Liebert® PPC-ISO

User Manual

Second - Generation Power Conditioning and Distribution Cabinet - 300 to 500 kVA, 3-phase, 50 and 60-Hz

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Technical Support Site

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

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

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1 Important Safety Instructions

Read this entire manual before installing or operating the system.

WARNING! Risk of cutting bands under tension. Can cause injury or death.
The shipping bands may be under tension. Use appropriate eye, face and hand protection to safeguard against injury from band backlash.

WARNING! Risk of electric shock and arc flash. Can cause equipment damage, injury and death. Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making connections, whether in the junction box or in the unit.
Equipment inspection and startup should be performed only by trained personnel. Lethal voltages are present during startup procedures. Electrical safety precautions must be followed throughout inspection and startup.
Only properly trained and qualified service personnel should perform maintenance on the Vertiv™ Liebert® PPC-ISO. All voltage sources to the unit must be disconnected before inspecting or cleaning within the cabinet.
Lethal voltages exist within the equipment during operation. Observe all warnings and cautions in this manual. Failure to comply may result in serious injury or death. Obtain qualified service for this equipment as instructed.
The monitoring system contains a lithium battery for memory backup. Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type. Dispose of used batteries according to manufacturer's instructions.

WARNING! Risk of electric shock. Can cause injury or death.
All power and control wiring should be installed by licensed electricians and must comply with the NEC and applicable codes.

WARNING! Risk of improper handling. Can cause equipment damage, injury or death. The Liebert® PPC-ISO is heavy: the unit's net weight is 3420 lb. (7540kg) and its shipping weight is 3600 lb. (7937kg) The unit should not be loosened from the shipping pallet until after all handling by forklift or pallet jack is completed.

ELECTROMAGNETIC COMPATIBILITY—The Liebert® PPC-ISO complies with the limits for a Class A digital device, pursuant to Part 15 of FCC rules.

Operation is subject to the following conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Operating this device in a residential area is likely to cause harmful interference that users must correct at their own expense.

The Liebert® PPC-ISO complies with the requirements of EMC Directive 2004/108/EC and the published technical standards. Continued compliance requires installation in accordance with these instructions and use of accessories approved by Vertiv.

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2 Introduction

The Vertiv™ Liebert® PPC-ISO is a unique configuration of the standard Liebert® PPC. The unit consists of two cabinets, a transformer cabinet and a distribution cabinet. The Liebert® PPC-ISO provides added flexibility for the end user through an isolated style distribution cabinet. The distribution cabinet allows up to eight 600AF or ten 250AF plug-in breakers to be installed and fed from the transformer.

Each breaker is isolated from the others and the transformer through the combination of metal and polycarbonate barriers. The plug-in breaker bases are factory-wired from the transformer. Installing a new breaker is as simple as plugging in the breaker from the front and connecting field wiring to the output of the plug-in base.

2.1 Unpacking and Installation

Read the entire manual before installing and operating the system. Upon receipt of a Liebert® PPC-ISO the installer should perform the following steps to ensure a top-quality installation.

2.1.1 Unpacking and Preliminary Inspection

NOTE: The units should not be loosened or removed from the shipping pallet until after all handling by forklift or pallet jack is completed. Complete internal inspection should be performed only after the equipment has been positioned for installation, but before electrical hookup.

A high-quality installation begins on the receiving dock.

1. Inspect the shipping crate(s) for damage or signs of mishandling before unpacking the unit(s). Check Shock-Watch indicator if applied.
2. Open the shipping crate(s) carefully. Use care to avoid puncturing the container with sharp objects that would damage the contents.
3. Remove the packing and vapor barriers. Inspect the equipment for any obvious shipping damage.

If any shipping damage is observed, immediately file a damage claim with the shipping agency and forward copy to:
Vertiv
1050 Dearborn Drive
P.O. Box 29186
Columbus, Ohio 43229 USA

2.1.2 Handling Considerations

The Liebert® PPC-ISO is bolted to a wooden pallet to allow handling by forklift equipment. When moving the Liebert® PPC-ISO, the following points should be considered.

- Casters: The Liebert® PPC-ISO is equipped with casters to allow the unit to be rolled into place after it has been unbolted from the shipping pallet.
- Check size and weight: The unit is heavy. Verify that any surfaces can support the full weight of the unit and the transport equipment. The 300kVA unit has a net weight of 3420 lb (7540 kg); the shipping weight is 3600 lb (7937 kg). The 500kVA unit has a net weight of 4070 lb (1823 kg); the shipping weight is 4250 lb (1928 kg).
- Plan the route: The route the unit will follow to its installation area should be planned to ensure that all passages are large enough to accommodate the unit and that the floors are strong enough to support the weight. Check all doorways, hallways, elevators, ramps and other portions of the route to determine whether there are any obstructions and to ensure that each is large enough and strong enough to allow easy passage.

- **Move with care:** The unit should be moved to the installation area on the wood pallet using a forklift or pallet jack. To prevent damage, Vertiv recommends removing the exterior panels before moving the unit. When replacing panels, confirm all ground wires are reconnected.

2.1.3 Unit Preparation

The Vertiv™ Liebert® PPC-ISO may be removed from the shipping pallet and installed by the user. A typical procedure is:

1. Set the palletized assembly in a level area.
2. Cut the shipping bands.

WARNING! Risk of cutting bands under tension. Can cause injury or death.
The shipping bands may be under tension. Use appropriate eye, face and hand protection to safeguard against injury from band backlash.

3. Remove the side and rear panels from the unit. An Allen wrench for the side panels is furnished in the installation package. Carefully disconnect panel ground wires by pulling the easy-disconnect terminals at the unit frame.
4. Remove the bolts holding the unit to the shipping pallet in each of the four bottom corners.
5. Remove the shipping blocks from under the unit.
6. Remove chocks from all casters.

NOTICE

Risk of shock damage. Can cause damage to the casters and internal components. Exercise care when moving the Liebert® PPC-ISO over uneven flooring. Rolling the unit across large cracks or ledges can cause shock-loading that may damage the casters or internal components.

7. Lift the unit off the pallet and set it on the floor, or use the provided ramp to roll the assembly to the floor.
8. Roll the unit to its installation location. For units to be installed on a raised floor, use care when positioning the unit over the floor cutout to prevent the casters from falling through the cutout.

2.1.4 Location Considerations

The Liebert® PPC-ISO should be installed close to the load(s) it is supplying. The unit should not be located over combustible surfaces.

Equipment Location - Should employ the shortest output distribution cable runs consistent with logical equipment arrangement and allowances for additions.

Operating Environment

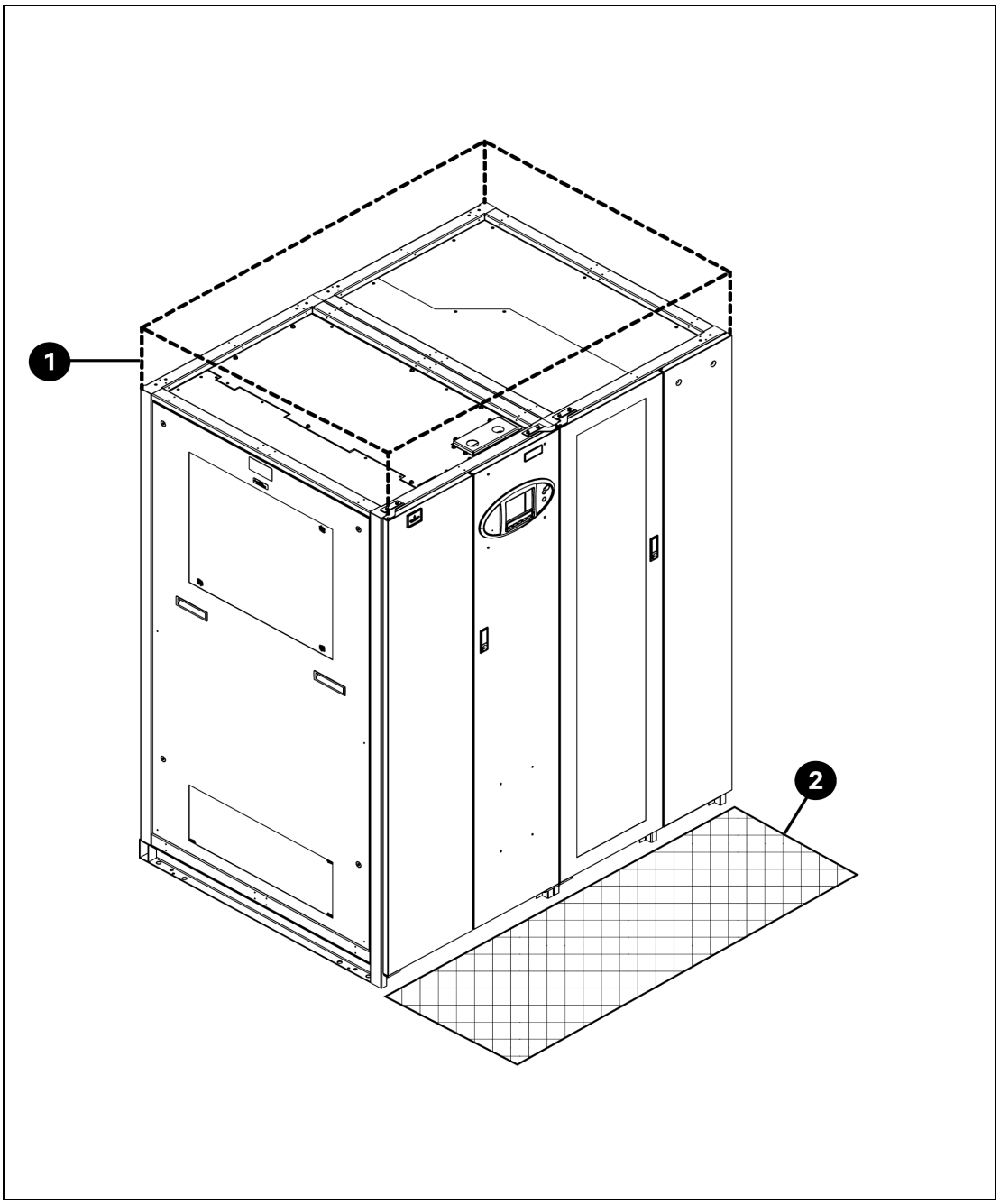
- Ambient Operating Temperatures
  - 80% rated breakers: 32°F to 104°F (0°C to 40°C)
  - 100% rated breakers: 32°F to 95°F (0°C to 35°C)
- Relative Humidity: 0% to 95% (non-condensing)

Top or Bottom Access is required for exit of cables and conduit.

- Bottom exit: This clearance is automatically provided by a raised floor-minimum height 12 in. (305mm).
- Top exit: The recommended clearance is 18 in. (460mm).

Recommended minimum service clearances are shown in Figure 2.1 below . The front clearance is required for service access by the National Electrical Code (NEC) Article 110-26. Clearance above the unit is required for cooling air flow (exhaust). A minimum of 6 inches from any wall or surface is required in the rear and on the left side of the unit for cooling air flow.

Figure 2.1 Recommended Clearances for Cooling and Service



Item	Description
1	At least 18" (457mm) clearance above the Liebert® PPC-ISO is
2	Clearance of 36" (914mm) in front of the Liebert® PPC-ISO is recommended for

Heat Output - Like any electrical device, the Vertiv™ Liebert® PPC-ISO produces heat under normal operation, see Table 2.1 below . Include this heat output when calculating the environmental conditions of the room.

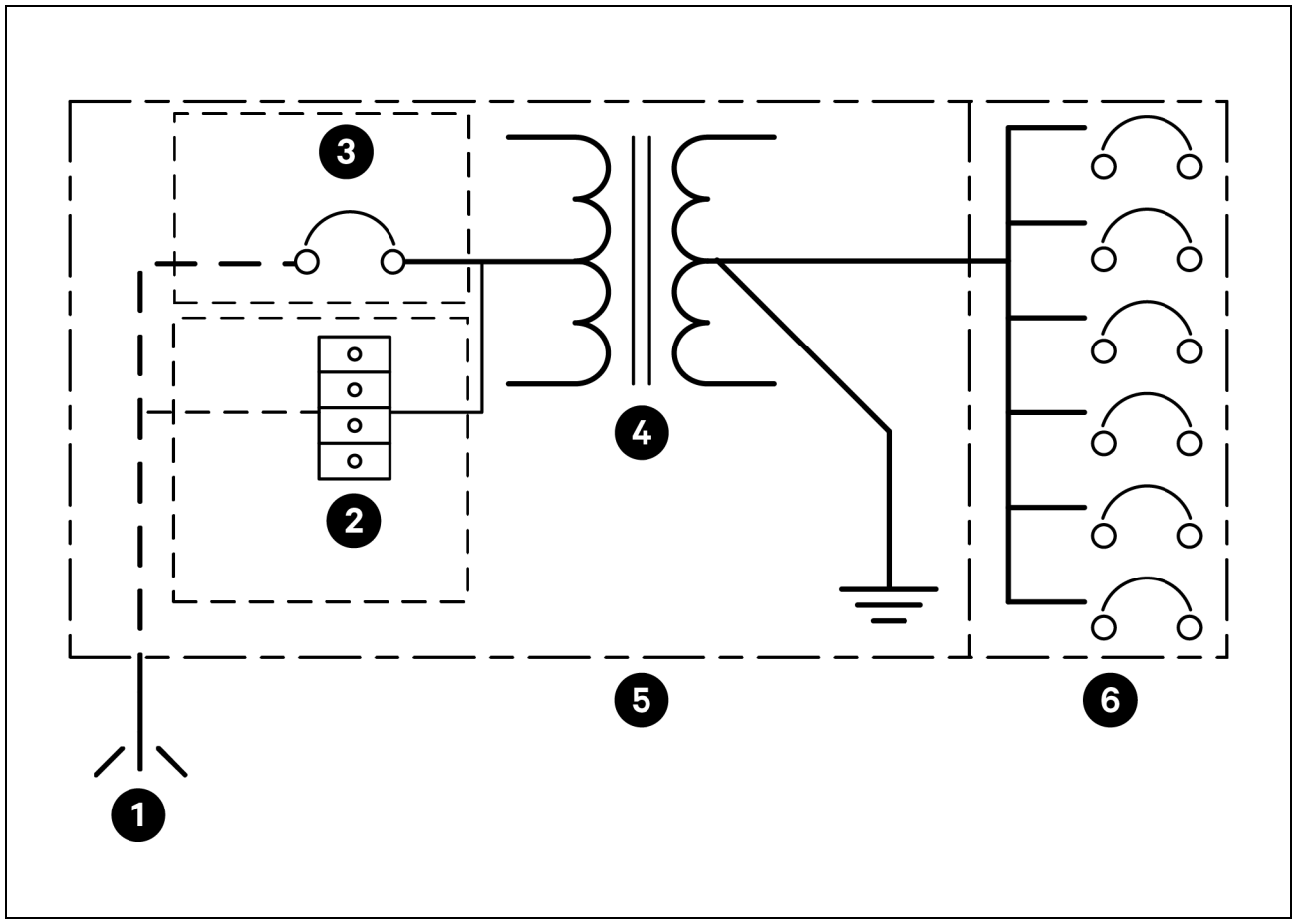
Table 2.1 Approximate Heat Output of PPC-ISO Units

Unit kVA	Heat Output, BTU/hr (kW)
300	23,860 (7)
450	35,486 (10.4)
500	32,415 (9.5)

2.2 Power and Control Wiring

Power and control wiring should be installed by licensed electricians. All power and control wiring must comply with the NEC and applicable local codes. See Figure 2.2 below for the one-line diagram.

Figure 2.2 One-line Diagram



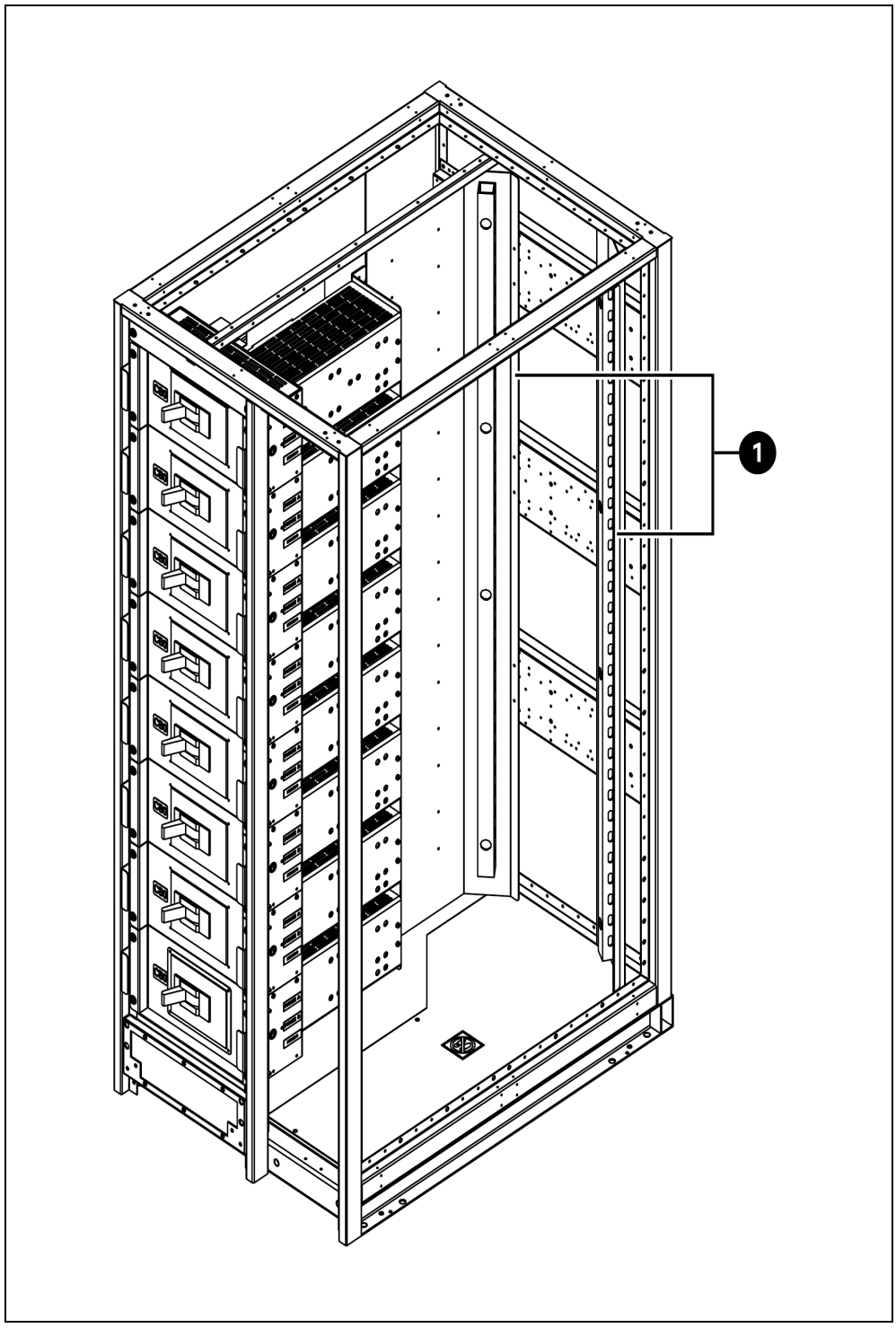
Item	Description	Item	Description
1	Input 3-Phase 3-Wire + G	4	Isolation Transformer
2	Terminal Block (Opt.)	5	Transformer Section
3	MICB (Opt.)	6	Distribution Section

2.2.1 Distribution Section Mounting and Wiring

The Vertiv™ Liebert® PPC-ISO has a distribution section for routing output cables and provide output distribution. The distribution section ships attached to the transformer section and includes factory-installed wiring between the transformer side and plug-in bases.

The distribution section is top or bottom entry. Remove the appropriate conduit plate and punch to match the number and size of input conduits. Replace the conduit plate and run the output wires to the correct breakers. Two pieces of non-conductive strut are provided to assist in routing and securing cables in the distribution cabinet. See Figure 2.3 on the next page for the location of the routing struts.

Figure 2.3 Cable Routing Struts



Item	Description
1	Cable

2.2.2 Input Power Connections

WARNING! Risk of electric shock and arc flash. Can cause equipment damage, injury and death. Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making connections in the unit.

To minimize disturbances caused by other loads in the building, the three-phase power input to the unit should be supplied directly from the service entrance or other power source (a dedicated power feeder).

The input feeder circuit should be sized in accordance with the NEC and any local building codes to ensure the feeder's ability to safely carry the system's full load current, including losses.

Input feeder conductors should be sized for no more than 2% voltage drop. If operation at undervoltage conditions for extended periods of time is desired, the input feeders must be oversized.

The main input feeder should consist of three-phase conductors and one (safety) ground conductor (3W + G).

WARNING! Risk of electric shock and arc flash. Can cause equipment damage, injury and death. Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making connections in the unit.

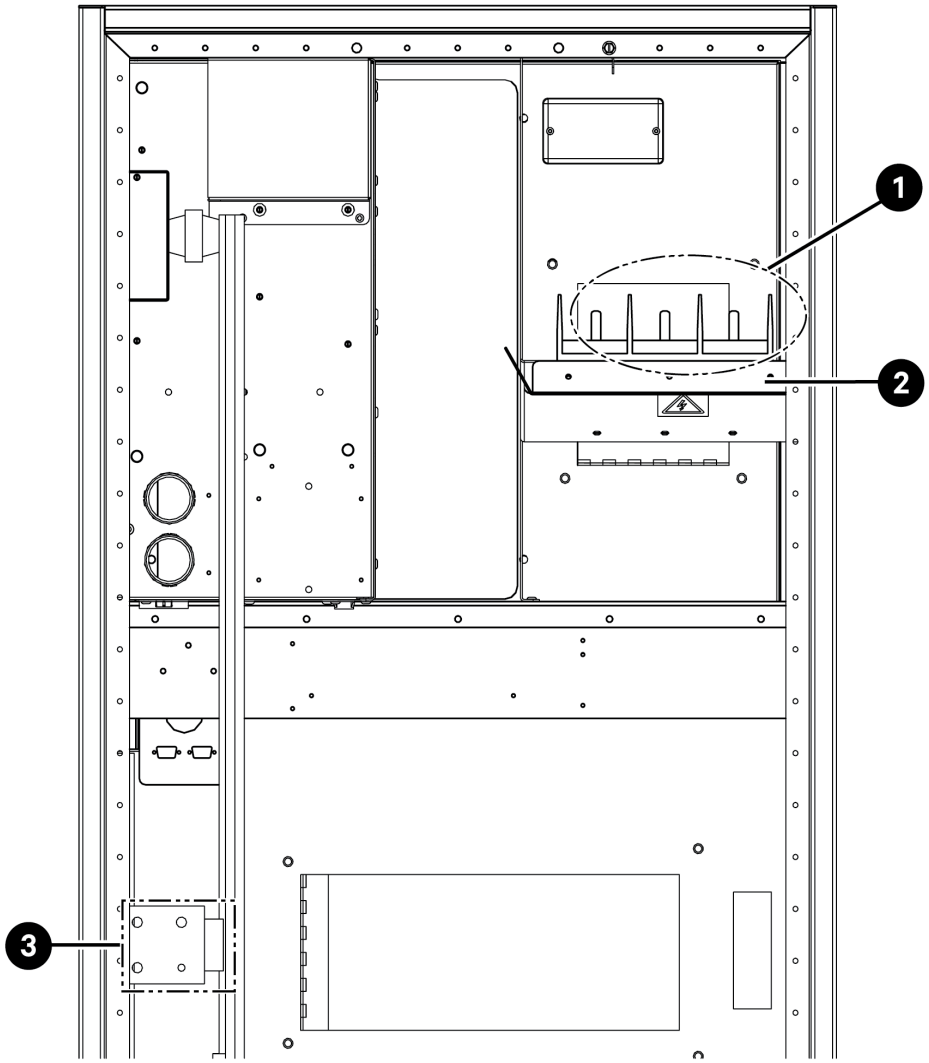
Input power cables enter the Vertiv™ Liebert® PPC-ISO through the top of the unit. Input power connections are made to power terminal blocks or input busbars on the main input circuit breaker. There is a separate ground connection to the main ground busbar.

1. Remove the top conduit plate. Retain the fasteners.
2. Punch the conduit plate to match the number and size of input conduit(s).
3. Reattach the conduit plate to the top of the unit using the fasteners from Step 1.
4. Pull the cables to the unit.
5. Attach the phase cables to the input power terminal blocks or bus bars. Torque the connections per the label on the front door of the unit.

WARNING! Risk of damaged cables, short circuits and electric shock. Can cause equipment damage, injury and death.
Do not rest cables on the heat shield near the main input power terminals. Resting cables on the heat shield may damage the input cable insulation.

6. Route the ground cable down the side of the unit frame and across the rear panel.
7. Attach the ground cable to the main input ground bus bar. Torque connections per the label on the front door of the unit.

Figure 2.4 Main Input Cable Connections



LIEBERT® PPC-ISO VIEWED FROM REAR.

Item	Description
1	Main Input Power
2	Input Terminal Heat Shield Do not rest cables on
3	Main Input

2.2.3 System Grounding

The performance and safety of any power conditioning system depends on proper grounding. Figure 2.5 on the next page shows the typical grounding arrangements for the Vertiv™ Liebert® PPC-ISO.

Equipment Grounding—Proper grounding is required for safe operation but also enhances equipment performance. All power feeders must include equipment grounding means as required by the NEC and local codes. An insulated ground conductor is recommended to be run in each feeder conduit. Ground conductors must be at least the minimum size per NEC Table 250-122. Larger wire sizes may be used for increased system performance. If the input power feeder conduit is used as a grounding conductor, adequate electrical continuity must be maintained at all conduit connections. Using isolating bushings in a metal conduit run can be a safety hazard and is not recommended.

Signal Reference Grid—If the unit will supply power to a computer room, an area equipped with a signal reference grid or a grounded, raised-floor stringer system, a grounding conductor should be connected from the system ground bus to the grid or floor system. This conductor should be stranded or braided #8 AWG or larger and as short as practical. Vertiv recommends that the conductor be less than 3 ft. (1m) long.

2.2.4 Grounding Electrode Conductor

WARNING! Touch current exceeds 10mA. Minimum grounding conductor must be sized 5% of the input current rating or greater in accordance with NEC Section 250.66. Larger sizes are permitted to be used.

Le courant de contact est supérieur à 10 mA. Le conducteur de terre doit avoir une intensité nominale d'au moins 5 % de l'intensité nominale d'alimentation, conformément à la section 250.66

du NEC. Des conducteurs de terre d'une intensité supérieure peuvent également être utilisés.

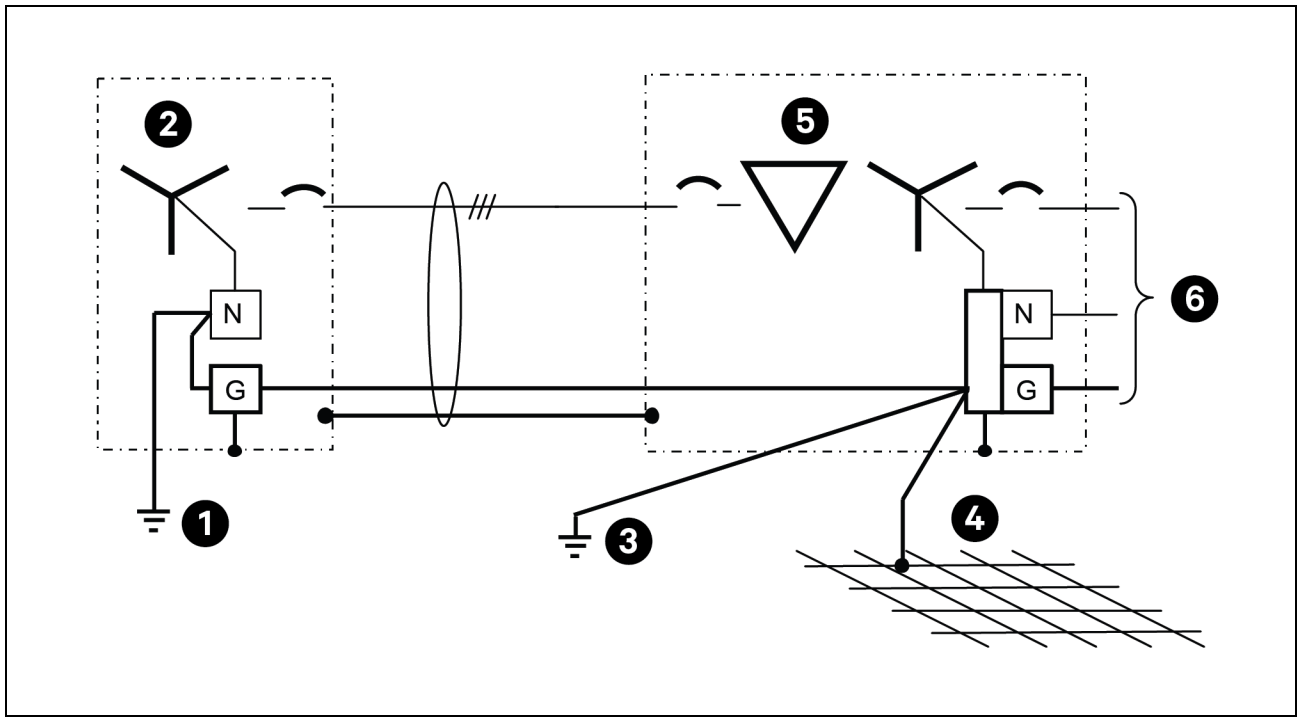
Required by code—The Liebert® PPC-ISO must be grounded according to the safety practices of NEC 250.30(a). Vertiv recommends installing a local grounding electrode conductor in addition to the equipment safety ground that is normally run with the input power conductors.

Electrode connection — As shown in Figure 2.5 on the next page , the grounding electrode conductor is run from the unit to the nearest effectively grounded item below (shown in order of preference):

- Building steel
- Metal water pipe
- Other made grounding electrode

The grounding electrode conductor sizing is based on the secondary circuit conductors, per NEC Table 250.66.

Figure 2.5 Typical Vertiv™ Liebert® PPC-ISO Grounding Arrangement



Item	Description	Item	Description
1	Service Entrance Grounding Electrode System	4	Signal Reference Grid (If Used)
2	Service Entrance	5	Liebert® PPC-ISO
3	Local Grounding Electrode Conductor Per NEC 250-30(a)	6	Output

Recommended methods for running the grounding electrode conductor (shown in order by preference for system performance and as acceptable by local and other applicable codes):

- Outside of conduit (where not subject to damage)
- Inside non-metallic conduit
- Inside non-ferrous conduit
- Inside ferrous conduit, bonded to the ferrous conduit at both ends, as acceptable by local and other applicable codes.

2.2.5 Output Power Connections

Output circuit breakers with ground and neutral provisions are available as an option for installation inside the unit for connecting loads as required. For best performance, the Liebert® PPC-ISO should be located as close to the load as practical. Initial system output loading should be between 50% and 75% of rated capacity. This allows the addition of future loads without immediately investing in another power conditioner. The high partial-load efficiency of the unit permits such sizing without imposing an energy-use penalty during initial operation.

Keep the load balanced—Balancing of loads is good practice on any three-phase system. All additions to the system and removals from it should be arranged to preserve balance in loads.

Code compliance—All output cables and connections must comply with the NEC and all other applicable codes.

Padlock-off provisions —All output breakers that are hard-wired to the load equipment must be equipped with a padlock-off accessory for the output circuit breaker. The padlock-off accessory is used to lock out and tag the circuit breaker when service is performed on the hard-wired load equipment in accordance with OSHA safety rules.

WARNING! Risk of electric shock and arc flash. Can cause equipment damage, injury and death. Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making connections in the unit.

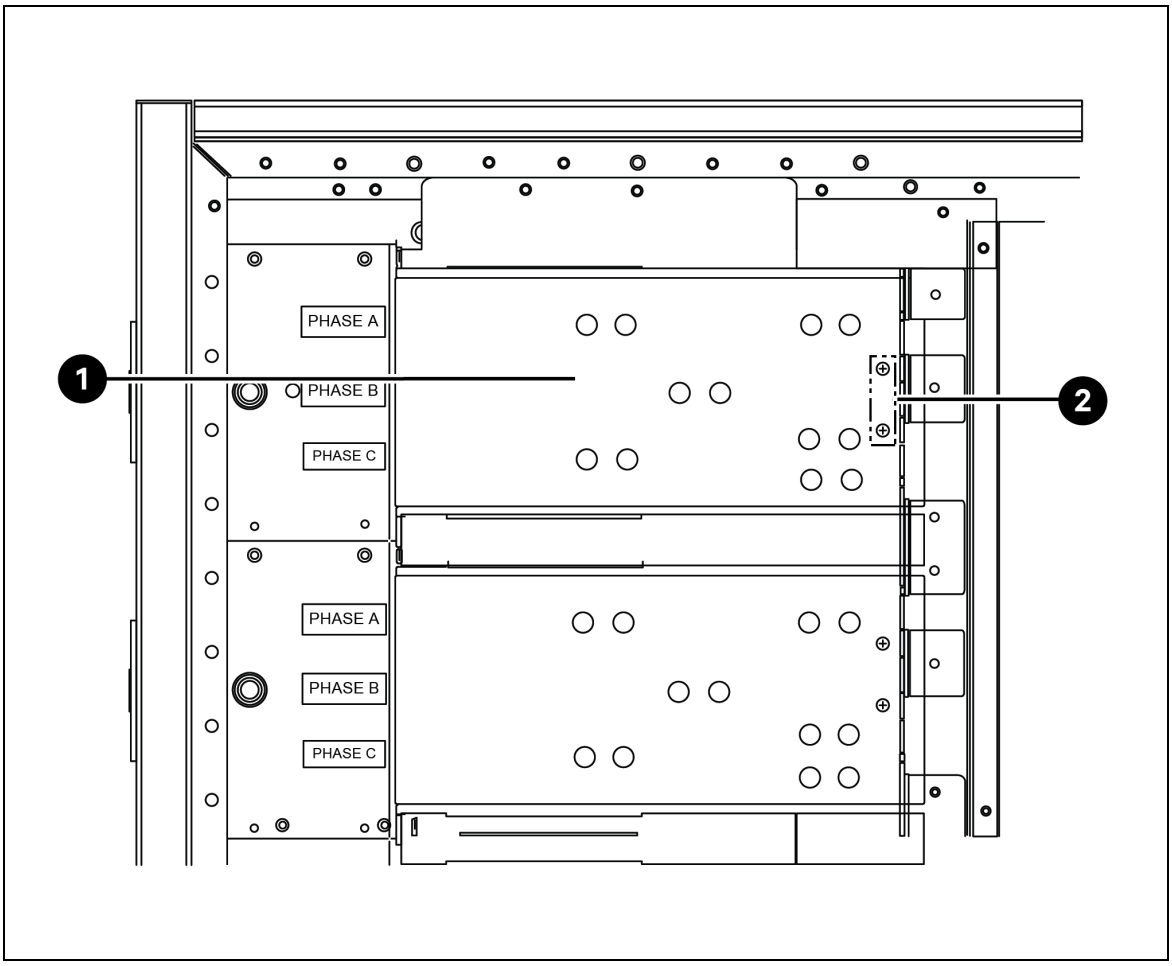
Connecting the output power conductors requires removing the polycarbonate separators. To install output cables:

1. Loosen the two captive Phillips head screws on the rear of the polycarbonate box. See Figure 2.6 on the next page .
2. The polycarbonate box is slotted into the metal breaker frame and the back polycarbonate panel. To remove it, slide the polycarbonate box toward the rear of the unit while rotating the box away from the breaker lugs.
3. Route cables through the appropriate holes in the polycarbonate end piece.
4. Connect the cables to the circuit breaker lugs.
   L-frame breakers: Torque the lugs to 275 lb.-in. (31 Nm) for 300 kcmil wire.
5. Reinstall the polycarbonate box by slotting the front into the metal breaker frame and rotating it back into position.
6. Verify the top and bottom tabs are seated in the back polycarbonate panel slots.
7. Tighten the two captive screws until tight.

NOTICE

Risk of over-tightening the captive screws during reattachment. Can damage the polycarbonate box. Use caution to not over-tighten the screws. Tightening the screws too much could crack the polycarbonate.

Figure 2.6 Remove the Polycarbonate Box

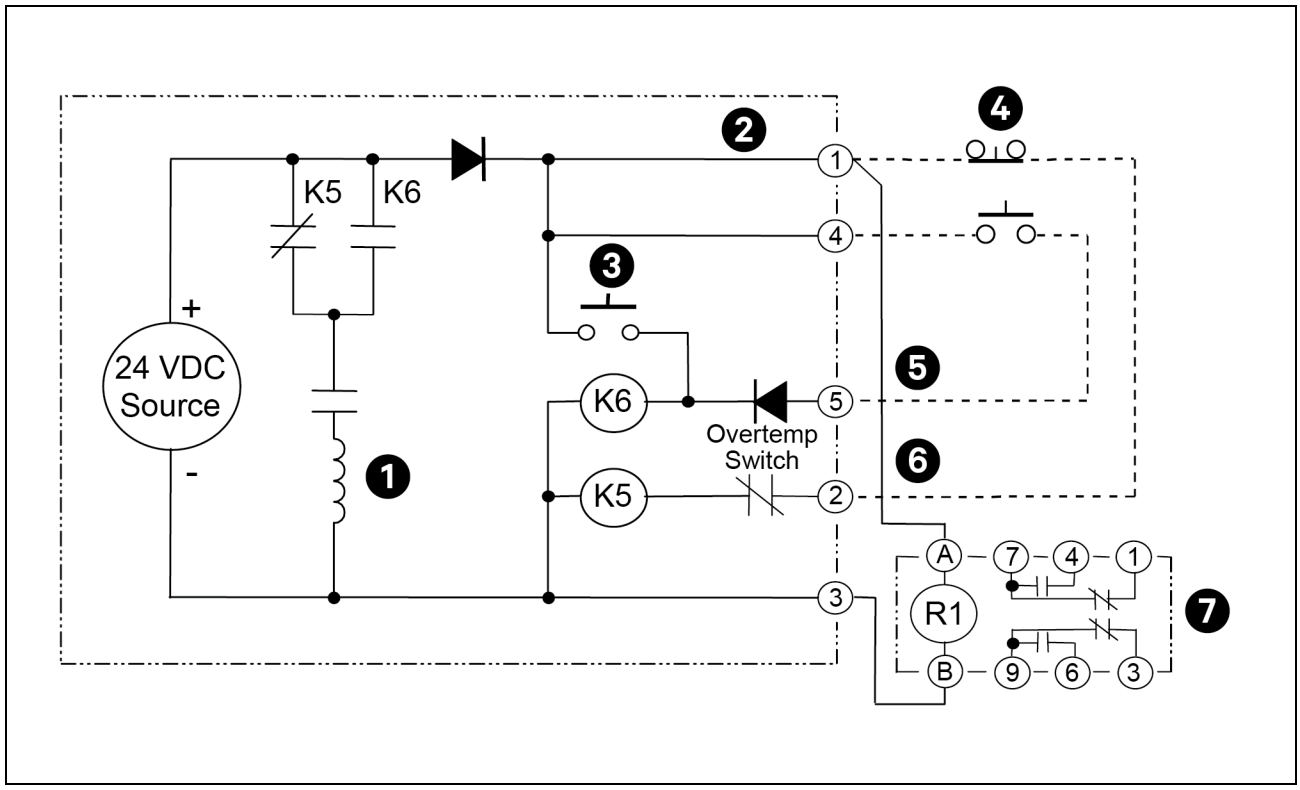


Item	Description
1	To remove, slide the box toward the rear of the unit and rotate it away from the
2	Captive Screws

2.2.6 Control Wiring Connections

NEC Article 645 requires installing Emergency Power Off (EPO) switches at the room's principal exits. All standard Liebert power conditioning systems have provision for external shutdown control from Remote Emergency Power Off (REPO) stations. Figure 2.7 below is a simplified diagram of the shutdown circuitry of the Vertiv™ Liebert® PPC-ISO.

Figure 2.7 Typical REPO Circuit



Item	Description	Item	Description
1	Main Input Breaker Shunt Trip	5	N.O. REPO
2	+ 24 VDC	6	N.C. REPO
3	Unit EPO	7	Building Interface Relay
4	Remote Shutdown Devices	–	–

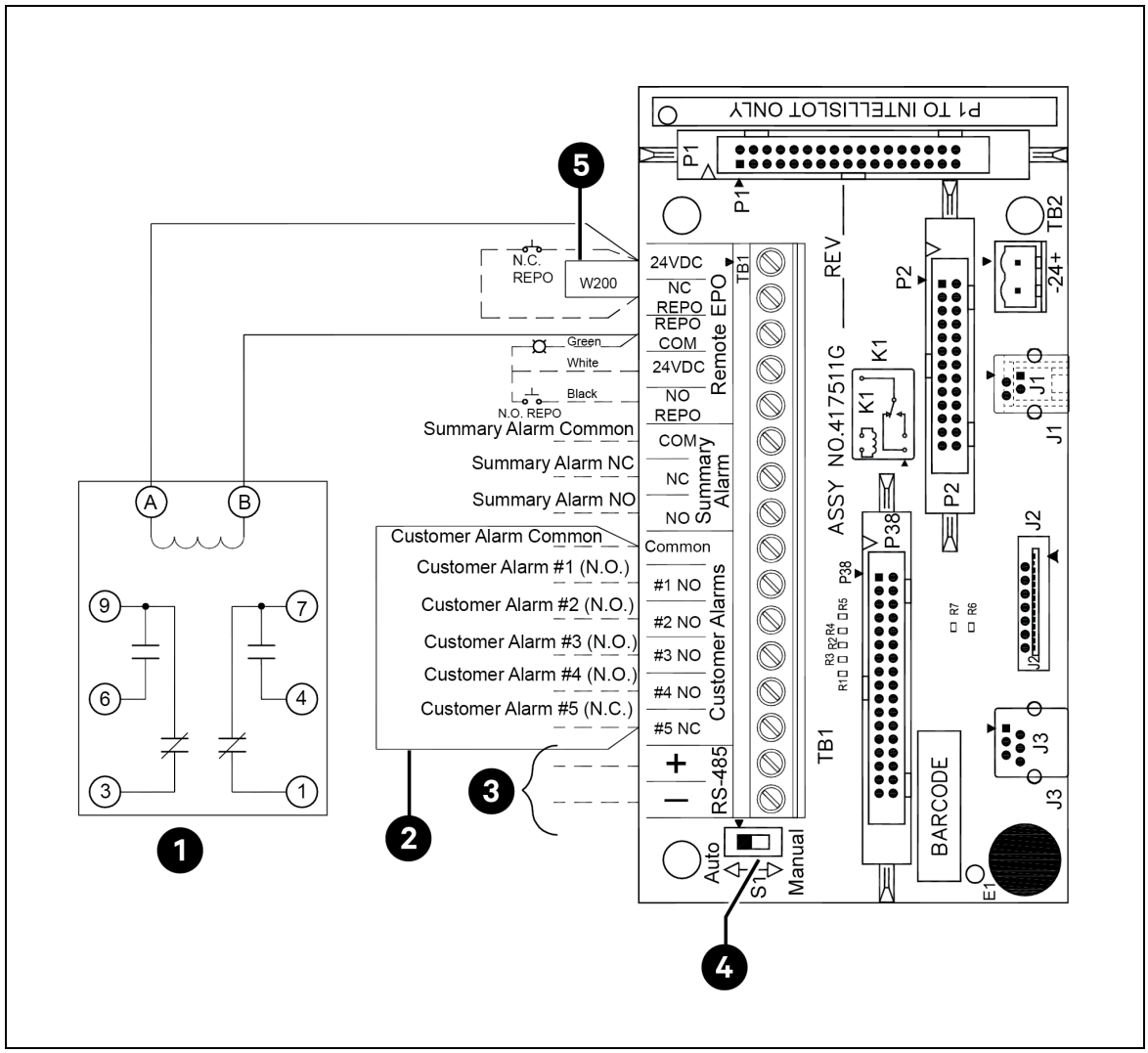
Low-Voltage Control Circuit—As shown in Figure 2.7 above , the control circuit operates on 24VDC. The shutdown device (represented by the REPO switch) activates a low-current 24VDC relay that operates the shunt-trip mechanism. The shunt-trip solenoid opens the main input breaker (if equipped), which de-energizes the Liebert® PPC-ISO.

Multiple-Unit Shutdown - When more than one Liebert® PPC-ISO is installed in a facility, a typical requirement is that actuating of a single device (REPO, for example) must shut down all Liebert® PPC-ISO units. The low-voltage control circuits of all standard Liebert® PPC-ISO systems are designed to meet this requirement.

External control wiring connections for remote shutdown, alarm and/or monitoring are made to the Adapter Board TB1 terminal block inside the unit. Control wiring connections are shown in Figure 2.8 on the next page .

Code Compliance - Control wiring connections must comply with the NEC and all other applicable codes.

Figure 2.8 Typical Control Wiring for Power Monitoring



Item	Description
1	Building Interface Relay
2	Remove jumper when 5th customer alarm is used
3	To Vertiv™ Liebert® SiteScan System
4	Auto-Manual Restart Switch
5	Remove jumper when Normally Closed (N.C.) REPO is used

NOTES TO FIGURE:

1. All switching devices are to be suitable for switching low current 24VDC. Minimum recommended wire size is 18 AWG stranded copper with 300V insulation. All wiring and devices are field-supplied except where noted.
2. The total load on the 24VDC supply (both N.O. and N.C. REPO circuits) must be limited to 1A.
3. Multiple normally open (N.O.) REPO switches may be paralleled. Multiple normally closed (N.C.) REPO switches may be connected in series. All lamps (if used) are connected in parallel.
4. The summary alarm contacts are rated for 0 to 30VAC or VDC, 0.5A, 10W maximum.
5. Customer Alarms 1 through 4 are normally open (indicates alarm on contact closure). Customer Alarm 5 is normally closed (indicates alarm on contact opening).
6. To connect Vertiv™ Liebert® SiteScan™, use #22AWG shielded cable with a maximum length of 1000ft. (300m).

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3 Inspection and Startup Checklist

Enter unit information below for reference when contacting Vertiv.

Unit Serial Number: _____

Unit Model Number: _____

Inspection Date: _____

Signature: _____

3.1 Internal Inspection Overview

A detailed internal inspection should be completed after the unit is in place and before it is energized to ensure trouble-free startup. The same internal inspection should be carried out when performing preventive maintenance.

WARNING! Verify that all incoming power and control circuits are de-energized and locked out before performing the internal inspection.

1. **Open the unit** - Remove the exterior panels to gain access to the internal components of the Vertiv™ Liebert® PPC-ISO.
2. **Open the unit** - Verify that the wiring and components are undamaged.
3. **Open the unit** - Verify that all power connections are secure. Refer to **Table 3.1** below for torque requirements of all electrical connections.
4. **Open the unit** - Follow the procedures described in Inspection and Startup Checklist above when performing detailed inspection.

Table 3.1 Torque Specifications (unless otherwise labeled)

Bolt Shaft Size	Torque, in/lb (Nm)	
	Electrical Connections With 1 Belleville Washer	Electrical Connections With 2 Belleville Washers
1/4" /M6	40 (4.5)	80 (9)
5/16"/M8	80 (9)	160 (18)
3/8"/M8	120 (13.6)	240 (27.1)
1/2"/M12	480 (54.2)	—

3.1.1 Internal Inspection Procedure

WARNING! Risk of electric shock and arc flash. Can cause equipment damage, injury and death. All equipment inspection procedures are to be performed with power to the unit turned Off and locked out.

1. Confirm the exterior of the unit is undamaged.
2. Confirm the service and ventilation clearances are sufficient (see **Figure 2.1** on page 5).

3. Remove accessible exterior panels. When removing exterior panels, disconnect panel ground wires by separating the easy-disconnect terminals on the frame. When replacing exterior panels, reconnect all panel ground wires.
4. Inspect all wire and conductor insulation for damage.
5. Check all transformer terminal connections for tightness. Retorque, if necessary, according to Table 3.1 on the previous page .
6. Check all breaker connections for tightness. Retorque if necessary according to the breaker manufacturer's specifications.
7. Check trip settings of adjustable breakers.
8. Check all terminal block connections for tightness. Retorque if necessary.
9. Check transformer mounting bolts for tightness. Retorque if necessary.
10. Remove any foreign objects from the components and the interior area of the unit. Make sure air passages on transformers are clear and free of debris.
11. Check that all intake and exhaust air screens are clean and free of obstructions.
12. Replace side panels, leaving access to circuit breakers for the following startup procedure. When replacing the side panels, be sure to reconnect the panel ground wires, removed in Step 3 .

3.1.2 Startup and Monitoring System Check Overview

Initial system startup—A qualified electrician should be employed to perform the equipment inspection and startup. Liebert system startup may be arranged by contacting your local Vertiv sales representative or Vertiv at 800-543-2378.

Warranty—A copy of the checklist furnished with the unit must be completed, signed, dated and returned to Vertiv™ (see Completed Checklist on page 23). Warranty coverage of the equipment is not effective unless the checklist is received by the factory.

3.1.3 Startup Procedure

WARNING! Risk of electric shock and arc flash. Can cause equipment damage, injury and death. Equipment inspection and startup should be performed only by trained personnel wearing appropriate safety headgear, gloves and shoes. Hazardous voltages are present during startup procedures. Electrical safety precautions must be followed throughout the inspection and startup.

1. Make certain that all circuit breakers are in the Off position and that power to the unit is locked out.
2. Verify proper input power connections to the unit, including equipment grounding conductor and local grounding electrode conductor.
3. Turn On the building input power to the unit.
4. Check the phase rotation at the main input terminal block or breaker. Phase rotation should be A, B, C, left-to-right.
5. Check and record the input voltage at the main input terminal block or breaker. Measured voltages should correspond to the unit's nameplate input voltage.

Voltage, phase A to phase B = _____

Voltage, phase B to phase C = _____

Voltage, phase C to phase A = _____

6. Turn on the main input breaker or input source; wait one minute. If breaker trips Off, check for wiring errors including control connections. Contact Vertiv or the local factory representative for assistance.
7. Check the phase rotation at the load-side terminals of the subfeeds. The rotation should be A, B, C, top-to-bottom.
8. Check and record the voltages at the load-side terminals of the output breakers. Measured voltages should correspond to the unit's nameplate output voltage within +4%, -0%.

Voltage, phase A to phase B =	
Voltage, phase B to phase C =	
Voltage, phase C to phase A =	
Voltage, phase A to neutral =	
Voltage, phase B to neutral =	
Voltage, phase C to neutral =	

If the output voltage is incorrect, check for wiring errors. Incorrect input voltage or improper transformer taps. Contact Vertiv at 800-543-2378 or your local Vertiv representative for assistance.

NOTE: The Vertiv™ Liebert® PPC-ISO transformer has input voltage taps for each input phase:

- 300kVA units, the taps are arranged in 2.1% increments. Taps include: two above nominal voltage (upper range limit of +4.2%) and three below nominal voltage, plus one below nominal of -4.1% (lower range limit of -10.4%).
- 450kVA units, the taps are arranged in 2.7% increments. Taps include: two above nominal voltage (upper range limit of 5.4%) and four below nominal voltage (lower range limit of - 10.8%).

This permits the transformer to provide the proper output voltage for a range of input voltages. Should it be necessary, the tap arrangement may be changed to match the input voltage:

a. Open the main input circuit breaker or shut off and lock out building power to the unit.
b. Set tap arrangement to match input voltage. (Refer to transformer nameplate for tap information.)
c. Secure each line to its proper tap.
d. Repeat Step 6 through Step 8.

9. Press the local Emergency Power Off (EPO) button and verify that the system shuts down. Turn the unit back on.
10. If the system is equipped with any Remote Emergency Power Off (REPO) switches, test each switch to ensure proper operation. Note that a REPO switch may shut down equipment or systems other than the Liebert® PPC-ISO being inspected.

3.1.4 Monitoring System Check

Basic Indicators

1. Turn On building power to the unit.
2. Turn On the main input breaker, if supplied.
3. Confirm the Power Indicator (green LED) next to the local display is illuminated.

Manual Restart Check—If the Unit is Equipped with Manual Restart

1. Turn on building power to the unit. Turn On the main input breaker.
2. Turn off all building power to the unit.
3. Observe that the main input breaker automatically trips open upon power loss.
4. Restore building power to the unit. Turn On the main input breaker.

Monitor Panel

1. Verify the voltage values indicated by the local display correspond to the voltage values measured at the main input circuit breaker (Startup Procedure on page 20 , Step 5) and output breaker (Startup Procedure on page 20 , Step 8).

Centralized Monitoring System—If the Unit is Connected to a Centralized Monitoring System

1. Turn the unit and centralized monitoring system On.
2. Verify proper communication with the central monitor system.

Control Voltage

1. Obtain access to the low-voltage terminals in the low voltage control section inside the unit.
2. With the unit On, measure and record the DC control voltage on +Vout (+) and -Vout (com).

Control Voltage _____

Customer Alarms

1. With the unit On, simulate alarm operation by jumpering the appropriate low voltage control terminals (Refer to the control wiring installation drawing furnished with the unit).
2. Verify correct alarm operation at the local display and the centralized monitoring system (if equipped).

3.2 Completed Checklist

After completing all procedures in Inspection and Startup Checklist on page 19 , sign, date and return the completed Inspection and Startup Checklist form to:
Vertiv
1050 Dearborn Drive
P.O. Box 29186
Columbus, Ohio 43229 USA

NOTE: The warranty is not in effect unless the Inspection and Startup Checklist form is received by the factory.

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4 Operating Instructions

4.1 Startup Procedures

Before the unit is placed into service after initial installation, after equipment relocation or after equipment has been de-energized for an extended period of time, perform equipment inspection and startup procedures as detailed in Inspection and Startup Checklist on page 19 .

After initial system startup, use the following guidelines for standard equipment operation. These guidelines should be modified as required for any special equipment modifications, special site considerations or company policies that may require changes to the standard equipment operation.

4.2 Emergency Shutdown

To immediately shut down the system, move the clear, protective cover away from the EPO button and push the button. See Figure 4.2 on page 29 for the button's location.

NOTICE

Risk of improper shutdown. Can cause equipment damage. Depending on the control circuit wiring, the Remote Emergency Power Off switch may shut down more equipment or systems than just the Vertiv™ Liebert® PPC-ISO.

If the site is equipped with a REPO switch – for example, as required by NEC Article 645.10 at the principal exit doors – activate one of the REPO switches to perform an immediate room shutdown.

4.3 Normal System Shutdown

To perform a normal system shutdown:

1. Shut down the load equipment—for example, a computer system—according to the manufacturer's recommendations. The load equipment can be turned Off at each piece of equipment or at the Liebert® PPC-ISO output distribution breakers, located behind the front door.
2. Turn Off all unit output breakers.
3. Turn Off the main input circuit breaker, if equipped.
4. To remove all power from the unit, turn Off the building power to the unit input breaker.

4.4 Normal System Startup

1. Make certain all unit circuit breakers are in the Off position. All unit circuit breakers are located behind the front door of the distribution section.
2. Turn On building power to the unit.
3. Turn On the unit's main input circuit breaker if equipped. If the circuit breaker has been tripped Off (instead of being turned Off), the circuit breaker handle must be moved to the Off position before being turned On.
4. If the unit has a voltage monitoring panel, verify proper output voltages before turning On output circuit breakers.
5. Individually turn On each output circuit breaker following the load equipment manufacturer's startup sequence.

4.5 Manual Restart

If the manual restart feature has been selected, the main input circuit breaker, if equipped, will be tripped by a power outage, preventing repetitive application of unstable voltage and allowing for an orderly system restart. If the main input circuit breaker is tripped by a power outage, follow the instructions in Normal System Shutdown on the previous page after power is restored.

4.6 Vertiv™ Liebert® Distribution Monitoring

The Liebert® Distribution Monitoring (LDMF) provides the current and voltage for each branch circuit breaker mounted in the distribution section. These measurements are used for reporting the average RMS current, power and other parameters. The Liebert® LDMF detects and annunciates alarm messages and status conditions for each circuit breaker. The monitored parameters and alarms appear on the local display (if supplied) and are available for communication to a customer or Liebert monitoring system.

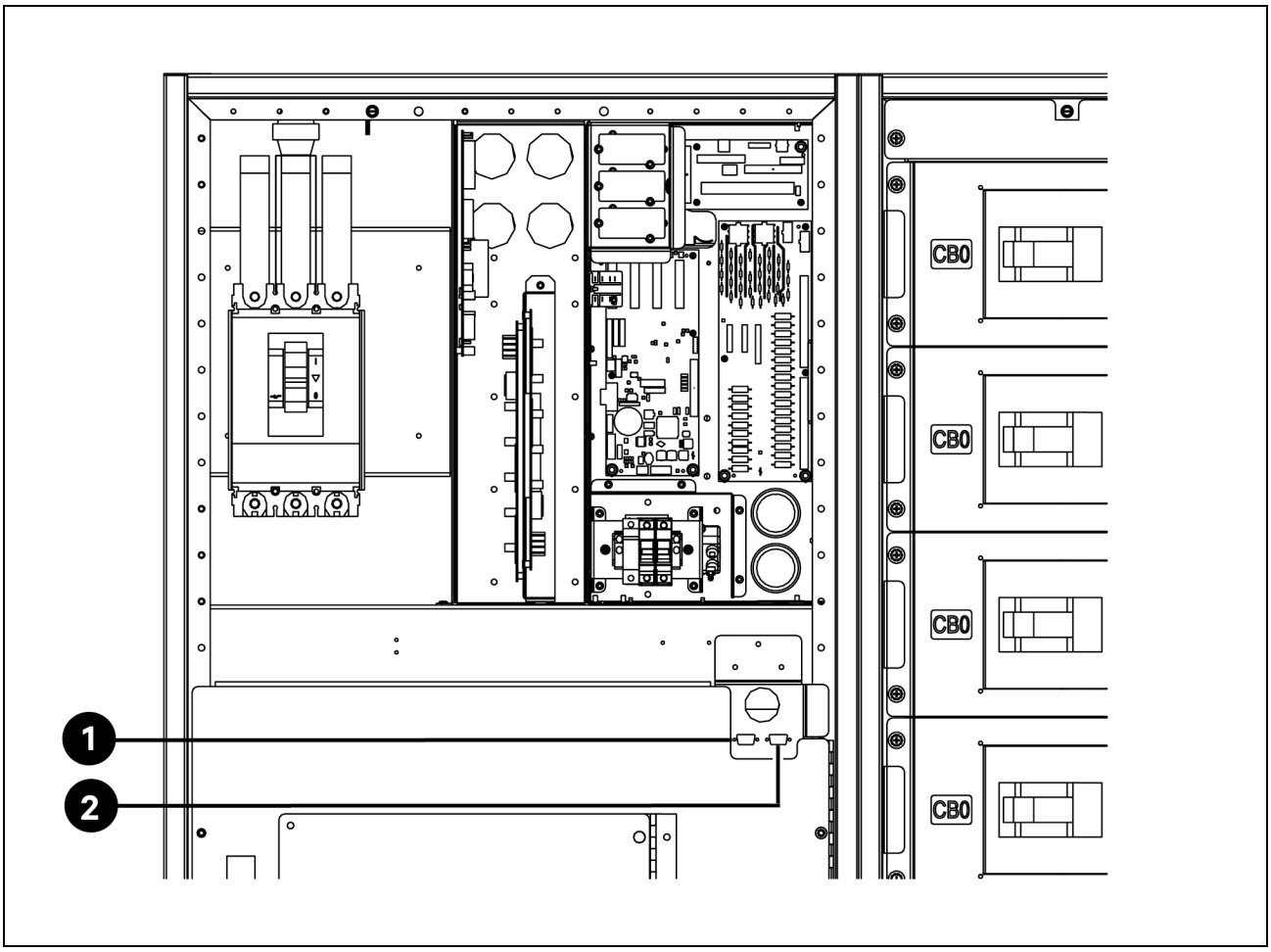
The Liebert® LDMF (if supplied) includes a monochrome LCD, power and alarm LEDs, an audible alarm and alarm silence and Emergency Power Off push buttons mounted on the front door. See Figure 4.2 on page 29 for details.

4.6.1 Display Controls and Indicators

- Power Indicator (green LED)—illuminates when power has been applied to the Liebert power product.
- Alarm Status Indicator (red LED)—illuminates when the Liebert® LDMF detects an alarm. The LED will remain illuminated until the alarm condition is cleared.
- Audible Alarm Speaker (represented by the speaker symbol)—a speaker behind the bezel will sound when the Liebert® LDMF records an alarm condition.
- Silence/Reset Push Button—Press and release the Silence/Reset button to silence the audible alarm. Press and hold the button to clear the alarm and turn off the red alarm indicator LED. If the alarm condition still exists, the alarm will be annunciated again.
- Emergency Power Off (EPO) push button—pressing the EPO button shunt trips the input circuit breaker (if supplied) to turn the unit off.
- LCD—displays power parameters and alarm data.
- Navigation Keys (soft function keys F1 through F4 and Help):
  - F1 selects the next Main Breaker, Next Subfeed or Next Branch.
  - F2 is the Sequence key. It selects the next set of items at the current level or the next item on a list.
  - F3 selects Subfeed (if supplied and monitored) at the top level or a menu item at a lower level.
  - F4 selects Branch Breakers at the top level or provide a Back function at lower levels. Pressing the Back key (F4) navigates to the top level (Main) except from the Help screen. From the Help screen, the Back key navigates to the previous screen.
  - Pressing the Help key navigates to the Help screen.

All alarm thresholds for monitored parameters are adjustable by way of the Liebert® LDMF DB-9 setup port to match site requirements. See Figure 4.1 on the facing page for port location. All alarms are stored in nonvolatile memory to protect against erasure by a power outage. Alarms must be reset manually after the alarm condition has been corrected. Alarms may be reset by pushing the Silence/Reset button on the display or through the remote monitoring system (if used).

Figure 4.1 DB-9 port Locations



Item	Description
1	Liebert® VPMP DB-9
2	Liebert® LDMF DB-9

The Vertiv™ Liebert® LDMF monitors and displays the following parameters for the panelboard main circuit breaker, each branch circuit breaker and subfeed circuit breakers (if supplied and monitored):

- Phase Current
- Percent Load
- kW
- kW-Hours

Metering - The following metering parameters may be displayed:

- Voltage - Line-to-Line
- Voltage - Line-to-Neutral
- Neutral Current
- Ground Current
- kVA

- Power Factor
- Voltage Total Harmonic Distortion (THD)
- Current Total Harmonic Distortion (THD)
- Crest Factor

Circuit identification and status of each breaker may be displayed.

Alarms - The Vertiv™ Liebert® LDMF detects and annunciates by alarm message the following conditions:

- Overvoltage
- Undervoltage
- Neutral Overcurrent
- Ground Overcurrent
- Phase Overcurrent
- Phase Overcurrent Warning
- Summary Alarm

All alarm thresholds for monitored parameters are adjustable by way of the Liebert® LDMF DB-9 setup port to match site requirements. The factory setpoints for the alarms are:

- Overvoltage: at least one of the line-to-line voltages exceeds +6% of nominal
- Undervoltage: at least one of the line-to-line or line-to-neutral voltages falls below -13% of
- nominal
- Phase Overcurrent Warning: current exceeds 75% of breaker amps
- Phase Overcurrent: current exceeds 80% of breaker amps
- Neutral Current: current exceeds 95% of breaker amps
- Ground Current: current exceeds: 15A (300kVA); 20A (450kVA);

Summary Alarm - Summary Alarm: detects and annunciates any alarm.

Summary Alarm Contacts - The Liebert® LDMF has a Form C (one NO and one NC) summary alarm contacts for remote alarm status. The contacts are rated at 24VAC @ 1A. The contacts change state upon occurrence of any alarm including warnings and resets when the alarm is cleared. Summary alarm contacts are located on the adapter board. The adapter board is on top of the monitoring enclosure.

Communication - Vertiv™ Liebert® IntelliSlot cards provide customer connection to a Building Management System (BMS) or Remote Monitoring Systems. The following cards are available:

- Liebert IS-WEBS Card provides SNMP/WEB output. An RJ-45 connector is supplied for customer connection to Ethernet LAN.
- Liebert IS-485S Card provides Modbus 485 output. A terminal strip is provided for two-wire connection.
- Liebert IS-IPBMS Card provides Modbus IP output. An RJ-45 connector is supplied for customer connection.
- Liebert IS-UNITY-DP Card provides two of these communication methods: HTTP/HTTPS, Vertiv Protocol, email, SMS, SNMP v1/v2c/v3, BACnet IP/MSTP and Modbus TCP/RTU output using a serial RS-485 two-wire connection

Up to three Liebert® IntelliSlot cards may be installed in the Liebert® LDMF system.

For communication to Vertiv™ Liebert® SiteScan™, customer connection can be made to the adapter board RS-485 terminals on TB1. The adapter board is on top of the monitoring enclosure.

Figure 4.2 Monitoring Panel Layout

4.7 Vertiv™ Liebert® Power Monitor Panel with Velocity Protocol

Liebert® Power Monitor Panel with Velocity Protocol (VPMP) provides input voltage, output current and voltage and other power parameters and will detect and annunciate alarm messages. The monitored parameters and alarms will be displayed on the local display and be available for communication to a customer or Liebert monitoring system.

The Liebert® VPMP works with the Vertiv™ Liebert® LDMF system interface detailed in Vertiv™ Liebert® Distribution Monitoring on page 26 . It is also offered as an stand-alone option utilizing the same HMI.

All alarm thresholds for monitored parameters are adjustable by way of the Liebert VPMP DB-9 setup port to match site requirements. See Figure 4.1 on page 27 for port location. All alarms are stored in nonvolatile memory to protect against erasure by a power outage. Alarms must be reset manually after the alarm condition has been corrected. Alarms may be reset by pushing the Silence/Reset button on the display or through the remote monitoring system (if used).

Metering - The metering parameters below may be displayed:

- Input Voltage, Line-to-Line for all three phases
- Output Voltages, Line-to-Line for all three phases
- Output Voltages, Line-to-Neutral for all three phases
- Output Voltage Total Harmonic Distortion (THD) for all three phases
- Output Current for all three phases
- Output Current Total Harmonic Distortion (THD) for all three phases
- Output Current Crest Factor (Peak/RMS) for all three phases
- Output Current Harmonic K-Factor for all three phases
- Output Neutral Current
- System Ground Current
- Output Frequency
- Output kVA
- Output kW
- Output Power Factor
- Output kW-Hours
- Percent Load
- Date & Time

Alarms - The Vertiv™ Liebert® VPMP detects and annunciates by alarm message the following conditions:

- Output Overvoltage
- Output Undervoltage
- Output Overcurrent
- Neutral Overcurrent
- Ground Overcurrent
- Output Voltage Distortion
- Frequency Deviation
- Phase Sequence Error
- Phase Loss
- Transformer Overtemperature

All alarm thresholds for monitored parameters are adjustable by way of the Liebert® VPMP DB-9 setup port to match site requirements. The factory setpoints for the alarms are as follows:

- Output Overvoltage - voltage exceeds +6% of nominal
- Output Undervoltage - voltage falls below - 13% of nominal
- Output Overcurrent - current exceeds 95% of full load amps
- Neutral Overcurrent - current exceeds 95% of full load amps
- Ground Overcurrent - current exceeds: 15 amps (300kVA); 20 amps (450kVA);
- Output Voltage Distortion - output voltage THD exceeds 10%
- Frequency Deviation - output frequency exceeds ±0.5Hz of nominal

Summary Alarm- Summary Alarm - detects and annunciates any alarm.

Summary Alarm Contacts - The Liebert® VPMP has a Form C (one NO and one NC) summary alarm contact for remote alarm status. The contacts are rated at 24VAC @ 1A. The contacts change state upon occurrence of any alarm including warnings and resets when the alarm is cleared. Summary alarm contacts are located on the adapter board. The adapter board is on top of the monitoring enclosure.

Communication - Vertiv™ Liebert® IntelliSlot cards provide customer connections to a Building Management System (BMS) or Remote Monitoring Systems. The following cards are available:

- Liebert® IS-WEBS Card provides SNMP/WEB output. An RJ-45 connector is supplied for customer connection to Ethernet LAN.
- Liebert IS-485S Card provides Modbus 485 output. A terminal strip is provided for 2-wire connection.
- Liebert IS-IPBMS Card provides Modbus IP output. An RJ-45 connector is supplied for customer connection.
- Liebert IS-UNITY-DP Card for HTTP/HTTPS, Vertiv Protocol, e-mail, SMS, SNMP v1/v2c/v3, BACnet IP/MSTP and Modbus TCP/RTU output using a serial RS-485 two-wire connection.

Up to three cards can be plugged into the Liebert® IntelliSlot ports provided with the Liebert® VPMP system.

For communication to Vertiv™ Liebert® SiteScan™, customer connection can be made to the adapter board RS-485 terminals on TB1. The adapter board is located on top of the monitoring enclosure.

5 Maintenance

5.1 Repair

Even the most reliable equipment may fail. Contact Vertiv for fast repair of your unit and minimum down-time of your installation.

WARNING! Risk of electric shock and arc flash. Can cause equipment damage, injury and death. All maintenance and repair must be performed only by trained personnel wearing appropriate safety headgear, gloves and shoes. Hazardous voltages are present in the Vertiv™ Liebert® PPC-ISO, even when the unit is Off. Input power must be disconnected and locked out before beginning any work within the Liebert® PPC-ISO. Electrical safety precautions must be followed throughout all work within the unit.

Standard electrical troubleshooting procedures should be used to isolate problems in the unit. If there are questions, contact Vertiv.

Repair or replacement of standard items, such as circuit breakers, fuses, transformers, capacitors and indicator lights can be handled either by qualified electricians or by Vertiv.

Repairs related to the monitoring system should be referred to Vertiv.

To contact Vertiv for information or repair service, call 800-543-2378.

5.2 Preventive Maintenance

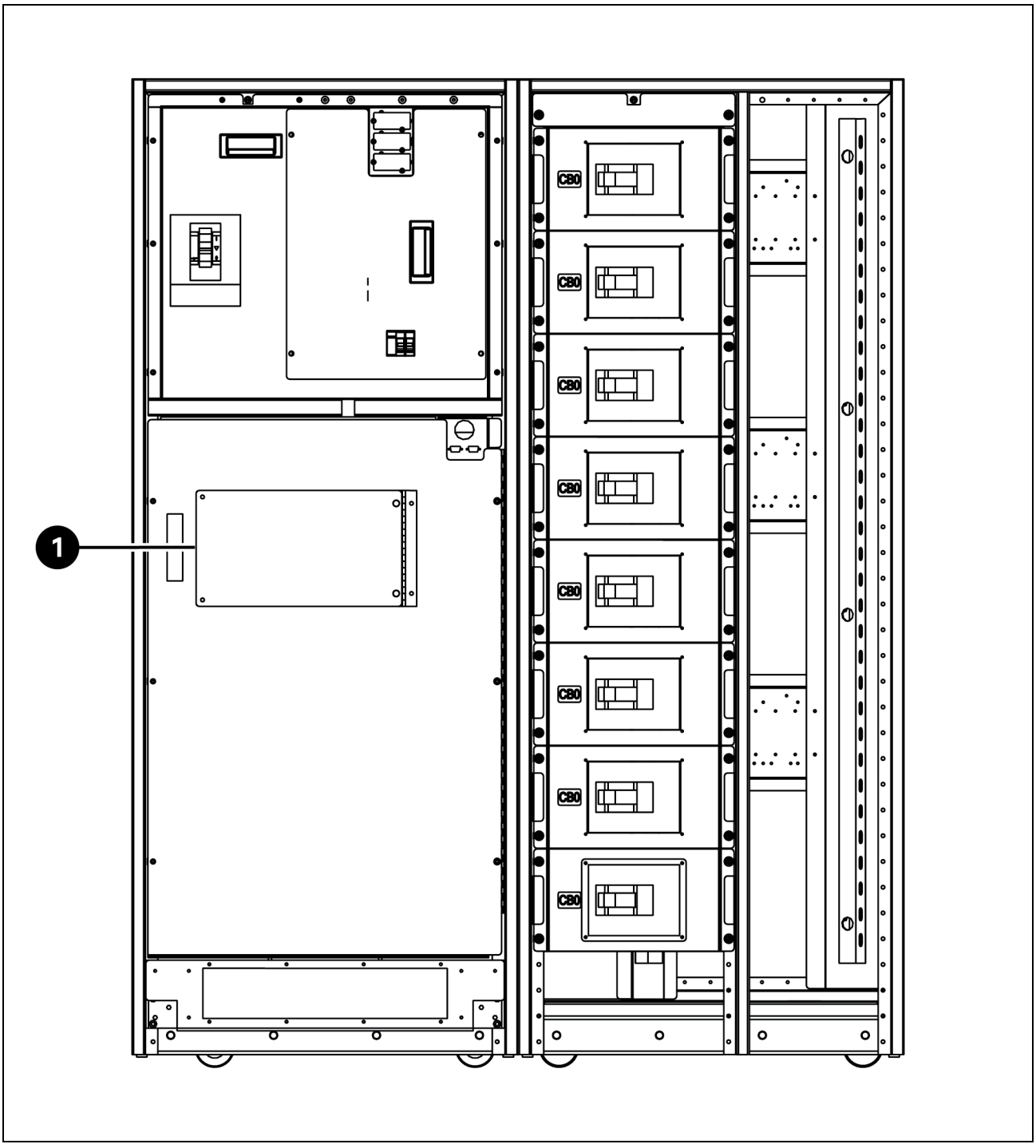
Air circulation through the cabinet may cause dust to accumulate on internal components. Cleaning should be done as necessary during electrical inspections.

Annual general system inspections, cleaning and operation checks are recommended to ensure system performance and long service life.

An optional viewing window is provided on the front of the transformer cabinet to allow infrared scanning of transformer terminal connections. Use extreme caution because high voltage is exposed when the viewing window is open. See Figure 5.1 on the next page .

WARNING! Risk of electric shock and arc flash. Can cause equipment damage, injury and death. All maintenance and repair must be performed only by trained personnel wearing appropriate safety headgear, gloves and shoes. Hazardous voltages are present in the Liebert® PPC-ISO, even when the unit is Off. Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before beginning any work within any part of the Liebert® PPC-ISO. Electrical safety precautions must be followed throughout all work within the unit.

Figure 5.1 Transformer Viewing Window



Item	Description
1	Transformer Viewing Window

5.3 Inspection Schedule

It is difficult to establish a schedule for periodic cleanings since conditions vary from site to site. Inspections after the first 24 hours, 30 days and 6 months of operation should help determine a schedule for inspections.

- Electrical connections and component mountings should be inspected after the first 24 hours, 30 days and 6 months of operation. Inspections should be conducted per local site procedure or annually at minimum thereafter.
- Ventilation openings and grilles should be inspected and cleaned every six months to one year at minimum.
- A complete inspection and operational checkout should be performed annually. This is best done by performing the inspection and startup procedures outlined in Inspection and Startup Checklist on page 19 .

Vertiv offers a complete range of preventive maintenance services. These include thorough equipment performance checks and calibration of electronics. Contact Vertiv at 800-543-2378 for details.

5.4 Adding and Removing Breakers

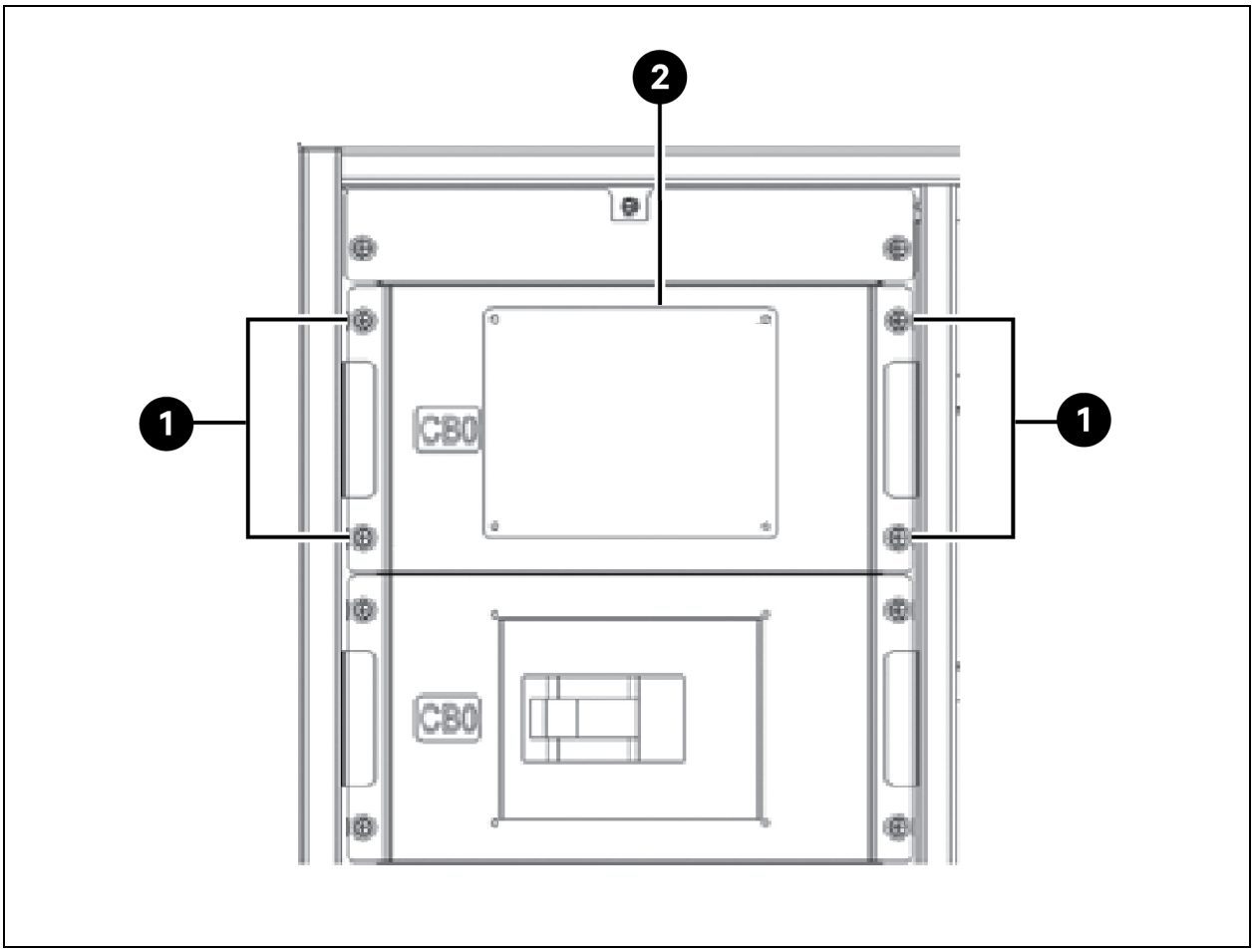
The Vertiv™ Liebert® PPC-ISO is designed with Square D™ Plug-In breakers. The breakers can be quickly added or removed to the cabinet. The plug-in bases allow the breakers to be removed or installed without having to touch electrical connections. The unit is equipped with eight L-frame plug-in mounting bases.

WARNING! Risk of electric shock and arc flash. Can cause equipment damage, injury and death. Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making connections in the unit.

To add a breaker to the unit:

1. Lock out and tag out the unit in accordance with local site procedures.
2. Locate an empty breaker slot on the unit for installation.
3. Remove the breaker faceplate by removing the four captive Phillips screws (see Figure 5.2 on the next page).
4. After removing the faceplate, remove the breaker blank panel by removing the four quarter-inch bolts.
5. Discard the blank plate and bolts or save for reuse.

Figure 5.2 Remove Breaker Faceplate



Item	Description
1	Captive
2	Breaker Blank Panel with Quarter-Inch Bolts (one in each

6. Trip the circuit breaker by pressing the red trip button on the front of the breaker.
7. Align the power connections on the breaker with the plug-in base and press the circuit breaker into place.
8. Fasten the circuit breaker to the plug-in base using screws provided with the circuit breaker.
9. Torque the screws for L-frame breakers to 35 lb.-in. (5 N-m).
10. Replace the breaker faceplate by inserting and tightening the four captive Phillips screws.
11. Follow the instructions in Output Power Connections on page 12 to wire the breaker output connections.

To remove or replace a breaker:

1. Lock out and tag out the unit in accordance with local site procedures.
2. Locate the circuit breaker to remove or replace.
3. Trip the circuit breaker by pressing the red trip button on the front of the breaker.
4. Remove the breaker faceplate by removing the four captive Phillips screws (see **Figure 5.2** above).
5. Remove the two screws holding the circuit breaker to the plug-in base.
6. Grasp the circuit breaker on the top and bottom. Pull the circuit breaker straight out.

7. If required, install the new breaker. Installation is the opposite of removal. Torque the screws per Step 9 above.
8. Replace the breaker faceplate by inserting and tightening the four captive Phillips screws.
9. If no breaker was installed in Step 7, install the breaker blank panel by inserting and tightening the four quarter-inch bolts.

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