Liebert®
Keeping Business in Business®

POWER AVAILABILITY

NX™

INSTALLATION MANUAL

10-30kVA
208V, 60Hz

EMERSON™
Network Power

CONTACTING LIEBERT FOR SUPPORT

To contact Liebert Global Services for information or repair service in the United States, call 1-800-LIEBERT (1-800-543-2378). Liebert Global Services offers a complete range of start-up services, repair services, preventive maintenance plans and service contracts.

For repair or maintenance service outside the 48 contiguous United States, contact Liebert Global Services, if available in your area. For areas not covered by Liebert Global Services, the authorized distributor is responsible for providing qualified, factory-authorized service.

For LGS to assist you promptly, please have the following information available:

Tag Number_____

Site ID_____

Part numbers: _____

Serial numbers:_____

Rating: _____

Date purchased: _____

Date installed:_____

Location: _____

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FIGURES

TABLES

SAVE THESE INSTRUCTIONS

This manual contains important instructions that should be followed during installation of your Liebert NX™ UPS and batteries.

Read this manual thoroughly, paying special attention to the sections that apply to your installation, before working with the UPS. **Retain this manual for use by installing personnel.**

WARNING

Exercise extreme care when handling UPS cabinets to avoid equipment damage or injury to personnel. The UPS module weight ranges from 850 to 1400 lb. (386 to 635kg).

Determine unit weight and locate center of gravity symbols before handling the UPS. Test lift and balance the cabinet before transporting. Maintain minimum tilt from vertical at all times.

Battery manufacturers supply details of the necessary precautions to be observed when working on, or in the vicinity of, a large bank of battery cells. These precautions should be followed implicitly at all times.

Follow all battery safety precautions when installing, charging or servicing batteries. In addition to the hazard of electric shock, gas produced by batteries can be explosive and sulfuric acid can cause severe burns. When connected, the nominal battery voltage is 324VDC and is potentially lethal.

In case of fire involving electrical equipment, use only carbon dioxide fire extinguishers or those approved for use in fighting electrical fires.

Extreme caution is required when performing maintenance.

Be constantly aware that the UPS system contains high DC as well as AC voltages.

Check for voltage with both AC and DC voltmeters prior to making contact.

WARNING

As with other types of high power equipment, dangerous voltages are present within the UPS and battery enclosure. The risk of contact with these voltages is minimized as the live component parts are housed behind a hinged, lockable door. Further internal safety screens make the equipment protected to IP20 standards.

No risk exists to any personnel when operating the equipment in the normal manner, following the recommended operating procedures.

All equipment maintenance and servicing procedures involve internal access and should be carried out only by trained personnel.

WARNING

High ground leakage current: Ground connection is essential before connecting the input supply.

This equipment must be grounded in accordance with local electrical codes.

Maximum load must not exceed that shown on the UPS rating label.

CAUTION

This equipment is fitted with RFI suppression filters.

Ground leakage current exceeds 3.5 mA and is less than 1000 mA.

Transient and steady-state ground leakage currents, which may occur when starting the equipment, should be taken into account when selecting instantaneous residual current circuit breakers (RCCBs) or residual current devices (RCDs).

RCCBs must be selected sensitive to DC unidirectional pulses (Class A) and insensitive to transient current pulses.

Note also that the ground leakage currents of the load will be carried by this RCCB or RCD.

WARNING

Under typical operation and with all UPS doors closed, only normal safety precautions are necessary. The area around the UPS system should be kept free of puddles of water, excess moisture and debris.

Special safety precautions are required for procedures involving handling, installation and maintenance of the UPS system and the battery. Observe all safety precautions in this manual before handling or installing the UPS system. Observe all precautions in the Operation and Maintenance Manual**,** before as well as during performance of all maintenance procedures. Observe all battery safety precautions before working on or near the battery.

This equipment contains several circuits that are energized with high voltage. Only test equipment designed for troubleshooting should be used. This is particularly true for oscilloscopes. Always check with an AC and DC voltmeter to ensure safety before making contact or using tools. Even when the power is turned Off, dangerously high electric charges may exist within the UPS.

All power and control wiring should be installed by a qualified electrician. All power and control wiring must comply with the NEC and applicable local codes.

ONLY qualified service personnel should perform maintenance on the UPS system. When performing maintenance with any part of the equipment under power, service personnel and test equipment should be standing on rubber mats. The service personnel should wear insulating shoes for isolation from direct contact with the floor (earth ground).

Never work alone, even if all power is removed from the equipment. A second person should be standing by to assist and summon help in case an accident should occur.

CAUTION

This unit complies with the limits for a Class A digital device, pursuant to Part 15 Subpart J of the FCC rules. These limits provide reasonable protection against harmful interference in a commercial environment. This unit generates, uses and radiates radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. This unit is not designed for use in a residential area. Operation of this unit in a residential area may cause harmful interference that the user must correct at his own expense.

Battery Cabinet Precautions

The following warning applies to all battery cabinets supplied with UPS systems. Additional warnings and cautions applicable to battery cabinets may be found in **3.0 - Battery Installation**.

WARNING

Internal battery strapping must be verified by manufacturer prior to moving a battery cabinet (after initial installation).

- Battery cabinets contain non-spillable batteries.
- Keep units upright.
- Do not stack.
- Do not tilt.

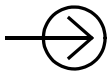
Failure to heed this warning could result in smoke, fire or electric hazard.

Call 1-800-LIEBERT before moving battery cabinets (after initial installation).

GLOSSARY OF SYMBOLS

Risk of electrical shock

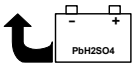
Indicates caution followed by important instructions



AC input

AC output

Requests the user to consult the manual



Indicates the unit contains a valve-regulated lead acid battery

Recycle

DC voltage

Equipment grounding conductor

Bonded to ground

AC voltage

1.0 INSTALLATION

The Liebert NX™ UPS is designed primarily for telecommunications and data processing applications. Liebert Corporation neither recommends nor knowingly sells this product for use with life support and other designated "critical" devices.

This section describes the NX's environmental requirements and mechanical considerations that must be taken into account when planning the positioning and cabling of the UPS equipment.

Because every site is unique, this section presents a guide to general procedures and practices that should be observed by the installing engineer, rather than step-by-step installation instructions.

WARNING

Do not apply electrical power to the UPS equipment before the arrival of the commissioning engineer.

WARNING

The UPS equipment should be installed by a qualified engineer in accordance with the information contained in this section.

WARNING

Special care should be taken when working with the batteries associated with this equipment. When connected together, the nominal battery voltage is 324 VDC and is potentially lethal.

- Eye protection should be worn to prevent injury from accidental electrical arcs.
- Remove rings, watches and all metal objects.
- Only use tools with insulated handles.
- Wear rubber gloves.

If a battery leaks electrolyte or is otherwise physically damaged, it must be replaced, stored in a container resistant to sulfuric acid and disposed of in accordance with local regulations.

If electrolyte comes into contact with skin, the affected area should be washed immediately with large amounts of water.

NOTE

The NX UPS can be used in TN utility system.

1.1 External Inspections

1. While the UPS system is still on the truck, inspect the equipment and shipping container(s) for any signs of damage or mishandling. Do not attempt to install the system if damage is apparent. If any damage is noted, file a damage claim with the shipping agency within 24 hours and contact Liebert Global Services at 1-800-LIEBERT to inform them of the damage claim and the condition of the equipment.
2. Compare the contents of the shipment with the bill of lading. Report any missing items to the carrier and your local Liebert representative immediately.

1.2 Internal Inspections

1. Remove any packaging material, then visually examine the UPS and battery equipment for transit damage, both internally and externally. Report any such damage to the shipper and to Liebert immediately.
2. Check the nameplate inside the cabinet door to verify that the model number and rating correspond to the ones specified. Record the model number and serial number in the front of this installation manual. This information is necessary should service be required.
3. Check for loose connections or unsecured components in the cabinet.
4. Check for shipping damage to internal components.

1.2.1 Storing for Delayed Installation

If the equipment will not be installed immediately, it must be stored indoors where the humidity is no higher than 90% and the temperature is no higher than 104°F (40°C). The storage area must protect the NX from excessive moisture (see **5.1 - Dual Bus Synchronizer**).

CAUTION

If the UPS must remain disconnected from power for more than six (6) months, the battery must be recharged before use. To charge the batteries, the unit must be connected to utility power and started up—the charger operates only while the NX is operating.

CAUTION

When batteries are installed in the UPS or are cabinet-mounted adjacent to the UPS unit, the battery—not the UPS—dictates the designed maximum ambient temperature.

1.3 Preliminary Checks

1.3.1 Identification

The equipment supplied has an identification tag on the back of the main door listing the type and size of the UPS.

1.4 UPS Location

1.4.1 Environmental Considerations

Before installing the NX, verify that the UPS room satisfies the environmental conditions stipulated in **5.1 - Dual Bus Synchronizer**, paying particular attention to the ambient temperature and air exchange system.

The UPS unit should be installed in a cool, dry, clean-air environment with adequate ventilation to keep the ambient temperature within the specified operating range 32°F to 104°F (0°C to 40°C).

All NX models are cooled by internal fans. Cooling air enters the devices through ventilation grids at various points on the cabinet and is released through grids on the top of the unit. To permit proper airflow and prevent overheating or malfunctioning, do NOT cover the ventilation openings or allow fans or equipment to blow air down onto the NX.

If necessary, a system of extractor fans should be installed to aid cooling-air flow If the unit is to be operated in an environment that is not clean-air, a suitable air filtration system should be used to ensure the unit works properly.

See **Table 9** for details on heat dissipation.

CAUTION

When batteries are installed in the UPS or are cabinet-mounted adjacent to the UPS unit, the battery—not the UPS—dictates the designed maximum ambient temperature.

Battery Location

Temperature is a major factor in determining battery life and capacity. Battery manufacturers recommend an operating temperature of 77°F (25°C). Ambient temperatures warmer than this reduce battery life; temperatures below this reduces battery capacity. In a typical installation, battery temperature should be maintained between 68°F and 86°F (20-30°C). Batteries should be placed where there are no main heat sources or air inlets to prevent portions of batteries from being either much warmer or much cooler than other parts of the batteries.

1.5 Mechanical Considerations

The NX is constructed with a steel frame and removable panels. Top and side panels are secured to the chassis by screws. The doors may be opened for access to power connections bars, auxiliary terminals blocks and power switches.

The UPS comes with an operator control panel, which provides basic operational status and alarm information. The cabinet houses both the power components and the internal batteries. Cooling is provided by internal fans. The unit sits on four casters. Adjustable leveling feet are provided to prevent the UPS from moving once it has been moved to its final position.

1.5.1 System Composition

A UPS system can comprise a number of equipment cabinets, depending on the individual system design requirements—e.g., UPS cabinet and External Bypass cabinet. In general, all cabinets used will be the same height and are designed to be positioned side-by-side to form an aesthetically appealing equipment suite.

Refer to **7.0 - Installation Drawings** for the positioning of the cabinets described below.

1.5.2 10-30kVA UPS

The 10-30kVA NX consists of a single cabinet housing the UPS and its internal battery string.

An extended battery option kit is available. This comprises a separate cabinet containing additional batteries that can be connected to the UPS to increase its total battery capacity (see **3.6 - External Battery Cabinet Installation**).

Maintenance Bypass-Transformer Cabinet options are available to:

- Provide an external wraparound maintenance bypass switch
- Change input voltage
- Change output voltage
- Provide three-wire input and four-wire output
- Provide load neutral isolation

For details on installing a Maintenance Bypass Cabinet or Transformer Cabinet, see **7.0 - Installation Drawings**.

1.5.3 Positioning the UPS

Choose a location for the UPS that offers:

- Easy connection to inputs, outputs and auxiliary equipment
- Enough space to service the UPS
- Air circulation sufficient to expel heat produced by UPS
- Protection against moisture and excessive humidity
- Protection against dust and other particulate matter
- Compliance with fire prevention regulations and practices
- Operating environment temperature of 68°F to 86°F (20°C to 30°C) for maximum battery efficiency

Considerations in Moving the NX

Ensure that the UPS weight is within the designated surface weight loading (lb./ft^2 or kg/cm^2) of any handling equipment. See **Table 9** for weights of various units.

To move the UPS and optional battery cabinets:

- The NX may be rolled on its casters when moving the unit a short distance. For longer distances, move the UPS with a forklift or similar equipment to ease the relocation and to reduce vibration.

The optional battery cabinets should be moved with a forklift or similar equipment.

WARNING

Ensure that any equipment that will be used to move the NX has sufficient lifting capacity. The NX weight ranges from 850 to 1400 lb. (386 to 635kg). See **Table 9** for details. The UPS presents a tipping hazard. Do not tilt the NX further than 15 degrees from vertical.

The UPS is fitted with casters—take care to prevent movement when unbolting the equipment from its shipping pallet. Ensure adequate personnel and lifting equipment are available when taking the NX off its shipping pallet. Do not tilt the unit more than 15 degrees from center.

WARNING

The casters are strong enough for movement across even surfaces only. Casters may fail if they are subjected to shock loading, such as being dropped or rolled over holes in the floor or obstructions. Such failure may cause the unit to tip over, injuring personnel and damaging the equipment.

Care must be taken when maneuvering units fitted with batteries. Keep such moves to a minimum. For further information, see **Battery Cabinet Precautions on page 2**.

Leveling in Final Position

When the equipment has been finally positioned, ensure that the adjustable leveling feet are set so that the UPS will remain stationary and stable (see **7.0 - Installation Drawings**).

1.5.4 Clearances

There are no ventilation grilles on the sides or rear of the UPS. The sides must be accessible during installation. After installation, the unit may be placed with the rear against a wall and optional cabinets on either side.

To enable routine tightening of power terminations within the UPS, make sure there is sufficient clearance in front of the NX to permit free passage of personnel with the door fully opened.

Leave a minimum of 2 ft. (610mm) between the top of the UPS and the ceiling to permit adequate air circulation above the unit. Liebert recommends against using air conditioning or other systems that blow air onto the top of the unit.

1.5.5 Floor Installation

The diagrams in **7.0 - Installation Drawings** show the location of holes in the base plate for bolting the equipment to the floor. An optional anchoring kit is available. For information, see your local Liebert representative.

If the equipment is to be placed on a raised floor, it should be mounted on a pedestal that will support the equipment point loading. Refer to the bottom view in **Figure 23** to design this pedestal.

1.5.6 Cable Entry

Cables can enter the NX from the top, through the bottom or through the left side. Cable entry is made possible by removing the left-side panel or a metal plate attached to the top or bottom of the UPS.

Connecting cables to the NX requires that the UPS be accessible from the left side to allow personnel to complete the connections and make necessary adjustments. After installation is complete, the NX may be serviced from the front.

NOTE

When installing the UPS, the customer must provide a disconnect at the output of the UPS.

1.5.7 Optional Cabinets

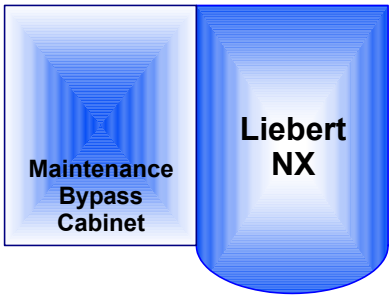
If your NX installation includes a Maintenance Bypass Cabinet, the NX must be positioned to allow the Maintenance Bypass Cabinet to be bolted to **left** side of the NX (see **Figure 1**). Cables from the Maintenance Bypass Cabinet must be brought through the bottom side of the NX for connection.

The Maintenance Bypass Cabinet must be cabled and bolted to the NX **before** the UPS and bypass cabinet are moved into their final position. Connect the input wiring to the Maintenance Bypass Cabinet ONLY after the units are connected and positioned.

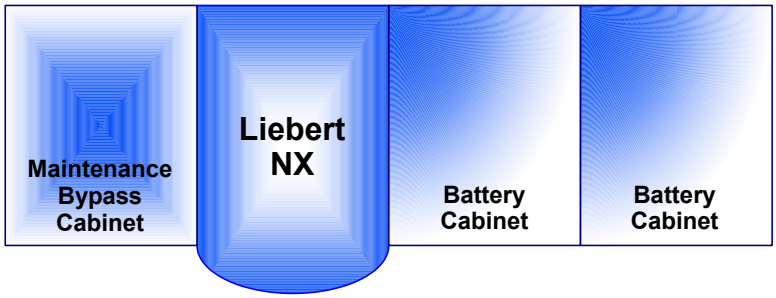
Battery cabinets may be bolted to either side of the NX, unless used in configurations that include a Maintenance Bypass Cabinet; refer to **1.5.7 - Optional Cabinets**.

Figure 1 Cabinet arrangement

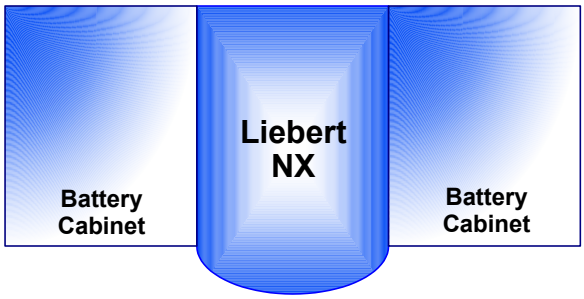
ALL UNITS VIEWED FROM ABOVE



NX connected only to MBC
(MBC must be on left side of the NX)



NX connected to Maintenance Bypass Cabinet and Battery Cabinets
(MBC must be on left side of the NX)
(Battery Cabinets may be on either side of the NX)



NX connected to Battery Cabinets
(Battery Cabinets may be on either side of the NX)

2.0 ELECTRICAL CONNECTIONS

The UPS requires both power and control cabling once it has been mechanically installed. All control cables must run separate from power cables in metal conduits or metal ducts that are electrically bonded to the metalwork of the cabinets to which they are connected.

WARNING

Before connecting input power to the NX, ensure that you are aware of the location and operation of the overcurrent protection devices that connect the UPS input/bypass supply to the power distribution panel.

De-energize and lockout or tagout all incoming high- and low-voltage power circuits before installing cables or making any electrical connections.

For cable entry information, refer to **1.5.6 - Cable Entry**.

2.1 Power Cabling

2.1.1 Cable Rating

The main factors affecting the choice and size of cable are voltage, current (also taking into account overcurrent), room temperature and conditions of installation of the cable.

The power cables of the system must be sized with respect to the following description:

- **UPS input cables** - The UPS input cables must be sized for the maximum input current, including the maximum battery recharge current, given in **Table 20**, with respect to the unit rating and the input AC voltage.
- **UPS bypass and output cables** - The bypass and output cables must be sized for the nominal output current, given in **Table 20**, with respect to the unit rating and the output AC voltage.
- **Battery cables** - Each UPS unit has its own internal batteries factory-wired. If connecting an external battery cabinet, the battery cables must be sized for the battery discharge current at the end-of-discharge voltage, as given in **Table 20**, with respect to the unit rating.

NOTE

Table 20 *gives nominal currents for determining the size of UPS power cables. Other important factors to consider include cable route length and coordination with protective devices.*

The power cables can be sized to suit the UPS unit rating according to **Table 20**.

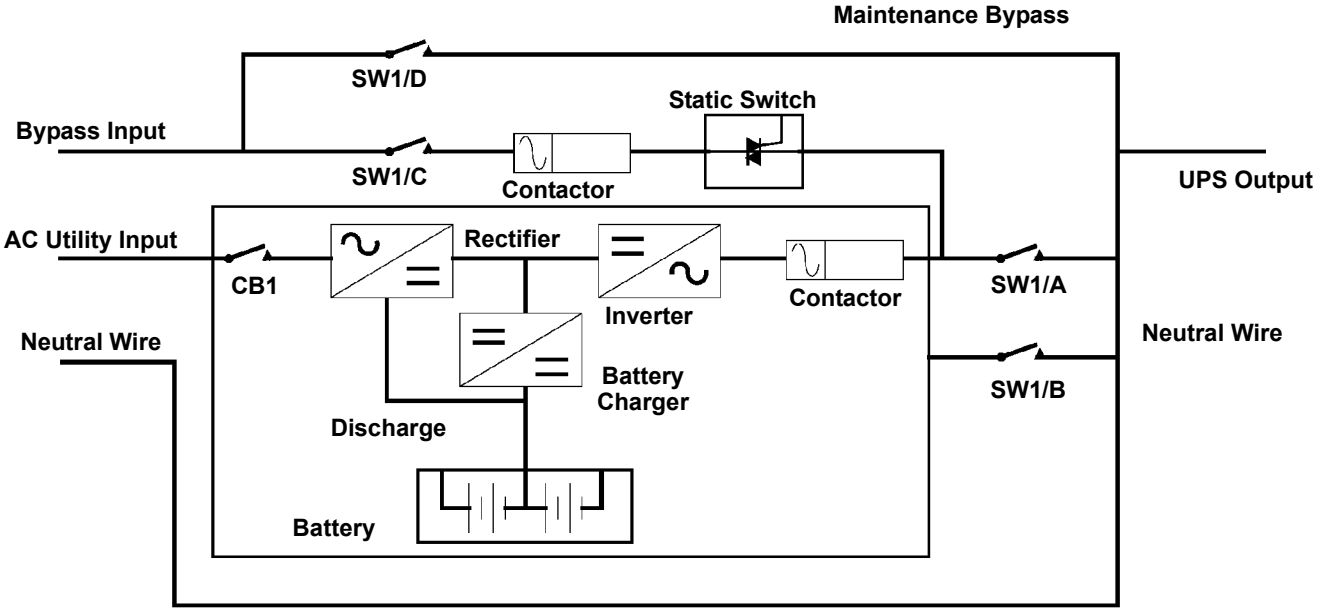
Lug Size and Torque Requirements

Refer to **Table 18** for lug size and torque requirements.

2.1.2 UPS Input Configuration

Figure 2 illustrates the NX in a split bypass (dual-input) configuration. In this configuration the Static Bypass and the Maintenance Bypass lines are supplied from a separate feed from the Main input. Both sources must be protected externally with properly sized protective devices. By default, the unit ships with internal links installed between the Bypass input and Main input (Single Input configuration). To wire the unit as a dual input UPS, remove the links and wire the bypass to the input bus bars, then wire the Main input directly to CB1 (see **Figure 3**).

Figure 2 Single module block diagram (dual input configuration)



2.1.3 Cabling Guidelines

The following are guidelines only and are superseded by local regulations and codes of practice where applicable.

1. Take special care when determining the size of the neutral cable, as current circulating on the neutral cable may be greater than nominal current in the case of non-linear loads. Refer to the values in **6.4 - UPS Electrical Characteristics**.
2. The ground conductor should be sized according to such factors as the fault rating, cable lengths and type of protection. The ground cable connecting the UPS to the main ground system must follow the most direct route possible.
3. Consider using paralleled smaller cables for heavy currents—this can ease installation.
4. When sizing battery cables, a maximum voltage drop of 4VDC is permissible at the current ratings in **Table 20**. For terminal connection sizing, see **Table 20**.
5. In most installations, especially parallel multi-module systems, the load equipment is connected to a distribution network of individually protected busbars fed by the UPS output, rather than connected directly to the UPS itself. When this is the case, the UPS output cables can be rated to suit the individual distribution network demands rather than being fully load-rated.

NOTE
If more load is added to the distribution panel, the unit's cabling must be resized.

6. When laying power cables, do not form coils; this will help avoid increasing formation of electromagnetic interference.

NOTE
Left-side access is required when making power connections. Cable connections must be made before a cabinet is attached to the left side of the NX or before the UPS is placed where another obstruction, such as a wall, is against the NX's the left side.

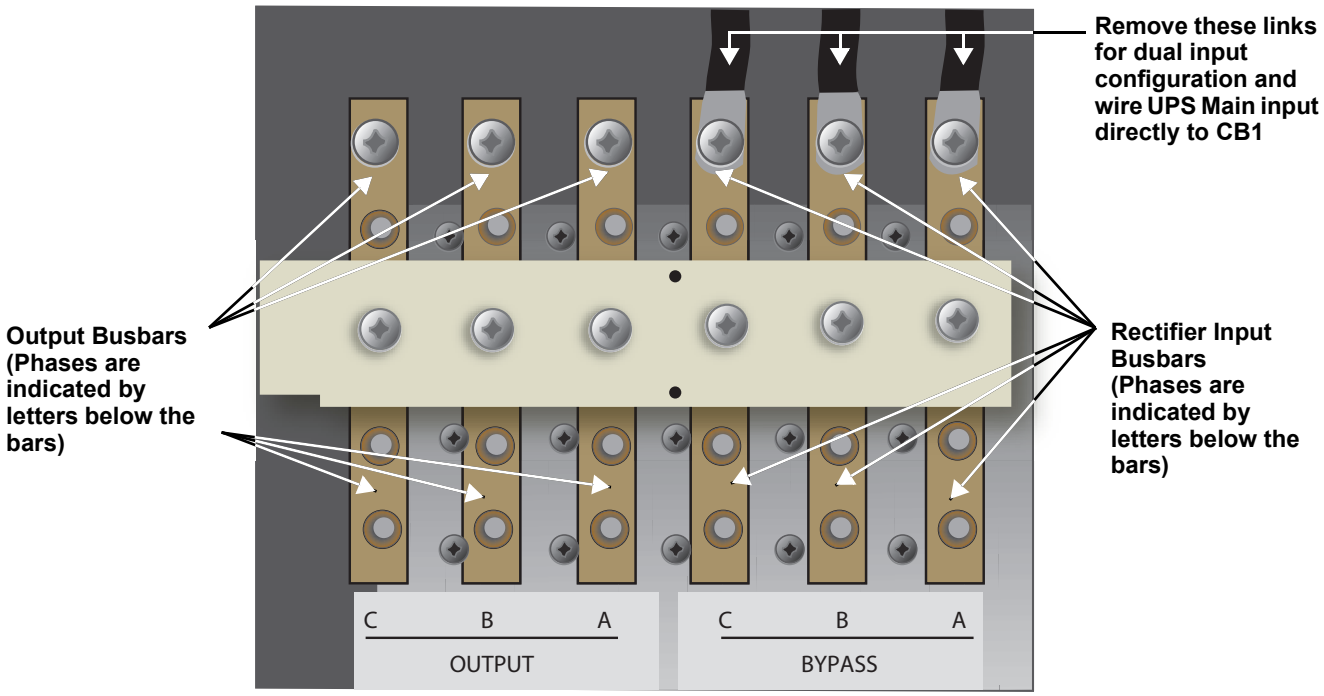
2.1.4 Cable Connections

The rectifier input, bypass and output are accessible from the left side of the unit for installation. All require lug type terminations. They are connected to busbars on the left side of the NX and below the switch, as shown in **Figure 3**. These busbars are accessible when the left side panel is removed. Busbars to connect external batteries are accessible from the front of the UPS.

NOTE

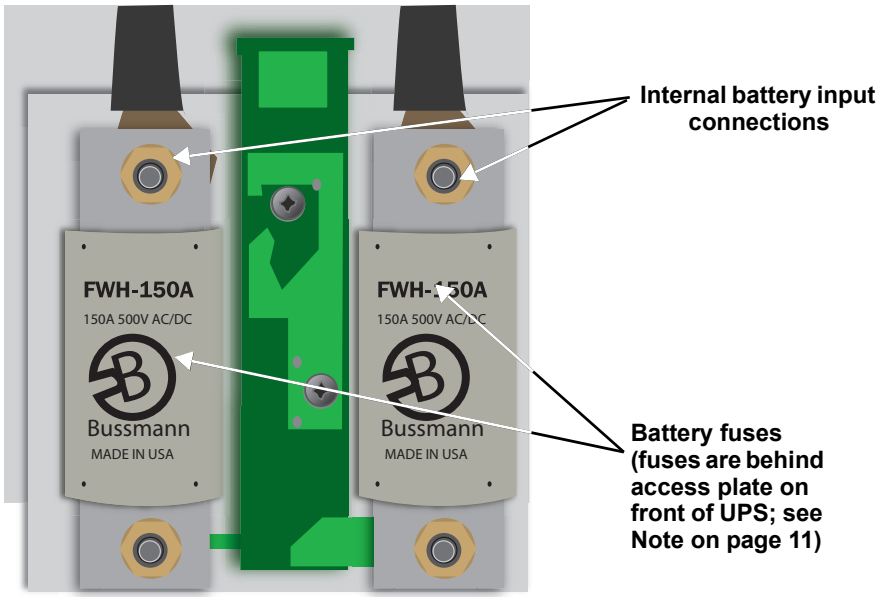
External battery connection access requires removal of a protective panel on the lower front of the UPS to the left of the bottom two battery shelves.

Figure 3 Input busbars



The internal batteries are connected with Anderson connectors inside the battery compartment. The batteries are connected to fuses to protect the NX and connected equipment (see **Figure 4**).

Figure 4 Battery fuses and connections



2.1.5 Safety Ground

The safety ground busbar is located below the neutral input and output busbars as shown in **Figure 5** below. The safety ground cable must be connected to the ground busbar and bonded to each cabinet in the system.

All cabinets and cable conduit should be grounded in accordance with local regulations.

WARNING

Failure to follow proper grounding procedures can result in electric shock hazard to personnel or the risk of fire, should a ground fault occur.

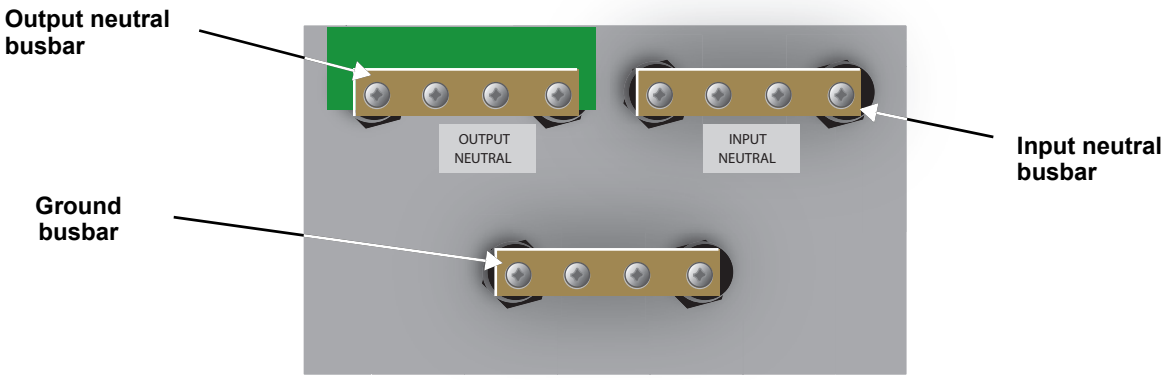
NOTE

Proper grounding significantly reduces problems in systems caused by electromagnetic interference.

NOTE

The ground and neutral busbars are accessible when the left protective cover plate is removed. Cable connections must be made before a cabinet is attached to the left side of the NX or before the UPS is placed where another obstruction, such as a wall, is against the NX's the left side.

Figure 5 Ground and neutral busbar connections



2.1.6 Protective Devices

For safety, it is necessary to install circuit breakers in the input AC supply and external battery battery cabinets, external to the UPS system. Given that every installation has its own characteristics, this section provides guidelines for qualified installation engineers with knowledge of operating practices, regulatory standards and the equipment to be installed.

UPS Rectifier and Bypass Input Supply

- **Protection from excessive overcurrents and short circuits in power supply input**

  External overcurrent protection for the AC output circuit is to be provided. See **6.4 - UPS Electrical Characteristics** and **Table 11** for overload capacity.

  High-speed fuses and SCRs are used for internal battery circuit overcurrent protection. When an external battery supply is used, overcurrent protection for the battery circuit is to be provided by the customer.
- **Dual Input**

  When wiring the UPS with dual inputs, the Rectifier input and the Bypass input must be protected separately. Size the breakers according to the input currents shown in **Table 20**.

System Output

When using an external distribution panel for load distribution, the output neutral and input neutral must be separated at the input to the UPS.

2.1.7 Cabling Procedure

CAUTION

The operations described in this section must be performed by authorized electricians or qualified technical personnel. If you have any difficulties, contact your local Liebert representative or Liebert Global Services.

NOTE

Hydraulic pressure pliers, combinative tools and piston ring pliers should be used to connect AC wiring.

Once the equipment has been positioned and secured for operation, and the battery and ground collars have been connected (see **2.1.4 - Cable Connections**), connect the power cables as described below. (Study the reference drawing in **7.0 - Installation Drawings**.)

1. Verify that all incoming high and low voltage power circuits are de-energized and locked out or tagged out before installing cables or making any electrical connections.
2. Remove the left side panel to gain access to the connections bars.
3. Connect the safety ground and any necessary bonding ground cables to the copper ground busbar located on the bottom of the equipment below the power connections. All cabinets in the UPS must be connected to the user's ground connection.

NOTE

The grounding and neutral bonding arrangement must comply with the National Electrical Code and all applicable local codes.

4. Identify and make power connections with incoming cables according to **Steps 5** through **11**.

Common Input Connections

5. For common bypass and rectifier inputs, connect the AC input supply cables between the power distribution panel and the UPS input busbars (A-B-C terminals) and tighten the connections to 44 lb-in. (5 N-m) (M6 bolt).
6. The input neutral cable must be connected to the input neutral busbar (N). See **Figure 5**.

Dual Input Connections

7. For bypass connect the AC input supply cables between the power distribution panel and the UPS input busbars (A-B-C terminals) and tighten the connections to 44 lb-in. (5 N-m) (M6 bolt).
8. For Rectifier Input connect AC input supply cables between the power distribution panel and the UPS input circuit breaker (A-B-C terminals)
9. The bypass input neutral cable must be connected to the input neutral busbar (N). See **Figure 5**.

Output System Connections—Ensure Correct Phase Rotation

10. Connect the system output cables between the UPS output busbars (A-B-C N terminals) and the critical load and tighten the connections to 44 lb-in. (5 N-m) (M6 bolt).

WARNING

If the load equipment will not be ready to accept power on the arrival of the commissioning engineer, then ensure that the system output cables are safely isolated.

Internal UPS Battery Connections

The UPS internal batteries will be connected at the factory, EXCEPT the Anderson connections between the shelves and to the fuses.

WARNING

The DC bus is live when this internal battery connection is made. This connection is to be performed ONLY by Liebert Global Services at startup.

Observe the battery cable polarity. Be sure that the battery connector is made with the correct polarity.

11. Refit all protective covers removed for cable installation

2.2 Control Cables

2.2.1 Monitor Board Features

Based on your site's specific needs, the UPS may require auxiliary connections to manage the battery system (external battery circuit breaker, battery temperature sensor), communicate with a personal computer or provide alarm signaling to external devices or for Remote Emergency Power Off (REPO). The monitor board, arranged for this purpose, is located on the rear of the operator access door. The main features are:

- Input and Output dry contacts signal (one pair of contacts of relay)
- Emergency Power Off control (EPO)
- Environmental parameter input interface
- User communication (for data setting and user background monitor)
- Intellislot™ interface
- Modem interface
- Temperature detect interface

Figure 6 shows the relationship and connection between the monitoring (U2) board and other boards in the UPS.

Figure 6 Monitor board U2

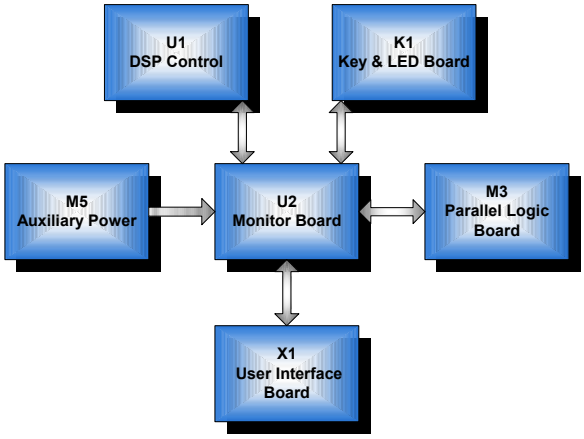
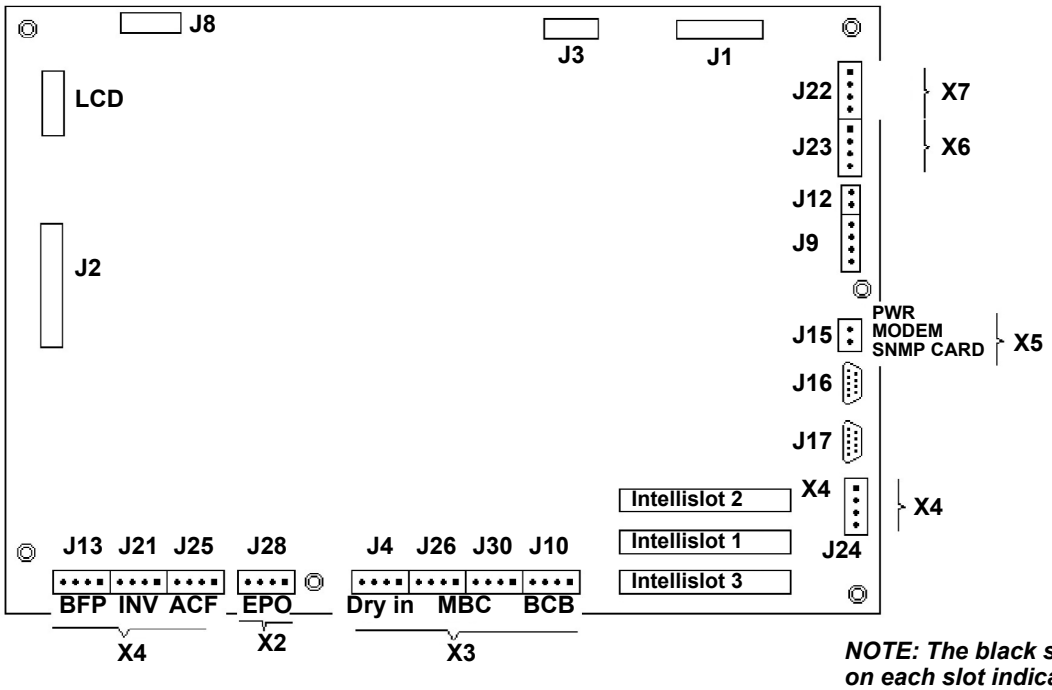


Figure 7 Auxiliary terminal block detail



NOTE: The black square (■) on each slot indicates Pin 1.

2.3 Dry Contacts

The UPS provides input dry contacts and output dry contacts.

2.3.1 Input Dry Contacts

There are several input dry contacts at the X3 slot.

Figure 8 Input dry contacts

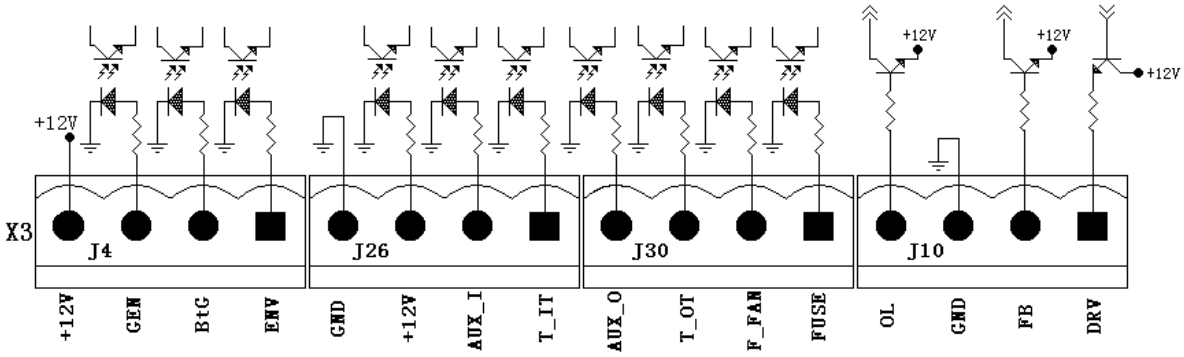


Table 1 Input dry contacts at X3

Position	Name	Description
J4.1	ENV[3]	Battery Room Alarm (N.C.)
J4.2	BtG	Battery Ground Fault Detection (N.C.)
J4.3	GEN[1,2]	Generator Join Detection (N.O.)
J4.4	+12V	+12V Power

1 - Must be configured by configuration software before becoming active.
2 - When activated, the charger current can be limited, via software, to a percentage of the full charger current (0-100%).
3 - Activating this feature turns the battery charger off.

2.3.2 Maintenance Bypass Cabinet Interface

J26 and J30 are the MBC interface.

Table 2 Maintenance bypass cabinet interface

Position	Name	Description
J26.1	T_IT[1]	Input transformer over temperature (N.C.)
J26.2	AUX_I	Reserved
J26.3	+12V	+12V Power
J26.4	GND	Power Ground
J30.1	FUSE	Reserved
J30.2	F_FAN	Fan Fail Alarm (N.C.)
J30.3	T_OT[1]	Output Transformer Overtemperature (N.C.)
J30.4	AUX_O	Reserved

1 - Must be configured by software before becoming active

NOTE
All auxiliary cables of terminal must be double insulated. Wire should be 16-20AWG stranded.

2.3.3 BCB Box Interface

J10 is the BCB box interface.

Table 3 BCB box interface

Position	Name	Description
J10.1	DRV	BCB Driver Signal - Output (N.O.)
J10.2	FB	BCB Contact State - Input (N.O.)
J10.3	GND	Power Ground
J10.4	OL	BCB On-Line - Input - This pin will become active when BCB interface is connected. (N.O.)

NOTE

All auxiliary cables of terminal must be double insulated. Wire should be 16-20AWG stranded.

2.3.4 Output Dry Contacts

There are three output dry contact relays at the X1 slot (see **Figure 9** and **Table 4**).

Figure 9 Output dry contacts and EPO wiring

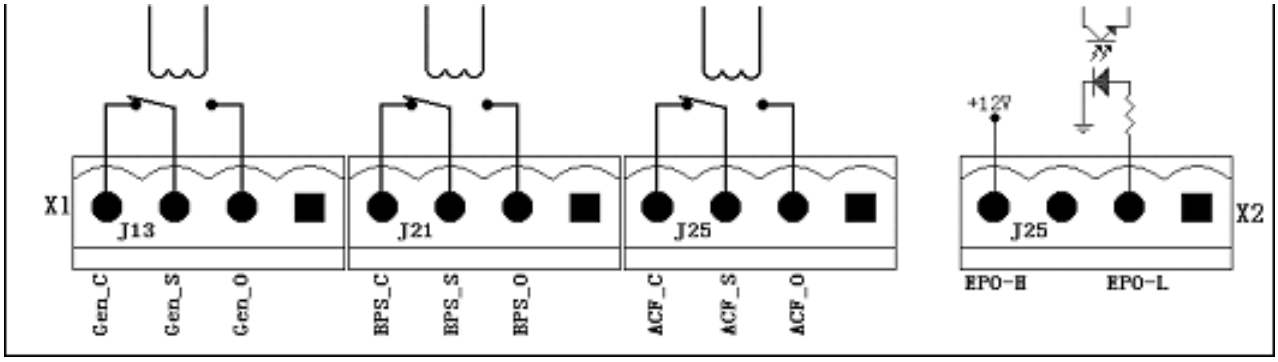


Table 4 Output dry contact relays

Position	Name	Description
J13.2	Gen_O	Generator Start Relay (N.O.)
J13.3	Gen_S	Generator Start Relay Center
J13.4	Gen_C	Generator Start Relay (N.C.)
J21.2	BPS_O	Bypass Mode Relay (N.O.)
J21.3	BPS_S	Bypass Mode Relay Center
J21.4	BPS_C	Bypass Mode Relay (N.C.)
J25.2	ACF_O	Main Input Fault Relay (N.O.)
J25.3	ACF_S	Main Input Fault Relay Center
J25.4	ACF_C	Main Input Fault Relay (N.C.)

NOTE

All auxiliary cables of terminal must be double insulated. Wire should be 16-20AWG stranded.

2.3.5 EPO Input—Optional

The UPS has an Emergency Power Off (EPO) function that operates by a button on the control panel and a dry contact. The EPO button is under a hinged, clear plastic shield.

The X2 slot, shown in **Figure 9**, is the EPO input interface. It is active when shorted from EPO-L to EPO-H.

If an external Emergency Stop facility is required, it is connected terminals EPO-L to EPO-H of the auxiliary terminal block (X2). It also is connected to the Normally Open remote stop switch between these two terminals using shielded cable (see **Figure 9** and **Table 5**). If this function is not used, terminals EPO-L to EPO-H must be opened.

Table 5 EPO input contact relays

Position	Name	Description
J28.2	EPO_L	Emergency Power Off Low
J28.4	EPO_H	Emergency Power Off High

NOTE

The Emergency Stop action within the UPS shuts down the rectifier, inverter and static bypass. It does not internally disconnect the input power supply.

2.4 UPS Startup

The NX must be fully installed and commissioned before startup, and external power isolators must be closed. Once those general conditions are met, the UPS may be started.

2.4.1 Startup Procedure

To start the UPS from a fully powered-down condition:

1. Open the UPS door to gain access to the main power switches.

WARNING

During this procedure the output terminals will become live.

If any load equipment is connected to the UPS output terminals, please check with the load user and ascertain whether it is safe to apply power to the load. If the load is not ready to receive power, then ensure that it is safely isolated from the UPS output terminals.

CAUTION

Do not operate the rotary switch too fast. Always wait at least three seconds when rotating the switch from one position to another.

2. Turn the rotary switch to TEST.

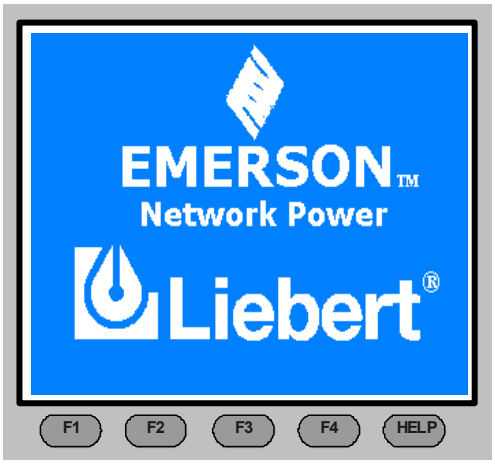
3. Close CB1.

   The bypass contactor (M2) closes automatically and the LCD begins to show startup screens.

   The Rectifier indicator flashes green while the rectifier is starting up. It stops flashing and becomes solid green about 30 seconds after the rectifier enters the normal operation state.

   After initialization, the bypass static switch closes. Because output switch SW1-A is still open, the UPS channels power through Maintenance Bypass Supply line (SW1-D). The bypass indicator extinguishes, provided that the bypass is normal.

   The opening display is shown at right.

   The UPS Mimic display indicators will be:

Indicator	State
Rectifier	Off
Battery	Off
Bypass	Off
Inverter	Off
Load	Off
Alarm	Off

WARNING

Do NOT turn the rotary switch until the rectifier indicator stops flashing green.

4. Turn the rotary switch to BYPASS.

Indicator	State
Rectifier indicator	Green
Battery indicator	Off
Bypass indicator	Green
Inverter indicator	Off
Load indicator	Green
Alarm indicator	Amber

   The maintenance switch SW1-D opens and output switch SW1-A closes. The UPS powers from static bypass instead of from maintenance bypass. The bypass and load indicators turn on. The design of the rotary switch ensures uninterrupted output.

5. Turn the rotary switch to NORMAL, then press the INVERTER ON control button for 2 seconds.

   The inverter will start and the inverter indicator will flash green. After the inverter is ready, the UPS transfers from bypass to inverter, the bypass indicator turns off and the inverter and load indicators turn on.

   The UPS is operating normally. The UPS Mimic display indicators will:

Indicator	State
Rectifier indicator	Green
Battery indicator	Off
Bypass indicator	Off
Inverter indicator	Green
Output indicator	Green
Alarm indicator	Green

2.5 Switching the UPS from Normal to Maintenance Bypass

Follow the procedure below to transfer the load from the inverter output to the Maintenance Bypass line of the UPS.

CAUTION

Before performing this operation, read the messages on the LCD to be sure that bypass supply is regular and the inverter is synchronous with it. If those conditions are not present, there is a risk of a short interruption in powering the load.

This procedure assumes that UPS is operating normally.

1. Press the INVERTER OFF button on the right side of the operator control panel for longer than 2 seconds.

   The Inverter indicator will turn off and the alarm indicator (6) will turn amber and an audible alarm will sound. The load will transfer to bypass and the inverter will shut off.

NOTE

Pressing the Alarm Silence Switch cancels the audible alarm, but leaves the warning message displayed until the appropriate condition is rectified.

2. Open the UPS door to gain access to the main power switches, SW1 and CB1.
3. Turn the rotary switch to BYPASS position. The UPS Bypass Static Switch still supply power to load.
4. Turn the rotary switch to TEST. The load is now on maintenance bypass.
5. Turn the rotary switch to MAINT.
6. Open rectifier switch CB1. All operator indicators and messages will turn off as the utility driven internal power supplies decay. The unit will power down, but the load will continue to be supplied by the manual Maintenance bypass.

WARNING

Wait 5 minutes for the internal DC busbar capacitors to discharge.

WARNING

Even with the UPS in maintenance bypass and “Off,” portions of the unit are still energized. Service must be performed only by qualified personnel.

CAUTION

The load equipment is not protected from normal supply aberrations when operating in the maintenance bypass mode.

2.6 Powering Down the UPS

To power down the UPS completely, follow the procedures in **2.5 - Switching the UPS from Normal to Maintenance Bypass**.

To completely isolate the UPS from the AC supplies, the main external power input isolator (both isolators, where separate supplies are provided for rectifier and bypass) should be opened (see **Figure 14**).

WARNING

To prevent injury to personnel, lockout or tagout the service supplies.

3.0 BATTERY INSTALLATION

3.1 Introduction

Liebert recommends that the batteries in external cabinets match the internal batteries be the same type used internally in the NX.

If using multiple sets of batteries connected in parallel to provide the required battery backup run times, fit each set with an isolating device to permit working on one of the battery sets while leaving the others in service and providing backup protection.

When replacing batteries, replace with the same manufacturer and type, or equivalent. See your Liebert representative for a list approve batteries.

NOTE
The NX, as shipped, has 24 12-volt batteries installed internally in each unit.

3.2 Safety

Special care should be taken when working with the batteries associated with the NX system equipment. When all batteries are connected together, the battery terminal voltage will exceed 324V and is POTENTIALLY LETHAL.

WARNING
The NX's internal batteries are connected and energized even if the UPS is turned Off. To minimize the risk of injury, a qualified service person should disconnect internal batteries before any maintenance is performed on the unit.

The center of the battery is connected to the neutral of the UPS and is grounded.

A battery can present a risk of electrical shock and high short circuit current. The following precautions should be observed when working on batteries:

- Remove watches, rings and other metal objects.
- Use tools with insulated handles.
- Wear rubber gloves and boots.
- Do not lay tools or metal parts on top of batteries.
- Disconnect charging source prior to connecting or disconnecting battery terminals.

3.3 UPS Batteries

The NX's internal batteries are fully charged before the unit is shipped. During storage and transportation, some charge is lost. All batteries should be recharged before use. The battery charger works only when the NX is connected to input power and turned On.

3.4 Temperature Considerations

Battery performance depends on the battery temperature.

When batteries are installed in the same room as the UPS, the battery dictates the designed maximum ambient temperature, not the UPS. In the case of valve-regulated batteries, for example, the ambient room temperature should be kept between 68°F and 86°F (20-30°C), not between 32°F and 104°F (0-40°C), which is the specified operating temperature range for the UPS.

NOTE
Full safety instructions concerning the use and maintenance of UPS batteries are provided in the appropriate battery manufacturer's manuals, available on the manufacturer's Web site.

The battery safety information contained in this section relates to key considerations that must be taken into account during the installation design process and might affect the design outcome, depending on your installation.

3.5 Battery Protection

3.5.1 Battery Undervoltage Pre-Warning

Before the end of discharge, the NX displays a battery undervoltage pre-warning. After this pre-warning, the battery has the capacity for 5 minutes discharging with full load (default time). The NX can be user-configured to display this warning from 3 to 60 minutes before end-of-discharge.

3.5.2 Battery End-of-Discharge (EOD) Protection

If the battery voltage is lower than the end-of-discharge voltage, the battery converter will be shut down.

3.5.3 Battery Fuse-Blow Warning

Battery current protection is provided by the battery fuses FU7 and FU8. If a battery fuse blows, the NX displays the battery fuse-blow warning and the battery converter will be shut down.

NOTE
All equipment servicing procedures must be carried out only by trained personnel.

3.6 External Battery Cabinet Installation

The following notes, in conjunction with the diagrams (**Figure 10** through **12**), illustrate the broad principles to be followed when fitting and connecting the majority of battery cabinet installations.

When installing an external battery cabinet, the customer must provide overcurrent protection. See **Table 20** for sizing of protection devices.

3.6.1 Fitting the Batteries

NOTE
*When using an external battery supply that is not provided with the UPS, please make reference to the battery manufacturer's installation manual for battery installation and maintenance instructions, available on the manufacturer's Web site. When replacing batteries, Liebert recommends that the batteries in external cabinets be the same type used internally in the NX. See **Table 10** for a list of batteries that are approved for use with this product.*

1. Leave at least 3/8 in. (10mm) on all vertical sides of the battery to permit free air circulation around the batteries.
2. Allow adequate clearance between the top of the batteries and the underside of the shelf above for monitoring and servicing the batteries.
3. When installing the batteries, always work from the bottom shelf up to prevent raising the center of gravity, which could cause a tip-over hazard.

3.6.2 Connecting the Batteries

If the NX battery cabinets are installed on a raised floor, the battery power cables and circuit breaker control cables may be routed to the UPS cabinet via the floor of the cabinet (bottom entry).

NOTE
If a battery breaker cabinet is not used, the customer must provided an isolating disconnect device on the output of the battery cabinet.

If the NX battery cabinets are installed adjacent to one another on a solid floor, these cables may be passed between the cabinets through lifting slots in the lower sides of the cabinets.

Liebert recommends connecting the batteries in the following sequence:

1. Connect cables between batteries on each individual tray.
2. Attach cables connecting the battery trays
3. Connect the cables to the circuit breaker.

An insulating shroud should be fitted to each terminal after its connection has been made.

When connecting the cables between the batteries to the circuit breaker, always connect the circuit breaker end of the cable first.

Figure 10 Narrow battery cabinet, 27 in. (690mm) - rear view

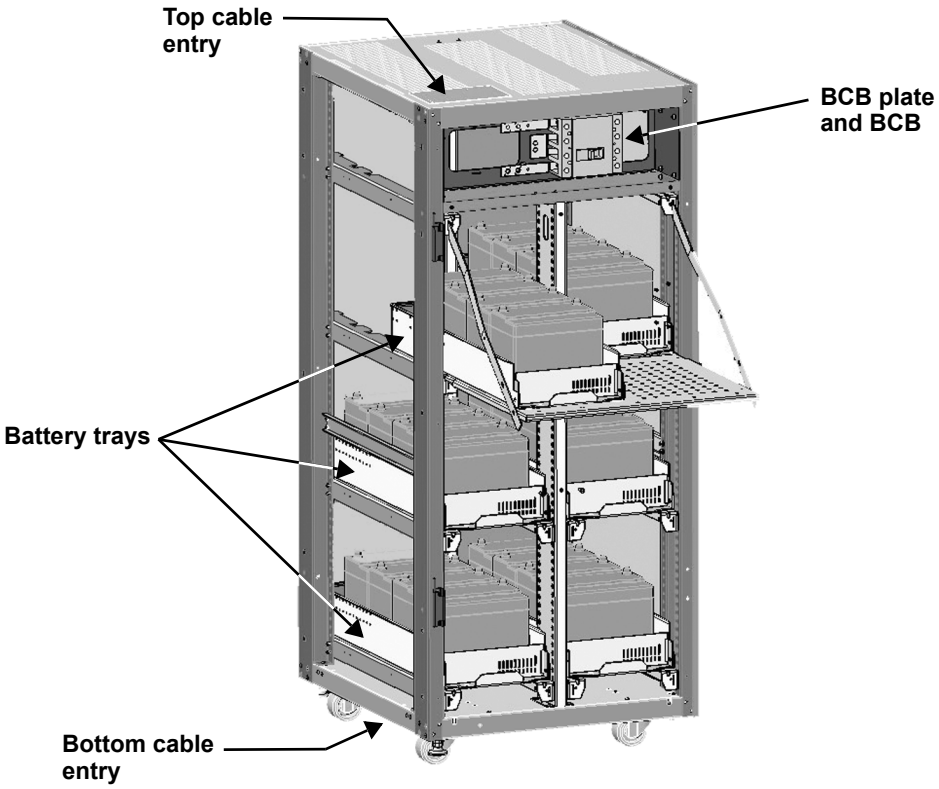


Figure 11 Wide battery cabinet, 57 in. (1488mm) - front view

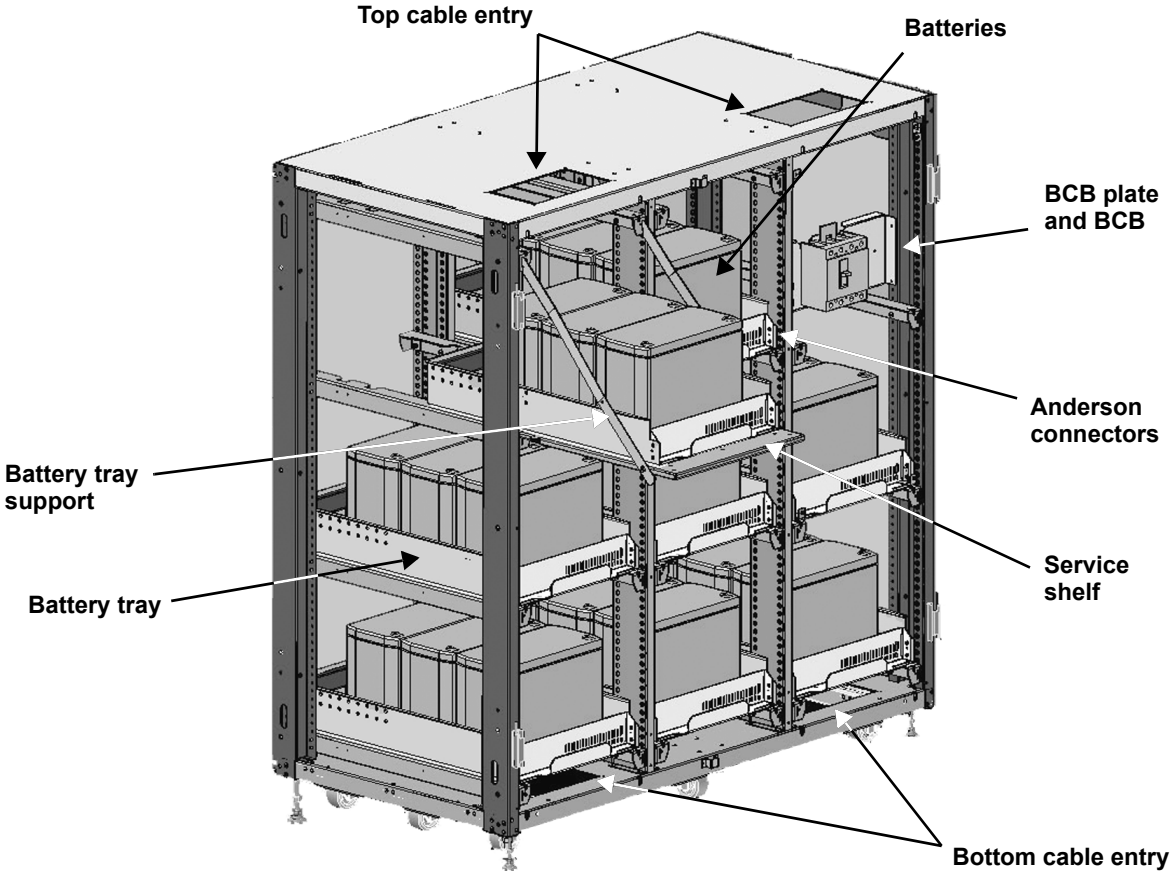
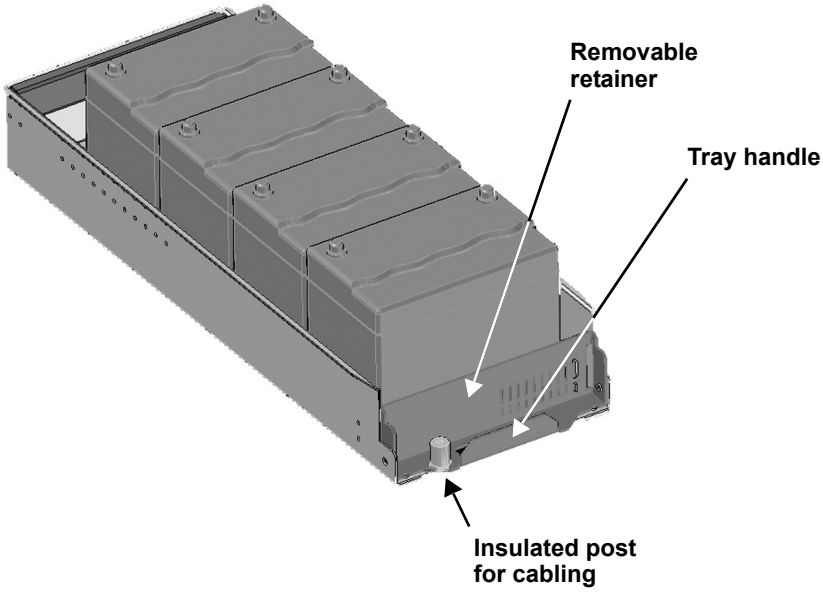


Figure 12 Battery cabinet—details



3.7 Matching Battery Cabinets

Two sizes of optional battery cabinets are available. Refer to **Figures 10** and **11**. The same model battery cabinet may be installed in parallel in multiple cabinet strings for additional capacity. Battery run time depends on the cabinet model, the number of cabinets and the load on the UPS.

Handling—The battery cabinet has casters to facilitate movement over short distances. The bottoms of the battery cabinets are reinforced to permit movement by forklift over longer distances.

Inspection—Remove all panels and visually inspect the batteries, bus connections, and cabinet for any damage. Exercise caution; voltage is present within the battery cabinet even before installation. If there are signs of damage, do not proceed. Call Liebert Global Services at 1-800-542-2378.

Storage—The batteries can be stored for up to six months without appreciable deterioration. If planning to store a battery cabinet for longer than six months or at temperatures higher than 77°F (25°C), contact Liebert Customer Service for recommended precautions.

3.7.1 Installation Considerations

The battery cabinet(s) can be located conveniently next to each UPS module, and are also available in stand-alone configurations with painted side panels. The front access design eliminates side and rear service clearance requirements. Refer to **Table 23** for battery cabinet dimensions and weights.

Environment—Install the battery cabinet in a clean, dry environment. The recommended temperature range for optimum performance and lifetime is 68 to 86°F (20-30°C).

Position—Liebert battery cabinets come in versions specific to either the left or right side of the UPS. Control wires and power cables are cut to different lengths for the different versions. For systems with multiple battery cabinets, the cabinets have different part numbers indicating placement of the cabinet relative to the UPS. An “A” or “1” designation means the cabinet is adjacent to the UPS. Cabinet “B” will be adjacent to cabinet “A.” If the system includes a matching maintenance bypass cabinet (MBC), the MBC should be mounted to the left of the UPS (nearest the busbars) and the battery cabinet(s) should be installed to the right of the UPS. Likewise left-side placement of the battery cabinet is preferable.

Service Clearance—Allow front access to the battery cabinet at all times for maintenance and servicing. Electrical codes require that the battery cabinet be installed with no less than 3 feet (1m) of clearance at the front of the cabinet when operating. Side and rear panels do not require service clearance.

Cables—Cables may be run between the cabinets through cutouts in the top of the cabinet, eliminating the need for external conduit runs. Route cables before moving cabinets into final position for bolting together. Remove top panels for access, if required. No top or bottom entry cables are required, except for remotely located cabinets which require conduits. Refer to **Figures 10** and **11**.

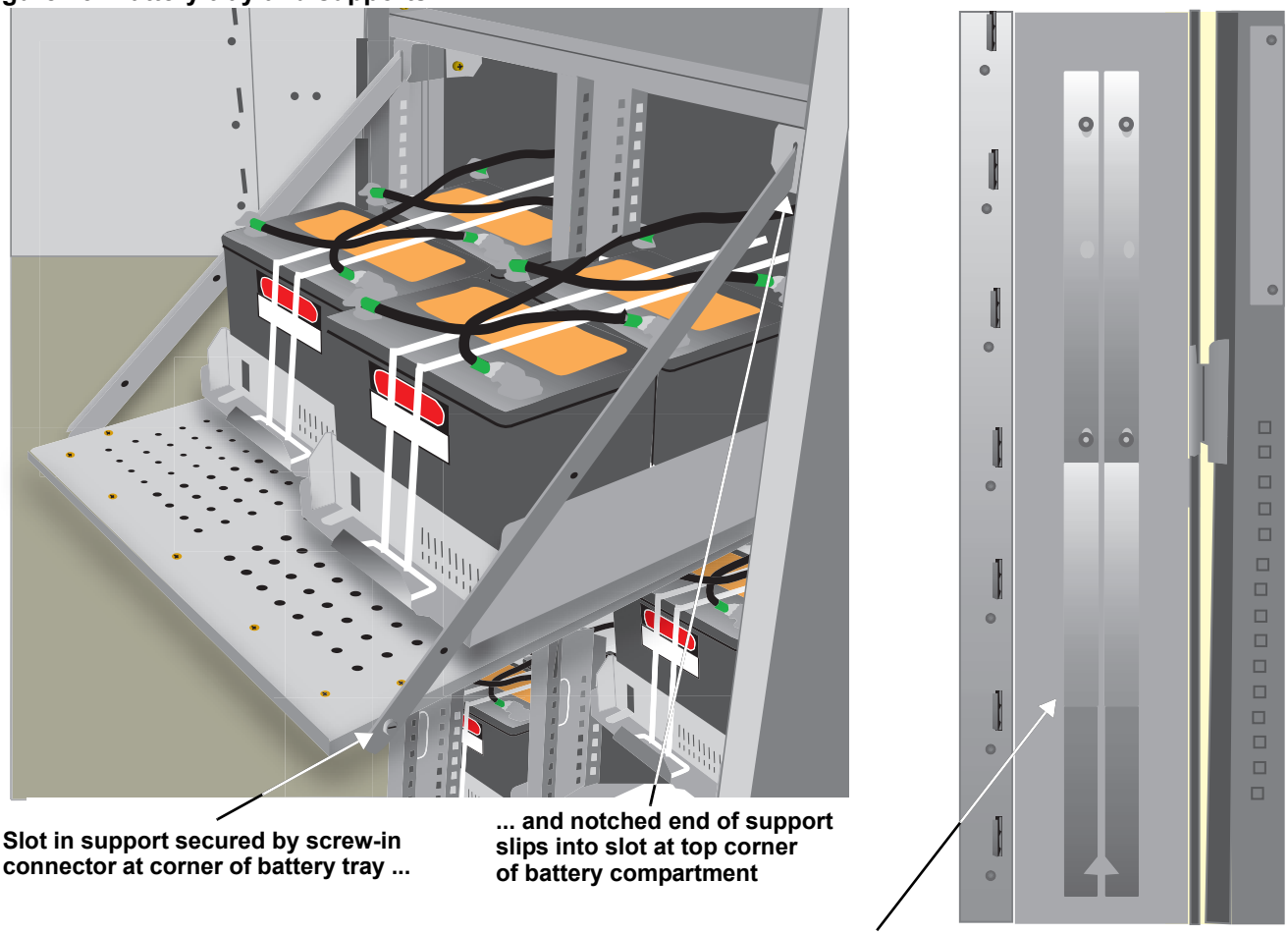
Bolt-On Cabinets—Matching battery cabinets are designed to bolt onto the side of the UPS module cabinet. Use bolts that ship with each unit to connect cabinet frames at posts, two places in the front and two places in the rear.

Software—The number of battery cabinets must be noted when performing initial startup and setup using the configuration software.

Casters and Leveling Feet—The leveling feet are not designed to bear the full weight of the cabinet. Lower the feet until they are finger-tight in contact with the floor. Then tighten a small amount with a wrench (less than two turns) to give a good friction fit. When mounting the battery cabinet on seismic stands, ensure that the casters are bearing the weight of the cabinet.

Battery Support Tray—Be sure to connect the battery tray support to the front of the cabinet before sliding a battery tray out for connection or service. Without the support, the battery tray may fall out of the cabinet. See **Figure 13** for details.

Figure 13 Battery tray and supports



3.7.2 Connecting the Battery Cabinet to the UPS

After the battery cabinet equipment has been positioned and secured for operation and the batteries have been connected, connect the power cables as described below. (See **Figure 30**.)

1. Verify that all incoming high and low voltage power circuits are de-energized and locked out or tagged out before installing cables or making any electrical connections.
2. Remove the UPS left side panel to gain access to the connection bars.
3. Remove the battery cabinet front panel to gain access to the connection bars.
4. Connect the safety ground and any necessary bonding ground cables to the copper ground busbar. (example: UPS located on the bottom of the equipment below the power connections).

   All cabinets in the UPS system must be connected to the user's ground connection.

NOTE

The grounding and neutral bonding arrangement must be in accordance with the National Electrical Code and all applicable local codes.

5. Connect the system battery cables from the UPS battery output terminals (+ N -) to battery cabinet BCB (+ N -) as shown in **Figure 30**. Be sure that the battery connector is made with the right polarity, and tighten the connections to 44 lb-in. (5 N-m) (M6 Bolt). Do not close the battery circuit breaker before the equipment has been commissioned.
6. Connect supplied auxiliary control cable to pins J10.2 and J10.3 on the U2 monitoring board (see **2.3 - Dry Contacts**). Add a jumper wire between J10.3 and J10.4.

3.8 Non-Standard Batteries

When batteries other than a matching battery cabinet are used, a remote battery disconnect switch with overcurrent protection is required per the National Electrical Code. Contact your local Liebert sales representative about this option.

Install battery racks, cabinets and batteries in accordance with the manufacturer's instructions.

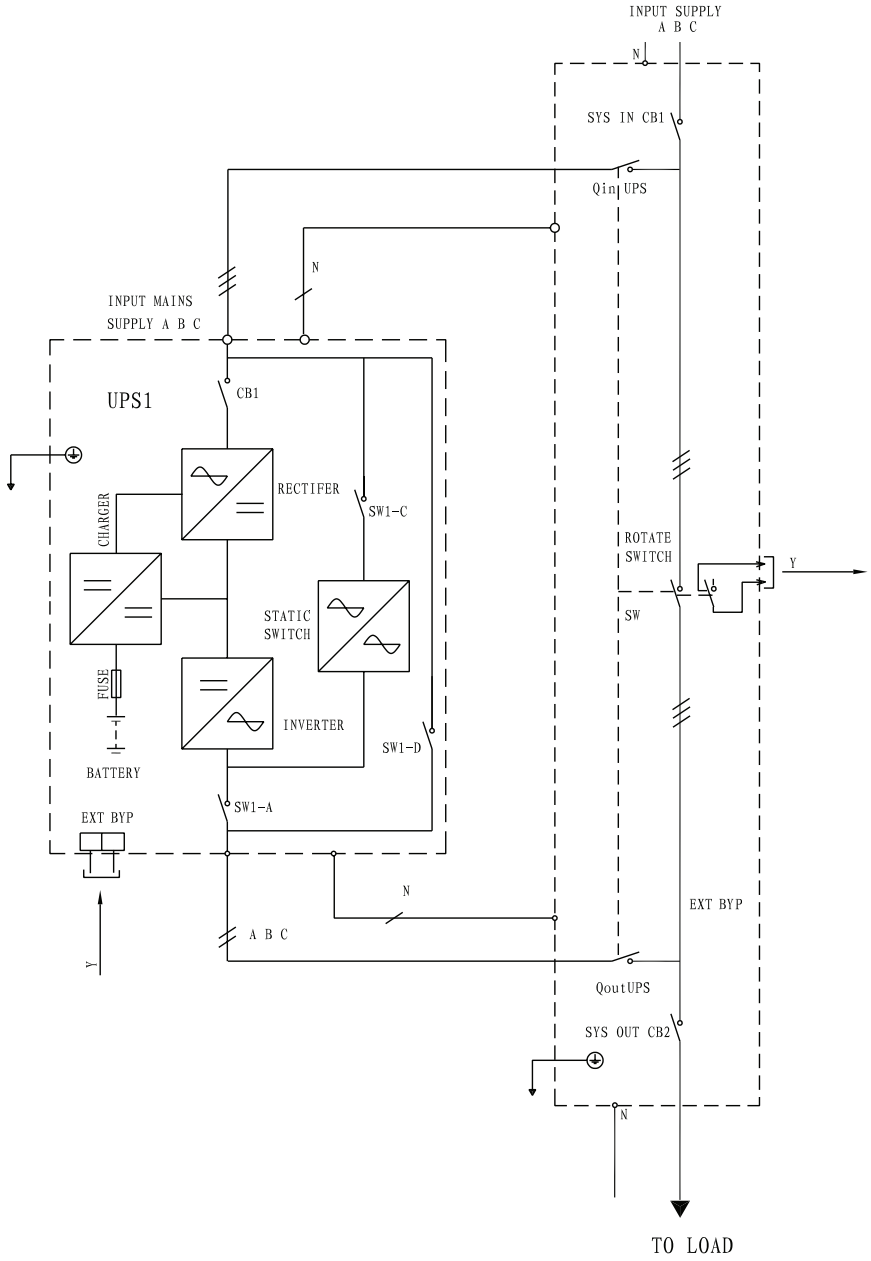
Verify that the battery area has adequate ventilation and battery operating temperature complies with the manufacturer's specifications.

If you have any questions concerning batteries, battery racks or accessories, contact Liebert Global Services at 1-800-543-2378.

4.0 MAINTENANCE BYPASS CABINET

The Maintenance Bypass Cabinet is designed to operate in UPS mode, bypass mode and maintenance mode. The mode is selected using the Bypass Switch.

Figure 14 Single UPS with external Maintenance Bypass Cabinet—typical configuration



4.1 Bypass Switch

The Bypass Switch allows easy and rapid transfer of connected loads between the UPS and Bypass source.

4.2 UPS Mode

While the Maintenance Bypass Cabinet is in UPS Mode, the UPS is supplying the connected load with continuous high quality AC power. In this mode of operation, the load is protected by the UPS.

The Bypass Switch is in the NORMAL position for this mode.

4.3 Bypass Mode

When the Maintenance Bypass Cabinet is in the Bypass mode it provides an alternate path for power to the connected equipment. Should the UPS need to be taken out of service for limited maintenance or repair, manual activation of the bypass will cause an immediate transfer of the equipment from the UPS inverter to the bypass source. In this mode, power will still be supplied to the UPS; however, the load is NOT protected by the UPS. The bypass switch is in the BYPASS position for this mode.

4.4 Maintenance Mode

When the maintenance bypass cabinet is in the Maintenance mode it provides an alternate path for power to the connected equipment. Should the UPS need to be taken out of service for limited maintenance or repair. In this mode of operation the load is NOT protected by the UPS. The Bypass Switch is in the MAINTENANCE position for this mode.

4.5 Mounting the Cabinet

This Maintenance Bypass Cabinet may be mounted to the left of the UPS or installed as stand-alone unit. In both cases, ensure that the unit is in a well-ventilated area with at least 12 inches (305mm) clearance for access to the switches and cable connections.

4.6 Cable Installation

4.6.1 Wiring Preparation

Be sure that the unit is not connected to any AC utility power source or UPS before installing any wiring to this unit. This Maintenance Bypass Cabinet should be installed by a qualified / certified electrician.

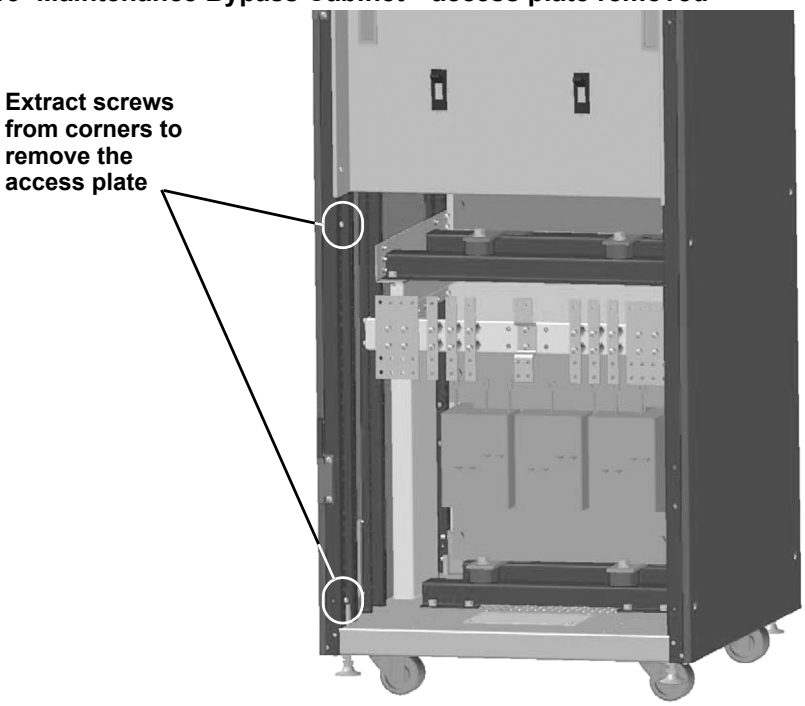
WARNING

Please read this section thoroughly before attempting to install wiring to this unit.

Removing the Cover Plates

Plates cover the input and output terminals on the front of the Maintenance Bypass Cabinet (see **Figure 15**). Remove these and keep the screws and plates for reinstallation.

Figure 15 Maintenance Bypass Cabinet—access plate removed



4.6.2 Power Cable Installation

Refer to **Table 22** when selecting cables.

NOTE

Transient and steady state earth leakage currents may occur when starting the equipment. This should be taken into account when selecting ground current detection devices because these will carry the earth leakage currents of both the UPS equipment and the load.

4.6.3 Input/Output Wiring

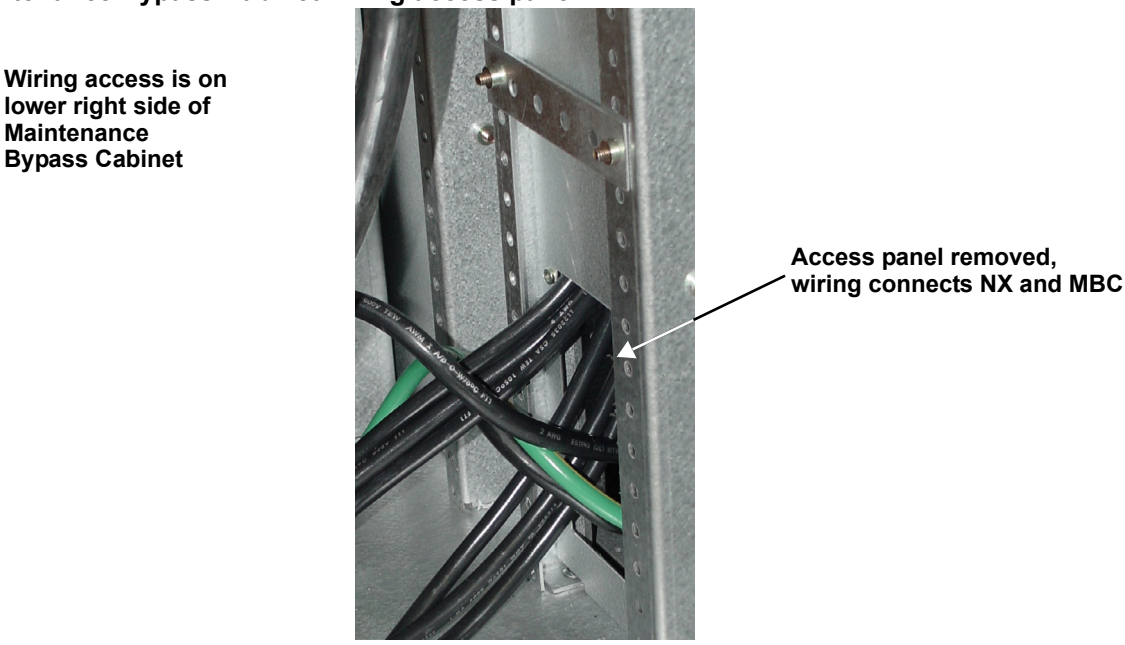
Follow the steps below to connect the input wiring:

NOTE

Input wiring must be installed using conduit.

1. Locate the input wiring access (top or bottom access), remove the knockout and pull the three/four input wires through it, allowing some slack for installation. See **Figure 16**.

Figure 16 Maintenance Bypass Cabinet wiring access panel



2. Secure the conduit to the access plate of the Maintenance Bypass Cabinet.
3. Input power cables connect to the system input circuit breaker. Refer to **Figure 31 - Maintenance Bypass interconnection**
4. Connect the ground (earth) wire to the earth busbar and tighten it to 44 lb-in. (5 N-m) (M6 bolt).
5. Locate UPS input and output cables and access panel to UPS on lower right side.

NOTE

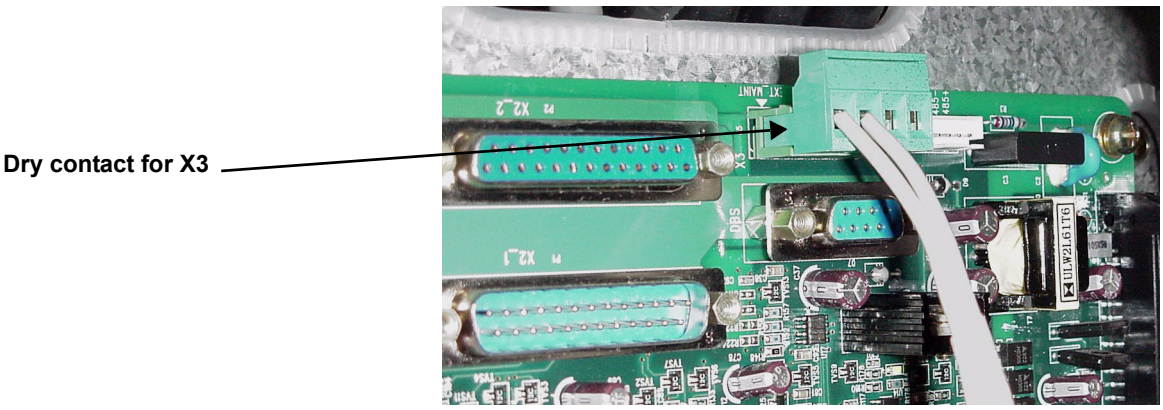
Cabinet is not to be bolted to the UPS, use either top or bottom access plate.

6. Connect the system ground cable between the Maintenance Bypass Cabinet and UPS and tighten the connections to 44 lb-in. (5 N-m) (M6 bolt).
7. Connect the system input cables between the Maintenance Bypass Cabinet 'UPS Input' Busbars (A-B-C N terminals) and UPS input busbars (A-B-C N terminals) and tighten the connections to 44 lb-in. (5 N-m) (M6 bolt).
8. Connect the system input cables between the Maintenance Bypass Cabinet 'UPS Output' Busbars (A-B-C N terminals) and UPS output busbars (A-B-C N terminals) and tighten the connections to 44 lb-in. (5 N-m) (M6 bolt).
9. Connect supplied dry contact wire to X3 on the Parallel (M3) board (see **Figure 17**).

WARNING

The dry contact wire must be installed to ensure proper operation of the system and fully protect the load when switching between bypass cabinet and UPS.

Figure 17 Dry contact for X3

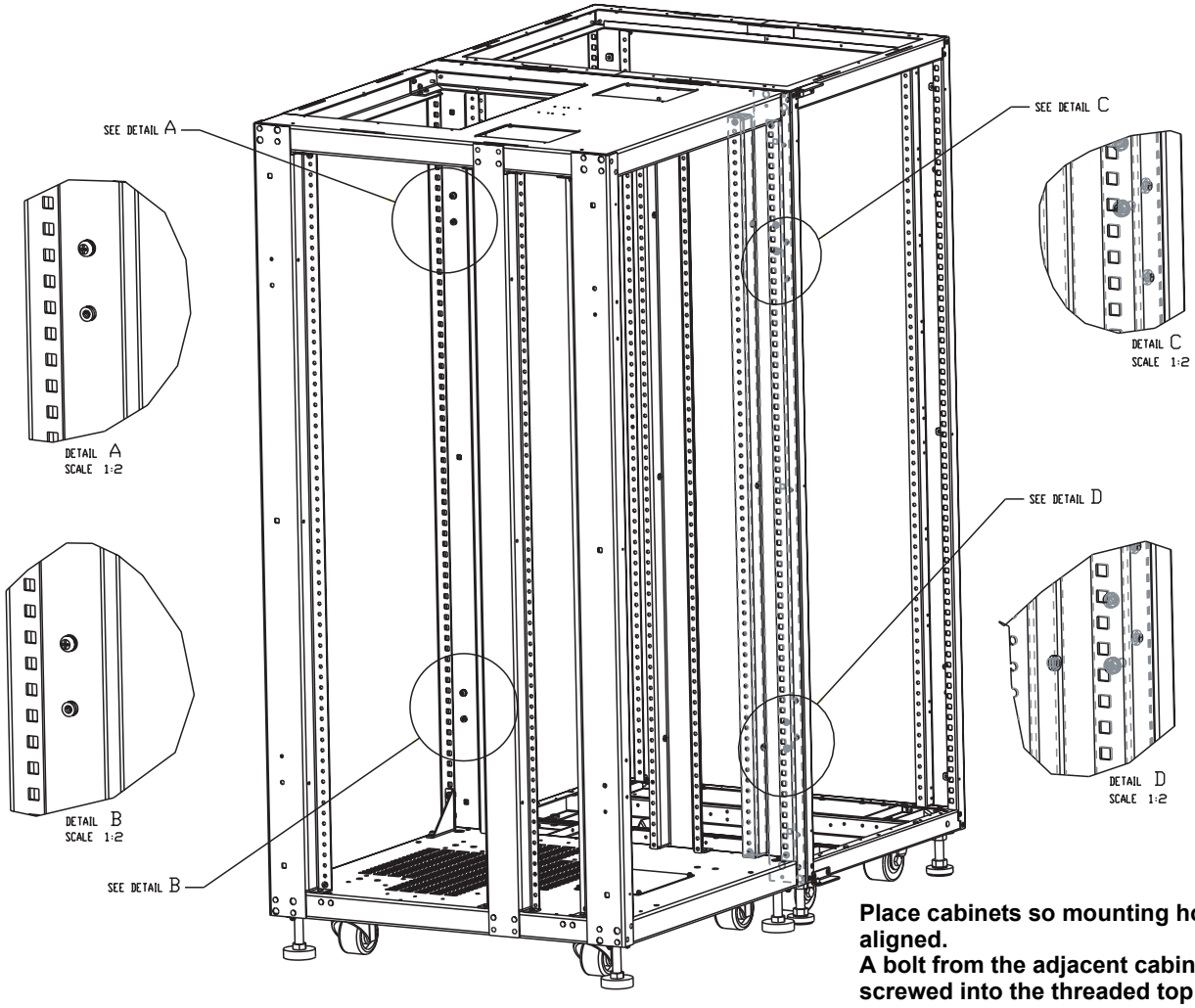


4.7 Bolting Cabinets Together

NOTE

UPS wiring must be completed before the cabinets are bolted together.

1. Line up cabinets so that mounting holes are aligned.



Place cabinets so mounting holes are aligned.
A bolt from the adjacent cabinet may be screwed into the threaded top hole, or a bolt may be inserted through the lower hole and screwed into the threaded hole in the adjacent cabinet.

2. Using supplied hardware, bolt the cabinets together. The bolts may be inserted from either the UPS side or from the MBS side, whichever is more convenient.

4.8 Operating Procedures

4.8.1 Startup and Initialization

Follow these steps to startup the UPS while connected to the Maintenance Bypass.

1. Set Maintenance Bypass switch to the Normal position on Maintenance Bypass Cabinet.
2. Close the system input circuit breaker.
3. Start the UPS as instructed in **2.4 - UPS Startup**
4. Close system output circuit breaker.

4.8.2 Shutting Down the UPS

Use the following procedure to power down the system.

1. Turn the NX off by following the procedures in **2.6 - Powering Down the UPS**.
2. Open system output circuit breaker.
3. Open system input circuit breaker.

4.8.3 Transferring System from UPS to Maintenance Bypass Operation

1. Turn the bypass switch (SW) to the bypass position on the Maintenance Bypass Cabinet. The UPS will switch to bypass mode.

   The connected equipment is now powered from the bypass source and is NOT protected.
2. To isolate the UPS from the system, rotate the bypass switch to the maintenance position.

4.8.4 Transfer the System from Maintenance Bypass to UPS Operation

1. Turn the bypass switch (SW) to the Normal position on the Maintenance Bypass Cabinet. The UPS will go to bypass mode.
2. Press the “Inverter On” button on the UPS and allow the UPS to go to normal mode.
3. The connected equipment is now powered and protected by the UPS.

4.8.5 Transfer the System from UPS Operation to Maintenance Bypass

If the UPS needs to be shut down completely while maintaining power to the load, follow these steps:

1. Perform **Steps 1** through **5** in **2.5 - Switching the UPS from Normal to Maintenance Bypass**.
2. Rotate Maintenance Bypass Switch to Maintenance position.
3. Post a label on the primary input distribution panel, which often is installed outside the UPS area, advising personnel that the UPS circuit is under maintenance.

The UPS is now completely powered down.

WARNING

Wait 5 minutes for the internal DC busbar capacitors to discharge.

NOTE

The Maintenance Bypass power switch may be operated at any time while the UPS is powered down to connect the load to the maintenance bypass supply.

The procedure can be performed only after the installation has been completed (which includes the maintenance bypass cabinet), after the system has been placed in operation by authorized personnel and after the external power switches have been closed. See **Figure 14** for more information.

4.9 Input and Output Transformer Voltages

The UPS is able to display the primary voltage of the input transformer and the secondary voltage of the output transformer.

1. Using configuration software, enable the input transformer configuration.
2. Calculate the input-to-output voltage ratio and enter into software.
   Example: a step-down transformer from 480VAC to 208VAC is determined by dividing 480 by 208, which equals 2.31.
3. Using configuration software, enable the output transformer configuration.
4. Calculate the input-to-output voltage ratio and enter into software.
   Example: a step-up transformer from 208VAC to 480VAC determined by dividing 208 by 480, which equals 0.43.

When configured, the input and output transformer voltages will be displayed on the front LCD. When not activated, the screens will be hidden.

NOTE
This feature is available with Monitoring firmware M150 or above.

5.0 OPTIONS

5.1 Dual Bus Synchronizer

The Dual-Bus Synchronizer (DBS) keeps the output of two independent UPS systems or parallel UPS systems in synchronization even when the systems are operating in different modes and even when either or both systems are operating on batteries. When the DBS is used, one UPS system is designated as master, the other as slave.

The DBS usually is used with Smart Switch to achieve Dual Bus Power Supply configuration.

5.1.1 Performance Requirements

The DBS operates under the following conditions:

- Both master and slave are on inverter
  (either system may be on inverter through the rectifier or on inverter through the batteries)
- Master on inverter, and slave on bypass
- Master on bypass, and slave on inverter
- Master and slave on bypass IF the bypass source is the same for both systems

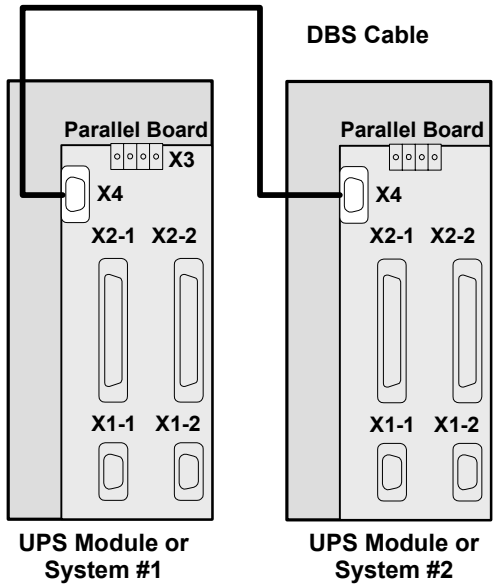
5.1.2 DBS Cable and Settings

For Paradigm-to-Paradigm dual bus configuration, with the help of only one optional DBS cable, the built-in DBS will operate normally without extra DBS control box or interface box. The DBS port is X4 on the Parallel Board (M3).

An optional, 9-pin DBS cable is used to connect two UPS systems through each system's DB9 port on its parallel board. For two parallel systems, the DBS cable can be mounted between any two units belonging to different parallel systems. For information about the DBS kit or to order the optional equipment, see your local Liebert representative.

The DBS cable is connected as illustrated in **Figure 18**.

Figure 18 DBS cable connection



The DBS function is activated with configuration software; when the DBS takes effect, the graphic LCD will display "LBS active."

5.2 Configuring Parallel System Operation

5.2.1 General

The Liebert NX UPS uses intelligent and reliable decentralized technology to achieve parallel operation of two modules of the same rating.

The 1+1 system is used to:

- Increase the reliability of the system to ensure adequate power supply to the critical load connected.
- Increase the power availability (system expansion) in the event an unforeseen power demand occurs. This guarantees a greater flexibility in relation to the critical load connected.
- Increase serviceability and allow the execution of maintenance operations and reparations without affecting the ordinary operating conditions of the system (depending on the redundancy level).

CAUTION

An external maintenance cabinet is strongly recommended to maintain the power supply to load in case of complete maintenance.

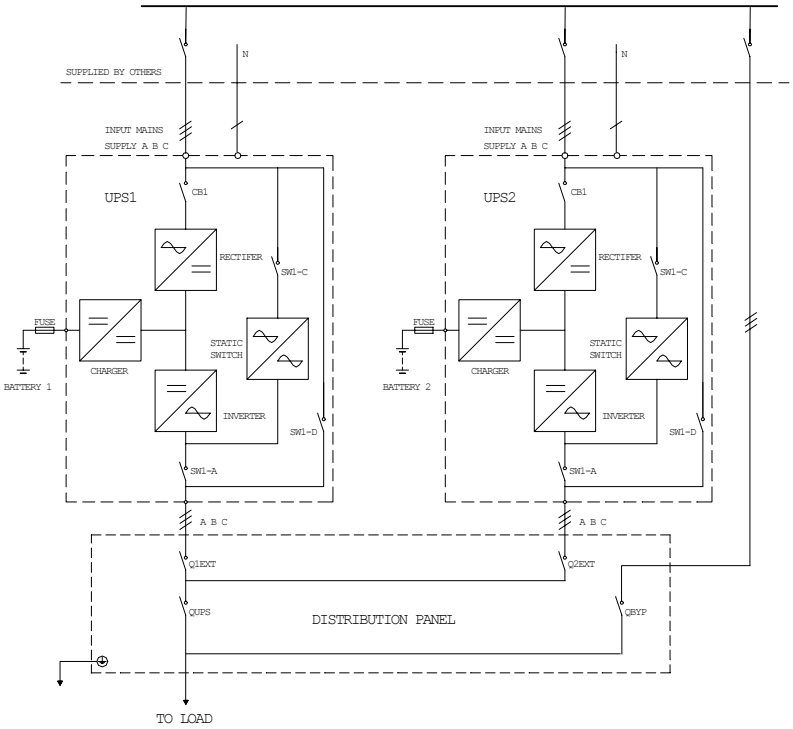
5.2.2 Conditions for Parallel System

- Each UPS module should have the same rating, the same firmware and hardware version.
- Each UPS module must have the same bypass source.
- The outputs of all UPS modules are connected altogether.
- The main inputs can be from different sources, but the phase rotation sequence of main inputs, bypass inputs and outputs must be correct and the same.
- The parallel logic cable and load sharing cable must be connected in a ring correctly (See **Figure 20**)

5.2.3 Features of Parallel System

- The hardware and firmware for parallel UPS module operation is standard in the Liebert NX, and the configuration can be set up by changing the settings in configuration software.
- It is easy to install the parallel cables in a ring, providing high reliability and redundancy. And the intelligent paralleling logic provides the user with maximum flexibility. For example, shutting down or starting up the UPS modules in the parallel system can be done in any sequence. If an overload transfer occurs, the whole system can recover automatically from bypass mode after the overload is cleared.
- The total load of the parallel system can be queried from each module's liquid crystal display screen.
- Optional monitoring background software can treat the entire parallel system as a big, single-module UPS and provide corresponding management. It can also get the information for all modules by connecting to just one of the modules.

Figure 19 1+1 system block diagram



5.2.4 Operating Principles

Redundancy Paralleling

The redundancy parallel system can noticeably improve system reliability. In normal condition, neither UPS module works at full load. That means that even if the load is increased, the system will not transfer to bypass. And when a UPS module shuts down due to any failure, the remaining UPS module can still power and protect the load. When redundancy is lost due to module failure or load increase, the parallel system will trigger an alarm.

5.2.5 Operation Modes Summary

The parallel system also has operation modes such as normal, battery, bypass and maintenance bypass. All UPS modules in the 1+1 parallel system operate in coordination.

- **Normal Mode Operation**
  The load is powered by the inverters of all the UPS modules in the system. If the frequency of bypass is within the synchronous range, the inverter will be synchronized with the bypass. Otherwise, the system will operate at nominal frequency.
- **Battery Mode Operation**
  The batteries of all UPS modules power the load through their inverters. The system operates at nominal frequency.
- **Bypass Mode Operation**
  The condition to transfer to bypass mode is essentially the same as that of single module system. The bypass of all the UPS modules powers the load.
- **Maintenance Bypass Mode Operation**
  The sequence to transfer to maintenance bypass mode is the same as for transferring a single-module system. The maintenance bypass switches should be switched on as synchronously as possible. Thus the system can be repaired without interrupting the power supply to critical load.

5.2.6 Intermodule Control

Two kinds of signals are used for the parallel cables:

- **Analog signals**—UPS output unbalanced current
- **Digital signals**—control logic signals, parallel cable status

Parallel control cables should be connected to the parallel board (M3) of all modules and form a ring to provide redundancy as shown in **Figure 20**.

Two types of Parallel control cables needed:

- **DB9** for analog signals with one end DB9/F and one end DB9/M
- **DB25** for digital signals with one end DB25/F and one end DB25/M

These come in lengths of 5m, 10m and 15m.

5.3 Installing Parallel System

The basic installation procedure of parallel system is the same as that of single module system. The following sections introduce only the installation procedures specific to the parallel system.

5.3.1 Cabinet Installation

Parallel system composed of two UPS modules

The two UPS modules that will form the 1+1 system should be placed side-by-side. Each battery cabinet is placed next to its corresponding UPS module.

5.3.2 Preliminary Checks

Each UPS module should have the same rating, the same firmware and the same hardware version. Refer to the instructions in **5.2.2 - Conditions for Parallel System**.

5.3.3 Protective Devices

Refer to the instructions supplied in the Liebert NX installation manual, SL-25215.

5.3.4 Power Cables

Wiring of power cables is similar to that of single module system (See the Liebert NX installation manual, SL-25215. The bypass sources of all modules should be the same, and the outputs should be connected altogether correctly.

NOTE
The length and specifications of power cables including the bypass input cables and UPS output cables should be the same, thus the load can be shared evenly in bypass mode.

5.3.5 Parallel Control Cables

Make the connections listed below on the parallel logic board (M3) inside the Liebert NX. (See **Figure 25** for the location of the parallel logic board):

- Connect one end of the DB-25 interconnecting cable the X2_1 connector of the first Liebert NX and the other end to the X2_2 connector of the second Liebert NX.
- Connect one end of the DB-25 interconnecting cable the X2_2 connector of the first Liebert NX and the other end to the X2_3 connector of the second Liebert NX.
- Connect one end of the DB-9 interconnecting cable the X1_1 connector of the first Liebert NX and the other end to the X1_2 connector of the second Liebert NX.
- Connect one end of the DB-25 interconnecting cable the X1_2 connector of the first Liebert NX and the other end to the X1_3 connector of the second Liebert NX.

Figure 20 Connecting '1+1' system parallel control cables

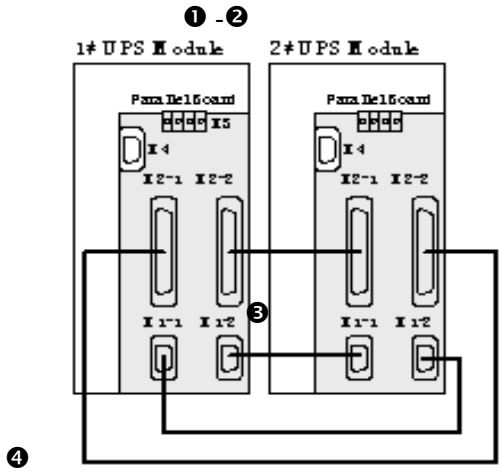


Table 6 Key to UPS control cable connections

❶ -❷	UPS unit
	Parallel connection board
❹	Interconnecting cables

5.4 Commissioning a Parallel System

CAUTION

The operations described in this section must be performed by authorized electricians or qualified technical personnel. If you have any difficult, do not hesitate to contact Liebert Global Service at **1-800-LIEBERT**.

Check the input and output wiring of each UPS module. Ensure that the phase rotation sequence of the main inputs and the bypass inputs and outputs of each UPS module are the same. Ensure the parallel cables are connected firmly.

It is assumed that the installation is complete, the system has been commissioned by authorized personnel and the external power isolators are closed. **Before startup, disconnect the load.**

Start the UPS modules separately and set the parameters of each UPS module through configuration software. Pay particular attention to the parameters directly relevant to the parallel system:

- UPS Configuration: Each UPS module belonging to the parallel system should be set as *Parallel* configuration.
- UPS ID No.: Each UPS module should have a unique identification number in the parallel system.
- Parallel system requisite UPS units: Set the minimum number of UPS modules to support the user's expected load. For 1+1 systems this settings needs to be set to 1.
- Parallel system redundant UPS units: Set the redundant number of UPS modules which will not cause the parallel system transfer to bypass even if they get failure during operation. For 1+1 systems this settings needs to be set to 1.

NOTE

The settings should be the same for all modules within the parallel system, except the UPS ID number.

5.5 Parallel System Startup

1. Start each UPS normally as described in the Liebert NX installation manual. SL-25215.
2. Turn on the inverter of each UPS module one at a time.
3. Apply the load after the last UPS module transfers to inverter. The total load can be determined through the LCD of either UPS.
4. Verify the load rate of each UPS module. If the load rates are roughly the same, then the parallel system may be assumed to be operating normally.

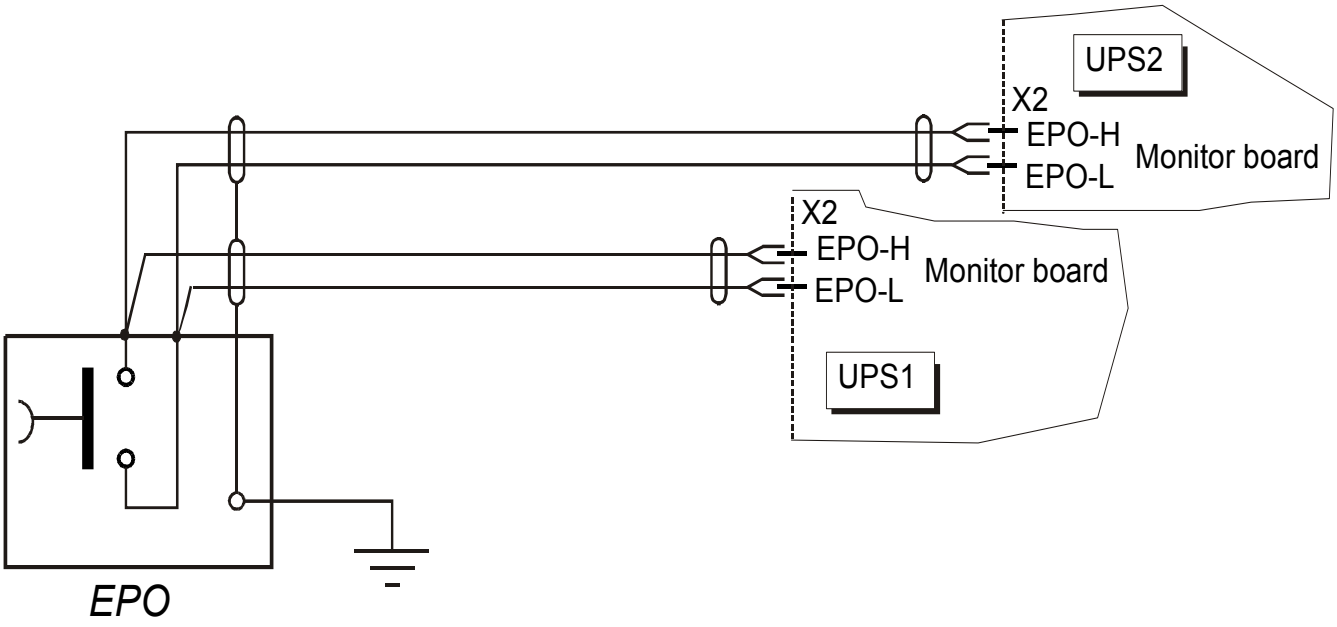
NOTE

If one module cannot transfer to inverter mode long after its inverter is on, its output connection may not be good or its output phase rotation may not be coincident with other modules. At this time, the LCD for the UPS module will display "inverter asynchronous" and the inverter indicator will flash continuously. If either UPS module makes abnormal noise after it transfers to inverter, its parallel cables may be incorrectly connected.

5.5.1 Emergency Power Off (EPO)

The external emergency stop facility is identical to that described for the single unit installation — that an individual emergency stop button is provided for each unit. Note that this is a Normally Open switch.

Figure 21 Connecting EPO push button



5.6 Battery Circuit Breaker Box

The box contains the same battery isolating circuit breaker as mounted in the battery cabinet.

Two battery circuit breaker boxes are available for use in installations where the battery is not installed in the battery cabinet, in which case the appropriate battery box is fitted as close as possible to the battery and connected to the UPS equipment as illustrated in **Figure 22**.

The battery circuit breaker box, is required to protect the battery from overcurrents. It also provides electrical isolation between the UPS and the battery, permitting technical service personnel to reduce the risks involved in maintenance work to a minimum.

A separate safety earth must be connected between the UPS unit and circuit breaker box.

Two boxes are available depending on the UPS power rating.

Table 7 Available battery circuit breaker boxes

UPS	Dimensions (in) H-W-D	Circuit Breaker
10-15 kVA	32.25x20.25x8.3	70A
20-30 kVA	32.25x20.25x8.3	125A

The weights listed above do not include package.

The circuit breaker has the following features:

- Short-circuit protection.
- Protection against battery cabinet and ups connection errors (polarity reversal +/-).

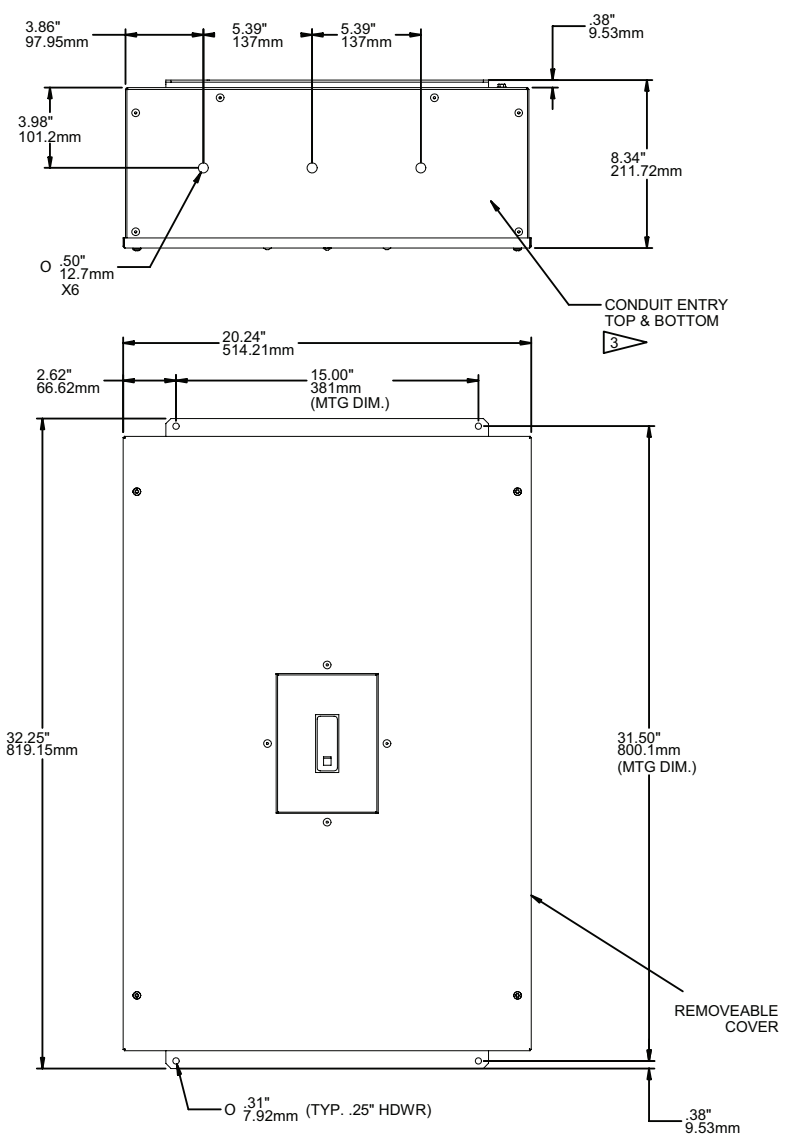
The battery circuit breaker boxes are of the same size for the 10 kVA to 30 kVA UPS, but switch capacity are different.

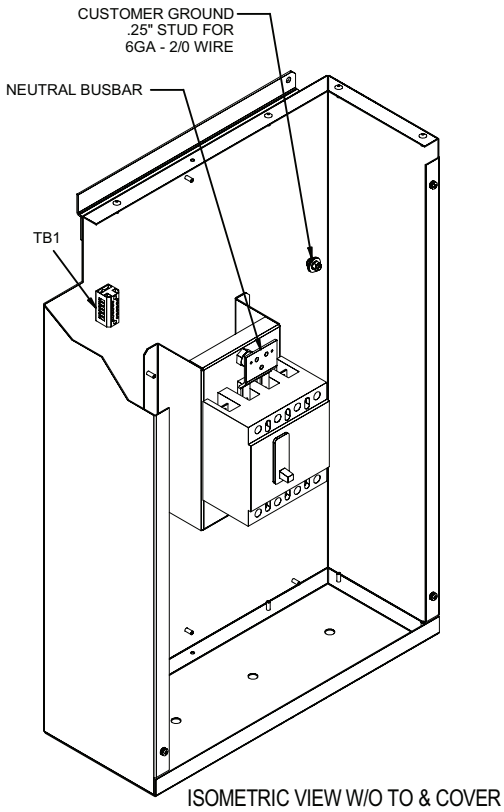
The information shown in **Figure 22** applies to both sizes.

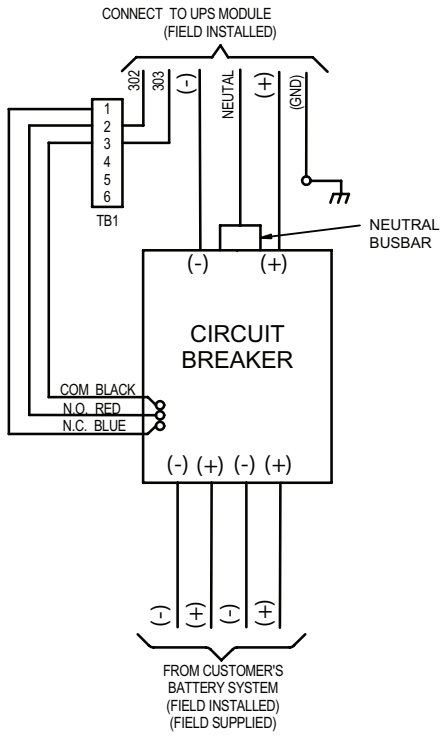
The BCB box contains a battery isolating circuit breaker.

The BCB box should be fitted as close as possible to the battery and connected to the UPS equipment as **Figure 22** illustrates.

Figure 22 Battery circuit breaker box connections







1. HARDWARE FOR CONNECTING CABLES TO THE BREAKER SUPPLIED.
2. "TYPE-1" RATED ENCLOSURE.
3. LOW VOLTAGE WIRING NEEDS TO ENTER THIS BOX FROM THE TOP.
4. DC OUTPUT POWER CONNECTIONS WILL ACCEPT (2) POSITIVE AND (2) NEGATIVE WIRES, ACCEPT 2GA.
5. DC INPUT CONNECTION WILL ACCEPT 2GA WIRE FOR 10 -15KVA UPS WITH 70A BREAKER, OR 20-30KVA UPS WITH 125A BREAKER.

NOTE

1. *The signal cables in this figure must be shielded and double-insulated.*
2. *Connect the Pes (Protection Earth) of the UPS cabinet and BCB box to the same point.*

6.0 SPECIFICATIONS

These specifications describe requirements for the Liebert NX Uninterruptible Power System (UPS).

6.1 Conformity and Standards

The UPS has been designed to conform to the following standards:

- IEEC1000-4-5
- ASME
- CSA 22.2, No. 107.1
- FCC Part 15, Class A
- ISO 9001
- National Electrical Code (NFPA-70)
- NEMA PE-1
- OSHA
- UL Standard 1778

The UPS system has UL and CSA approval.

6.2 UPS Environmental

The UPS is designed to operate under the following environmental conditions without damage or degradation in electrical operating characteristics:

Table 8 Environmental characteristics

Rated Power	10-30kVA
Operating Temperature, UPS	32°F to 104°F (0°C to 40°C)
Optimal Operating Temperature, Battery	68°F to 86°F (20°C to 30°C)
Relative Humidity	0 to 95%, non-condensing
Acoustical Noise, dBA at 39 in. (1m)	54
Altitude of Operation	≤1000m per IEC 62040/3
Storage-Transport Temperature, UPS	-4°F to 158°F (-20°C to 70°C)
Storage-Transport Temperature, Battery	-4°F to 86°F (-20°C to 30°C)

6.3 UPS Mechanical Characteristics

Table 9 Mechanical characteristics

Parameter	10kVA	15kVA	20kVA	30kVA
Width, in. (mm)	24 (600)			
Depth, in. (mm)	32.5 (825)			
Height, in. (mm)	63 (1600)			
Weight Without Inner Batteries, lb. (kg)	450 (205)	450 (205)	550 (250)	550 (250)
Ventilation	By internal extract fans			
Heat Dissipation, BTU/H (kWH)	2800 (0.82)	4200 (1.23)	5500 (1.61)	8300 (2.43)
Airflow, CFM (m^3/h)	400 (680)	500 (850)	600 (1019)	1000 (1699)
Cable Entry	Bottom or top			
Color	PMS 877			
Protection Grade (with open/closed front doors)	IP 20			

6.4 UPS Electrical Characteristics

6.4.1 Battery Manufacturers and Models

Either of two manufacturers' batteries will be installed in the Liebert NX for 10-30 kVA 208V NX as shipped. Below are the battery makers and the models they supply.

Table 10 Approved batteries

Battery Manufacturer	Models Supplied		
Enersys Yuasa	NPX-80FR	NPX-100FR	NPX-150FR
C&D Dynasty	UPS12-100FR	UPS12-140FR	-

6.4.2 Input Rectifier

Table 11 Rectifier input power

Rated Power	10kVA	15kVA	20kVA	30kVA
Rated Voltage, VAC	120/208			
Supply	3-phase, 4-wire plus ground			
Input Voltage Tolerance, VAC (without derating)	166-228			
Frequency, Hz	50 / 60			
Input Frequency Tolerance %	±10			
Power Factor	≤ 0.99 at full load ≤ 0.95 at 50% load			
Harmonic Current	Less than 4% at full rated UPS output load			
Rated Power (208V), kVA	10	15	20	30
Input Current,[1] Nominal, A	28	42	56	83
Output Current, Nominal, A	28	42	56	83

Notes

1. Overload capacity of input current: 100% Imax <I<125% Imax: 10 min.
   125% Imax <I<150% Imax: 1 min.
   I>150%: Limits input current immediately

6.4.3 DC Intermediate Circuit

Table 12 DC intermediate circuit

Rated Power	10kVA	15kVA	20kVA	30kVA
Voltage range for inverter operation, VDC	DC voltage is positive 210V and negative 210V for 200/208 input and output in normal mode **NOTE:** When the DC bus voltage is less than 190V between positive and negative, the UPS will transfer to battery mode.			
Recommended number of lead-acid batteries	Number of batteries is field-selectable from 20 to 24 jars (12V per jar), or from 120 to 144 cells (2V per cell) when battery type is VRLA. The unit is shipped with a nominal voltage of 324VDC.			
Recommended float charge voltage	2.25VDC*			
Recommended boost charge voltage	2.3VDC*			
Recommended end of discharge voltage	1.65-1.8 VDC			
Maximum recharge battery current, A	7.5	7.5	15	15
Maximum boost charge duration, min.*	1440			
Boost-float threshold current, A*	0.1 C default			
Temperature voltage compensation, mV/°C*	2			
Ripple voltage superimposed %	≤ 1			

* Set by configuration software

6.4.4 Inverter Output

Table 13 Inverter output

Rated Power	10kVA	15kVA	20kVA	30kVA
Rated voltage, VAC	120/208			
Supply	3-phase, 4-wire plus ground			
Frequency, Hz	50 / 60			
Rated Power, kVA	10	15	20	30
Rated Power, kW	8	12	16	24
Three -phase transient overload, min. load	10 minutes - 105-125% load			
	1 minute - 126-150% load			
Voltage Regulation %	±1.0% three-phase RMS average for a balanced three-phase load ±2.0% three-phase RMS average for a 100% unbalanced load			
Frequency Regulation %	Nominal frequency regulation is ±0.05% in single module mode, and+/- 0.25% in parallel mode.			
Maximum rate of change of frequency, Hz/sec	For single mode, the slew rate is adjustable from 0.1Hz/s to 3Hz/s			
Current rating of neutral cable, A	1.5 x input current			

Table 14 Linear load derating

	Lagging						Leading				
PF	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**	**1.0**	**0.9**	**0.8**	**0.7**	**0.6**	**0.5**
K (200V)	1.00	1.00	1.00	1.00	0.88	0.80	0.75	0.73	0.72	0.71	0.71
K (208V)	1.00	1.00	1.00	1.00	0.88	0.80	0.75	0.73	0.72	0.71	0.71

6.4.5 Bypass Input

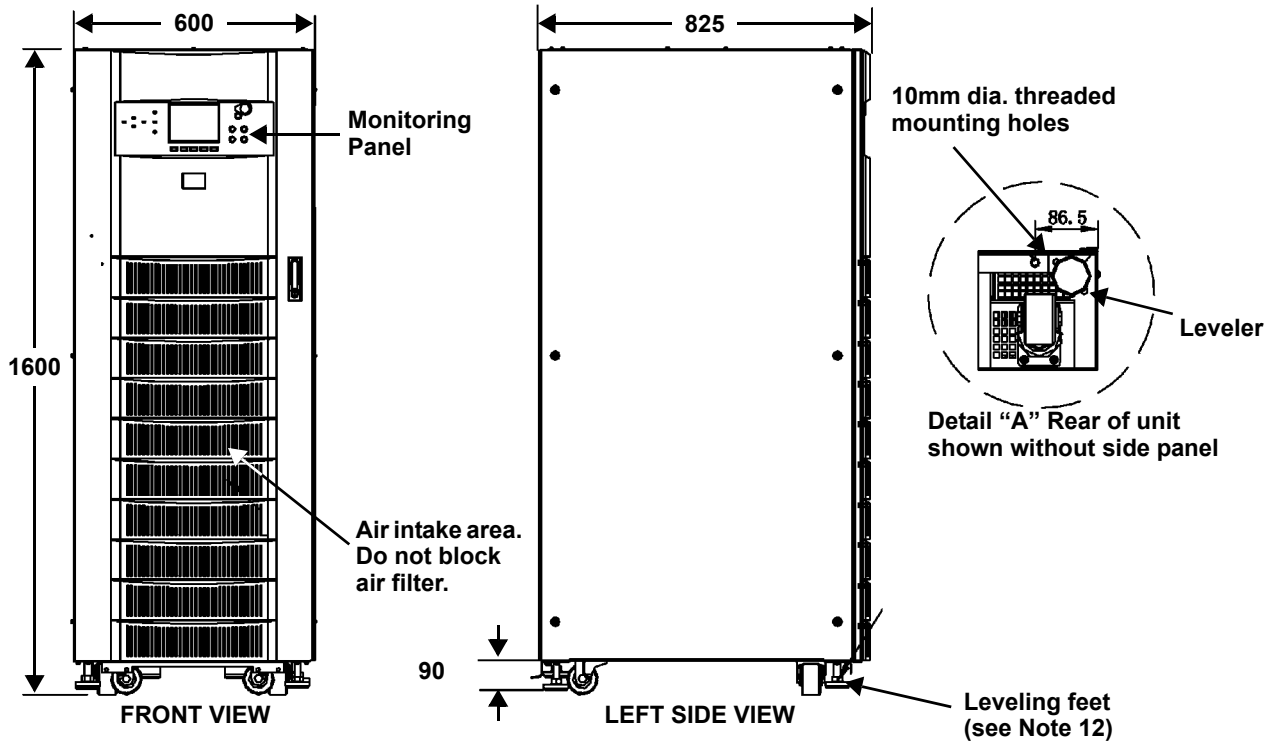
Table 15 Bypass input

Rated Power	10kVA	15kVA	20kVA	30kVA
Rated voltage, VAC	120/208			
Supply	Three-phase, 4-wire plus ground			
Rated Current, A				
200VAC, A	32	48	64	96
208VAC, A	28	42	56	83
Bypass voltage tolerance %	Upper limit: +10%, +15% or +20% Lower limit: -10%, -20%, -30% or -40%		Upper limit default: +15% Lower limit default: -20%	
Delay time to recognize bypass voltage returned to window, sec.	2			
Inverter output voltage window %	± 10			
Frequency, Hz	50 / 60			
Input frequency tolerance %	± 10 or ± 20%; default ±10%			
Maximum frequency slew rate, Hz/sec	For single mode, the slew rate should be adjustable from 0.1Hz/s to 3Hz/s			
Current rating of neutral cable, A	1.5 x input current			
Bypass overload capacity (all ratings)	**Time** **Load** Long-term operation: <135% load 10 minutes: 135% - 170% load 100milliseconds: 1000% full UPS rated output current			

7.0 INSTALLATION DRAWINGS

The diagrams in this section illustrate the key mechanical and electrical characteristics of the NX UPS System cabinets.

Figure 23 Dimensional view- front and left side views



1. All dimensions are metric.
2. A minimum of 24 inches clearance above the unit is required for air exhaust.
3. Installation and service access required. Remove left plate. Left-side access recommended for maximum ease of installation.
4. Keep cabinet within 15 degrees of vertical while handling.
5. Top and bottom cable entry available through removal access plates. Remove punch to suit conduit size and replace.
6. Color - PMS 877.
7. Unit bottom is structurally adequate for forklift handling.
8. Open door to replace air filter, washable type, size 354x314.
9. Threaded mounting holes used for seismic anchoring or floor stand. **Note**: If a floor stand is used, the weight of the unit must be supported under all casters.
10. Each mounting location is supported by two 10 GA. (.135") galvanized steel. The threaded 12mm insert is approximately 3/4" deep. Mounting bolts must be threaded into unit.
11. Includes side panel. Refer to Detail A for dimension to frame with side panel removed. Side panels are removed between adjacent units that are bolted together.
12. Leveling feet are not designed to carry the full weight of the cabinet. Finger-tighten leveler against the floor, then tighten with a wrench less than two turns for friction against floor.

kVA Rating	Voltage		Weight		Heat Rejection BTU/Hr	Cooling Air CFM
	Input	Output	lb.	kg		
10	208	208	550	250	3422	324
15	208	208	550	250	4107	468
20	208	208	638	290	6844	540
30	208	208	682	310	8215	900

Figure 24 Dimensions continued—top and bottom views

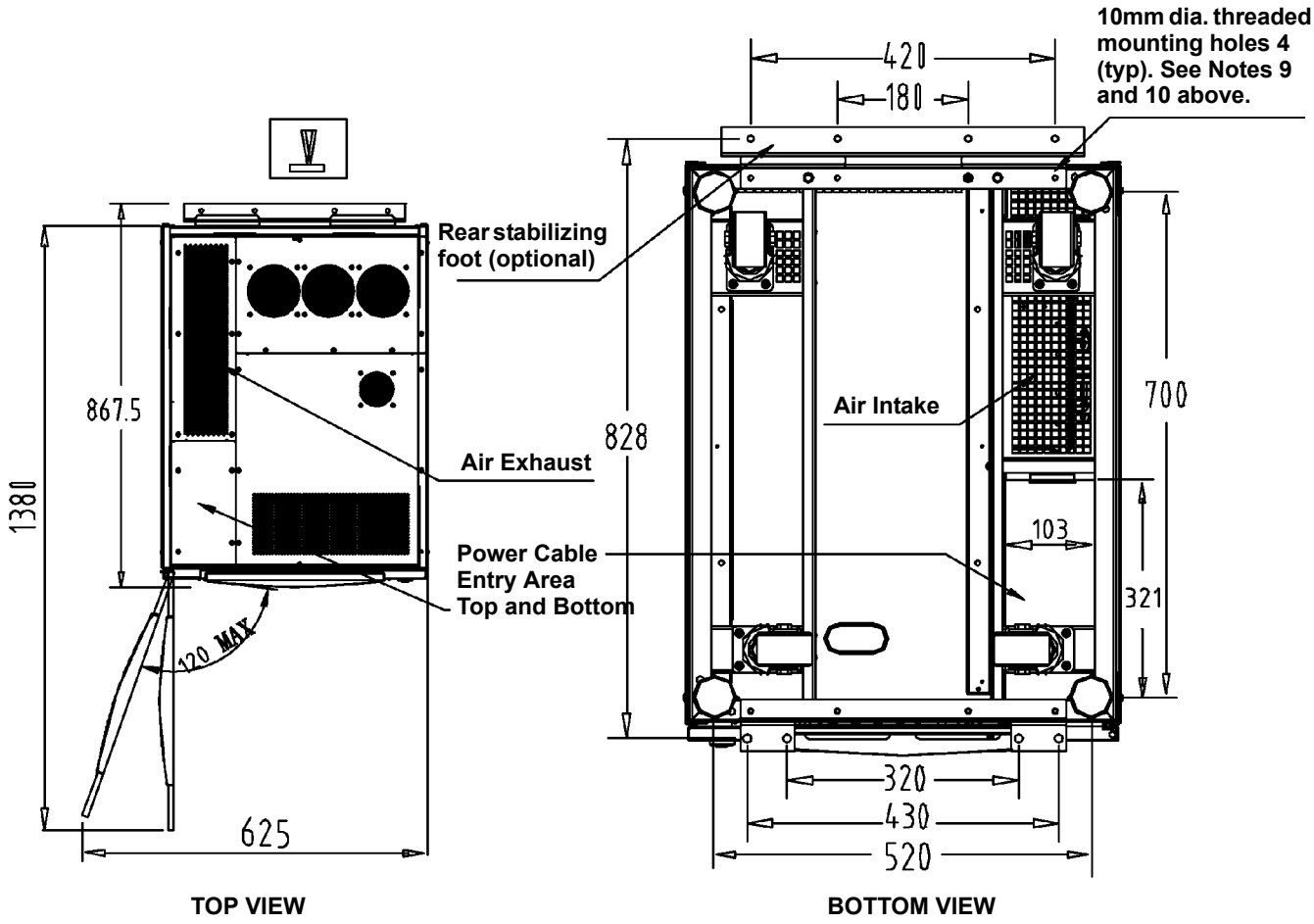
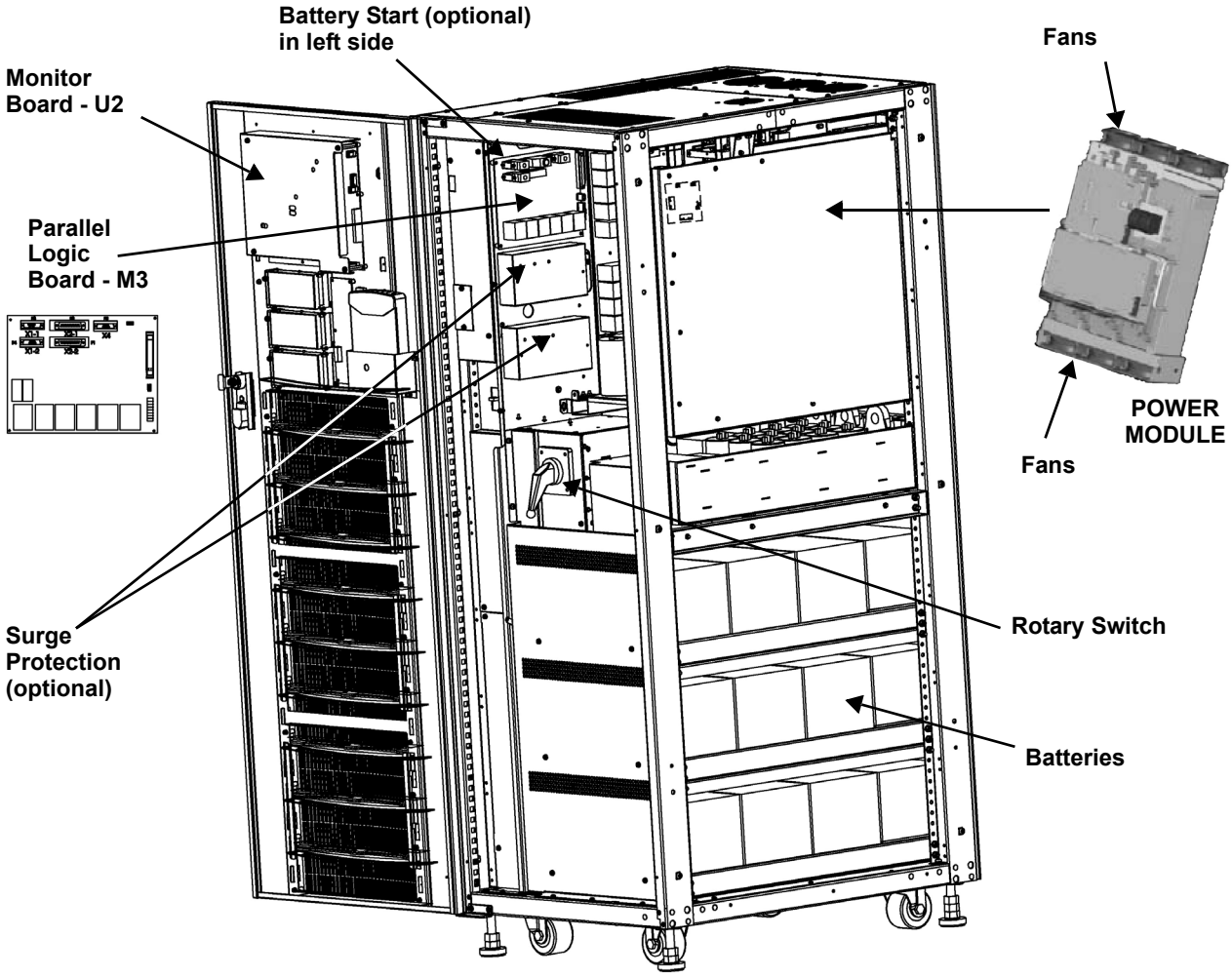


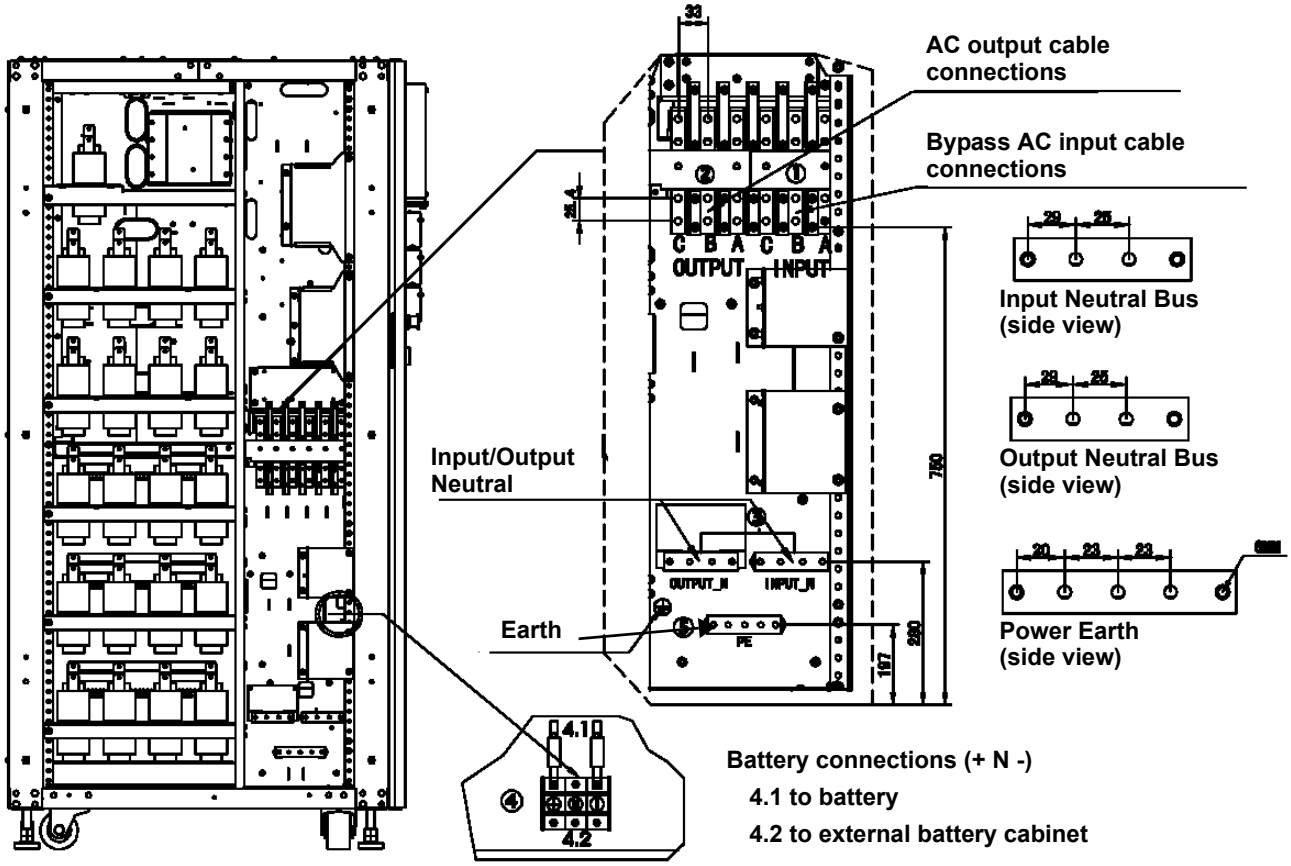
Figure 25 Main components—typical unit



NOTES

1. Main components are shown in the drawing.
2. Typical options are shown; actual positions on control wiring may vary depending on which options are included on your unit.
3. Refer to **3.0 - Battery Installation** for battery installation details.
4. All wiring must be installed in accordance with all national and local electrical codes.

Figure 26 Cable connections



NOTES

1. All dimensions are millimeters.
2. Top and bottom cable entry available through removable access plates. Remove, punch to accommodate conduit size and replace.
3. Control wiring and power wiring must be run in separate conduit. Output and input cables must be run in separate conduit.
4. Aluminum and copper-clad aluminum cables are not recommended,
5. All wiring is to be in accordance with national and local electrical codes.

Figure 27 Location of internal batteries

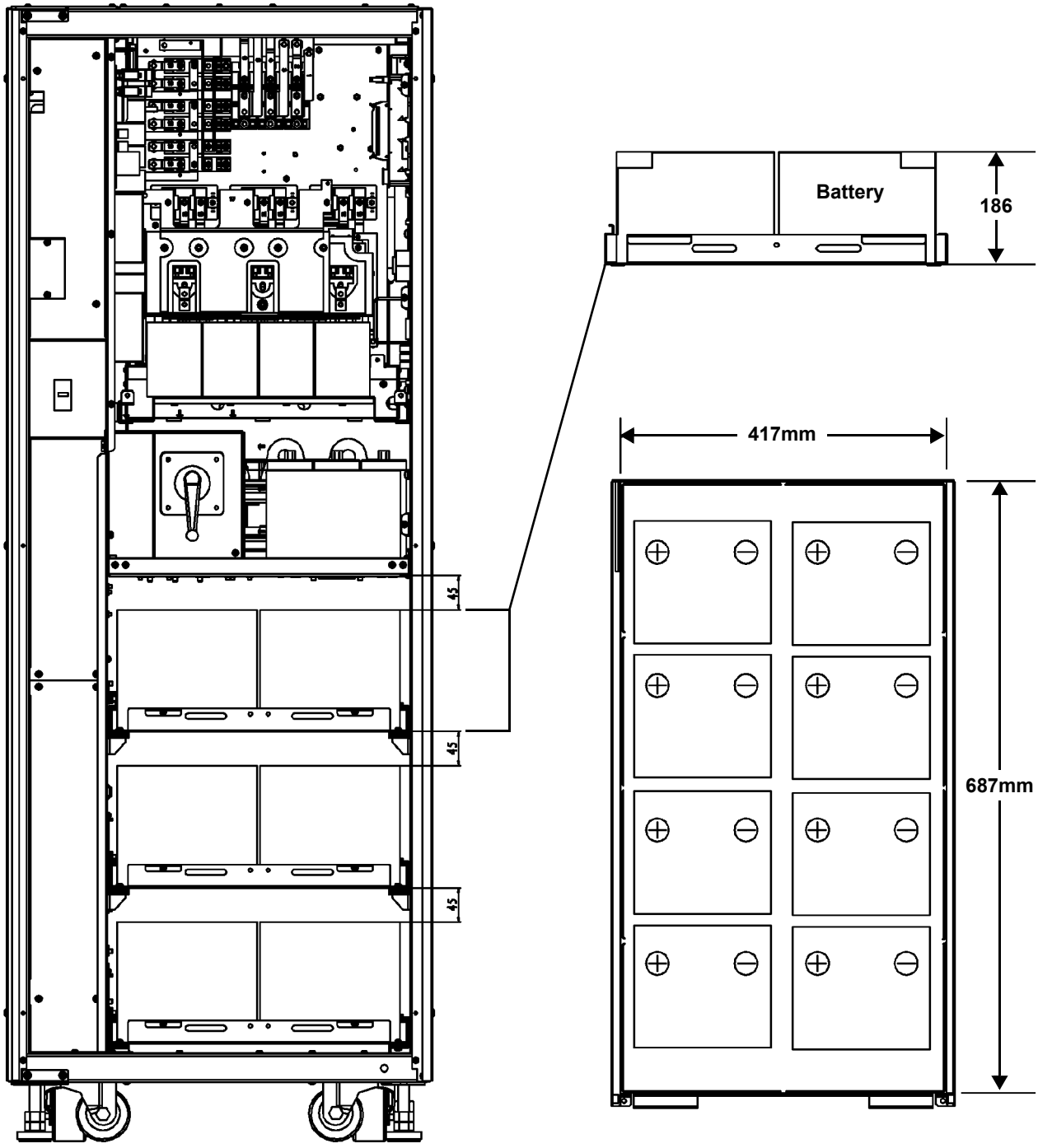


Figure 28 Battery connections

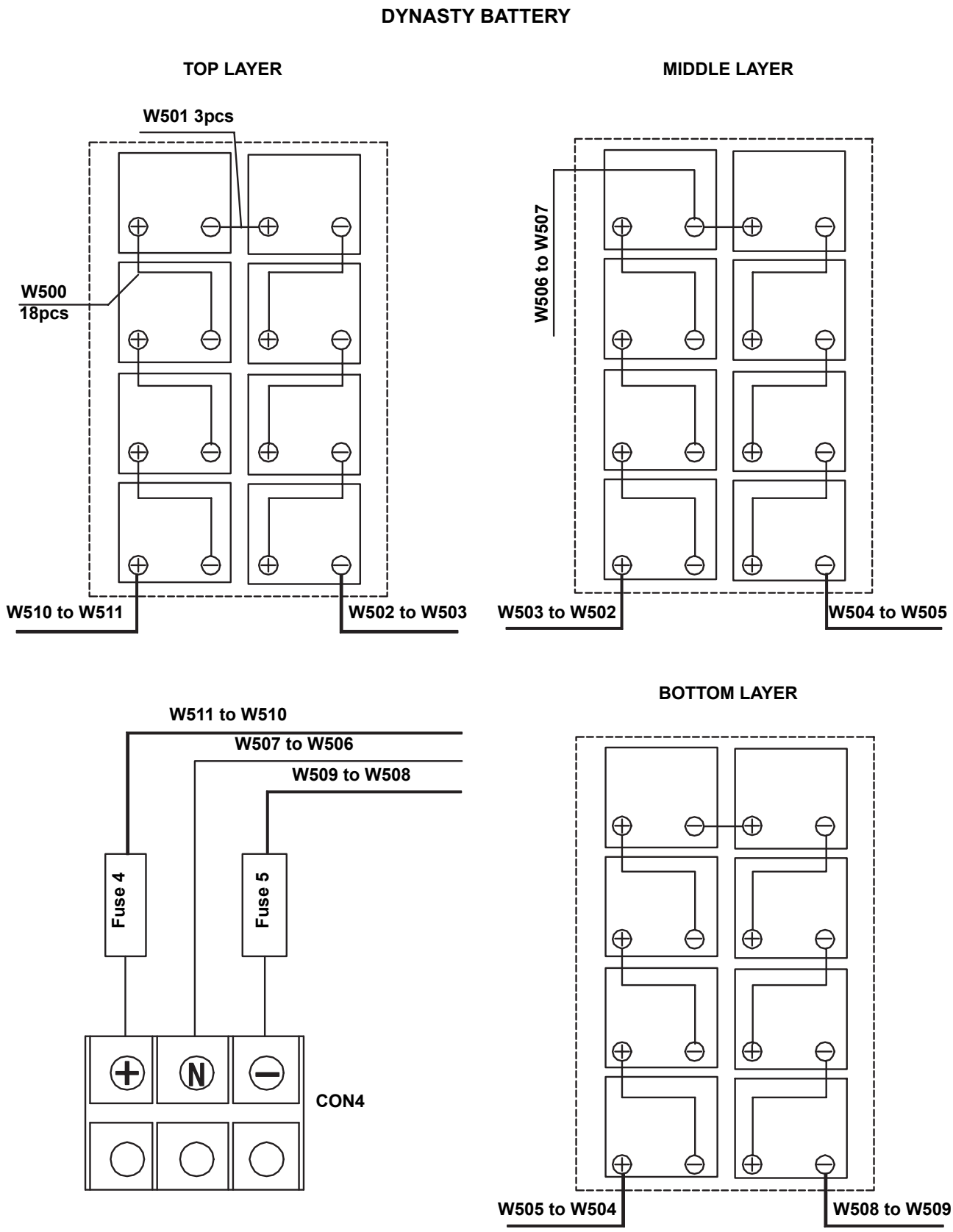


Figure 29 Electrical connections

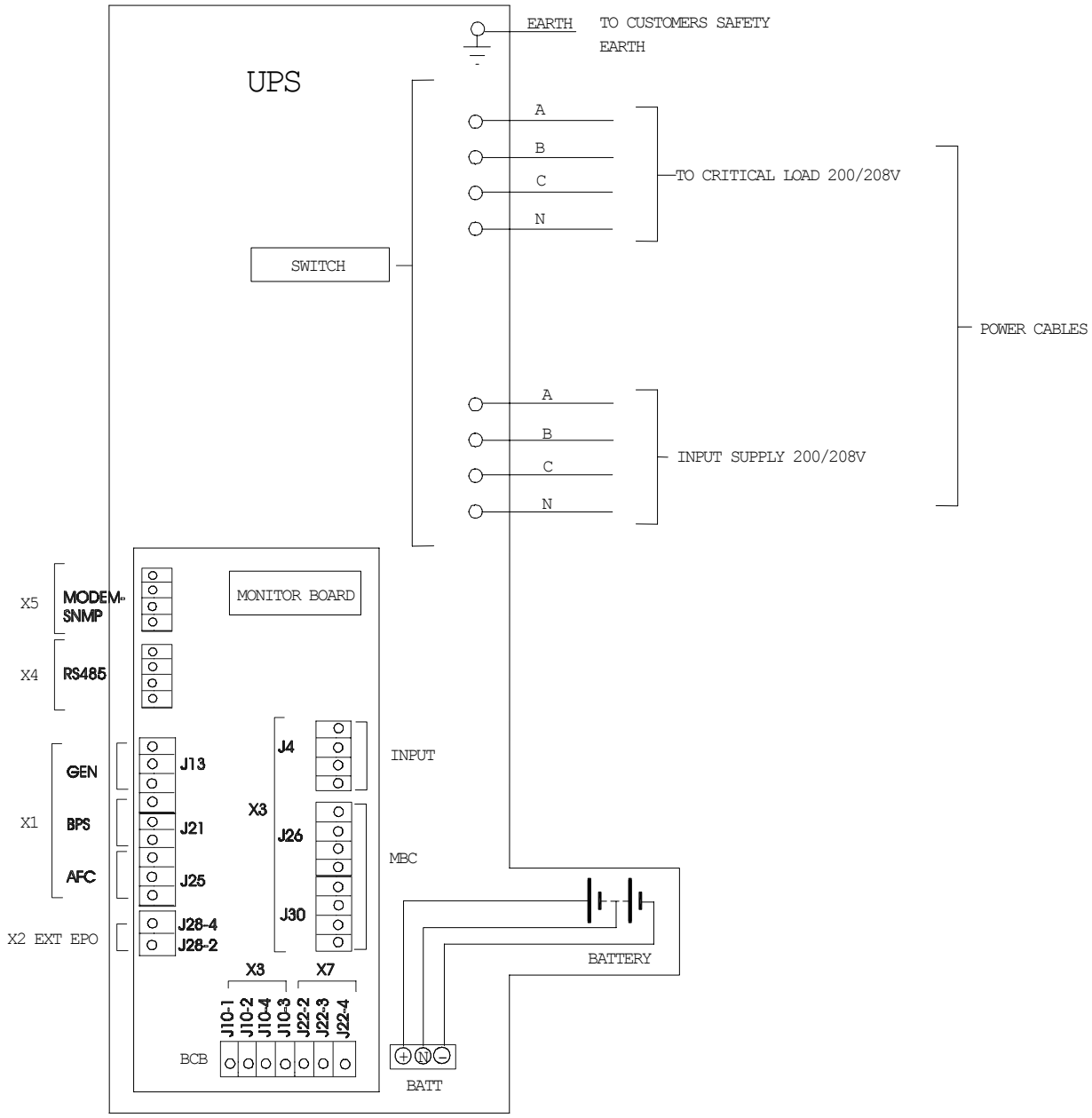
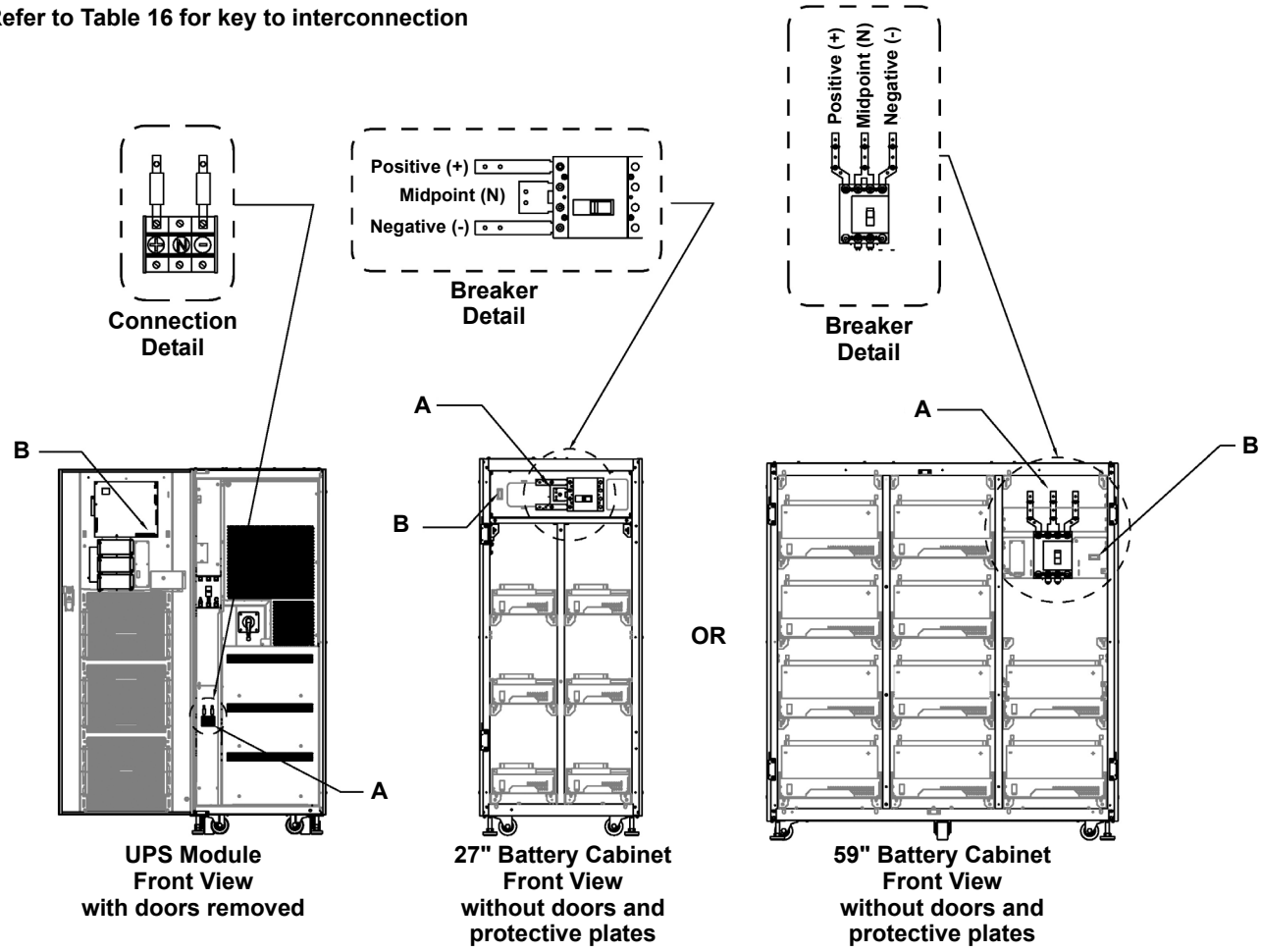


Figure 30 Battery cabinet interconnection



NOTES:

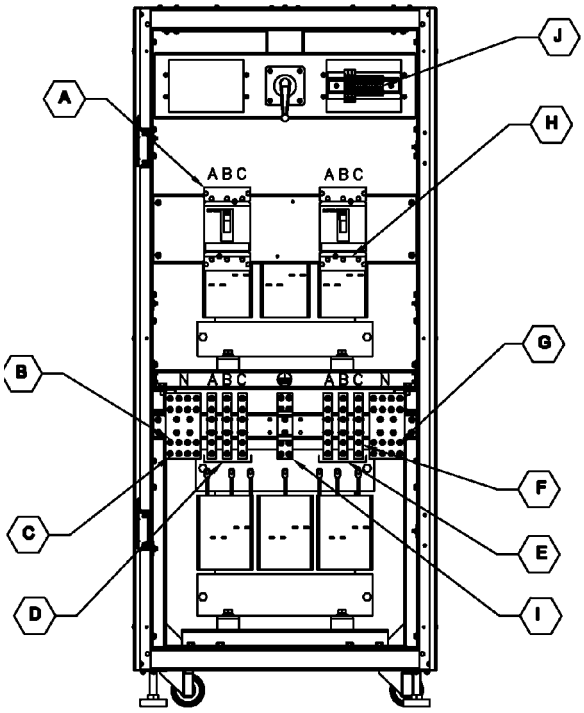
1. All Liebert-supplied cable must be repositioned prior to and while the cabinets are being placed in their final installed location.
2. All interconnection hardware supplied by Liebert
3. All interconnection cables supplied by Liebert when bolted together.
4. Interconnection cables field-supplied when battery cabinets are stand-alone.
5. Refer to the individual drawing of each piece of equipment for additional details.

Table 16 Liebert -supplied interconnect wiring

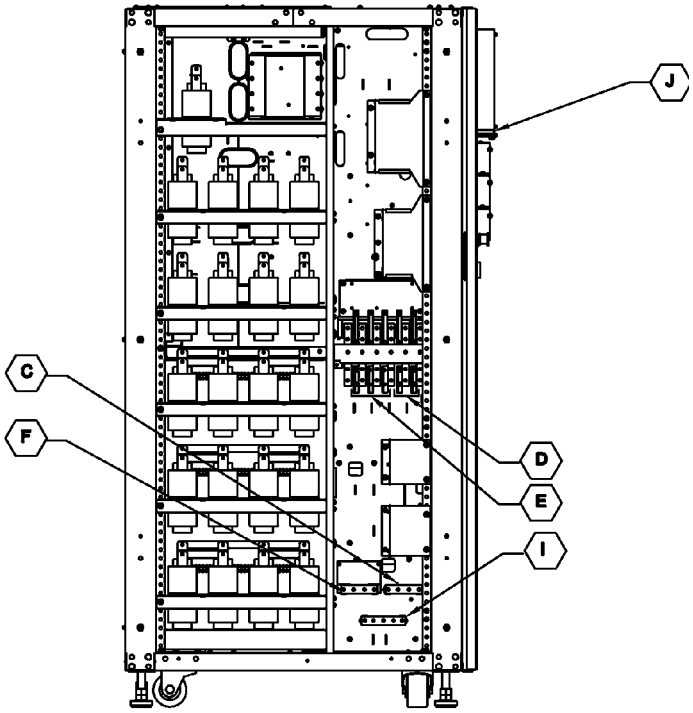
Run	From	To	Conductors
A	UPS battery terminal block	External 27" or 59" battery cabinet	Positive, midpoint, negative
B	Battery cabinet terminal block	UPS monitor board	Battery breaker aux contacts

Figure 31 Maintenance Bypass interconnection

Refer to Table 17 for key to interconnection



Maintenance Bypass/Transformer Cabinet
front view without front door and panel



UPS Module
left-side view without side panel

NOTES

1. All Liebert-supplied cable must be repositioned prior to and while the cabinets are being placed in their final installed location.
2. All interconnection hardware supplied by Liebert.
3. AC connections must be made to the UPS module before attaching maintenance bypass/transformer cabinet to UPS module.
4. Utility AC source neutral not required for maintenance bypass/transformer cabinet types D, E, M, N.
5. All cabling will be field-supplied when maintenance bypass/transformer cabinet is configured as stand-alone cabinet.
6. Maintenance bypass/transformer cabinets must attach to the left side only.
7. Refer to the individual drawing of each piece of equipment for additional details.

Table 17 Liebert-supplied interconnect wiring for Maintenance Bypass Cabinet

Run	From	To	Conductors
A	Utility AC source	Maintenance	Ph A, B, C bypass/ transformer cabinet
B	Utility AC source	Maintenance	Neutral bypass/ transformer cabinet
C	Maintenance	UPS module AC input	Neutral bypass cabinet
D	Maintenance	UPS module AC input	Ph A, B, C bypass cabinet
E	UPS module AC output	Maintenance	Ph A, B, C bypass/transformer cabinet
G	UPS module AC output	Maintenance	Neutral bypass/transformer cabinet
F	Maintenance	Load AC connection	Neutral bypass cabinet
H	Maintenance	Load AC connection	Ph A, B, C bypass cabinet
I	Utility AC source	All ground connections	Ground
J	Monitoring terminal block	UPS terminal block	Bypass contacts

8.0 SPECIFICATIONS AND TECHNICAL DATA

8.1 Lug Size and Torque Requirements

Use commercially available solderless lugs for the wire size required for your application. Refer to **Table 18**. Connect wire to the lug using tools and procedures specified by the lug manufacturer.

Table 18 Torque specifications

Nut and Bolt CombinationS				
	Grade 2 Standard		Electrical Connections with Belleville Washers	
Bolt Shaft Size	Lb-in	N-m	Lb-in	N-m
1/4	53	6.0	46	5.2
5/16	107	12	60	6.8
3/8	192	22	95	11
1/2	428	22	256	29

Circuit Breakers With Compression Lugs (For Power Wiring)		
Wire Size or Range	Lb-in	N-m
#6 - #4	100	11
#3 - #1	125	14
1/0 - 2/0	150	17
3/0 - 200 MCM	200	23
250 - 400 MCM	250	28
500 - 700 MCM	300	34

Circuit Breakers With Compression Lugs (For Power Wiring)		
Current Rating	Lb-in	N-m
400 - 1200 Amps	300.00	34.00

Terminal Block Compression Lugs (For Control Wiring)		
AWG Wire Size or Range	Lb-in	N-m
#22 -#14	3.5 to 5.3	0.4 to 0.6

NOTE: Use the values in this table unless the equipment is labeled with a different torque value.

Table 19 Battery torque rating

Battery	Initial Torque in-lb (N-m)	Annual Torque in-lb (N-m)
UPS12-100FR	40 (4.5)	32 (3.48)
UPS12-140FR	40 (4.5)	32 (3.48)
UPS12-200FR	40 (4.5)	32 (3.48)
UPS12-270FR	40 (4.5)	32 (3.48)
UPS12-310FR	65 (7.4)	52 (5.88)
UPS12-370FR	65 (7.4)	52 (5.88)
UPS12-475FR	110 (12.4)	110 (12.4)
NPX-80FR	26 (2.9)	26 (2.9)
NPX-100FR	26 (2.9)	26 (2.9)
NPX-150FR	26 (2.9)	26 (2.9)

Table 20 UPS terminal

Bypass input (single or dual input unit)

Unit Rating	Nominal Input Current	Maximum Input Current	OCP Current	OCP Device Rating	Bolt Size	Maximum Recommended Lug	
						Lug T&B One Hole 54000	Lug T&B One Hole REDDY
10	28	35	42	45	6M (1/4”)	54105	62204
15	42	53	63	70	6M (1/4”)	54106	62204
20	56	70	84	90	6M (1/4”)	54107	62204
30	83.3	104	125	125	6M (1/4”)	54152	62205

Rectifier Input (for Dual input unit only)

Unit Rating	Nominal Input Current	Maximum Input Current	OCP Current	OCP Device Rating	Bolt Size	Maximum Recommended Lug	
						Lug T&B One Hole 54000	Lug T&B One Hole REDDY
10	24.9	31	37	40	6M (1/4”)	54130	62204
15	37.3	47	56	60	6M (1/4”)	54106	62204
20	49.8	62	75	80	6M (1/4”)	54107	62204
30	74.7	93	112	125	6M (1/4”)	54152	62205

Output

Unit Rating	Nominal Output Current	OCP Current	OCP Device Rating	Bolt Size	Maximum Recommended Lug	
					Lug T&B One Hole 54000	Lug T&B One Hole REDDY
10	28	35	35	6M (1/4”)	54130	62204
15	42	53	60	6M (1/4”)	54106	62204
20	56	70	70	6M (1/4”)	54106	62204
30	84	105	110	6M (1/4”)	54108	62205

Battery

Unit Rating	Battery Current	OCP Current	OCP Device Rating	Bolt Size	Maximum Recommended Lug	
					Lug T&B One Hole 54000	Lug T&B One Hole REDDY
10	37	37	40	6M (1/4”)	54130	62204
15	55	55	60	6M (1/4”)	54106	62204
20	73	73	80	8M (5/16”)	54142	62212
30	110	110	125	8M (5/16”)	54153	62212

Table 21 Maintenance Bypass Cabinet

kVA	Type	I/P Voltage (VAC)	Max Input Current	Input OCP CB Size (A)	O/P Voltage (VAC)	Nominal O/P Current Rating (A)	Output OCP CB Size (A)
030	A, J	208	104	125	208	83	125
030	B, K	480	47	60	208	83	125
030	B, K	600	37	50	208	83	125
030	B, K	220	101	125	208	83	125
030	C, L	480	48	60	480	36	50
030	C, L	600	38	50	600	29	40
030	C, L	220	105	125	220	79	100
030	D, M	480	47	60	208	83	125
030	D, M	600	38	50	208	83	125
030	D, M	208	108	150	208	83	125
030	D, M	220	103	125	208	83	125
030	E, N	480	48	60	480	36	50
030	E, N	600	39	50	600	29	40
030	E, N	220	106	125	220	79	100
020	A, J	208	69	90	208	56	70
020	B, K	480	31	40	208	56	70
020	B, K	600	25	30	208	56	70
020	B, K	220	68	90	208	56	70
020	C, L	480	32	40	480	24	30
020	C, L	600	26	40	600	19	30
020	C, L	220	70	90	220	52	70
020	D, M	480	31	40	208	56	70
020	D, M	600	25	40	208	56	70
020	D, M	208	72	90	208	56	70
020	D, M	220	68	90	208	56	70
020	E, N	480	32	40	480	24	30
020	E, N	600	26	40	600	19	30
020	E, N	220	70	90	220	52	70
015	A, J	208	52	70	208	42	60
015	B, K	480	23	30	208	42	60
015	B, K	600	19	30	208	42	60
015	B, K	220	51	70	208	42	60
015	C, L	480	24	30	480	18	30
015	C, L	600	19	30	600	14	20
015	C, L	220	52	70	220	39	50
015	D, M	480	23	30	208	42	60
015	D, M	600	19	30	208	42	60
015	D, M	208	54	70	208	42	60
015	D, M	220	51	70	208	42	60
015	E, N	480	24	30	480	18	30
015	E, N	600	19	30	600	14	20
015	E, N	220	53	70	220	39	50
010	A, J	208	35	50	208	28	40
010	B, K	480	16	20	208	28	40
010	B, K	600	12	15	208	28	40
010	B, K	220	34	50	208	28	40
010	C, L	480	16	20	480	12	15
010	C, L	600	13	20	600	10	15
010	C, L	220	35	50	220	26	40
010	D, M	480	16	20	208	28	40
010	D, M	600	13	15	208	28	40
010	D, M	208	36	50	208	28	40
010	D, M	220	34	50	208	28	40
010	E, N	480	16	20	480	12	15
010	E, N	600	13	20	600	10	15
010	E, N	220	35	50	220	26	40

Table 22 Maintenance Bypass Cabinet lug sizes

Input

Unit Rating	Nominal System Input Voltage	OCP Device Rating	Bolt Size	Maximum Recommended Lug	
				Lug T&B One Hole 54000	Lug T&B One Hole REDDY
30	600	45	6M (1/4”)	54105	62204
30	480	60	6M (1/4”)	54106	62204
30	220	125	6M (1/4”)	54152	62205
30	208	125	6M (1/4”)	54152	62205
20	600	30	6M (1/4”)	NA	62204
20	480	35	6M (1/4”)	54130	62204
20	220	80	6M (1/4”)	54107	62204
20	208	80	6M (1/4”)	54107	62204
15	600	25	6M (1/4”)	NA	62204
15	480	30	6M (1/4”)	NA	62204
15	220	60	6M (1/4”)	54106	62204
15	208	60	6M (1/4”)	54106	62204
10	600	15	6M (1/4”)	NA	62204
10	480	20	6M (1/4”)	NA	62204
10	220	40	6M (1/4”)	54130	62204
10	208	40	6M (1/4”)	54130	62204

Output

Unit Rating	Nominal System Output Voltage	OCP Device Rating	Bolt Size	Maximum Recommended Lug	
				Lug T&B One Hole 54000	Lug T&B One Hole REDDY
30	600	40	6M (1/4”)	54130	62204
30	480	50	6M (1/4”)	54106	62204
30	220	100	6M (1/4”)	54108	62205
30	208	110	6M (1/4”)	54108	62205
20	600	25	6M (1/4”)	NA	62204
20	480	35	6M (1/4”)	54130	62204
20	220	70	6M (1/4”)	54106	62204
20	208	70	6M (1/4”)	54106	62204
15	600	20	6M (1/4”)	NA	62204
15	480	25	6M (1/4”)	NA	62204
15	220	50	6M (1/4”)	54106	62204
15	208	60	6M (1/4”)	54106	62204
10	600	15	6M (1/4”)	NA	62204
10	480	15	6M (1/4”)	NA	62204
10	220	35	6M (1/4”)	54130	62204
10	208	35	6M (1/4”)	54130	62204

Table 23 Battery cabinet physical characteristics

Battery Cabinet Type	Dimensions WxDxH in. (mm)	Net Weight Without Batteries, lb. (kg)
Short Narrow	27.2x31.4x63 (690x825x1600)	551 (250)
Short Wide	58.5x31.4x63 (1488x825x1600)	889 (400)

Table 24 Maintenance Bypass Cabinet weights

UPS Rating	Maintenance Bypass Cabinet Style, lb. (kg)									
	A	B	C	D	E	L	J	K	M	N
10kVA	408 (185)	545 (247)	675 (306)	602 (273)	732 (332)	670 (304)	403 (183)	540 (245)	597 (271)	728 (330)
15kVA	408 (185)	567 (257)	728 (330)	659 (299)	822 (373)	723 (328)	403 (183)	562 (255)	655 (297)	818 (371)
20kVA	408 (185)	646 (293)	842 (382)	739 (335)	935 (424)	838 (380)	403 (183)	642 (291)	734 (333)	930 (422)
30kVA	408 (185)	694 (315)	893 (405)	807 (366)	1027 (466)	888 (403)	403 (183)	690 (313)	802 (364)	1023 (464)

Table 25 Maintenance Bypass Cabinet dimensions

Unit	Width	Depth	Height
inch	27.2	31.4	63
mm	690	825	1600

8.2 Cable Lengths: Floor to Connection Point Inside UPS

To help calculate the total cable length required, refer to **Table 26** for the distance from the floor to selected connection points inside the NX. Determine the cable length required to reach the NX, then add the appropriate length from the table and adequate slack for repair and maintenance.

Table 26 Distance to connection points on the NX

Connection Point on UPS	Distance	
	From Floor in. (mm)	From Top of Unit in. (mm)
Bypass AC input supply	30 (750)	30 (750)
UPS output AC	30 (750)	30 (750)
Neutral busbars—Input and Output	11 (280)	55 (1397
Battery power	16 (400)	58 (1474)
Auxiliary cables: Monitor board (U2)	60 (1500)	20 (508)
Communications	55 (1400)	25 (635)
Ground	8 (197)	56 (14227)

NOTES

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