



Liebert[®] DSE Packaged Solution

Installer/User Guide

400 kW to 500 kW

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Technical Support Site

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

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

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1 Important Safety Instructions

SAVE THESE INSTRUCTIONS

This manual contains important safety instructions that should be followed during the installation and maintenance of the Vertiv™ Liebert® DSE Packaged Solution. 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 Vertiv™ Liebert® iCOM™ 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 Liebert® iCOM™ controller. The factory-supplied disconnect switch is on the exterior of the enclosure. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high-voltage. 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 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.



WARNING! Risk of pressurized doors flying open or slamming closed suddenly. Can cause serious injury. Do not attempt to open doors while fans are running. Do not turn on fans with doors open. Before opening the door, open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is off, and verify that all fans have stopped rotating. Do not leave unsecured objects in the fan's bay after any maintenance operation.



WARNING! Risk of contact with flying objects. Can cause serious injury or death. Do not leave unsecured objects or tools in the fan's bay after performing maintenance operations. Re-install all panels before starting up this unit after maintenance is performed.



WARNING! Risk of very heavy, 250-lb (113.4-kg) fan modules dropping downward suddenly. Can cause injury or death. Support fan modules before removing mounting hardware. Use caution to keep body parts out of the fan modules pathway during repositioning. Only properly trained and qualified personnel should work on this equipment.



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. Use the center of gravity indicators on the unit to determine the position of the slings. Unit weights are listed in **Table 3.3** on page 16 , and **Table 3.4** on page 16 .



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 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 wiring damage, short circuits and electric shock. Can cause overheated wiring, smoke, fire, activation of fire suppression systems and EMS personnel and equipment, building and equipment damage, injury or death. Insert CSA certified or UL listed bushings into holes and or knockouts used to route wiring through metal panels to protect the wire insulation from contact with sheet metal edges.



WARNING! Risk of explosive discharge of high-pressure refrigerant. Can cause serious injury. Neutral and service ports on the rotalock valve do not have a valve core. Front-seat the service valves and relieve pressure from the compressor before loosening a part or a component attached to the service valve. Follow local codes to properly reclaim refrigerant.



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 125 lbs. (56.7 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 low-hanging panels. Can cause injury or equipment damage. Wear appropriate, OSHA-approved PPE when entering and working within the enclosure.



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.

Vertiv™ Liebert® DSE Packaged Solution 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 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 operation in high-humidity conditions. Can cause unit damage and water carryover.

The Liebert® DSE Packaged Solution operations only as a sensible cooling unit and does not provide dehumidification.

NOTE: The Liebert® cooling unit has a factory installed high pressure safety switch in the high side refrigerant circuit.

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 configuration number for Vertiv™ Liebert® DSE Packaged Solution 400 kW/500 kW unit and components.

2.1 Vertiv™ Liebert® DSE Packaged Solution Model Number Nomenclature

The following tables describe each digit of the 40-digit Liebert® DSE Packaged Solution.

Table 2.1 Liebert® DSE 400 kW/500 kW Packaged Solution Configuration Number Digits 1 to 10 Example

DSE 400 kW/500 kW Packaged Solution Configuration Number Digits 1 to 10 Example									
1	2	3	4	5	6	7	8	9	10
D	P	4	0	0	F	P	2	A	T

Table 2.2 Liebert® DSE 400 kW/500 kW Packaged Solution Configuration Number Digits 11 to 36 Example

DSE 400 kW/500 kW Packaged Solution Configuration Number Digits 11 to 36 Example														
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25 – 36
0	H	0	8	1	6	L	0	U	0	P	A	A	P	—

Table 2.3 Liebert® DSE 400 kW/500 kW Packaged Solution Configuration Number Digits 37 to 40 Example

DSE 400 kW/500 kW Packaged Solution Configuration Number 37 to 40 Example			
37	38	39	40
—	—	—	—

Table 2.4 Liebert® DSE Packaged Solution Model Number Digit Definitions

Digit	Description
Digits 1 and 2 = Product Family	DP = Liebert® DSE Packaged Solution
Digit 3 to 5 = Cooling Capacity, kW	400 = Nominal sensible capacity, 400-kW 500 = Nominal sensible capacity, 500-kW
Digit 6 = Air Discharge	F = Perimeter, front inlet/front supply R = Roof-top, bottom inlet/bottom supply B = Roof-top draw-thru, bottom inlet/bottom supply
Digit 7 = System Type	P = Air-cooled, EconoPhase
Digit 8 = Air-flow (Fan Type)	2 = Direct-drive plenum fans and VFD (standard air flow)
Digit 9 = Power Supply	A = 460 V - 3 ph - 60 Hz
Digit 10 = Cooling System	T = Tandem with digital scroll, R-410A
Digit 11 = Humidifier	0 = None
Digit 12 = Display	2 = Liebert® iCOM™ (High Definition)
Digit 13 = Options	0 = None A = Supply-air isolating gravity damper ¹
Digit 14 = Air Filter	8 = MERV 8, 4-in. 9 = MERV 11, 4-in.
Digit 15 = Coil Option	1 = Non-coated evaporator coil, non-coated condenser coil
Digit 16 = Enclosure Option	6 = Liebert® standard pebble-gray color
Digit 17 = High-voltage option	L = Locking disconnect 6 = Locking disconnect + ATS

Table 2.4 Liebert® DSE Packaged Solution Model Number Digit Definitions (continued)

Digit	Description
Digit 18 = Option packages	0 = None L = Low-voltage terminal package
Digit 19 = Monitoring Cards	B = Base Comms and Connectivity
Digit 20 = Sensors	0 = None A = Compressor high-temp
Digit 21 = Packaging	P = Domestic
Digit 22 = Controls Power	0 = Controls power from main input feed ² A = Separate, 120-V feed from UPS S = Quick Start and Capacitive Buffer
Digit 23 = EconoPhase	A = Standard capacity
Digit 24 = Packaging	P = Domestic
Digit 25 to 36 = Placeholder	
Digit 37 to 40 = Factory configuration number	
1. For damper: If Digit 6 = F, the damper is on front supply. Damper is not available if Digit 6 = R or B. 2. For controls power: if Digit 22 = 0, there is no power buffer.	

2.2 Component Location

The unit component locations are described in the submittal documents included in the [Submittal Drawings](#) on page 65 .

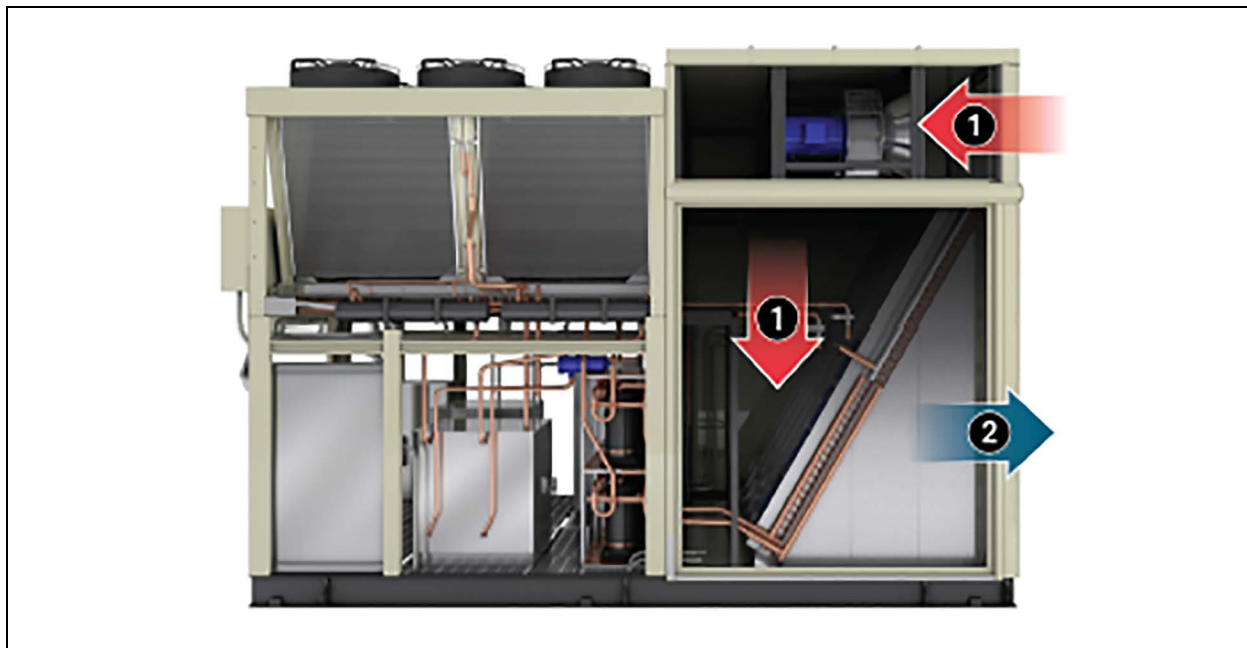
The following table lists the relevant documents by number and title.

Table 2.5 Component Location Drawings

Document Number	Title
DPN004155	Component Location, Perimeter Unit
DPN004190	Component Location, Roof-top Unit
DPN004592	Component Location, Roof-top Draw-through Unit

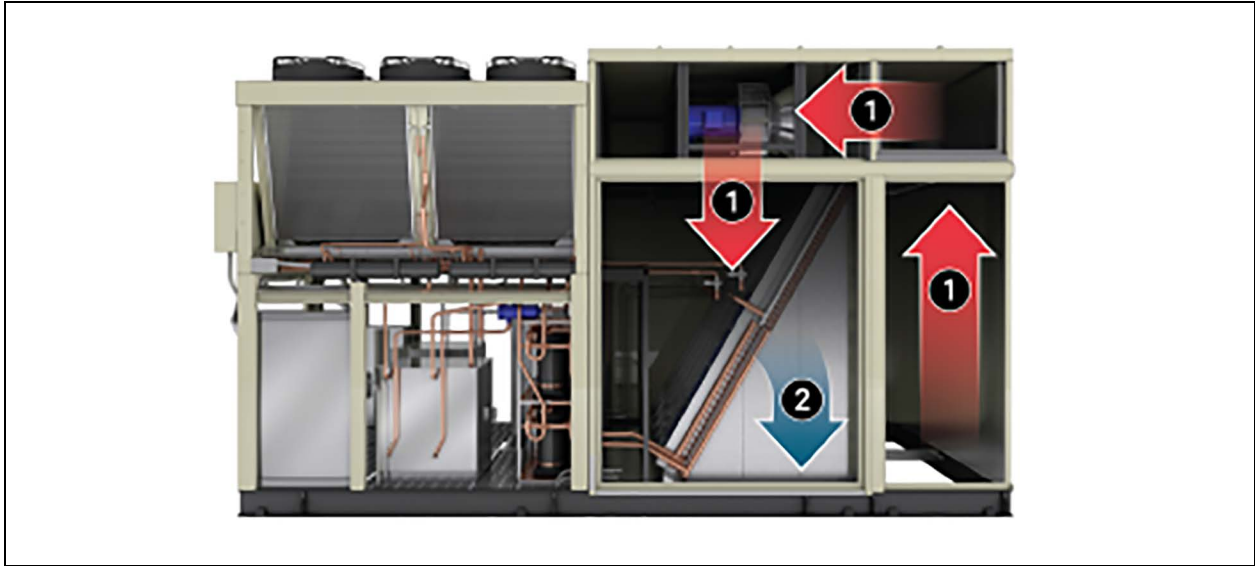
2.3 Air Flow Configurations

Figure 2.1 Perimeter Unit Air Flow Configuration



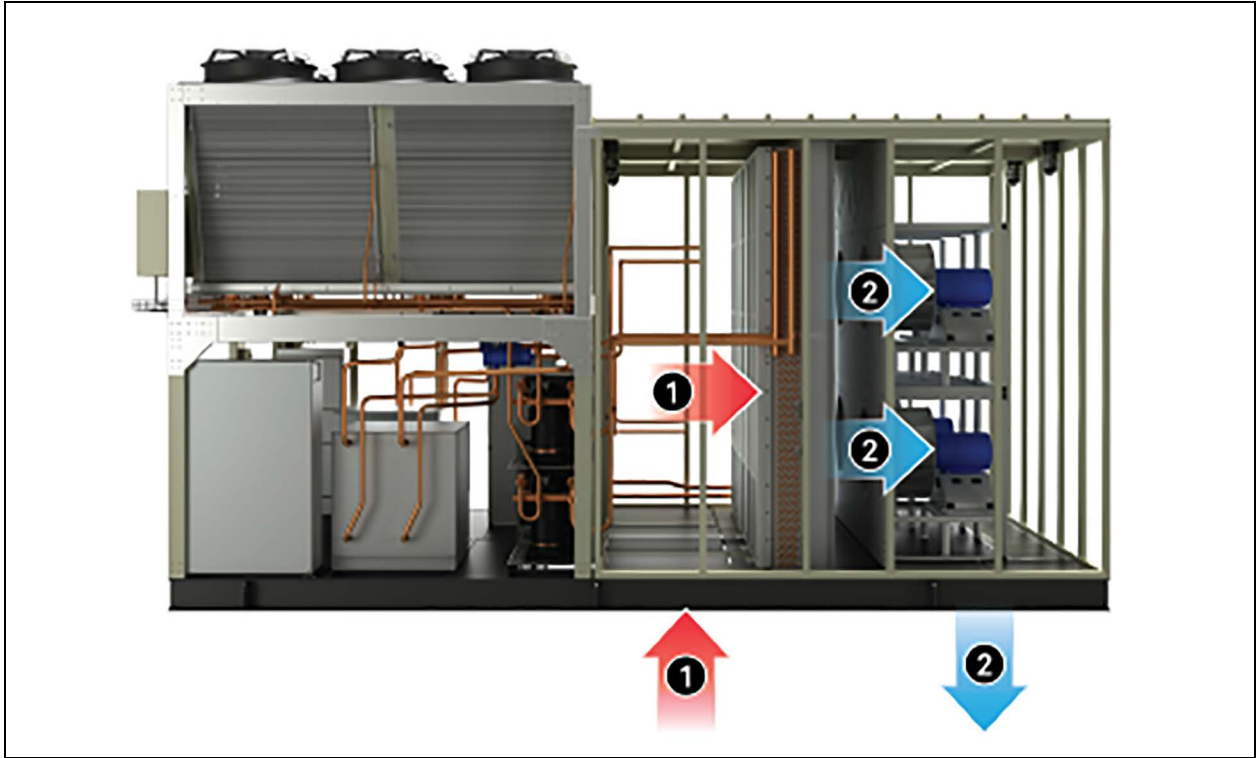
Item	Description
1	Return air from data center
2	Supply air to data center

Figure 2.2 Rooftop Unit Air Flow Configuration



Item	Description
1	Return air from data center
2	Supply air to data center

Figure 2.3 Rooftop Unit Draw Through Air Flow Configuration



Item	Description
1	Return air from data center
2	Supply air to data center

Table 2.6 Air Flow Configuration Drawings

Document Number	Title
DPN004598	Airflow Schematic, Perimeter Unit
DPN004190	Component Location, Rooftop Unit
DPN004592	Component Location, Rooftop Draw Through Unit

3 Pre-installation Preparation and Guidelines

3.1 Storage before Installation

If storing the unit for long periods before installation:

- Remove the packaging from the unit, and allow proper clearance around the unit to perform periodic inspections and maintenance.
- Inspect the unit periodically for condensation inside the unit or other signs of other effects of the storage environment.
- Rotate the fans and motor shaft by hand periodically for several revolutions. Look for signs of lubrication problem or obstructions.
- If storing at low temperatures trapped moisture can collect on walls and electrical components. We recommend routine inspections and, if needed, install electric heaters to prevent condensation.

NOTE: Before installing unit, determine whether any building alterations are required to run 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 **Table 2.4** on page 6, and submittal drawings to determine the type of system being installed and anticipate building alterations and duct work needed.

The unit and anchor dimensions are described in the submittal documents included in the [Submittal Drawings](#) on page 65.

- Verify that mounting surface/roof top is level, solid and sufficient to support the unit. See **Table 3.3** on page 16, and **Table 3.4** on page 16, for Unit Weights.
- Verify that the support structure for the unit (concrete or other type) has a flat, regular surface and is adequate to support the unit operating weight.
- Verify that adequate water-control/drain system is in place. If connecting the drip-pan clean-out line, refer to the appropriate submittal document in **Table 3.1** on page 13, for the clean-out line location and port size.
- Verify that the high-voltage electric-supply lines are adequately sized based on the electrical specification on the unit's name plate and meet local code.
- Verify that the utility electric-supply lines (lights and outlet) are adequately sized and meet local code.
- Verify that all control and communication wiring are properly routed to the unit control panel and meet local code.
- Confirm that the conditioned space has a proper envelope and vapor barrier.
- Handle outside air and humidity control externally to the Vertiv™ Liebert® DSE Packaged Solution unit. The Liebert® DSE Packaged Solution does not control humidity and is not intended to handle outside air.
- Allow at least the minimum recommended clearances for maintenance and service. See the appropriate submittal documents for dimensions in [Submittal Drawings](#) on page 65.
- Ensure that there is no obstruction when installing duct work connections and transitions to minimize friction losses and turbulence.
- Verify that all duct joints are sealed to prevent air leakage or water penetration.
- If unit is installed but will not be commissioned for a long period, operate the fans or install electric heaters to prevent internal condensation. Refer to [Storage before Installation](#) above, and follow the guidelines until commissioned.

3.2 Rooftop Unit Installation Guidelines

The rooftop units must be supported by an appropriately designed curb. A curb is the interface between the building and the rooftop unit. It supports the weight of the roof-top unit by transferring the load onto the roof's structural members, streamlines duct-work connections, and provides the weatherproof seal to the roof.

- A structural engineer must verify that the roof has adequate strength and ability to support loads from the weight of the unit, curb, snow, wind and seismic events.
- The curb and any cribbing must be designed and certified by a qualified engineer to support the anchoring loads of the unit and provide for a leak free design. Sealing of the curb to the roof is the responsibility of the qualified engineer or architect to design and qualified contractor to execute.
- The roof curb should be installed by qualified personnel. Improper installation or faulty construction can result in water or air leaks or in structural failure and collapse.
- The roof curb mounting surface must be square and level prior to setting equipment.
- The installer must ensure that any appropriate sealing material is applied between the unit and the curb to provide water- and air-tight connections in accordance with the design of the curb.
- Sealing materials cannot interfere with the anchoring connection surface of the roof-top unit, or the unit may not be able to withstand its rated seismic or wind capacities. Vibration isolators should not be used without the express consent of Vertiv engineering.
- Any flashing from the rooftop unit to the curb is the responsibility of the installing contractors.
- Any water ingress through any penetrations from flashing or other connections to the roof-top unit are the responsibility of the installing contractor to remedy.

3.2.1 Service Clearance for Rooftop Units

Allow for recommended service clearances around the unit per appropriate submittal drawing for your unit, listed in **Table 3.1** on the facing page . Provide a roof walkway along the sides of the unit for service and access to controls and components. Contact your Vertiv sales representative for service requirements that are less than those recommended . Applications in geographic areas subjected to seismic or hurricane conditions must meet code requirements for fastening the unit to the curb and the curb to the building structure.

3.3 Planning Dimensions

The unit and anchor dimensions are described in the submittal documents included in the [Submittal Drawings](#) on page 65.

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

Table 3.1 Dimension Planning Drawings

Document Number	Title
DPN004465	Equipment Floor Plan Layout for Perimeter and Rooftop Units
DPN004653	Equipment Floor-Plan Layout for Rooftop Draw Through Units
Perimeter Units	
DPN004148	Cabinet and Anchor Dimensional Data
DPN004326	Drip Pan Clean Out Access and Location
Rooftop Units	
DPN004188	Cabinet and Anchor Dimensional Data
DPN004593	Cabinet and Anchor Dimensional Data, Draw Through Units
DPN004651	Condensate Drain Access and Location

3.4 Connections and System Setup

3.4.1 Electrical Connections

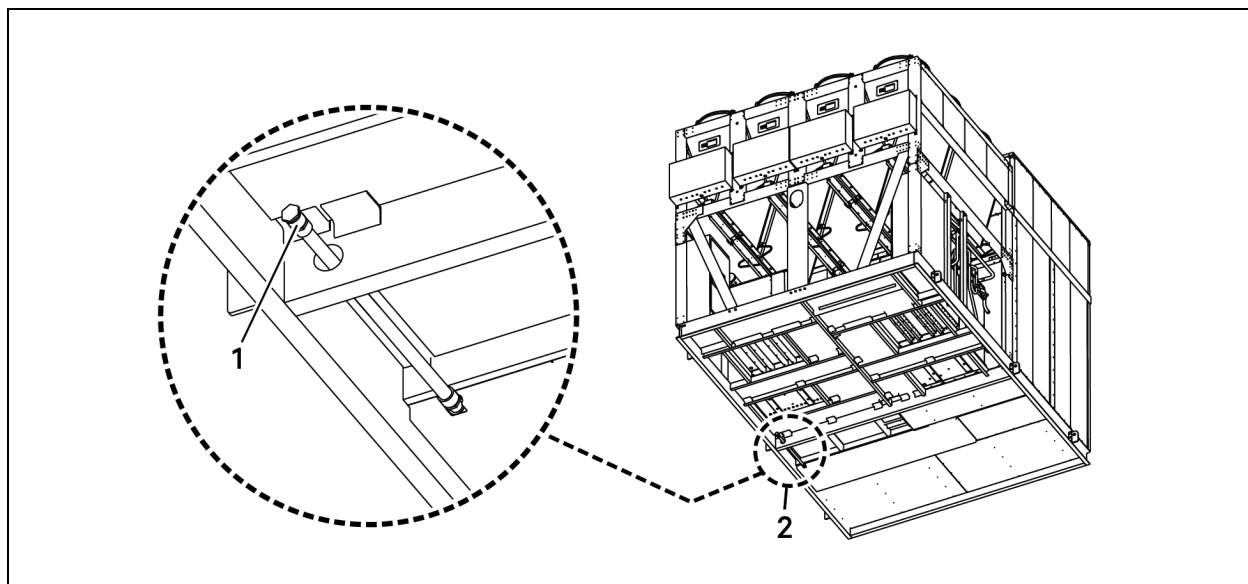
- Three-phase electrical service is required for all models. Electrical service must conform to national and local electrical codes. See [Electrical Field Connections](#) on page 21, for the details.
- Plan the routing of wiring and duct work to the unit. Refer to the appropriate electrical connection drawings for your system in [Submittal Drawings](#) on page 65.

3.4.2 Evaporator Drip Pan Connection

Connect the evaporator clean-out line to an adequate water-drain system. See **Figure 3.1** on the next page, or **Figure 3.2** on page 15, for the connection on the unit. Observe the following requirements when installing and routing the clean out line:

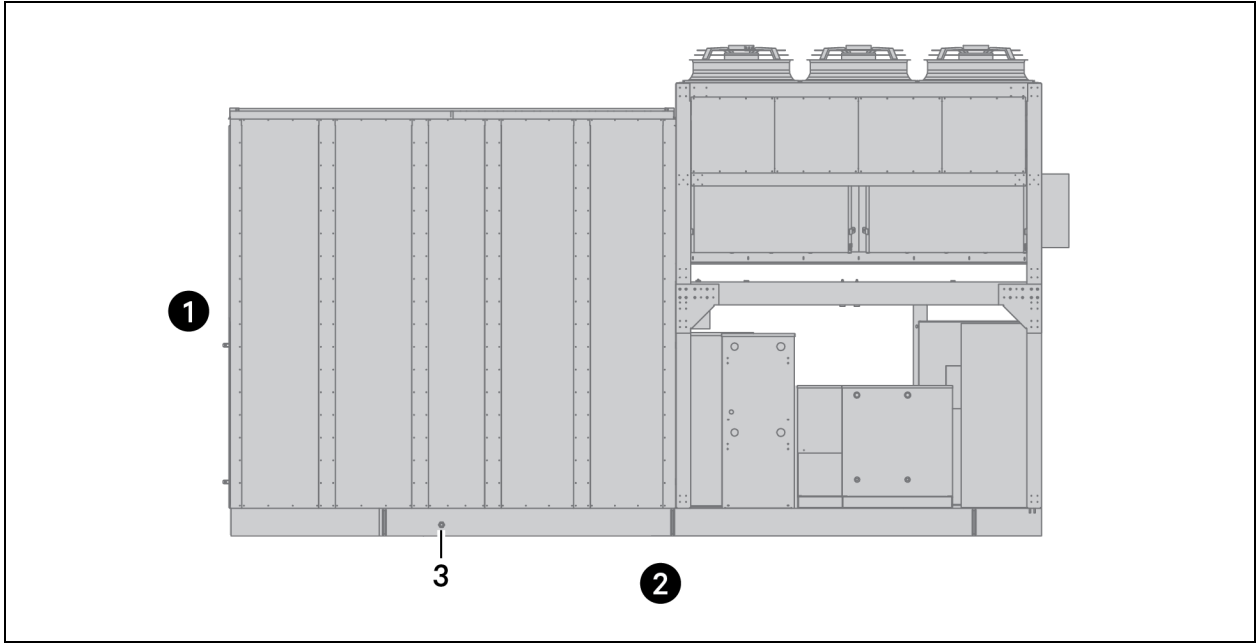
- Insulate the line with heat trace so it will not freeze.
- The line must be the full size of the drain connection. The connection port is 1 in. pipe with CPVC 1 in. FPT fitting.
- Slope the drain line continuously away from the unit, and pitch the drain line toward the drain.
- The line must be made of a material that is suitable for draining water and be rigid enough that it does not sag between supports, which creates unintentional traps.
- The drain line must comply with all applicable codes.

Figure 3.1 Drip Pan Clean Out Line Location on Perimeter and Rooftop Units



Item	Description
1	Water drain connection for evaporator drip pan. Accessed by removing the floor panel above it. (Next to the compressor compartment).
2	Location of the drip-pan clean-out line in the perimeter unit.

Figure 3.2 Drip Pan Clean Out Line Location on Draw-Through Rooftop Units



Item	Description
1	Rear of unit
2	Left side view of unit
3	Location of the drip-pan clean-out line on rooftop unit.

3.5 Operating Conditions

The Vertiv™ Liebert® DSE Packaged Solution must supply air to a conditioned space within the operating envelope that ASHRAE recommends for data centers. Operating the Liebert® DSE Packaged Solution outside of this envelope can decrease equipment reliability. Refer to ASHRAE’s publication, “Thermal Guidelines for Data Processing Environments.”

3.5.1 Cooling

Table 3.2 below, provides the recommended maximum and minimum return-air temperature and dew-point conditions for the Vertiv™ Liebert® DSE Packaged Solution Applications.

Table 3.2 Application Envelope for DP400/500

Control Settings	DP400F DP400R DP400B	DP500F	DP500B DP500R
Maximum Return Air Temperature	105°F (40°C)	105°F (40°C)	105°F (40°C)
Minimum return-air temperature	85°F (29°C)	95°F (35°C) *	95°F (35°C) *
Maximum dew point	59°F (15°C)	52°F (11°C)	52°F (11°C)
Maximum Supply-Air Setpoint	80°F (27°C)	80°F (27°C) *	80°F (27°C) *
Minimum Supply Air Control Setpoint	68°F (20°C)	70°F (21°C)	75°F (24°C)
*Note: DP500 minimum air-side temperature differential at full load is 25°F (14°C)			

Operating outside this envelope can decrease equipment reliability.

NOTE: When running above 77°F (25°C) supply-air temperature, the superheat readings on the refrigeration circuits may be higher than 13°F (7.2°C). The EEVs will run out of stroke and limit mass flow, which will result in higher than normal superheat.

3.6 Unit Weights

Table 3.3 DSE400 Unit Weights

Model	Weight, lb (kg)
Perimeter	23,500 (10,659)
Rooftop	25,500 (11,567)
Rooftop Draw Through	25,500 (11,567)

Table 3.4 DSE500 Unit Weights

Model	Weight, lb (kg)
Perimeter	224,000 (10,886)
Rooftop	26,000 (11,793)
Rooftop Draw Through	26,000 (11,793)

4 Equipment Inspection and Handling

SAFETY INFORMATION



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. Use the center of gravity indicators on the unit to determine the position of the slings. Unit weights are listed in **Table 3.3** on page 16 and **Table 3.4** on page 16 .



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.

- 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:

- Lift beam
- Slings
- Spreader bars
- Shims and blocks

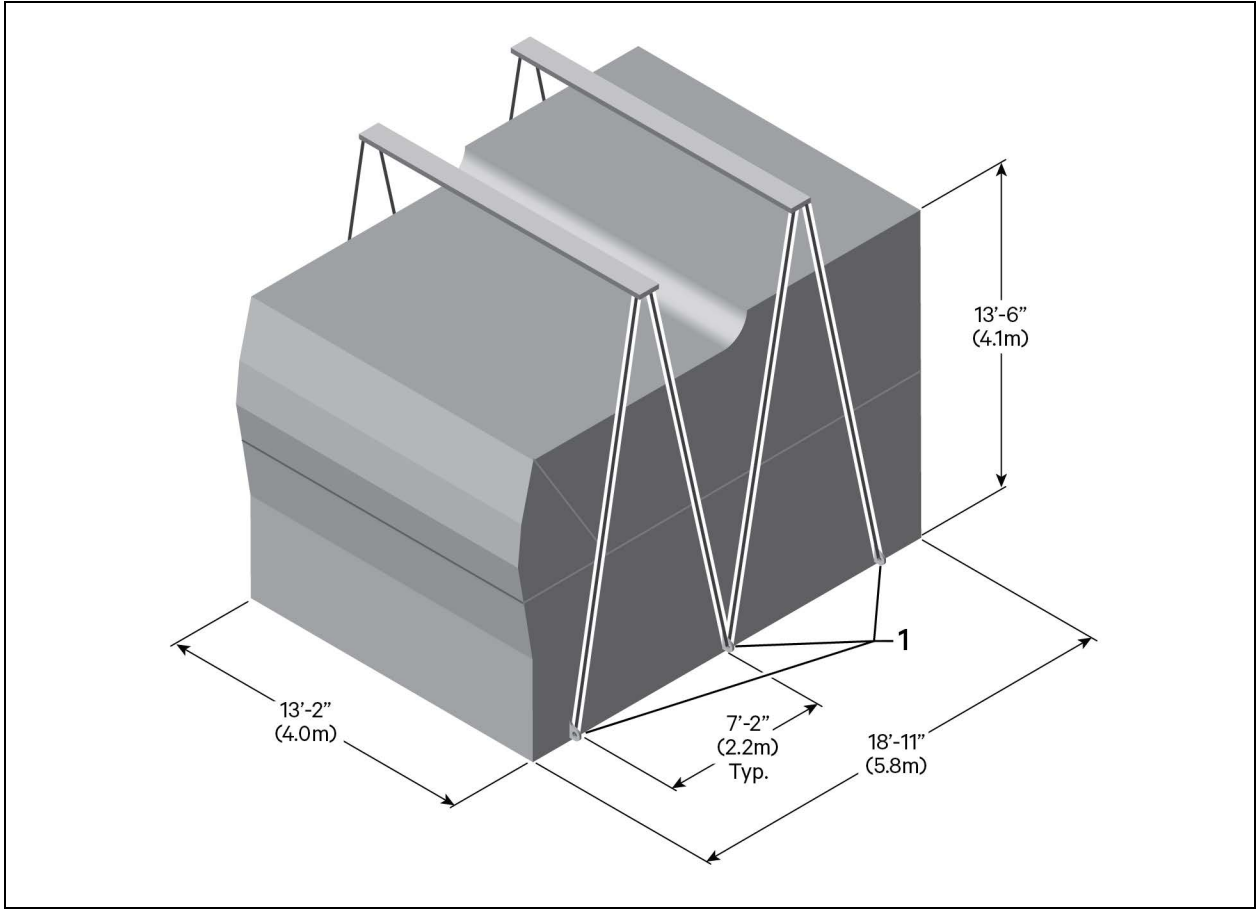
4.1 Rigging to Lift the Unit

Depending on whether you have a perimeter or roof-top configuration, see **Figure 4.1** on the next page , or **Figure 4.2** on page 19 , for the location of the lifting lugs on the unit and for the use of spreader bars and shimmed blocks to prevent damage to the unit.

- Unit must remain level when lifted to prevent damage to internal equipment.
- Do not place unit directly on the ground. If the unit must be set down, use shims or blocks for leveling and to keep unit off the ground.

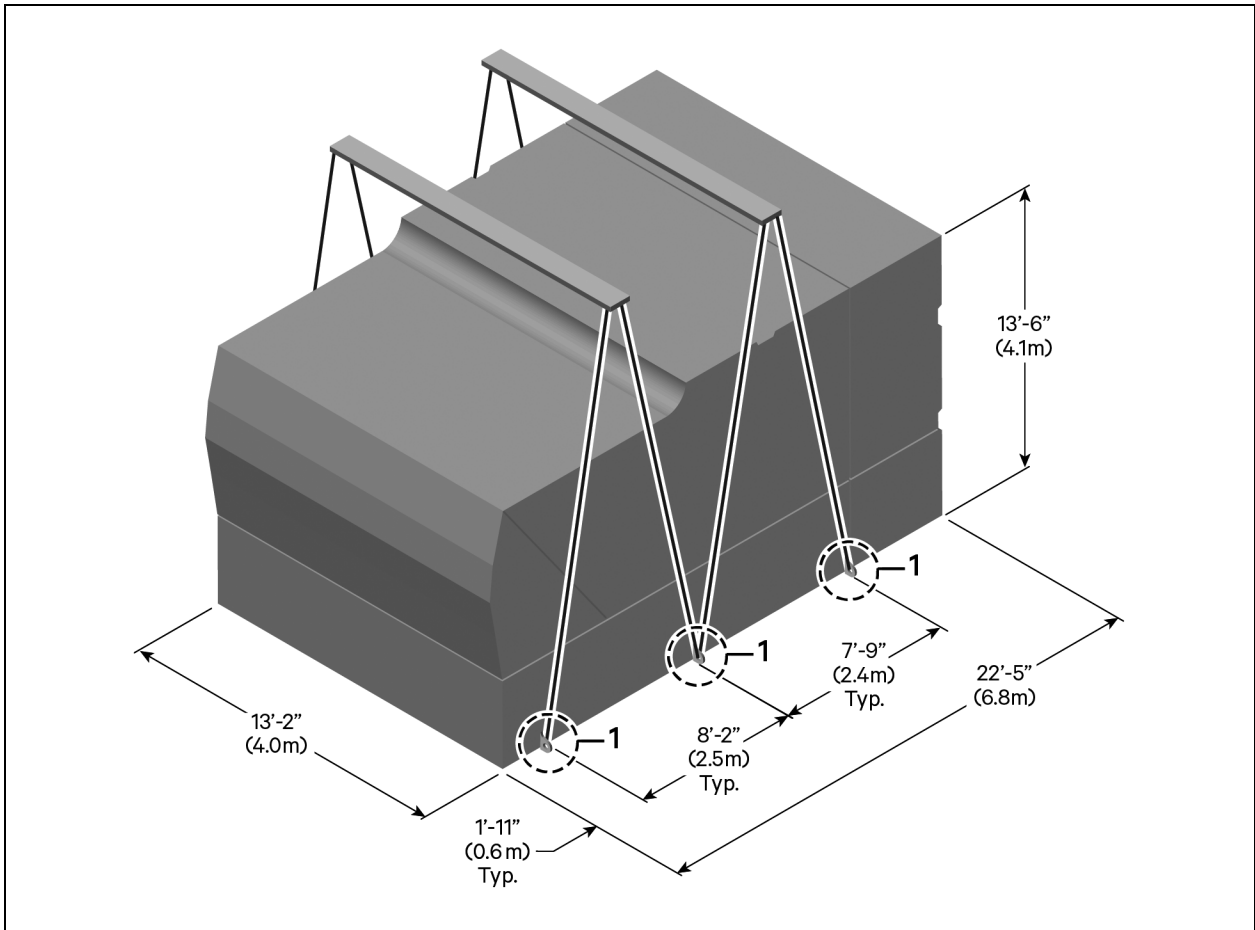
Before lifting or moving, clear the area of all unnecessary personnel. Clear the area of any debris and unrelated tools or foreign objects.

Figure 4.1 Lugs to Attach Rigging to a Perimeter Unit Configuration



Item	Description
1	Lugs to attach rigging. Typical both sides.

Figure 4.2 Lugs to Attach Rigging to a Rooftop Unit Configuration



Item	Description
1	Lugs to attach rigging. Typical both sides.

The unit cabinet dimensions are described in the submittal documents included in the [Submittal Drawings](#) on page 65 .

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

Table 4.1 Dimension Planning Drawings

Document Number	Title
DPN004377	Cabinet Rooftop Unit Rigging/Lift Points
DPN004334	Cabinet Perimeter Front Inlet/Front Supply Rigging/Lift Points

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5 Electrical Field Connections

Three-phase electrical service is required for all models. Electrical service must conform to national and local electrical codes. Refer to equipment nameplate regarding wire size and circuit protection requirements. Refer to the appropriate submittal drawing, listed in **Table 5.1** on the next page, for electrical service entrances into unit

A manual electrical disconnect switch should be installed in accordance with local codes and distribution system. Consult local codes for external disconnect 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 Vertiv™ Liebert® iCOM™ 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 Liebert® iCOM™ controller. The factory-supplied disconnect switch is on the exterior of the enclosure. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high-voltage. 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 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 wiring damage, short circuits and electric shock. Can cause overheated wiring, smoke, fire, activation of fire suppression systems and EMS personnel and equipment, building and equipment damage, injury or death. Insert CSA certified or UL listed bushings into holes and or knockouts used to route wiring through metal panels to protect the wire insulation from contact with sheet metal edges.

NOTICE

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

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

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

NOTICE

Risk of improper electrical connection of three-phase input power. Can cause backward compressor rotation and unit damage. Service technicians should use a gauge set on the system during the initial start up to verify that the three-phase power is connected properly. Three-phase power must be connected to the unit line voltage terminals in the proper sequence so that the compressors rotate in the proper direction. Incoming power must be properly phased to prevent compressors from running backward. We recommend checking the unit’s phasing with proper instrumentation to ensure that power connections were made correctly. We also recommend verifying discharge and suction pressures during start up to ensure that the compressors are running in the correct direction.

NOTE: Use water-tight fittings for all electrical connections. Failure to do so risks damage to the outdoor unit.

The unit requires two separate power-supply connections:

- A 3-phase, 460V power supply to the Vertiv™ Liebert® DSE Packaged Solution unit electrical enclosure or ATS.
- A separate 120V power feed to the utility box (for light switches and convenience outlet).
- An optional, separate 120V power feed from a field-supplied UPS to the Liebert® DSE Packaged Solution-unit low-voltage controls, which are located in the main electrical panel.

The electrical connections are described in the submittal documents included in the [Submittal Drawings](#) on page 65 .

Low voltage connections are detailed in:

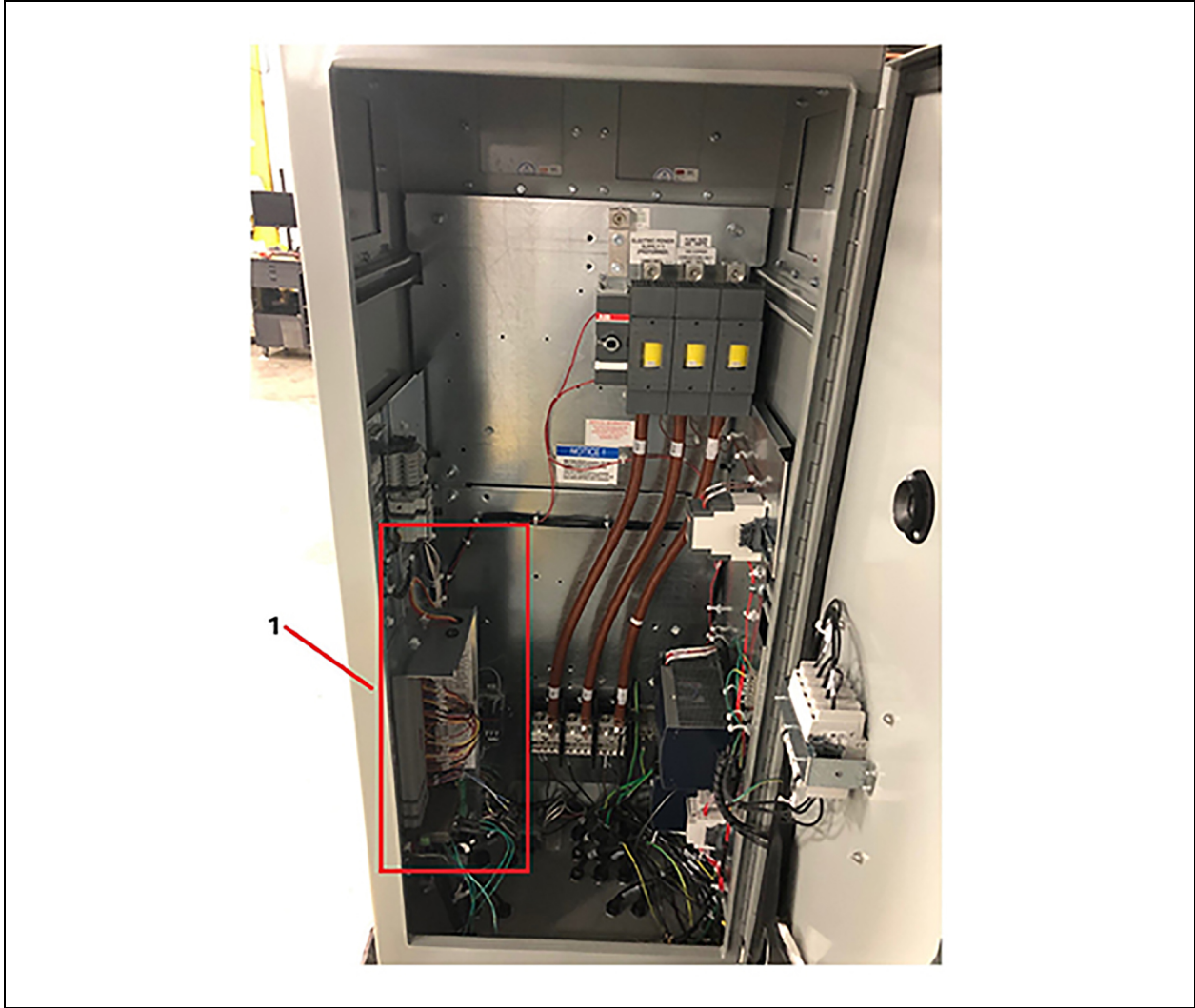
- **Figure 5.1** on the facing page
- **Figure 5.2** on page 24
- **Figure 5.3** on page 25
- **Figure 5.4** on page 26
- **Figure 5.5** on page 27

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

Table 5.1 Electrical Field Connection Drawings

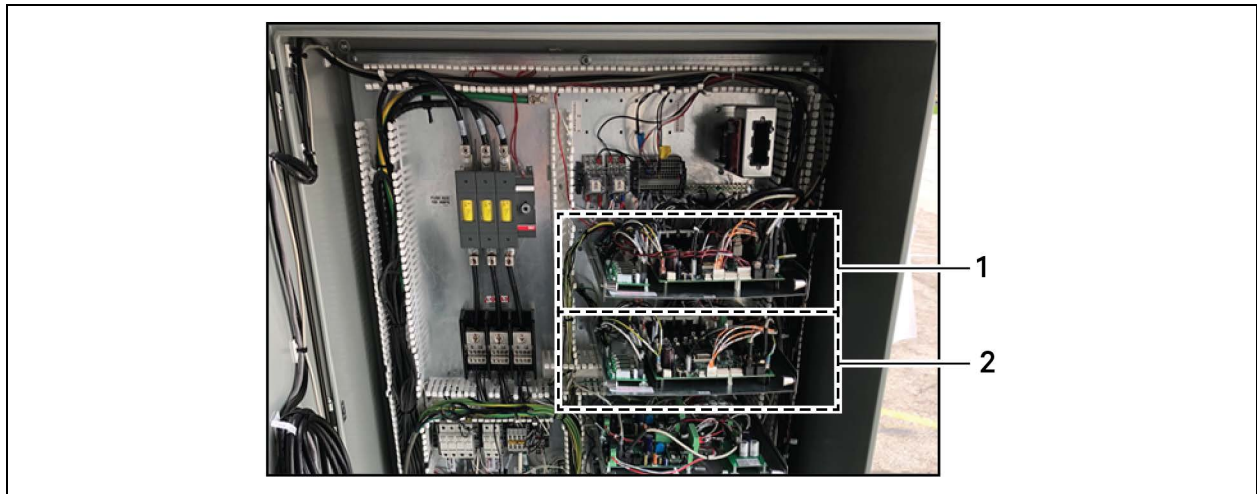
Document Number	Title
DPN004960	Electrical Connections
DPN005099	Service Door Access 400/500 kW Perimeter Unit
DPN005150	Service Door Access 400/500 kW Draw Through Rooftop Unit

Figure 5.1 Low Voltage BMS Wiring to Unit in Main Electrical Enclosure



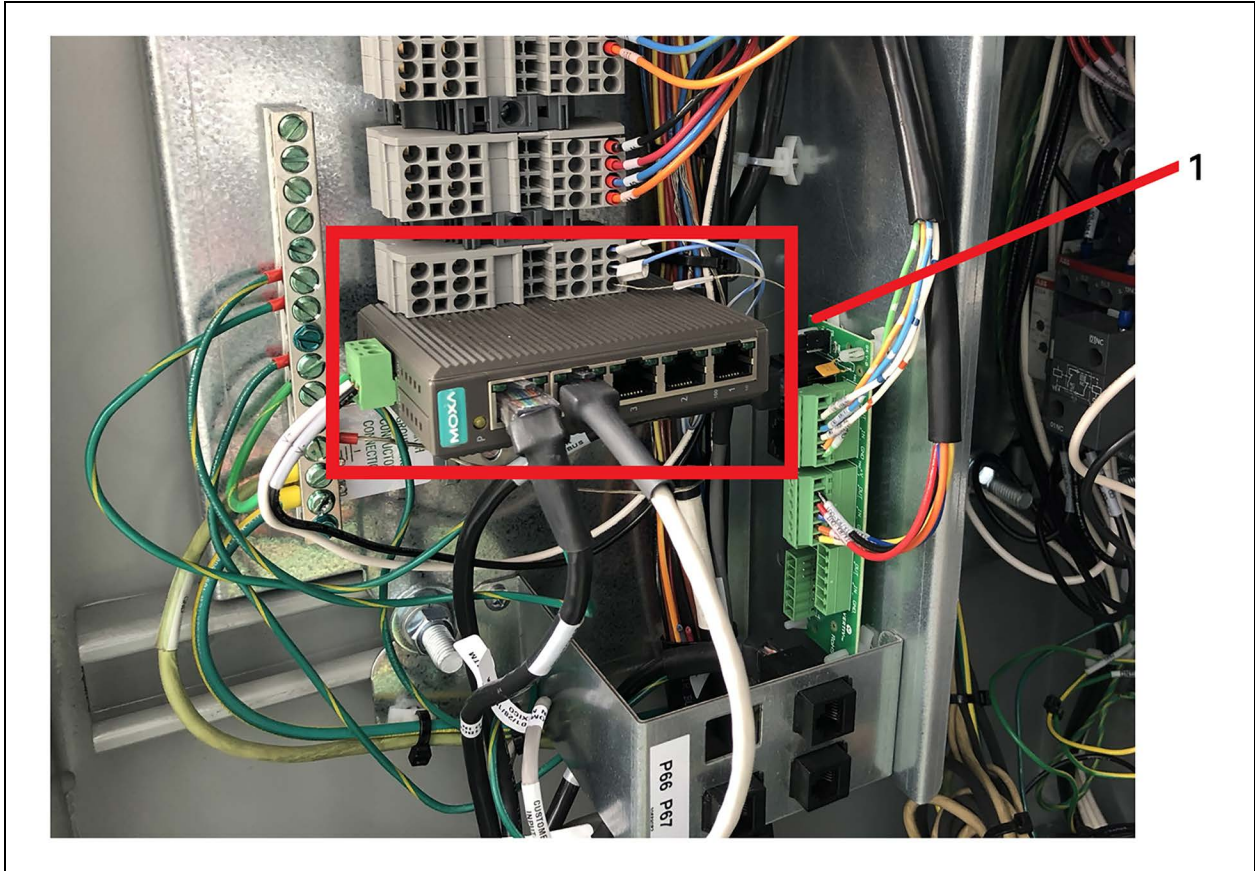
Item	Description
1	Low voltage BMS wiring to unit

Figure 5.2 Location of Vertiv™ Liebert® iCOM™ Primary Board and Liebert® iCOM™ Secondary Board



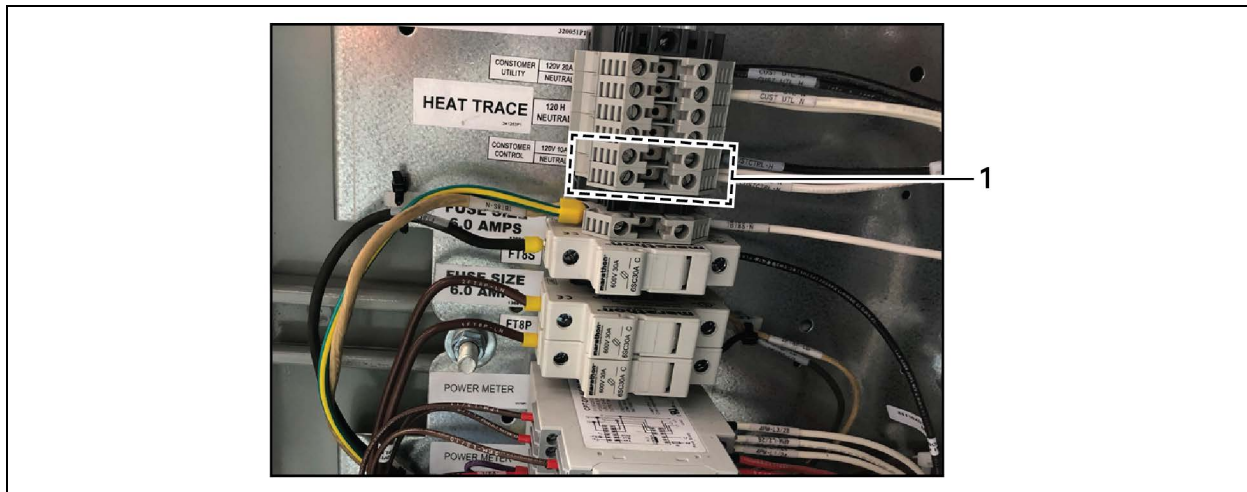
Item	Description
1	Liebert® iCOM™ primary control board
2	Liebert® iCOM™ secondary control board

Figure 5.3 Low Voltage Vertiv™ Liebert® iCOM™/Vertiv™ Liebert® vNSA Switch Wiring to Unit in Main Electrical Enclosure



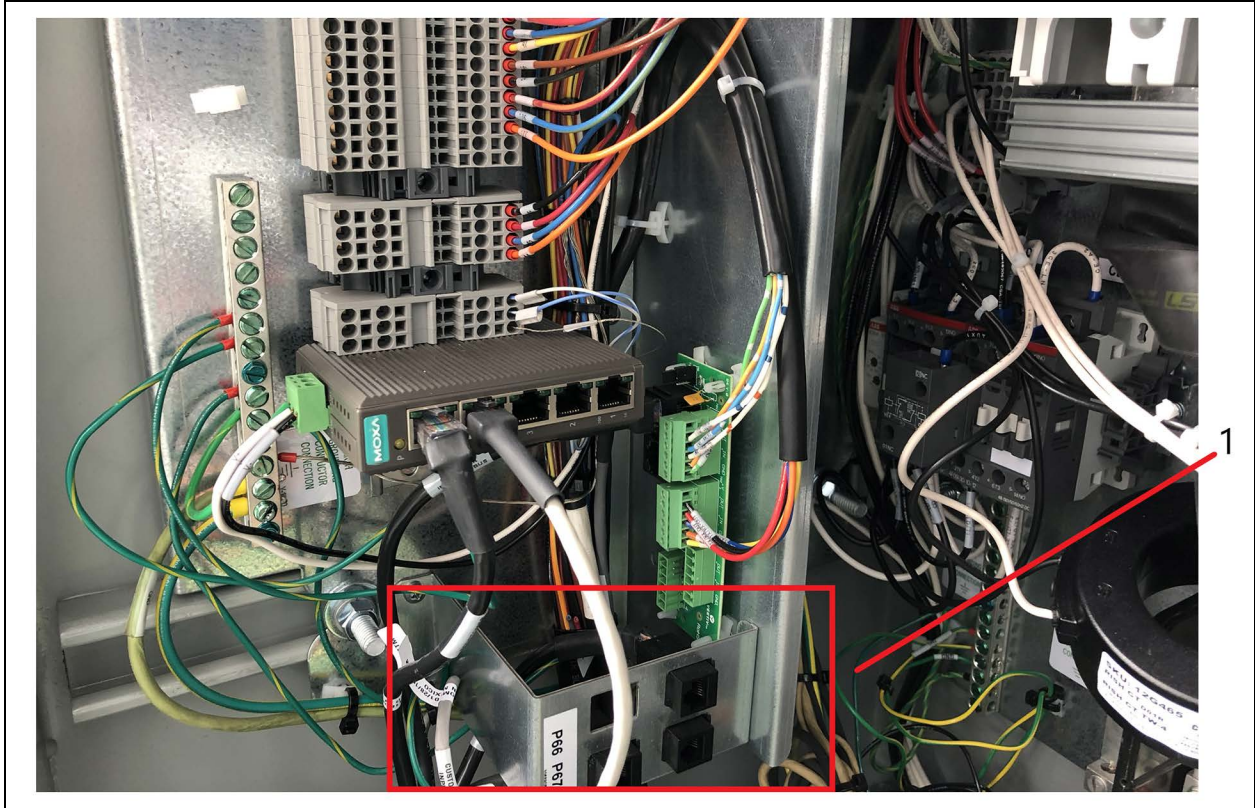
Item	Description
1	Location of the connection for CAT5 cable from Liebert® VNSAICOM8 network switch.

Figure 5.4 120V UPS Power Feed Connection for Low Voltage Controls in Main Electrical Enclosure



Item	Description
1	Location of the connection for the power feed from the optional 120-V UPS

Figure 5.5 Factory Installed Return Air Temperature and Humidity Sensor (RA) and 2T CANbus Cable Connection in Main Electrical Enclosure



Item	Description
1	2T CANbus-cable connector inside the main electrical enclosure.

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6 Checklist for Completed Installation

6.1 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.
4. Proper evaporator drip pan clean-out system is in place.
5. Check that curb and counter-flashing is sealed on roof-top units.

6.2 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. All internal and external high- and low-voltage wiring connections are tight.
5. Confirm that unit is properly grounded to an earth ground.
6. Control transformer setting matches incoming power.
7. Electrical service conforms to national and local codes.
8. Confirm that power wiring connections to the utility box are completed.

6.3 Other Installation Checks

1. Ducting complete.
2. Confirm ducting is attached to unit and building structure, and any openings around supply- and return-duct connections are sealed.
3. Filters installed.
4. Check fasteners that secure the evaporator fan motors
5. All fans are free of debris.
6. Seal openings around electrical connections and make sure that the seals are water-tight.
7. Installation materials and tools have been removed from equipment (literature, shipping materials, construction materials, tools, etc.).
8. Check for refrigerant leaks.

6.4 BMS and Sensor Installation Checks

1. CAT5 cables are installed from each unit and the network switch, and all cables have RJ45 jacks on each end.
2. The network switch/Vertiv™ Liebert® vNSA panel (if present) is installed and powered.
3. Confirm the static-pressure-sensor transducer (if present) is installed in the room and wired back to the Vertiv™ Liebert® DSE Packaged Solution unit
4. Confirm the supply-air sensor is installed in the best location possible to obtain a temperature reading representative of the supply air in the duct or plenum serviced by the unit and that the sensor is wired back to the unit control panel.
5. All remote and 2T rack sensors (if present) are installed and wired using CANBUS cables.

7 Initial Start-up Checks and Commissioning Procedure for Warranty Inspection



WARNING! Arc flash and electric shock hazard. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Vertiv™ Liebert® iCOM™ 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 Liebert® iCOM™ controller. The factory-supplied disconnect switch is on the exterior of the enclosure. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high-voltage. 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.

NOTICE

Risk of improper electrical connection of three-phase input power. Can cause backward compressor rotation and unit damage. Service technicians should use a gauge set on the system during the initial start up to verify that the three-phase power is connected properly. Three-phase power must be connected to the unit line voltage terminals in the proper sequence so that the compressors rotate in the proper direction. Incoming power must be properly phased to prevent compressors from running backward. We recommend checking the unit’s phasing with proper instrumentation to ensure that power connections were made correctly. We also recommend verifying discharge and suction pressures during start up to ensure that the compressors are running in the correct direction.

- Confirm that all items on [Checklist for Completed Installation](#) on page 29 have been done.
- Locate “Liebert® DSE Packaged Solution Warranty Inspection Check Sheet” in the unit’s electric panel.
- Complete “Liebert® DSE Packaged Solution Warranty Inspection Check Sheet” during start-up.
- Forward the completed “Liebert® DSE Packaged Solution 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 1-800-222-5877 for contacts.

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8 Maintenance



WARNING! Arc flash and electric shock hazard. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Vertiv™ Liebert® iCOM™ 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 Liebert® iCOM™ controller. The factory-supplied disconnect switch is on the exterior of the enclosure. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high-voltage. 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.

The Vertiv™ Liebert® DSE Packaged Solution is a single component in the facility heat-removal system. Proper application and maintenance of the entire system is critical to the life and reliability of the thermal-management units.

- 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.
- See the Liebert® iCOM™ User Manual, (SL-31075), available at www.Vertiv.com, for instructions on using the controller to predict some service maintenance intervals.
- We recommend the use of trained and authorized service personnel, extended service contracts and factory-specified replacement parts. Contact your Vertiv sales representative.

8.1 Service Access for Unit Maintenance



WARNING! Risk of pressurized doors flying open or slamming closed suddenly. Can cause serious injury. Do not attempt to open doors while fans are running. Do not turn on fans with doors open. Before opening the door, open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is off, and verify that all fans have stopped rotating. Do not leave unsecured objects in the fan's bay after any maintenance operation.



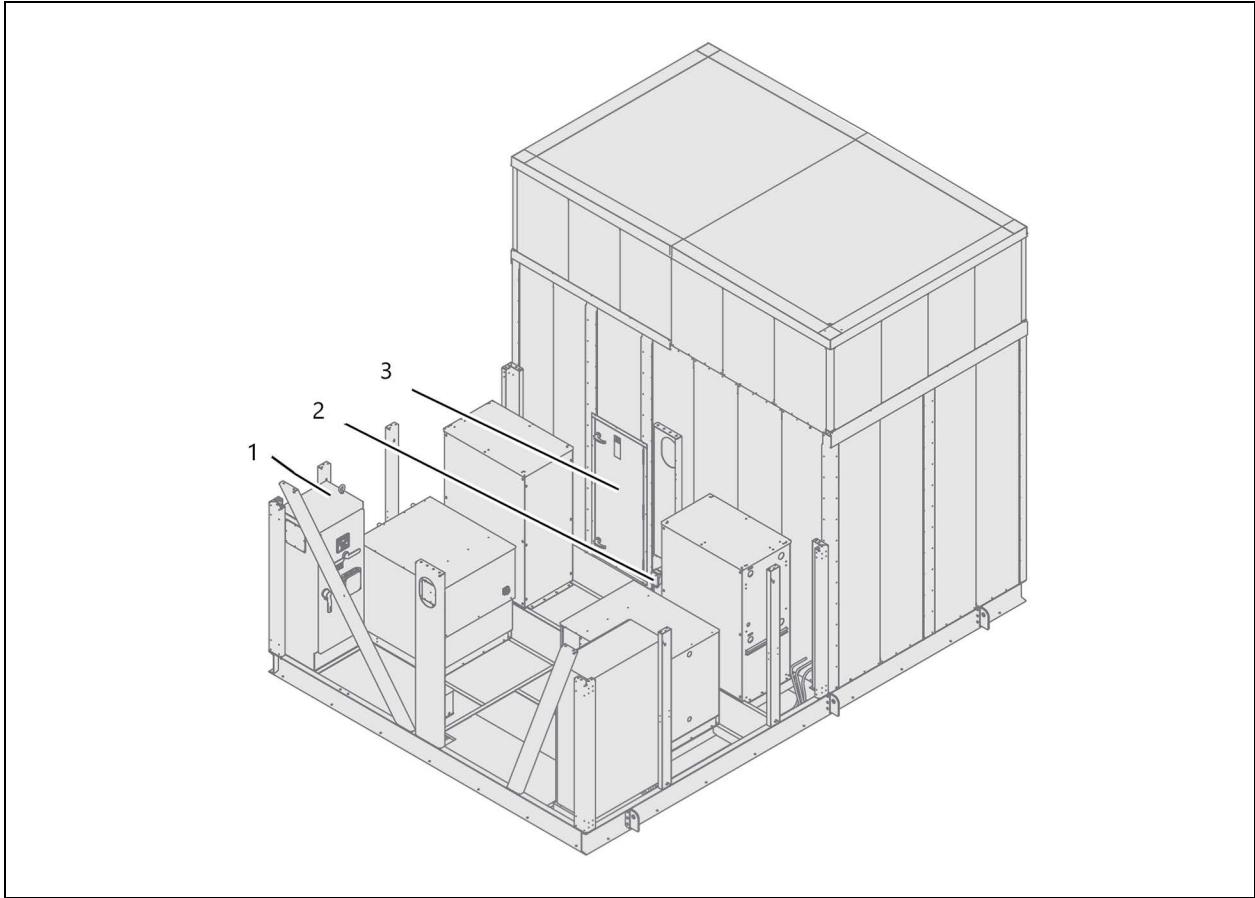
WARNING! Risk of contact with flying objects. Can cause serious injury or death. Do not leave unsecured objects or tools in the fan's bay after performing maintenance operations. Re-install all panels before starting up this unit after maintenance is performed.

The Vertiv™ Liebert® DSE Packaged Solution includes a service door, see **Figure 8.1** on the facing page, for access to perform maintenance on components inside the thermal management unit. An electric enclosure next to the door provides a 120-V outlet and switches for lights inside the unit.



CAUTION: Risk of low-hanging panels. Can cause injury or equipment damage. Wear appropriate, OSHA-approved PPE when entering and working within the enclosure.

Figure 8.1 Service Door Lighting and Outlet for Perimeter and Rooftop Units



Item	Description
1	Enclosure for air-proof and filter-clog switch
2	Separate, 120-V, field-supplied power feed for lights and convenience outlet
3	Service-access door to evaporative section and filter replacement

8.2 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.

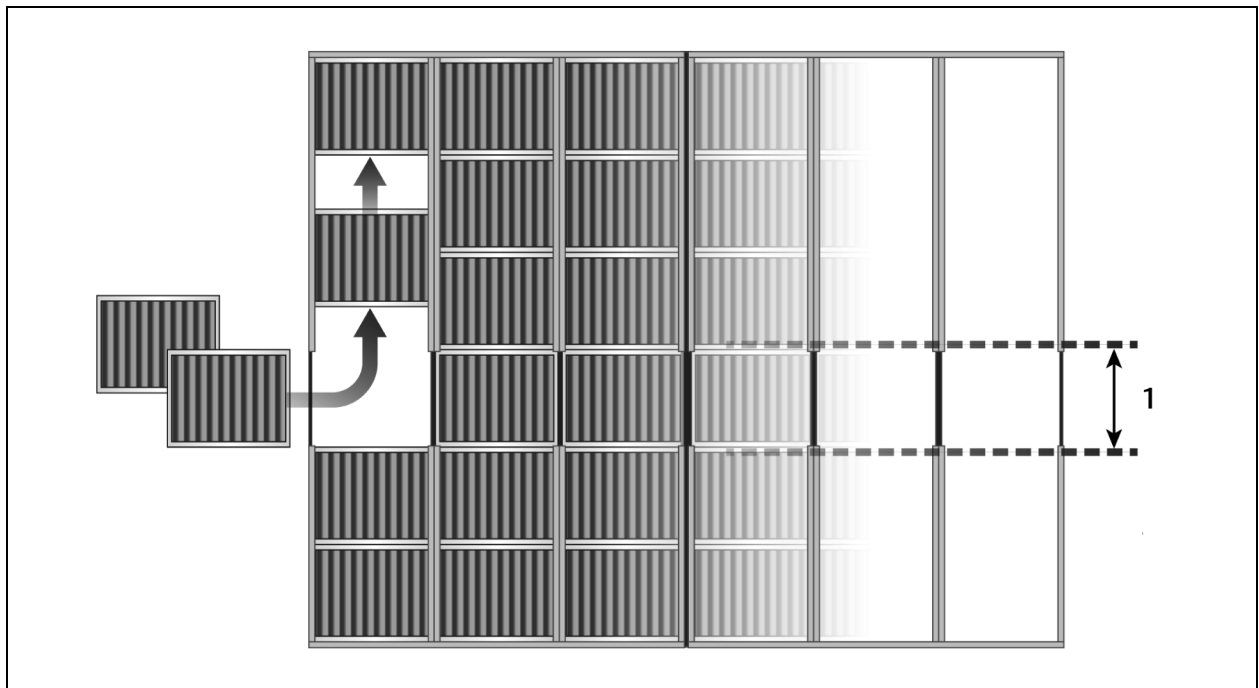
8.2.1 Replacing the Filters



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.

1. Enter the unit through the service access door, and locate the supply-side air filters in front of the heat exchanger.
2. Using the slot on the filter rack, shown in the following figure, remove all 30 filters:
3. Referring **Figure 8.2** below, install the new air filters in each column as follows:
 - At the slot, insert the bottom two filters.
 - Add filters, and slide them upward until the column is filled.
 - The last filter is installed in the slot in the column.

Figure 8.2 Supply Fan Air Filters in the Rack



Item	Description
1	Slot in filter rack

8.3 Evaporator Fan Maintenance



WARNING! Risk of very heavy, 250-lb (113.4-kg) evaporator fan modules dropping downward suddenly. Can cause injury or death. Support fan modules before removing mounting hardware. Use caution to keep body parts out of the fan modules pathway during repositioning. Only properly trained and qualified personnel should work on this equipment.

Consult the factory for fan, blower, or inverter maintenance. Do not attempt to service or remove the fans without first contacting Vertiv support at 1-800-222-5877.

8.3.1 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.

8.3.2 Fan Assembly Maintenance

Inspect the fan assembly at regular intervals. Keep the assembly clean and clear of dust, dirt, and other debris.

8.3.3 Blower Motor Lubrication

The motor is initially lubricated at the factory.

- Contact the motor manufacturer for the lubrication interval for motor bearings.
- Contact the motor manufacturer to determine the type of grease to use for lubrication.

8.3.4 Removing Fan Assembly

Do not attempt to remove the fan assemblies without first contacting Vertiv Technical Support at 1-800-222-5877.

8.4 Electronic Expansion Valve (EEV) Maintenance

The EEV controls superheat through the Vertiv™ Liebert® iCOM™ controls by actively measuring suction pressure via a transducer attached to the suction-line rotalock and suction temperature via a thermister strapped to the suction line. The EEV actively adjusts the orifice size and resulting mass flow of refrigerant to maintain the superheat setpoint (set in Liebert® iCOM™). The EEV is used in place of the standard thermal expansion valve (TXV).



WARNING! Risk of electric shock. Can cause serious injury or death. The Vertiv™ 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.

NOTE: Intermittent loss of subcooling may result in EEV/superheat instability.

8.5 Compressor Maintenance



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.

8.5.1 Compressor Oil

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 Vertiv technical support or the compressor manufacturer if questions arise.

8.5.2 Replacement Compressors

Replacement compressors are available through your Vertiv sales office. If the unit is under warranty, the replacement compressor must be obtained from and the original compressor returned to your local Vertiv sales office. Compressors are shipped in reusable packaging, and the original compressor should be returned in the same packaging.

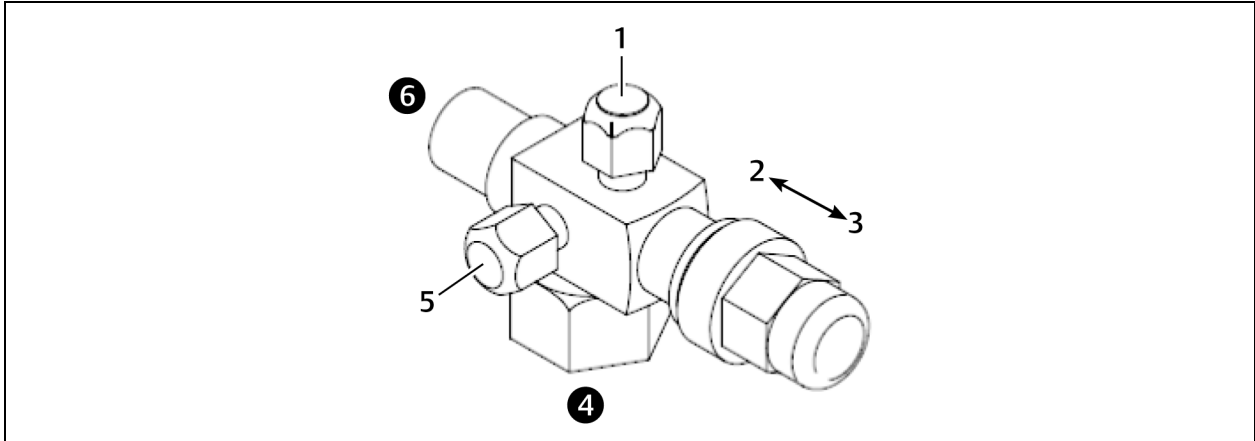
8.5.3 Rotalock Valve on Digital Scroll Compressors



WARNING! Risk of explosive discharge of high-pressure refrigerant. Can cause serious injury. Neutral and service ports on the rotalock valve do not have a valve core. Front-seat the service valves and relieve pressure from the compressor before loosening a part or a component attached to the service valve. Follow local codes to properly reclaim refrigerant.

- The Neutral port remains open to the compressor side in all positions of the valve stem, see **Figure 8.3** on the next page . A high-pressure cut-out switch or low-pressure switch/transducer will be connected to this port.
- The Service port is closed to the system when valve stem is back-seated, see **Figure 8.3** on the next page . It is open to the system as soon as the valve is adjusted away from the back-seated position.

Figure 8.3 Rotalock Valve



Item	Description
1	Service port (gauge)
2	Front seat
3	Back seat
4	Compressor side of valve
5	Neutral port
6	System side of valve

8.5.4 Unloading Solenoids on a Digital Scroll Compressor

When replacing a digital scroll compressor, the digital solenoid valve and coil must be replaced. The compressor and valve kit are shipped separately. The valve kit must be field-brazed to the top of the compressor in proper orientation and supported with the original factory bracket.

8.5.5 Compressor Electrical Failure (Motor Burnout)

If a burnout has occurred, a full system clean-out is required. If not cleaned, compressor and system problems will continue.

Consult the factory for compressor maintenance. Do not attempt to remove the compressor without first contacting Vertiv support at 1-800-222-5877.

8.5.6 Replacing a Compressor with Electrical Failure (Motor Burnout)



WARNING! Risk of electric shock. Can cause serious injury or death. The Vertiv™ 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 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.

NOTE: Release of refrigerant to the atmosphere is harmful to the environment. Refrigerant must be recycled or discarded in accordance with federal, state, and local regulations.

1. Attach suction and discharge gauges to access fittings.
2. Recover refrigerant using an approved recovery procedure and equipment. Use a filter drier when charging the system with recovered refrigerant.
3. Remove marked pressure transducer and discharge pressure switch. Disconnect all electrical connections.
4. Remove failed compressor.
5. Follow compressor manufacturer's suggested clean out procedures.
6. Install replacement compressor and make all connections. Replace unloading solenoid.
7. Evacuate, charge and operate per the appropriate procedure per local codes:

NOTICE

Risk of improper component re-installation. Can cause equipment damage.

Identify and mark location of suction pressure transducer and discharge pressure switch. These devices look similar and they must be reinstalled in their original location.

8.5.7 Compressor Mechanical Failure

If mechanical failure of the compressor has occurred, only the compressor needs replaced. A full system clean-out is not required.

8.5.8 Replacing a Compressor with Mechanical Failure



WARNING! Risk of electric shock. Can cause serious injury or death. The Vertiv™ 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 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.

NOTE: Release of refrigerant to the atmosphere is harmful to the environment. Refrigerant must be recycled or discarded in accordance with federal, state, and local regulations.

1. Front-seat service valves to isolate the compressor. Recover refrigerant using an approved recovery procedure and equipment
2. Remove failed compressor.

3. Keep the replacement compressor sealed until installation is complete to the point that the system isolation valves are ready to be engaged. Keep exposure of the POE oil in compressor to atmosphere to a minimum.
4. Install replacement compressor, replace gaskets or seals on service valves, and make all connections. Replace unloading solenoid if equipped.
5. Once the compressor is completely installed, keep isolation valves closed to the system and open to compressor. Add dry nitrogen to compressor and check all connections for leaks. With no leaks confirmed, evacuate the isolated compressor prior to introducing to the rest of the system.
6. When evacuating the isolated compressor volume, pull a vacuum of 500 microns with no decay above 1000 microns within 20 minutes. Once evacuation requirements of compressor are met, open the valves to open the compressor to the system.
7. Check compressor and system operation. Make any necessary adjustments for proper equipment operation.

The unit piping schematic is described in the submittal documents included in the [Submittal Drawings](#) on page 65 .

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

Table 8.1 Piping Schematic Drawing

Document Number	Title
DPN004345	Piping Schematic

8.5.9 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.



CAUTION: Risk of excessive refrigerant line pressure. Can cause tubing and component rupture resulting in equipment damage and personal injury. Do not close off refrigerant-line isolation valve 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).

NOTE: 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. Refrigerant charge must be weighted 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 52 psig (358 kPa). Operation for extended periods at less than 52 psig (358 kPa) can cause premature compressor failure.

NOTICE

Risk of improper refrigerant charging. Can cause equipment damage. Refrigerant charge must be weighted 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 52 psig (358 kPa). Operation for extended periods at less than 52 psig (358 kPa) can cause premature compressor failure.

8.5.10 Refrigerant Charge Requirements for Air Cooled Systems

Table 8.2 below and **Table 8.3** below provide the refrigerant charge and oil requirements for the Vertiv™ Liebert® DSE Packaged Solution.

Table 8.2 DP400 Refrigerant Charge Requirements

Circuit	R410A (lbs.)	Additional POE Oil (oz.)
1	88.5	50
2	88.5	50
3	88.5	50
4	88.5	50

Table 8.3 DP500 Refrigerant Charge Requirements

Circuit	R410A (lbs.)	Additional POE Oil (oz.)
1	88.5	50
2	88.5	50
3	88.5	50
4	88.5	50

8.5.11 Additional Oil Requirements for Scroll and 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. See [Evacuation, Leak Testing, and Charging](#) below for the recommended oil for the system.

- Do not mix polyolestor (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.

Table 8.4 Compressor Type and Oil Type

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

See [Refrigerant Charge Requirements for Air Cooled Systems](#) on the previous page for the amount of 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.

The amount of oil added by field service must be recorded on the tag marked "Oil Added Field Service Record" that is attached to each compressor. The date of oil addition must also be included.

8.5.12 Evacuation, Leak Testing, and Charging

Evacuation and Leak Testing Air Cooled Systems

For proper leak check and evacuation, you must open all system valves and account for all check valves.

NOTE: The system includes a factory installed check valve and an additional downstream Schrader valve with core in the compressor discharge line. Proper evacuation of the condenser side of the compressor can be accomplished only using the downstream Schrader valve. See the appropriate piping schematic for your system in [Submittal Drawings](#) on page 65 .

1. Starting with Circuit #1, open the services valves and place 150 PSIG (1034kPa) of dry nitrogen with a tracer of refrigerant. Check system for leaks with a suitable leak detector.
2. With pressure still in Circuit #1, open the compressor service valves in Circuit #2.
 - If pressure increases in Circuit #2, the system is cross-circuited and must be re-checked for proper piping.
 - If there is no pressure increase, repeat [Step 1](#) on Circuit #2.
3. 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.
4. After 4 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 2 hours.

When the three checks are complete, remove the jumper hose from the service valve fitting and the condenser, and proceed to [Charging Air Cooled Systems](#) on the facing page .

Charging Air Cooled Systems

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 compressor suction service valve. 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.

NOTICE

Risk of improper operation. Can cause compressor failure.

Operating the unit with the EEV closed can cause compressor failure. The reheat and humidifier are disabled. A minimum of 20 psig (138 kPa) must be established and maintained for the compressor to operate. The charging function can be reset as many times as required to complete.

To charge the system:

1. Check the nameplate on the unit for refrigerant type to be used.
2. The unit must be operating during charging. Refer to [Checklist for Completed Installation](#) on page 29 .
3. Calculate the amount of charge for the system. See [Refrigerant Piping and Charging](#) on page 42 .
4. Accurately weigh in as much of the system charge as possible before starting the unit. Do not exceed the calculated charge by more than 0.5 lb (0.37 kg).
5. Close the heat-rejection disconnect switch.
 - We recommend charging the unit with the return-air setpoint between 75°F and 85°F (24°C and 29°C).
 - The return-air temperature to the unit being charged must be stable and must be maintained greater than 65°F (18°C). If this is not possible due to lack of heat load, then the load banks must be used to offset the cooling load during start-up. See **Table 8.5** on the next page .
6. Close the Vertiv™ Liebert® DSE disconnect switch.
7. In the Service menu of the Vertiv™ Liebert® iCOM™ controller, select Diagnostics/Service > Diagnostics.
 - a. Enable Manual Mode.

NOTE: Manual Mode will timeout after 30 minutes.

- b. In Evaporator Fan options, set Motors to ON to operate the fan during Manual Mode.
- c. In Compressor Circuit 1 options, set Compressor Mode to Charge to operate the compressor at full capacity, energize the blower motor, and open the EEV.
- d. Reset the charge function as many times as needed to complete unit charging.

NOTE: You must establish and maintain a minimum of 20 psig (138 KPa) for the compressor to operate.

- e. Repeat [Step 7](#) for Compressor Circuit 2.
8. Check the refrigerant level in the refrigerant-level sight glasses on each receiver after the unit has been operating for at least 15 minutes.
9. Adjust the refrigerant level in each circuit to meet the level shown in **Table 8.5** on the next page .

10. After adjusting the refrigerant, allow the system to operate for another additional 15 minutes before checking need of further adjustment.
11. Repeat the procedure for the second circuit.

NOTE: A digital scroll compressor can have a clear unit sight glass on the liquid line only when operating at 100% capacity. When operating with a receiver, the unit sight glass might not become clear even when operating at 100% capacity. When operating below 100%, the unit sight glass may show bubbles with each 15 second unloading cycle.

Table 8.5 Refrigerant Level in Sight Glasses at Outdoor Temperatures

Temperature	Sight Level
40°F (4.5°C) and lower	Bottom sight glass is 3/4 full
40°F (4.5°C) and higher	Bottom sight glass is full
If the return air temperature cannot be maintained between 75°F and 85°F (24°C and 29°C) due to lack of load, then the liquid-level receiver must be adjusted to the following if return air is between 65°F and 75°F (18°C and 24°C):	
40°F (4.5°C) and lower	Charge to the bottom of the top sight glass.
40°F (4.5°C) and higher	Top sight glass is 1/4 full

8.6 General Condenser Maintenance

Periodic attention is necessary for continued satisfactory operation of your unit. Restricted air flow through the condenser coil, reduced air flow from non-functionin fans and low refrigerant system charge levels will reduce the operating efficiency of the unit and can result in high condensing temperatures and loss of cooling. In winter, do not permit snow to accumulate around the sides or underneath the condenser coil.

Monthly and semi-annual inspections and maintenance are recommended for proper system operation. Use copies of [Preventive Maintenance Checklist](#) on page 59 for each of these inspections.

8.7 Condenser Cleaning - Standard Coil

Keeping the coils in the outdoor unit clean is an important factor in maintaining peak efficiency, reliability, and long life of the equipment. The unit will operate more efficiently with frequent cleanings. If you delay cleaning until heavy build-up occurs, head-pressure problems with the evaporator units can develop.

8.7.1 When to Clean the Condenser Coil

Normal conditions typically dictate cleaning twice a year, in spring and fall. On-site or area conditions such as cottonwood trees, construction, etc., can increase cleaning frequency. On your standard monthly preventive maintenance schedule, we recommend a visual inspection of the coil to monitor conditions.

8.7.2 What to Use to Clean the Condenser Coil

NOTICE

Risk of improper cleaning agent selection, including non-base paint solvents. Can cause building and equipment damage and loss of refrigerant charge.

Using acid-based or sodium hydroxide-based cleaners can damage the drycooler coil and cause a loss of charge. This could cause equipment damage as well as damage to the surrounding structure.

Start with removing dirt, leaves, fibers, etc. with a soft brush or vacuum cleaner fitted with a soft-brush attachment. Do not use a wire brush or scrape the coil with a metal vacuum hose. The best overall coil cleaner is plain water. If the coil is maintained and cleaned at regular intervals, water is sufficient to remove dirt and debris from the fins. Water pressure from a garden hose and sprayer usually works well. If a pressure washer is used, make sure that the equipment is set to a lower pressure setting and that the nozzle is set to the fan spray, not stream. Otherwise, damage to the fins could result. If a cleaner is required, we recommend using a neutral cleaner, neither acidic nor base. Acid-type cleaners can damage the coil fins and surrounding areas. Many sites do not allow the use of acidic cleaners for environmental reasons.

8.7.3 Cleaning the Condenser Coil

The condenser coil is accessible through the cleaning window, which allows you to clean the coil without removing the fans from the unit.

To clean the coil:

1. Disconnect the power supply before working on the unit.
2. Open the cleaning window(s) on the side of the condenser by loosening the mounting screws.
3. Insert a spray nozzle on the end of a suitable extension and apply the water/cleaning solution, working back and forth across the coil face.
The solution pushes dirt and debris out the bottom of the coil.
 - If you are using a cleaner along with the spraying process, follow recommended manufacturer instructions and be sure to rinse the coil thoroughly. Any residue left on the coil can act as a magnet to dirt.
4. Reinstall the cleaning window and reconnect the power supply to the condenser.
5. Coils will possibly retain water after cleaning and rinsing, so manually reverse the fans briefly using condenser controls to speed drying of the coils and prevent a possible high-head-pressure condition when the condenser is put back into service.

NOTE: Spraying the coil from the outside repeatedly can push a majority of the dirt to the inner section of the fins and continue to restrict air flow. Keep in mind you may not have the luxury of shutting the unit down for an extended time. A scheduled shutdown with the operator may be in order.

8.7.4 Cleaning the Condenser Fan

- Clean the EC fan with water only when temperatures are greater than 50°F (10°C)
- Make sure that no water gets into the inside of the motor.
- Do not hold the jet spray directly on the motor openings and seals.
- During cleaning work using a jet spray, no guarantee is assumed regarding corrosion formation/paint adhesion for unpainted/painted fans.

8.8 Replacing the Condenser EC Fan



WARNING! Arc flash and electric shock hazard. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Vertiv™ Liebert® iCOM™ 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 Liebert® iCOM™ controller. The factory-supplied disconnect switch is on the exterior of the enclosure. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high-voltage. 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 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 fan electric control/connection enclosures. Use only fully-trained and qualified HVAC technicians to perform maintenance on the 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 contact with hot surfaces. Can cause injury. The 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 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 125 lbs. (56.7 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.

NOTE: If at any time a parameter is entered and the condenser display does not show 888 or if the display shows Err, re-enter the parameter. If the display still shows Err after ENT is pressed, power cycle the control board by unplugging P24, waiting 15 seconds and plugging P24 back in. Contact the factory if the parameter still displays Err after ENT is pressed.

To replace the fan:

1. Turn Off power to the unit using the disconnect.
2. Use a voltmeter verify that voltage is no longer present at the unit. Wait a minimum of 10 minutes to allow the EC fan capacitors to discharge before proceeding.
3. Remove the fan cover, disconnect electrical connections internal to the EC fan and remove the cable glands from the EC fan to be replaced.
4. Remove hardware that attaches the EC fan to the condenser.
5. Use lifting equipment or an adequate number of personnel to remove the EC fan from the condenser.

NOTE: A spreader bar may be required for the lifting equipment if only one technician is performing the fan replacement.

6. Install a spreader bar over the new EC fan if only one technician is performing the fan replacement.
7. Verify that the wire harness on the new EC fan is secured out of the way before lifting the fan.
8. Verify that the lifting cable/chains are not in contact with fan blades before lifting the new fan into place on the condenser.
9. Install the new fan in the condenser and connect the mounting hardware.
10. Verify that the fan blades rotate freely when installed in unit.
11. Install the new cable glands included with the new EC Fan. Torque for the cable glands is:
 - 630 mm and 710 mm fans: 19.5 to 24.75 in-lb (2.2 to 2.8 Nm)
 - 800 mm fans: 32.75 to 38 in-lb (3.7 to 4.3 Nm)

Dispose of the old cable glands once the new glands are installed.

12. Add a compression nut to the wire. Do not tighten the nut.
13. Reconnect the wiring to the proper terminals. (For more details look at factory provided electrical schematic.)
 - The torque for the electrical terminals is 11.5 in-lb (1.3 Nm). Tighten the compression nut to a torque of 22 in-lb (2.5 Nm).
14. With the PCB powered, the board display should read *FOO*.
15. Press the **ESC** button.
16. Press the **UP** arrow button once:
 - If *P-* is displayed, see [P--Menu Programming](#) below .
 - if *P-* is not displayed, see [Manual Fan Addressing \(No P-- Menu\)](#) on the next page .
 - Once set-up is complete, see [Verifying the Fan Address](#) on page 52 .

NOTE: The complete list of P--, C--, and F-- parameters is located inside the lid of the electrical box panel.

8.8.1 P--Menu Programming

1. If *P-* is displayed, press the **ENT** button to enter the *P-* Menu.
2. The *P-* Menu allows compact set-up/preparation of the condenser in the factory or in the field. Use the functions described in [Table 8.6](#) on the next page , to establish a default control configuration for the board.

Table 8.6 P-- Menu Items and Definitions

Item ID	Meaning	Default	Notes
P01	Enter Preparation Mode	0	Setting this value to '1' enables preparation mode. All other 'P--' menu items are disabled until this value is '1'. Note that control operations may be affected during preparation mode, therefore the cooling unit should be off. Setting this value back to '0' creates new default values based upon selections in this menu. After default values are established, the board exits preparation mode and reboots.
P02	Automatic VSD Configuration	1	This item should only be used to address the VSDs for the unit. The value entered indicates the model of the VSD: 1 – EBM 2 – Ziehl-Abegg 3 – Fans Tech 4 – Rosenberg 6 – Multi-wing All fans must be the same model to use this parameter. When <i>ENT</i> is pressed, the board will operate and power contactors for the VSDs and assign ModBus addresses. This procedure may take up to 5 minutes to complete.
P03	Refrigerant Type	2	1 = R22 2 = R407C 3 = R410A
P04	Number of Circuits	1	1 = Single Circuit 2 = Dual Circuit
P05	Liebert® Lee Temp Option	0	0 = No Lee Temp installed 1 = Liebert® Lee-Temp installed
P06	Condenser	1	0 = Small

NOTE: Once set-up is complete, see [Verifying the Fan Address](#) on page 52 .

8.8.2 Manual Fan Addressing (No P-- Menu)

1. Unplug all fans before making changes to the fan configuration menu. If a fan has been replaced or is being re-addressed, keep it unplugged until the fan type has been configured and it is ready to be addressed ([Step 15](#)).
2. Turn the power On.
3. The control board flashes *FOO* on the display when it has completed its boot cycle.
4. Press the **ESC** button.
5. Use the **UP** or **DOWN** arrow button until *C--* displays.
6. Press the **ENT** button.
7. Use the **UP** or **DOWN** arrow button until *C03* displays.
8. Press the **ENT** button.

9. Use the **UP** or **DOWN** arrow button to select one of five options:

Table 8.7 Configuration Code Values

Configuration Code	Fan #	Value
C03	Fan 1	0 = No Fan
C04	Fan 2	1 = EBM Papst
C05	Fan 3	2 = Ziehl-Abegg
C06	Fan 4	4 = Rosenberg
		6 = Multi-wing

10. Press the **ENT** button.
11. If the new value is entered into the control board, the display flashes "888."
12. Press the **ESC** button to display C03.
13. Repeat Step 4 through Step 11 for C04, C05 and C06 setting them to 0, No Fan.
14. Unplug the power connector to the Condenser controller board (24).
15. Reconnect only the fan to be addressed, to P23 (on the control board), Fan 1's connection. Make sure to only plug in one fan at a time during this process or you may corrupt the settings in other fans. Plugs listed below.
 - P23 = Fan 1
 - P27 = Fan 2
 - P28 = Fan 3
 - P29 = Fan 4
16. Wait 30 seconds (60 seconds when using Multi-wing).
17. Power the condenser board back up and wait for the F00 to be displayed.
18. Use the **UP** or **DOWN** arrow button to select one of the following parameters.

The correct parameter depends on the supplier of the fan that will be addressed.

 - C00—EBM Papst fan
 - C01—Ziehl-Abegg fan
 - C29 —Rosenberg
 - C30 = Multi-wing
19. Press the **ENT** button.
20. Use the **UP** or **DOWN** arrow button to the correct fan address number. Fan 1 should be 1 (fan closest to electric panel end). Fan 2 should be 2, etc.
21. Press the **ENT** button. The display flashes "888 " when the command is accepted.
22. Press the **ESC** button for the parameter to be shown on the display.
23. Repeat [Step 7](#) through [Step 22](#) for the rest of the fans that need to be addressed such that only the fan to be addressed is connected and it is plugged into the fan 1 output P23.
24. Once addressing is complete, unplug all fans so they can be connected to the correct output after configuration ([Step 28](#)).
25. Use the C3-C6 commands as shown in [Step 9](#) so that all installed fans are set to the correct matching brand.
26. Unplug the power plug, P24, from the control board.
27. Wait 30 seconds.
28. Plug all the contactor output plugs back into the board in their correct positions.
29. Plug P24 back into the control board.

30. Once the control board has completed its boot cycle and all the contactors are energized, wait 5 seconds.
31. Press the **ESC** button.
32. Use the **UP** or **DOWN** arrow button until A-- is on the display.
33. Press **ENT** button.
34. Use the **UP** or **DOWN** arrow button to see if any of the following errors are shown.
 - a. 115: Unable to communicate with Fan 1.
 - b. 215: Unable to communicate with Fan 2.
 - c. 315: Unable to communicate with Fan 3.
 - d. 415: Unable to communicate with Fan 4.
35. If any of these errors appear, check the communication wiring at the problem fan and the fan before it.
36. If the wiring is correct and properly wired to the terminal, repeat the fan addressing procedure in [Step 14](#) through [Step 34](#).
37. If none of the errors listed in [Step 34](#) are displayed, press the **ESC** button.

8.8.3 Verifying the Fan Address

To verify that each fan has a unique address:

1. Use the **UP** or **DOWN** arrow button until C-- displays.
2. Press the **ENT** button.
3. In the Manual/System Control Selection parameter use the **UP** or **DOWN** arrow button until C24 displays.
4. In the Manual Control configuration parameter, press the **ENT** button.
5. Use the **UP** or **DOWN** arrow button to select 0.
6. Press the **ENT** button.
The reads "888" if the command is accepted.
7. Press the **ESC** button to display C24 .
8. Use the **UP** or **DOWN** arrow button until C34 displays.
9. Press **ENT** button.
If Fan 1 is running, the fans speed should display in terms of percentage of full speed. If Fan 1 is not running, 0.00 should display.
10. Use the **UP** or **DOWN** arrow button to enter 100% speed.
11. Press the **ENT** button.
The display reads "888" if the command is accepted.
 - Fan 1 should speed up to 100%, and all the other fans should stay the same speed.
12. If Fan 1 is not running or if any of the other fans also speed up to 100%, [Step 15](#) through [Step 22](#) of [Replacing the Condenser EC Fan](#) on page 48 , must be repeated.
13. Press the **ESC** button for the parameter to be shown on the display.
14. Repeat [Step 3](#) through [Step 8](#) for the rest of the fans, if present.
 - C35: for Fan 2.
 - C36: for Fan 3.
 - C37: for Fan 4.

NOTE: All fans should be at 100% speed.

15. Use the **UP** or **DOWN** arrow button until C24 displays.
16. Press the **ENT** button.

17. In the System Control configuration parameter, use the **UP** or **DOWN** arrow button to select 1.
18. Press the **ENT** button.
The display flashes "888" if the command is accepted.
19. Press the **ESC** button to display C24.
All fans should return to a normal speed based on the pressure input and the state of indoor unit's compressor.

Notes on the Premium Efficiency Control Board

- J6 is the CANbus termination jumpers. If the condenser is the last device in the CANbus communication line, the jumper must be placed between Pins 1 and 2 of J6. If the condenser is not the last device in the CANbus communication line, then the jumper on J6 must be placed on Pins 2 and 3. CANbus communication errors may occur if the jumpers are not in the correct positions.
- A jumper must be present at J2. If a jumper is not present, the control board will not boot properly during power start-up.

8.9 Replacing the Premium Efficiency Control Board

Use these steps to replace the Premium Efficiency Control Board in the condenser.



WARNING! Arc flash and electric shock hazard. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Vertiv™ Liebert® iCOM™ 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 Liebert® iCOM™ controller. The factory-supplied disconnect switch is on the exterior of the enclosure. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high-voltage. 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.

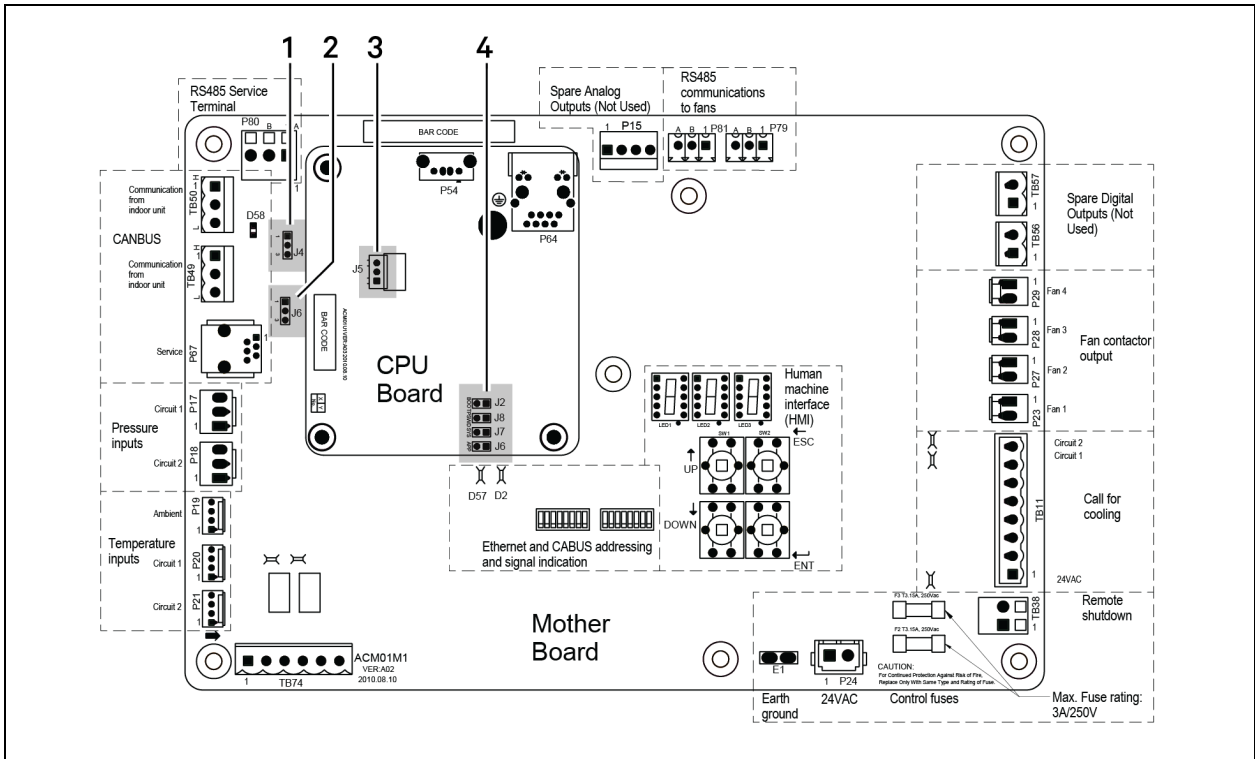
8.9.1 Preparing to Replace the Board

1. Verify that the following jumpers are installed on the new board (see **Figure 8.4** on the facing page):
 - Jumper at J4 and J6 on Pins 2 and 3.
 - Jumper on J2.
 - Jumper on J5 on Pins 1 and 2.
2. Locate the latest revision of the HMI parameters label, 30384-7P1, included with the new control board.

NOTE: In **Figure 8.4** on the facing page, J6 is the CANbus termination jumper. J4 is the RS485 service termination jumper. If the condenser is the last device in the CANbus communication line, the jumper must be placed between Pins 1 and 2 of J6. If the condenser is not the last device in the CANbus communication line, the jumpers on J6 must be placed on Pins 2 and 3. If the jumper is not in the correct positions, CANbus communication errors may occur. The jumper on J4 will always be placed between Pins 1 and 2.

NOTE: In **Figure 8.4** on the facing page, a jumper must be present at J2. If a jumper is not present, the control board will not boot properly during power start-up.

Figure 8.4 Jumper Locations on Control Board



Item	Description
1	J4, RS485 service termination jumper
2	J6, Canbus termination jumper
3	J5
4	J2

8.9.2 Installing the Replacement Board



WARNING! Arc flash and electric shock hazard. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Vertiv™ Liebert® iCOM™ 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 Liebert® iCOM™ controller. The factory-supplied disconnect switch is on the exterior of the enclosure. The factory-supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high-voltage. 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.

1. Turn Off the disconnect switch on the condenser enclosure cover.
2. Open the control enclosure cover.
3. Manually turn On the disconnect switch.

NOTE: Power is On and a shock hazard exists with exposure to hazardous voltage components.

4. If the board can still be powered up and has a display, record the parameter settings.
 - To obtain parameters go to the C-- menu and press the **UP** or **DOWN** arrow button to read and record the values for C03-09 and C27.
5. Record all of the DIP switch positions for the CANbus DIP switch package. Retain these for setting up the new board.
6. Record the positions of the jumpers for J2, J4, J5 and J6 on control board in the unit. Retain these for setting up the new board.
7. Disconnect power from the condenser by turning Off the main disconnect switch.
8. Use a voltmeter to verify that voltage is no longer present in the unit.
9. Remove the plugs and field-installed wires from the old board. Note the polarity for the CANbus wiring going to P49 and P50, if present.
10. Mark wires P49-1, P49-3, etc, if they are not already marked.
11. Remove the mechanical fasteners holding the control board in place and remove the old control board.
12. Install the new control board using the fasteners removed in [Step 11](#).
13. Reattach the plugs. Refer to the hot-stamps on the wire harnesses that correspond to the correct plug on the board. Verify that the plugs are installed properly.
14. Change the CANbus DIP switch positions so they match the control board that was removed. If the condenser is the second condenser on the CANbus communication line, set Position 1 of the CANbus DIP switch from On to Off.
15. Change the jumper positions for J2, J4, J5 and J6 to match the control board that was removed. If the condenser is the last device on the CANbus communication line, move the jumper at J6 from Pins 2 and 3 to Pins 1 and 2 (see [Figure 8.4](#) on the previous page).
16. Power up the unit.
17. Change the parameters to match the parameters from the control board that was removed if they were obtained from the old board in [Step 4](#). See [Step 18](#) if the parameters were unavailable.

18. If the old board parameters were unavailable, use the new HMI label included in kit to obtain the proper settings. Parameters C03, C04, C05 and C06 must be programmed with the proper EC fan supplier used on the unit.
19. Address the fans (refer to [Replacing the Condenser EC Fan](#) on page 48).
20. Compare the HMI label on the unit with the latest revision.
 - If there are differences, clean and dry the surface of the old HMI label; attach the new label on top of the old label, covering the old label with the new one.
21. Verify that the control board is reading pressure and temperature.
22. Verify that there are no communication alarms with the fans or with the cooling unit the condenser is serving.
23. Verify proper fan operation by adjusting the cooling unit that this condenser serves so that it calls for cooling.

8.10 Pumped Refrigerant Economizer (PRE)

Your Vertiv™ Liebert® DSE Packaged Solution includes two Vertiv™ Liebert® PRE systems. Refer to the Vertiv™ Liebert® EconoPhase Installer/User Guide, available at www.Vertiv.com, for the maintenance and operation details.

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9 Preventive Maintenance Checklist

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

Not all units will have all components. To determine your unit’s configuration, compare the [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 and the Vertiv™ Liebert® iCOM™ User Manual (SL-31075) 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

- Replace/check filters.
- Wipe section clean.
- Clean coil.
- Clean condensate pan.
- Clean/test filter clog switch operation.

Blower Section (Evaporator Fans)

- Mounting bolts are tight.
- Blower wheels are free of debris and spin freely.
- Motor bearings are in good condition and are lubricated.
- Check the motor mount.
- Check/test the air sail switch.
- Check motor amp draw. Compare to nameplate amps.

#1 L1 _____ L2 _____ L3 _____

#2 L1 _____ L2 _____ L3 _____

#3 L1 _____ L2 _____ L3 _____

#4 L1 _____ L2 _____ L3 _____

Electrical Panel

- Check fuses.
- Check the contactors for pitting. Replace if pitted.
- Check/re-torque wire connections.

Controls

- Check/verify the control operation (sequence).
- Check/test the changeover devices, if equipped.

Compressors

- Check oil level.
- Check for oil leaks.
- Check compressor mountings (bushings).
- Check that cap tubes are not rubbing.
- Check/re-torque wire connections (inside compressor box).
- Check compressor operation for vibration/noise.
- Check crank case heater fuses and operation (if equipped).
- Check suction pressure
Circuit #1 _____ Circuit #2 _____ Circuit #3 _____ Circuit #4 _____
- Check discharge pressure
Circuit #1 _____ Circuit #2 _____ Circuit #3 _____ Circuit #4 _____
- Check superheat
Circuit #1 _____ Circuit #2 _____ Circuit #3 _____ Circuit #4 _____
- Check low pressure cut in
Circuit #1 _____ Circuit #2 _____ Circuit #3 _____ Circuit #4 _____
- Check high pressure cut out
Circuit #1 _____ Circuit #2 _____ Circuit #3 _____ Circuit #4 _____
- Amp draw
Compressor #1A L1 _____ L2 _____ L3 _____
Compressor #1B L1 _____ L2 _____ L3 _____
Compressor #2A L1 _____ L2 _____ L3 _____
Compressor #2B L1 _____ L2 _____ L3 _____
Compressor #3A L1 _____ L2 _____ L3 _____
Compressor #3B L1 _____ L2 _____ L3 _____
Compressor #4A L1 _____ L2 _____ L3 _____
Compressor #4B L1 _____ L2 _____ L3 _____

Condenser

- Clean coils.
- Fans are free of debris.
- Fans are security mounted.
- Motor bearings are in good condition.
- Check all refrigerant lines for vibration isolation. Support as necessary.
- Check for refrigerant leaks.
- Check the status indicator lights of surge protection device (if installed).
- Check/re-torque wire connections.
- Check contactors for pitting. Replace if pitted.
- Verify the operation sequence/set points.
- Charge verification:
 - a. Outdoor ambient temperature _____
 - b. Subcooling _____
 - c. Indoor unit return air temperature _____
 - d. Sight glass level (if Lee-Temp or pumped refrigerant) _____
- Motor amp draw
 - #1 L1 _____ L2 _____ L3 _____
 - #2 L1 _____ L2 _____ L3 _____
 - #3 L1 _____ L2 _____ L3 _____
 - #4 L1 _____ L2 _____ L3 _____
 - #5 L1 _____ L2 _____ L3 _____
 - #6 L1 _____ L2 _____ L3 _____
 - #7 L1 _____ L2 _____ L3 _____
 - #8 L1 _____ L2 _____ L3 _____
 - #9 L1 _____ L2 _____ L3 _____
 - #10 L1 _____ L2 _____ L3 _____
 - #11 L1 _____ L2 _____ L3 _____
 - #12 L1 _____ L2 _____ L3 _____

Pumped Refrigerant Economizer

- Check for refrigerant leaks.
- Check/re-torque wire connections.
- Check contactors for pitting. Replace if pitted.
- Check pump mounting.

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

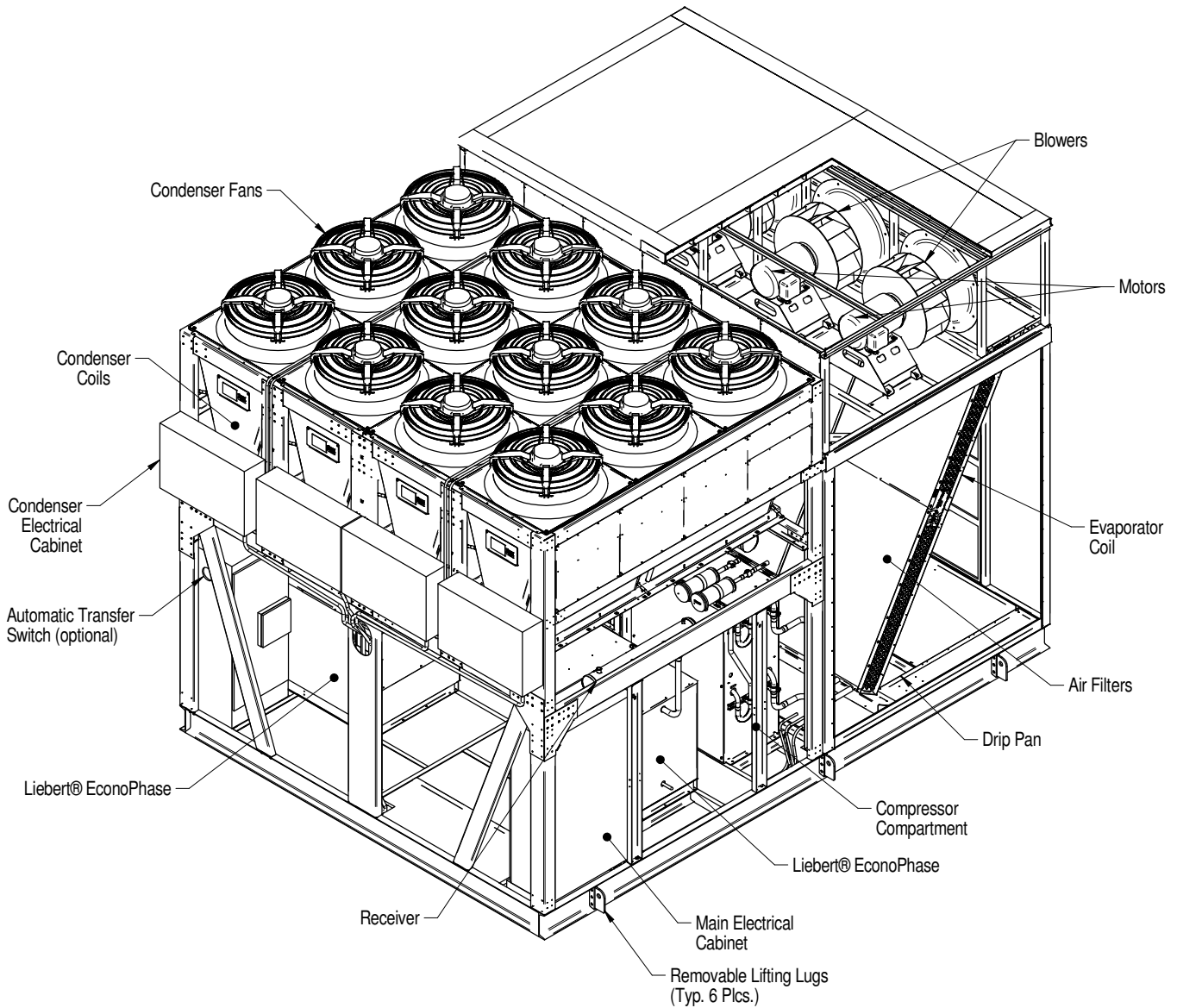
Document Number	Title
Component Location Drawings	
DPN004155	Perimeter Front Inlet/Front Supply Components
DPN004190	Rooftop Components
DPN004592	Draw-Thru Rooftop Components
Air Flow Schematic and Duct Connection	
DPN004154	Perimeter Front Inlet/Front Supply Airflow Schematic
DPN004189	Rooftop Airflow Schematic
DPN004558	Draw-Thru Rooftop Airflow Schematic
Planning Dimensions	
DPN004465	Internal Equipment Floor Plan for Rooftop & Perimeter Units
DPN004653	Draw-Thru Rooftop Floor Plan
DPN004148	Cabinet and Anchor Dimensional Data for Perimeter Units
DPN004995	Cabinet and Anchor Dimensional Data, Rooftop
DPN004326	Drip Pan Clean Out Access and Location
DPN005001	Draw-Thru Rooftop Cabinet & Anchor iCOM™2
DPN004993	Perimeter Front Inlet/Front Supply Cabinet & Anchor
DPN004377	Cabinet Rooftop Unit Rigging/Lift Points
DPN004334	Cabinet Perimeter Front Inlet/Front Supply Rigging/Lift Points
DPN004593	Cabinet and Anchor Dimensional Data, Draw Through Units
DPN004651	Condensate Drain Access and Location
Electrical Field Connection Drawings	
DPN004960	High & Low Voltage Electrical Field with & without ATS
DPN005099	Perimeter Front Inlet/Front Supply Service Access Door
DPN005150	Draw-Thru Rooftop Service Access Door
Packaged Solution Piping Drawings	
DPN004345	Piping Schematic
DPN004326	Perimeter Drip Pan Clean Out
DPN004651	Draw-Thru Rooftop Drip Pan Clean Out

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LIEBERT® DSE PACKAGED SOLUTION

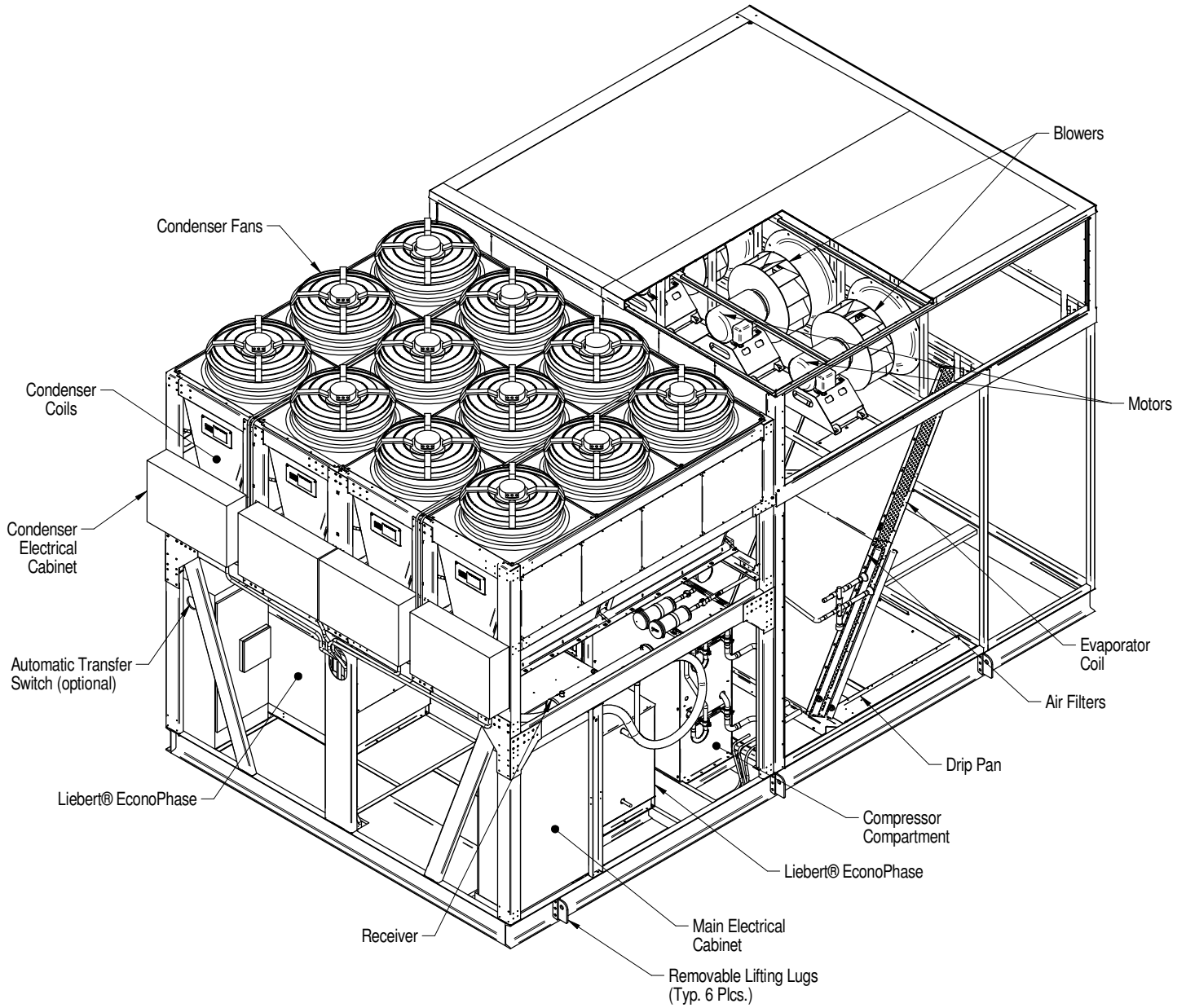
COMPONENT LOCATION DIAGRAM 400/500kW PERIMETER UNIT





LIEBERT® DSE PACKAGED SOLUTION

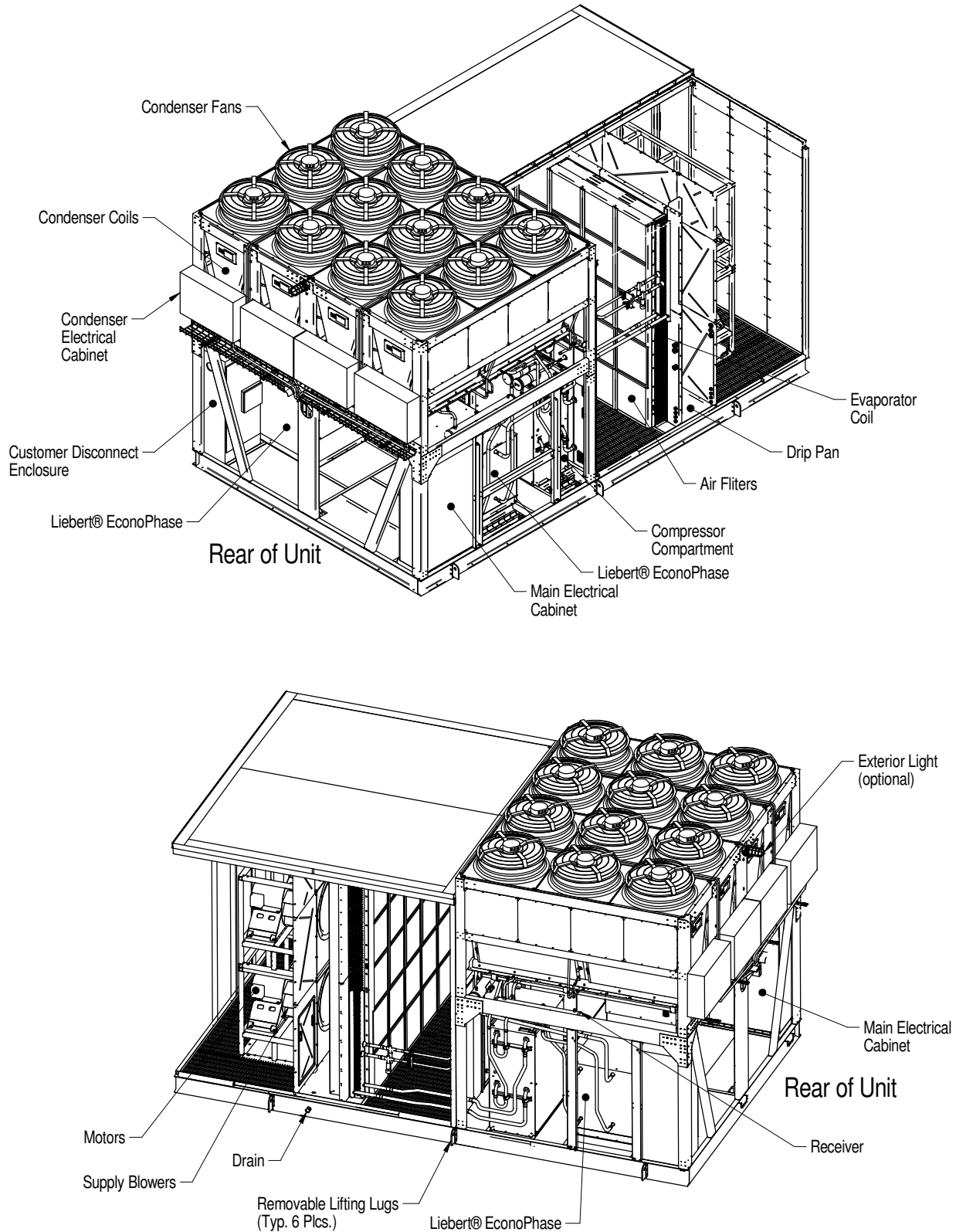
COMPONENT LOCATION DIAGRAM 400/500kW ROOFTOP UNIT



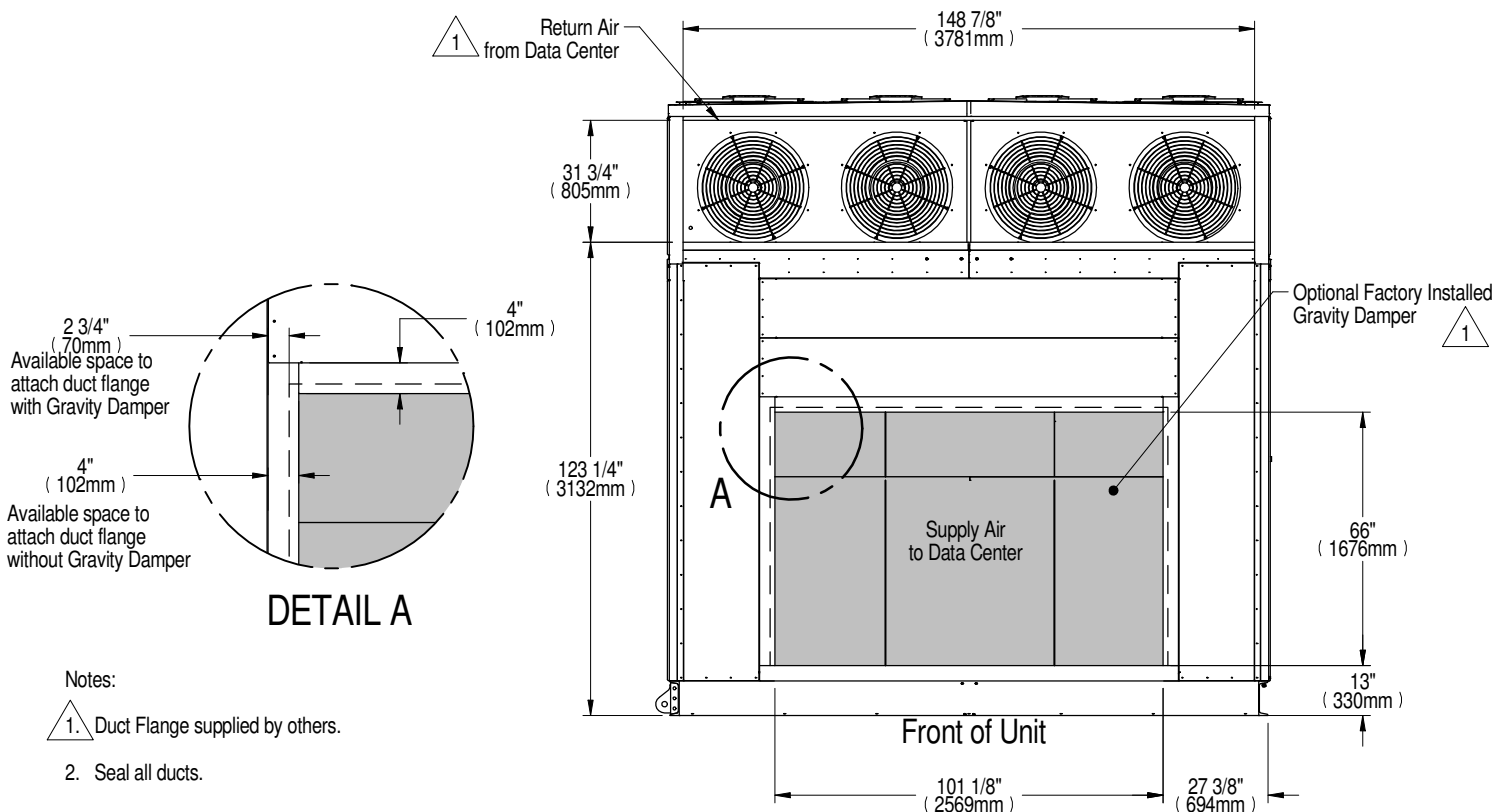
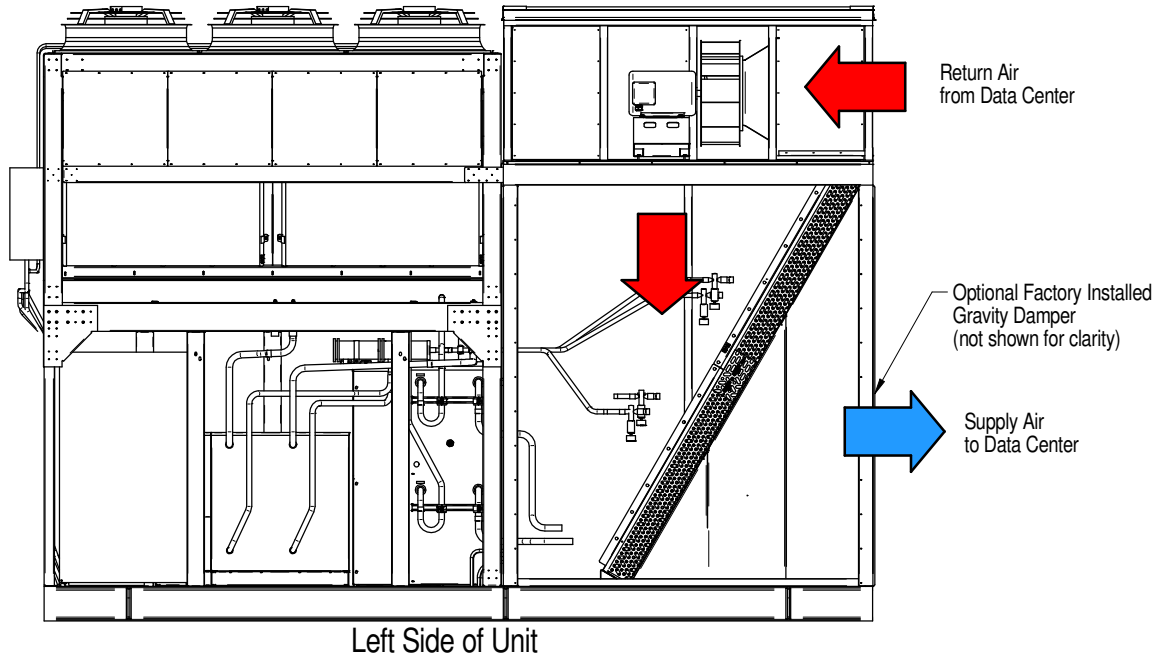


LIEBERT® DSE PACKAGED SOLUTION

COMPONENT LOCATION DIAGRAM 400/500kW ROOFTOP DRAW THRU UNIT



AIRFLOW SCHEMATIC 400/500kW PERIMETER UNIT



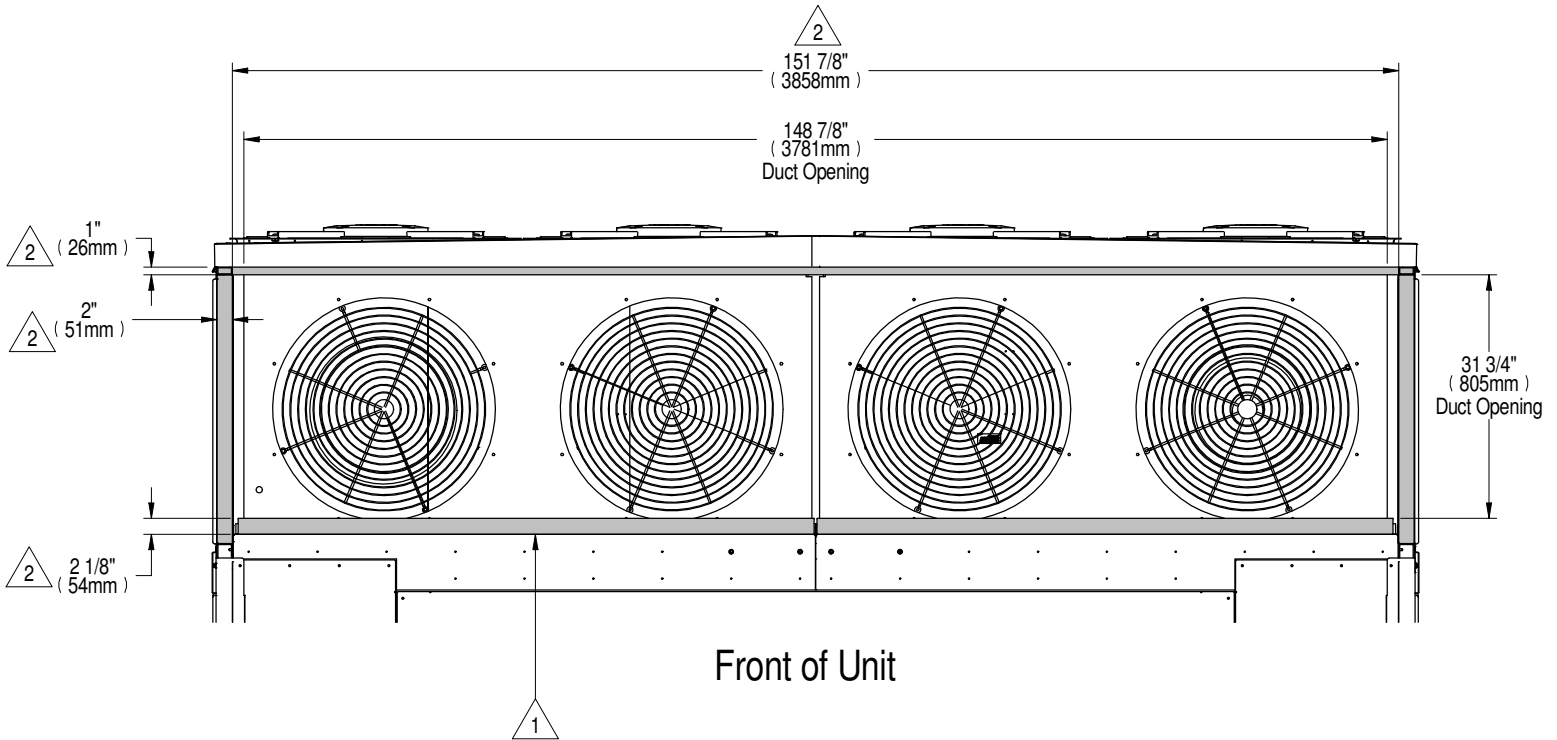
Notes:

1. Duct Flange supplied by others.
2. Seal all ducts.



LIEBERT® DSE PACKAGED SOLUTION

AIRFLOW SCHEMATIC 400/500kW PERIMETER UNIT



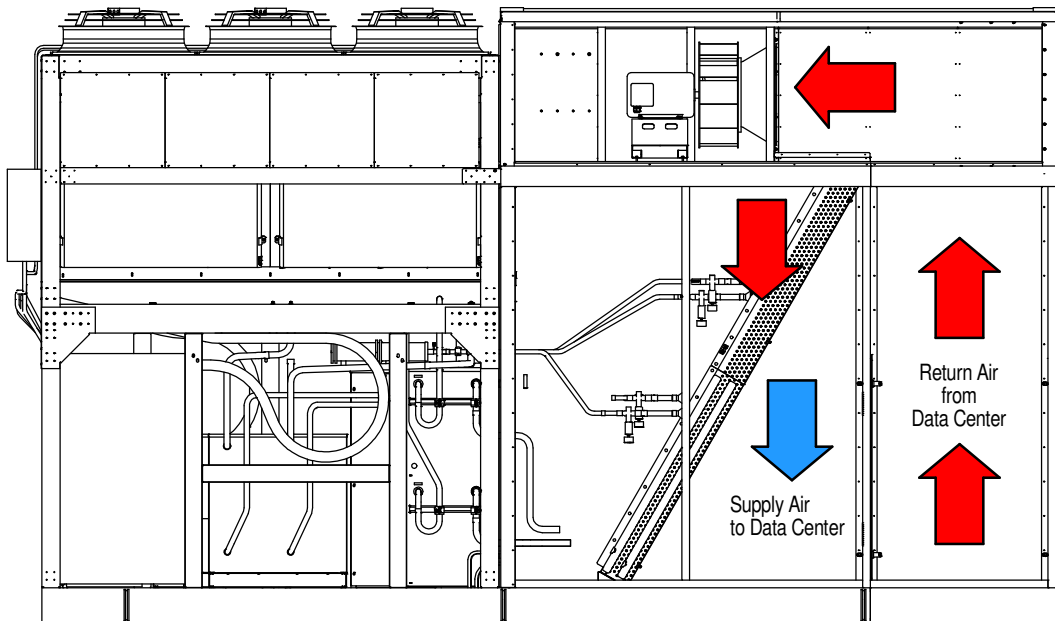
Notes:

1. Duct Flange supplied by others.
2. Perimeter available to attach Return Duct Flange.
3. Seal all ducts.

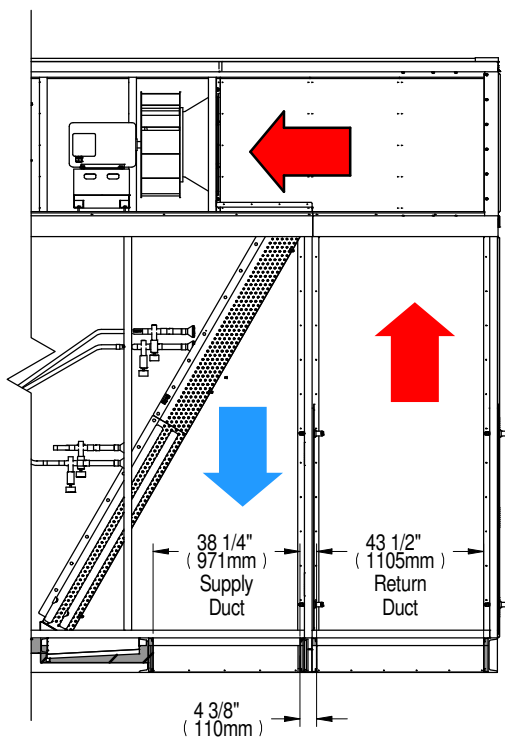


LIEBERT® DSE PACKAGED SOLUTION

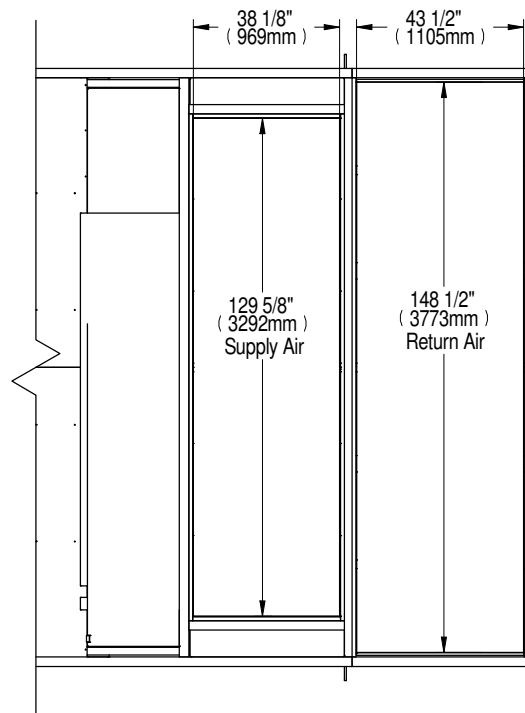
AIRFLOW SCHEMATIC 400/500kW ROOFTOP UNIT



Left Side of Unit



Left Side of Unit



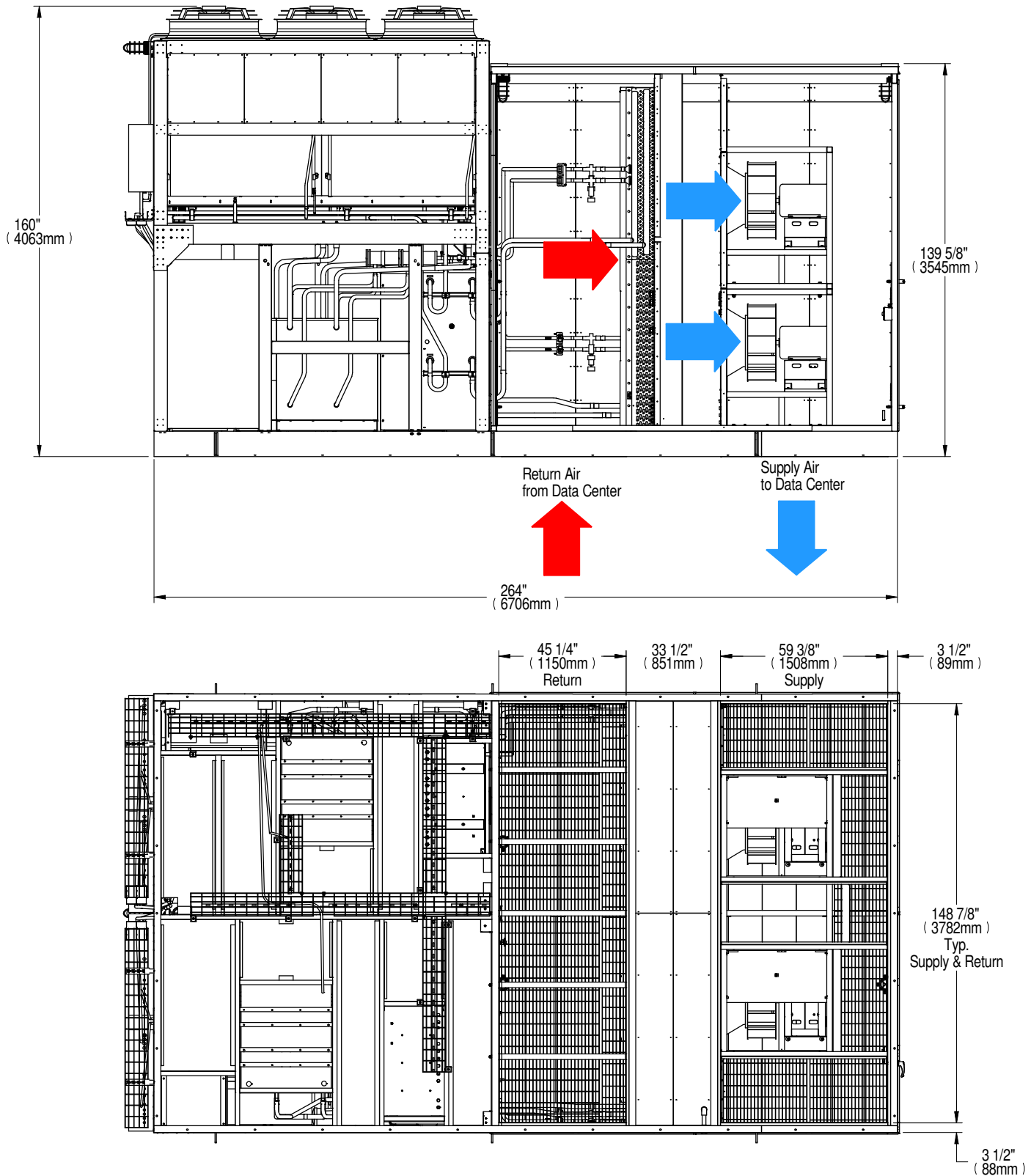
Bottom of Unit

Notes:
1. Seal all ducts.

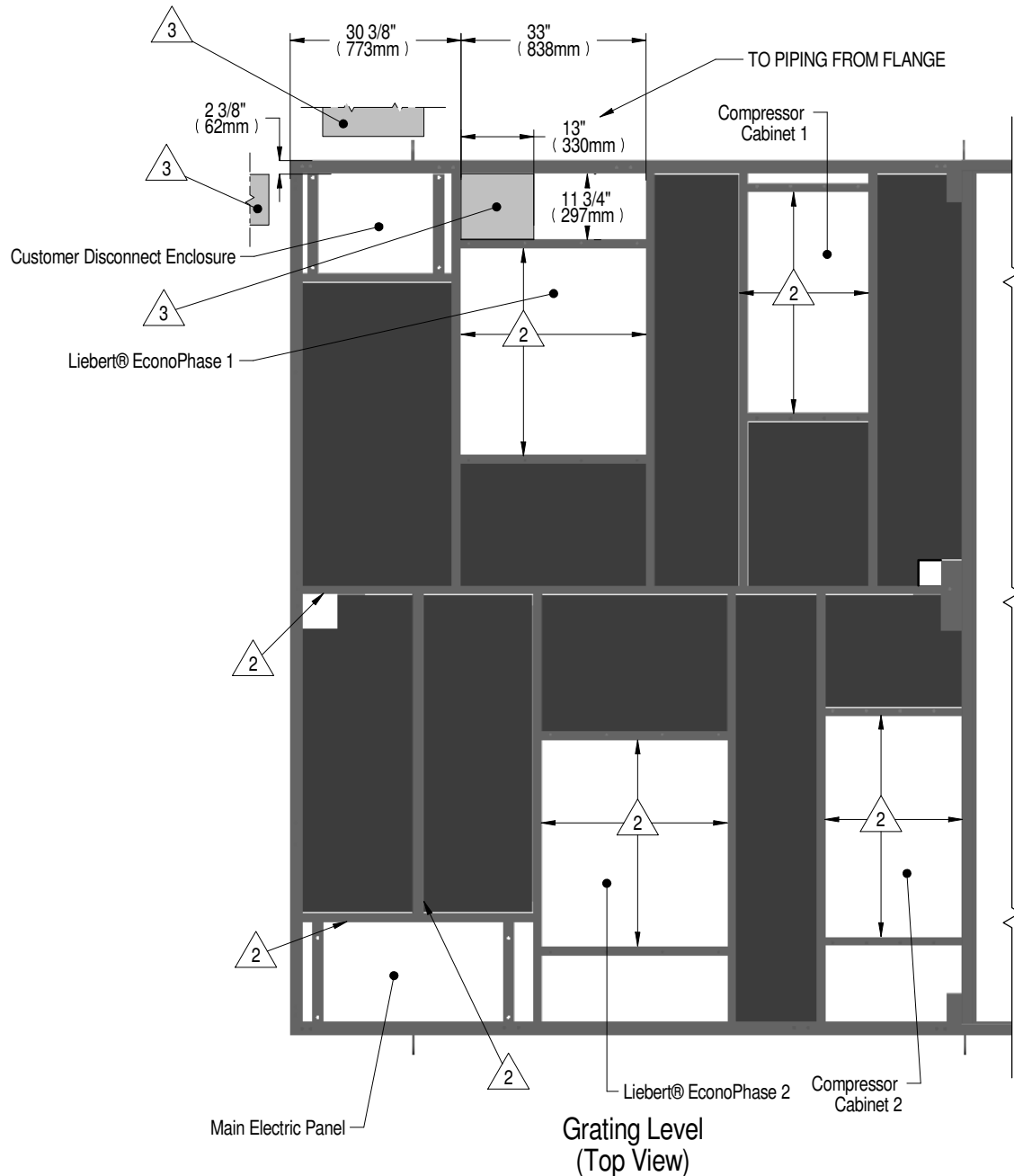


LIEBERT® DSE PACKAGED SOLUTION

AIRFLOW SCHEMATIC 400/500kW ROOFTOP DRAW THRU UNIT



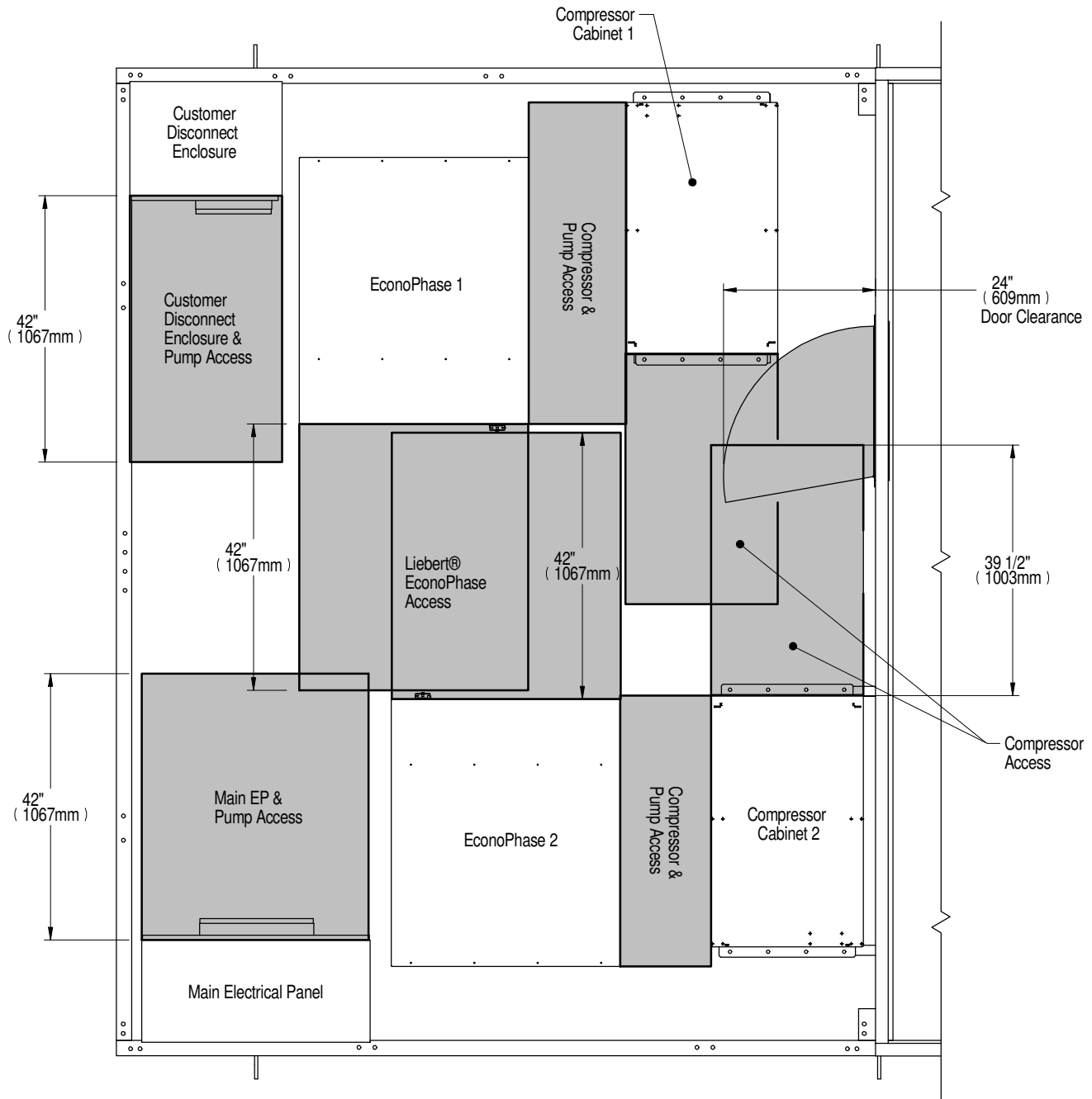
EQUIPMENT FLOOR PLAN 400/500kW PERIMETER AND ROOFTOP UNIT



Notes:

1. Grating is Removable.
2. Frame Member.
3. Area for running power wiring. Entry point is at different height than shown. Refer to submittal DPN004960 for more information.
4. For low voltage and communication wiring entry points, please refer to DPN004960 for more information.

EQUIPMENT FLOOR PLAN 400/500kW PERIMETER AND ROOFTOP UNIT



Notes:

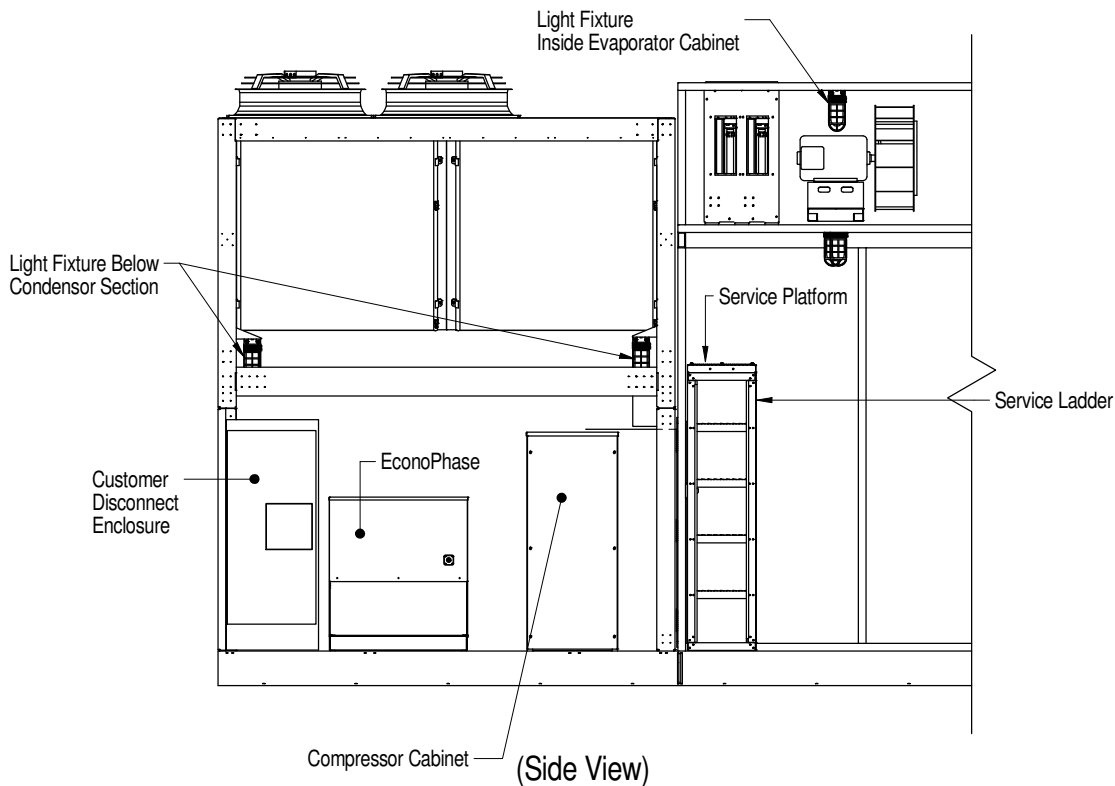
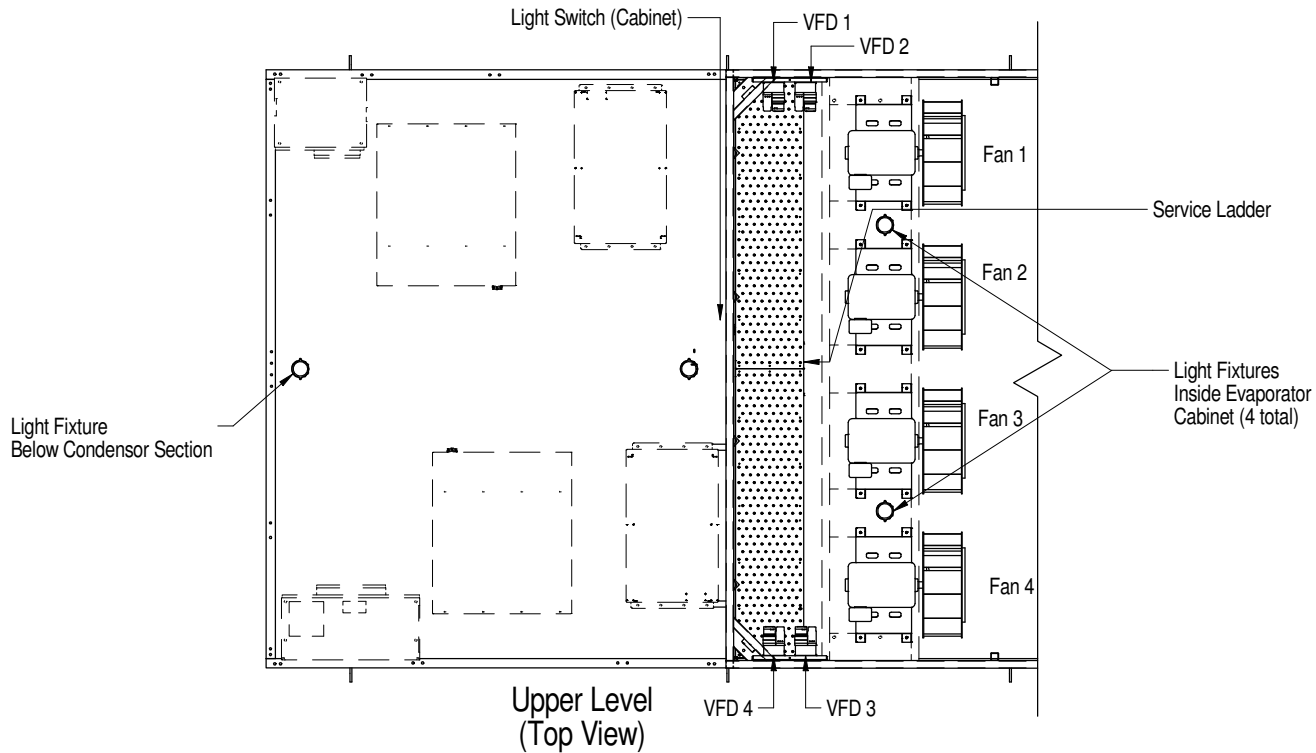
1. Service access areas are shaded.

Base Level
(Top View)

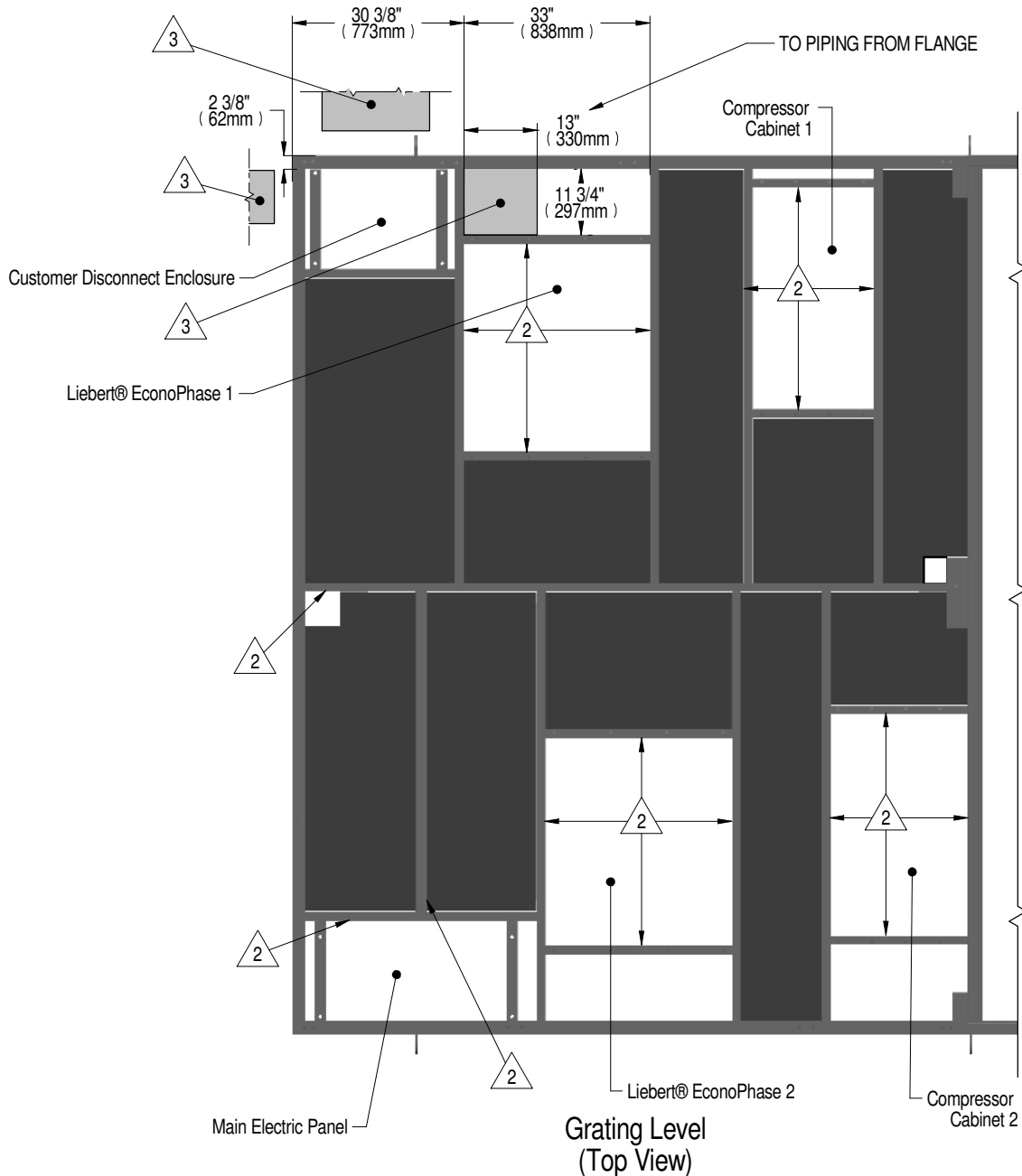


LIEBERT® DSE PACKAGED SOLUTION

EQUIPMENT FLOOR PLAN 400/500kW PERIMETER AND ROOFTOP UNIT



EQUIPMENT FLOOR PLAN 400/500kW DRAW THRU ROOFTOP UNIT



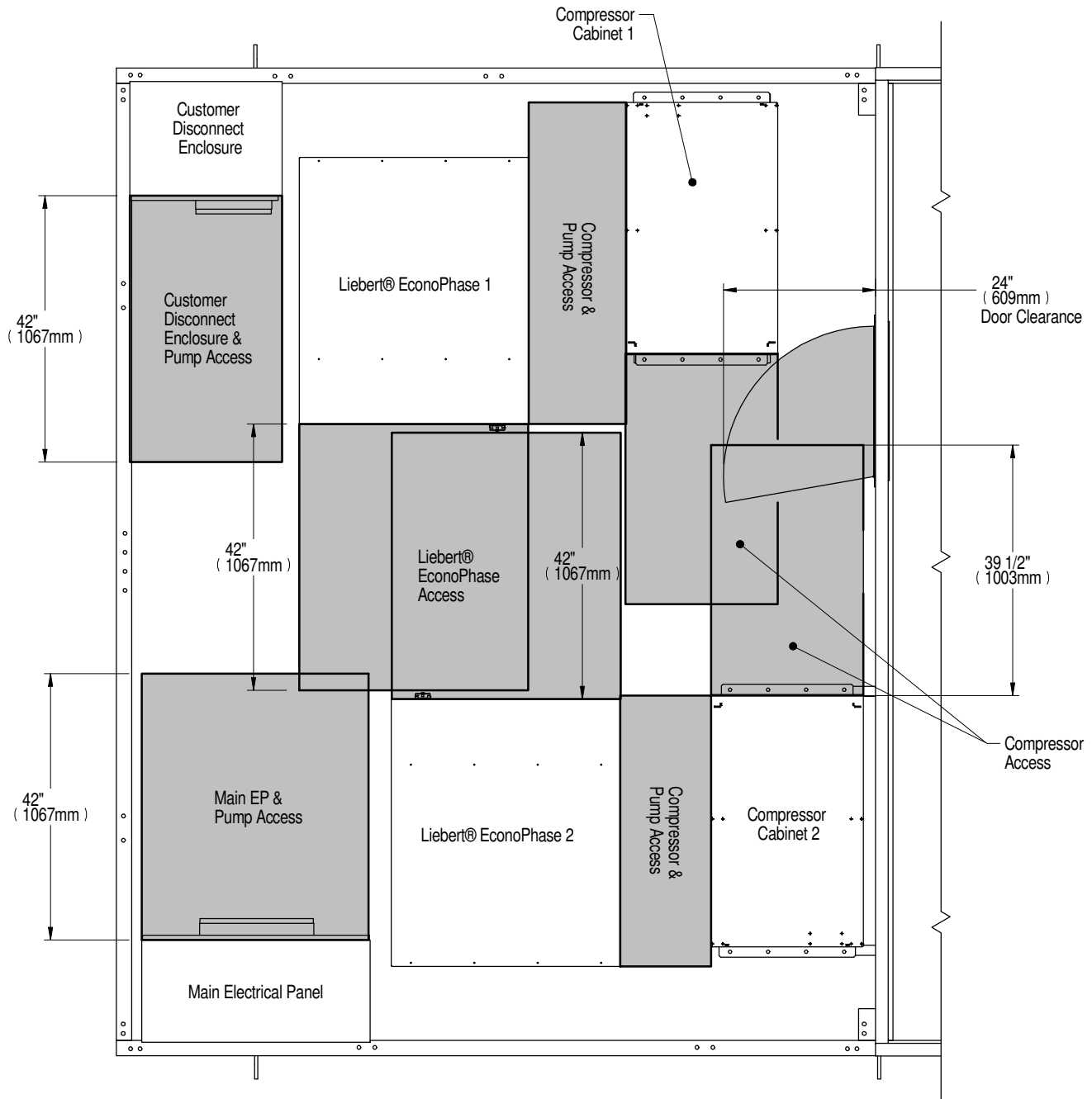
Notes:

1. Grating is Removable.
2. Frame Member.
3. Area for running power wiring. Entry point is at different height than shown. Refer to submittal DPN004960 for more information..
4. For low voltage and communication wiring entry points, please refer to DPN004960 for more information.



LIEBERT® DSE PACKAGED SOLUTION

EQUIPMENT FLOOR PLAN 400/500kW DRAW THRU ROOFTOP UNIT



Notes:

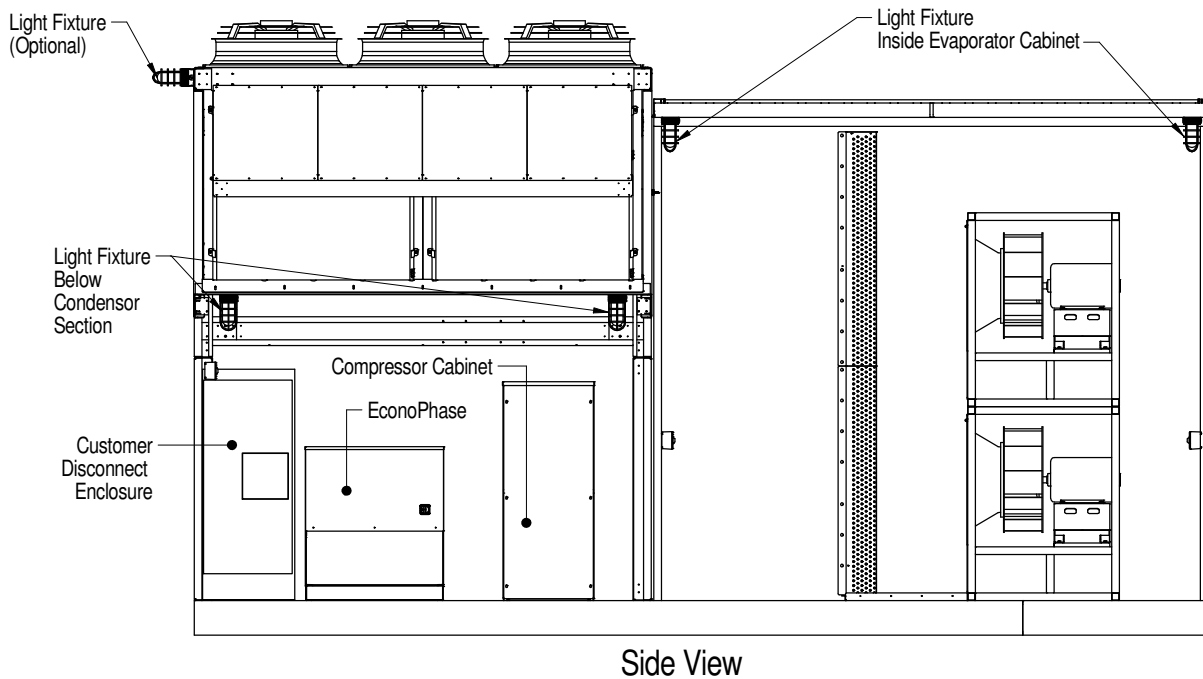
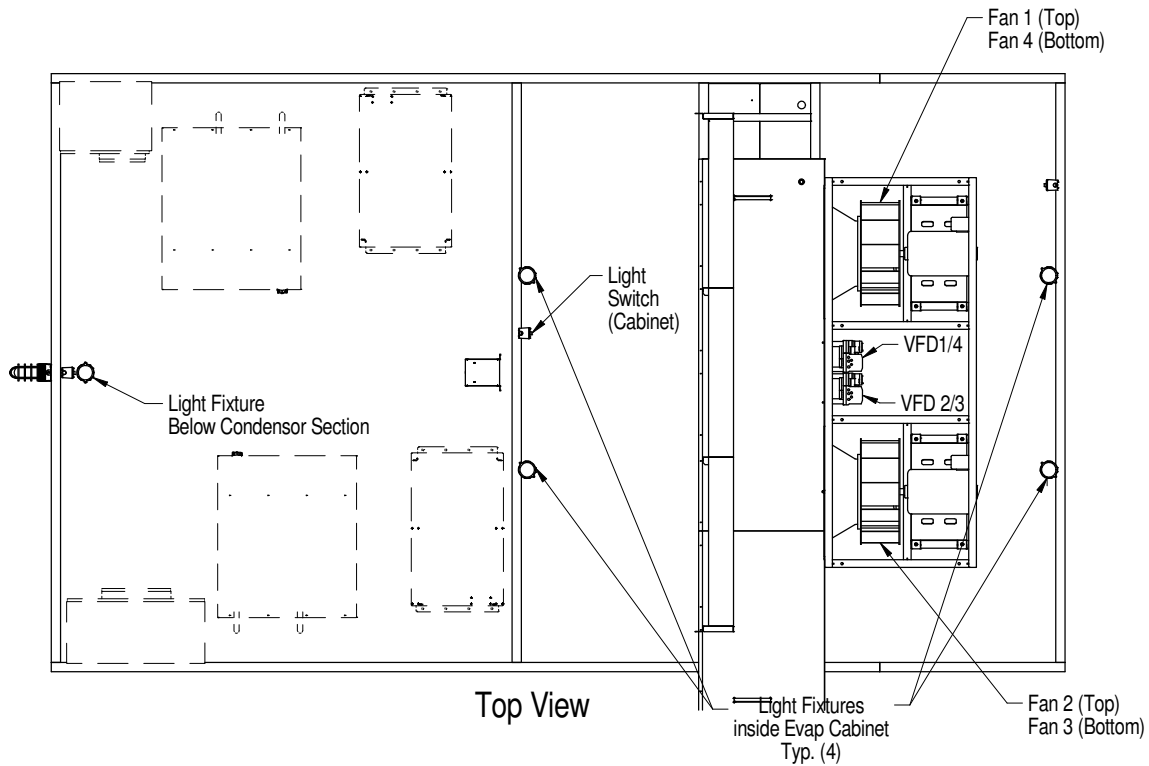
- 1. Service access areas are shaded.

Base Level
(Top View)



LIEBERT® DSE PACKAGED SOLUTION

EQUIPMENT FLOOR PLAN 400/500kW DRAW THRU ROOFTOP UNIT

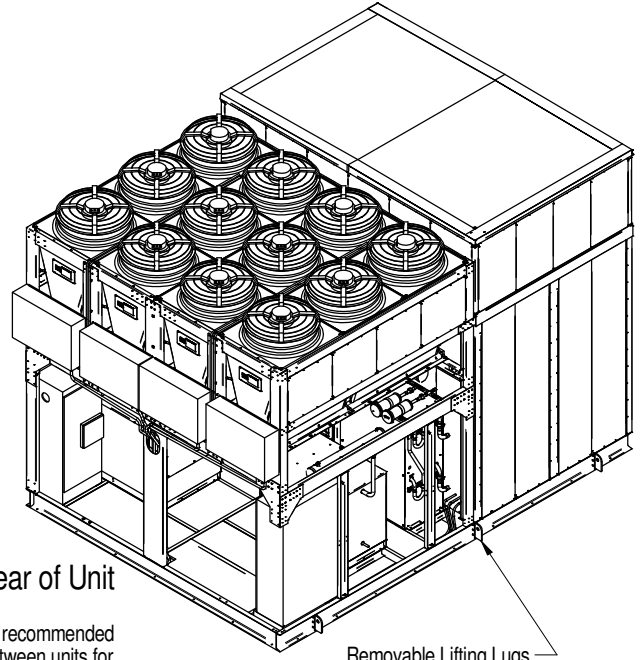
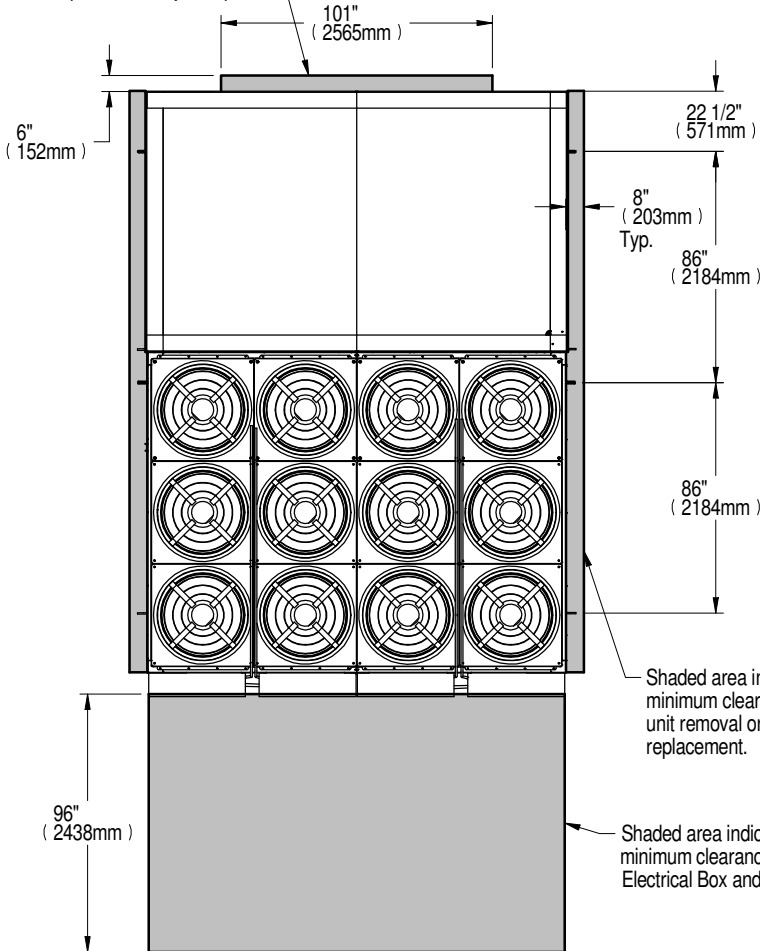




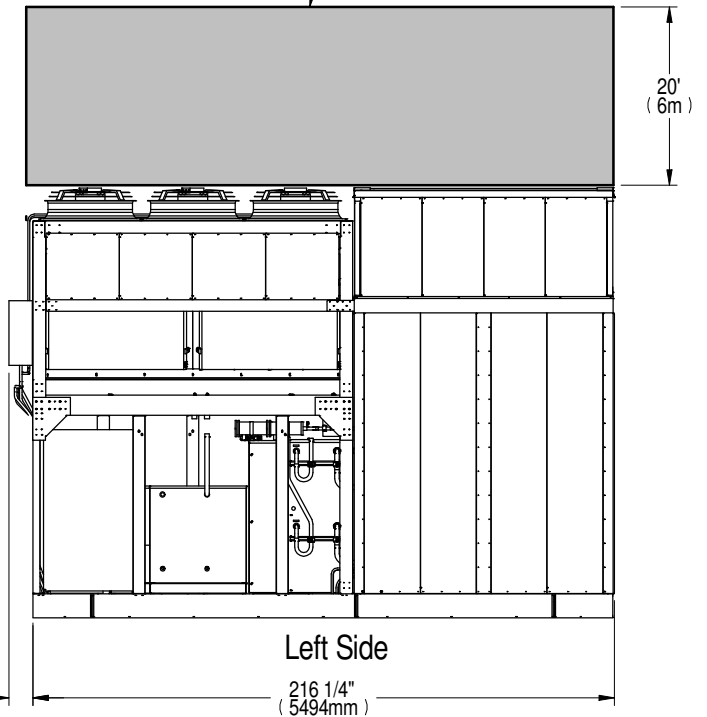
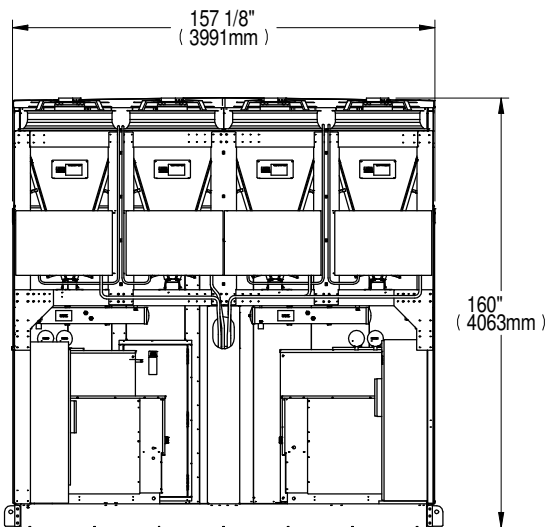
LIEBERT DSE PACKAGED SOLUTION

CABINET & ANCHOR DIMENSIONAL DATA 400/500kW PERIMETER UNIT

Shaded area indicates required minimum clearance for Optional Gravity Damper



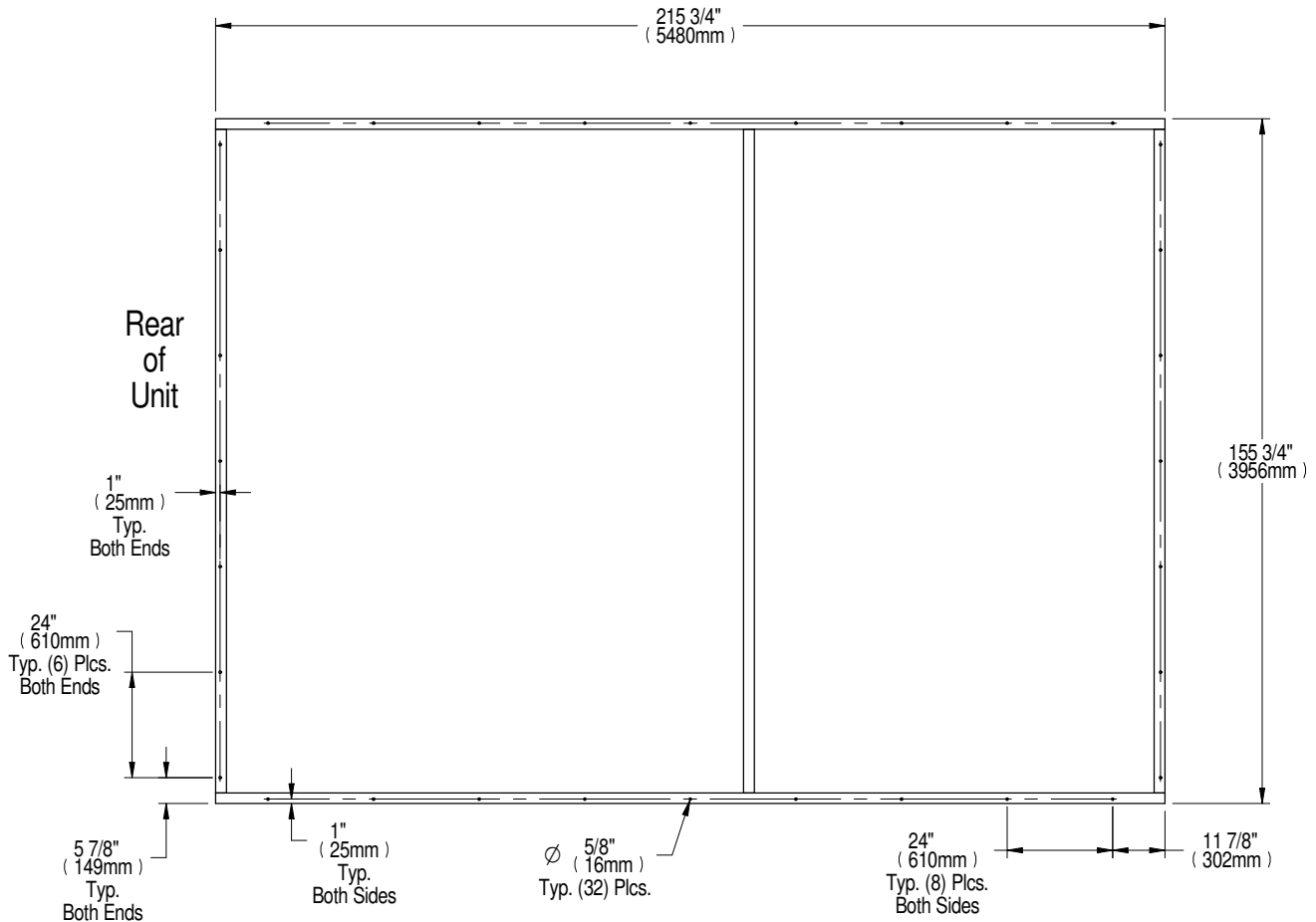
Shaded area indicates recommended minimum clearance to be provided to remove Evaporator Coil.





LIEBERT DSE PACKAGED SOLUTION

CABINET & ANCHOR DIMENSIONAL DATA 400/500kW PERIMETER UNIT

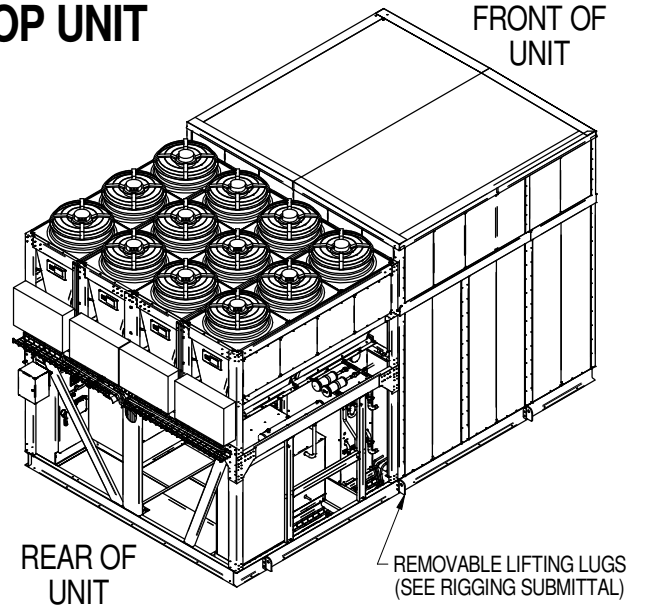
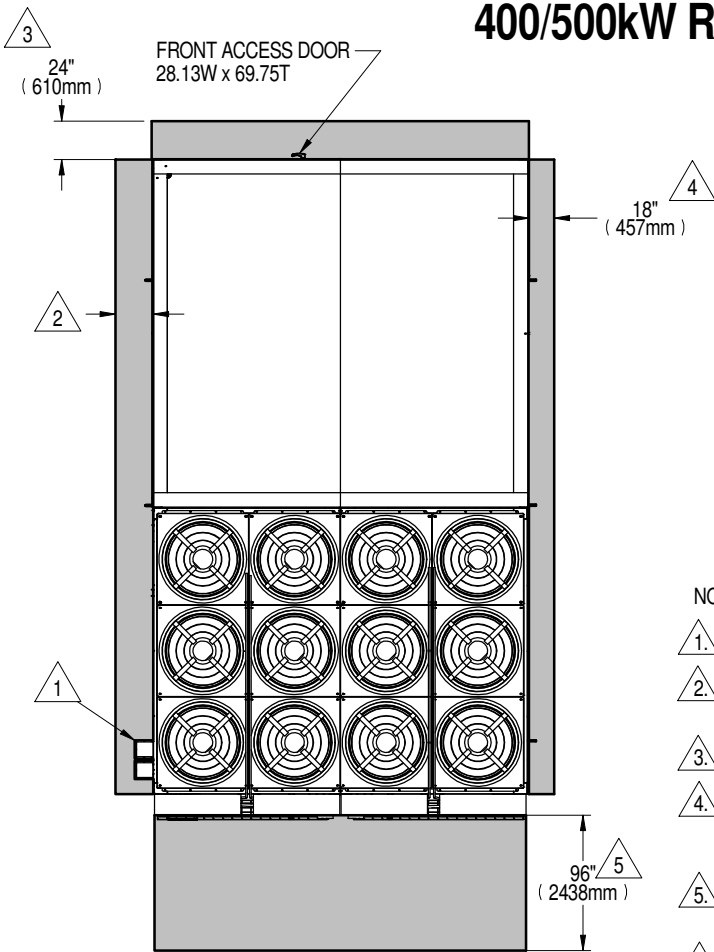


Notes:

1. Underside of unit. Coil and fan removed for clarity.
2. Quantity of 32 mounting holes of 5/8" diameter provided for anchorage. Mounting requirement details such as brand, type, embedment depth, concrete strength, wall bracing, and special inspection must be outlined and approved by the project Structural Engineer of Record.
3. Structural floors and housekeeping pads must be designed and approved by the project Structural Engineer of Record to withstand the seismic and wind anchor loads as defined on the installation drawings. The installing contractor is responsible for the proper installation of all anchors and mounting hardware, observing the mounting requirement details outlined by the Engineer of Record.

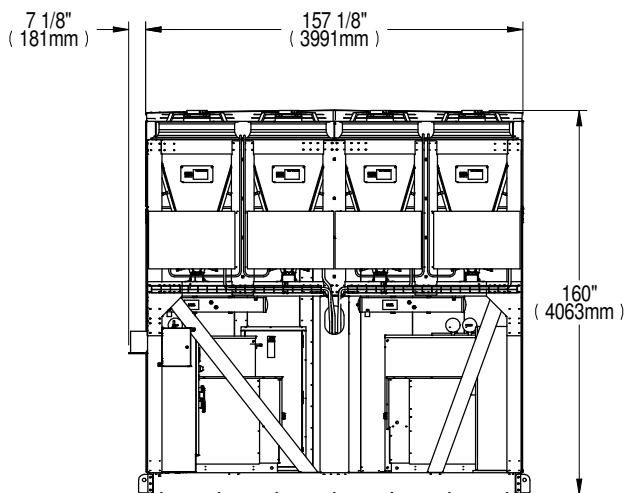
CABINET & ANCHOR DIMENSIONAL DATA

400/500kW ROOFTOP UNIT

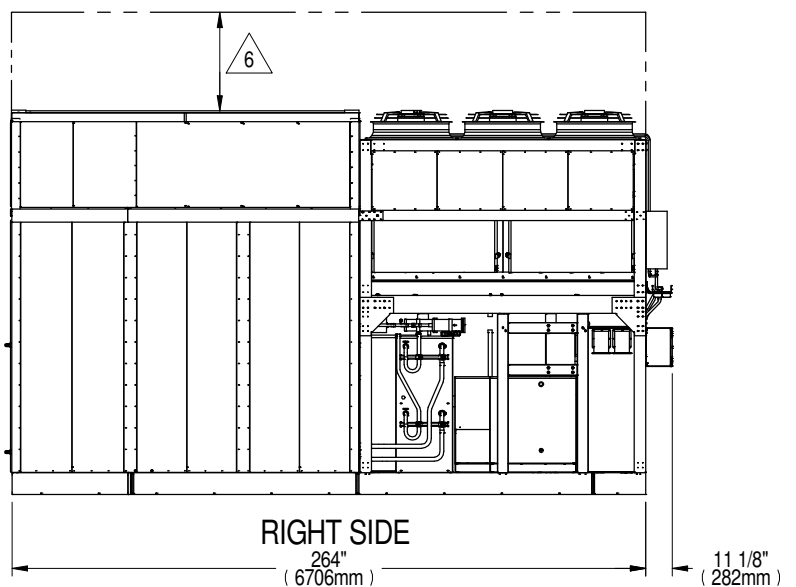


NOTES:

1. ITEMS ONLY PRESENT WHEN ENTRY KIT 342985 IS ORDERED.
2. 24" (610mm) CLEARANCE NEEDED WHEN ENTRY KITS 342985 OR 342986 ARE ORDERED. 18" (457mm) CLEARANCE NEEDED WHEN OTHER ENTRIES USED.
3. SHADED AREA INDICATES MINIMUM FRONT SERVICE ACCESS CLEARANCE
4. SHADED AREA INDICATES RECOMMENDED MINIMUM CLEARANCE BETWEEN UNITS TO ALLOW ACCESS FOR ANCHORAGE INSTALLATION FOR FULL WIND AND SEISMIC PERFORMANCE. MINIMUM 8" IS NEEDED FOR UNIT OPERATION.
5. SHADED AREA INDICATES RECOMMENDED MINIMUM CLEARANCE TO BE PROVIDED FOR ELECTRICAL BOX AND COMPONENT ACCESS.
6. 20' (6 m) IS THE RECOMMENDED MINIMUM CLEARANCE TO BE PROVIDED TO REMOVE EVAPORATOR COIL.
7. SOME COMPONENTS SHOWN MAY NOT BE INCLUDED, REFER TO SPECIFIC ORDER DETAILS



REAR OF UNIT

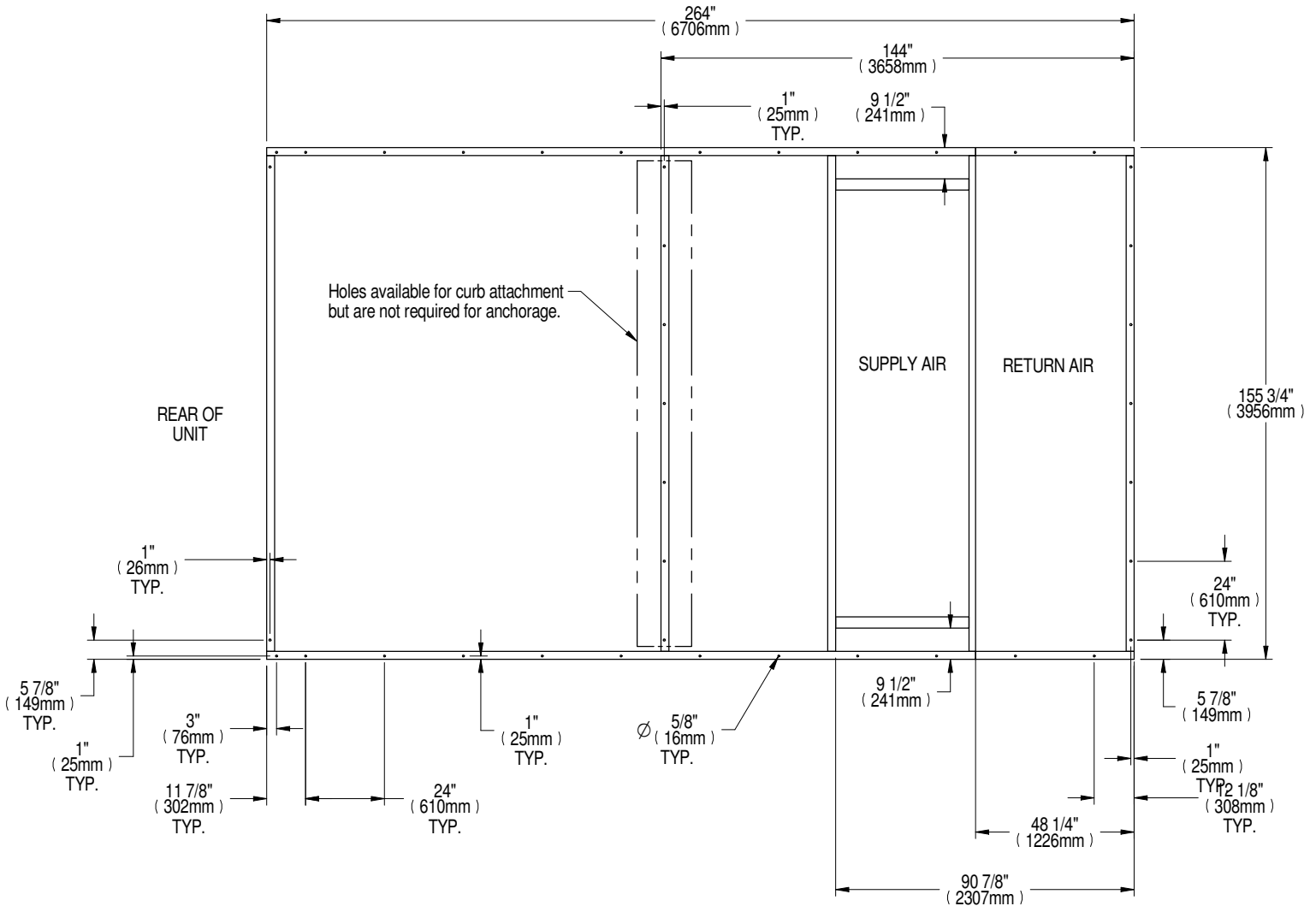


RIGHT SIDE



LIEBERT® DSE PACKAGED SOLUTION

CABINET & ANCHOR DIMENSIONAL DATA 400/500kW ROOFTOP UNIT



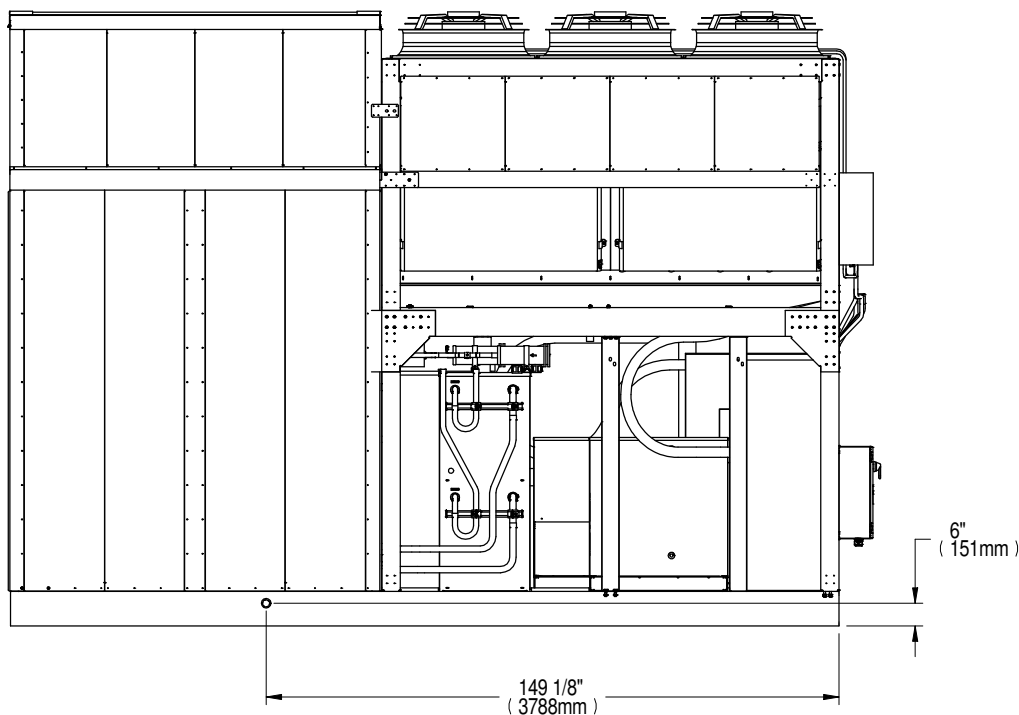
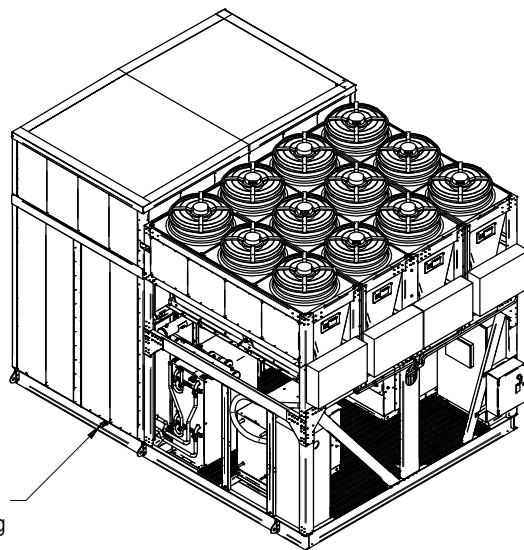
Notes:

1. Underside of unit. Coil and fan removed for clarity.
2. 5/8" diameter holes are provided for anchorage for full wind and seismic performance. Mounting requirement details such as brand, type, embedment depth, concrete strength, wall bracing, and special inspection must be outlined and approved by the project Structural Engineer of Record.
3. Structural floors, housekeeping pads and curbs must be designed and approved by the project Structural Engineer of Record to withstand the seismic and wind anchor loads as defined on the installation drawings. The installing contractor is responsible for the proper installation of all anchors and mounting hardware, observing the mounting requirement details outlined by the Engineer of Record.



LIEBERT® DSE PACKAGED SOLUTION

DRIP PAN CLEANOUT ACCESS & LOCATION 400/500kW PERIMETER UNIT



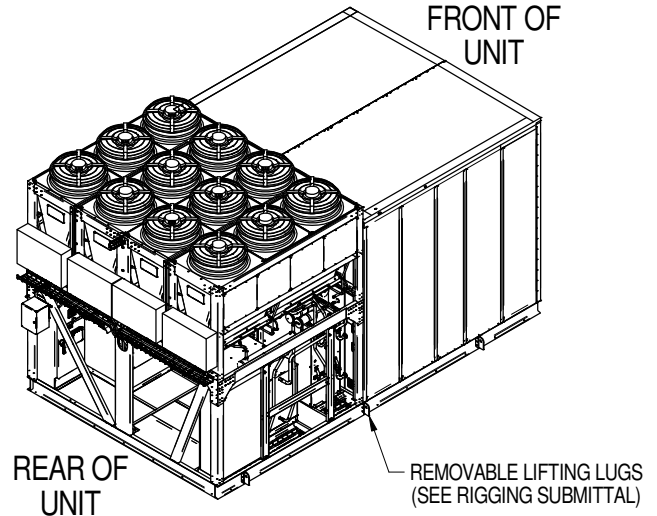
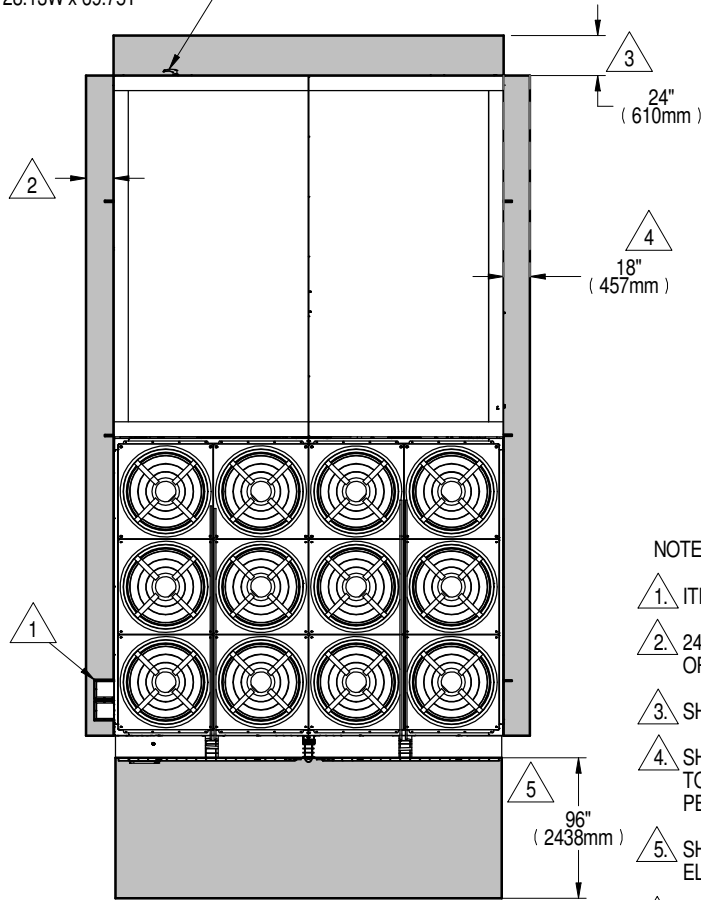
Side View showing
clean-out location



LIEBERT® DSE PACKAGED SOLUTION

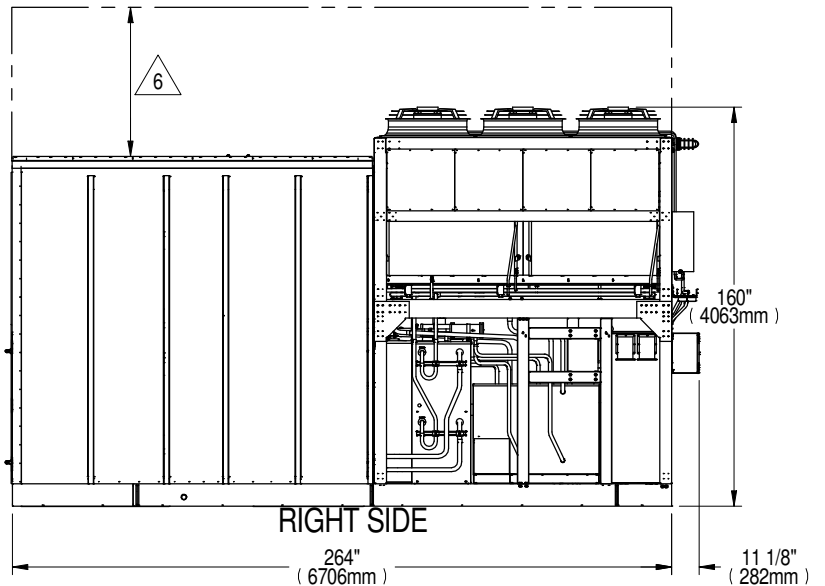
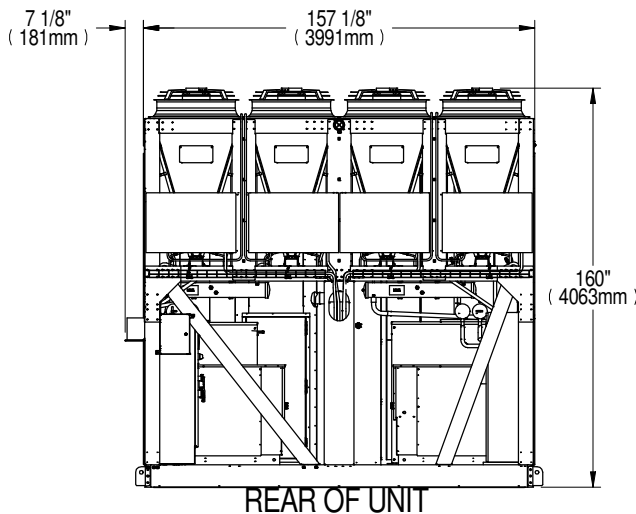
CABINET & ANCHOR DIMENSIONAL DATA 400/500kW ROOFTOP DRAW THROUGH UNIT

FRONT ACCESS DOOR
28.13W x 69.75T



NOTES:

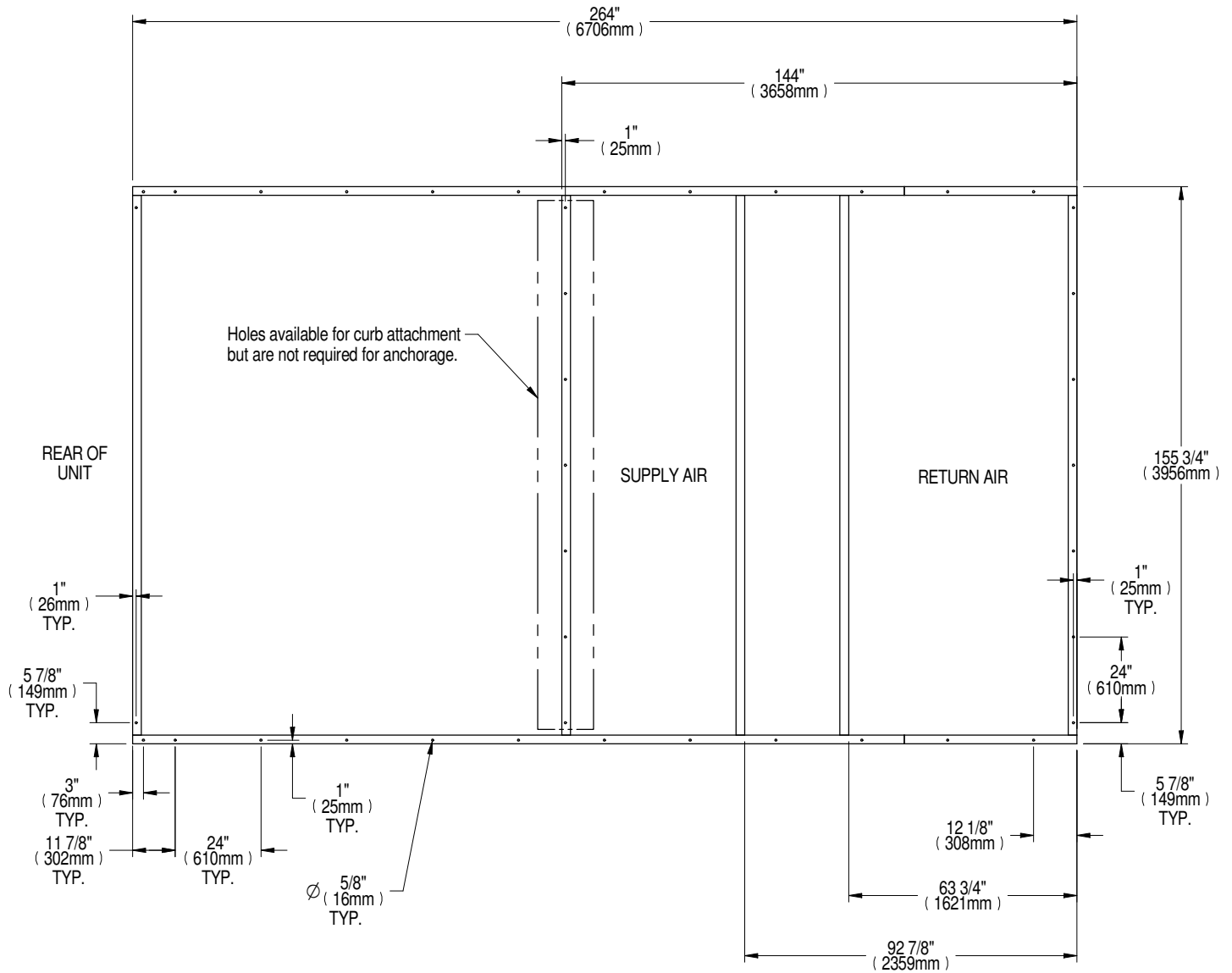
1. ITEMS ONLY PRESENT WHEN ENTRY KIT 342985 IS ORDERED.
2. 24" (610mm) CLEARANCE NEEDED WHEN ENTRY KITS 342985 OR 342986 ARE ORDERED. 18" (457mm) CLEARANCE NEEDED WHEN OTHER ENTRIES USED.
3. SHADED AREA INDICATES MINIMUM FRONT SERVICE ACCESS CLEARANCE
4. SHADED AREA INDICATES RECOMMENDED MINIMUM CLEARANCE BETWEEN UNITS TO ALLOW ACCESS FOR ANCHORAGE INSTALLATION FOR FULL WIND AND SEISMIC PERFORMANCE. MINIMUM 8" IS NEEDED FOR UNIT OPERATION.
5. SHADED AREA INDICATES RECOMMENDED MINIMUM CLEARANCE TO BE PROVIDED FOR ELECTRICAL BOX AND COMPONENT ACCESS.
6. 20' (6 m) IS THE RECOMMENDED MINIMUM CLEARANCE TO BE PROVIDED TO REMOVE EVAPORATOR COIL.
7. SOME COMPONENTS SHOWN MAY NOT BE INCLUDED, REFER TO SPECIFIC ORDER DETAILS





LIEBERT® DSE PACKAGED SOLUTION

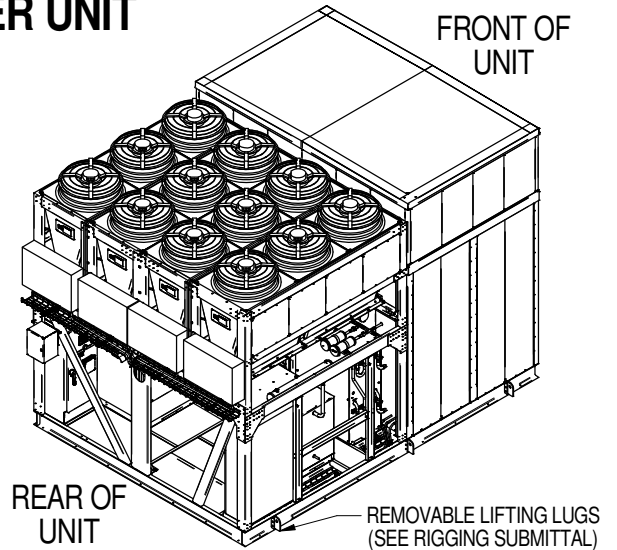
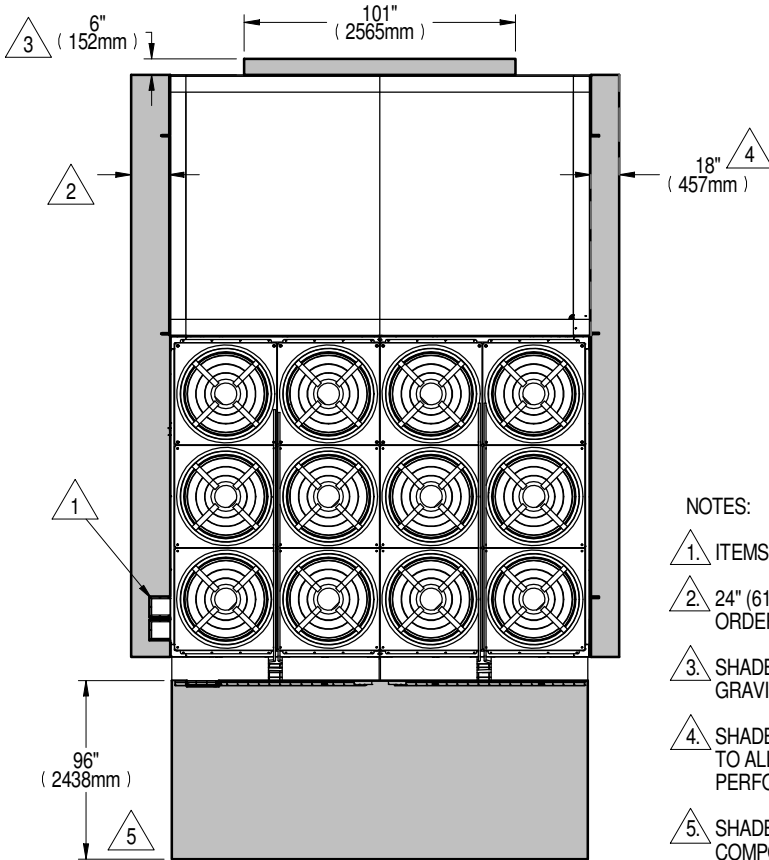
CABINET & ANCHOR DIMENSIONAL DATA 400/500kW ROOFTOP DRAW THROUGH UNIT



Notes:

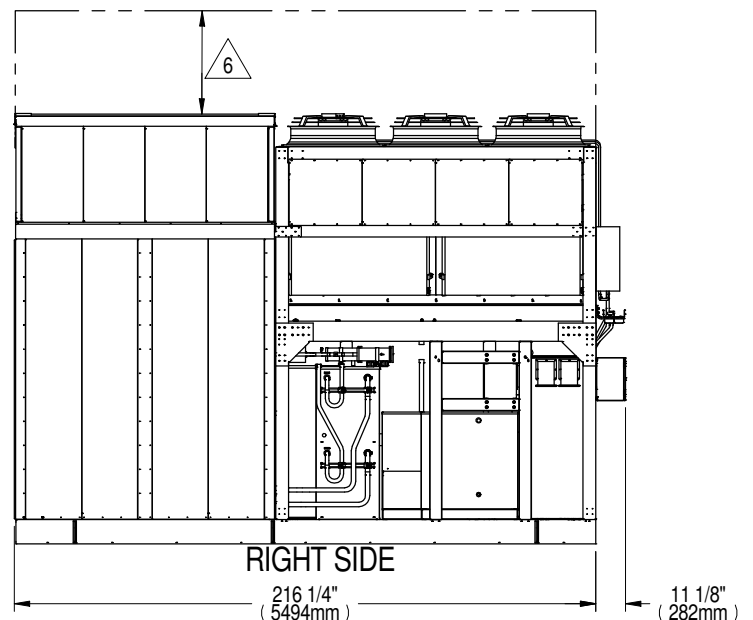
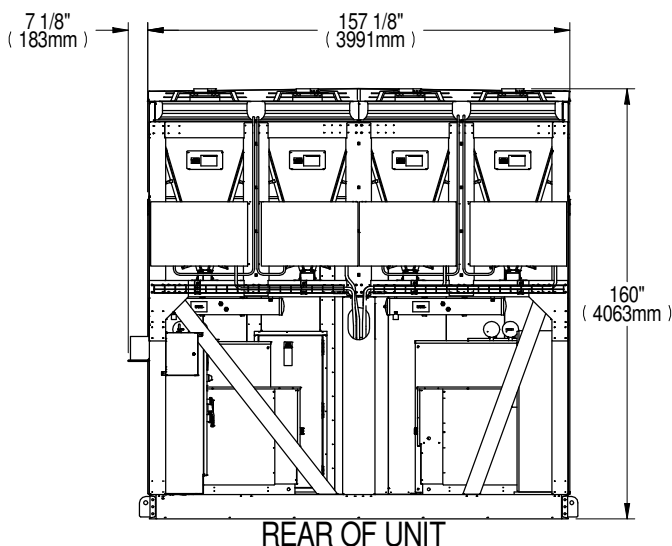
- Underside of unit. Coil and fan removed for clarity.
- 5/8" diameter holes are provided for anchorage for full wind and seismic performance. Mounting requirement details such as brand, type, embedment depth, concrete strength, wall bracing, and special inspection must be outlined and approved by the project Structural Engineer of Record.
- Structural floors, housekeeping pads and curbs must be designed and approved by the project Structural Engineer of Record to withstand the seismic and wind anchor loads as defined on the installation drawings. The installing contractor is responsible for the proper installation of all anchors and mounting hardware, observing the mounting requirement details outlined by the Engineer of Record.

CABINET & ANCHOR DIMENSIONAL DATA 400/500kW PERIMETER UNIT



NOTES:

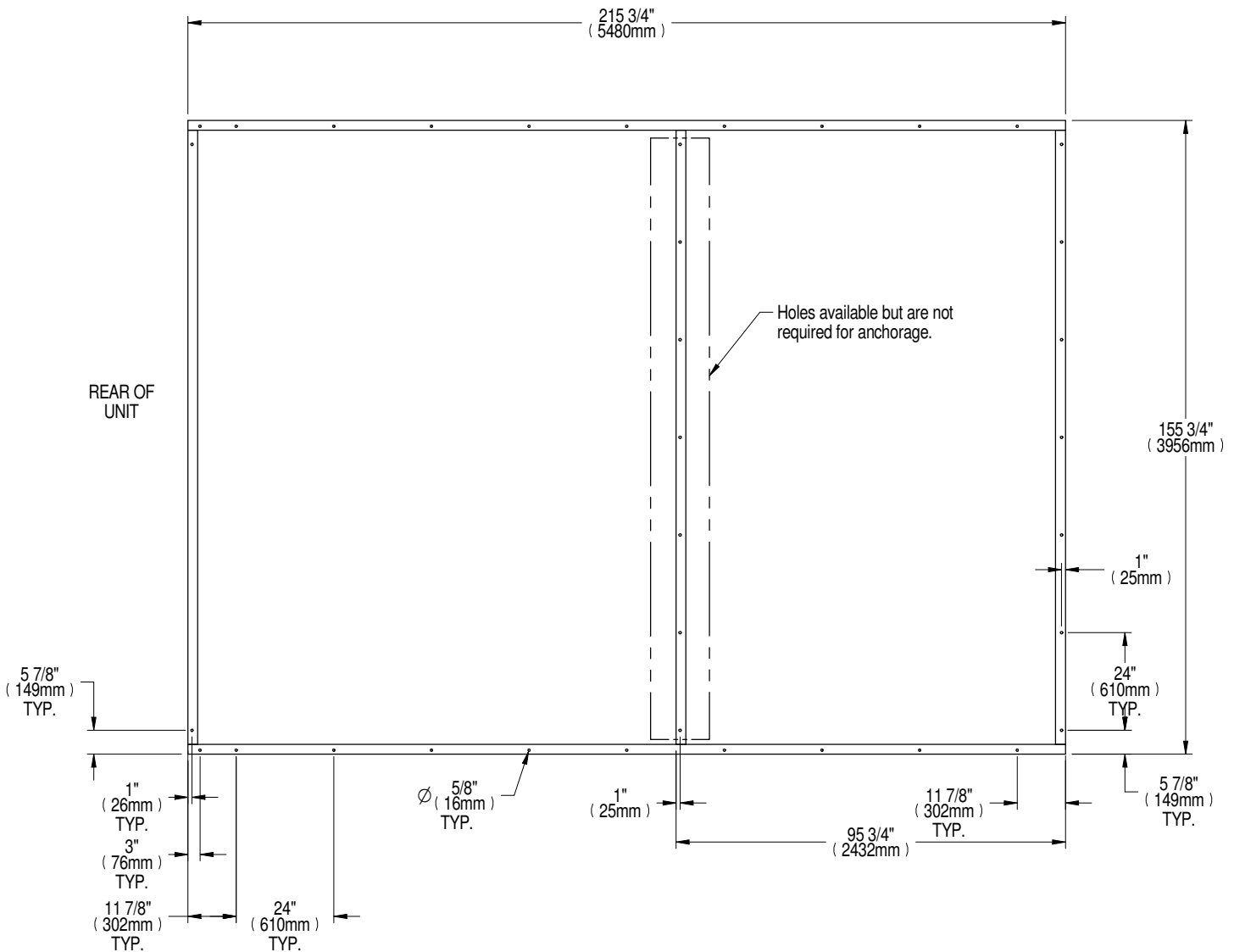
1. ITEMS ONLY PRESENT WHEN ENTRY KIT 342985 IS ORDERED.
2. 24" (610mm) CLEARANCE NEEDED WHEN ENTRY KITS 342985 OR 342986 ARE ORDERED. 18" (457mm) CLEARANCE NEEDED WHEN OTHER ENTRIES USED.
3. SHADED AREA INDICATES RECOMMENDED MINIMUM CLEARANCE FOR OPTIONAL GRAVITY DAMPER.
4. SHADED AREA INDICATES RECOMMENDED MINIMUM CLEARANCE BETWEEN UNITS TO ALLOW ACCESS FOR ANCHORAGE INSTALLATION FOR FULL WIND AND SEISMIC PERFORMANCE. MINIMUM 8" IS NEEDED FOR UNIT OPERATION.
5. SHADED AREA INDICATES MINIMUM CLEARANCE FOR ELECTRICAL BOX AND COMPONENT ACCESS.
6. 20' (6 m) IS THE RECOMMENDED MINIMUM CLEARANCE TO BE PROVIDED TO REMOVE EVAPORATOR COIL.
7. SOME COMPONENTS SHOWN MAY NOT BE INCLUDED, REFER TO SPECIFIC ORDER DETAILS





LIEBERT® DSE PACKAGED SOLUTION

CABINET & ANCHOR DIMENSIONAL DATA 400/500kW PERIMETER UNIT



Notes:

1. Underside of unit. Coil and fan removed for clarity.
2. 5/8" diameter holes are provided for anchorage for full wind and seismic performance. Mounting requirement details such as brand, type, embedment depth, concrete strength, wall bracing, and special inspection must be outlined and approved by the project Structural Engineer of Record.
3. Structural floors and housekeeping pads must be designed and approved by the project Structural Engineer of Record to withstand the seismic and wind anchor loads as defined on the installation drawings. The installing contractor is responsible for the proper installation of all anchors and mounting hardware, observing the mounting requirement details outlined by the Engineer of Record.



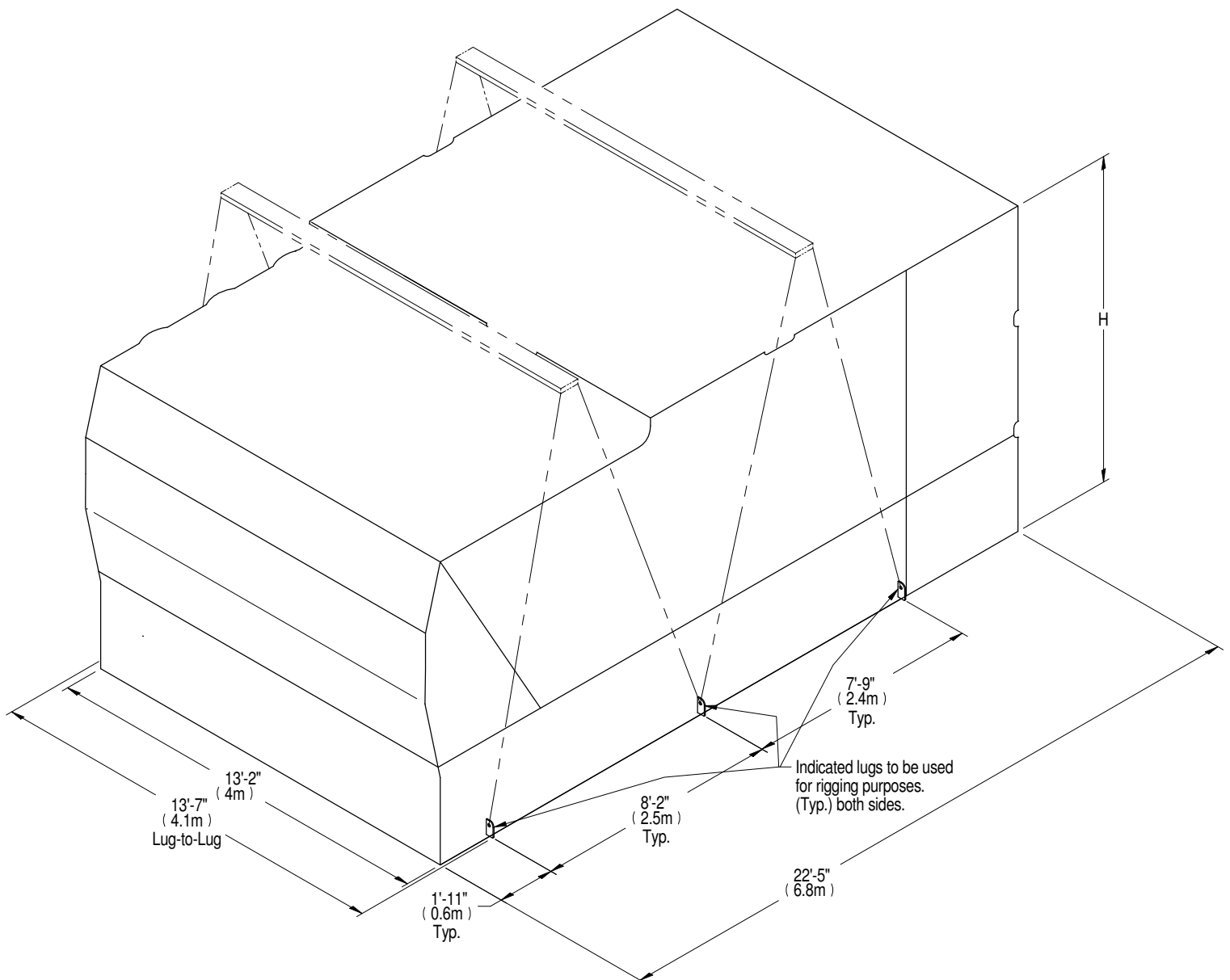
LIEBERT® DSE PACKAGED SOLUTION

RIGGING INSTRUCTIONS 400/500kW ROOFTOP UNIT

Note:

1. Inspect unit for damages.
2. Clear area of all unnecessary personnel.
3. Clear area of any debris, unrelated tools, or foreign objects.
4. Use indicated lifting lugs to lift the unit. Use spreader bars (provided by others) and/or shimmed blocks to prevent external damage.
5. Unit must be lifted level. Tilting can cause damage to the equipment inside. Use shims or blocks for leveling when placing the unit on the ground before lifting.
6. Approximate Shipping Weight:

Model	Capacity	Shipping Wt.	Height (H)
DP400R	400kW	25,500 lbs. (11567 kg)	13'-6"
DP500R	500kW	26,000 lbs. (11793 kg)	13'-6"
DP400B	400kW	25,500 lbs. (11567 kg)	12'-9"
DP500B	500kW	26,000 lbs. (11793 kg)	12'-9"





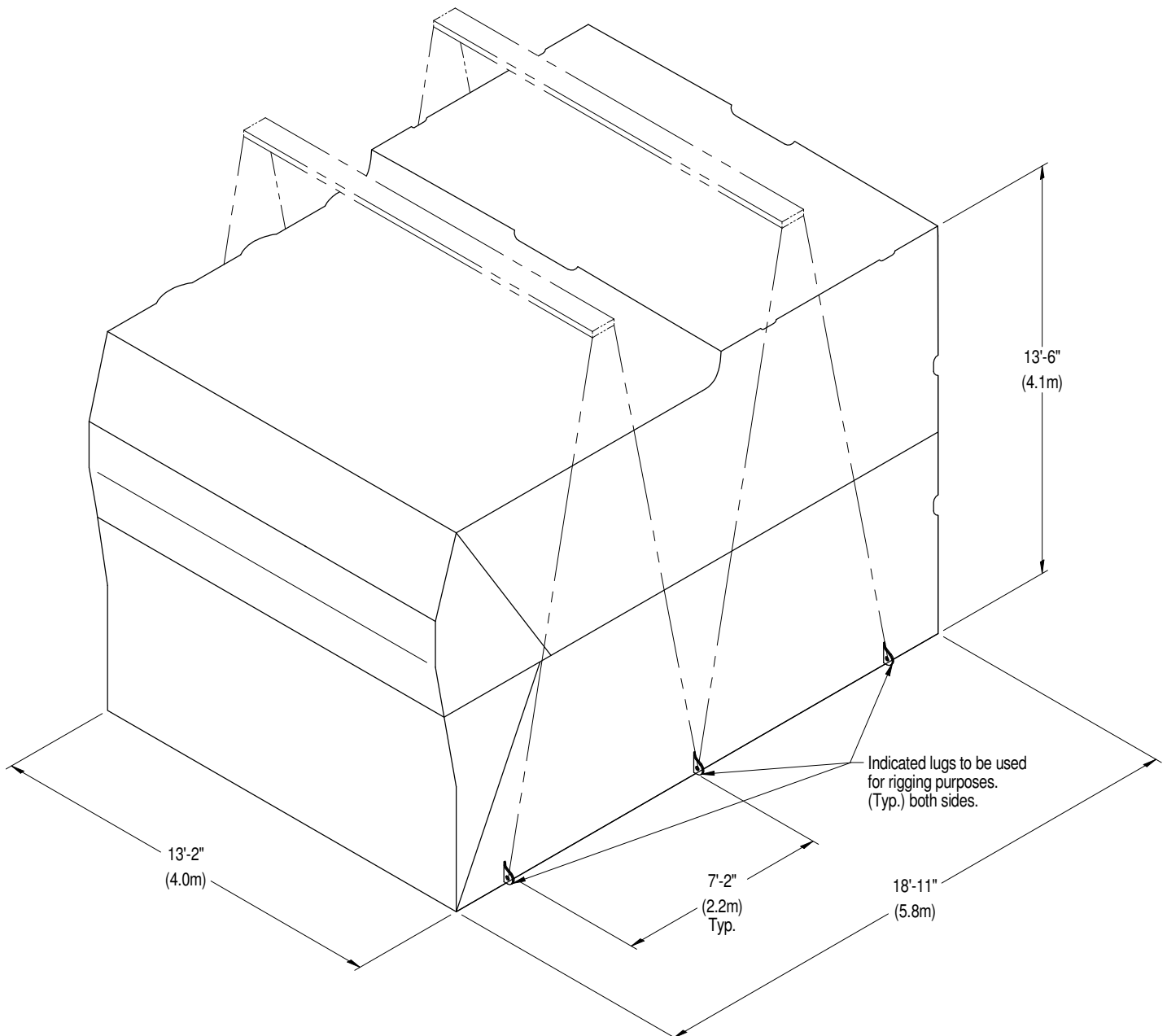
LIEBERT® DSE PACKAGED SOLUTION

RIGGING INSTRUCTIONS 400/500kW PERIMETER UNIT

Note:

1. Inspect unit for damages.
2. Clear area of all unnecessary personnel.
3. Clear area of any debris, unrelated tools, or foreign objects.
4. Use indicated lifting lugs to lift the unit. Use spreader bars (provided by others) and/or shimmed blocks to prevent external damage.
5. Unit must be lifted level. Tilting can cause damage to the equipment inside. Use shims or blocks for leveling when placing the unit on the ground before lifting.
6. Approximate Shipping Weight:

Model	Capacity	Shipping Wt.
DP400F	400kW	23,500 lbs. (10,659 kg)
DP500F	500kW	24,000 lbs. (10,886 kg)

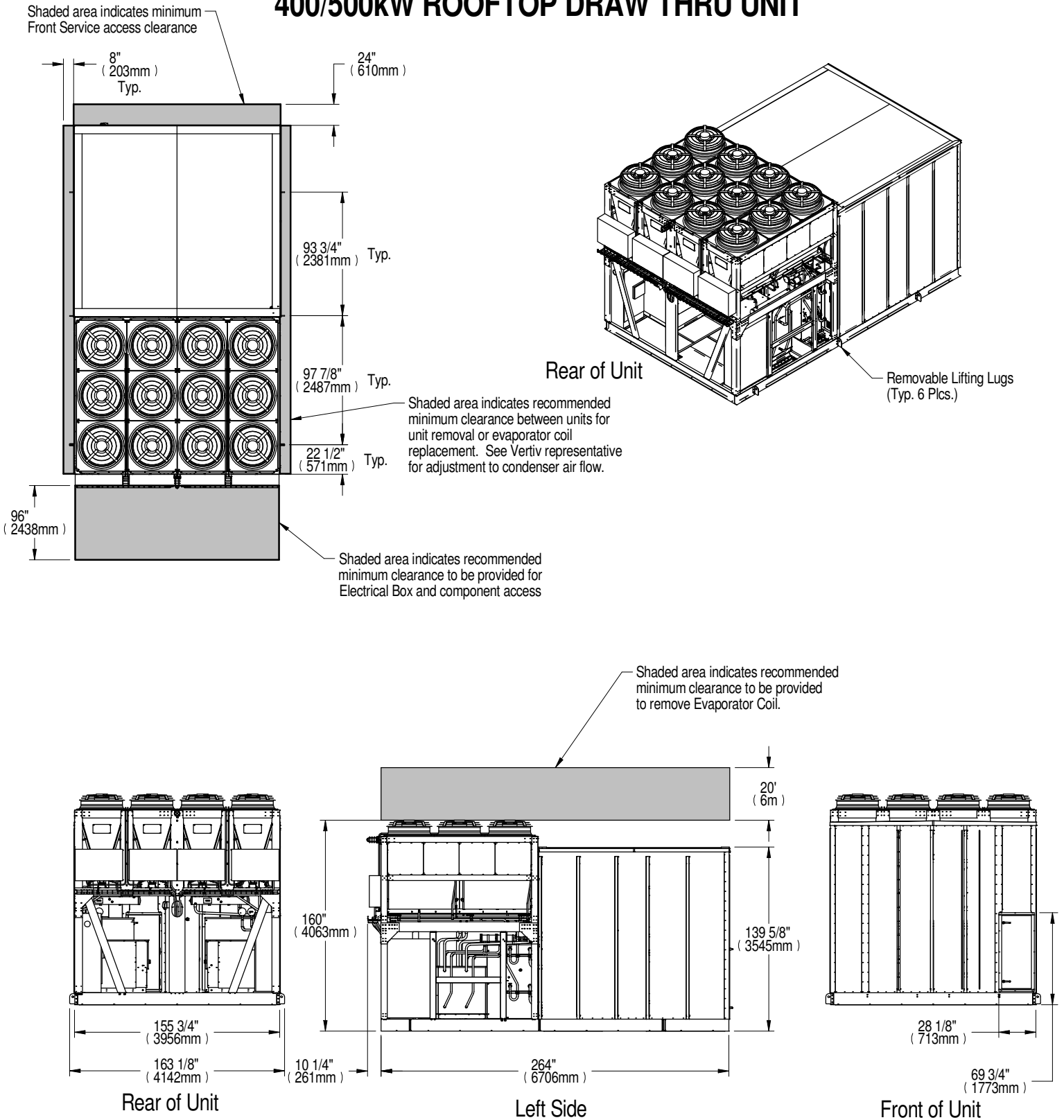




LIEBERT DSE PACKAGED SOLUTION

CABINET DIMENSIONAL DATA

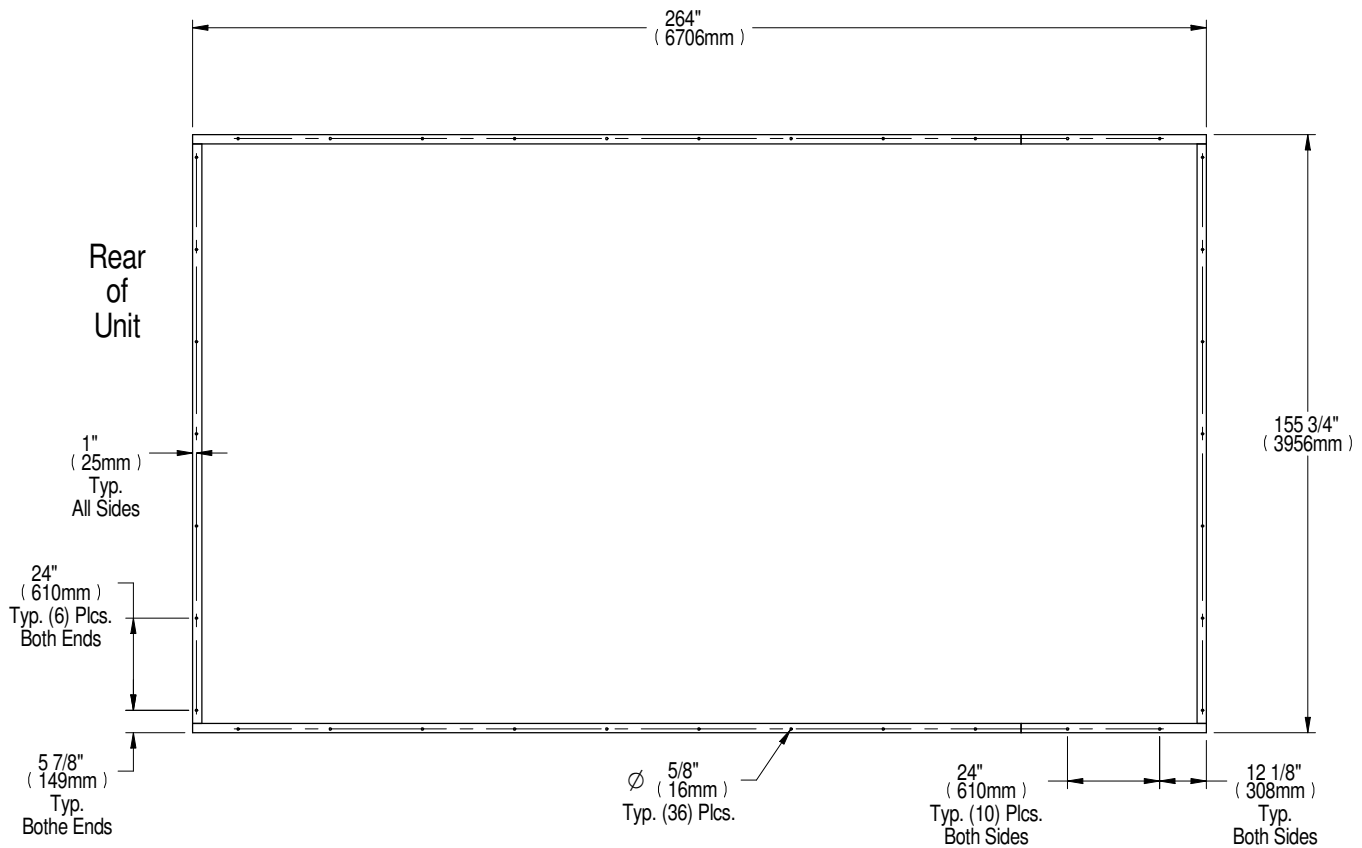
400/500kW ROOFTOP DRAW THRU UNIT





LIEBERT DSE PACKAGED SOLUTION

CABINET DIMENSIONAL DATA 400/500kW ROOFTOP DRAW THRU UNIT



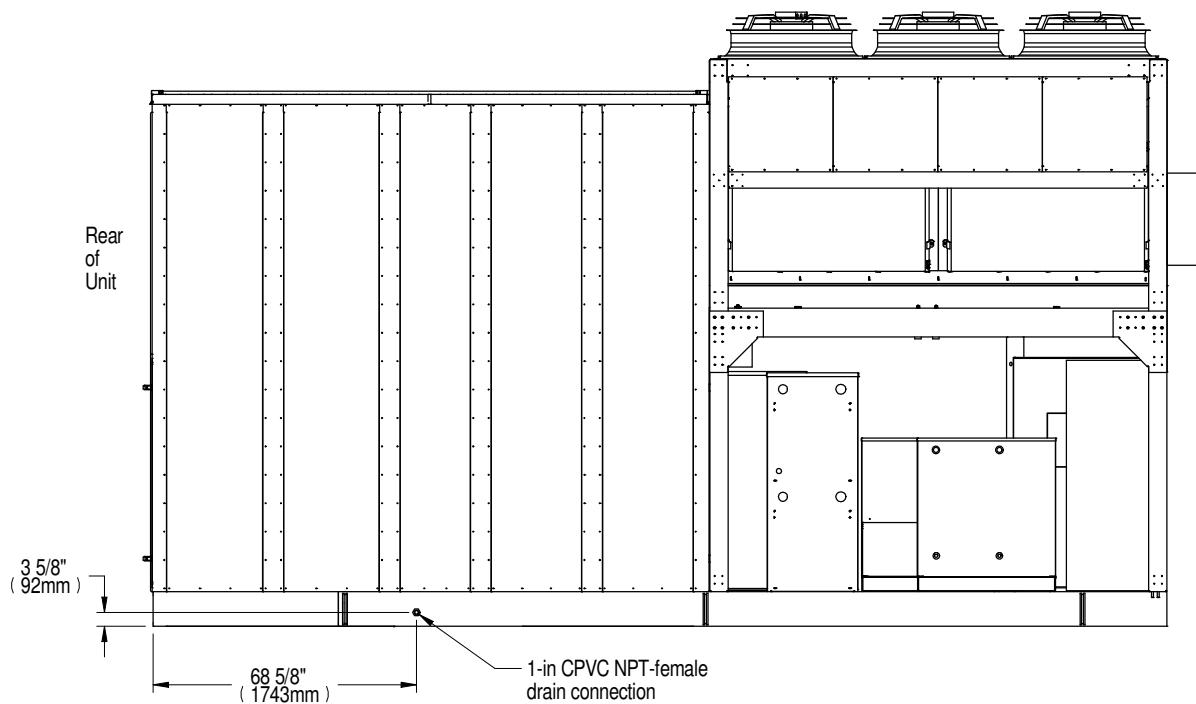
Notes:

1. Underside of unit. Coil and fan removed for clarity.
2. Quantity of 36 mounting holes of 5/8" diameter provided for anchorage. Mounting requirement details such as brand, type, embedment depth, concrete strength, wall bracing, and special inspection must be outlined and approved by the project Structural Engineer of Record.
3. Structural floors and housekeeping pads must be designed and approved by the project Structural Engineer of Record to withstand the seismic and wind anchor loads as defined on the installation drawings. The installing contractor is responsible for the proper installation of all anchors and mounting hardware, observing the mounting requirement details outlined by the Engineer of Record.



LIEBERT® DSE PACKAGED SOLUTION

DRAIN CONNECTION 400/500kW ROOFTOP DRAW THRU UNIT



Left Side View

Notes:

1. The drain should be trapped to prevent outdoor air from being pulled in to the unit and constructed per local code.
2. Vertiv recommends the installation of threaded plugs at several locations to permit periodic cleaning and filling of the trap.
3. Where freezing temperatures are anticipated, the drain line and trap should be heat-traced to prevent freezing.



LIEBERT® DSE PACKAGED SOLUTION

ELECTRICAL FIELD CONNECTIONS DP400/500 DEFINITIONS AND LOCATIONS SINGLE POWER INPUT

STANDARD ELECTRICAL CONNECTIONS

- 1) **HIGH VOLTAGE ENTRANCE** – This area will be used for the high voltage entrance (120V or more). Enclosure is provided with provisions for field installed power entry kit to be completed by installer in the field. Power entry kits are not provided with holes or knockouts, which must be done by the installer in the field. The fittings used must have the proper environmental rating per code. The location to be used will be determined by which power entry kit is ordered. Refer to the installation instructions of the power entry kit ordered for more information on installation.

ACCEPTABLE POWER SUPPLIES FOR 480V NOMINAL UNITS:

- i. 480V wye with solidly grounded neutral and 277V line to ground;
- ii. Wye with high resistance (or impedance) ground;
- iii. Delta with corner ground (EMC Filter of VFD's must be removed; see DPN001946).

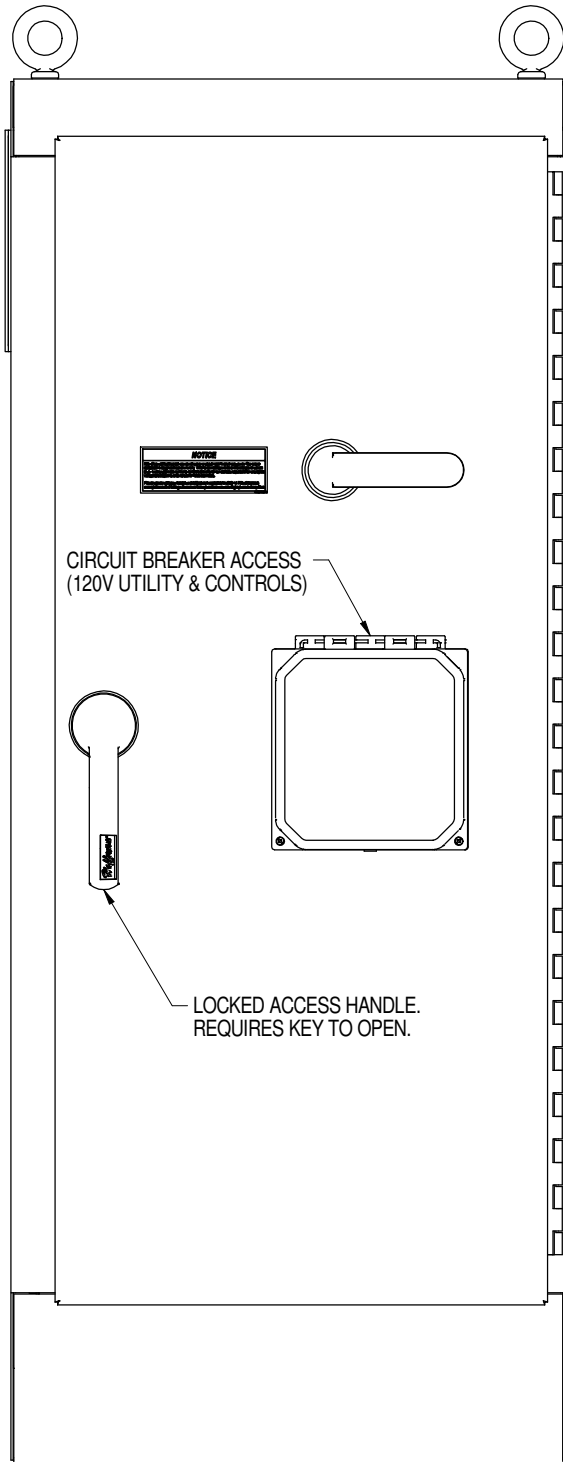
UNACCEPTABLE POWER SUPPLIES FOR UNITS:

- iv. Delta without ground or with floating ground;
 - v. Delta with grounded center tap.
- 2) **LOW VOLTAGE ENTRANCE** – This area will be used for the low voltage and communication fittings. Enclosure is not provided with holes or knockouts, which must be done by the installer in the field. The fittings used must have the proper environmental rating per code.
 - 3) **MAIN UNIT POWER CONNECTION** – Terminals are located on top of the locking disconnect switch. Three phase service not provided by Vertiv.
 - a. Terminal lugs that accept a single conductor with a wire range of 2AWG-600KCMIL and wire tightening torque of 375 in-lb are factory installed.
 - b. Terminal lugs that accept two conductors with a wire range of 4AWG-300KCMIL and a wire tightening torque of 200 in-lb are provided and shipped as a kit loose with the equipment. If these are required, they shall be site installed by installer in the field following the mounting torque specification found in the terminal kit.
 - 4) **EARTH GROUND CONNECTION FOR MAIN UNIT POWER** – Terminal for field supplied source earth grounding wire. Earth grounding required for Liebert units. 6AWG-350KCMIL wire range, 375 in-lb wire tightening torque.
 - 5) **FIELD SUPPLIED 120V UTILITY POWER** – Terminals for the connection of a field supplied 120V 20A utility power to feed the light and service electrical outlet. 22-8AWG wire range, 14.2lb-in tightening torque.
 - 6) **EARTH GROUNDING CONNECTION FOR FIELD SUPPLIED 120V UTILITY POWER** - Terminal for field supplied 120V earth grounding wire. Earth grounding required for Liebert units. 14-4AWG wire range, 14-10AWG – 20 in-lb, 8AWG – 25 in-lb, 6-4AWG – 35 in-lb.
 - 7) **FIELD SUPPLIED 120V CONTROL POWER** – Terminals for the connection of a field supplied 120V 10A control power to feed the equipment controls. 22-8AWG wire range, 14.2lb-in tightening torque.
 - 8) **EARTH GROUNDING CONNECTION FOR FIELD SUPPLIED 120V CONTROL POWER** – Terminal for field supplied 120V earth grounding wire. Earth grounding required for Liebert units. 14-4AWG wire range, 14-10AWG – 20 in-lb, 8AWG – 25 in-lb, 6-4AWG – 35 in-lb.

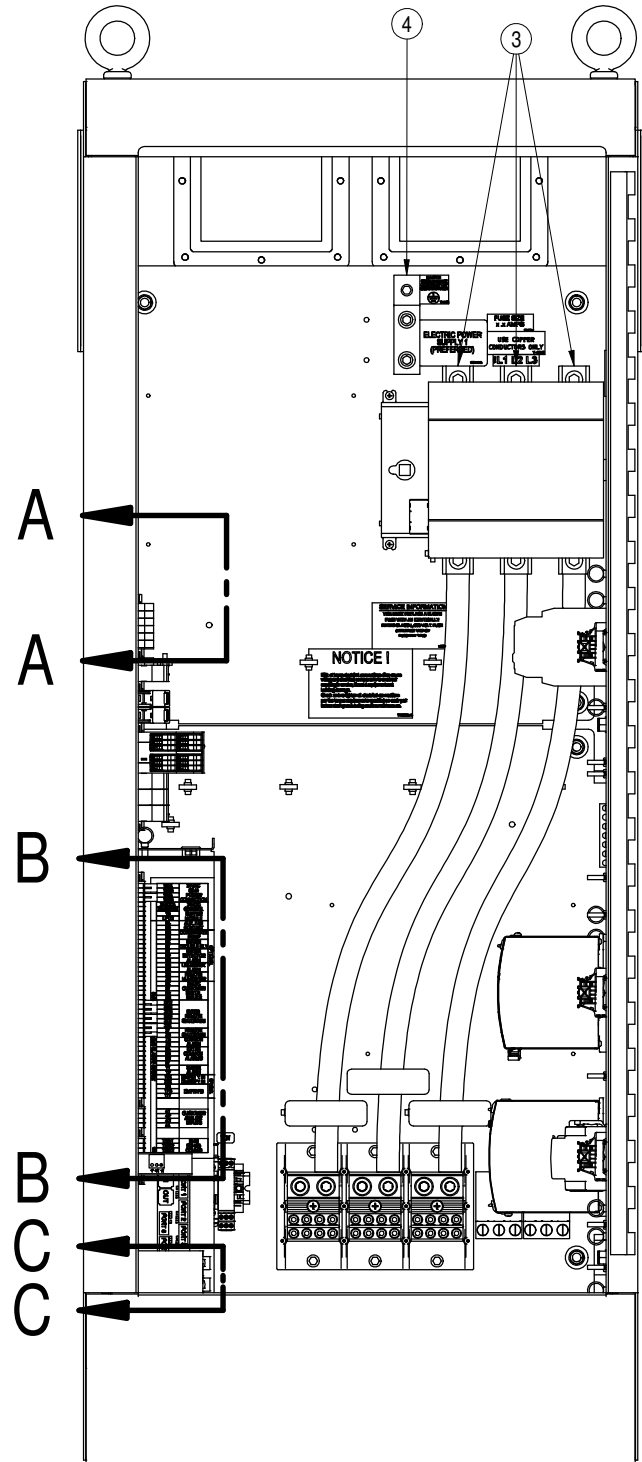
NOTE: Items 5 and 6 may not be present if Unit supplied 120V utility option is selected.

NOTE: Items 7 and 8 may not be present if Unit supplied 120V control option is selected.

ELECTRICAL FIELD CONNECTIONS DP400/500 DEFINITIONS AND LOCATIONS SINGLE POWER INPUT



DOOR CLOSED



DOOR REMOVED
FOR CLARITY



LIEBERT® DSE PACKAGED SOLUTION

ELECTRICAL FIELD CONNECTIONS DP400/500 DEFINITIONS AND LOCATIONS DUAL POWER INPUT

STANDARD ELECTRICAL CONNECTIONS

- 1) **HIGH VOLTAGE ENTRANCE** – This area will be used for the high voltage entrance (120V or more). Enclosure is provided with provisions for field installed power entry kit to be completed by installer in the field. Power entry kits are not provided with holes or knockouts, which must be done by the installer in the field. The fittings used must have the proper environmental rating per code. The location to be used will be determined by which power entry kit is ordered. Refer to the installation instructions of the power entry kit ordered for more information on installation.

ACCEPTABLE POWER SUPPLIES FOR 480V NOMINAL UNITS:

- i. 480V wye with solidly grounded neutral and 277V line to ground;
- ii. Wye with high resistance (or impedance) ground;
- iii. Delta with corner ground (EMC Filter of VFD's must be removed; see DPN001946).

UNACCEPTABLE POWER SUPPLIES FOR UNITS:

- iv. Delta without ground or with floating ground;
- v. Delta with grounded center tap.

- 2) **LOW VOLTAGE ENTRANCE** – This area will be used for the low voltage and communication fittings. Enclosure is not provided with holes or knockouts, which must be done by the installer in the field. The fittings used must have the proper environmental rating per code.
- 3a) **SOURCE 1 MAIN UNIT POWER CONNECTIONS** – Terminals are located on top of the locking disconnect switch. Three phase service not provided by Liebert.
 - a. Terminal lugs that accept a single conductor with a wire range of 2AWG-600KCMIL and wire tightening torque of 375 in-lb are factory installed.
 - b. Terminal lugs that accept two conductors with a wire range of 4AWG-300KCMIL and a wire tightening torque of 200 in-lb are provided and shipped as a kit loose with the equipment. If these are required, they shall be site installed by installer in the field following the mounting torque specification found in the terminal kit.
- 4a) **EARTH GROUND CONNECTION FOR SOURCE 1 MAIN UNIT POWER** – Terminal for field supplied Source 1 earth grounding wire. Earth grounding required for Liebert units. 6AWG-350KCMIL wire range, 375 in-lb wire tightening torque.
- 3b) **SOURCE 2 MAIN UNIT POWER CONNECTIONS** – Terminals are located on top of the locking disconnect switch. Three phase service not provided by Liebert.
 - a. Terminal lugs that accept a single conductor with a wire range of 2AWG-600KCMIL and wire tightening torque of 375 in-lb are factory installed.
 - b. Terminal lugs that accept two conductors with a wire range of 4AWG-300KCMIL and a wire tightening torque of 200 in-lb are provided and shipped as a kit loose with the equipment. If these are required, they shall be site installed by installer in the field following the mounting torque specification found in the terminal kit.
- 4b) **EARTH GROUND CONNECTION FOR SOURCE 2 MAIN UNIT POWER** – Terminal for field supplied Source 2 earth grounding wire. Earth grounding required for Liebert units. 6AWG-350KCMIL wire range, 375 in-lb wire tightening torque.
- 5) **FIELD SUPPLIED 120V UTILITY POWER** – Terminals for the connection of a field supplied 120V 20A utility power to feed the light and service electrical outlet. 22-8AWG wire range, 14.2lb-in tightening torque.
- 6) **EARTH GROUNDING CONNECTION FOR FIELD SUPPLIED 120V UTILITY POWER** - Terminal for field supplied 120V earth grounding wire. Earth grounding required for Liebert units. 14-4AWG wire range, 14-10AWG – 20 in-lb, 8AWG – 25 in-lb, 6-4AWG – 35 in-lb.
- 7) **FIELD SUPPLIED 120V CONTROL POWER** – Terminals for the connection of a field supplied 120V 10A control power to feed the equipment controls. 22-8AWG wire range, 14.2lb-in tightening torque.
- 8) **EARTH GROUNDING CONNECTION FOR FIELD SUPPLIED 120V CONTROL POWER** – Terminal for field supplied 120V earth grounding wire. Earth grounding required for Liebert units. 14-4AWG wire range, 14-10AWG – 20 in-lb, 8AWG – 25 in-lb, 6-4AWG – 35 in-lb.

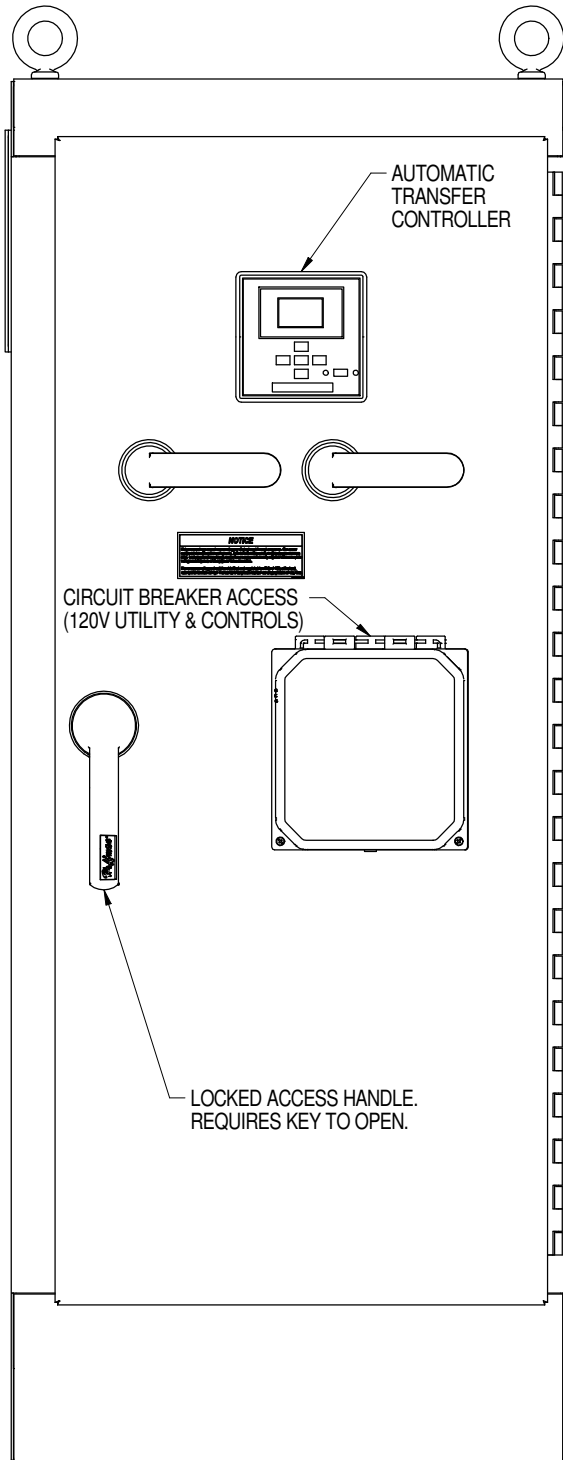
NOTE: Items 5 and 6 may not be present if Unit supplied 120V utility option is selected.

NOTE: Items 7 and 8 may not be present if Unit supplied 120V control option is selected.

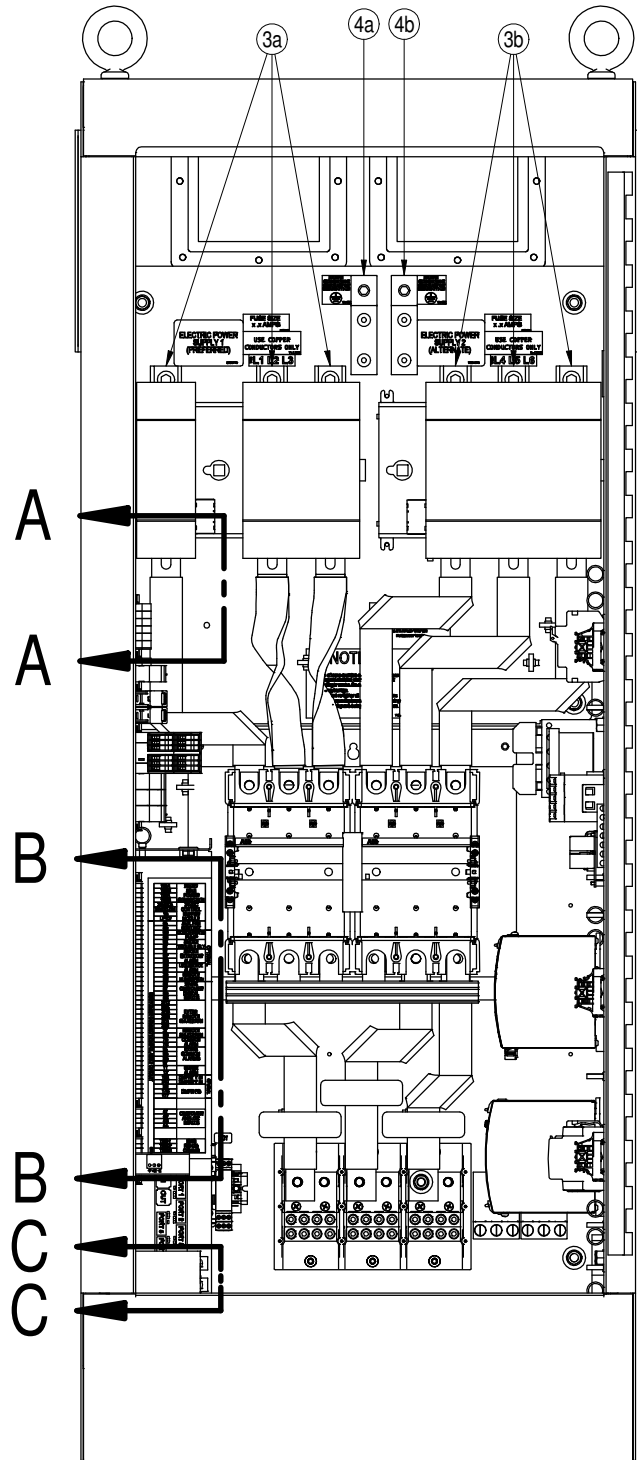


LIEBERT® DSE PACKAGED SOLUTION

ELECTRICAL FIELD CONNECTIONS DP400/500 DEFINITIONS AND LOCATIONS DUAL POWER INPUT



DOOR CLOSED



DOOR REMOVED
FOR CLARITY



LIEBERT® DSE PACKAGED SOLUTION

ELECTRICAL FIELD CONNECTIONS DP400/500 DEFINITIONS AND LOCATIONS

LOW VOLTAGE TERMINAL CONNECTIONS

- 9) **REMOTE SHUTDOWN** - Replace existing jumper between terminals 37 & 38 with field supplied normally closed switch having a minimum 1 AMP, 24VAC rating. Use field supplied Class 1 wiring.
- 10) **CUSTOMER ALARM INPUTS** – Terminals for field supplied, normally open contacts, having a minimum 1 AMP, 24VAC rating, between terminals 50, 51, 55, & 56. Use field supplied Class 1 wiring.
- 11) **COMMON ALARM** – On any alarm, normally open dry contact is closed across terminals 75 & 76 for remote indication. 1 AMP, 24VAC max load. Use field supplied Class 1 wiring.
- 12) **EXTRA REMOTE UNIT SHUTDOWN** – Three additional contact pairs available for unit shutdown (labeled as 37A & 38A, 37B & 38B, 37C & 38C). Replace jumpers with field supplied normally closed switch having a minimum 1 AMP, 24VAC rating. Use field supplied Class 1 wiring.
- 13) **EXTRA COMMON ALARM** – On any alarm, two additional normally open contacts are closed across terminals 94 & 95 and 96 & 97 for remote indication. 1 AMP, 24VAC max load. Use field supplied Class 1 wiring.
- 14) **MAIN FAN AUXILIARY SWITCH** – On closure of the main fan contactor, normally open dry contact is closed across terminals 84 & 85 for remote indication. 1 AMP, 24VAC max load. Use field supplied Class 1 wiring.
- 15) **REMOTE ANALOG INPUTS** – Terminals for field supplied normally open contacts, having a minimum of 1 AMP, 24VAC rating, between terminals 41, 42, 43, & 44. Use field supplied Class 1 wiring.
 - a) **REMOTE SENSOR FAN CONTROL** – Allows fan speed control to be driven by a remote sensor capable of transmitting a 4-20Ma, 0-5V, or 0-10V signal. Applications for this control method include, but are not limited to, underfloor static pressure.
- 16) **SURGE PROTECTION ALARM** – When surge protection device needs replacement, normally open dry contact is closed across terminals 11 & 12 for remote indication. 1 AMP, 24VAC max load. Use field supplied Class 1 wiring.

ADDITIONAL INFORMATION

SUPPLY AIR SENSOR (SAS) – A factory-provided, installed and commissioned supply air sensor ships with the unit for sensor location in the field by others. The sensor is terminated on the Liebert® iCOM™ unit controller terminal strip and the associated cable wiring is coiled within the unit for shipment. It is the responsibility of others to uncoil and locate the sensor in accordance with acceptable best practices and any local codes (50ft provided).

VFD REMOTE KEYPAD – Allows remote control of VFD's (one keypad for each VFD, located in Main Controls EP).

NOTE: All low voltage terminal connections are spring-cage with a wire range of 28-12AWG.



LIEBERT® DSE PACKAGED SOLUTION

ELECTRICAL FIELD CONNECTIONS DP400/500 DEFINITIONS AND LOCATIONS

STANDARD COMMUNICATION CONNECTIONS

- 17) **RS485 BMS CONNECTION** – Terminal TB3-1 is TX/RX+. Terminal TB3-2 is TX/RX-. Terminal TB3-3 is earth ground. Use shielded cable with 120ohm characteristic impedance. (Supplied by other).
- 18) **CANBUS REMOTE SENSOR CONNECTION(P67)** – Remove the inserted plug from this connector and attach the remote sensor cable to power and communicate with Liebert® remote Temperature/humidity sensors. Use shielded cable with 120ohm characteristic impedance. (Supplied by other)
 - a) **SUPPLY AIR AGGREGATOR SENSOR** – Is a control option that allows the use of the 1 NTC sensor that is already provided as a standard with the unit and the ability to ADD up to an additional 5 - 2T sensors to be used together to measure the supply temperature for a total of up to 6 supply sensors. The ability to use multiple sensors to measure the supply temperature provides Liebert® iCOM™ the ability to control using the Maximum or Average of all the supply sensors. This is especially useful in application of ducted systems and non-raised floor application because of the ability to have additional sensors strategically placed to measure supply temperature and they provide benefits in raised floor applications.
 - b) **2T SENSOR** – Is a control option that allows temperature data from multiple sensors to be averaged together when used in Team Work 1 Mode. In this mode, one unit is selected as the “master”. When cascade control is enabled, selected unit or units will operate continuously, standby unit will cycle on when additional cooling is required. If Lead/Lag control is enabled, Standby unit will automatically start upon detection of a Lead unit. The Lead unit will automatically rotate every 24 hours (Adj) to ensure equal run time between all units if auto rotate is enabled.
- 19) **ETHERNET BMS CONNECTION(P74)** – RJ-45 connection for connecting to BMS Ethernet network. Use Class 5 shielded cable (Supplied by other).
- 20) **ETHERNET UNIT TO UNIT CONNECTION(P64)** – RJ-45 connection for connecting to other units. Use Class 5 shielded cable (Supplied by other).

NOTE: All low voltage terminal connections are spring-cage with a wire range of 28-12AWG.

NOTE: All communication cables should be kept separate from high-voltage wiring.

OPTIONAL ELECTRICAL CONNECTIONS

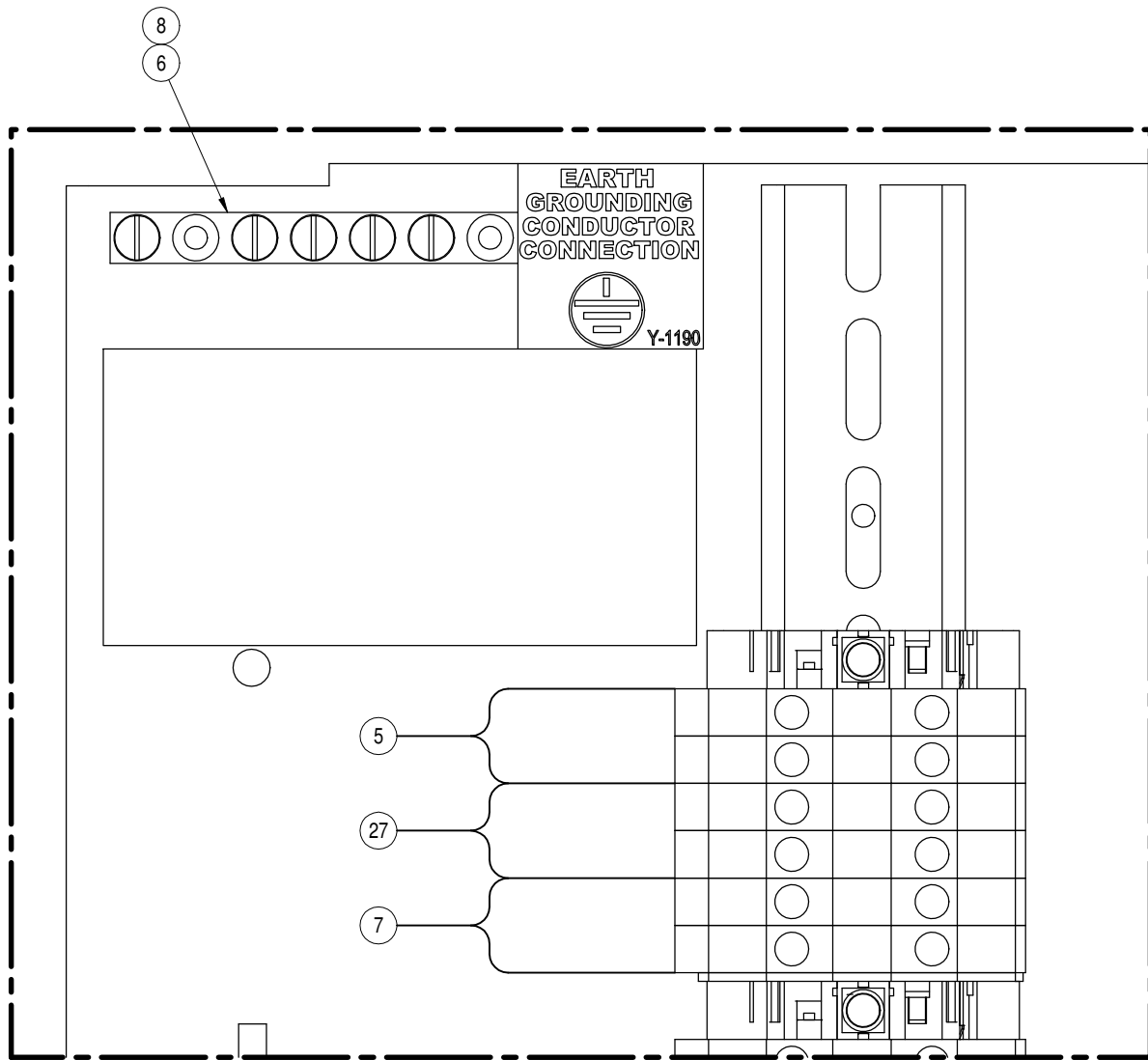
(Contact factory for availability)

- 21) **SMOKE SENSOR ALARM** – Factory wired dry contacts from smoke sensor are 91-common, 92-Normally Open, and 93-Normally Closed. Supervised contacts, 80 & 81, open on sensor trouble indication. This smoke sensor is not intended to function as, or replace, any room smoke detection system that may be required by local or national codes. 1 AMP, 24VAC max load. Use field supplied Class 1 wiring.
- 22) **SPARE TERMINALS**– Spare terminals for Class 1 wiring.
- 23) **LIEBERT® LIQUI-TECT™ SHUTDOWN AND DRY CONTACT** – On Liebert® Liqui-Tect™ activation, normally open dry contact is closed across terminals 58 & 59 for remote indication (Liebert® Liqui-Tect™ sensor ordered separately). 1 AMP, 24VAC max load. Use field supplied Class 1 wiring.
- 24) **REMOTE HUMIDIFIER** – On any call for humidification, normally open dry contact is closed across terminals 35 & 36 to signal field supplied remote humidifier. 1 AMP, 24VAC max load. Use field supplied Class 1 wiring.
- 25) **DAMPER MOTOR CONTROL INPUT** – Terminals for field supplied connection for damper motor off relay (factory set to 100 SEC), having minimum of 1 AMP, 24VAC max load. Use field supplied Class 1 wiring. Damper input will use one of the customer alarm inputs of item 12.
- 26) **DAMPER MOTOR FEEDBACK** – On damper motor end switch activation, normally open dry contacts are closed across terminals 176 & 99, 177. 1 AMP, 24VAC max load. Use field supplied Class 1 wiring. Damper input will use one of the customer alarm inputs of item 10.
- 27) **HEAT TRACE** – Terminals for field supplied connection of heat trace used to heat the condensate water line. Power is supplied from the 120V Utility Power (item 5). 22-8AWG wire range, 14.2lb-in tightening torque.

NOTE: Terminals for items 21 through 27 are always present. Refer to the order to verify if the options are installed on the unit.

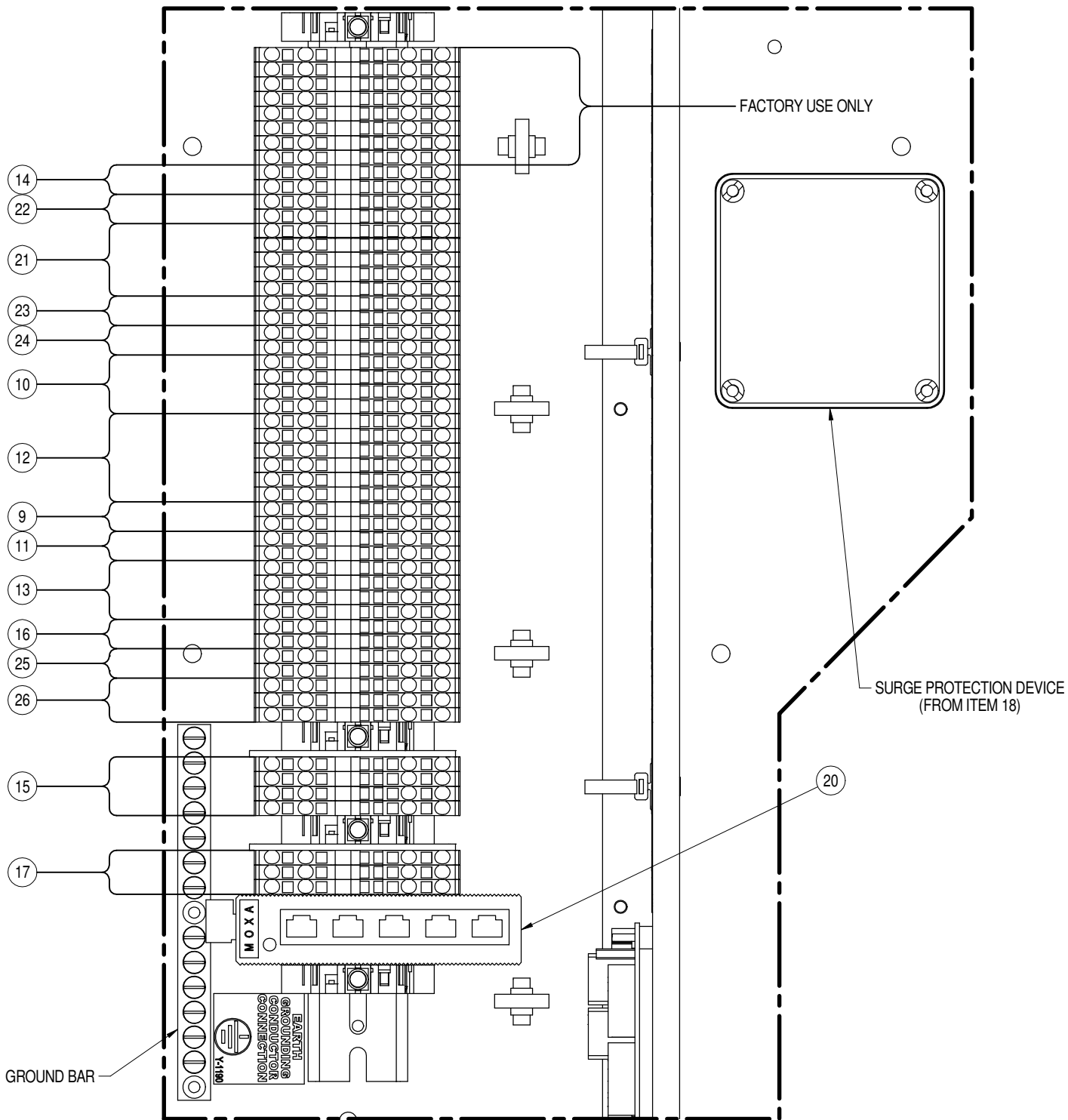
NOTE: All low voltage terminal connections (items 21 through 26) are spring-cage with a wire range of 28-12AWG.

ELECTRICAL FIELD CONNECTIONS DP400/500 DEFINITIONS AND LOCATIONS



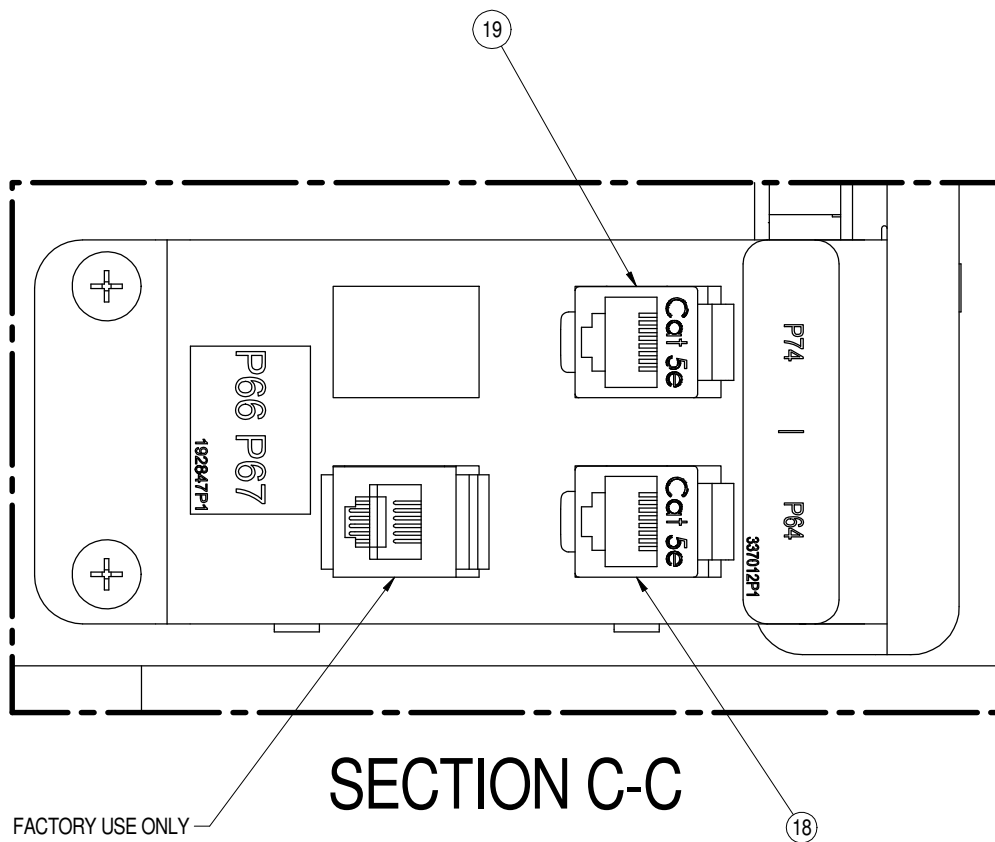
SECTION A-A

ELECTRICAL FIELD CONNECTIONS DP400/500 DEFINITIONS AND LOCATIONS

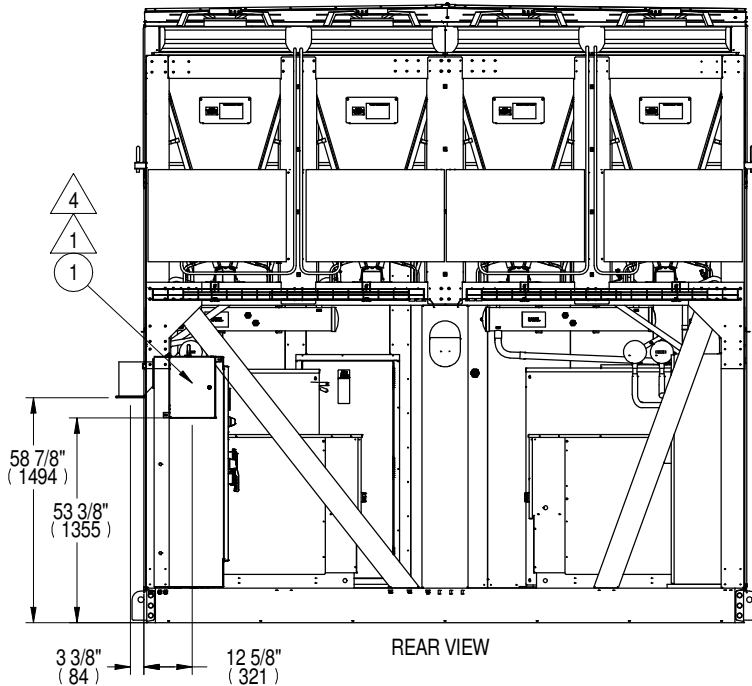
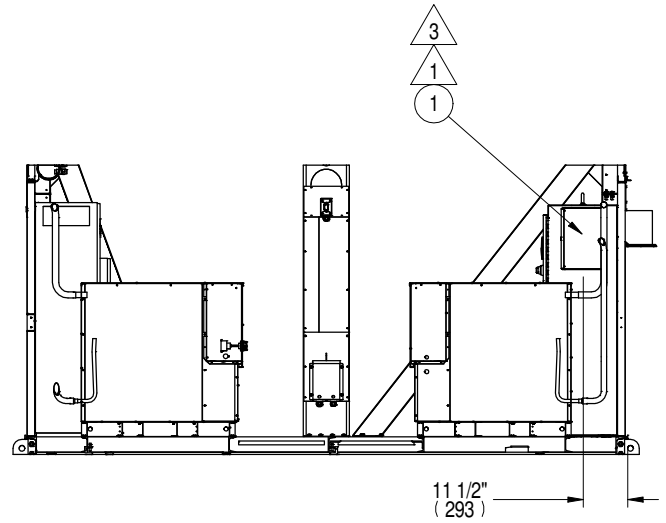
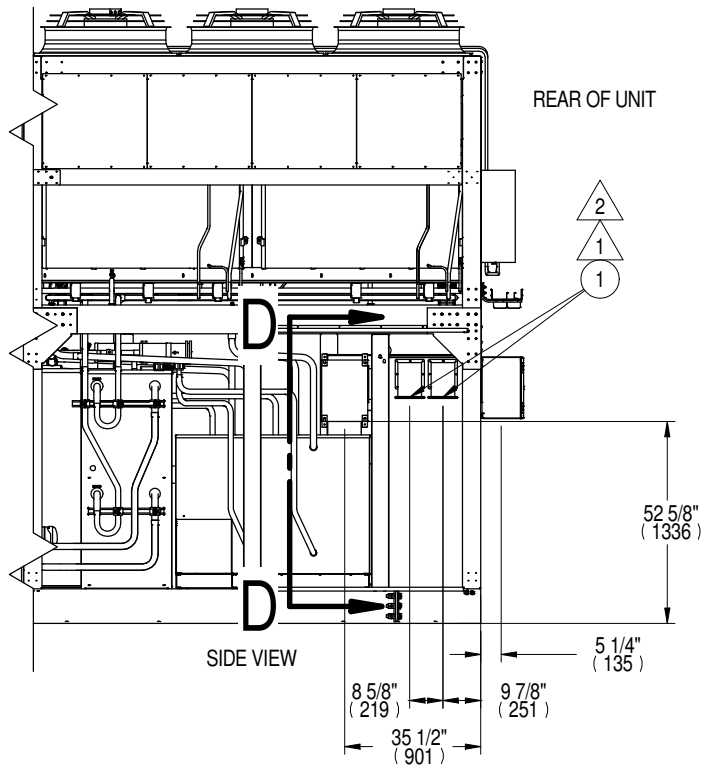


SECTION B-B

ELECTRICAL FIELD CONNECTIONS DP400/500 DEFINITIONS AND LOCATIONS



ELECTRICAL FIELD CONNECTIONS DP400/500 DEFINITIONS AND LOCATIONS HIGH VOLTAGE ENTRANCES



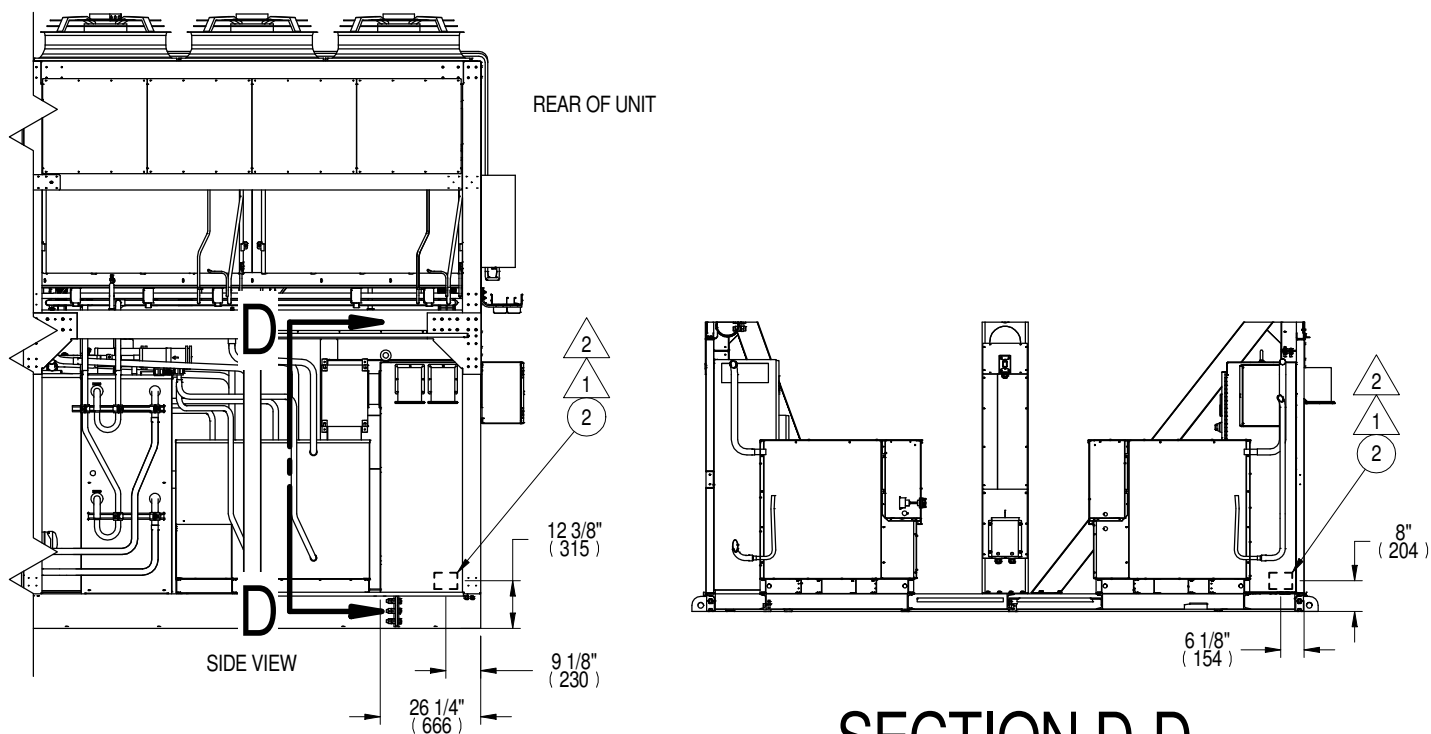
NOTES:

1. LOCATION DEPENDS ON ENTRY KIT CHOSEN AT TIME OF ORDER.
2. 5 1/4" (133) x 5 1/4" (133) AREA FOR KNOCKOUTS PROVIDED. KNOCKOUTS TO BE DONE ON SITE BY INSTALLER.
3. 8" (203) x 9" (229) AREA FOR KNOCKOUTS PROVIDED. KNOCKOUTS TO BE DONE ON SITE BY INSTALLER.
4. 9" (229) x 8" (203) AREA FOR KNOCKOUTS PROVIDED. KNOCKOUTS TO BE DONE ON SITE BY INSTALLER.
5. NOT ALL COMPONENTS SHOWN WILL BE INCLUDED, REFER TO SPECIFIC ORDER DETAILS.

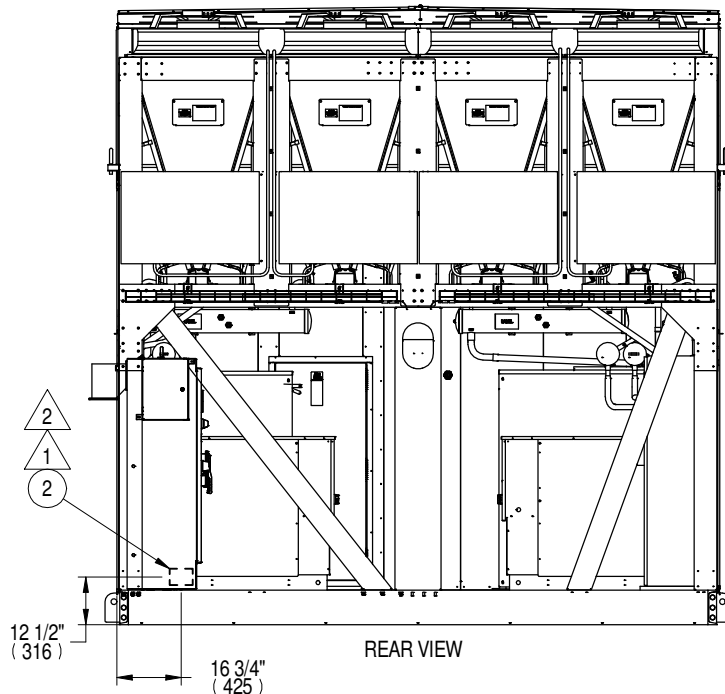


LIEBERT® DSE PACKAGED SOLUTION

ELECTRICAL FIELD CONNECTIONS DP400/500 DEFINITIONS AND LOCATIONS LOW VOLTAGE & COMMUNICATION ENTRANCES



SECTION D-D



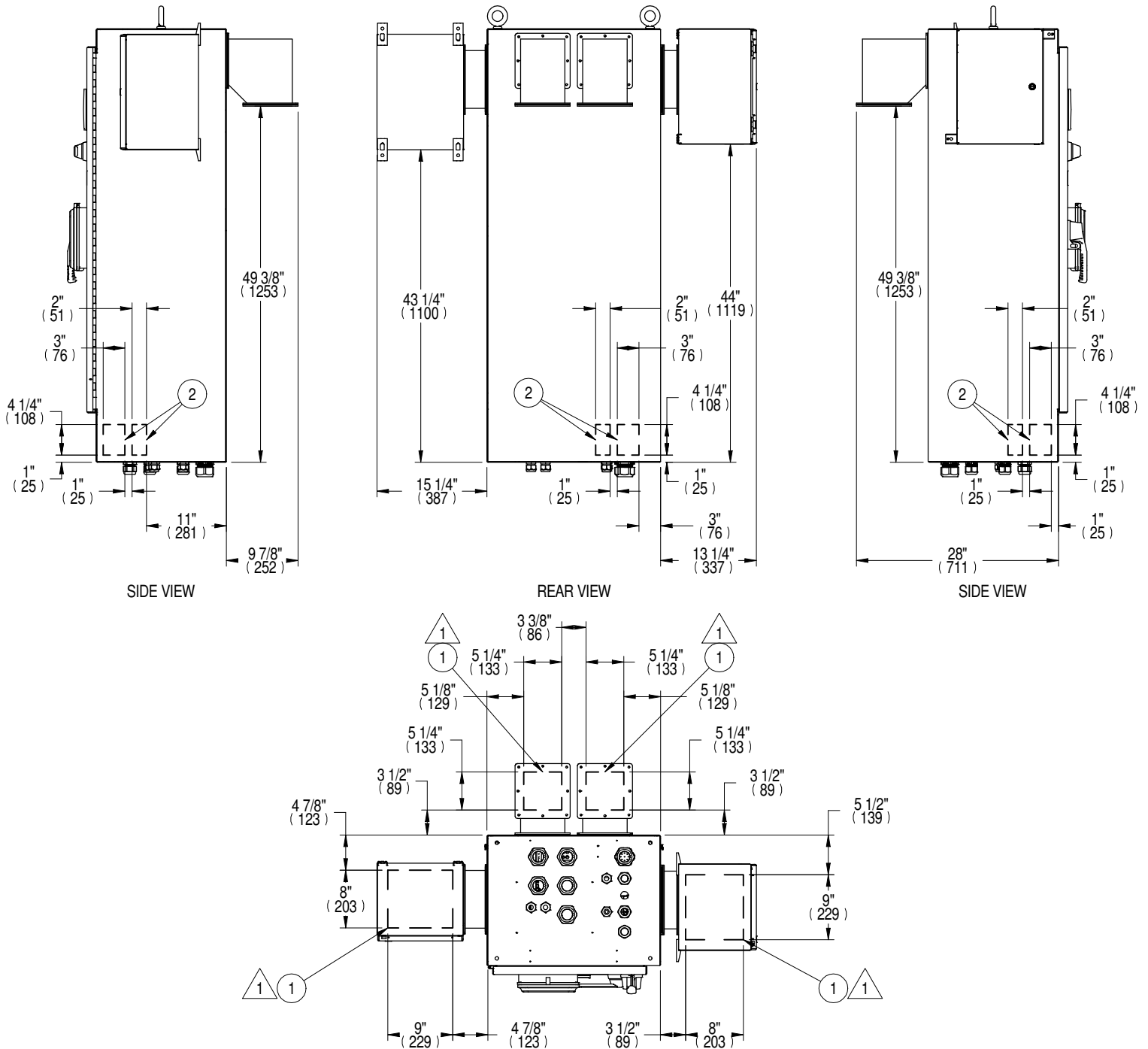
NOTES:

1. LOCATION DEPENDS ON ENTRY KIT CHOSEN AT TIME OF ORDER. ONLY ONE LOCATION IS REQUIRED.
2. 4 1/4" (108) x 6" (152) AREA FOR KNOCKOUTS PROVIDED. KNOCKOUTS TO BE DONE ON SITE BY INSTALLER.
3. NOT ALL COMPONENTS SHOWN WILL BE INCLUDED, REFER TO SPECIFIC ORDER DETAILS.



LIEBERT® DSE PACKAGED SOLUTION

ELECTRICAL FIELD CONNECTIONS WIRE ENTRY DIMENSIONS



NOTES:

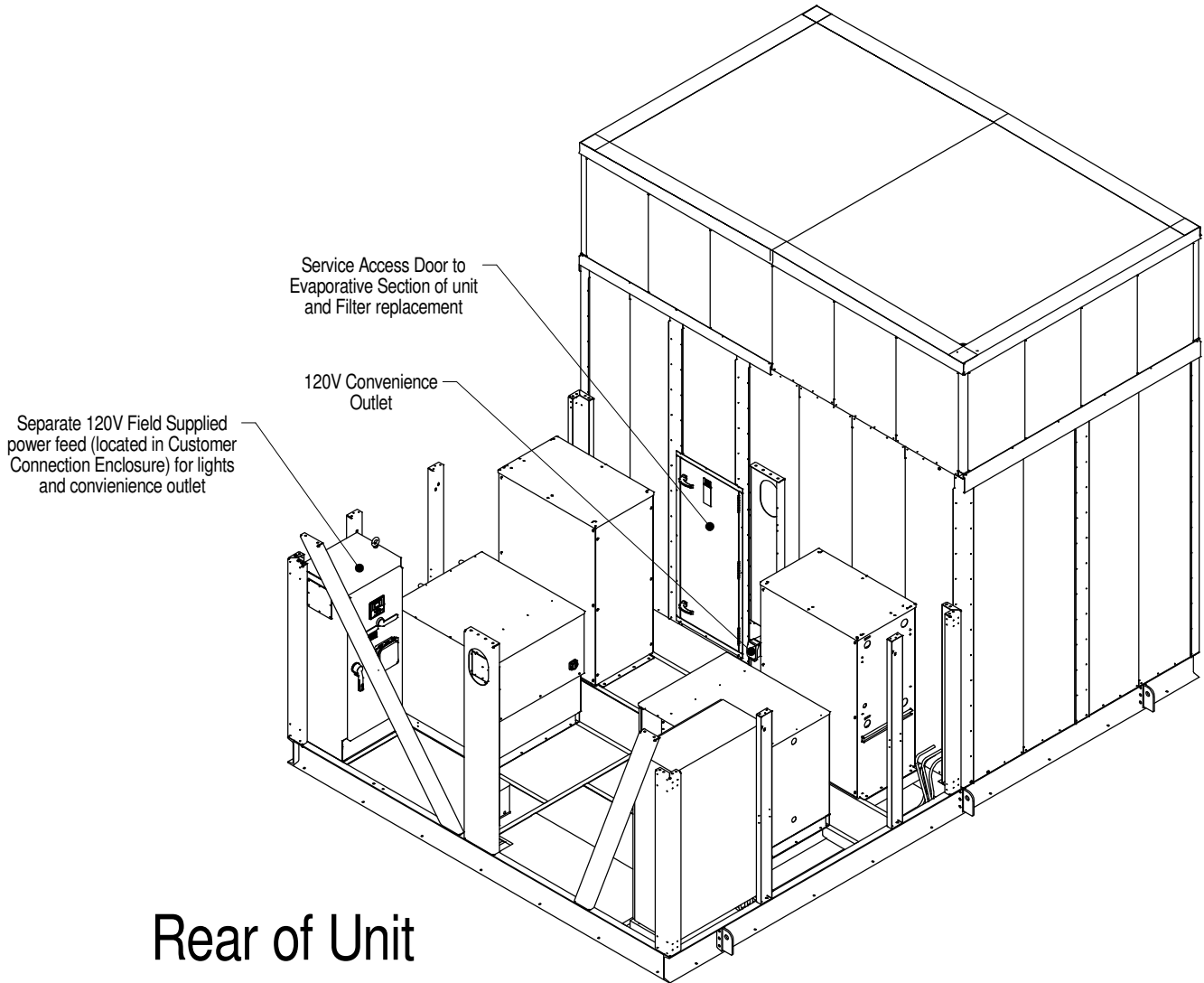
1. LOCATION DEPENDS ON ENTRY KIT CHOSEN AT TIME OF ORDER.

2. NOT ALL COMPONENTS SHOWN WILL BE INCLUDED, REFER TO SPECIFIC ORDER DETAILS.



LIEBERT® DSE PACKAGED SOLUTION

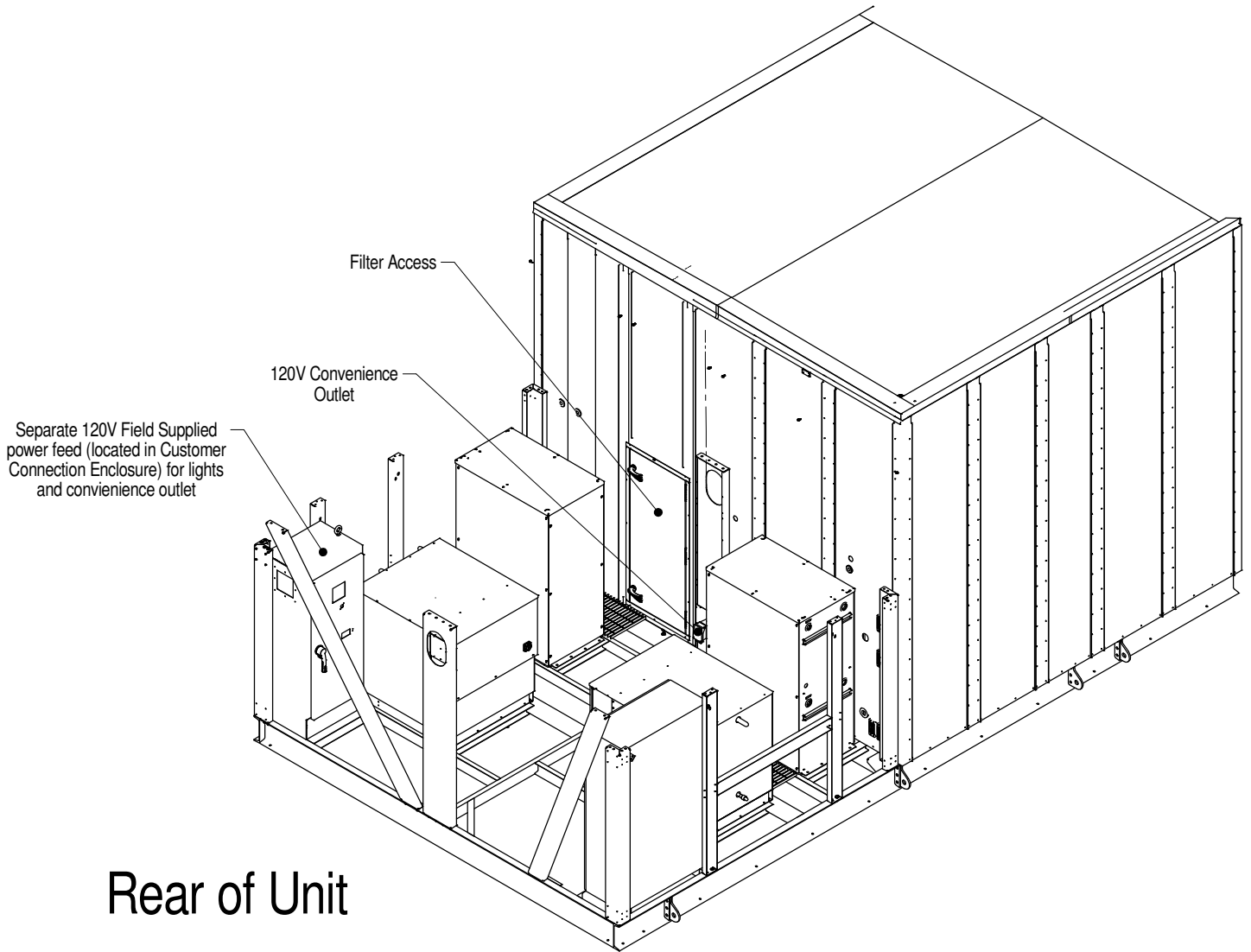
SERVICE DOOR ACCESS 400/500kW PERIMETER UNIT





LIEBERT® DSE PACKAGED SOLUTION

SERVICE DOOR ACCESS 400/500kW DRAW THRU ROOFTOP UNIT

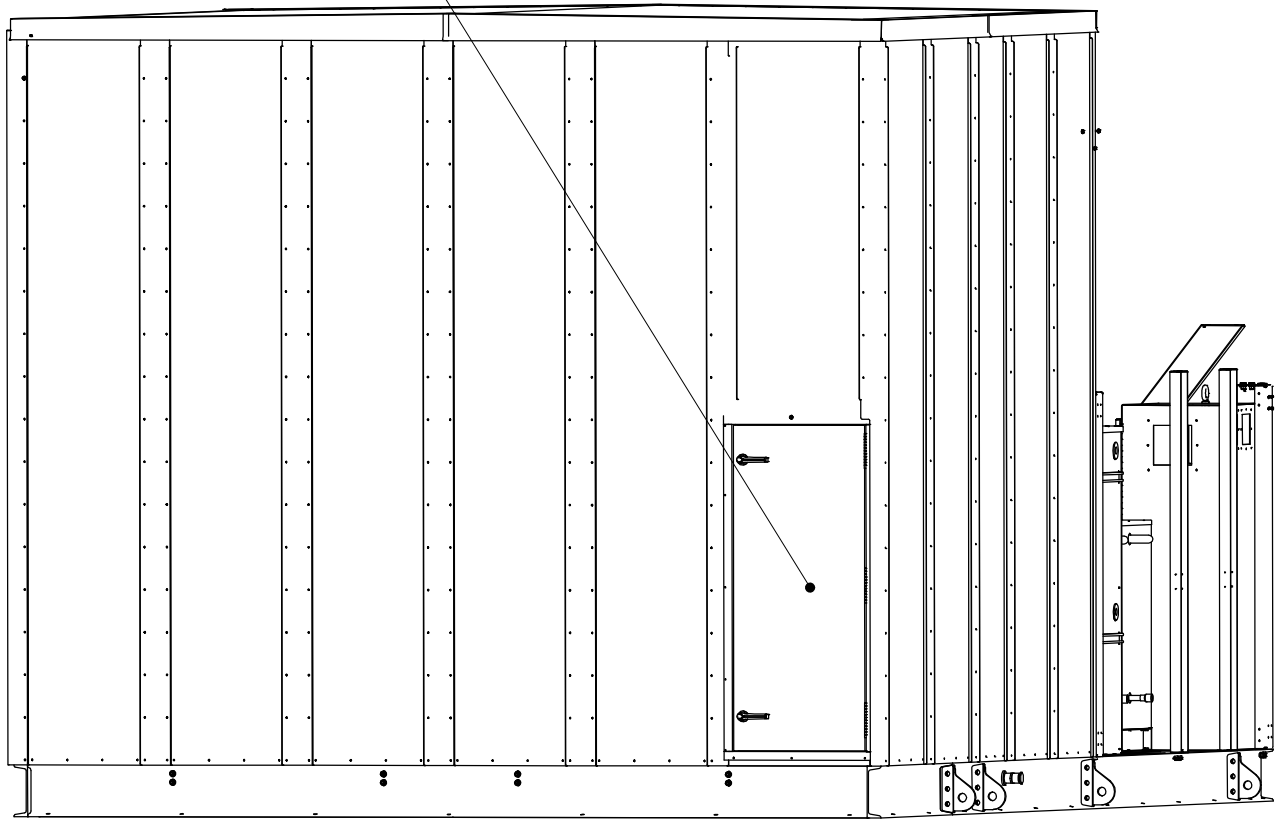




LIEBERT® DSE PACKAGED SOLUTION

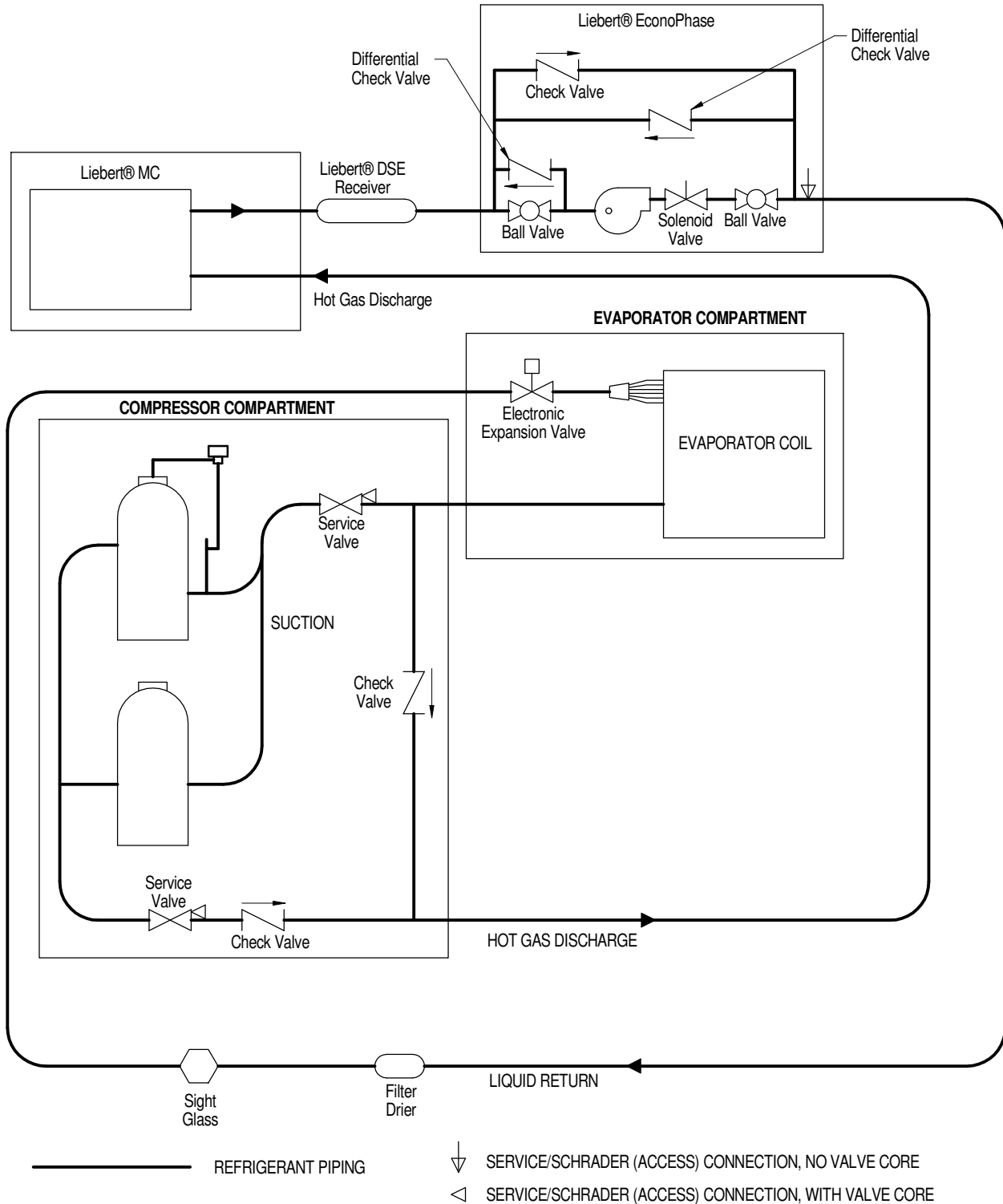
SERVICE DOOR ACCESS 400/500kW DRAW THRU ROOFTOP UNIT

Access to VFDs,
Supply Fans/Motors



Front of Unit

PIPING SCHEMATIC 400/500kW PERIMETER & ROOFTOP UNIT

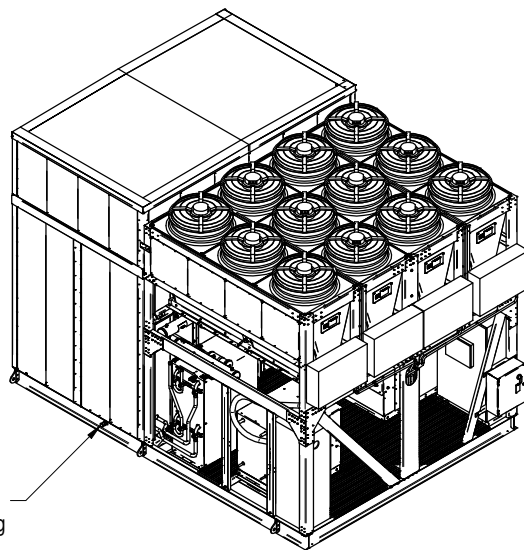


Notes:
1. Four (4) Refrigeration Circuits provided. Single Refrigeration Circuit shown for clarity.

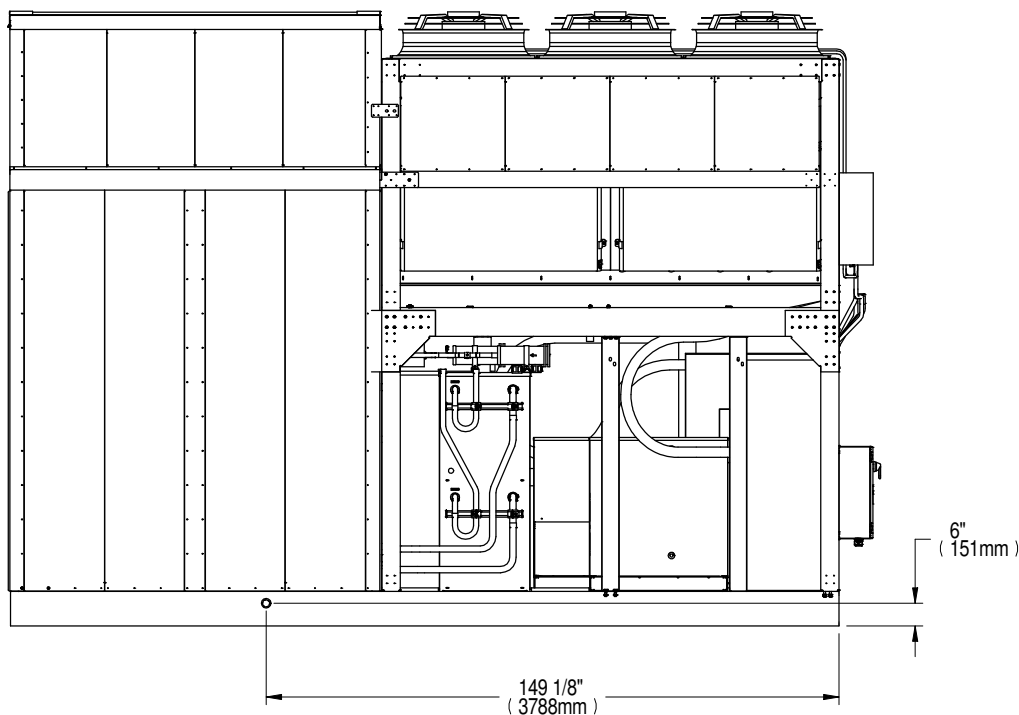


LIEBERT® DSE PACKAGED SOLUTION

DRIP PAN CLEANOUT ACCESS & LOCATION 400/500kW PERIMETER UNIT



Ø1" pipe with
CPVC 1" FPT fitting
Clean Out Port
for Service Pan

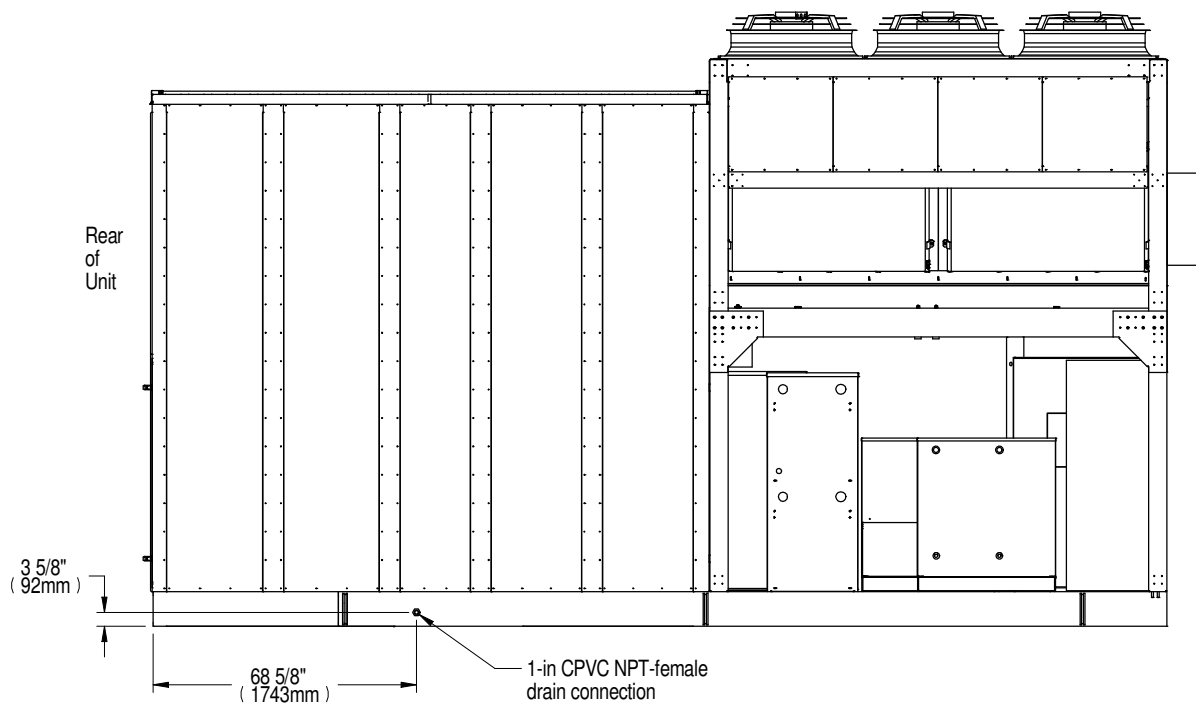


Side View showing
clean-out location



LIEBERT® DSE PACKAGED SOLUTION

DRAIN CONNECTION 400/500kW ROOFTOP DRAW THRU UNIT



Left Side View

Notes:

1. The drain should be trapped to prevent outdoor air from being pulled in to the unit and constructed per local code.
2. Vertiv recommends the installation of threaded plugs at several locations to permit periodic cleaning and filling of the trap.
3. Where freezing temperatures are anticipated, the drain line and trap should be heat-traced to prevent freezing.

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SL-70401_REV2_08-22