



# POWERWARE<sup>®</sup> 9315

## *Parallel Redundant Uninterruptible Power Supply*

## Installation/Operation Manual

164202013 Rev. D

## **IMPORTANT SAFETY INSTRUCTIONS**

Instructions Importantes Concernant La Sécurité

### **SAVE THESE INSTRUCTIONS**

Conserver Ces Instructions

**This manual contains important instructions for your Uninterruptible Power Supply (UPS) system. You should follow these instructions during the installation and maintenance of the UPS, options, accessories, and batteries.**

Cette notice contient des instructions importantes concernant la sécurité.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

**WARNING:**

**This is a product for restricted sales distribution to informed partners. Installation restrictions or additional measures may be needed to prevent disturbances.**

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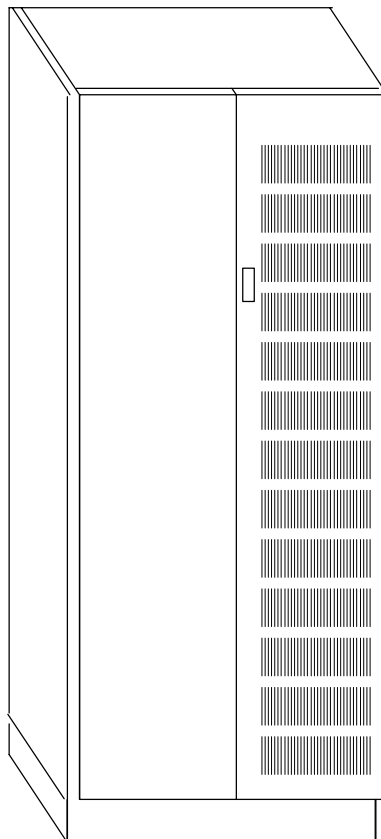
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# Introduction

The parallel redundant system allows two UPS modules to operate in parallel and as backup for each other. When one UPS module is taken out of service for maintenance or is not operating properly, the redundant UPS module continues to supply uninterrupted power to the critical load. The parallel redundant system refers to the parallel cabinet in conjunction with the UPS modules. The parallel redundant system consists of one parallel cabinet, two identical UPS cabinets, and up to four battery cabinets per UPS. Each UPS module may have its own battery cabinet(s), or may share the same battery cabinet(s) with the other UPS module.

**NOTE:** *The installation procedures of this manual only refer to the parallel cabinet and its connection to the UPS cabinets for parallel redundant operation. The operation section of this manual refers to the operation for the parallel cabinet and the UPS system when in parallel. For full installation and operation of the UPS system and battery installation, refer to the **Powerware® 9315 Installation, Powerware® 9315 Operation, and the Powerware® Series 685 and 1085 Auxiliary Battery Cabinets Installation** manuals provided with the UPS system and battery cabinet accessory.*

The parallel cabinet is a free-standing cabinet. Figure 1 shows a typical parallel cabinet.



**Figure 1. Typical Parallel Cabinet**

## Using This Manual

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This manual contains installation and operation procedures for the Powerware® 9315 Parallel Redundant system. In this manual, parallel redundant system refers to the parallel cabinet, its internal components, and those components of the UPS modules that assist in parallel redundant operation. The text uses these conventions:

- **Bold type** highlights important concepts in discussions, key terms in procedures, and menu options.
- *Italic type* highlights notes, references to other system manuals, references to other sections of this manual, and new terms where they are defined.
- Rectangular boxes containing bold type are warnings or cautions that pertain to the parallel redundant system or its electrical connections. This important information indicates possible dangers pertaining to personnel safety, equipment damage, critical load protection, or operational concerns.

Before installation of the parallel redundant system, read through each installation procedure provided in *Section 1 Installation* of this manual. Below is a description of each chapter in each section as they appear:

### Section 1

- Chapter 1 tells you how to prepare the site for the installation of the parallel cabinet. It discusses equipment environmental requirements, inspecting and unpacking the parallel cabinet, and pallet removal.
- Chapter 2 describes how to install the parallel cabinet.
- Chapter 3 describes parallel redundant configurations of UPS modules utilizing separate battery cabinets or sharing a common battery cabinet.

### Section 2

- Chapter 4 describes the parallel redundant system and its operation.
- Chapter 5 provides information on understanding parallel operation.
- Chapter 6 contains operation instructions for the parallel redundant system.
- Appendix A contains important information on wiring requirements and recommendations, and important diagrams of the cabinet's mechanical details and electrical access.

Read through each procedure before you begin. Perform only those procedures that apply to the UPS system you are installing.



## For More Information

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This manual describes the installation and operation of the parallel redundant system. For more information on the installation and operation of the UPS system and its accessories, refer to the following:

- 164200252**      ***Powerware® 9315 30 – 160 kVA UPS Operation***
- 164201036**      ***Powerware® 9315 200 – 300 kVA UPS Operation***
- 164201119**      ***Powerware® 9315 400/500 (300 – 500 kVA) UPS Operation***

Each manual describes the UPS cabinet Control Panel and Monitor Panel, and explains the functions of the UPS; discusses the standard features of the UPS and optional accessories; provides procedures for starting and stopping the UPS, and information about maintenance and responding to system events.

Also described are the RS – 485 and RS – 232 serial communications capabilities of the UPS system; discusses the two communications ports on the Customer Interface Panel inside the UPS and how to connect optional remote accessories to your UPS system; provides information about enabling, disabling, and customizing building alarms.

- 164200253**      ***Powerware® 9315 30 – 80 kVA UPS Installation***
- 164200292**      ***Powerware® 9315 100 – 160 kVA UPS Installation***
- 164201037**      ***Powerware® 9315 200 – 300 kVA UPS Installation***
- 164201118**      ***Powerware® 9315 400/500 (300 – 500 kVA) UPS Installation***

Each manual contains the following information: how to prepare the site and plan for installation, detailed step-by-step procedures for installing each component of your system, how to join cabinets in a line-up-and-match system, detailed illustrations of cabinets and optional accessories, including dimensions and connection points.

Contact the local Powerware Field Service office for information on how to obtain copies of these manuals.

## Getting Help

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If you have a question about any of the information in this manual, or if you have a question this manual does not answer, please call Powerware Corporation Field Service:

- United States**              **1-800-843-9433**
- Canada**                      **1-800-461-9166**
- Outside the U.S.**          **Call your local representative**

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# **Section I**

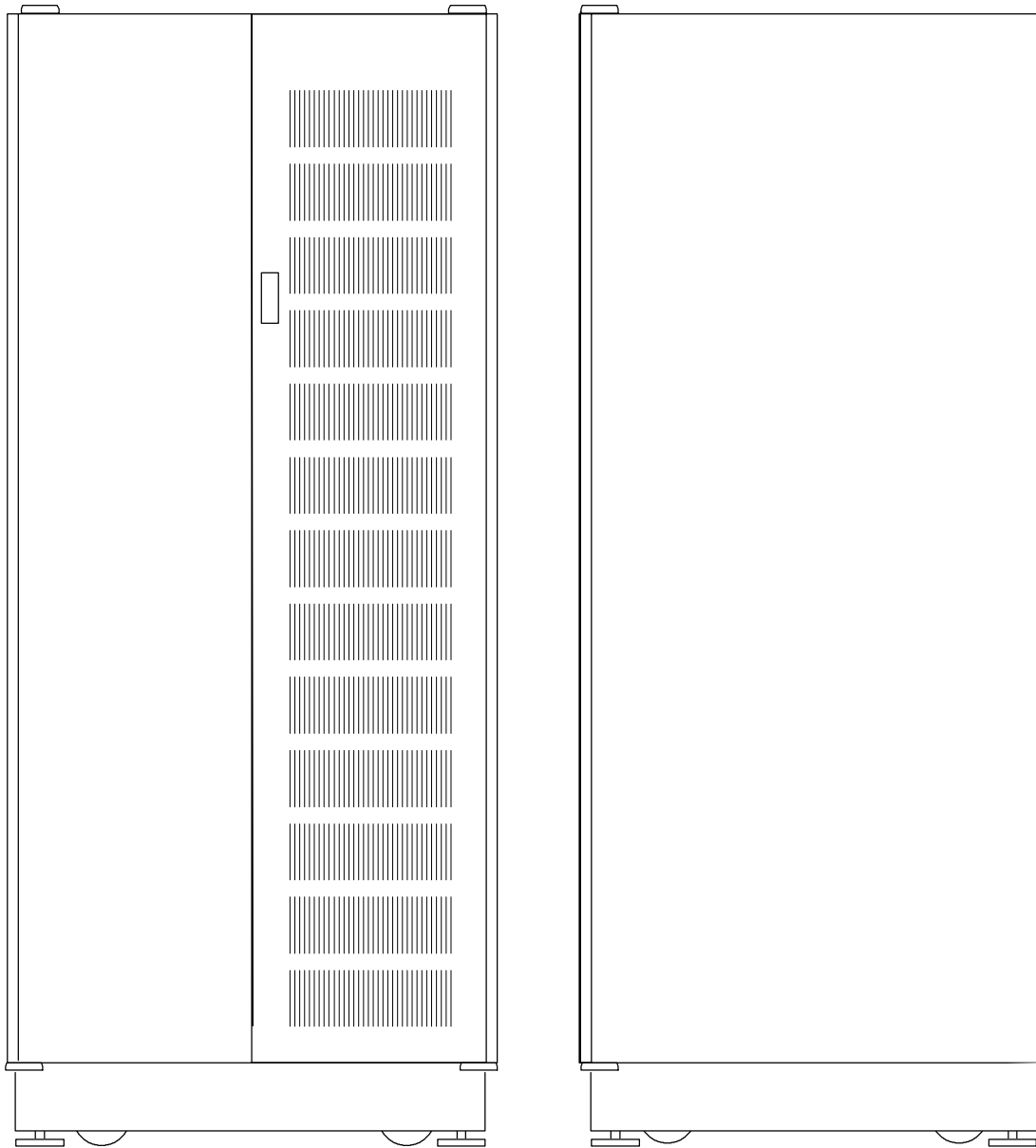
# **Installation**

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# 1

## Getting Started

This section describes how to install the parallel cabinet. It contains only instructions for installing the parallel cabinet as a remote cabinet, configuration needed for parallel redundant operation, and basic site preparation procedures. Figure 2 shows the front and side view of the parallel cabinet.



**Figure 2. Front and Side View of Parallel Cabinet**

The parallel cabinet is shipped on a separate pallet. Use a forklift or pallet jack to move the packaged cabinet to the installation site, or as close as possible to the site, before unloading from the pallet.

The basic sequence of the installation steps is:

1. Prepare the site for the cabinet installation.
2. Inspect, unpack, and unload the cabinet.
3. Create an installation plan for wiring the parallel cabinet to the corresponding UPS modules.
4. Prepare for wiring.
5. Complete the installation checklist from the *Powerware® 9315 Installation* manual.
6. Have authorized service personnel perform preliminary checks and startup.

**NOTE:** *Startup and operational checks should be performed only by authorized service personnel. This service is usually offered as part of the sales contract for your UPS system.*

## Preparing the Site

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For the parallel redundant system to operate at peak efficiency, the installation site should meet the environmental parameters outlined in the *Powerware® 9315 Operation* manual provided with the UPS system. The operating environment must meet the size and weight requirements supplied in the *Powerware® 9315 Installation* manual provided with the UPS system. If the parallel redundant system is to be operated at an altitude higher than 1500 meters (5000 feet), contact the local sales or service office for important information about high altitude operation.

The basic environmental requirements for operation of the parallel redundant system are:

**Ambient Temperature Range:** 0–40°C (32–104°F)

**Recommended Operating Range:** 20–25°C (68–77°F)

**Maximum Relative Humidity:** 95%

The parallel cabinet uses convection cooling to regulate internal component temperature. Air inlets are in the front of the cabinet, and outlets are in the top. Clearance in front of and above each cabinet for proper air circulation is essential.

## Environment Considerations

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The life of the parallel redundant system will be adversely affected if the installation does not meet the following guidelines:

1. The parallel cabinet must be installed on a sealed concrete pad on a sealed concrete floor.
2. The parallel cabinet must be installed in a dust-free environment.
3. The parallel cabinet must be installed in a humidity-controlled environment.

## Preparing for Wiring the Parallel Redundant System

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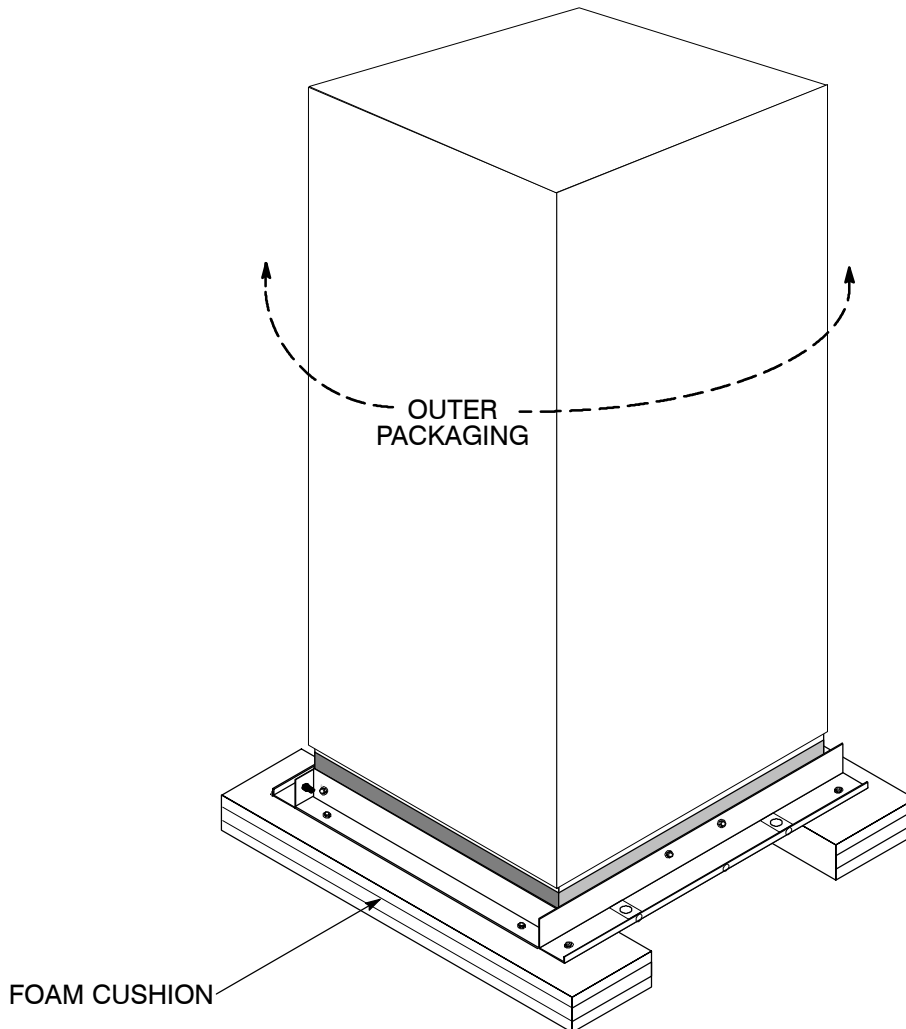
See Tables A–1 through A–4 in Appendix A of this manual for wiring requirements. The power wiring for this equipment is rated at 75°C. If wire is run in an ambient temperature greater than 30°C, higher temperature and/or larger size wire may be necessary. Wiring for the parallel cabinet should be installed through the 28.6 mm (1.1 in.) knockout in the bottom of the UPS cabinet. The top entry connection requires installation of 1/2-in. flexible conduit within the UPS. Bottom entry connection requires no additional routing of conduit within the UPS. For UPS external wiring requirements, including minimum AWG size of external wiring, see the *Powerware® 9315 Installation* manual provided with the UPS system.

**NOTE:** *Material and labor for external wiring are to be provided by designated personnel.*

## Inspecting and Unpacking the Parallel Cabinet

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The first task in preparing for installation of the parallel cabinet is inspecting and unpacking the cabinet. The cabinet arrives covered with protective packaging material as shown in Figure 3.



**Figure 3. Cabinet as Shipped, with Outer Packaging and Pallet**

1. Carefully inspect the outer packaging for evidence of damage during transit.

**CAUTION:**

**Do not install a damaged cabinet. Report any damage to the carrier and contact the local sales or service office immediately.**

2. Use a forklift or other material handling equipment to move the cabinet to a convenient unpacking area. Insert the forklift jacks between the foam cushions on the bottom of the unit.

**CAUTION:**

**Do not tilt cabinet more than 10 degrees from vertical.**



3. Set the pallet on a firm, level surface, allowing a minimum clearance of 4.6m (15 ft) on each side for removing the cabinet from the pallet.
4. Cut the steel bands around the cabinet.
5. Remove the protective cardboard covering from the cabinet, cutting where indicated, using a knife blade no longer than 25 mm (1 in.).

**NOTE:** *Do not discard the packaging material yet. Instructions for unloading the cabinet from the pallet are printed on the cardboard, and you will need to refer to them.*

6. Remove the plastic bag and foam packing material, and discard or recycle them in a responsible manner.

## **Unloading the Parallel Cabinet From the Pallet**

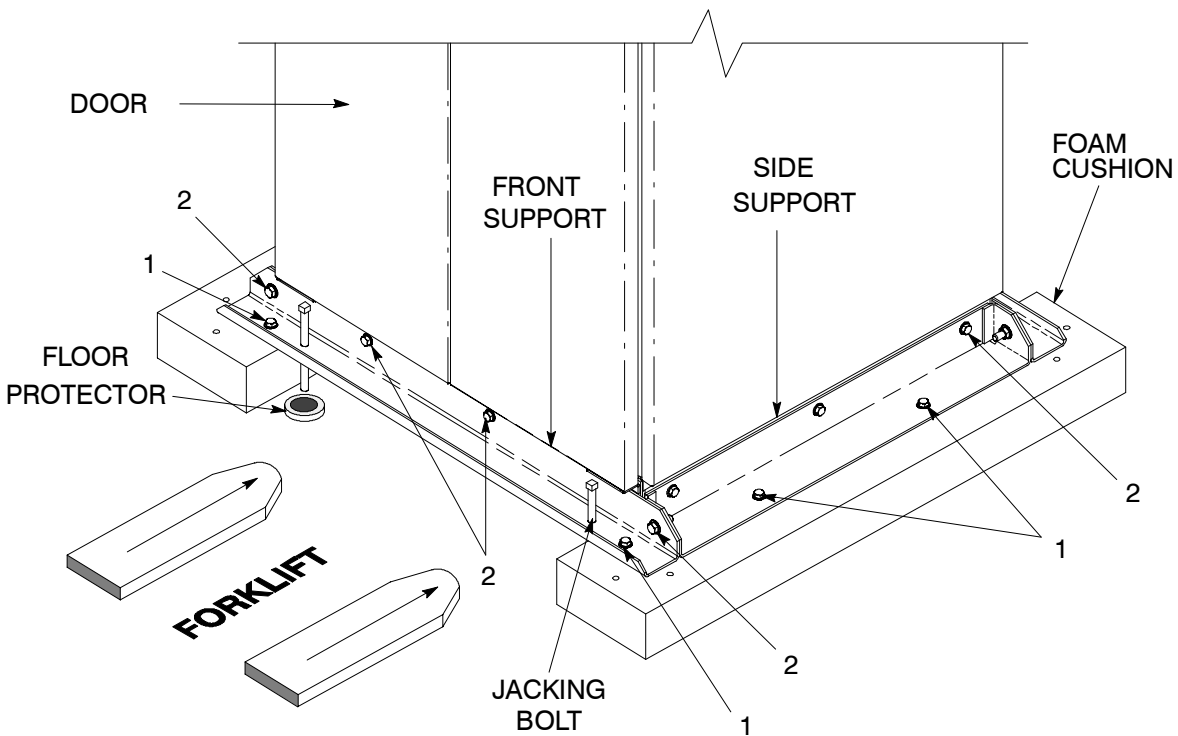
The parallel cabinet consists of four supports secured to foam cushions. The foam cushions act as shock absorbers for the cabinet during shipment.

**WARNING:**

**Cabinet is extremely heavy. If unloading instructions are not closely followed, the cabinet may tip and cause serious injury.**

**Turning the jacking bolts unevenly may cause the cabinet to become unbalanced. To prevent tipping, raise and lower the jacking bolts evenly. The cabinet should only be raised approximately 3 mm (1/8 in.) above the floor (just enough to remove foam cushions).**

1. Remove the doors. Remove the retaining screw located inside each door at the bottom hinge pivot point, then lift the door off. Save the retaining screws for reinstallation of the doors.
2. Locate the field kit (packed inside of the cabinet or communication panel). Locate the four 1/2-in. jacking bolts and install them in the threaded holes in the front and rear supports. Place a floor protector underneath each jacking bolt, and screw the bolts down against them. The floor protectors will save the floor from being marred by the jacking bolts.
3. Loosen, but do not remove the hardware holding the foam cushions to the front and rear supports (labeled "1" in Figure 4).
4. Turn each jacking bolt consecutively, two full turns, until the foam cushions clear the floor by approximately 3 mm (1/8 in.).
5. After the foam cushions clear the floor, remove the hardware loosened in step 3. Pull the foam cushions out from under the cabinet, and discard or recycle them in a responsible manner.



**Figure 4. Removing Front and Rear Supports**

**WARNING:**  
**Cabinet may fall. Do not loosen hardware attaching the side or front supports to the cabinet base. Also, do not loosen supports from each other. The cabinet must be lowered using jacking bolts before supports can be removed.**

6. Carefully and evenly lower the cabinet by turning each jacking bolt consecutively two full turns (maximum) until the supports contact the floor, and the cabinet is no longer supported by the jacking bolts.
7. After the cabinet is resting on the floor, remove the jacking bolts and discard or recycle them in a responsible manner.
8. Remove the hardware labeled "2" in Figure 4, holding the front, rear and side supports to the cabinet base. Discard or recycle the hardware and support brackets in a responsible manner.
9. Install the doors removed in step 1. The parallel cabinet is now ready to be rolled to its final location.

## Creating an Installation Plan

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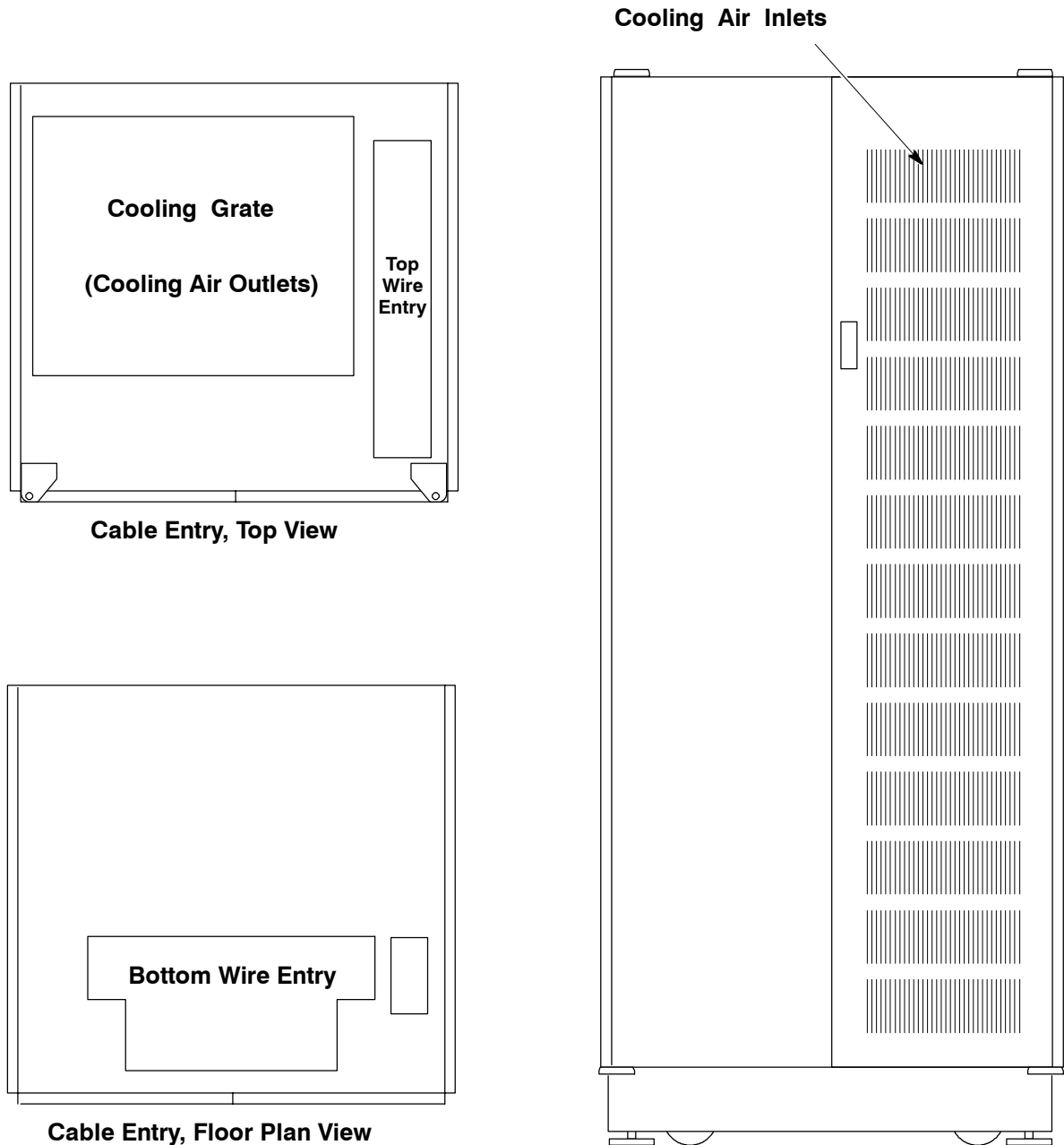
Before beginning to install the parallel cabinet, read and understand how this manual applies to the system being installed. It is important to note that UPS module installation procedures are contained in the *Powerware® 9315 Installation* manual provided with the UPS system. It is recommended to first understand how to install the UPS modules. The information in Chapter 2 of this manual is a guide in installation of the parallel cabinet to the UPS modules.

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# 2

## Installing the Parallel Redundant System

Once the parallel cabinet has been moved to its installed location, unpacked, and inspected, it is ready for installation. This manual discusses the typical configuration of installing the parallel cabinet in a remote location. The parallel cabinet arrives as shown in Figure 5.



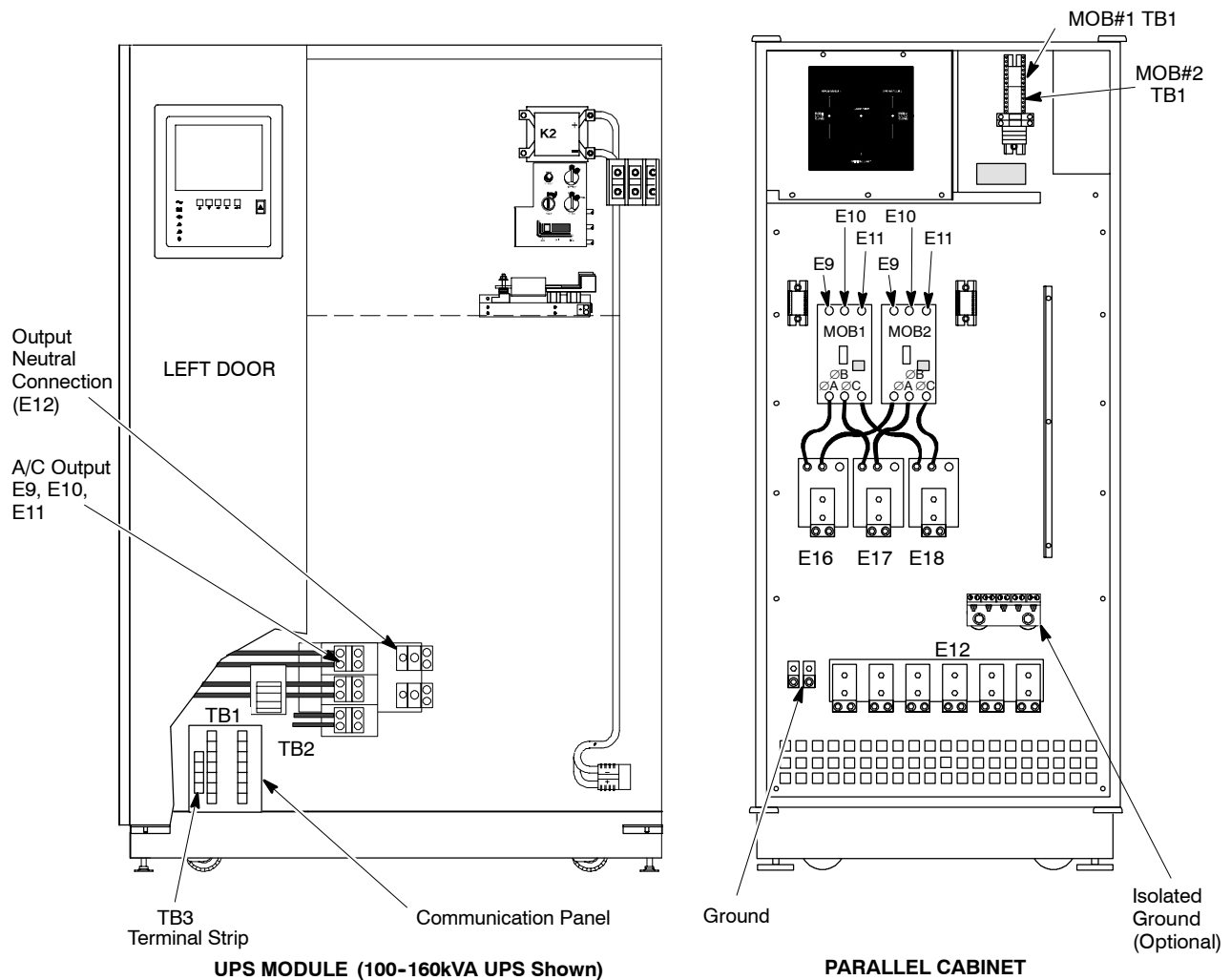
**Figure 5. Top, Bottom, and Front View of Parallel Cabinet**

Refer to the following while installing the parallel cabinet:

- Dimensions in this manual are in millimeters and inches.
- Do not tilt the cabinet more than  $\pm 10^\circ$  during installation.
- The conduit landing plates are to be removed to add conduit landing holes as required. Plate material is 16 gauge steel (0.06 in. thick).
- Terminals E9–E12 and E16–E18 are UL and CSA rated at 90°C. A hex key tool is required to attach wires to the terminals.
- Details about control wiring are provided in Table A–1 of Appendix A and the *Control Wiring Interconnect Details* in Chapter 3 of this manual.

Figure 6 shows typical control wiring and power wiring terminations of the UPS module and parallel cabinet. Refer to the Powerware 9315 Installation manual provided with the UPS system for location of UPS module cabinet wiring terminations.

**NOTE:** Material and labor for external wiring are to be provided by designated personnel.



**Figure 6. Typical Control and Power Wiring Terminations of UPS Module and Parallel Cabinet**

# 3

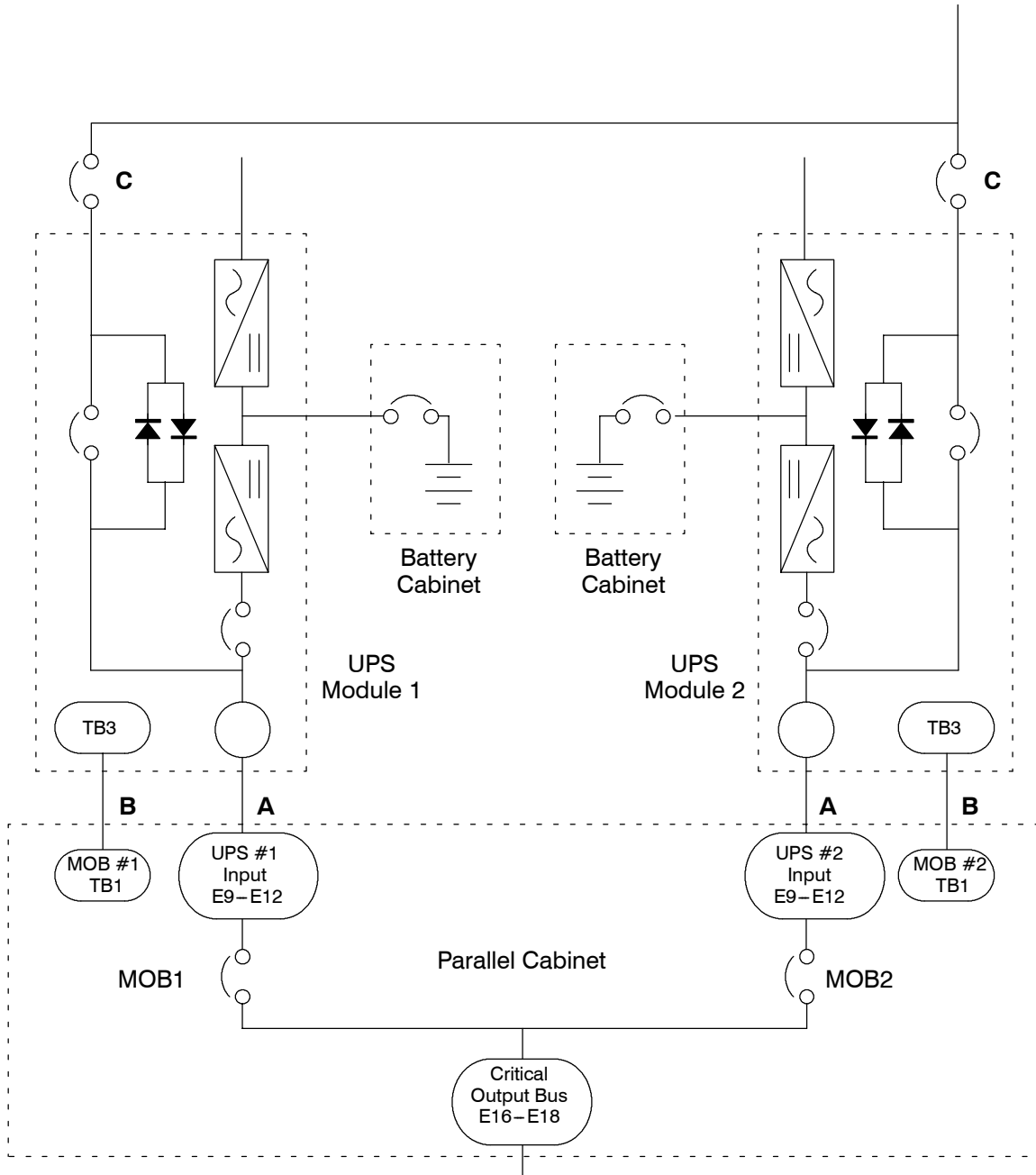
## *Parallel Redundant Modules with Separate Batteries and Common Batteries*

This chapter describes the internal connections of the parallel cabinet to UPS modules utilizing separate battery cabinet(s) and a shared battery cabinet(s). Determine which battery configuration is being utilized before beginning installation. If battery cabinets and remote disconnects provided by Powerware Corporation are being installed, refer to the *Powerware Series 685 and 1085 Auxiliary Battery Cabinets Installation* manual, 164200300, for instructions on installation. If battery cabinets not provided by Powerware Corporation are being installed, refer to the battery cabinet manufacturer's manual for instructions on battery cabinet installation and maintenance.

## Parallel Redundant Modules with Separate Batteries

There are two possible configurations for battery connection of the parallel redundant system. The two UPS modules may share the same battery cabinet(s), or each module may use a separate battery cabinet(s). Figure 7 shows a diagram of the parallel redundant system with UPS modules utilizing separate battery cabinets.

**NOTE:** Refer to Powerware 9315 Installation manual provided with the UPS system for battery shunt trip connections.



**Figure 7. Modules with Separate Batteries**



Figure 7 points out the connection areas of the two UPS modules and the parallel cabinet. The **A** connection is the power input connections from UPS 1 and UPS 2 to the parallel cabinet. It is recommended that the UPS modules are labeled in accordance with Module Output Breaker (MOB) labeling (e.g., the MOB 1 terminals E9 through E11 should be wired with UPS 1 terminals E9 through E11, E12 is the neutral). The MOB's have already been designated as MOB 1 and MOB 2. See Table A–2 in Appendix A of this manual for power terminations of the parallel cabinet and the UPS modules. For power wiring requirements and recommendations, see Tables A–3 and A–4 in Appendix A of this manual. For power wiring connections or terminal strip locations, refer to Figure 13 in Appendix A of this manual.

The **B** connection is the control wiring connection between the communication panels of the UPS modules and the parallel cabinet. In the UPS module, the TB3 terminal strip is located on the left side of the UPS cabinet and to the left of the TB1 terminal strip on its communication panel. For control wiring requirements and recommendations, see Table A–1 in Appendix A in this manual. For control wiring connections and terminal strip locations, refer to Figure 13 in Appendix A of this manual.

For the UPS Module connections, please refer to the *Powerware® 9315 Installation* manual provided with the UPS system for protection and wiring requirements and recommendations.

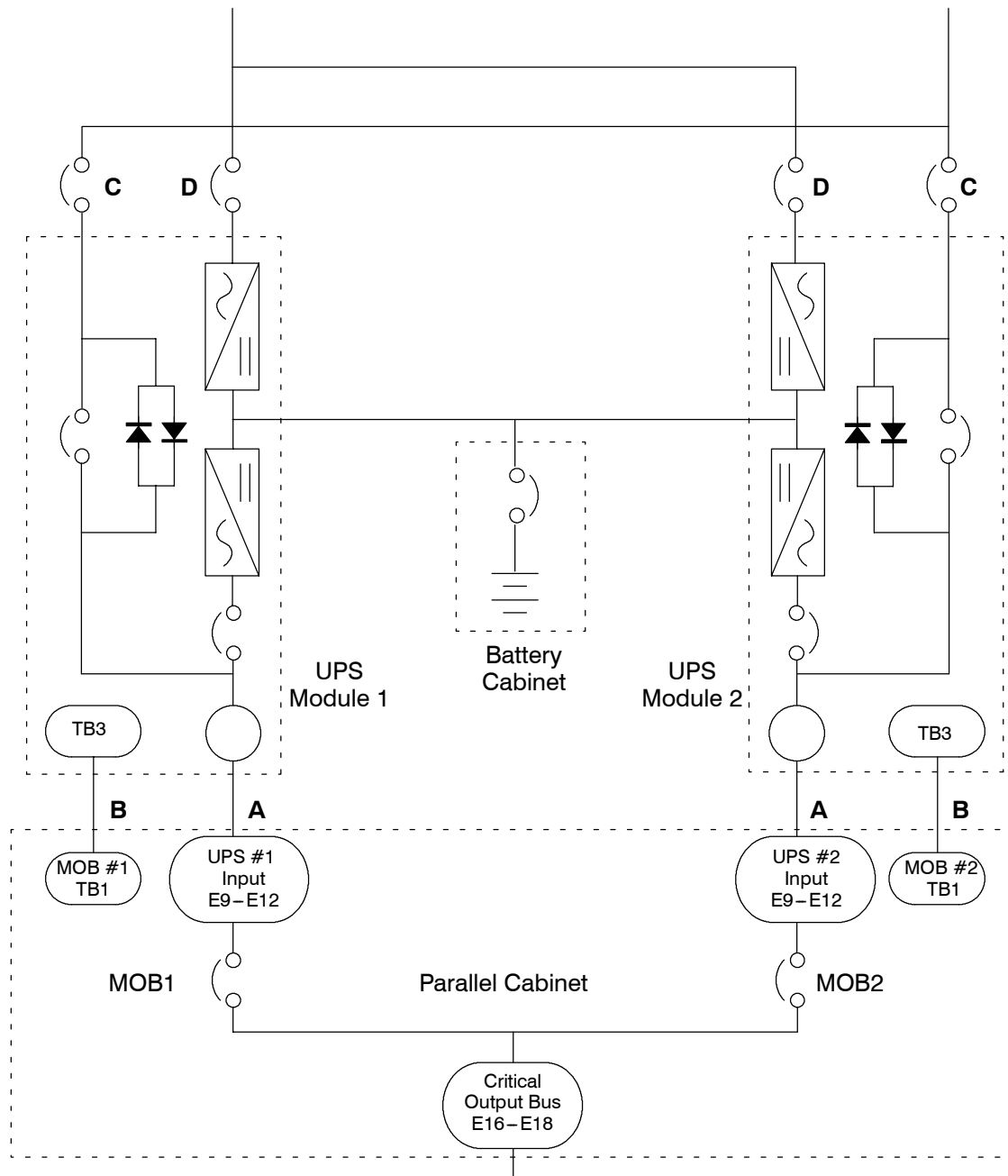
For the **C** connections, make sure the bypass feeds originate from the same power source. Means for separate isolation (circuit breaker or disconnect) are recommended. Refer to the *Powerware® 9315 Installation* manual provided with the UPS system for bypass power wiring.

## Parallel Redundant Modules with Common Battery

Figure 8 is a diagram of the parallel redundant system containing UPS modules sharing a common battery cabinet.

**NOTE:** UPS modules sharing a battery cabinet(s) must utilize a remote battery cabinet(s). Refer to the Powerware Series 685 and 1085 Auxiliary Battery Cabinets Installation manual 164200300, for instructions on installation.

Refer to Powerware 9315 Installation manual provided with the UPS System for battery breaker shunt trip connections.



**Figure 8. Modules with Common Battery**

Figure 8 points out the connection areas of the two UPS modules and the parallel cabinet. The **A** connection is the power input connections from UPS 1 and UPS 2 to the parallel cabinet. It is recommended that the UPS modules are labeled in accordance with Module Output Breaker (MOB) labeling (e.g., the MOB 1 terminals E9 through E11 should be wired with UPS 1, terminals E9 through E11, E12 is the neutral). The MOB's have already been designated as MOB 1 and MOB 2. See Table A–2 in Appendix A of this manual for power terminations of the parallel cabinet and the UPS modules. For power wiring requirements and recommendations, see Tables A–3 and A–4 in Appendix A of this manual. For power wiring connections or terminal strip locations, refer to Figure 13 in Appendix A of this manual.

The **B** connection is the control wiring connection between the communication panels of the UPS modules and the parallel cabinet. In the UPS module, the TB3 terminal strip is located on the left side of the UPS cabinet and to the left of the TB1 terminal strip on its communication panel. For control wiring requirements and recommendations, see Table A–1 in Appendix A in this manual. For control wiring connections and terminal strip locations, refer to Figure 13 in Appendix A of this manual.

For the UPS Module connections, please refer to the *Powerware® 9315 Installation* manual provided with the UPS system for protection and wiring requirements and recommendations.

For the **C** connections, make sure the bypass feeds originate from the same power source. Means for separate isolation (circuit breaker or disconnect) are recommended. Refer to the *Powerware® 9315 Installation* manual provided with the UPS system for bypass power wiring.

For the **D** connection, make sure input feeds originate from the same power source. Means for separate isolation (circuit breaker or disconnect) are recommended. Refer to the *Powerware® 9315 Installation* manual provided with the UPS system for input feeds to the UPS module.

## Power Wiring Details

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Each UPS module must be wired to its corresponding module output breaker in the cabinet with power cables sufficient for carrying the load. Recommended wiring size is listed in Tables A–3 and A–4 of Appendix A of this manual. Each of the three phases plus the neutral must be wired. Nonlinear loads can create neutral currents that are greater than 100%. The neutral bus (terminal strip E12) contains sufficient cable landing to wire double-size neutrals if needed.

**NOTE:** *Material and labor for external wiring are to be provided by designated personnel.*

## Control Wiring Interconnect Details

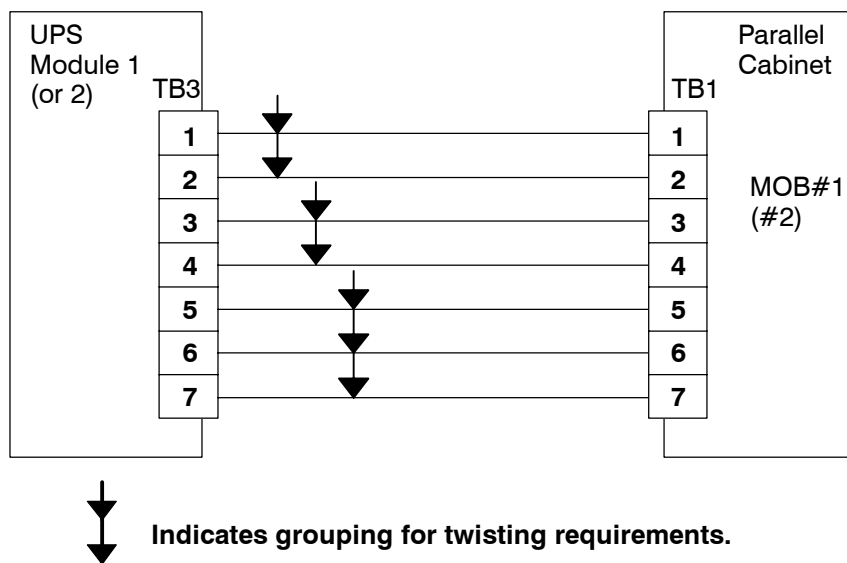
Each UPS module requires control signal wiring from the module to the parallel cabinet. The purpose of signaling is to facilitate the closing of the module output breakers and coordinate transfers to and from bypass. Once this system has been properly placed into operation, it will operate as a parallel redundant system even if the control wiring becomes disabled through shorts or opens. Figure 9 shows the grouping for twisting requirements. Refer to Table A in this chapter for control wiring recommendations and termination capability.

**NOTE:** Material and labor for external wiring are to be provided by designated personnel.

Table A. Control Wiring Requirements and Termination Requirements					
Connection Points in Parallel Cabinet	Size of Pressure Termination (lb-in)	Maximum Voltage and Current	Connection Points in UPS	Size of Pressure Termination (lb-in)	Recommended Wiring Size
TB1-1 through TB1-7	#18-#8, (55)	24V, 0.25A	TB3-1 through TB3-7	#22-#12, (5-7)	#18-#12

Notes for Table A:

1. Install the control wiring in separate conduit from the power wiring. Only copper wire or tinned copper wire should be used.
2. Control wiring is NEC class 2 (IEC 950 SELV).
3. Class 1 methods are recommended for control wiring.
4. Control wiring should be twisted pairs and twisted triple as shown in Figure 9.



**Figure 9. Grouping for Twisting Requirements**

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# **Section II**

# **Operation**

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# 4

## Getting Started

The Powerware® 9315 Uninterruptible Power Supply (UPS) continually monitors incoming electrical power and removes the surges, spikes, sags, and other irregularities that are inherent in commercial utility power. With the Powerware® 9315 Parallel Redundant system, when one UPS module is taken off line or becomes disabled, the redundant module continues working with the building's electrical system to supply clean, consistent power that sensitive electronic equipment requires for reliable operation.

The parallel redundant system should function automatically and require very little attention during normal operation. However, once installation has been completed, read and understand the procedures in this section as they are provided to ensure trouble-free operation.

Each component of the parallel redundant system is housed in a free-standing cabinet designed for industrial or computer room applications. The parallel cabinet has safety shields behind the doors for hazardous voltage protection.

The following descriptions provide a brief overview of the standard parallel redundant features.

**NOTE:** *Read the Operation section and have thorough knowledge of parallel redundant operation before attempting to operate. For a more detailed description of UPS operation, refer to Powerware® 9315 Operation manual supplied with the UPS system.*

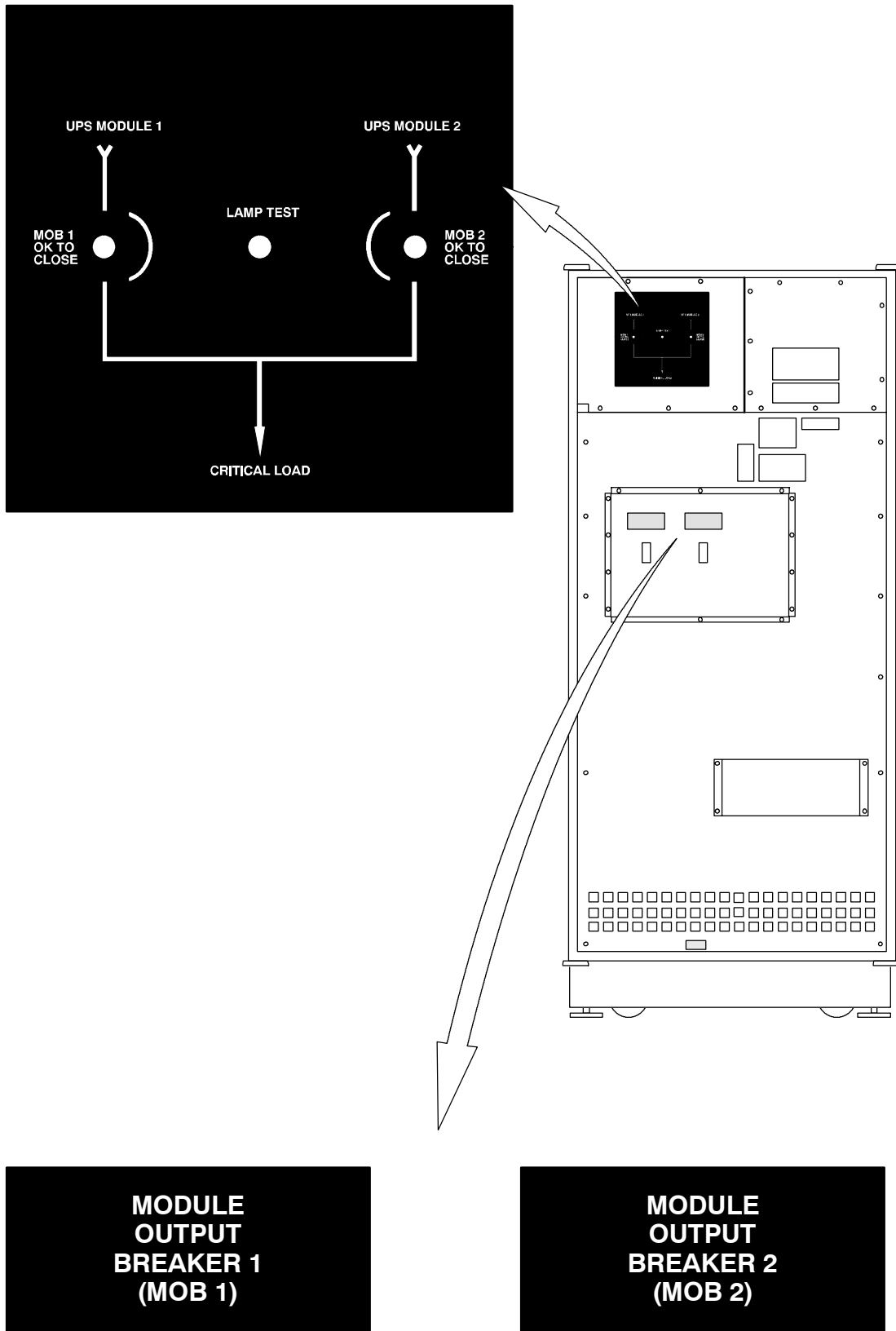
## Parallel Redundant System Description

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The parallel redundant system consists of two identical UPS modules, a parallel cabinet, and one or two battery racks or cabinets.

The parallel cabinet consists of two module output breakers designated MOB 1 and MOB 2. These output breakers receive power input from the AC output of the UPS modules. If one UPS module becomes disabled, it trips off, leaving the redundant UPS module to continue to supply power to the critical load. The primary function of the MOBs is to allow isolation of a module for maintenance or service. In a parallel redundant system the redundant module becomes the system's maintenance bypass source.

There are two lamps located on the inside of the parallel cabinet labeled **OK TO CLOSE**. When one of these lamps illuminates, the corresponding MOB can be closed. It is important to note that it is only safe to close the MOBs when the **OK TO CLOSE** indicator lights are illuminated. A **LAMP TEST** pushbutton is located inside the parallel cabinet for testing these indicators. The parallel cabinet also includes associated terminal strips for making the power and control connections to UPS modules. Figure 10 shows the controls and indicators of the parallel cabinet.



**Figure 10. Controls and Indicators**

## Looking Inside the Parallel Redundant System

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The parallel redundant system supports the normal operation of the Powerware® 9315 UPS system by offering parallel redundant capability. The UPS system continues to maintain power to the critical loads during commercial electrical power brownout, blackout, overvoltage, undervoltage, and out-of-tolerance frequency conditions. The parallel redundant system ties two UPS modules together, in parallel, in order for continuous power to flow even when one module becomes disabled. Refer to Figure 13 in Appendix A of this manual for the detailed relationship of the parallel cabinet and the UPS modules.

If utility power is interrupted or falls outside the parameters specified in the *Powerware® 9315 Operation* manual, the UPS system uses a backup battery supply to sustain power to the critical load for a specified period of time or until the utility power returns. For extended power outages, the backup battery supply allows you to either transfer to an alternate power system (such as a generator) or shut down the critical load in an orderly manner. Refer to the *Powerware® 9315 Operation* manual provided with the UPS system for operation of the UPS.

## Safety Considerations

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The UPS cabinet and parallel cabinet enclosures are designed for industrial or computer room applications, and contain safety shields behind the doors. However, the parallel redundant system is a sophisticated power system and should be handled with appropriate care, following these guidelines:

- **Keep surroundings clean and free from excess moisture.**
- **Do not operate the parallel redundant system close to gas or electric heat sources.**
- **The system is not intended for outdoor use.**
- **The operating environment should be maintained within the parameters stated in this manual and the *Powerware 9315 Operation* manual provided with the UPS system.**
- **Keep the cabinet doors closed to ensure proper cooling airflow and to protect personnel from dangerous voltages inside the unit.**
- **The parallel redundant system contains its own power source. Lethal voltages are present even when the UPS is disconnected from utility power.**

**WARNING:**  
Only **AUTHORIZED SERVICE PERSONNEL** should perform service or maintenance on the parallel redundant system.

If service or routine maintenance is required:

- **Ensure all power is disconnected before performing installation or service.**
- **Ensure the area around the parallel redundant system is clean and uncluttered.**
- **Battery cabinet maintenance or battery replacement should be performed only by authorized service personnel.**
- **Observe all DANGER, CAUTION, and WARNING notices affixed to the inside and outside of the equipment.**
- **Refer to the more detailed safety precautions described in the *Powerware 9315 Operation* manual provided with the UPS system.**

## Symbols, Controls, and Indicators

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These symbols may appear on the parallel redundant system or on labels inside the UPS or parallel cabinet. They are accepted by most international safety agents. Everyone who works with the parallel redundant system should understand the meaning of these symbols:



**ON**

The principal power switch is in the “On” position.



**OFF**

The principal power switch is in the “Off” position.



**PHASE**

The word “phase.”



**CAUTION: REFER TO MANUAL**

Stop and refer to the Operator’s Manual for more information.



**RISK OF ELECTRIC SHOCK**

There is a risk of electric shock present, and you should observe associated warnings. The equipment contains high voltages.

# 5

## *Understanding Parallel Redundant Operation*

With the parallel redundant system, the UPS system continues to function automatically to supply AC electrical power to the critical load. There are three operation modes in this system:

- In *Normal* mode, the UPS system functions normally as described in the *Powerware® 9315 Operation* manual provided with the UPS system. In the parallel redundant system, power leaves the UPS module from its AC output and is routed into the designated MOB in the parallel cabinet. As the system is in Normal mode, the MOBs are closed and clean power is routed directly to the AC output of the parallel cabinet and then to supply the critical load.
- In *Battery* mode, the battery cabinet supplies DC power, which maintains UPS operation. The battery supports the critical load through the parallel cabinet's AC output.
- In *Bypass* mode, interunit signaling is used by each UPS to determine if its designated MOB is closed and if the redundant module is on bypass or normal. This information causes differences to the usual bypass operation of the UPS system.

The following description provides the operating mode differences between the parallel redundant and single UPS module systems.

## Normal, Battery, and Bypass Modes with Parallel Operation

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With the parallel redundant system, there are operating mode differences. These differences primarily deal with the way transfers to and from bypass are handled.

When both UPS modules are in Normal mode, the parallel redundant system functions normally to supply clean, filtered power to the critical load. The AC output of the UPS modules feed the clean power to its designated MOB in the parallel cabinet. In Normal mode, the MOBs are closed and power continues to the AC output (critical bus) of the parallel cabinet, supporting the critical load.

When there is a power outage or some disturbance in the utility, the UPS modules automatically switch to Battery mode. In Battery mode, the battery supplies power to the critical load as in normal UPS system operation. The only difference is that the critical bus in the parallel cabinet is the AC output. See the *Powerware® 9315 Operation* manual provided with the UPS system for details on Battery mode of operation.

When both UPS modules are in Bypass mode, utility power directly supports the critical load as is normal in UPS system operation.

When one UPS module becomes disabled and the redundant module is in Normal mode, the disabled module shuts off rather than transfer to Bypass. The redundant module continues to supply power to the critical load. Bypass is only activated if the critical bus in the parallel cabinet fails to recover within a quarter cycle of the initial disturbance.

If a manual transfer to Bypass mode is initiated while the redundant module is in Normal mode, the module to be transferred to Bypass simply shuts off.

If both UPS modules are in bypass and their mode switches are in the Normal mode position, activate the key switch on either UPS module and both modules transfer to Normal.

If one UPS module is in Normal mode and the redundant module is in Bypass mode, the following sequence will take place:

- The module in Bypass will automatically try to transfer to Normal mode
- If unable to transfer to Normal mode, the redundant module will try to automatically clear itself from Bypass
- If the redundant module is unable to clear itself from Bypass, the module in Normal mode will wait ten (10) seconds and then transfer to Bypass.



# 6

## Operating Instructions for the Parallel Redundant System

The following procedures are for the operation of UPS modules in parallel. After installation of the parallel redundant system, the UPS modules run in parallel with each other.

### Module Output Breakers (MOBs)

The parallel cabinet contains two MOBs labeled MOB 1 and MOB 2. The UPS modules should be labeled in accordance with which MOB it is connected (e.g., MOB 1 should be wired to UPS 1).

When both MOB 1 and MOB 2 are closed, each UPS module operates as part of a parallel system. When one MOB is open, the redundant UPS module continues to support the critical load. The redundant UPS module acts as a single stand-alone system.

### How to Open and Close the MOB

**CAUTION:**  
Improper operation of these circuit breakers can cause the loss of the critical bus (output) or damage equipment.

Close the MOB only when its designated **OK TO CLOSE** lamp is illuminated.

A UPS module's designated MOB, MOB 1 or MOB 2, may be opened if the MOB for the redundant module is closed and its **OK TO CLOSE** lamp is illuminated.

Refer to *How to Isolate a Module* in this chapter for information on when a module's designated MOB can be opened.

### Starting and Stopping Using Parallel Redundant System

Start each module as described for normal UPS system startup in the *Powerware® 9315 Operation* manual provided with the UPS system. If the MOBs have been opened, they should only be closed when the **OK TO CLOSE** lamp is illuminated. The following descriptions give details on starting in modes, turning the module off, and using the **LOAD OFF** pushbutton.

## How to Isolate a Module

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The primary function of the MOBs is to allow isolation of a module for maintenance or service. In parallel operation, each module becomes the other's maintenance bypass source.

Do not attempt to isolate a module until it is assured that the redundant module can support the critical load. The best assurance is if the redundant UPS module's designated MOB is closed and the **OK TO CLOSE** lamp is illuminated.

As an alternative:

1. Make sure the designated MOB for both modules is closed.
2. Place the UPS module to be isolated in Bypass mode.
3. Place the redundant module in Bypass mode.
4. Open the designated MOB of the UPS module to be isolated.

When a module's designated MOB is open, it will work like a standard *Reverse Transfer* module as described in the *Powerware® 9315 Operation* manual provided with the UPS system. The MOB should only be closed when its **OK TO CLOSE** lamp is illuminated.

## Shut Down a Module

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To turn a module off, place its mode switch to the Bypass position and open its circuit breaker (CB1).

## Transfer System to Bypass

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To place the system in Bypass mode:

1. Turn the mode switch on both UPS modules to the Bypass position. The first module will shut off its inverter and the redundant module will transfer to Bypass.

To place both UPS modules on Bypass:

1. Turn the mode switch on both UPS modules to the Bypass position.
2. After the first module shuts off and the redundant module is in Bypass, activate the start switch on the first module with the mode switch still in the Bypass position.

To transfer both UPS modules from Bypass mode to Normal mode:

1. Turn the mode switch on both modules to the Normal position.
2. Activate the start switch on either UPS module.

## LOAD OFF

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The **LOAD OFF** pushbutton (referred to as the emergency power off) only interrupts the ability of a single module to deliver power to the critical bus. The redundant module will continue to support the critical load. Refer to the *Powerware 9315 Operation* manual for details on the **LOAD OFF** pushbutton.

**NOTE:** *The **LOAD OFF** pushbutton will only interrupt the ability for that module to deliver power to the critical bus. The **LOAD OFF** pushbutton must be pressed on both UPS modules in order to cut off power from the critical load. For a single emergency power off switch, a switch should be connected to both modules. Each module should be wired from an isolated contact of that switch.*

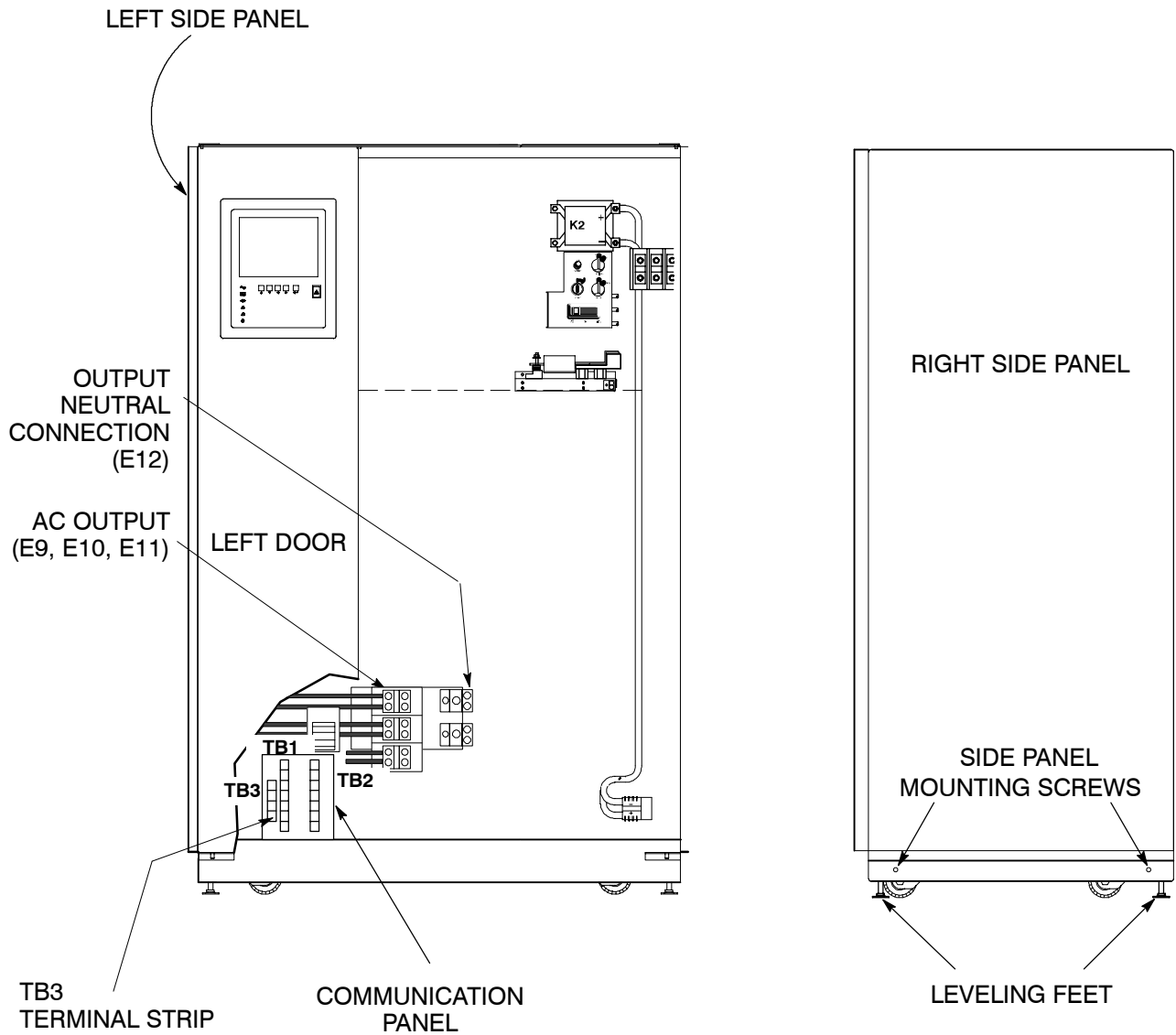
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# Appendix A

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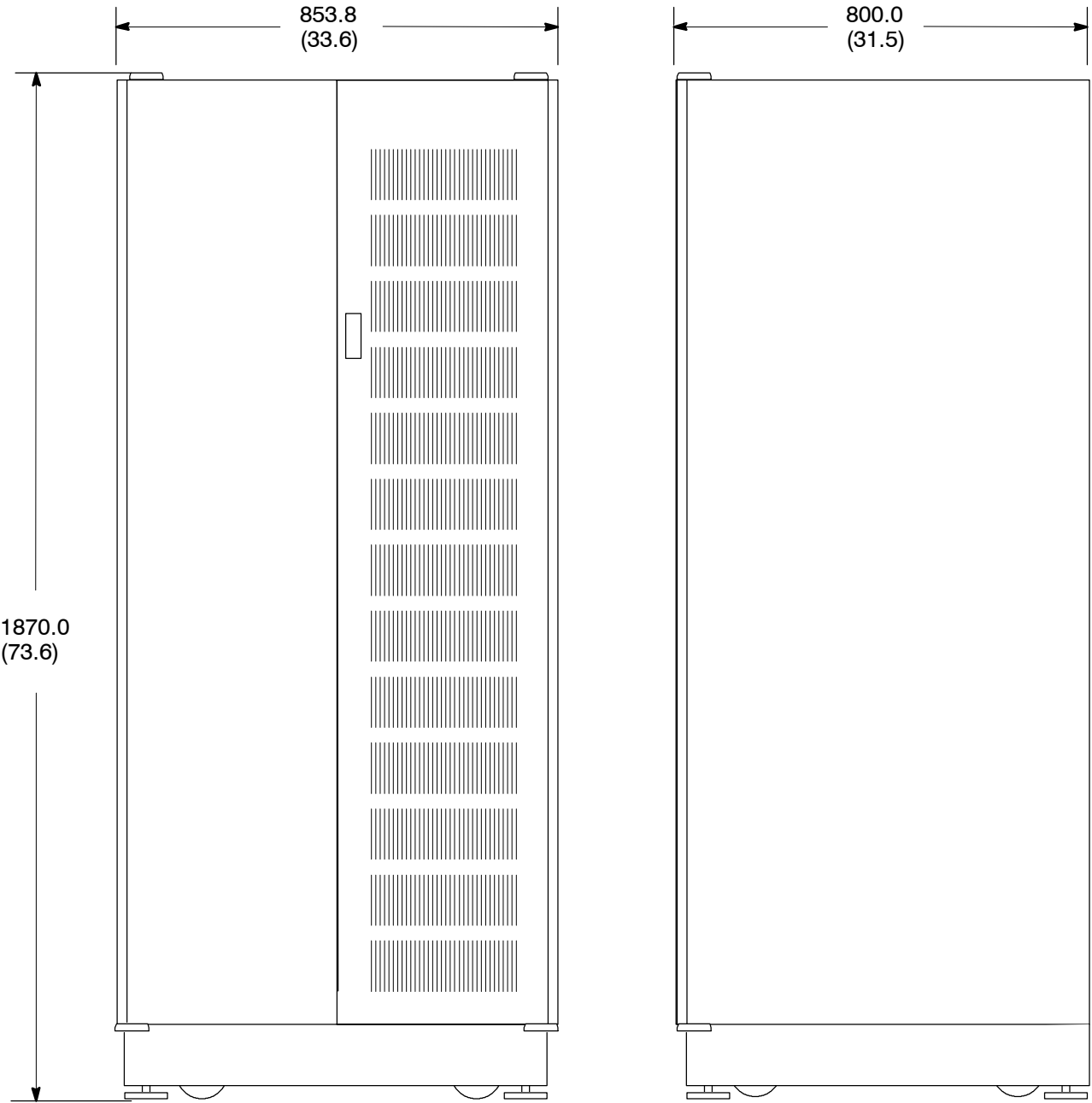
The information in Appendix A will help plan for and install the parallel redundant system. The appendix contains the following figures and tables:

- Figure 11 UPS Outputs and Communications
- Figure 12 Mechanical Details
- Figure 13 Electrical Access Details
- Table A–1 Control Wiring Requirements and Termination Requirements
- Table A–2 UPS Power Cable Terminations and Connection Points
- Table A–3 Tie Cabinet Power Inputs and Termination Requirements
- Table A–4 Power Output Termination Requirements



NOTE: 100–160 KVA UPS Shown with Right Door Open or Removed

**Figure 11. UPS Outputs and Communications**



**PARALLEL TIE CABINET**

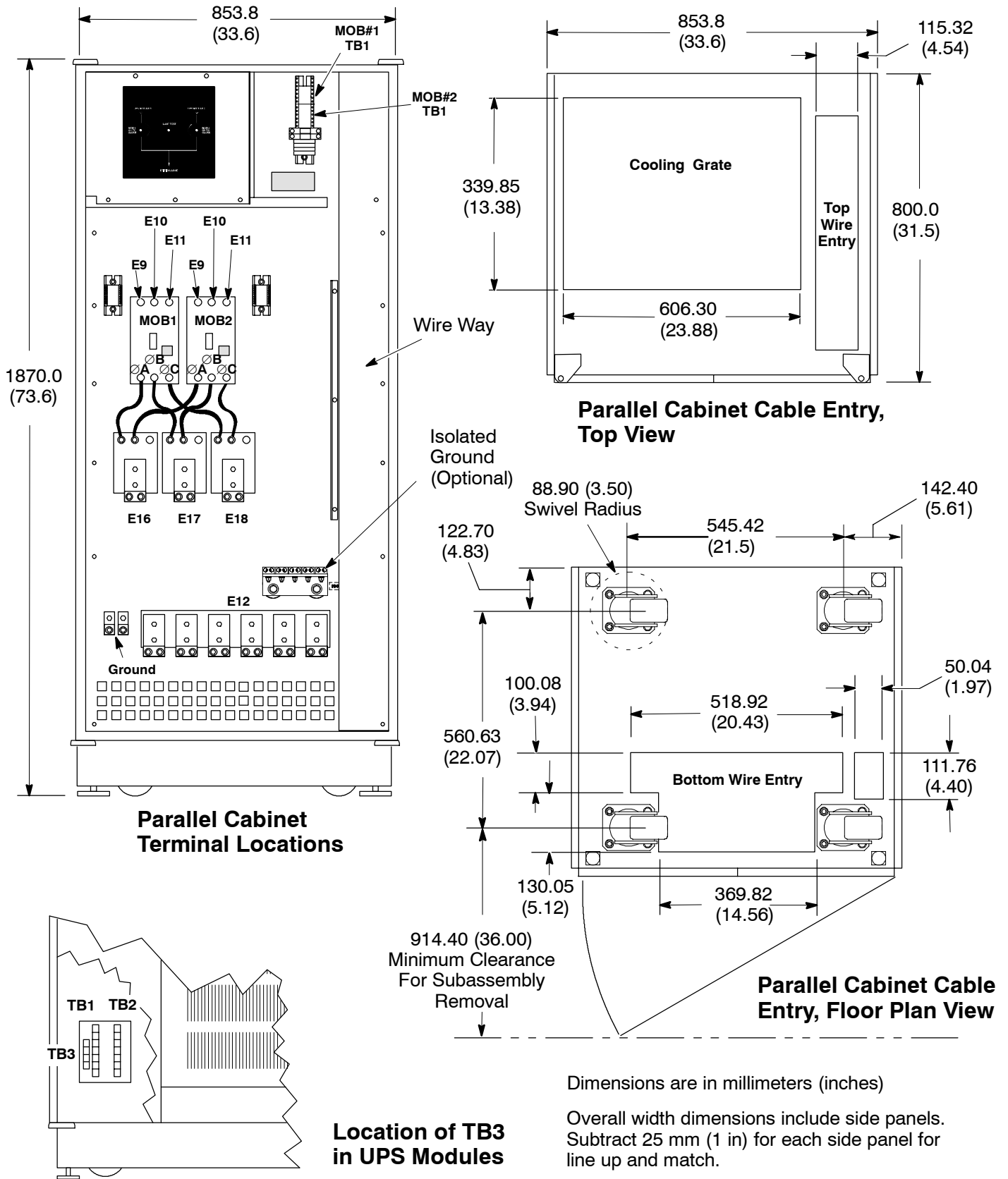
**FRONT VIEW**

**SIDE VIEW**

Dimensions are in millimeters (inches)

Cabinet Weight: 260 kg (570 lb)  
 Cooling Requirements: Convection  
 Heat Rejection: Nil

**Figure 12. Mechanical Details**



**Figure 13. Electrical Access Details**



Connection Points in Tie Cabinet	Size of Pressure Termination (lb-in)	Maximum Voltage and Current	Connection Points in UPS	Size of Pressure Termination (lb-in)	Recommended Wiring Size
TB1-1 through TB1-7	#18-#8, (55)	24V, 0.25A	TB3-1 through TB3-7	#22-#12, (5-7)	#18-#12

Notes for Table A-1:

1. Install the control wiring in separate conduit from the power wiring. Only copper wire or tinned copper wire should be used.
2. Control wiring is NEC class 2 (IEC 950 SELV).
3. Class 1 methods are recommended for control wiring.
4. Control wiring should be twisted pairs and twisted triple as shown in Figure 9.

Connection Point in UPS	Function	Size of Pressure Termination	Tightening Torque N-M (lb-in)	Int Hex Size (In.)	Connection Point in Tie Cabinet
E9	Phase A	Refer to the applicable Powerware 9315 UPS installation manual for this information			E9
E10	Phase B				E10
E11	Phase C				E11
E12	Neutral/ Gnd				E12

**Table A-3. Tie Cabinet Power Inputs and Termination Requirements**

UPS Model	UPS Output NP Voltage	Minimum Conductor Size	Breakers MOB 1 and 2 (Amps)	Terminal Point in Tie Cabinet	Function	Size of Pressure Termination (CU wire)	Tightening Torque (lb-in)	Internal Hex Size (In.)
40	400	4 AWG	80	E9, E10, E11	Phase A, B, C	#14-3/0	#14-#10, (35) #8-#3, (100) #2-#3/0, (150)	7/32
50	600	6 AWG	60	E9, E10, E11	Phase A, B, C	#14-3/0	#14-#10, (35) #8-#3, (100) #2-#3/0, (150)	7/32
50	480	4 AWG	80	E9, E10, E11	Phase A, B, C	#14-3/0	#14-#10, (35) #8-#3, (100) #2-#3/0, (150)	7/32
50	208	2/0 AWG	175	E9, E10, E11	Phase A, B, C	#8-350 kcmil	#8-#4, (150) #3-#1, (200) #1/0-350 kcmil, (250)	5/16
65	400	1 AWG	125	E9, E10, E11	Phase A, B, C	#8-350 kcmil	#8-#4, (150) #3-#1, (200) #1/0-350 kcmil, (250)	5/16
80	600	3 AWG	100	E9, E10, E11	Phase A, B, C	#8-350 kcmil	#8-#4, (150) #3-#1, (200) #1/0-350 kcmil, (250)	5/16
80	480	1 AWG	125	E9, E10, E11	Phase A, B, C	#8-350 kcmil	#8-#4, (150) #3-#1, (200) #1/0-350 kcmil, (250)	5/16
80	400	1/0 AWG	150	E9, E10, E11	Phase A, B, C	#8-350 kcmil	#8-#4, (150) #3-#1, (200) #1/0-350 kcmil, (250)	5/16
80	208	350 kcmil	300	E9, E10, E11	Phase A, B, C	(2) #2/0-400 kcmil or (1) #6-600 kcmil	#2-600 kcmil, (375) #8-#3, (275)	3/8
125	400	4/0 AWG	225	E9, E10, E11	Phase A, B, C	#8-350 kcmil	#8-#4, (150) #3-#1, (200) #1/0-350 kcmil, (250)	5/16
130	400	250 kcmil	250	E9, E10, E11	Phase A, B, C	#8-350 kcmil	#8-#4, (150) #3-#1, (200) #1/0-350 kcmil, (250)	5/16

*continued*

**Table A-3. Tie Cabinet Power Inputs and Termination Requirements (cont.)**

UPS Model	UPS Output NP Voltage	Minimum Conductor Size	Breakers MOB 1 and 2 (Amps)	Terminal Point in Tie Cabinet	Function	Size of Pressure Termination (CU wire)	Tightening Torque (lb-in)	Internal Hex Size (In.)
150	600	3/0 AWG	200	E9, E10, E11	Phase A, B, C	#8-350 kcmil	#8-#4, (150) #3-#1, (200) #1/0-350 kcmil, (250)	5/16
150	480	4/0 AWG	225	E9, E10, E11	Phase A, B, C	#8-350 kcmil	#8-#4, (150) #3-#1, (200) #1/0-350 kcmil, (250)	5/16
150	400	350 kcmil	300	E9, E10, E11	Phase A, B, C	(2) #2/0-400 kcmil or (1) #6-600 kcmil	#2-600 kcmil, (375) #8-#3, (275)	3/8
150	208	(2) 350 kcmil	600	E9, E10, E11	Phase A, B, C	(2) #2/0-400 kcmil or (1) #6-600 kcmil	#2-600 kcmil, (375) #8-#3, (275)	3/8
160	600	3/0 AWG	200	E9, E10, E11	Phase A, B, C	#8-350 kcmil	#8-#4, (150) #3-#1, (200) #1/0-350 kcmil, (250)	5/16
160	480	250 kcmil	250	E9, E10, E11	Phase A, B, C	#8-350 kcmil	#8-#4, (150) #3-#1, (200) #1/0-350 kcmil, (250)	5/16
160	400	350 kcmil	300	E9, E10, E11	Phase A, B, C	(2) #2/0-400 kcmil or (1) #6-600 kcmil	#2-600 kcmil, (375) #8-#3, (275)	3/8
160	208	(2) 350 kcmil	600	E9, E10, E11	Phase A, B, C	(2) #2/0-400 kcmil or (1) #6-600 kcmil	#2-600 kcmil, (375) #8-#3, (275)	3/8
225	208	(2) 300 kcmil	800	E9, E10, E11	Phase A, B, C	(3) #3/0-500 kcmil	#3/0-500 kcmil (375)	3/8
225	480	(2) #4/0	350	E9, E10, E11	Phase A, B, C	(2) #2/0-400 kcmil or (1) #6-600 kcmil	#2-600 kcmil, (375) #8-#3, (275)	3/8
300	480	(2) 250 kcmil	450	E9, E10, E11	Phase A, B, C	(2) #2/0-400 kcmil or (1) #6-600 kcmil	#2-600 kcmil, (375) #8-#3, (275)	3/8

*continued*

**Table A-3. Tie Cabinet Power Inputs and Termination Requirements (cont.)**

UPS Model	UPS Output NP Voltage	Minimum Conductor Size	Breakers MOB 1 and 2 (Amps)	Terminal Point in Tie Cabinet	Function	Size of Pressure Termination (CU wire)	Tightening Torque (lb-in)	Internal Hex Size (In.)
300	600	(2) 4/0 AWG	400	E9, E10, E11	Phase A, B, C	(2) #2/0-400 kcmil or (1) #6-600 kcmil	#2-600 kcmil, (375) #8-#3, (275)	3/8
400	480	(3) 300 kcmil	800	E9, E10, E11	Phase A, B, C	(3) #3/0-500 kcmil	#3/0-500 kcmil (375)	3/8
500	480	(3) 300 kcmil	800	E9, E10, E11	Phase A, B, C	(3) #3/0-500 kcmil	#3/0-500 kcmil (375)	3/8
All Models	—	—	—	E12	Neutral	(12) #6-350 kcmil	(275)	3/8
All Models	—	1/0 AWG	—	Ground	Ground	(2) #6-350 kcmil	(275)	3/8
All Models (Optional)	—	(2) 1/0 AWG	—	Isolated Ground (Optional)	Isolated Ground	(10) #14-1/0 AWG	(275)	Slotted

**Table A-4. Power Output Termination Requirements**

UPS Model	Minimum Conductor Size	Terminal Point in Tie Cabinet	Function	Size of Pressure Termination (CU wire)	Tightening Torque (lb-in) ± 10%	Internal Hex Size (In.)
40 through 300, except Model 225 at 208 volt output	Same as input	E16, E17, E18	Phase A, B, C	(2) #6-350 kcmil	(275)	3/8
Model 225 at 208 volt output and Models 400 and 500	Same as input	E16, E17, E18	Phase A, B, C	(4) #6-350 kcmil	(275)	3/8

Notes for Tables A-2, A-3, and A-4:

1. Refer to national and local electrical codes for acceptable external wiring practices.
2. Material and labor for external wiring requirements are to be provided by designated personnel.
3. Power wiring size recommendation is copper wire rated at 75°C for Powerware 9315 models 40 through 300 and 90°C the Powerware 9315 400 and 500. If the wire is run in ambient temperature higher than 30°C, larger size and/or higher temperature wire is necessary.
4. The output for the UPS is a separately derived source. Output neutral is bonded to equipment ground through the main bonding jumper. Refer to NEC Article 250 and local codes for proper grounding practices.

5. External overcurrent protection is not provided by this product, but is required by codes. Refer to Tables A–3 and A–4 for power wiring recommendations and requirements for the parallel cabinet. Refer to the *Powerware® 9315 Installation* manual provided with the UPS system for UPS module power wiring requirements. If an output lockable disconnect is required, it is to be supplied by designated personnel.
6. Nonlinear loads can create neutral currents that are greater than 100%. This product can accommodate double-size neutral terminations if needed. The neutral bus (E12) in the parallel cabinet has pressure termination size six (6) times that as listed for the output (E16–E18).
7. Terminals E9 through E12 and E16 through E18 are UL and CSA rated at 90°C. A hex key tool is required to attach wires to terminals. Refer to Table A–3 for power cable terminations. Figure 13 shows the location of the power cable terminations inside the UPS and parallel tie cabinets.
8. The ground pressure termination size for all models is: (4) #6–350 kcmil. Tighten with 3/8 in. internal hex tool to 375 lb-in.

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