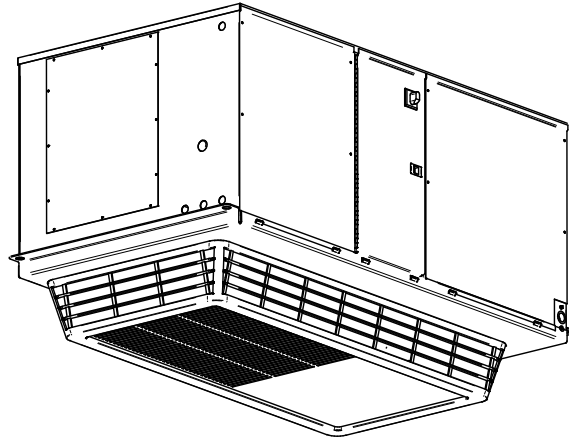
DIMENSIONAL DATA OPTIONAL FIELD INSTALLED FILTER BOX & DISCHARGE DUCT FLANGE 3 TON MODEL





LIEBERT MINI-MATE VARIABLE CAPACITY

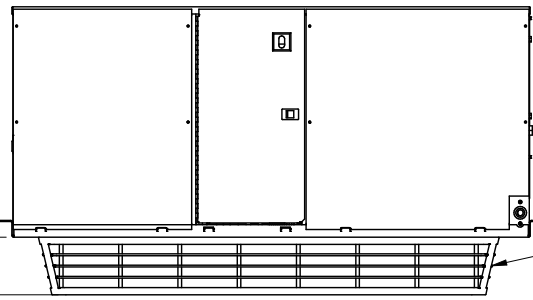
OPTIONAL FIELD INSTALLED AIR DISTRIBUTION PLENUM 3 TON MODEL



Return Side of Unit

Cover Plate supplied with Plenum

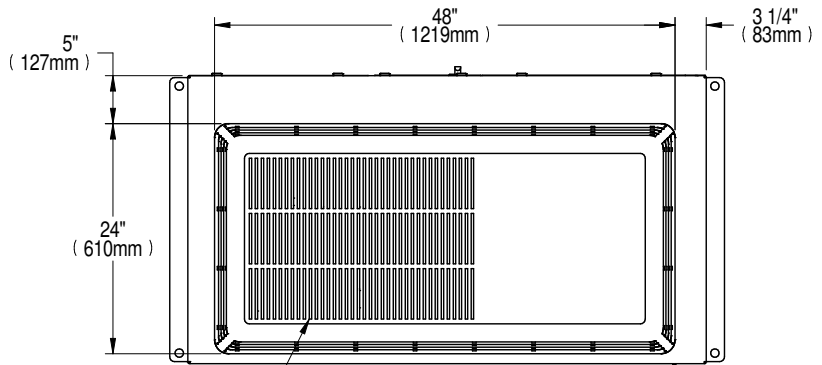
Removable panel on side of plenum. Minimum Clearance 30" (762mm) for filter access and removal.



Front of Unit

Air Discharge out sides of plenum

6"
(152mm)



Bottom of Unit

Air Inlet through grille in bottom center of plenum

5"
(127mm)

24"
(610mm)

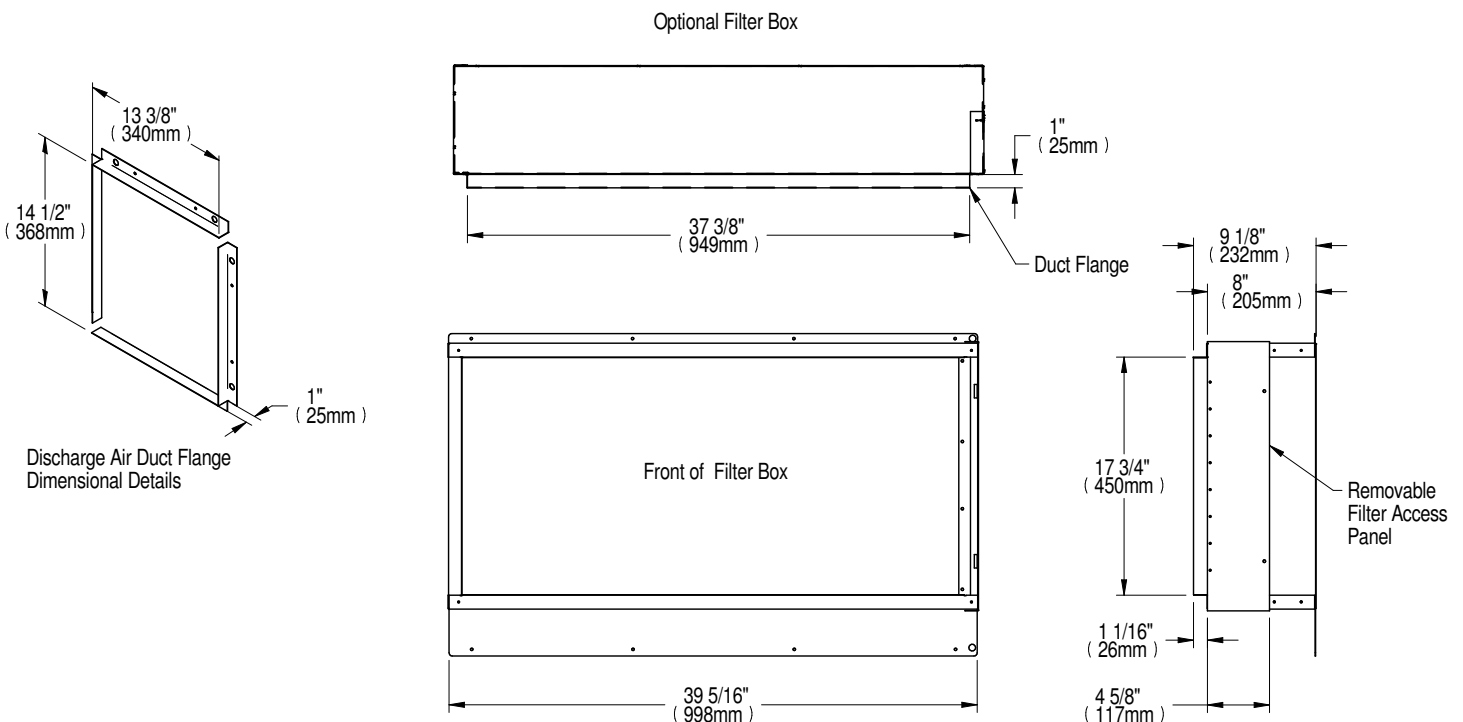
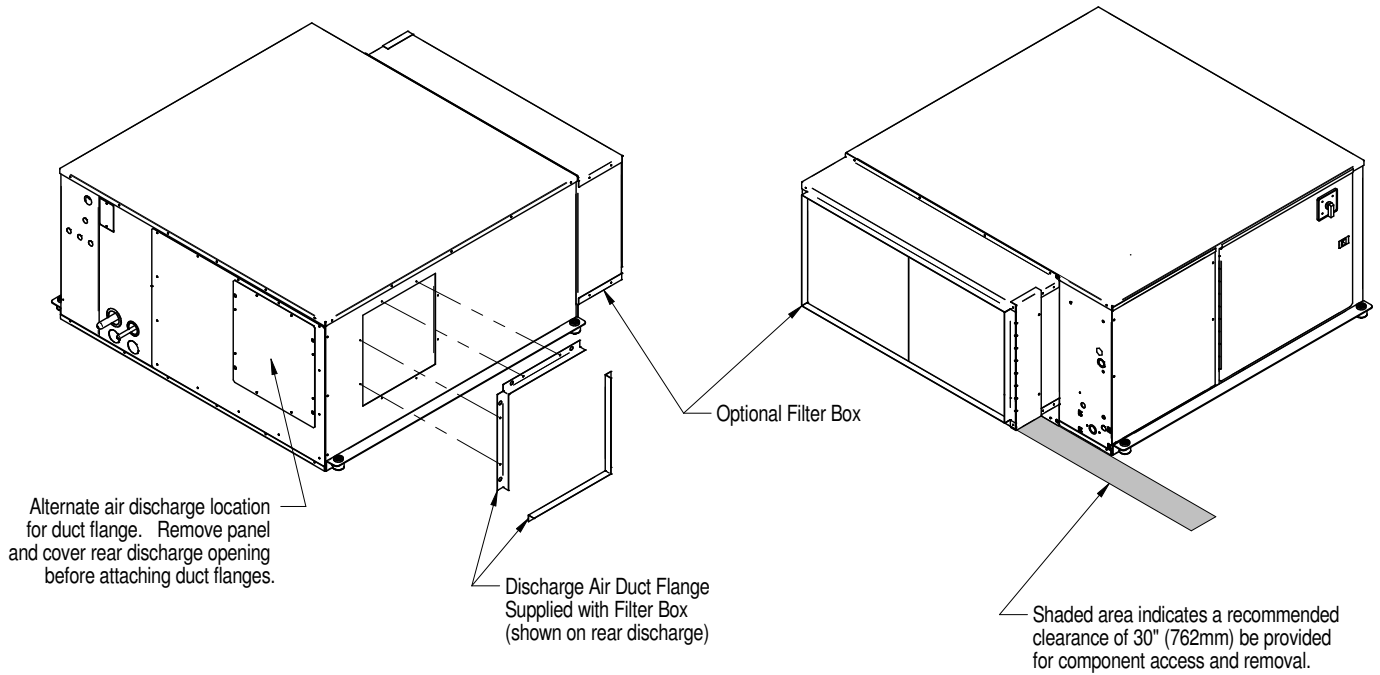
48"
(1219mm)

3 1/4"
(83mm)



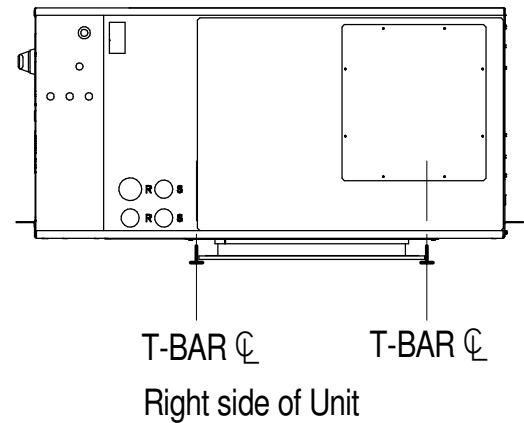
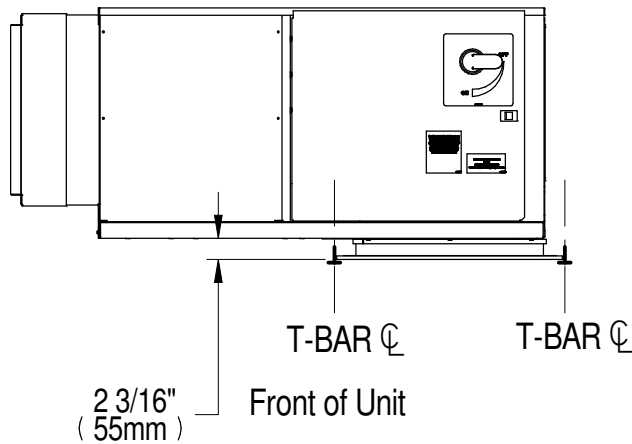
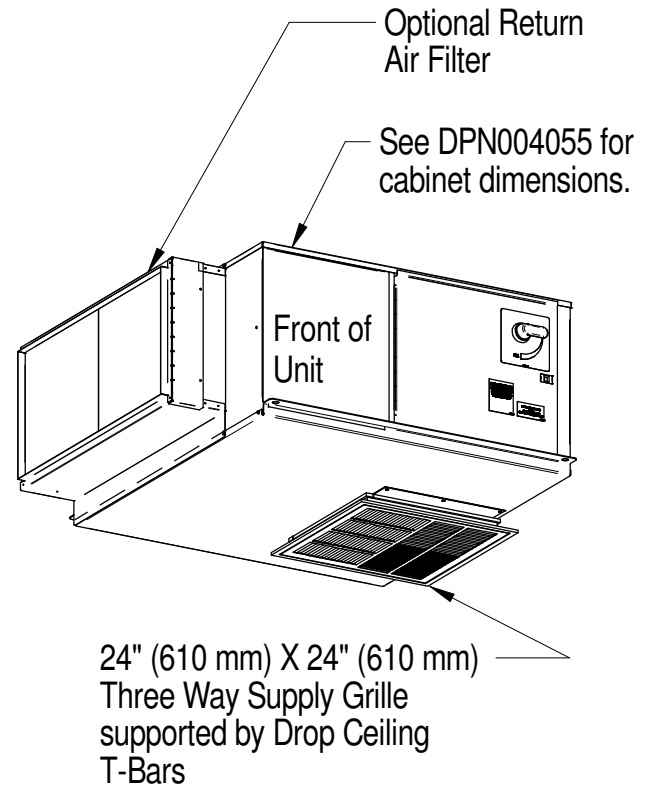
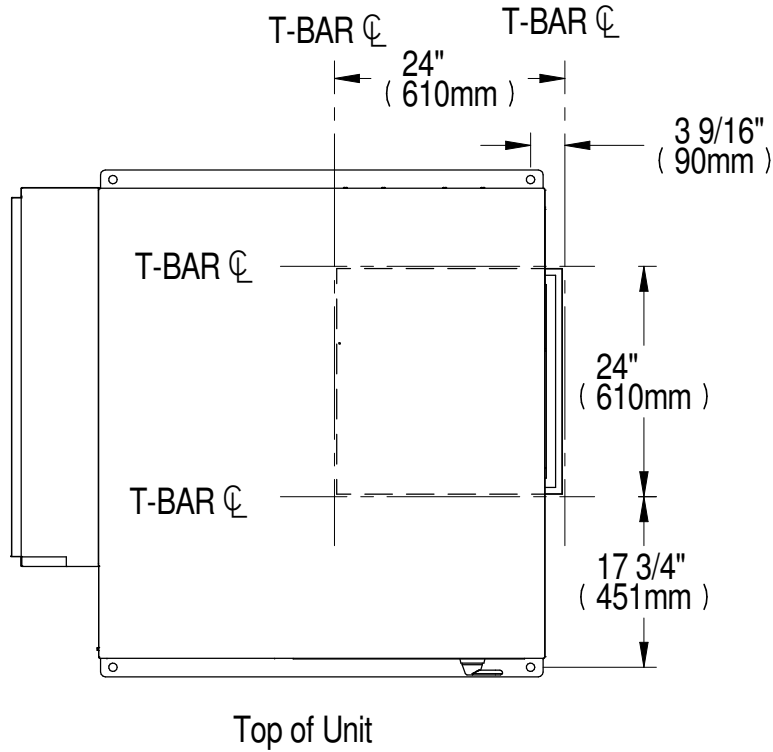
LIEBERT MINI-MATE VARIABLE CAPACITY

DIMENSIONAL DATA 4 & 5 TON DIRECT EXPANSION FAN/COIL MODULE OPTIONAL FILTER BOX & DISCHARGE DUCT FLANGE



LIEBERT MINI-MATE VARIABLE CAPACITY

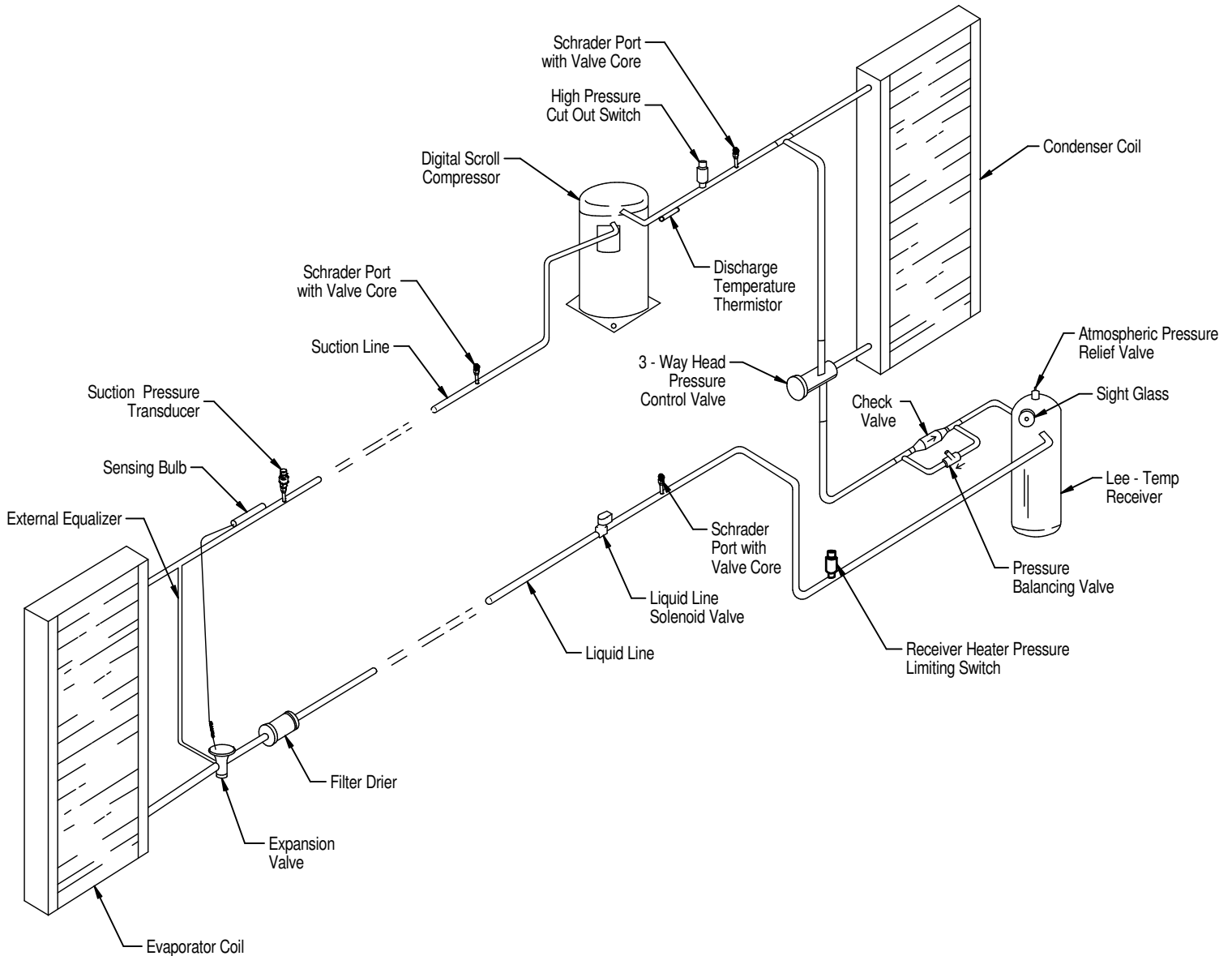
4 & 5 TON OPTIONAL SUPPLY GRILLE DIMENSIONAL DATA





LIEBERT MINI-MATE VARIABLE CAPACITY

GENERAL ARRANGEMENT SPLIT SYSTEMS W/ AIR COOLED CONDENSING UNIT

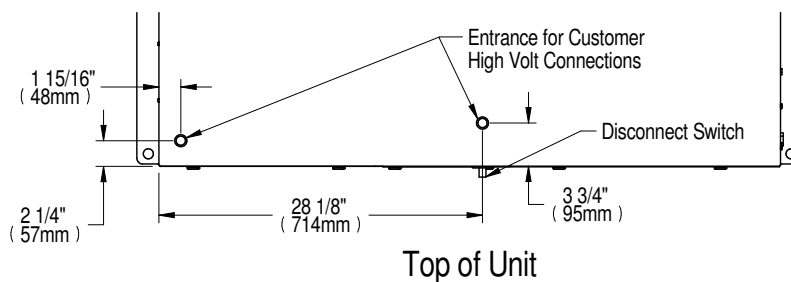
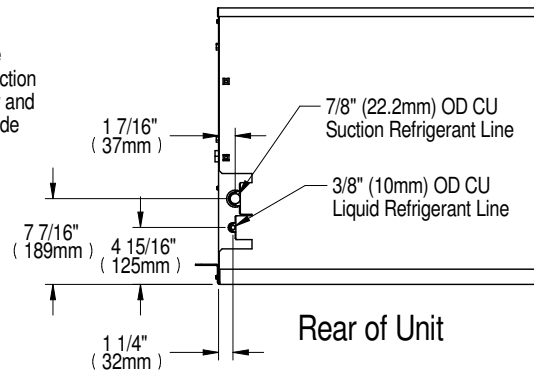
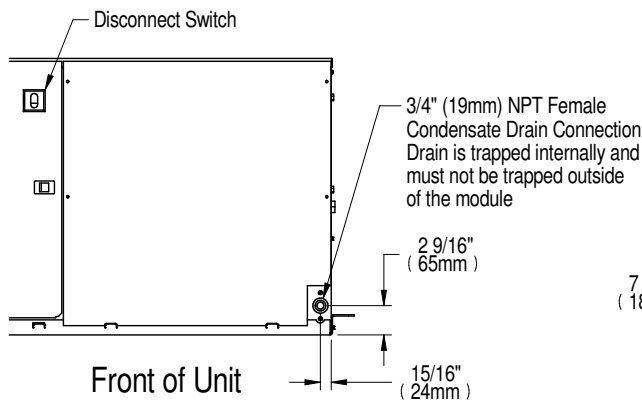
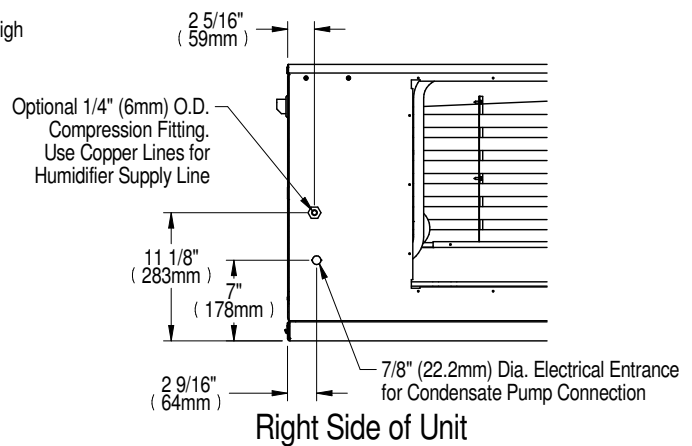
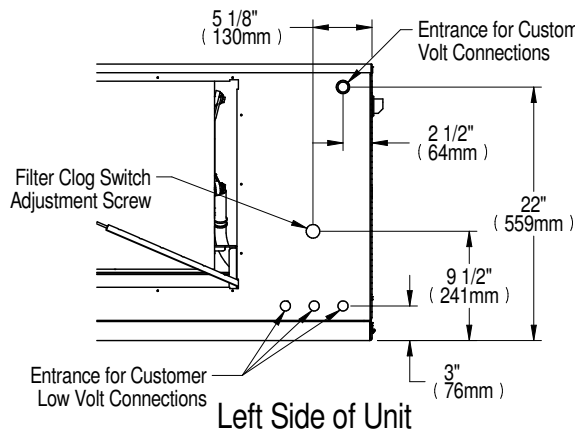
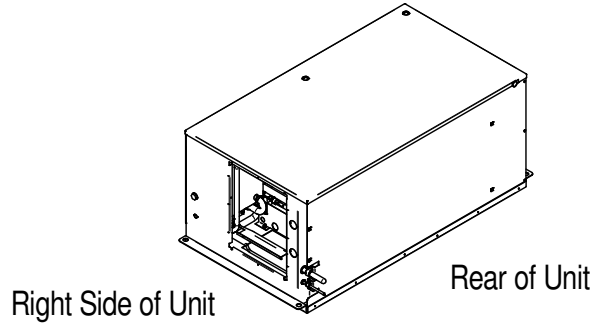
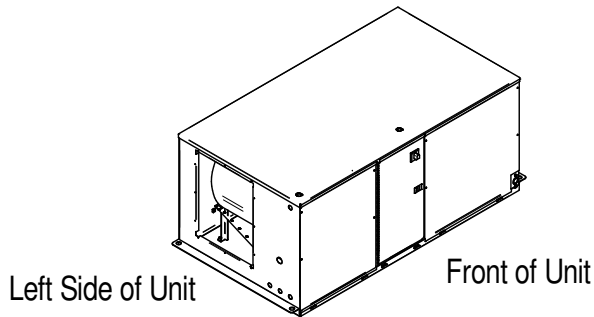


--- FIELD PIPING
==== FACTORY PIPING



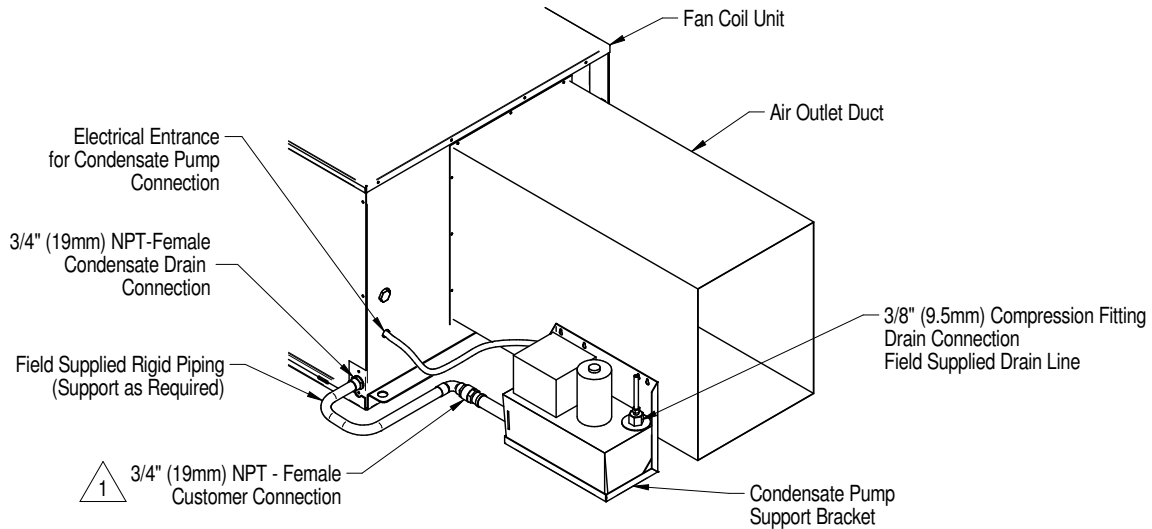
LIEBERT MINI-MATE VARIABLE CAPACITY

PRIMARY CONNECTION LOCATIONS 3 TON DIRECT EXPANSION FAN/COIL MODULE

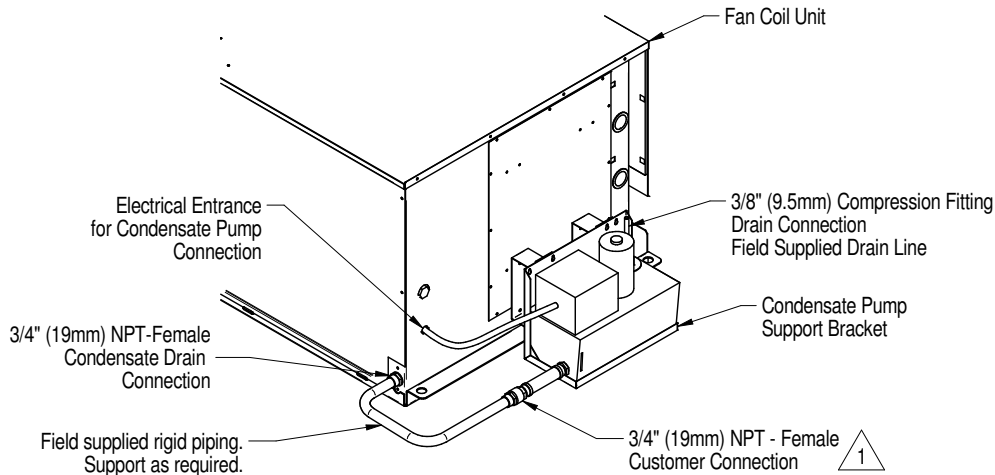


LIEBERT MINI-MATE VARIABLE CAPACITY

OPTIONAL FIELD INSTALLED CONDENSATE PUMP CONNECTION LOCATIONS 3 TON MODEL




**CONDENSATE PUMP (FIELD INSTALLED)
ON UNIT WITH AIR OUTLET DUCTWORK**



**CONDENSATE PUMP (FIELD INSTALLED)
ON UNIT WITH AIR DISTRIBUTION PLENUM**

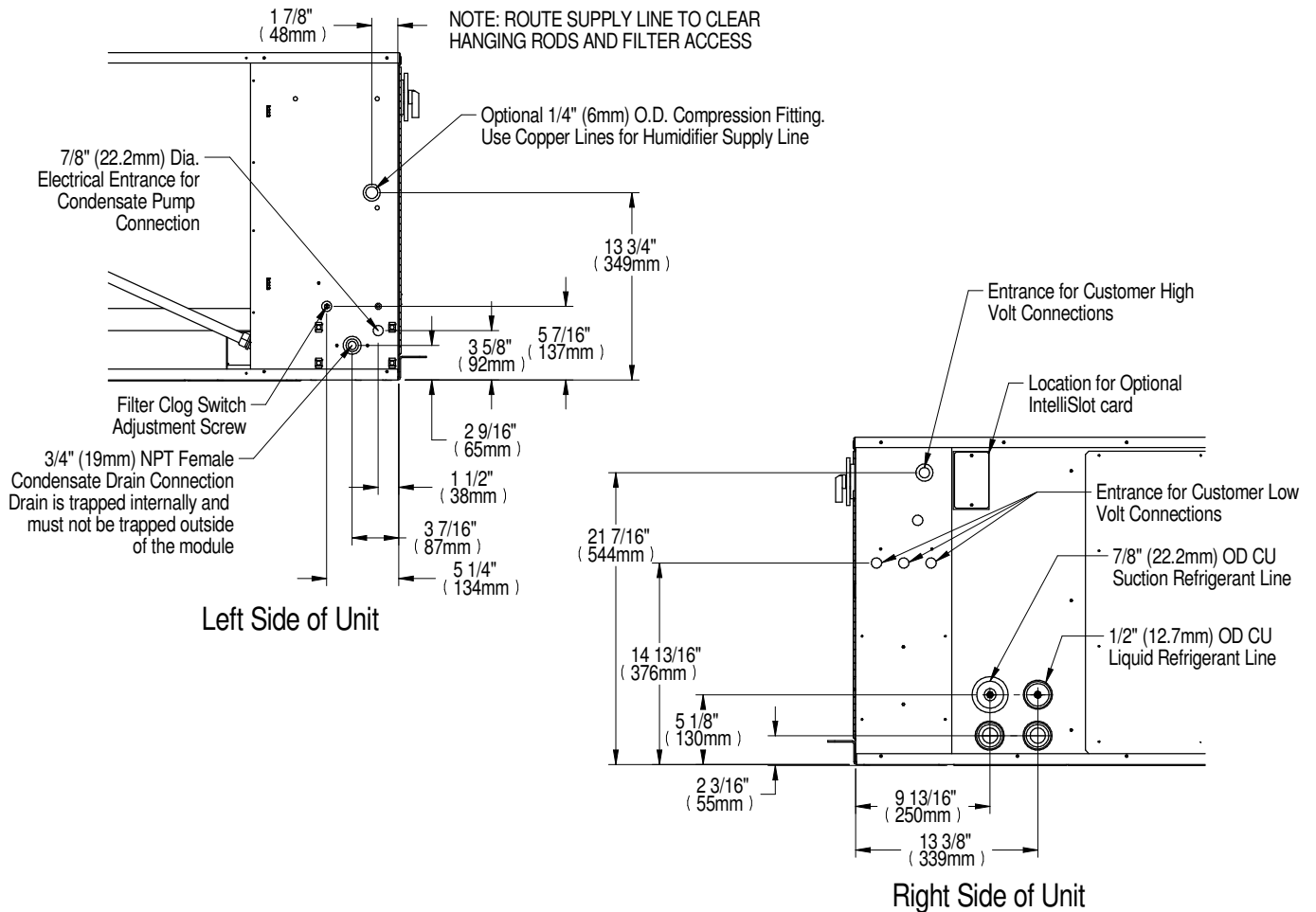
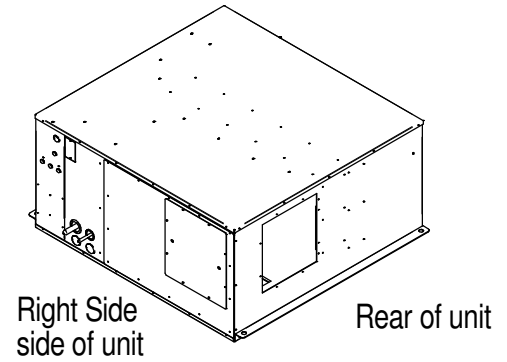
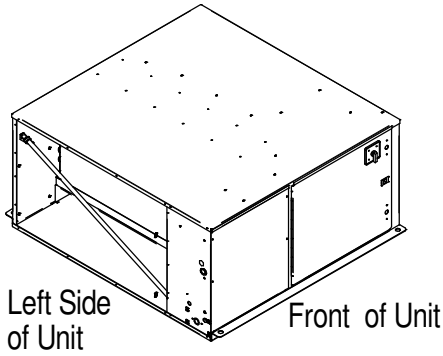
Notes:

1.  3/4" NPT-Male to 3/4" (19mm) flexible rubber tubing assembly supplied must be installed between condensate drain and pump inlet fitting and secured.
2. The Auxiliary Float Switch included with pump must be field interlocked with unit control to enable unit shutdown feature. Wire to Mini-Mate terminal per unit schematic.
3. Refer to DPN003401 for installation instructions.
4. Condensate pump is energized through Mini-Mate Module. Separate power supply is not necessary.
5. Condensate pump includes built in drain line check valve.



LIEBERT MINI-MATE VARIABLE CAPACITY

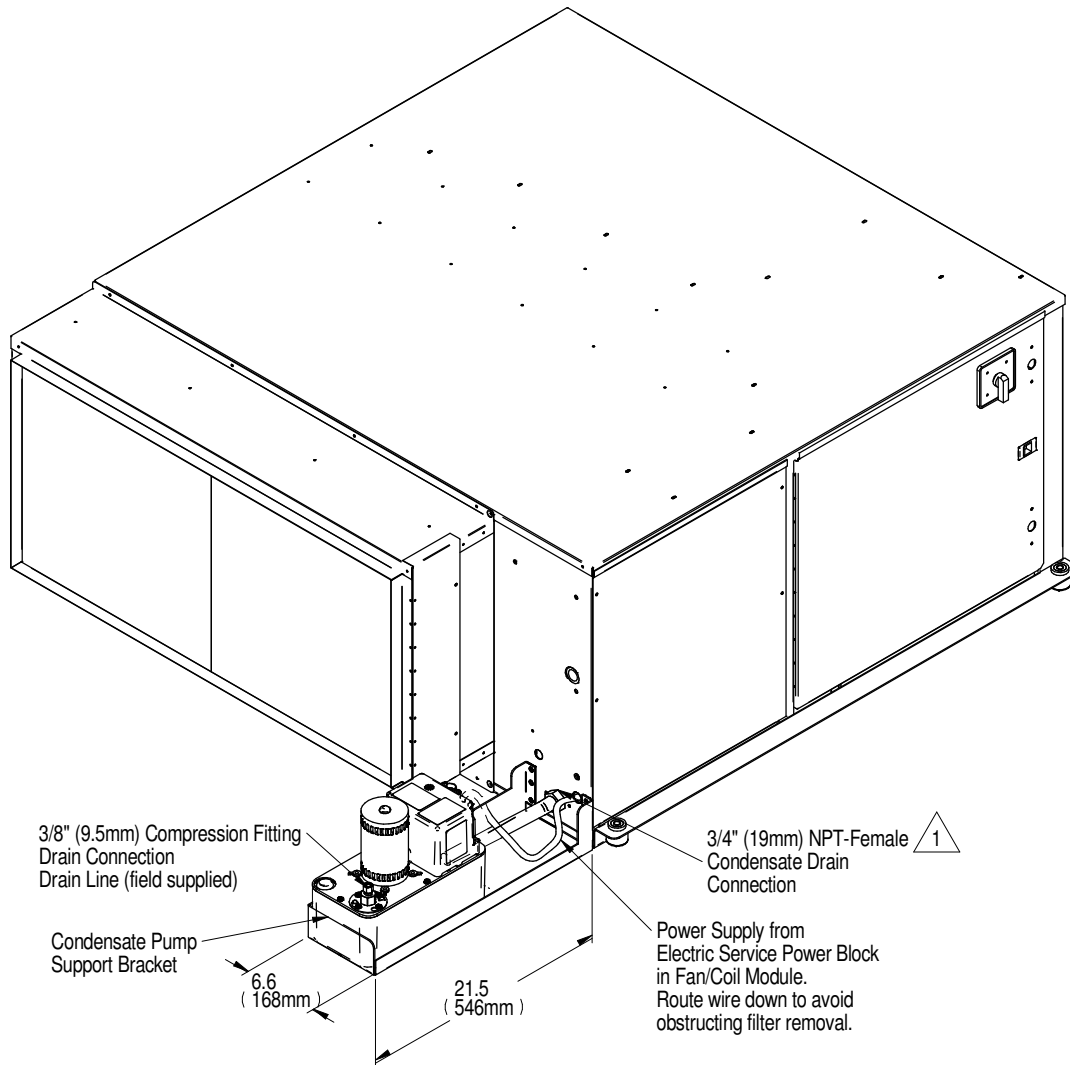
PRIMARY CONNECTION LOCATIONS 4 & 5 TON DIRECT EXPANSION FAN/COIL MODULE





LIEBERT MINI-MATE VARIABLE CAPACITY

OPTIONAL FIELD INSTALLED CONDENSATE PUMP CONNECTION LOCATIONS 4 & 5 TON MODELS

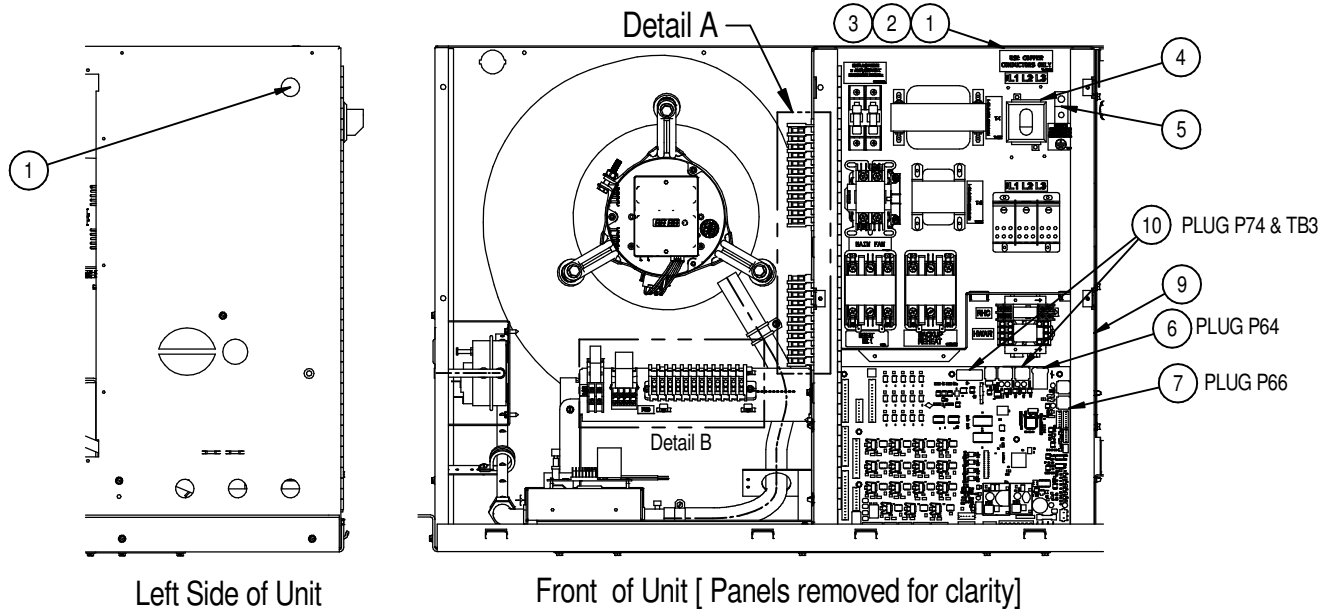


Notes:

1. 3/4" NPT-Male to 3/4" (19mm) flexible rubber tubing assembly supplied must be installed between condensate drain and pump inlet fitting and secured.
2. The Auxiliary Float Switch included with pump must be field interlocked with unit control to enable unit shutdown feature. Wire to Mini-Mate terminal per unit schematic.
3. Refer to DPN003401 for installation instructions.
4. Condensate pump is energized through Mini-Mate Module. Separate power supply is not necessary.
5. Condensate pump includes built in drain line check valve.

LIEBERT MINI-MATE VARIABLE CAPACITY

ELECTRICAL FIELD CONNECTIONS 3 TON DIRECT EXPANSION FAN/COIL MODULE



HIGH VOLTAGE FEATURES:

1. **High Voltage Entrance:** located on top and left side of unit.
2. **Single and three Phase Electric Service and Earth Ground.** Field supplied power and service.
3. **Single and three Phase connection.** Electric service connection terminals on disconnect.
4. **Disconnect Switch:** locking type standard.
5. **Earth ground connection:** Connection terminals for field supplied earth grounding wire.

CONTROL FEATURES:

6. **iCOM Display Communication:** Field supplied Ethernet wire; Connection to P64 and Ethernet port on iCOM display.
7. **Remote Temperature/Humidity Sensor :** Factory supplied Ethernet wire; Connection to P66 and ETH1 port on Sensor.
8. **iCOM Display Power:** Field supplied Class 1 wiring between unit terminals 13, 14 & 15 and supplied wiring connector at iCOM display (See Detail A, page 2/3).
9. **Low Voltage And Control Wiring Entrance:** located on right side of unit.

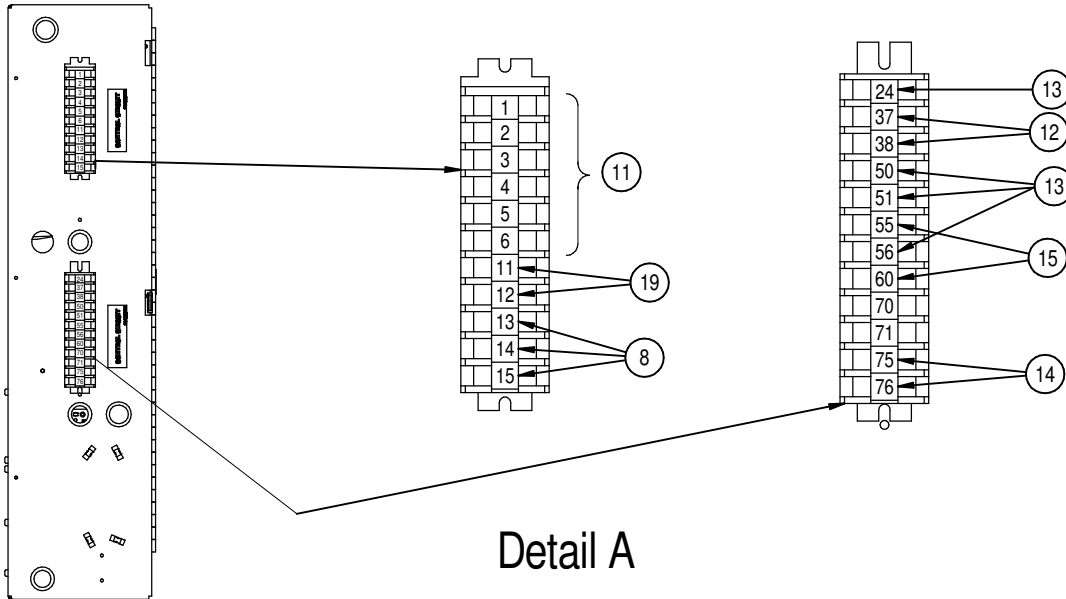
OPTIONAL COMMUNICATION CONNECTIONS

10. **Site and BMS Plug 74 and Terminal Block TB3** are reserved for Site and BMS connections. Plug 74 is an eight (8) pin RJ45 for Cat 5 cable. Terminal Block TB3 is a two (2) position screw terminal block for use with twisted pair wires.

Unit-to-Unit See DPN004840 for connections made between ETH2 on iCOM displays.

LIEBERT MINI-MATE VARIABLE CAPACITY

ELECTRICAL FIELD CONNECTIONS 3 TON DIRECT EXPANSION FAN/COIL MODULE



STANDARD LOW VOLTAGE FEATURES: (See Detail A)

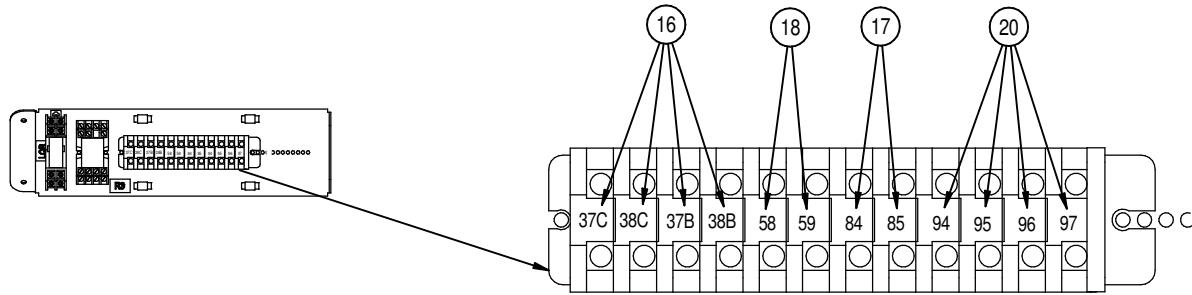
- 11. Condensing Unit (DX system only) :** Field supplied Class 1 wiring between Evaporator and Condensing unit. Terminals 1, 2, 3, 4, 5 and 6 used with outdoor air cooled condensing units and terminals 1, 2, 3, 4 and 5 used with indoor water/glycol condensing unit.
- 12. Remote Unit Shutdown** Replace existing jumper between terminals 37 & 38 with normally closed switch having a minimum 75VA, 24VAC rating. Use field supplied Class 1 wiring.
- 13. Remote Alarm Device (RAD)** Alarm connections may be factory wired or field wired. See schematic RAD1-3 for factory wired alarms. Use Class 1 wiring to connect normally open contacts between terminals 24 & 50, 24 & 51, 24 & 56. Suitable for 24VAC.
- 14. Common Alarm Connection** Field supplied Class 1 wiring to common alarm terminals 75 & 76, 1 Amp, 24VAC maximum on common alarm relay (K3).
- 15. Optional Condensate Alarm (Dual Float Condensate Pump only).** Relay terminals located on customer connection terminal block for remote indication. Field supplied Class 1 wiring to connections #55 & #60.

NOTES:

1. Refer to specification sheet for full load amp. and wire size amp. ratings.
2. Control voltage wiring must be a minimum of 16 GA (1.3mm) for up to 75' (23m) or not to exceed 1 volt drop in control line.

LIEBERT MINI-MATE VARIABLE CAPACITY

ELECTRICAL FIELD CONNECTIONS 3 TON DIRECT EXPANSION FAN/COIL MODULE



Detail B

OPTIONAL LOW VOLTAGE TERMINAL PACKAGE: (See Detail B)

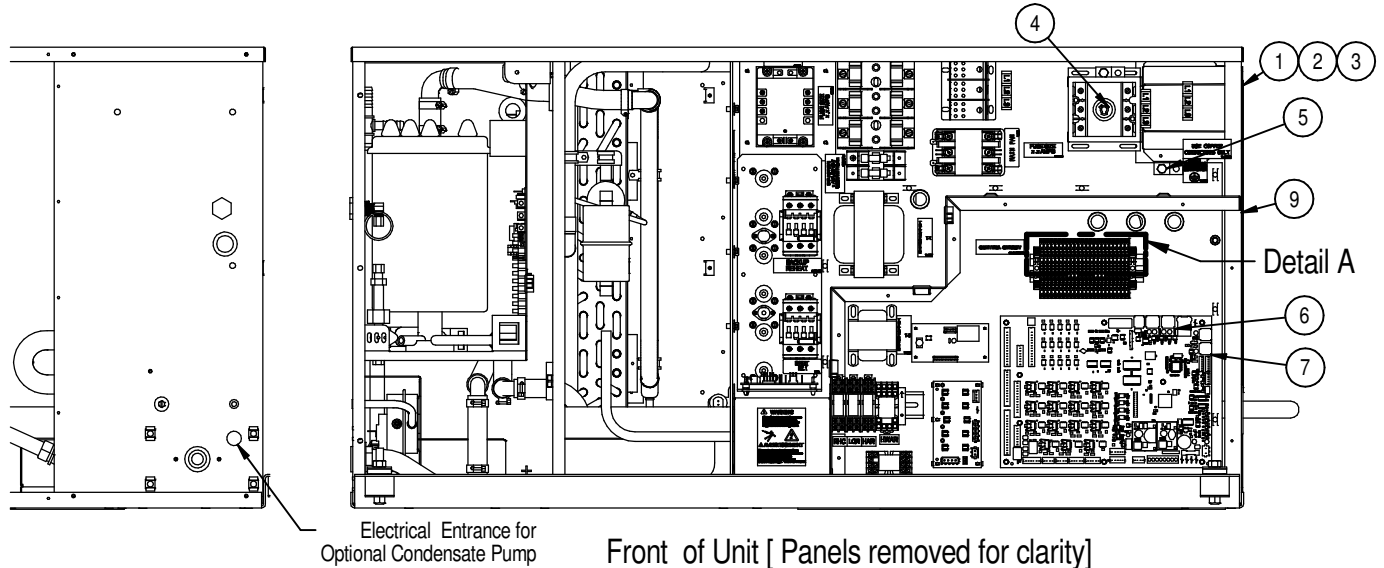
- 16. Remote Unit Shutdown, two additional pairs** Replace existing jumper between terminals 37B & 38B and 37C & 38C with normally closed switch having minimum 75VA, 24VAC rating. Use field supplied Class 1 wiring.
- 17. Main Fan Auxiliary Switch** Optional main fan auxiliary side switch. Terminals located on customer connection terminal block for remote indication that the evaporator fan motor/unit is on. Field connect to 24V maximum, Class1 wiring to connections #84 & #85.
- 18. Unit Shutdown by Liqui-TECT with Remote Indicator** Requires field wiring from optional Liqui-TECT device to Remote Alarm Device terminal 24 & 51 for unit shutdown, and field wiring from connections #58 & #59 for remote indicator of unit shutdown by Liqui-TECT. 24V maximum, Class 1 wiring required.
- 19. Remote Humidifier Control** Field to connect 24V maximum, Class 1 wiring to connections #11 & #12 (See Detail A).
- 20. Common Alarm Connection, two additional connections** Field supplied Class 1 wiring to common alarm terminals 94 & 95 and 96 & 97 which are factory connected to normally open contacts, 1 Amp, 24VAC maximum on common alarm relay (R3).

NOTES:

1. Refer to specification sheet for full load amp. and wire size amp. ratings.
2. Control voltage wiring must be a minimum of 16 GA (1.3mm) for up to 75' (23m) or not to exceed 1 volt drop in control line.

LIEBERT MINI-MATE VARIABLE CAPACITY

ELECTRICAL FIELD CONNECTIONS 4 & 5 TON DIRECT EXPANSION FAN/COIL MODULE



HIGH VOLTAGE FEATURES:

1. **High Voltage Entrance:** located on right side of unit.
2. **Three Phase Electric Service and Earth Ground.** Field supplied power and service.
3. **Three Phase connection.** Electric service connection terminals on disconnect.
4. **Disconnect Switch:** Non-locking type standard (Locking fused disconnect optional).
5. **Earth ground connection:** Connection terminals for field supplied earth grounding wire.

CONTROL FEATURES:

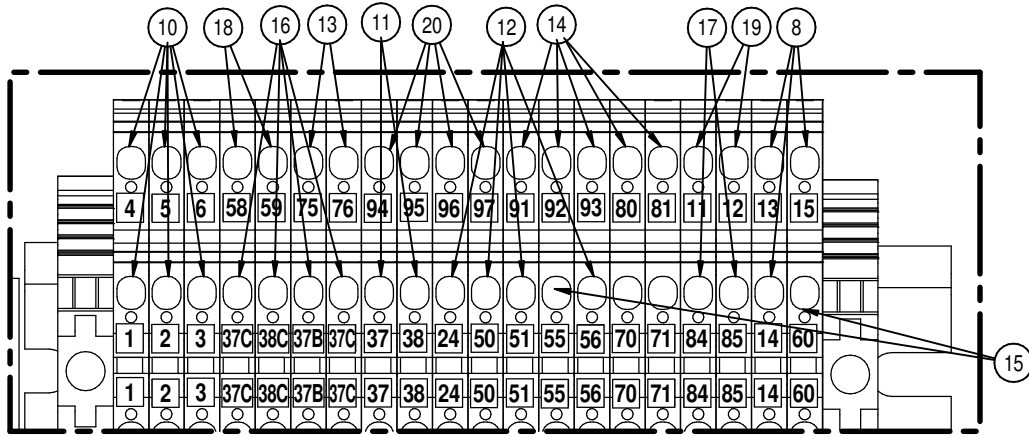
6. **iCOM Display Communication:** Field supplied Ethernet wire; Connection to P64 and Ethernet port on iCOM display.
7. **Remote Temperature/Humidity Sensor :** Factory supplied Ethernet wire; Connection to P66 and Ethernet port on Sensor
8. **iCOM Display Power:** Field supplied Class 1 wiring between unit terminals 13, 14 & 15 and supplied wiring connector at iCOM display
9. **Low Voltage And Control Wiring Entrance:** located on right side of unit.

STANDARD LOW VOLTAGE FEATURES: (See Detail A – Page 2/2)

10. **Condensing Unit (DX system only) :** Field supplied Class 1 wiring between Evaporator and Condensing unit. Terminals 1, 2, 3, 4, 5 and 6 used with outdoor air cooled condensing units and terminals 1, 2, 3, 4 and 5 used with indoor water/glycol condensing unit.
11. **Remote unit shutdown.** Replace existing jumper between terminals 37 & 38 with normally closed switch having a minimum 75VA, 24VAC rating. Use field supplied Class 1 wiring.
12. **Remote Alarm Device (RAD) .** Alarm connections may be factory wired or field wired. See schematic, RAD1- 3, for factory wired alarms. For field wired alarms, use Class 1 wiring to connect normally open contacts between terminals 24 & 50, 24 & 51, 24 & 56. Suitable for 24VAC.
13. **Common alarm connection.** Field supplied Class 1 wiring to common alarm terminals 75 & 76, 1 Amp, 24VAC maximum on common alarm relay (K3).

LIEBERT MINI-MATE VARIABLE CAPACITY

ELECTRICAL FIELD CONNECTIONS 4 & 5 TON DIRECT EXPANSION FAN/COIL MODULE



DETAIL A CUSTOMER CONNECTIONS

OPTIONAL LOW VOLTAGE FEATURES:

- 14. **Smoke detector alarm connections.** Field supplied Class 1 wiring to 1 Amp, 24VAC maximum remote alarm circuits. Factory wired contacts from optional smoke detector are #91-Common, #92-NO, and #93-NC. Optional smoke detector trouble (SDT) connections #80 & #81.
- 15. **Optional Condensate Alarm (Dual Float Condensate Pump only).** Relay terminals located on customer connection terminal block for remote indication. Field supplied Class 1 wiring to connections #55 & #60.

Low Voltage Terminal Package:

- 16. **Remote unit shutdown, two additional pairs.** Replace existing jumper between terminals 37B & 38B and 37C and 38C with normally closed switch having a minimum 75VA, 24VAC rating. Use field supplied Class 1 wiring
- 17. **Main Fan Auxiliary Switch.** Optional main fan auxiliary side switch. Terminals located on customer connection terminal block for remote indication that the evaporator fan motor/unit is on. Field to connect 24V maximum, Class 1 wiring to connections #84 & #85.
- 18. **Unit Shutdown by Liqui-tect with Remote Indicator.** Requires field wiring from optional Liqui-tect device to Remote Alarm Device terminal 24 & 51 for unit shutdown and field wiring from connections #58 & #59 for remote indicator of unit shutdown by Liqui-tect. 24V maximum, Class 1 wiring required.
- 19. **Remote Humidifier Control** Field to connect 24V maximum, Class 1 wiring to connections #11 & #12.
- 20. **Common alarm connection, two additional connections.** Field supplied Class 1 wiring to common alarm terminals 94 & 95, and 96 & 97, which are factory connected to normally open contacts, 1 Amp, 24VAC maximum on common alarm relay (R3).

NOTES:

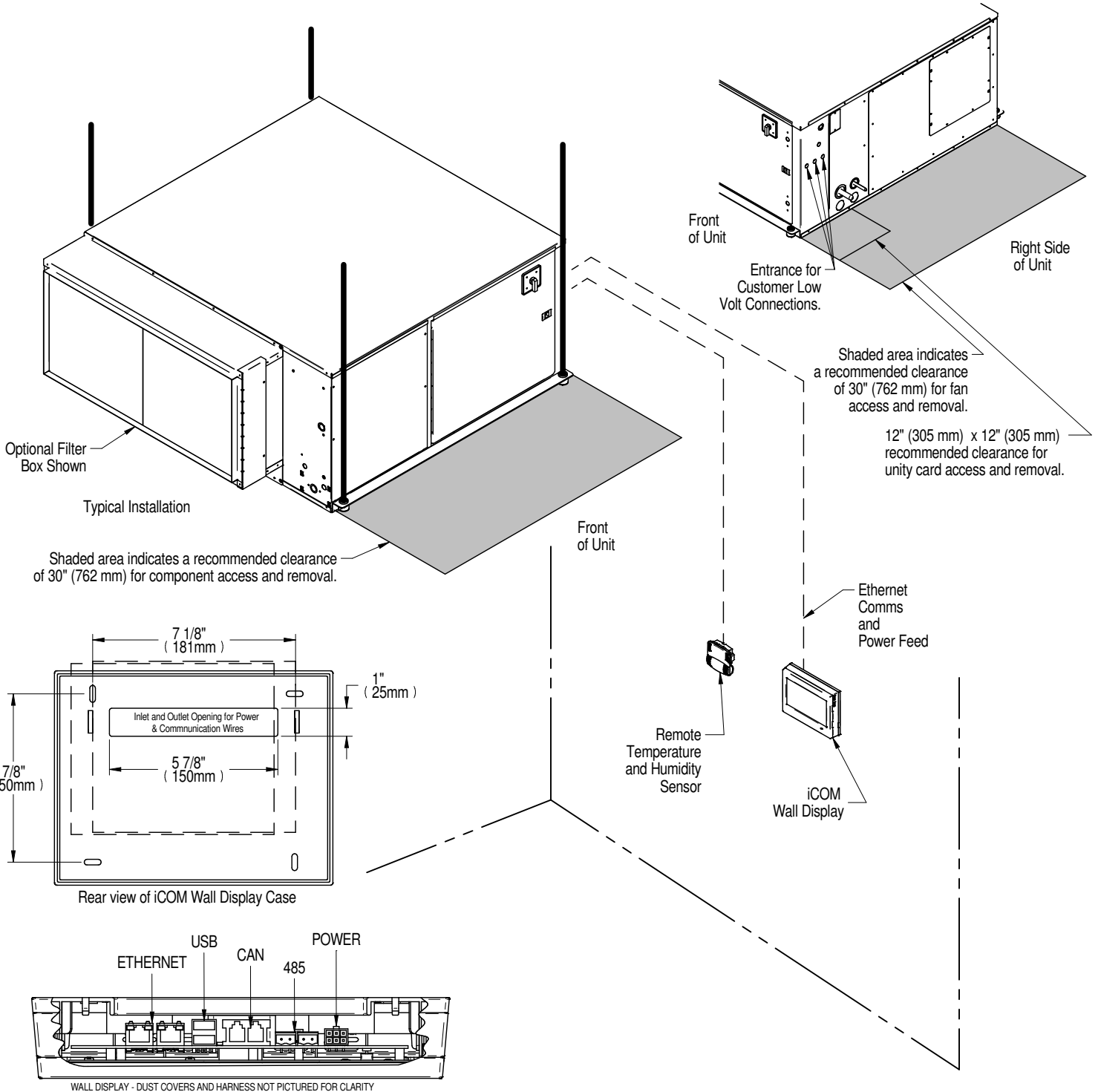
1. Refer to specification sheet for full load amp. and wire size amp. ratings.
2. Control voltage wiring must be a minimum of 16 GA (1.3mm) for up to 75' (23m) or not to exceed 1 volt drop in control line.



LIEBERT MINI-MATE VARIABLE CAPACITY

4 & 5 TON GENERAL ARRANGEMENT, DIMENSIONAL DATA & FIELD CONNECTIONS

LIEBERT iCOM™ WALLMOUNT DISPLAY



Notes:
1. Refer to DPN004057 for connection points on Liebert Mini-Mate unit.

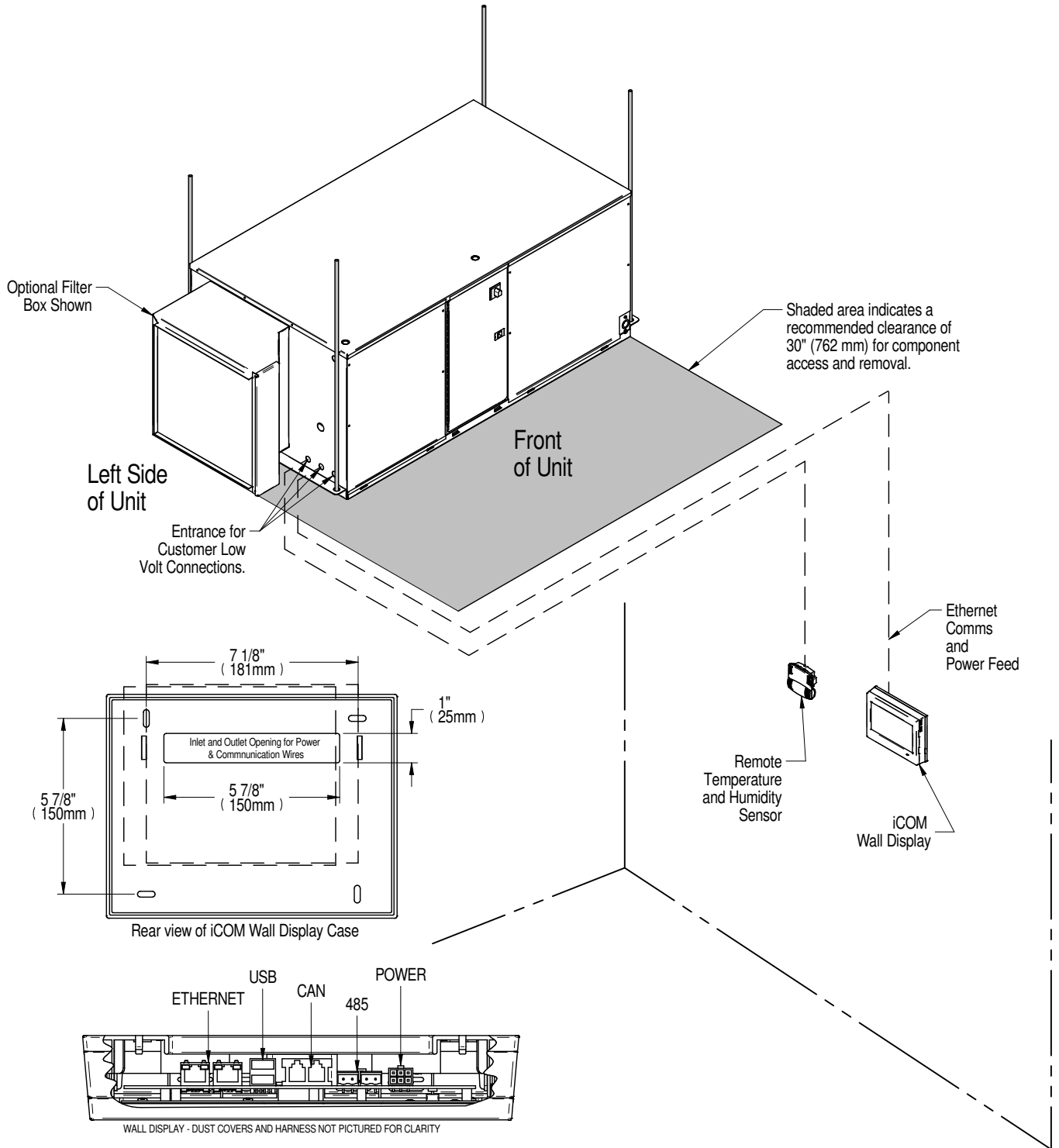
--- Field Provided Wiring
- - - Wall



LIEBERT MINI-MATE VARIABLE CAPACITY

3 TON GENERAL ARRANGEMENT, DIMENSIONAL DATA & FIELD CONNECTIONS

LIEBERT iCOM™ WALLMOUNT DISPLAY

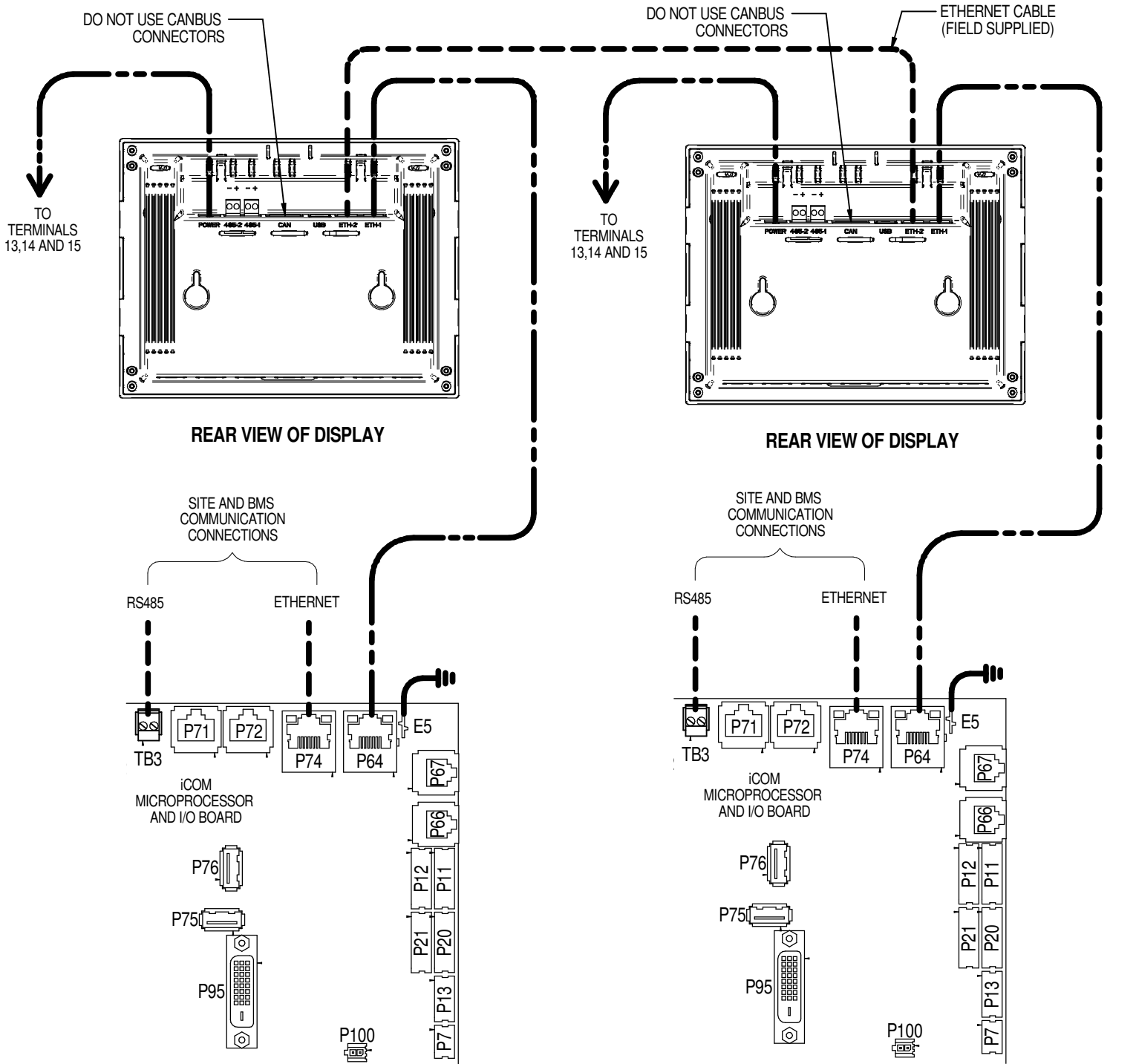


Notes:
1. Refer to DPN004802 for connection points on Liebert Mini-Mate unit.

--- Field Provided Wiring
- - - Wall

LIEBERT MINI-MATE VARIABLE CAPACITY

UNIT TO UNIT NETWORK CONNECTIONS TWO 3 TON UNITS NETWORKED

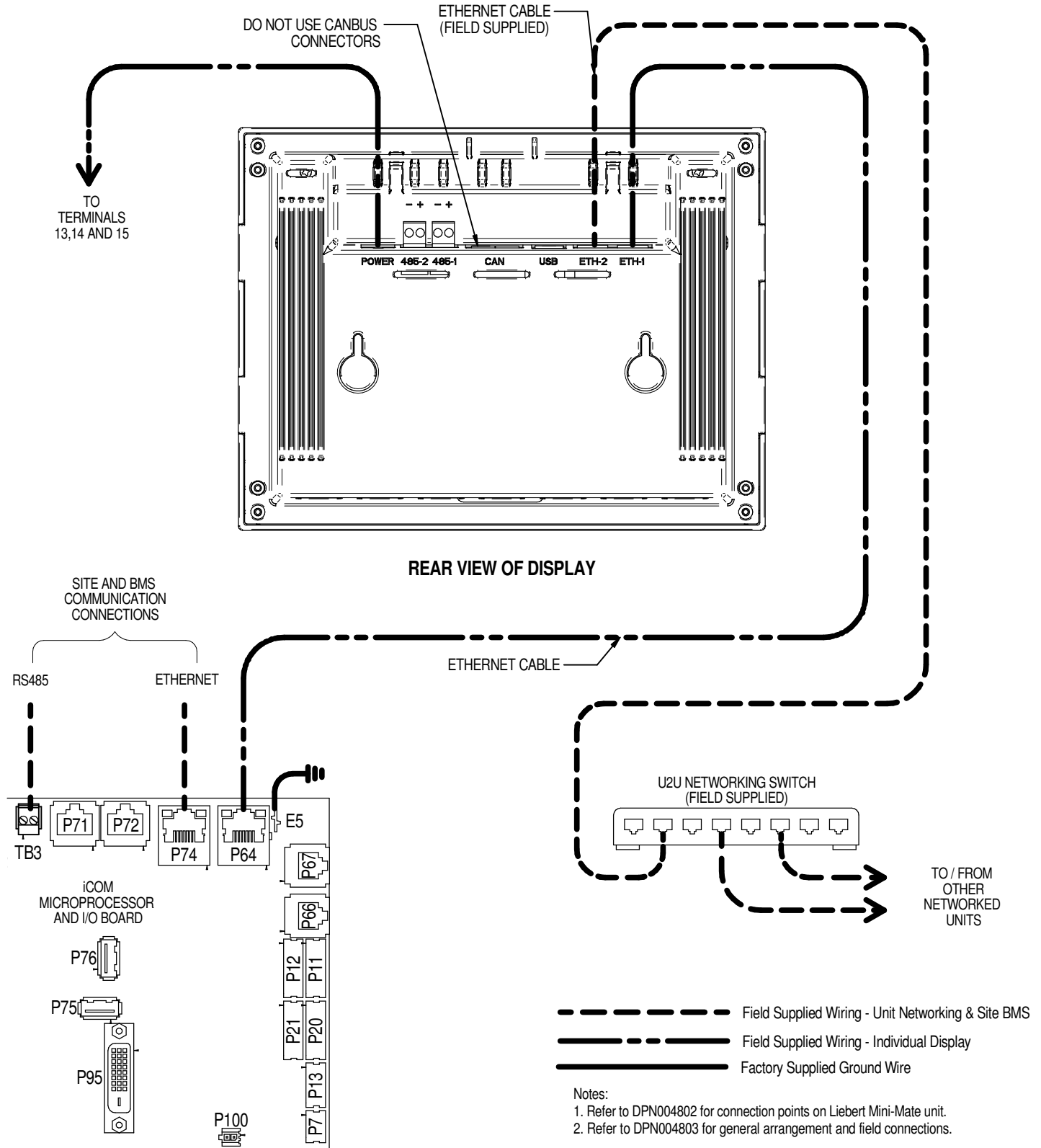


Notes:

1. Refer to DPN004802 for connection points on Liebert Mini-Mate unit.
2. Refer to DPN004803 for general arrangement and field connections.

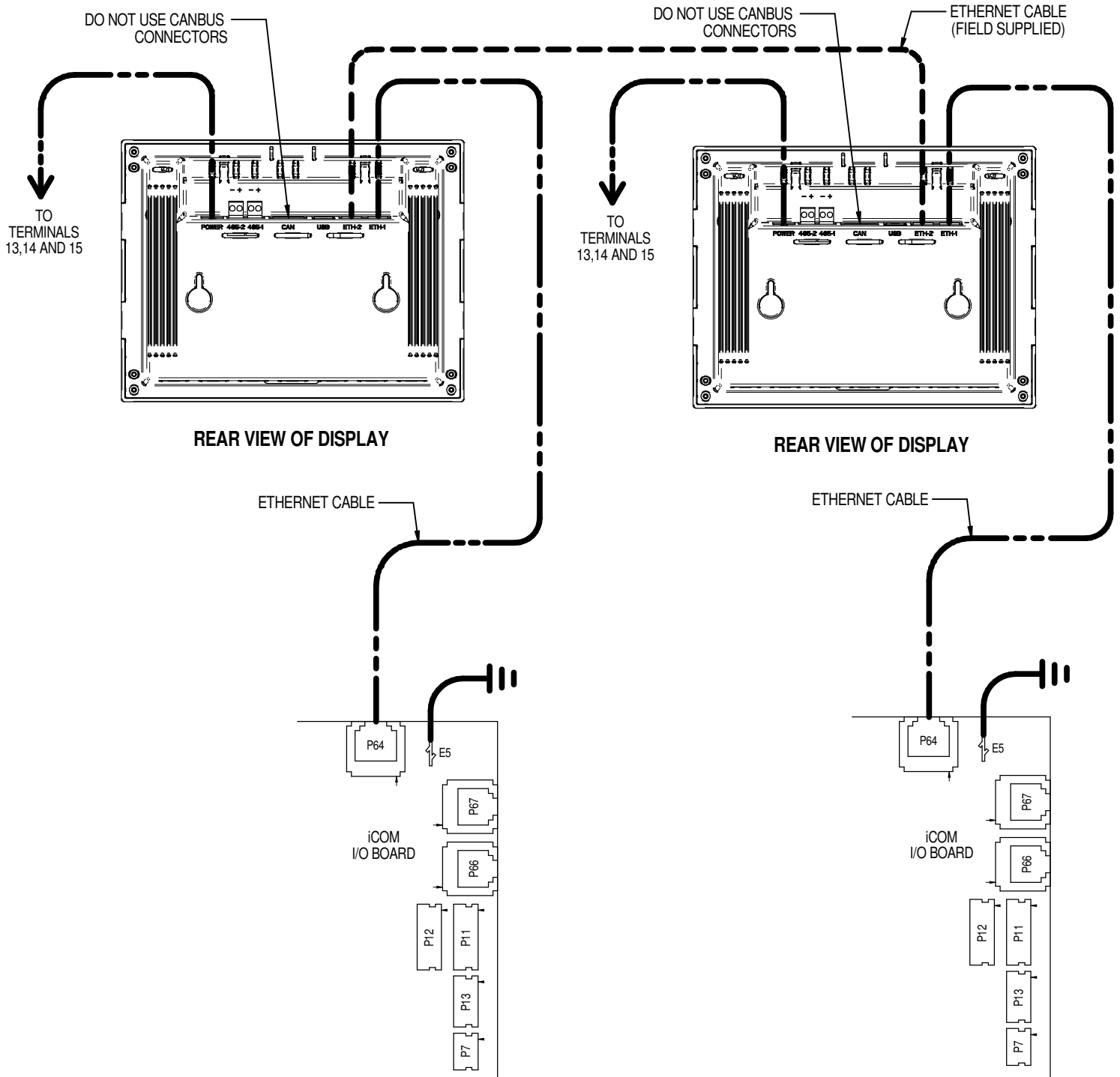
LIEBERT MINI-MATE VARIABLE CAPACITY

UNIT TO UNIT NETWORK CONNECTIONS TWO OR MORE 3 TON UNITS NETWORKED USING SWITCH



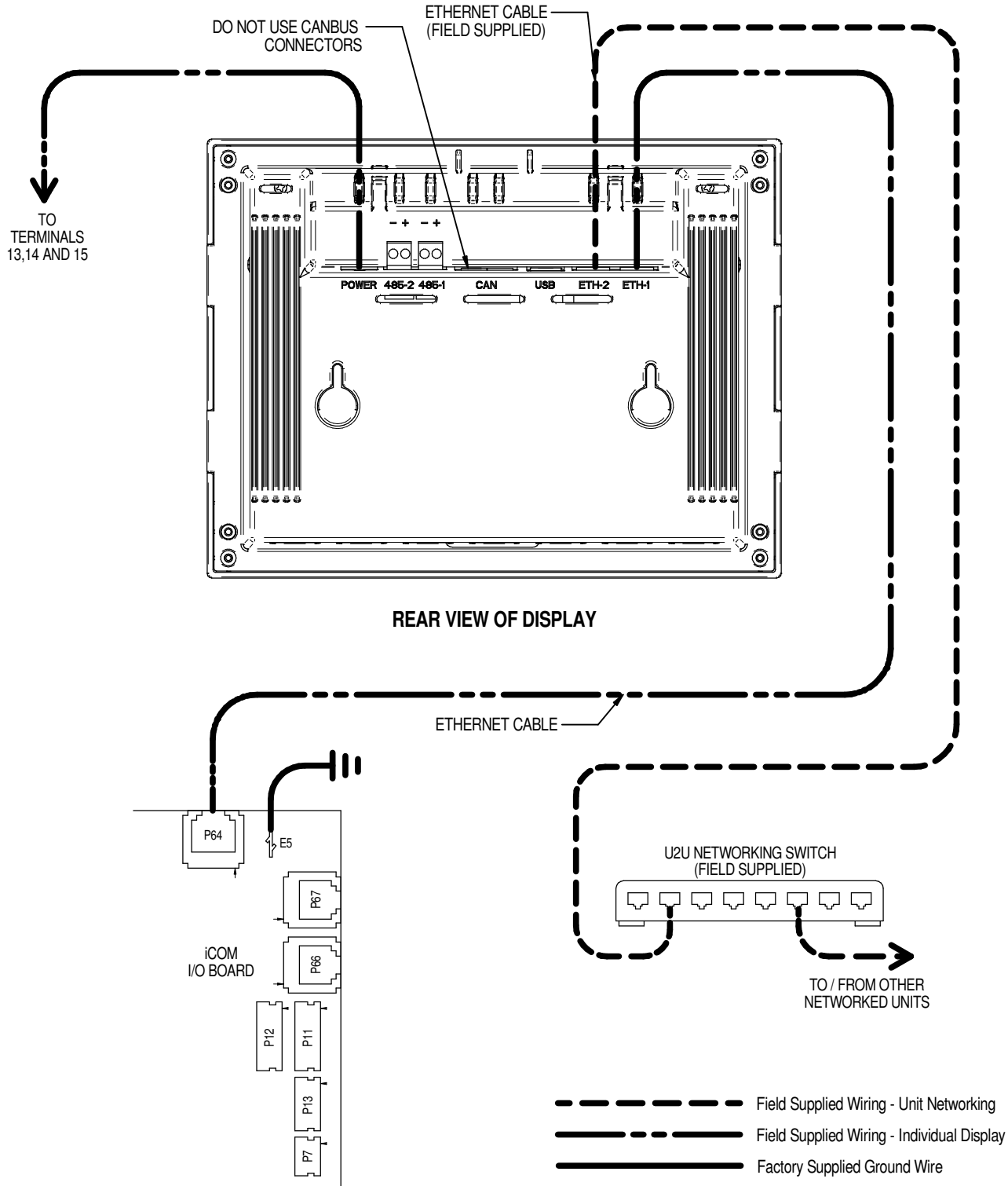
LIEBERT MINI-MATE VARIABLE CAPACITY

UNIT TO UNIT NETWORK CONNECTIONS TWO 4-5 TON UNITS NETWORKED



LIEBERT MINI-MATE VARIABLE CAPACITY

UNIT TO UNIT NETWORK CONNECTIONS TWO OR MORE 4-5 TON UNITS NETWORKED USING SWITCH



Notes:

1. Refer to DPN004057 for connection points on Liebert Mini-Mate unit.
2. Refer to DPN004238 for general arrangement and field connections.





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