

Liebert® NXL™

Installation Manual – 250-400kVA, 60Hz, Three-Phase, Single-Module



CONTACTING EMERSON NETWORK POWER FOR SUPPORT

To contact Emerson Network Power Liebert Services for information or repair service in the United States, call 1-800-LIEBERT (1-800-543-2378). Liebert 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 Services, if available in your area. For areas not covered by Emerson Network Power Liebert Services, the authorized distributor is responsible for providing qualified, factory-authorized service.

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

Part numbers: _____

Serial numbers: _____

Rating: _____

Date purchased: _____

Date installed: _____

Location: _____

Input voltage/frequency: _____

Output voltage/frequency: _____

Battery reserve time: _____

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To register for warranty protection, visit the **Service and Support** section of our Web site at:

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IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

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

Risk of electrical shock. Can cause personal injury or death.

This UPS has several circuits that are energized with high DC as well as AC voltages. Check for voltage with both AC and DC voltmeters before working within the UPS. Check for voltage with both AC and DC voltmeters before making contact.

Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes and glasses should be involved in installing the UPS or preparing the UPS for installation. When performing maintenance with any part of the equipment under power, service personnel and test equipment should be standing on rubber mats.

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 installation and maintenance.


Special safety precautions are required for procedures involving handling, installation and maintenance of the UPS system. Observe all safety precautions in this manual before handling or installing the UPS system. Observe all precautions in the Operation and Maintenance Manual, SL-25425, before as well as during performance of all maintenance procedures. Observe all DC safety precautions before working on or near the DC system.



WARNING

Risk of heavy unit falling over. Improper handling can cause equipment damage, injury or death.

Exercise extreme care when handling UPS cabinets to avoid equipment damage or injury to personnel. The UPS module weight ranges from 3965 to 6380 lb. (1768 to 2894kg).

Locate center of gravity symbols  and determine unit weight before handling each cabinet. Test lift and balance the cabinets before transporting. Maintain minimum tilt from vertical at all times.

Slots at the base of the modules cabinets are intended for forklift use. Base slots will support the unit only if the forks are completely beneath the unit.

Read all of the following instructions before attempting to move, lift, remove packaging from or preparing unit for installation.



WARNING

Risk of electrical shock and fire. Can cause equipment damage, personal injury or death.

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.

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 potential electric charges may exist at the capacitor banks and at the DC connections.

All wiring must be installed by a properly trained and qualified electrician. All power and control wiring must comply with all applicable national, state and local codes.

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

**NOTE**

Materials sold hereunder cannot be used in the patient vicinity (e.g., use where UL, cUL or IEC 60601-1 is required). Medical applications such as invasive procedures and electrical life support equipment are subject to additional terms and conditions.

NOTICE

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 communication. Operation of this unit in a residential area may cause harmful interference that the user must correct at his own expense.

1.0 SINGLE-MODULE MECHANICAL INSTALLATION

1.1 Introduction

This following section describes the requirements that must be taken into account when planning the positioning and cabling of the Liebert NXL uninterruptible power supply and related equipment.

This chapter is a guide to general procedures and practices that should be observed by the installing personnel. The particular conditions of each site will determine the applicability of such procedures.



WARNING

Risk of electrical shock. Can cause injury or death.

Special care must be taken when working with the batteries associated with this equipment. When connected together, the battery terminal voltage will exceed 400VDC and is potentially lethal.

NOTICE

All equipment not referred to in this manual is shipped with details of its own mechanical and electrical installation.

NOTICE

Three-phase input supply required.

The standard Liebert NXL UPS is suitable for connection to three-phase, four-wire (+ Earth) TN-C, TN-S, IT-G, IT-IG or, three-phase, three-wire plus ground, IT-UG.

If using with IT Power system, a 4-pole disconnect device must be included as part of building installation.

NOTICE

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

1.2 Preliminary Checks

Before installing the UPS, please carry out the following preliminary checks:

- Visually examine the UPS equipment for transit damage, both internally and externally. Report any damage to the shipper immediately.
- Verify that the correct equipment is being installed. The equipment supplied has an identification tag on the back of the main door reporting: the type, size and main calibration parameters of the UPS.
- Verify that the UPS room satisfies the environmental conditions stipulated in the equipment specification, paying particular attention to the ambient temperature and air exchange system.

1.3 Environmental Considerations

1.3.1 UPS Room

The UPS module is intended for indoor installation and should be located in a cool, dry, clean-air environment with adequate ventilation to keep the ambient temperature within the specified operating range (see **Environmental Parameters** in **Table 7**).

The Liebert NXL UPS is cooled with the aid of internal fans. To permit air to enter and exit and prevent overheating or malfunctioning, do not cover the ventilation openings.

**NOTE**

To ensure proper airflow, the unit must be installed only on a solid surface made of a non-combustible material, such as concrete.

The Liebert NXL UPS is equipped with air filters located behind the front doors. A schedule for inspection of the air filters is required. The period between inspections will depend upon environmental conditions.

When bottom entry is used, the conduit plate must be installed.

**NOTE**

The UPS is suitable for mounting on concrete or other non-combustible surface only.

1.3.2 Storage

Should the equipment not be installed immediately, it must be stored in a room for protection against excessive humidity and or heat sources (see **Environmental Parameters** in **Table 7**).

1.4 Positioning

The cabinet is structurally designed to handle lifting from the base.

Access to the power terminals, auxiliary terminals blocks and power switches is from the front.

The door can be opened to give access to the power connections bars, auxiliary terminal blocks and power isolators. Front door can be opened at 180° for more flexibility in installations.

**NOTE**

The UPS must be placed a solid surface. There must be no openings in the surface except those required for conduit landing areas. All provided kick plates must be installed.

1.4.1 Moving the Cabinets

The route to be travelled between the point of arrival and the unit's position must be planned to make sure that all passages are wide enough for the unit and that floors are capable of supporting its weight (for instance, check that doorways, lifts, ramps, etc. are adequate and that there are no impassable corners or changes in the level of corridors).

Ensure that the UPS weight is within the designated surface weight loading (kg/cm²) of any handling equipment. For weight details, see **Table 7**.

The UPS can be handled with a forklift or similar equipment. Ensure any lifting equipment used in moving the UPS cabinet has sufficient lifting capacity. When moving the unit by forklift, care must be taken to protect the panels. Do not exceed a 15-degree tilt with the forklift. Bottom structure will support the unit only if the forks are completely beneath the unit.

Handling with straps is not authorized.




WARNING

Risk of heavy unit falling over. Improper handling can cause equipment damage, injury or death.

Because the weight distribution in the cabinet is uneven, use extreme care while handling and transporting. Take extreme care when handling UPS cabinets to avoid equipment damage or injury to personnel.

The UPS module weight ranges from 3965 to 6380 lb. (1768 to 2894kg).

Locate center of gravity symbols  and determine unit weight before handling each cabinet. Test lift and balance the cabinets before transporting. Maintain minimum tilt from vertical at all times.

1.4.2 Clearances

The Liebert NXL has no ventilation grilles at either side or at the rear of the UPS. Clearance around the front of the equipment should be sufficient to enable free passage of personnel with the doors fully opened. It is important to leave a distance of 24" (610mm) between the top of the UPS and any overhead obstacles to permit adequate circulation of air coming out of the unit.

1.4.3 Raised Floor Installations

If the equipment is to be located on a raised floor it should be mounted on a pedestal suitably designed to accept the equipment point loading. Refer to the base view to design this pedestal. The top of pedestal must be solid.



NOTE

The UPS must be placed on a solid surface. There must be no openings in the surface except those required for conduit landing areas. All provided kick plates must be installed.

1.4.4 Kick Plate Installation

Kick plates must be installed. If the unit is to be installed in a position that does not permit access to the rear kick plates, then kick plates must be installed before the unit is placed in its final position.

1.4.5 Special Considerations for 1+N Parallel Systems

Consider the grounding configuration of your system before finalizing module placement See **2.5 - Configuring Neutral and Ground Connections**.

Emerson Network Power recommends matching the impedance in the bypass path of paralleled systems as closely as possible.

The impedance mismatch can be minimized by controlling the wiring length of each unit. The design and the layout of the UPS system and associated panels and cabling should be examined closely to ensure that cable lengths and impedances are closely matched. The Liebert 1+N UPS module is supplied with a sharing reactor to minimize the impact of cable impedance mismatch.

The cabling impedance must be carefully controlled to ensure good bypass current sharing.

For Liebert NXL Systems, the cabling impedances must be within 10% from maximum to minimum. If the cabling impedances need to be greater than 10%, contact your Emerson representative to calculate whether the system will result in an overload condition when operating on bypass.

When bringing the 1+N system online for the first time or after removing one unit, Emerson recommends checking the bypass current mismatch. To check the bypass current mismatch:

1. Place a load on the bypass of each UPS module.
2. View the output current of each unit.

The accuracy of the currents displayed on the UPS module is sufficient for this check. If the mismatch is greater than 10%, the bypass impedances must be balanced or the load must be limited to less than the maximum rating.

1.5 System Composition

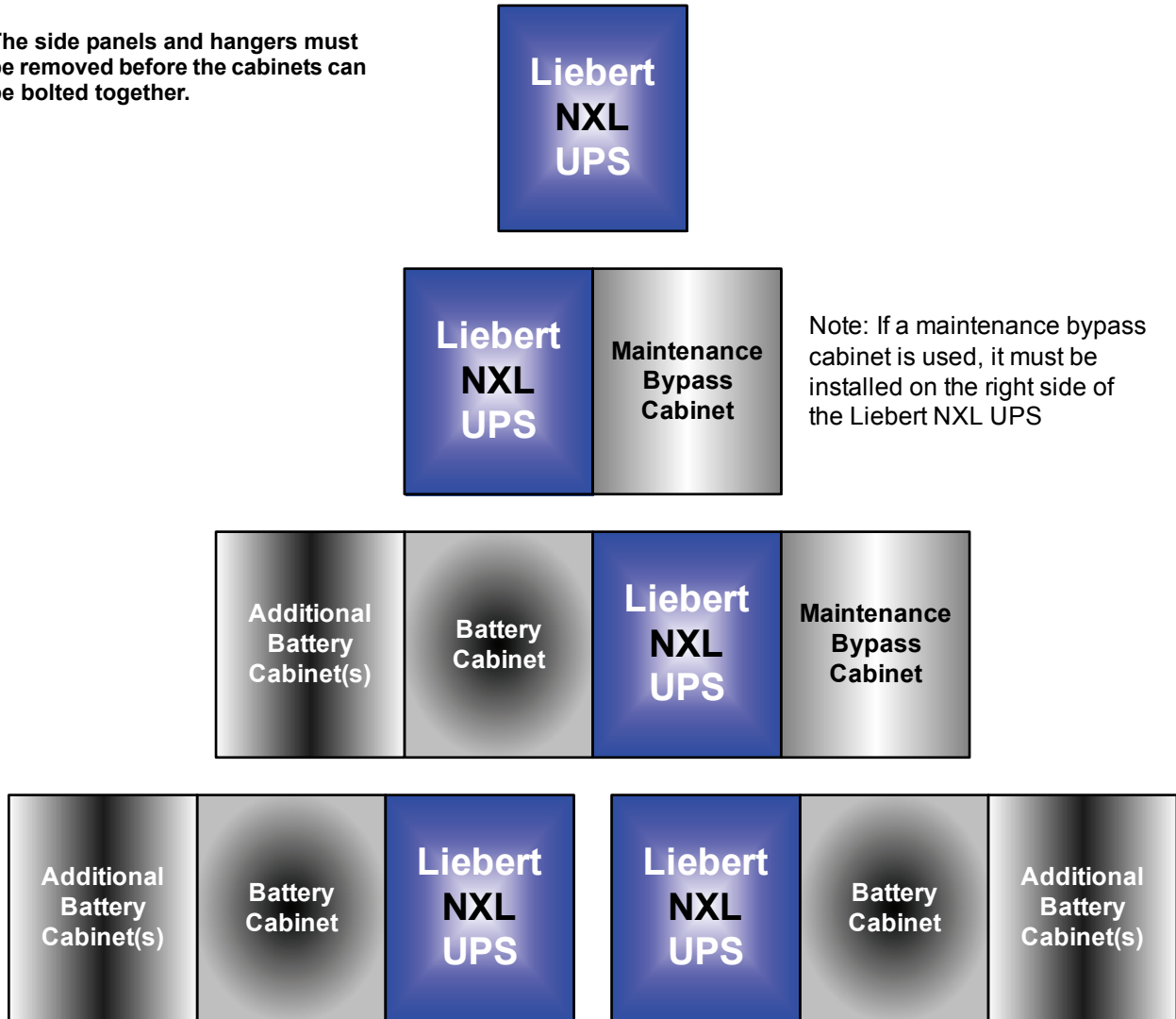
A UPS system can comprise a number of equipment cabinets, depending on the individual system design requirements, e.g. UPS cabinet, battery cabinet, maintenance bypass cabinet. In general, all the cabinets used in a particular installation are of the same height. Refer to the drawings provided in **4.0 - Installation Drawings** for the positioning of the cabinets as shown in **Figure 1**.

1.6 Cable Entry

Cables can enter the UPS cabinet from bottom or top into the Input/Output (I/O) section of the unit, see the figures in **4.0 - Installation Drawings**.

Figure 1 Cabinet arrangement—Liebert NXL, battery cabinets, maintenance bypass cabinet

The side panels and hangers must be removed before the cabinets can be bolted together.



2.0 UPS ELECTRICAL INSTALLATION

This chapter provides guidelines for qualified installers who must have knowledge of local wiring practices pertaining to the equipment to be installed.



WARNING

Risk of electrical shock. Can cause injury or death.

The UPS contains high DC as well as AC voltages. Check for voltage with both AC and DC voltmeters before working within the UPS.

Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes and glasses should be involved in installing the UPS or preparing the UPS for installation.

2.1 External Protective Devices

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

External overcurrent protection must be provided. See **Table 7 - Liebert NXL UPS specifications** for overload capacity.

Dual Input

When wiring the UPS with a separate rectifier and bypass input, each input must be protected separately. Size the breakers according to the input currents shown in **Table 7**.

2.2 Power Cables

The UPS requires both power and control cabling. All control cables, whether shielded or not, should be run separate from the power cables in metal conduits or metal ducts which are electrically bonded to the metalwork of the cabinets to which they are connected

The cable design must comply with the voltages and currents in **Table 7**, follow local wiring practices and take into consideration the environmental conditions (temperature and physical support media), room temperature and conditions of installation of the cable and system's overload capacity (see **5.0 - Specifications**).

For cable entry terminal, refer to **Figure 15**.



WARNING

Risk of electrical shock. Can cause injury or death.

Before cabling the UPS, ensure that you are aware of the location and operation of the external isolators that connect the UPS input/bypass supply to the power distribution panel. Check that these supplies are electrically isolated, and post any necessary warning signs to prevent their inadvertent operation.

NOTICE

For dual input operation ensure that any busbars between the bypass and the rectifier input are removed.

When sizing battery cables, a maximum volt drop of 2VDC is permissible at the current ratings given in **Table 11**.

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

- Take special care when determining the size of the neutral cable (grounded conductor), because current circulating on the neutral cable may be greater than nominal current in the case of non-linear loads. Refer to the values in **Table 7**.
- The grounding conductor should be sized according to the fault rating, cable lengths, type of protection, etc. The grounding cable connecting the UPS to the main ground system must follow the most direct route possible.
- Consideration should be given to the use of paralleled smaller cables for heavy currents, as this can ease installation considerably.
- AC and DC cables must be run in conduits according to local codes, national codes and standard best practices. This will prevent creation of excess EMI fields.

2.2.1 Sizing the Input Breaker Feeding a Liebert NXL UPS

The rectifier nominal input current value (**Table 8**) is based on providing enough power to operate the inverter at full rated load when the input voltage is nominal. The published rectifier maximum input current value is based on the maximum input current limit setting of 125%.

The recommended input breaker ampacity is based on the NEC calculation for a branch circuit with the current limit set at the maximum value. The calculation for an 80% rated breaker is 125% of the nominal current (continuous) plus 100% of the difference between the nominal and the maximum currents (non-continuous). The calculation for a 100% rated breaker is 100% of the nominal current (continuous) plus 100% of the difference between the nominal and maximum currents (non-continuous).

The rectifier input current limit can be adjusted from 25% to 125% of the nominal value. This setting is accessible only to a factory-trained service engineer. The effect of changing this setting is similar to that of changing the setting of the trip unit on a solid-state circuit breaker. With a lower current limit setting, the calculation for the branch circuit will result in a lower value.

The input current limit should not be set less than 105% of the current needed to support the inverter at full load for normal operation. This results in sufficient power to recharge the battery in a reasonable time and to operate over the published input voltage range.

2.2.2 Power Cable Connection Procedure

The rectifier input, bypass, output and battery power cables (all require lug type terminations) are connected to busbars situated in the I/O section as shown in **Figures 15** through **17**.

Equipment Ground

The equipment ground busbar is located in the I/O section as shown in **Figure 15**. The grounding conductor must be connected to the ground busbar and bonded to each cabinet in the system.

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



NOTE

Proper grounding reduces problems in systems caused by electromagnetic interference.



WARNING

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

All operations described in this section must be performed by properly trained and qualified electricians or technical personnel. If any difficulties are encountered, contact Emerson Network Power Liebert Services. See the back page of this manual for contact information.

The grounding and neutral bonding arrangement must be in accordance with local and national codes of practice.

Once the equipment has been positioned and secured, connect the power cables as described below (refer to the appropriate cable connection drawing in **4.0 - Installation Drawings**):

1. Verify that the UPS equipment is isolated from its external power source and all the UPS power isolators are open. Check that these supplies are electrically isolated and post any necessary warning signs to prevent their inadvertent operation.
2. Open exterior and interior panels on the front of the I/O.
3. Connect the ground and any necessary main bonding jumper to the equipment ground busbar located in the I/O section.
4. Make power connections and tighten the connections to the proper torque according to one of the two procedures below, depending on the type of installation:

Ensure correct phase rotation.

- Top Cable Entry (see **Figure 16**)
- Bottom Cable Entry (see **Figure 17**)

Top Cable Entry

When making the power connections for top cable entry, the recommended order of pulling and installing cables is to start from the top connections to the bottom connections. The cables must be routed around the fault braces (see Detail in **Figure 16**). This is to prevent the cables from contacting other busbars. The recommended conduit layout is shown in **Figure 15**.

Bottom Cable Entry

When making the power connections for bottom cable entry, the recommended order of pulling and installing cables is to start from the bottom connections to the top connections. The cables must be routed around the fault braces (see Detail in **Figure 17**). This is to prevent the cables from contacting other busbars. The recommended conduit layout is shown in **Figure 15**.



NOTE

For a Single Input configuration, linking busbars must be installed between the bypass and the rectifier input.



WARNING

Risk of electrical shock. Can cause injury or death.

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



WARNING

Risk of electrical shock. Can cause injury or death.

When connecting the cables between the battery extremities to the circuit breaker always connect the circuit breaker end of the cable first.

- For control connection details, see 2.3 - Control Cable and Communication.



NOTE

*If fault bracing brackets were removed during installation, they **MUST** be replaced.*

- Close and secure the interior and exterior doors.

Figure 2 Cabinet grounding plates

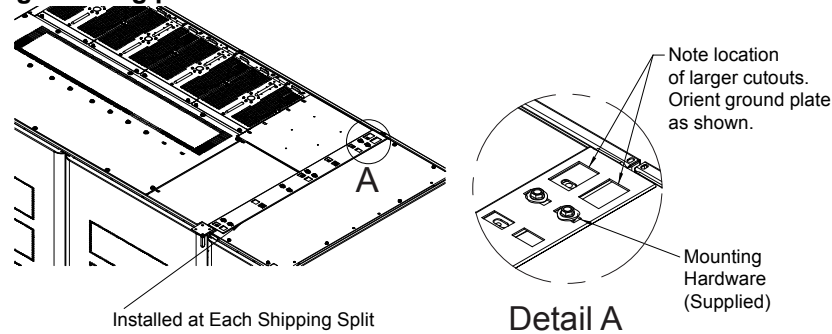
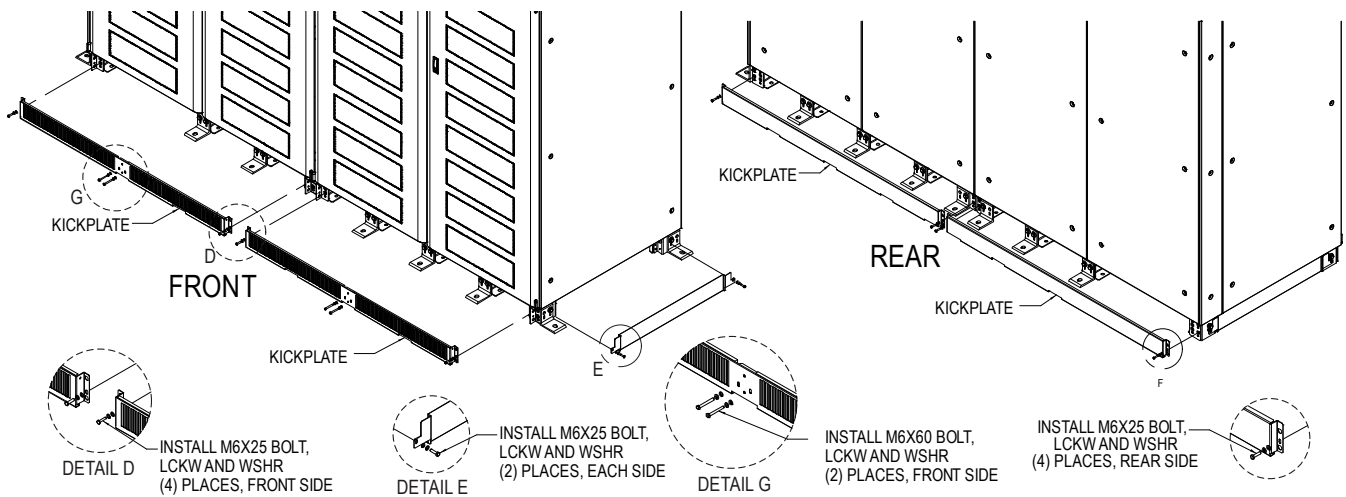


Figure 3 Kick plate and filter locations



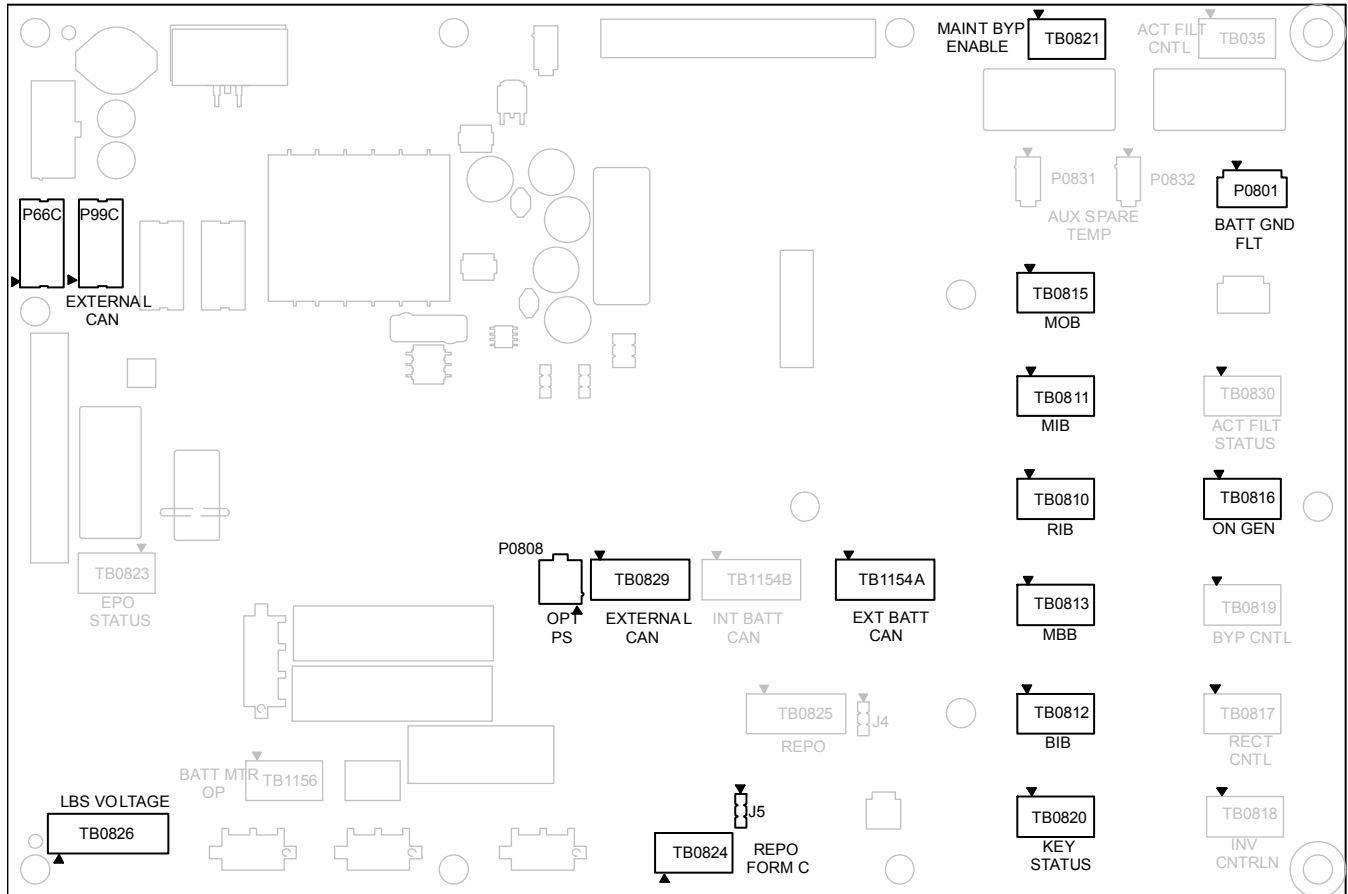
NOTE

*Kick plates **must** be installed. If the unit is to be installed in a position that does not permit access to rear kick plates, then kick plates must be installed before the unit is placed in its final position.*

2.3 Control Cable and Communication

Based on your site's specific needs, the UPS may require auxiliary connections to manage the battery system (external battery circuit breaker), communicate with a personal computer or provide alarm signaling to external devices, or for Remote Emergency Power Off (REPO). The External Interface Board, arranged for this purpose, is next to the option box in the Rectifier section (refer to **4.0 - Installation Drawings**).

Figure 4 External Interface Board connections layout



2.3.1 Dry Contacts



NOTE

If connection to more than one module is required, use a separate contact for each module.

Table 1 UPS input dry contacts

Item	Terminal Block	Pin	Connects to (Description of External Item)	Wire Size/ Max Length
Remote EPO Input Form C	TB0824	1	REPO Switch, normally open contact	14AWG/ 500ft. (150m).
		2	REPO Switch, common contact	
		3	REPO Switch, normally closed contact, set jumper J5: 1-2 to enable, 2-3 to disable	
On Generator Input Form C	TB0816	1	On Generator switch, closed = On Generator	
		2	On Generator switch, common	
		3	On Generator switch, closed = Not On Generator	

Table 2 UPS control with battery cabinet or module battery disconnect

Item	Terminal Block	Pin	Connects to (Description of External Item)	Wire Size/ Max Length
CAN Bus and 24V Power Supply	TB1154A	1	Battery Interface Board TB1154-1	18 AWG 1000ft. (300m).
		2	Battery Interface Board TB1154-2	
		3	Battery Interface Board TB1154-3	
		4	Battery Interface Board TB1154-4	

Table 3 UPS control contacts with global maintenance bypass

Item	Terminal Block	Pin	Connects to (Description of External Item)	Wire Size/ Max Length
Maintenance Isolation Breaker (MIB) Form C ¹	TB0811	1	CB aux. contact, closed = CB is closed	14AWG/500ft. (150m)
		2	CB aux. contact, common	
		3	CB aux. contact, closed = CB is open	
Maintenance Bypass Breaker (MBB) Form C ¹	TB0813	1	CB aux. contact, closed = CB is closed	14AWG/500ft. (150m)
		2	CB aux. contact, common	
		3	CB aux. contact, closed = CB is open	
Maintenance Bypass Enable Form C ¹	TB0821	1	Maintenance Bypass Cabinet, closed = load not on inverter	14AWG/500ft. (150m)
		2	Maintenance Bypass Cabinet, common	
		3	Maintenance Bypass Cabinet, closed = load on inverter	
Remote EPO Input ¹	TB0825	1	REPO Switch, normally open contact	14AWG/500ft. (150m)
		2	REPO Switch, common contact	
Key Status Input ^{1, 3}	TB0820	1	Key status switch, closed = key removed	14AWG/500ft. (150m)
		2	Key status switch, common	
		3	Key status switch, closed = key inserted	
Module Output Breaker (MOB) Form C ²	TB0815	1	CB aux. contact, closed = CB is closed	14AWG/500ft. (150m)
		2	CB aux. contact, common	
		3	CB aux. contact, closed = CB is open	

1. For 1+N systems with a maintenance Bypass, these Aux contacts must be run to each module from an isolated source.
2. For 1+N systems, these breaker Aux contact go to the UPS that it is associated with.
3. Key Status Input can be either Form-C, N.O. or N.C. contact.

Table 4 UPS control contacts to remote status panel

Item	Terminal Block	Pin	Connects to (Description of External Item)	Wire Size/ Max Length
CAN Bus and 24V Power Supply	TB0829	1	Remote Status Panel TB-2	18 AWG/1000ft. (300m)
		2	Remote Status Panel TB-1	
		3	Remote Status Panel TB-3	
		4	Remote Status Panel TB-4	

2.3.2 Multi-Module Communication

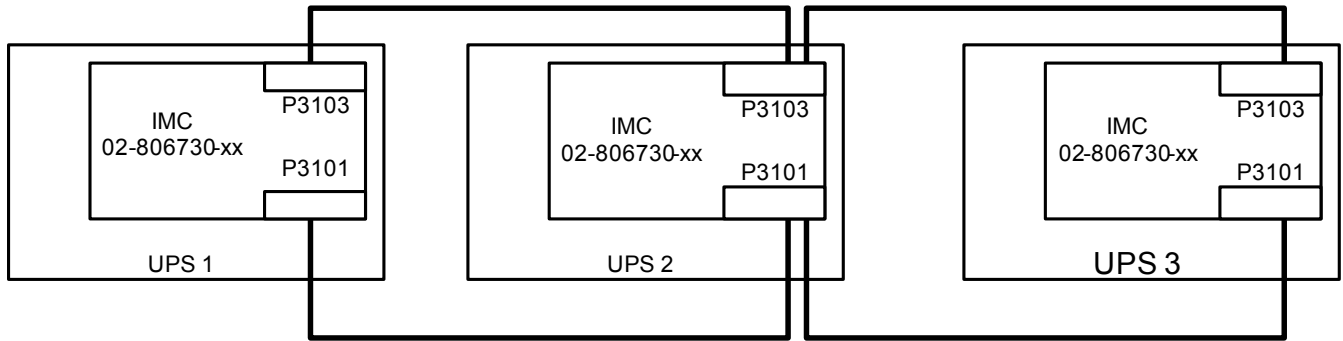
Paralleling cables that connect the module to the system are connected to terminals P3101 and P3103 on the Inter-Module Communication (IMC) board (refer to **4.0 - Installation Drawings**).

Table 5 Parallel from UPS module Inter-Module Communication Board to other Inter-Module Communication Board in system

Terminal Designation		Signal Name	Wire Size/ Max Length
From	To		
Primary Connections			
P3101-1	P3101-1	Share CAN +24V	1000ft. (300m)
P3101-2	P3101-2	Share CAN common	
P3101-3	P3101-3	System CAN +24V	
P3101-4	P3101-4	System CAN common	
P3101-5	P3101-5	SER synch CAN+24V	
P3101-6	P3101-6	SER synch CAN common	
P3101-7	P3101-7	Ground - Drain Wire	
P3101-14	P3101-14	Ground	
P3101-8	P3101-8	PWM synch CAN +24V	
P3101-9	P3101-9	PWM synch CAN common	
P3101-10	P3101-10	MMS synch CAN +24V	
P3101-11	P3101-11	MMS synch CAN common	
Redundant Connections			
P3103-1	P3103-1	Redundant share CAN +24V	1000ft. (300m)
P3103-2	P3103-2	Redundant share CAN common	
P3103-3	P3103-3	Redundant system CAN +24V	
P3103-4	P3103-4	Redundant system CAN common	
P3103-5	P3103-5	Redundant SER synch CAN +24V	
P3103-6	P3103-6	Redundant SER synch CAN common	
P3103-7	P3103-7	Ground - Drain Wire	
P3103-14	P3103-14	Ground	
P3103-8	P3103-8	Redundant PWM synch CAN +24V	
P3103-9	P3103-9	Redundant PWM synch CAN common	
P3103-10	P3103-10	Redundant MMS synch CAN +24V	
P3103-11	P3103-11	Redundant MMS synch CAN common	

1. Belden 810x or Belden 89901 cables are the only approved cables.
2. Belden 89901 cable can be used for underground installations.
3. If using multiple parallel cables for each run, all cables must be run in the same conduit.
4. Each cable group should be run in a separate grounded conduit to ensure redundancy.
5. The maximum lengths must include all the parallel cables from the first module to the last module. The primary and redundant cable lengths can be counted separately.
6. The ground pins on the Inter-Module Communication Board (Pins 7 and 14) are connected together on the board. If using cable with only one (1) drain wire, then connect the ground (drain wire) to Pin 7.
7. Care must be taken to prevent the drain wire from touching any other component in the module.
8. Attach control wires to the side of the control door where the Inter-Module Board (IMC) is attached. Do not run wires across the IMC board.

Figure 5 Inter-Module Communication Board wiring diagram—Multi-modules



2.4 Digital LBS

The Load Bus Sync interface enables independent UPS units to remain in sync when operating on battery or when supplied by unsynchronized input sources.

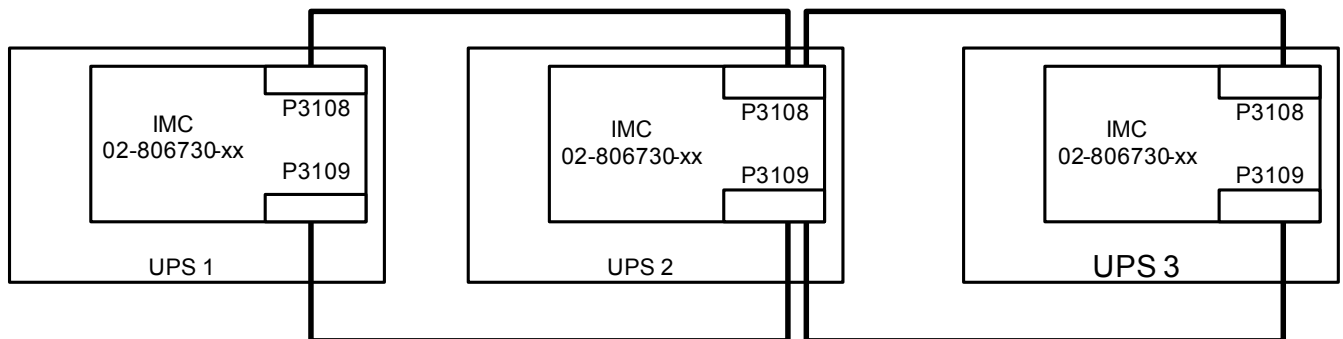
Digital LBS cables that connect the module to the system are connected to terminals P3108 and P3109 on the Inter-Module Communication (IMC) board. See **Figure 6**.

Table 6 Wire size, length for digital LBS connection of UPS Inter-Module Communication Boards

Terminal Designation		Signal Name	Wire Size/ Max Length
From	To		
Digital LBS from UPS inter-module communication board to other UPS inter-module communication board			
P3108-1	P3108-1	LBS Synch CANH	3000ft (900m)
P3108-2	P3108-2	LBS Synch CANL	
P3108-3	P3108-3	Ground - Drain Wire	
Redundant Digital LBS from UPS Inter-Module Communication Board to Other UPS Inter-Module Communication Board			
P3109-1	P3109-1	Redundant LBS Synch CANH	3000ft (900m)
P3109-2	P3109-2	Redundant LBS Synch CANL	
P3109-3	P3109-3	Ground - Drain Wire	

1. Belden 810x or Belden 89901 cables are the only approved cables.
2. Each cable group should be run in a separate grounded conduit to ensure redundancy.
3. The maximum lengths must include all the LBS cables from the first module to the last module.
4. The primary and redundant cable lengths can be counted separately.
5. Belden 89901 cable can be used for underground installations.
6. Attach the control wire to the side of the control door where the Inter-Module Board (IMC) is attached. Do not run wires across the IMC board.

Figure 6 Inter-Module Communication Board wiring diagram—Digital LBS



2.5 Configuring Neutral and Ground Connections

Improper grounding is the largest single cause of UPS installation and startup problems. Grounding techniques vary significantly from site to site, depending on several factors.

Proper grounding should be based on NEC Section 250, but safe and proper equipment operation requires further enhancements. The following pages detail recommendations for grounding various system configurations to ensure optimal UPS system performance.



NOTE

*Some UPS modules are equipped with input isolation transformers. However, these transformers have no effect upon any system grounding considerations. These modules will be grounded exactly as shown in **Figures 7 through 10**.*



CAUTION

The UPS ground lug must be solidly connected to the service entrance ground by an appropriately sized wire conductor per NEC Article 250. Each conduit or raceway containing phase conductors must also contain a ground wire, both for UPS input and output, which are solidly connected to the ground terminal at each termination point. Conduit-based grounding systems tend to degrade over time. Therefore, using conduit as a grounding conductor for UPS applications may degrade UPS performance and cause improper UPS operation.

2.5.1 Four-Wire Input connections

The UPS module main input and bypass input are connected to a grounded service. In this configuration, the UPS module is not considered a separately derived source. The UPS module output neutral is solidly connected to the building service neutral, which is bonded to the grounding conductor at the service entrance equipment.

Advantages of this configuration include:

- A measure of common-mode noise attenuation, since the isolation (common-mode rejection) occurs as close to the load as practical (i.e., at the PDU).
- The UPS module can be located remotely from the PDU without compromising common-mode noise performance.
- By using UPS modules with 480VAC input and output and creating 208VAC at the PDU, smaller and less costly power feeders can be used and less voltage drop (as a percent of nominal) occurs.

2.5.2 Three-Wire Input Connections

This configuration must NOT be used when single-phase loads are directly connected to the UPS.

The UPS output transformer is considered a separately derived source. The UPS module neutral is bonded to the UPS ground, which is connected to a local grounding electrode in accordance with NEC 250-26. Please note that this configuration represents a price/performance trade-off. Whenever the UPS module transfers to or from bypass, two AC sources (input and bypass) are briefly connected together and circulating current must flow. In this configuration, the current flows through the ground path, possibly tripping ground fault interrupters (GFIs) and distorting the bypass waveform reference. Proper adjustment of ground fault interrupters is necessary to avoid unwanted tripping. The time delay should be set to at least 0.2 seconds to prevent tripping when the UPS performs a transfer or retransfer operation.

NOTICE

Risk of improperly set ground fault interrupters. Can cause equipment damage.

Failure to set the ground fault interrupters properly could cause loss of power to the critical load.

2.5.3 Preferred Grounding Configuration, Battery Systems

Open-rack battery systems, depending on local code requirements and customer preference, are normally:

- Floating (ungrounded)
OR
- Center-tapped and floating

Battery cabinet systems must be connected as floating (ungrounded) systems.

Center-tapped or grounded battery systems are not possible with battery cabinet systems.

Whether the battery system is open-rack or cabinet, the metal rack parts or cabinet must be grounded to the UPS module ground bus.

2.5.4 Multi-Module Systems

For both N+1 and 1+N systems, the neutrals of all UPS modules in the system must be connected together inside the switchgear or parallel cabinet. The neutral conductors must be rated for 20% of phase conductor current minimum. Site and load conditions will determine if larger neutrals are required.

For Multi-Module systems using a 3-wire bypass, the Neutral-Ground bond must be made at the common neutral connection point in the switchgear or parallel cabinet.

2.5.5 High Resistance Ground Systems

The Liebert NXL is compatible with High Resistance Ground Systems. See your local Emerson representative for details.

2.6 Grounding Diagrams, Single- and Multi-Module Systems

Figure 7 Grounding diagram, three-wire single-module system

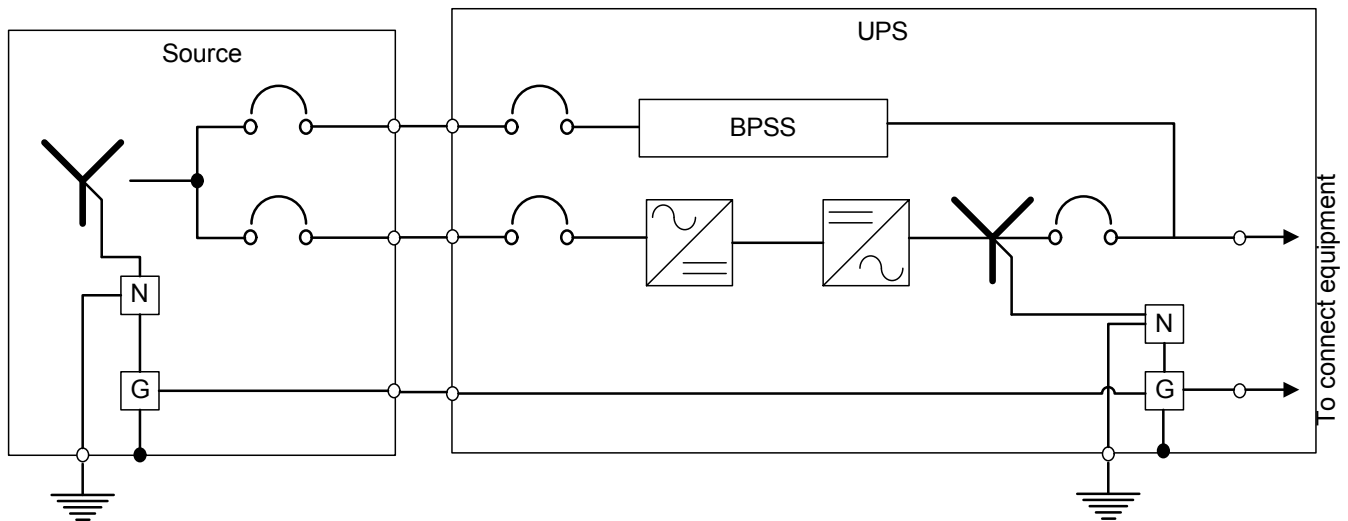


Figure 8 Grounding diagram, four-wire single-module system

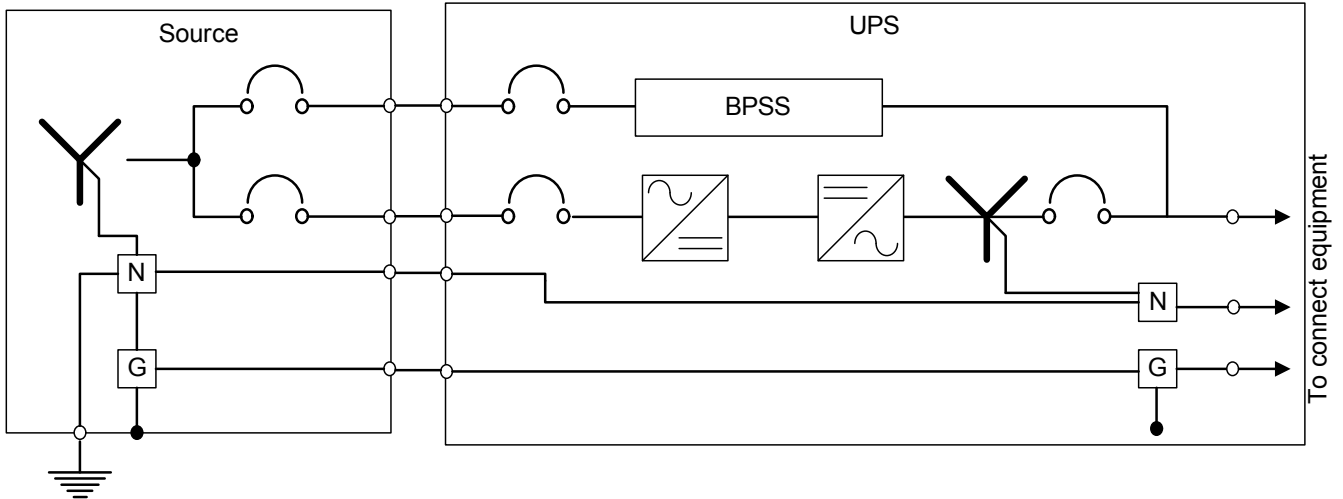
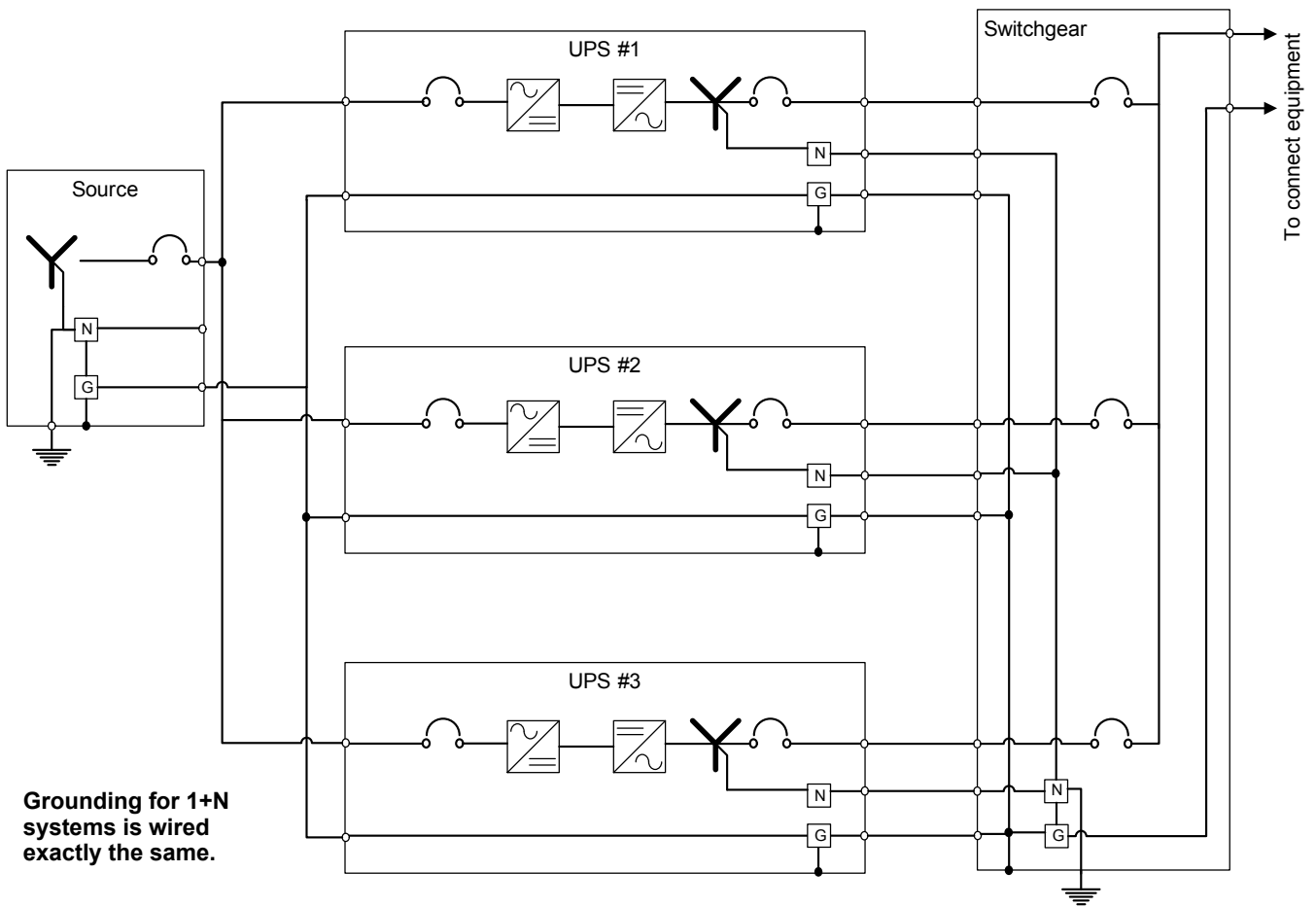
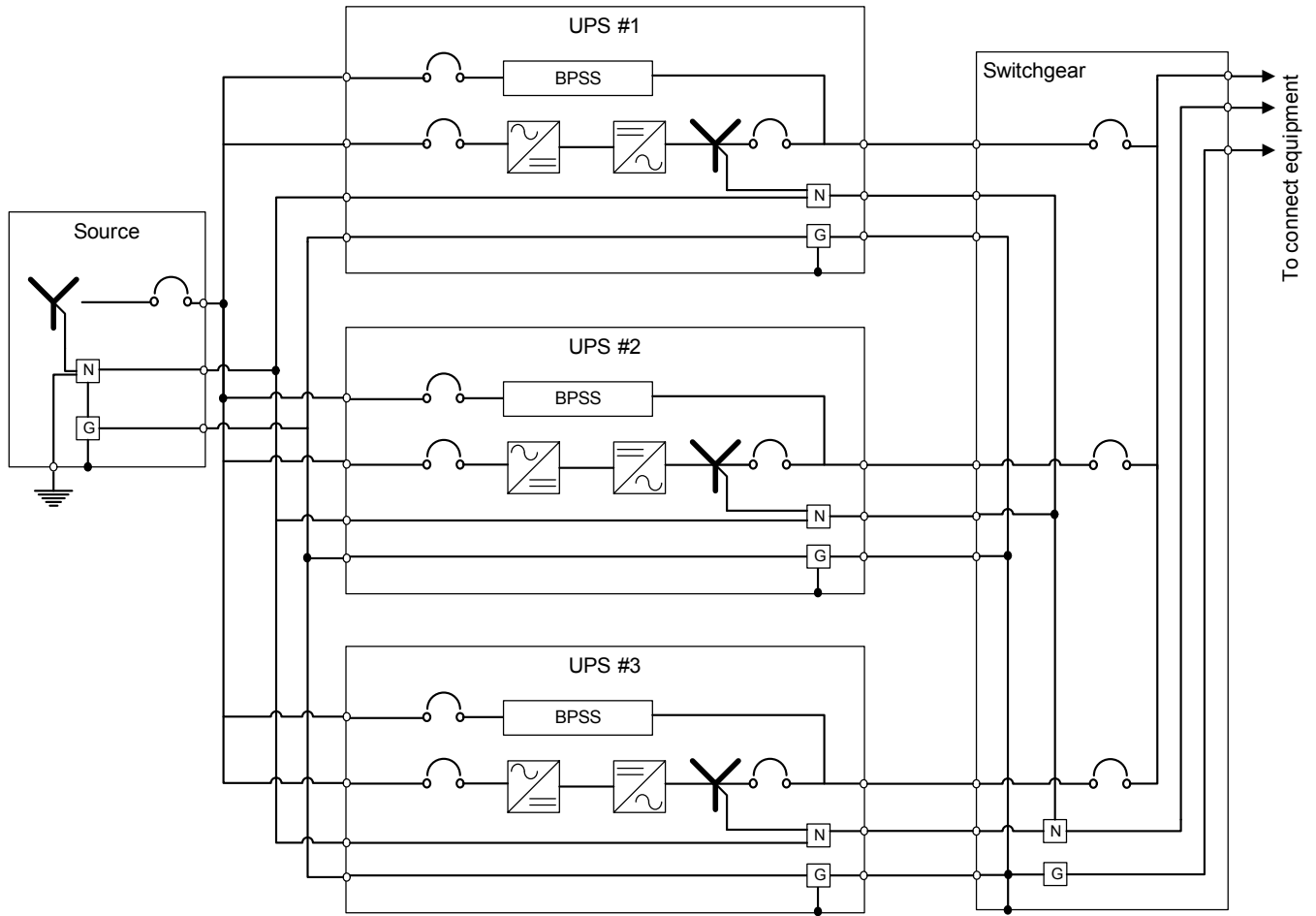


Figure 9 Grounding diagram, three-wire multi-module system



Grounding for 1+N systems is wired exactly the same.

Figure 10 Grounding diagram, four-wire multi-module system



3.0 OPTIONAL EQUIPMENT

3.1 Single-Module System Options

3.1.1 Matching Maintenance Bypass Cabinet

A matching Liebert NXL Maintenance Bypass cabinet is available. See Maintenance Bypass Cabinet Installation Manual (SL-24532) for more details.

3.1.2 Battery Temperature Sensor

The optional external battery temperature sensor kit, supplied separately from the battery circuit breaker, contains one probe and one temperature transport board.

3.1.3 Matching Liebert NXL Battery Cabinet

The optional matching Liebert NXL Battery Cabinet can be used to obtain the desired autonomy time. The battery cabinets are designed to be either attached to the UPS or separate from the UPS (for details, see the Liebert NXL Battery Cabinet installation manual, SL-25430, available at Liebert's Web site www.liebert.com).

3.1.4 Matching Module Battery Disconnect—MBD

The optional Module Battery Disconnect (MBD) can be used as a battery disconnect between a battery system and the Liebert NXL UPS. (for details, see the Liebert NXL Battery Cabinet installation manual, SL-24530, available at Liebert's Web site www.liebert.com).

3.1.5 Load Bus Synch

An optional Load Bus Synch (LBS) system can be used to synchronize two Liebert NXL UPSs or an Liebert NXL UPS to a Liebert Series 610 UPS.

3.1.6 Remote Alarm Panel

The remote alarm panel has LED alarm lights. An audible alarm sounds upon any alarm condition. The surface- or flush-mounted NEMA 1 enclosed panel indicates: Load on UPS, Load on Bypass, Battery Discharging, Low Battery Warning, Overload Warning, Ambient Overtemp Warning, UPS Alarm Condition and New Alarm Condition (for a second UPS alarm condition).

3.2 Communication and Monitoring

- Liebert IntelliSlot® Web Card - SNMP/HTTP Network Interface Card
- Liebert IntelliSlot® 485 Web Card - Modbus, J-bus, IGM Net
- Remote Monitoring Services IntelliSlot Card
- RS485/422 Protocol Converter IntelliSlot Card
- Programmable Relay Board
- Input Contact Isolator Board

3.2.1 Alber Monitoring System

The matching Liebert NXL Battery Cabinet allows installing an optional Alber Battery monitoring system in the cabinet. The Alber Battery Monitoring by Liebert continuously checks all critical battery parameters, such as cell voltage, overall string voltage, current and temperature. Automatic periodic tests of internal resistance of each battery will verify the battery's operating integrity. Additional capabilities include automatic internal DC resistance tests and trend analysis providing the ability to analyze performance and aid in troubleshooting.

4.0 INSTALLATION DRAWINGS

Figure 11 Main components location, 250kVA Liebert NXL N+1 multi-module unit without static bypass

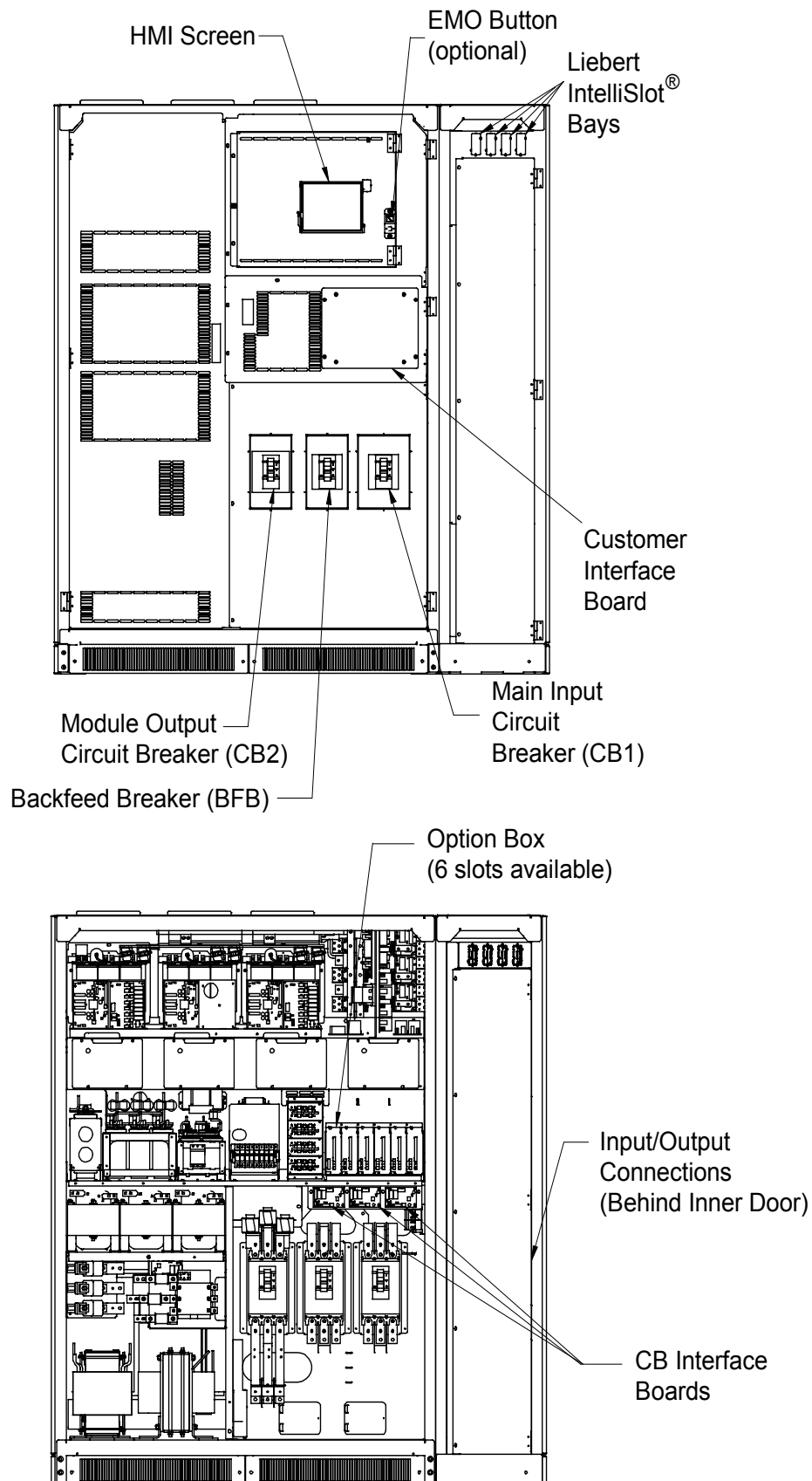
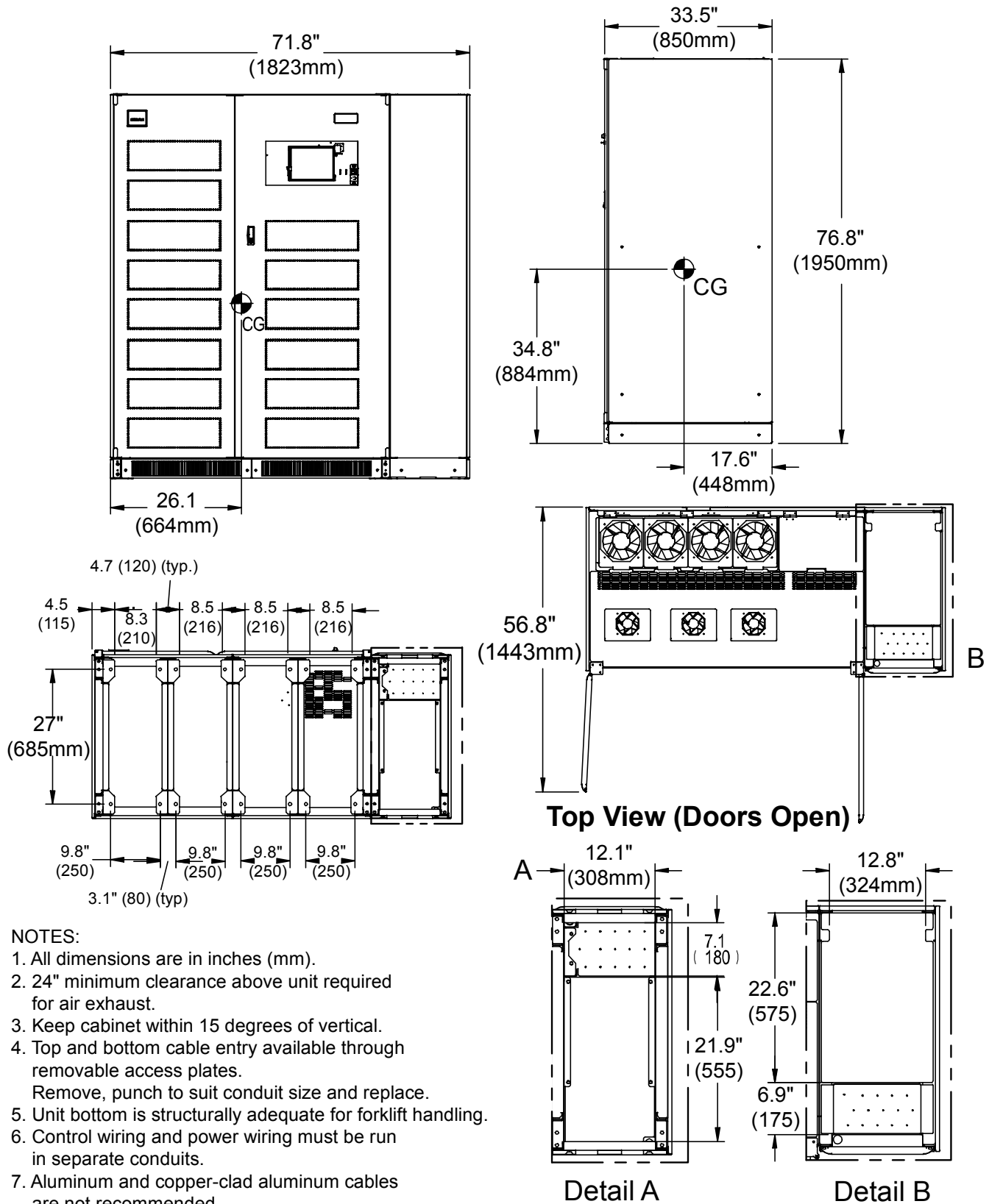


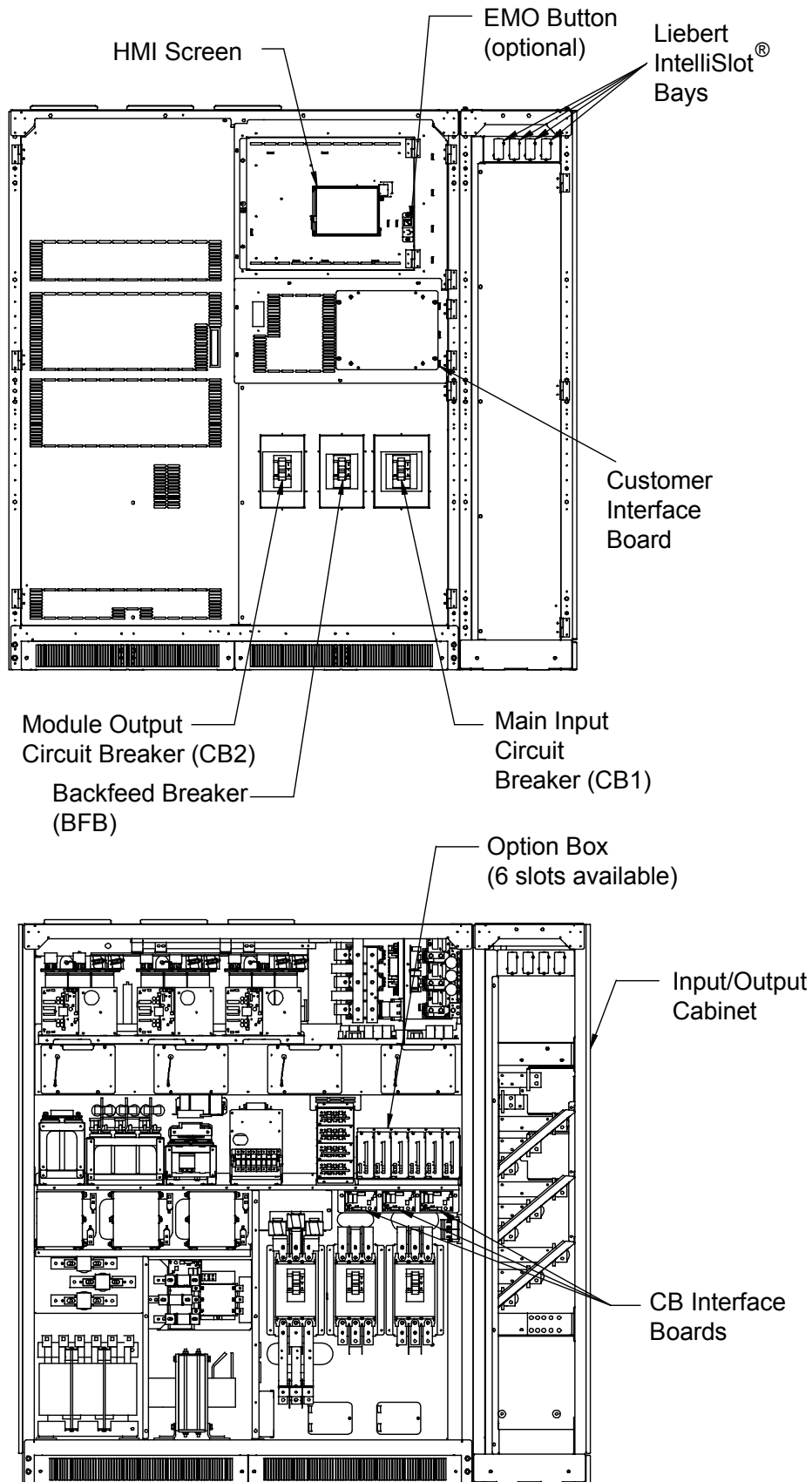
Figure 12 Outline drawing, 250kVA Liebert NXL N+1 multi-module unit without static bypass



NOTES:

1. All dimensions are in inches (mm).
2. 24" minimum clearance above unit required for air exhaust.
3. Keep cabinet within 15 degrees of vertical.
4. Top and bottom cable entry available through removable access plates.
Remove, punch to suit conduit size and replace.
5. Unit bottom is structurally adequate for forklift handling.
6. Control wiring and power wiring must be run in separate conduits.
7. Aluminum and copper-clad aluminum cables are not recommended.
8. Widths are with side panels. the width is 70" (1778mm) without side panels.
9. The depth dimension includes the front door and rear panel.

Figure 13 Main components location, 300kVA Liebert NXL N+1 multi-module unit without static bypass



Doors and Inner Skins Removed

Figure 14 Outline drawing, 300kVA Liebert NXL N+1 multi-module unit without static bypass

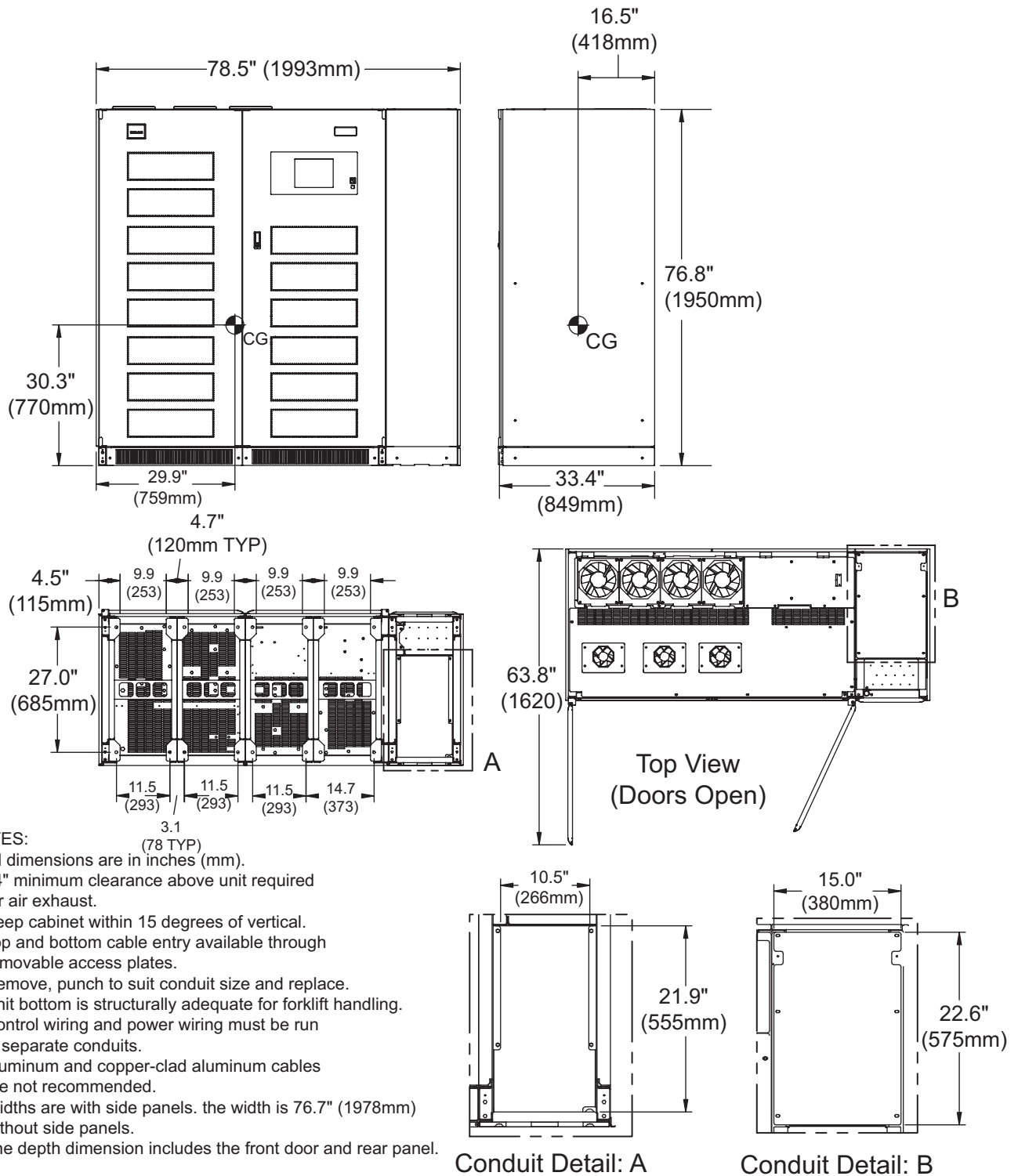
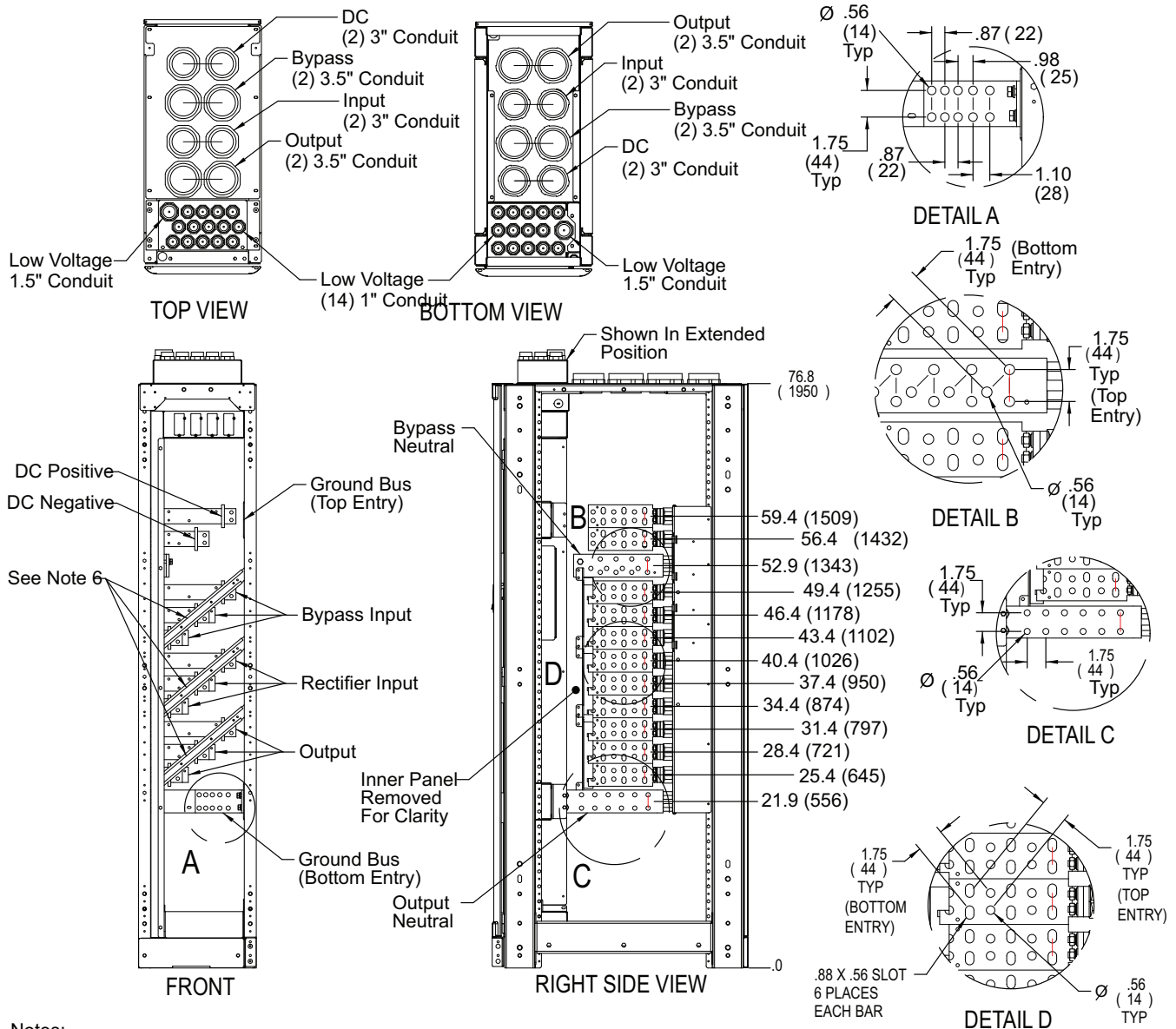


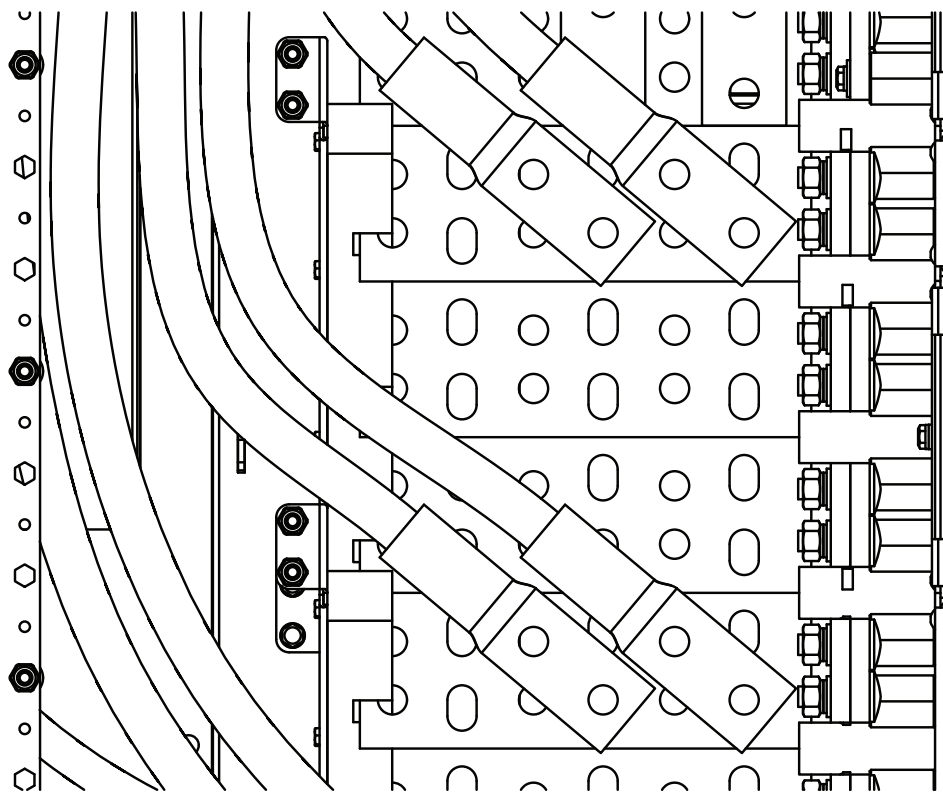
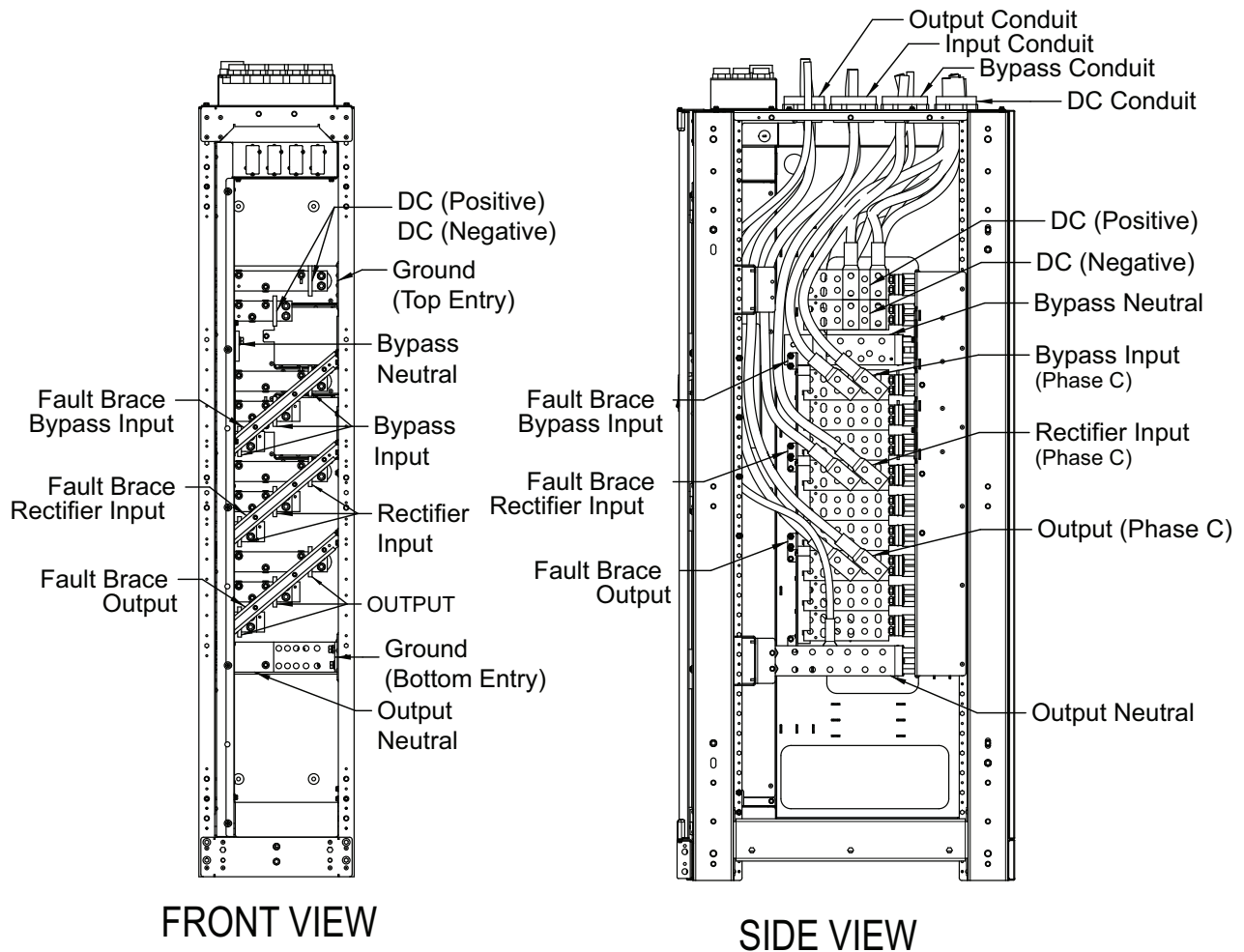
Figure 15 Input/output conduit detail drawing, 250-300kVA Liebert NXL N+1 multi-module unit without static bypass



Notes:

1. All dimensions are in inches (mm).
2. 24" minimum clearance above unit required for air exhaust.
3. Keep cabinet within 15 degrees of vertical.
4. Top and bottom cable entry available through removable access plates. Remove, punch to suit conduit size and replace.
5. Unit bottom is structurally adequate for forklift handling.
6. These brackets can be removed during installation but must be replaced after installation.
7. Control wiring and power wiring must be run in separate conduits.
8. Aluminum and copper-clad aluminum cables are not recommended.
9. All wiring is to be in accordance with national and local electrical codes.

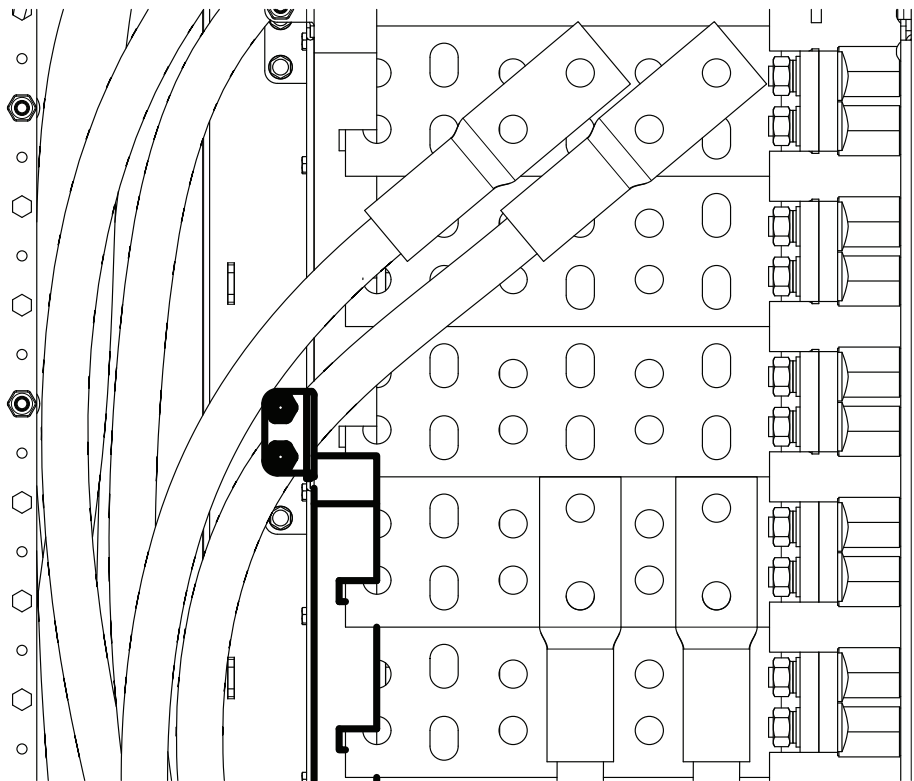
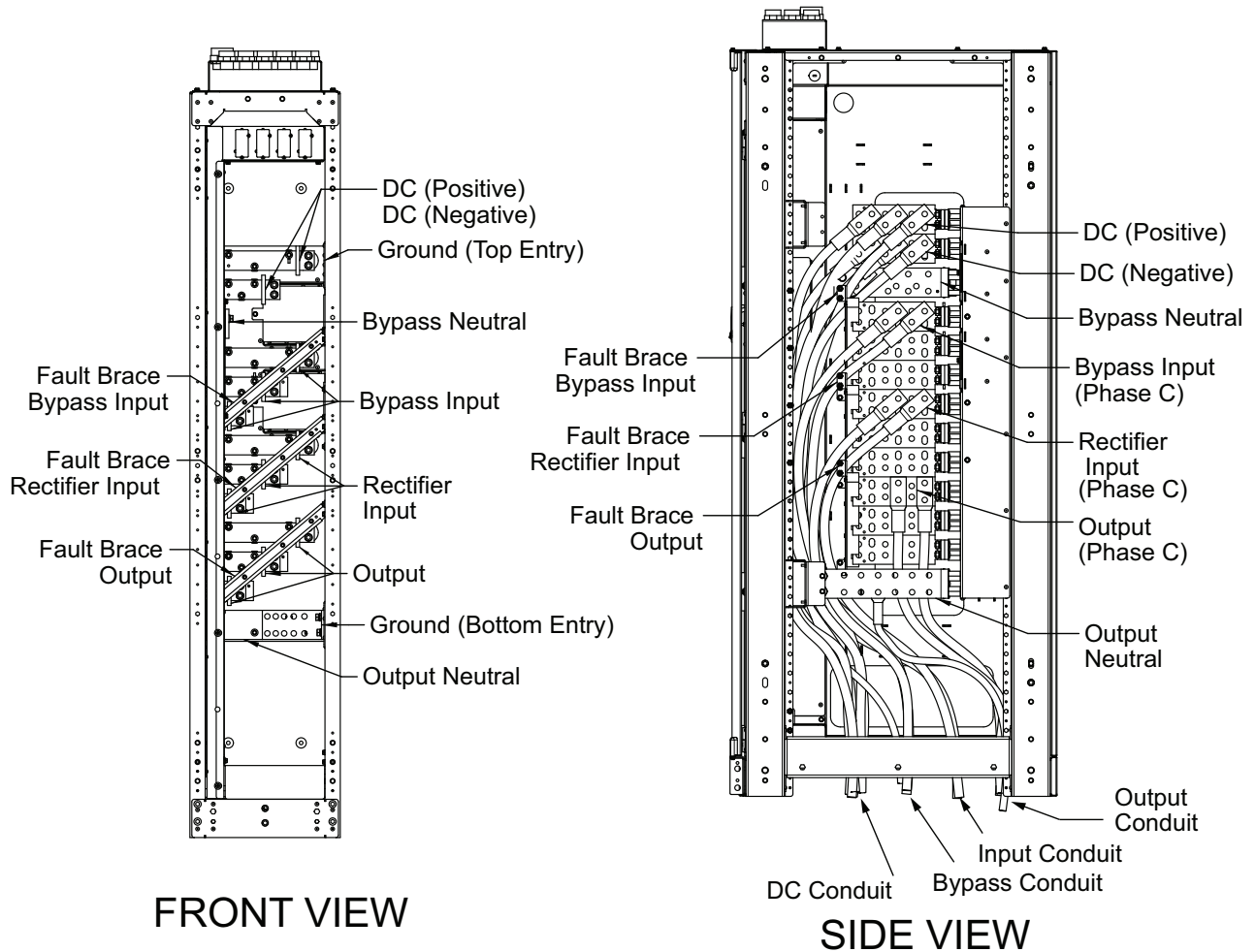
Figure 16 Top cable entry routing and installation order



- Recommended cable installation order :
1. DC Power
 2. Bypass Neutral
 3. Bypass Input Power (Phases A-B-C)
 4. Rectifier Input Power (Phases A-B-C)
 5. Output Power (Phases A-B-C)
 6. Output Neutral
 7. Ground

The cables must be routed around the fault braces to prevent the cables from coming in contact with other busbars.

Figure 17 Bottom cable entry routing and installation order

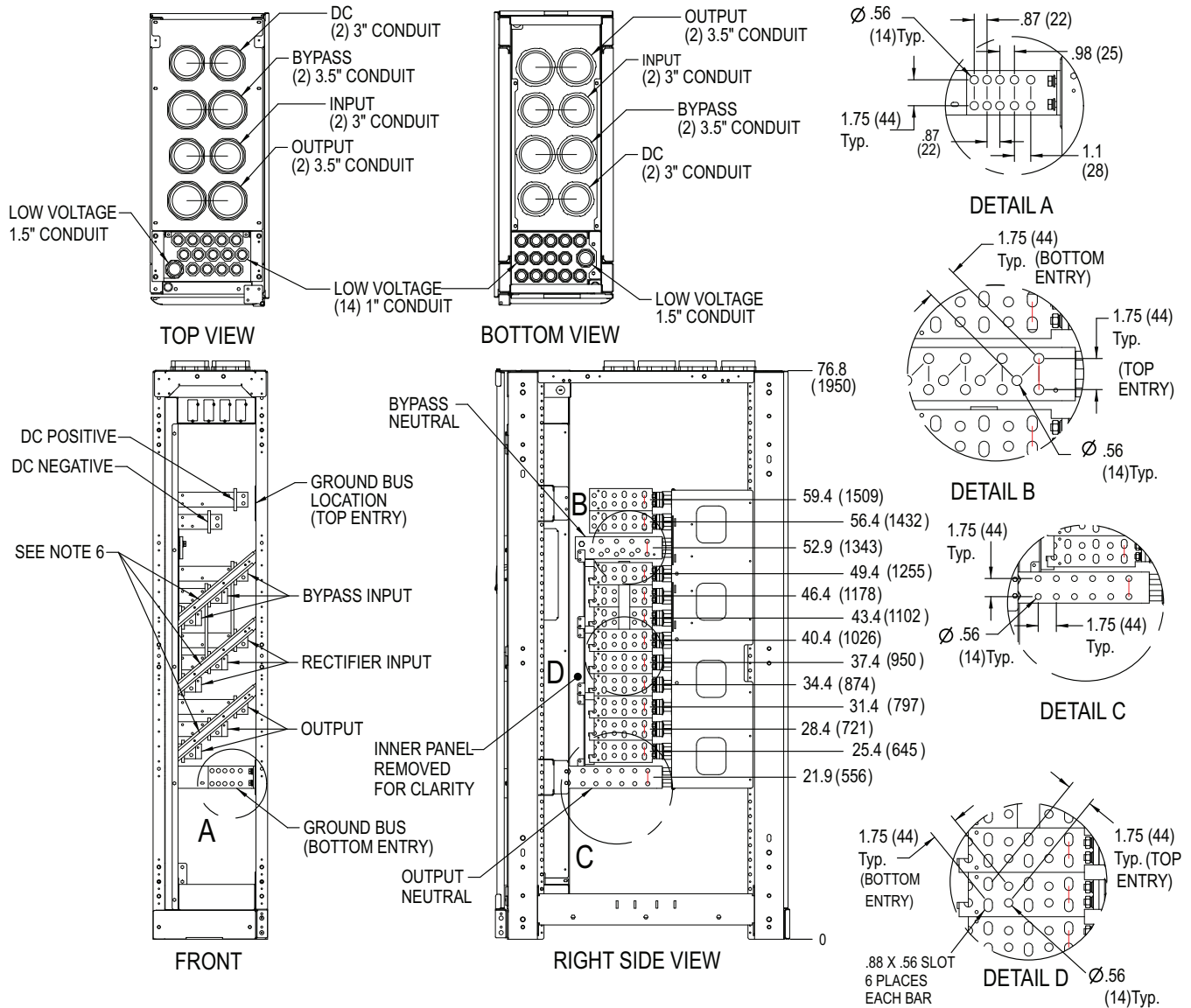


Recommended cable installation order :

- 1.) Output Neutral
- 2.) Output Power (Phases A-B-C)
- 3.) Rectifier Input Power (Phases A-B-C)
- 4.) Bypass Input Power (Phases A-B-C)
- 5.) Bypass Neutral
- 6.) DC Power
- 7.) Ground

The cables must be routed around the fault braces to prevent the cables from coming in contact with other busbars.

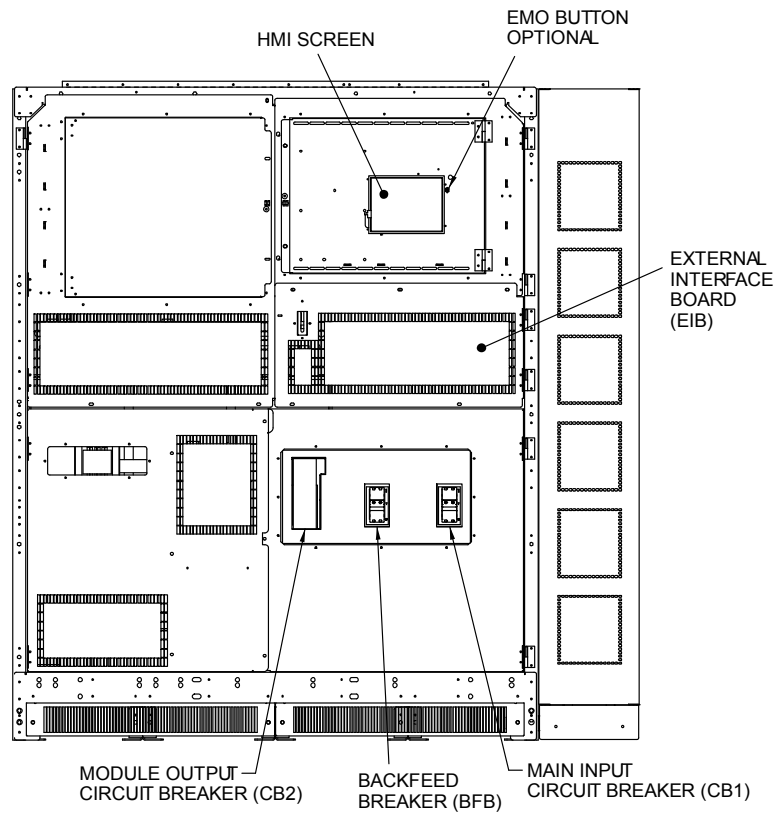
Figure 18 Input/output terminal detail, 400kVA Liebert NXL



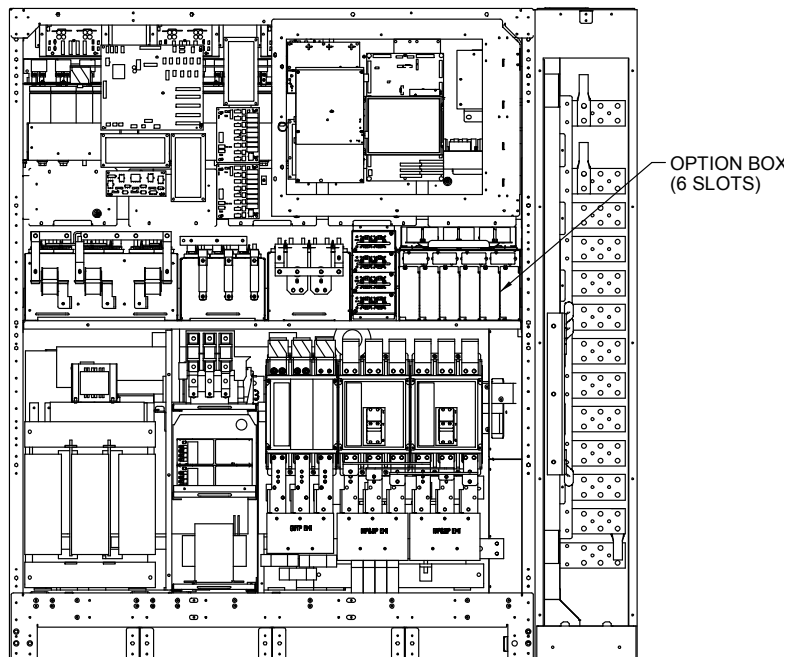
NOTES:

1. All dimensions are in inches (mm).
2. 24" minimum clearance above unit required for air exhaust.
3. Keep cabinet within 15 degrees of vertical.
4. Top and bottom cable entry available through removable access plates. Remove, punch to suit conduit size and replace.
5. Unit bottom is structurally adequate for forklift handling.
6. These brackets can be removed during installation but must be replaced after installation.
7. Control wiring and power wiring must be run in separate conduits.
8. Aluminum and copper-clad aluminum cables are not recommended.
9. All wiring is to be in accordance with national and local electrical codes

Figure 19 Main components, 400kVA Liebert NXL N+1 multi-module unit without static bypass

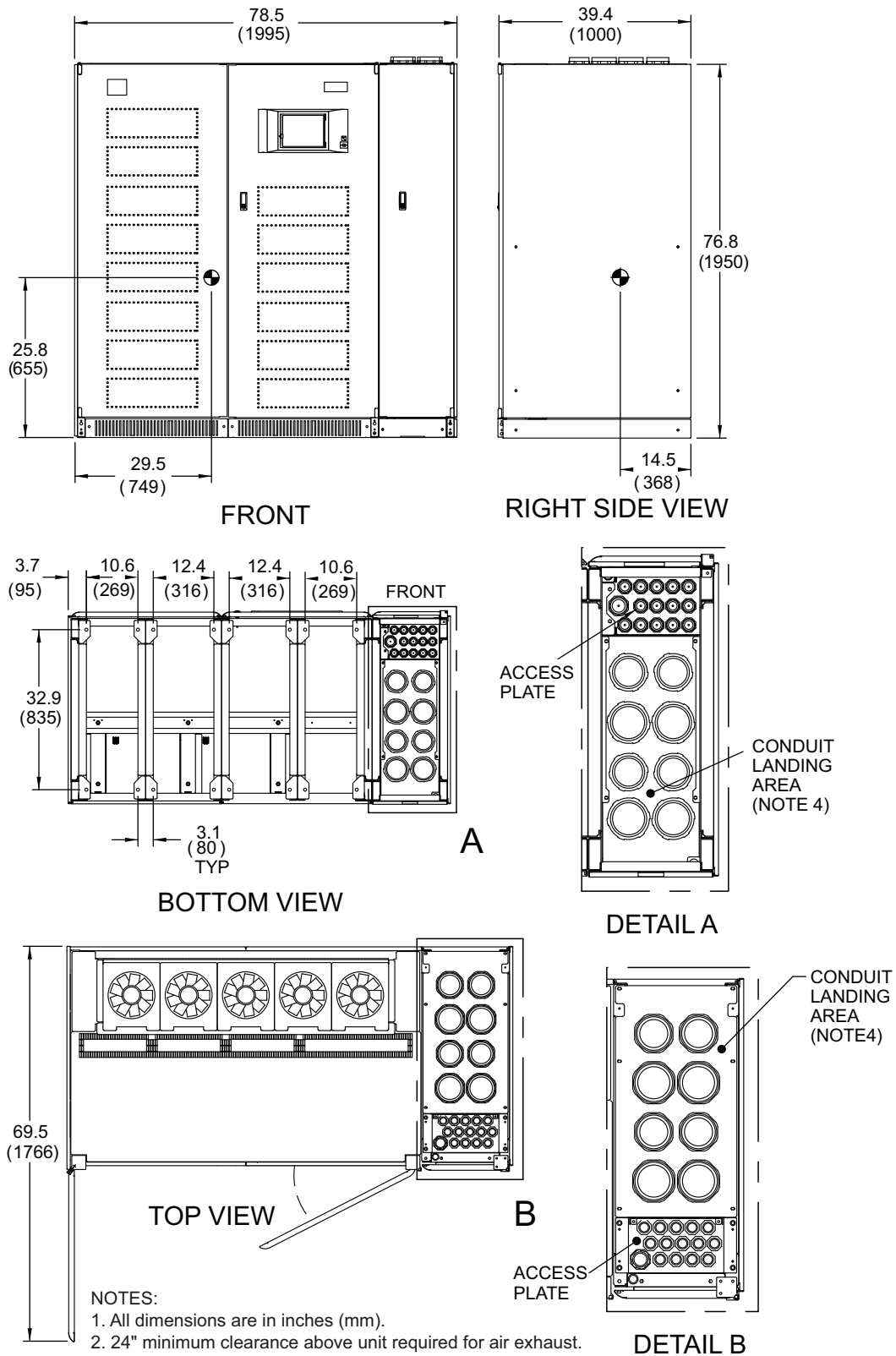


FRONT DOORS REMOVED



DOORS AND INNER SKINS REMOVED

Figure 20 Outline drawing, 400kVA Liebert NXL N+1 multi-module unit without static bypass



NOTES:

1. All dimensions are in inches (mm).
2. 24" minimum clearance above unit required for air exhaust.
3. Keep cabinet within 15 degrees of vertical.
4. Top and bottom cable entry available through removable access plates.
Remove, punch to suit conduit size and replace.
5. Unit bottom is structurally adequate for forklift handling.
6. Control wiring and power wiring must be run in separate conduits.
7. Aluminum and copper-clad aluminum cables are not recommended.
8. Widths are with side panels. the width is 76.7" (1948mm) without side panels.

Figure 21 Single-input busbar arrangement

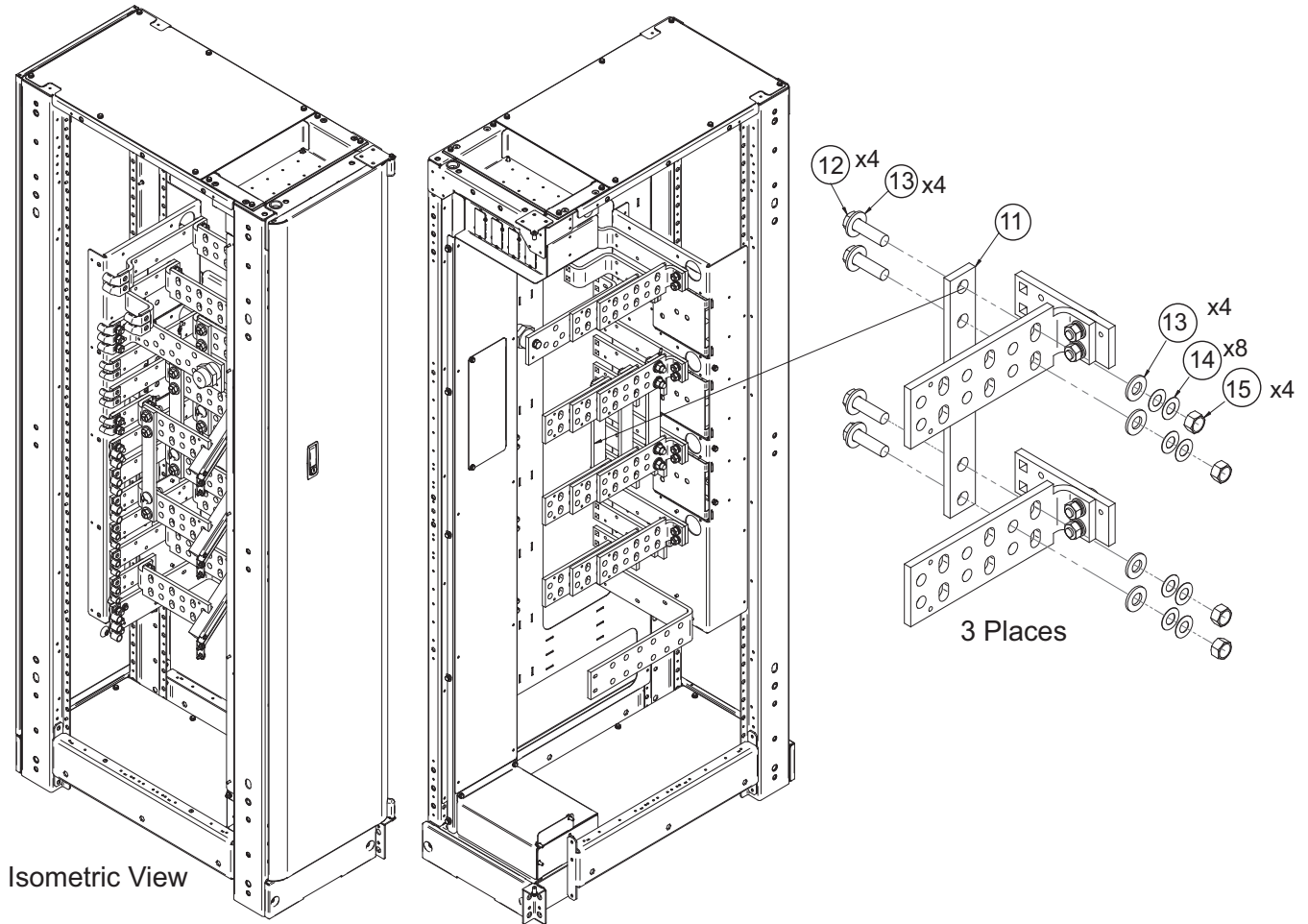
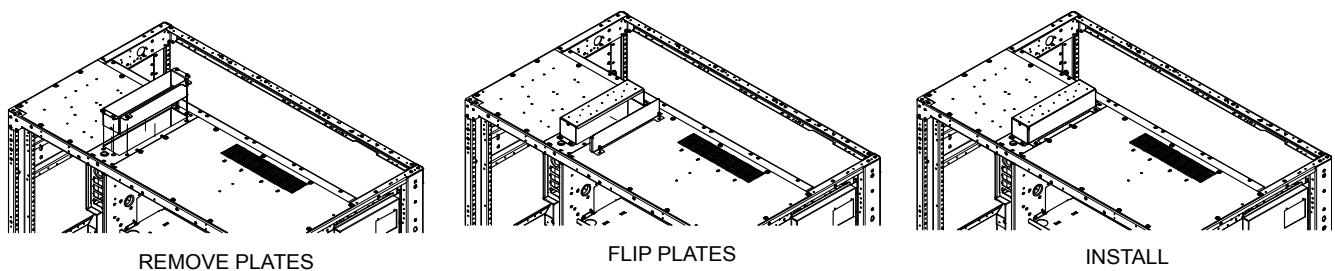


Figure 22 Low-voltage cable entry



Low-voltage cables can be install through the top of each unit. The entry conduit landing plate is shipped inverted. To install, remove conduit plate, flip and reinstall. Removal of side plate is for access to pull wires.

5.0 SPECIFICATIONS

Table 7 Liebert NXL UPS specifications

	250	300	400
Input Parameters			
Input Voltage to Rectifier, VAC	480V 3-phase, 3-wire		
Input Voltage to Bypass, VAC	480V 3-phase, 3-wire or 4-wire		
Input Voltage Range, VAC	+10% to -15 -15% to -20%* -20% to -30%** <-30%***		
Input Frequency, Hz	60		
Permissible Input Frequency Range, Hz	55 to 65		
Reflected Input THDi at Nominal Voltage at Full Load, %	<10% with 6-pulse & Passive Filter		
Power Walk-In, sec	1 to 30 (selectable) in 1 sec. Increment		
Bypass Neutral Current	1.7 times full-phase current		
Battery & DC Parameters			
Battery Type	VRLA (Valve Regulated Lead Acid) or (FLA) Flooded Lead Acid		
Nominal Battery Bus, VDC	480V		
Battery Float Voltage, VDC	540V		
Minimum End of Discharge Voltage, VDC	384V (for VRLA / Flooded Lead Acid)		
DC Ripple Voltage in Float & Const V Ch. Mode, %	<1 (RMS value) < 3,4% Vpp		
Temperature Compensated Battery Charging	Standard (with temperature probe)		
Output Parameters			
Inverter Type	IGBT-based Sine-Sine PWM Controlled		
Output Power, kW	225	270	360
Output Voltage, VAC	480V 3-ph, 4-w		
Output Voltage Regulation, %	< 1% (3-phase RMS average)		
Output Voltage Regulation (100% Unb. Load)	< 2% (3-phase RMS average)		
Output Frequency, Hz	60		
Output Frequency Regulation, %	± 0.1		
Output THDv Linear Load at Nominal Voltage, %	<2%		
Output THDv at Nominal Voltage Including a 100kVA Non Linear Load per EN 62040-3, %	2.5% (max)		
Capacity to Handle High Crest Factor Load	3:1		
Capacity to handle Step Load, %	0-100 or 100-0		
Transient Recovery (linear loads), %	Within 5% peak-to-peak in one line cycle.		
Unbalance Loads Current Capacity	100% of nominal phase current		
Capacity to Handle Leading PF Load			
0.9 lag to Nom	Subject to Max. kW rating		
at 0.95 Lead	Subject to Max. kW rating		
at 0,9 Lead	Subject to 12.5% kW derate or same Rating and 50°F (10°C) Temp. Derate		
Voltage Displacement, ° el	120° ±1° el (with 100% unbalanced load)		
Overload Conditions, % FL	105% for 85 minutes 110% for 60 minutes 125% for 10 minutes 150% for 1 minute		

* The UPS will operate at full load, but the battery charge will either be reduced or off (depending on input current).

** The UPS will operate at full load, but UPS may source share with the batteries (depending on input current).

*** UPS will be in Battery mode

Table 7 Liebert NXL UPS specifications (continued)

	250	300	400
Physical Parameters and Standards, in (mm)			
Width, With Side Panels *	71.8 (1823)	78.5 (1993)	78.5 (1993)
Depth **	33.5 (850)	33.5 (850)	39.4 (1000)
Height	76.8 (1950)		
SMS Weight, Unpacked, lb. (kg) approx.	3965 (1798)	4840 (2195)	6280 (2849)
1+N Weight, Unpacked, lb. (kg) approx.	4040 (1833)	4915 (2229)	6380 (2894)
Max heat Dissipation, Full Load, BTU/hr	53,592	63,036	77,638
Cooling Air CFM	5894	5894	7092
Color	Black (ZP-7021)		
Front Door Opening (for serviceability)	More than 180°		
Degree of Protection for UPS Enclosure	IP 20 (with and without front door open)		
Minimum Clearance, Top, in (mm)	24 (610)		
Minimum Clearance, Back, in (mm)	0		
Minimum Clearance, Sides, in (mm)	0		
Location of Cable Entrance	Top or Bottom		
Standards and Conformities	UL 1778, 4th Ed CSA 22.2 107.3 FCC Part 15, Class A FCC, Class A—Standard IEC62040-2, Level 4, Criteria A EN61000-4-3, Level 3, Criteria A EN61000-4-6, Level 4, Criteria A EN61000-2-2, Criteria A EN61000-4-4, Level 4, Criteria A ANSI C62.41, Category A3 &B3 ISTA Procedure 1H WEEE		
Environmental Parameters			
Storage Temperature Range, °F (°C)	-13 to 158 (-25 to 70)		
Operating Temperature Range, °F (°C)	32 to 104 (0 to 40) (UPS)		
Acoustical Noise, dBA	68		
Relative Humidity	95% or less Non-Condensing (Operating and Non-Operating)		
Maximum Altitude Above MSL, ft (m)	4920 (1500) (as per IEC 62040/3) - 1% Max kW derate / 328 rise between 4921-9842 (100m rise between 1500-3000m)		

* Width dimensions are with side panels attached. Subtract 1.4" (35mm) for dimensions without side panels.

** Depth dimensions include the front door and rear panel.

Table 8 Current ratings—rectifier input

UPS Rating		Voltage, VAC			Nominal Current	Maximum Current
kVA	kW	Input	Bypass	Output		
250	225	480	480	480	311	389
300	270	480	480	480	373	466
400	360	480	480	480	495	618

Table 9 Current ratings—bypass input

UPS Rating		Voltage, VAC			Nominal Current
kVA	kW	Input	Bypass	Output	
250	225	480	480	480	301
300	270	480	480	480	361
400	360	480	480	480	481

Table 10 Current ratings—output

UPS Rating		Voltage, VAC			Nominal Current
kVA	kW	Input	Bypass	Output	
250	225	480	480	480	301
300	270	480	480	480	361
400	360	480	480	480	481

Table 11 Current ratings—battery

UPS Rating		Nominal VDC	Maximum Battery Current at EOD
kVA	kW		
250	225	480	618
300	270	480	730
400	360	480	980

Notes on Tables

1. Nominal input current (considered continuous) is based on full-rated output load. Maximum current includes nominal input current and maximum battery recharge current (considered noncontinuous). Continuous and noncontinuous current are defined in NEC 100.
2. Maximum input current is controlled by the current limit setting, which is adjustable. Values shown are for a maximum setting of 125%. The standard factory setting is 125%. If a smaller input feed breaker is used, the input current limit must be adjusted accordingly.
3. For units with an input transformer, the Rectifier Input Feed Breaker must be set to handle the Liebert NXL transformer inrush of up to eight times the nominal current.
4. For breaker coordination while the module is overloaded, see the current-versus-time values on the overload curves, **Figures 23** and **24**.
5. Nominal battery voltage is shown at 2.0V/cell.

Table 12 Recommended conduit and cable sizes

Rectifier Input					
UPS Rating		Voltage, VAC			Nominal Selection (#) Conduit Size, Ph, G
kVA	kW	Input	Bypass	Output	
250	225	480	480	480	(2) 2.5C 3-250kcmil, #1/0AWG
300	270	480	480	480	(2) 3C 3-350kcmil, #1/0AWG
400	360	480	480	480	(2) 3.5C 3-500kcmil, #1/0AWG
Bypass Input					
UPS Rating		Voltage, VAC			Nominal Selection (#) Conduit Size, Ph, N, G
kVA	kW	Input	Bypass	Output	
250	225	480	480	480	(2) 3C 3-250kcmil, 2-250kcmil, #1/0AWG
300	270	480	480	480	(2) 3.5C 3-350kcmil, 2-350kcmil, #1/0AWG
400	360	480	480	480	(2) 4C 3-500kcmil, 2-500kcmil, #1/0AWG
Output					
UPS Rating		Voltage, VAC			Nominal Selection (#) Conduit Size, Ph, N, G
kVA	kW	Input	Bypass	Output	
250	225	480	480	480	(2) 3C 3-250kcmil, 2-250kcmil, #1/0AWG
300	270	480	480	480	(2) 3.5C 3-350kcmil, 2-350kcmil, #1/0AWG
400	360	480	480	480	(2) 4C 3-500kcmil, 2-500kcmil, #1/0AWG
Battery					
UPS Rating		Voltage, VAC			Nominal Selection (#) Conduit Size, Ph, G
kVA	kW	Input	Bypass	Output	
250	225	480	480	480	(2) 2.5C 2-350kcmil, #1/0AWG
300	270	480	480	480	(2) 3C 2-500kcmil, #1/0AWG
400	360	480	480	480	(3) 2.5C 2-500kcmil, #2/0AWG
Bonding					
UPS Rating		Voltage, VAC			Main Bonding Jumper/Grounding Electrode Conductor
kVA	kW	Input	Bypass	Output	
250	225	480	480	480	(1) #1/0AWG/ (1) #1/0AWG
300	270	480	480	480	(1) #2/0AWG/ (1) #2/0AWG
400	360	480	480	480	(1) #2/0AWG/ (1) #2/0AWG

1. Recommended cable sizes are 167°F (75°C) (THW) wire at 86°F (30°C) ambient.
2. For continuous operations not at 86°F (30°C), recommend that the site planner chose the appropriate cable type based on the particular installation requirements.

Figure 23 Inverter overload data

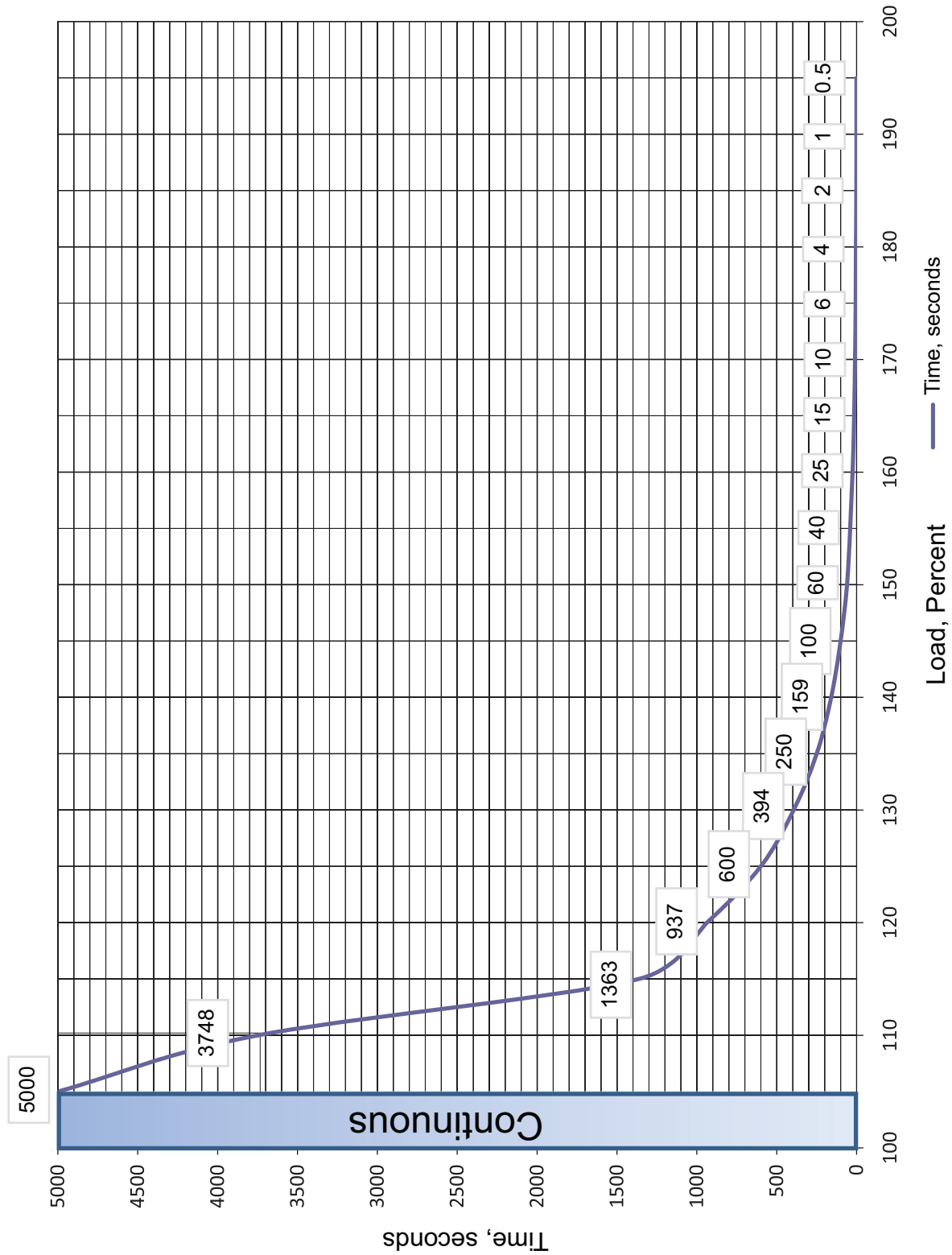


Figure 24 Bypass overload data

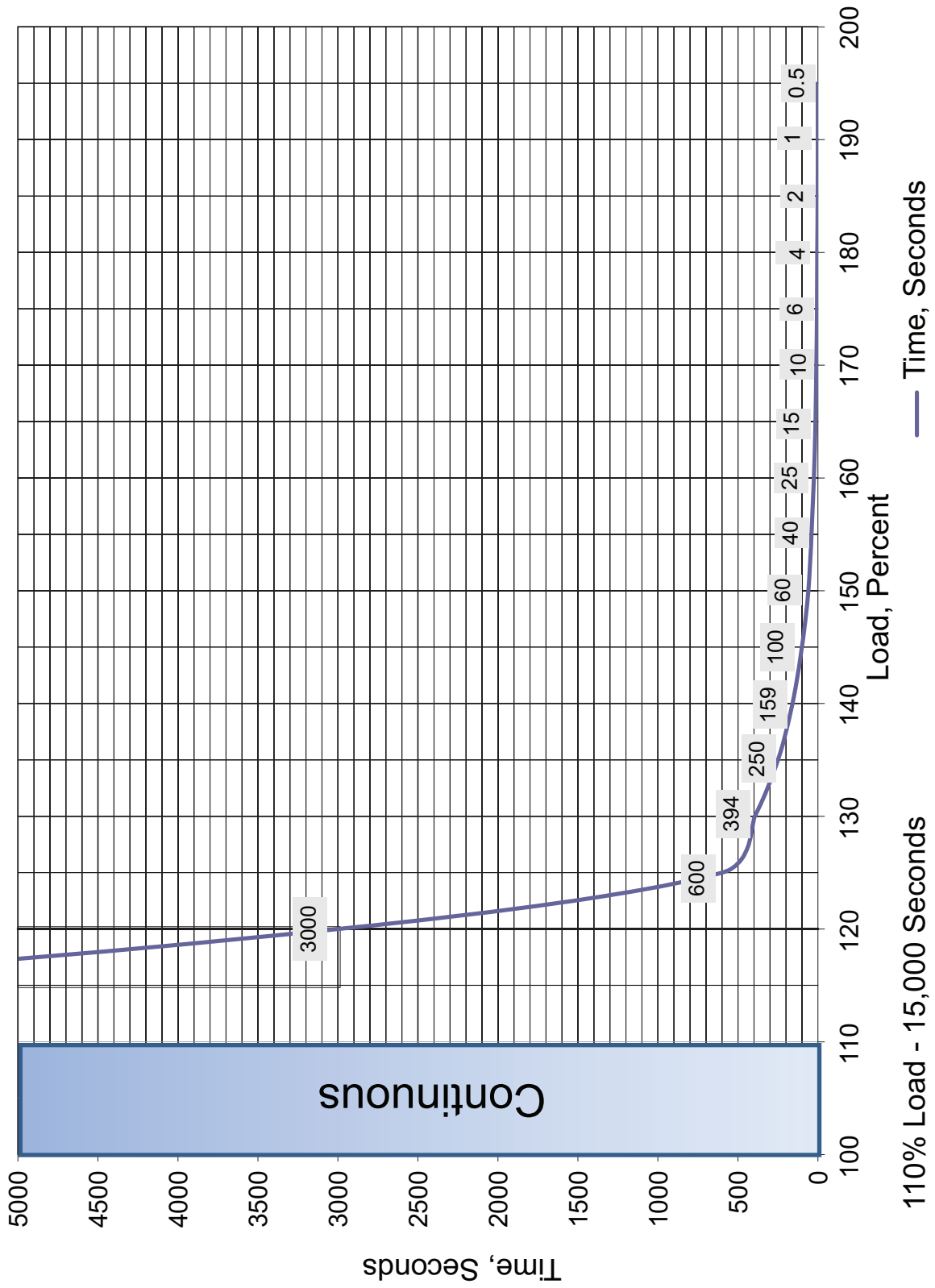


Table 13 Recommended lug sizes

Cable Size	T&B Series 54000 One Hole	T&B Series 54000 Two Hole
#8 AWG	54930BE	54850BE
#6 AWG	54905BE	256-30695-868
#4 AWG	54906BE	256-30695-733
#2-3 AWG	54942BE	54811BE
#1 AWG	54947BE	54857BE
#1/0 AWG	54950BE	256-30695-593
#2/0 AWG	54951BE	54862BE
#3/0 AWG	54965BE	54864BE
#4/0 AWG	54970BE	54866BE
250kcmil	54913BE	54868BE
300kcmil	54914BE	54870BE
350kcmil	54915BE	54872BE
400kcmil	54916BE	54874BE
500kcmil	54918BE	54876BE
600kcmil	54920BE	54878BE
750kcmil	54922BE	54880BE

Use the T&B crimping tools recommended for these types of lugs.

Table 14 Recommended torque values

Grade 5 Steel – Unified Thread System Torque Units - lbf.*in.						Class 8.8 Steel – Metric Thread System Torque Units - N*m					
Fastener Finish =>		Plain Steel		Zinc Plating		Fastener Finish =>		Plain Steel		Zinc Plating	
Size	Threads/Inch, T _{pi}	No Washer/Flat Washer	Lock Washer	No Washer/Flat Washer	Lock Washer	Size	Thread Pitch T _p	No Washer/Flat Washer	Lock Washer	No Washer/Flat Washer	Lock Washer
1/4	20	101	—	91	—	M5	0.8	6.1	—	5.5	—
	28	116	—	104	—		0.5	6.9	—	6.2	—
5/16	18	209	224	188	203	M6	1	10	—	9	—
	24	231	246	208	223		0.75	11	—	10	—
3/8	16	370	392	333	355	M8	1.25	25	—	23	—
	24	420	442	378	400		1	27	—	24	—
7/16	14	593	—	534	—	M10	1.5	50	64	45	59
	20	662	—	596	—		1.25	53	67	47	61
1/2	13	904	934	814	844	M12	1.75	87	128	78	119
	20	1,020	1,050	918	948		1.25	95	136	86	127
9/16	12	1,305	—	1,175	—	M14	2	139	—	125	—
	18	1,456	—	1,310	—		1.5	151	—	136	—

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