Dell EMC VMAX Best Practices Guide for AC Power Connections

For: VMAX3 Family and VMAX All Flash

March 2021
Rev. 9.0

DELL EMC

Notes, cautions, and warnings

NOTE: A NOTE indicates important information that helps you make better use of your product.

CAUTION: A CAUTION indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

WARNING: A WARNING indicates a potential for property damage, personal injury, or death.

Contents

Preface

Contact your Dell EMC technical support professional if a product does not function properly or does not function as described in this document.

NOTE: This document was accurate at publication time. Go to Dell EMC Online Support (https://support.emc.com) to ensure that you are using the latest version of this document.

Purpose

This document describes best practices for connecting AC power to the following VMAX arrays:

- VMAX3 Family: VMAX 100K, VMAX 200K, VMAX 400K
- VMAX All Flash: VMAX 250F, VMAX 450F, VMAX 850F, VMAX 950F

Audience

This document is intended for customers who are installing a VMAX3 Family or VMAX All Flash array and must assure that fault tolerant AC power is supplied to the arrays from independent, customer-supplied, power distribution units (PDUs).

Related documentation

The following publications provide additional information:

EMC VMAX3 Family Product Guide for VMAX 100K, VMAX 200K, VMAX 400K with HYPERMAX OS	Provides product information regarding the purchase of a VMAX3 Family 100K, 200K, 400K.
Dell EMC VMAX All Flash Product Guide for VMAX 250F, 450F, 850F, 950F with HYPERMAX OS	Provides product information regarding the purchase of a VMAX 250F, 450F, 850F, 950F with HYPERMAX OS.
Dell EMC VMAX3 Family Site Planning Guide for VMAX 100K, VMAX 200K, VMAX 400K with HYPERMAX OS	Provides planning information regarding the purchase and installation of a VMAX3 Family 100K, 200K, 400K.
Dell EMC VMAX All Flash Site Planning Guide for VMAX 250F, 450F, 850F, 950F with HYPERMAX OS	Provides planning information regarding the purchase and installation of a VMAX 250F, 450F, 850F, 950F with HYPERMAX OS.
Dell EMC VMAX Securing Kit Installation Guide	Describes how to install the securing kit on a VMAX3 Family array or VMAX All Flash array.

Dell EMC VMAX Power-down/Power-up Procedure	Describes how to power-down and power-up a VMAX3 Family array or VMAX All Flash array.

Special notice conventions used in this document

Dell EMC uses the following conventions for special notices:

NOTE: A NOTE indicates important information that helps you make better use of your product.

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Table 1. Typographical conventions used in this content

Bold	Used for names of interface elements Examples: Names of windows, dialog boxes, buttons, fields, tab names, key names, and menu paths (what the user selects or clicks)
Italic	Used for full titles of publications referenced in text
`Monospace`	Used for: • System code • System output, such as an error message or script • Pathnames, filenames, prompts, and syntax • Commands and options
Monospace italic	Used for variables
`Monospace bold`	Used for user input
[ ]	Square brackets enclose optional values.
|	A vertical bar indicates alternate selections. The bar means "or".
{ }	Braces enclose content that the user must specify, such as x or y or z.
...	Ellipses indicate nonessential information that is omitted from the example.

Where to get help

EMC support, product, and licensing information can be obtained as follows:

Product information	Dell EMC technical support, documentation, release notes, software updates, or information about Dell EMC products can be obtained at https://www.dell.com/support/home (registration required) or https://www.dellemc.com/en-us/documentation/vmax-all-flash-family.htm.
Technical support	To open a service request through the Dell EMC Online Support (https://www.dell.com/support/home) site, you must have a valid support agreement. Contact your Dell EMC sales representative for details about obtaining a valid support agreement or to answer any questions about your account.
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  - licensing@emc.com
  - North America, Latin America, APJK, Australia, New Zealand: SVC4EMC (800-782-4362) and follow the voice prompts.
  - EMEA: +353 (0) 21 4879862 and follow the voice prompts.

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Your suggestions help improve the accuracy, organization, and overall quality of the documentation. Send your comments and feedback to: VMAXContentFeedback@emc.com

Revision history

The following table presents the revision history of this document:

Revision	Description and/or Change	Date
9.0	Added 32A circuit breaker voltage for international power connections	March 2021
8.0	Added note to provide strain relief when host cabling and power are handled from overhead or wall-mounted.	April 2020
7.0	Removed instructions on how to ground the cabinet from this guide. Instructions are included in other guides.	June 2018
6.0	• Updated for VMAX 950F. • Added instructions on how to ground the cabinet.	May 2017
5.0	Formatting edits for readability.	September 2016
4.0	Updated for VMAX 250F.	August 2016
3.0	Updated name and doc references. Minor edits for readability. Modified front matter.	February 2016
2.0	Format change. No change in content.	August 2015
1.0	Initial release.	September 2014

1

Best Practices Guide for AC Power Connections

Topics include:

Topics:

Best practices overview for AC power connections

To assure fault tolerant power, external AC power must be supplied from independent, customer-supplied, power distribution units (PDUs) as shown in Two independent customer-supplied PDUs on page 8.

For systems operating from three phase AC power, two independent and isolated AC power sources are recommended for the two individual power zones in each rack of the system. This provides for the highest level of redundancy and system availability. If independent AC power is not available, there is a higher risk of data unavailability should a power failure occur, including individual phase loss occurring in both power zones.

Before connecting external AC power to storage bays, verify that the bays have been placed in their final position as explained in the installation guide.

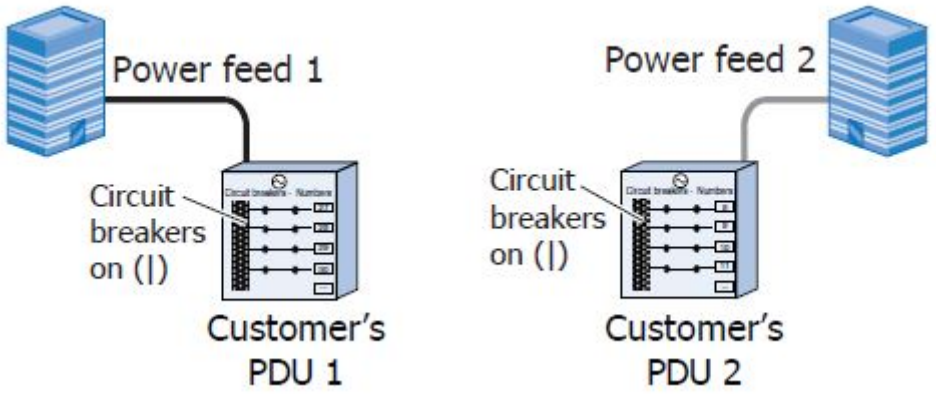

Figure 1. Two independent customer-supplied PDUs

Selecting the proper AC power connection procedure

NOTE: The Dell EMC Customer Engineer must select the proper AC power connection procedure.

Procedure options for AC power connection on page 9 summarizes the three possible scenarios to connect customer AC power to the storage array. Select the procedure that matches the customer's situation.

Table 2. Procedure options for AC power connection

Situation on site	Procedure
The customer's electrician is available at the installation site.	Procedure A: Working with the customer's electrician onsite on page 10. This procedure assures fault tolerant power in the storage array.
The customer's electrician is NOT available at the installation site, but you have access to customer-supplied, labeled, power cables (beneath a raised floor or overhead).	Procedure B: Verify and connect on page 21
The customer's electrician is NOT available at the installation site, customer-supplied PDU source cables are already plugged into the PDU (or VMAX 250F PDP) , and you have no access to the customer-supplied power cables.	Procedure C: Obtain customer verification on page 22

Procedure A: Working with the customer's electrician onsite

Use this procedure if the customer’s electrician is available at the installation site.

This procedure requires three basic tasks that alternate between the customer's electrician, the Dell EMC CE and back to the customer's electrician.

- Task 1: Customer's electrician
- Task 2: Dell EMC Customer Engineer (CE)
- Task 3: Customer's electrician

Procedure A, Task 1: Customer's electrician

About this task

NOTE: This task is performed by the customer's electrician.

Steps

1. Verify that the customer-supplied AC source voltage output on each customer-supplied PDU is within the AC power specification shown in AC power specifications on page 27. Measure the voltage output of each power cable as shown in Circuit breakers ON — AC power within specification on page 11.
2. Turn **OFF** all the relevant circuit breakers in customer-supplied PDU 1 and customer-supplied PDU 2.
3. Verify that the customer-supplied power cables connected to PDU 1 and PDU 2 have no power as shown in Circuit breakers OFF — No AC power on page 11.

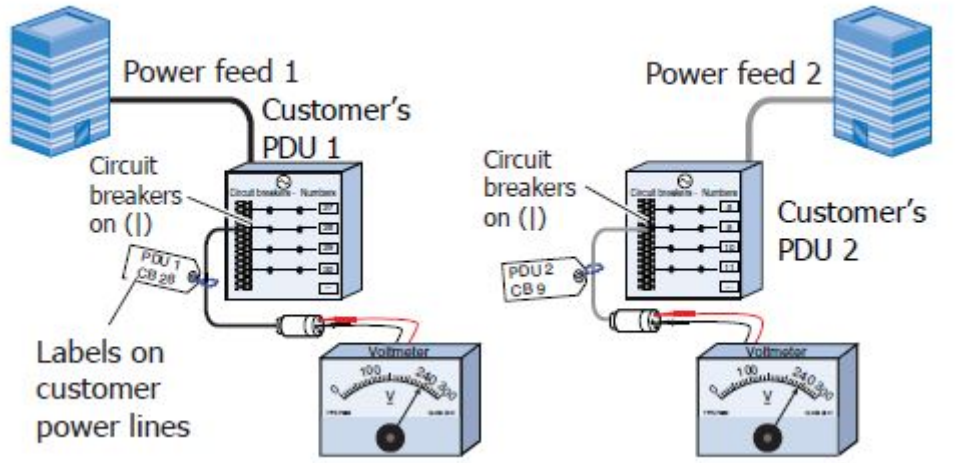

Figure 2. Circuit breakers ON — AC power within specification

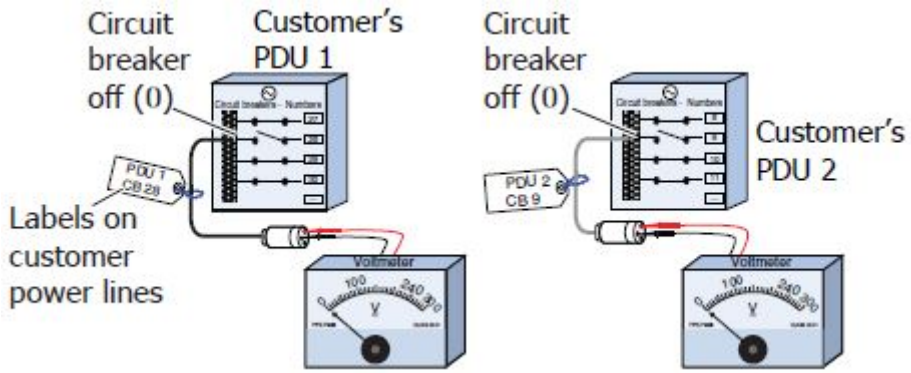

Figure 3. Circuit breakers OFF — No AC power

Procedure A, Task 2: Dell EMC Customer Engineer

Prerequisites

Before connecting power to the system, make sure that the power for both zone A and zone B are turned OFF. This task is performed by the Dell EMC Customer Engineer.

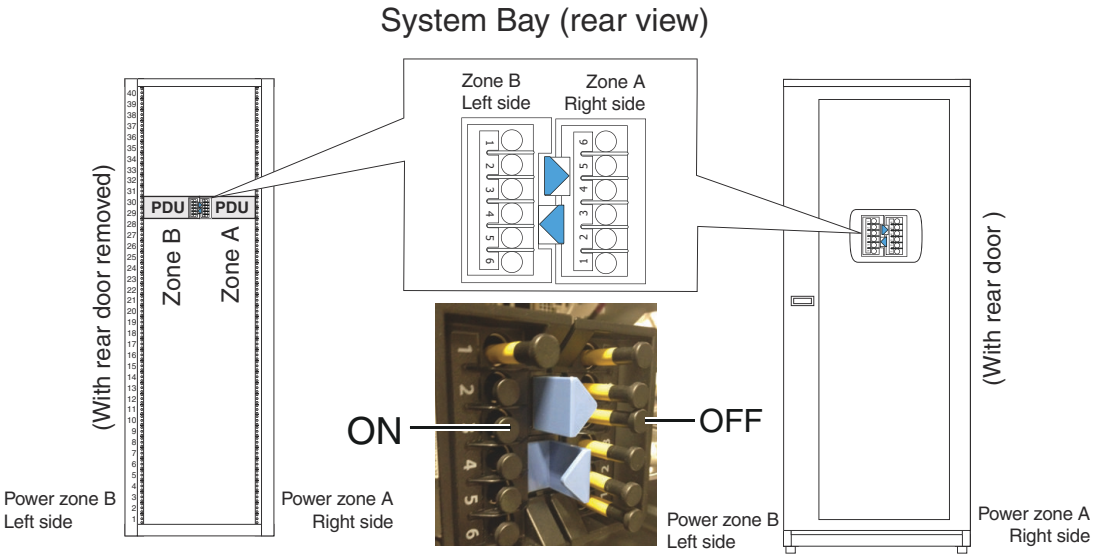

Figure 4. System bay power tee breakers (OFF = pulled out)

Steps

1. Confirm that the customer-supplied power cables are labeled and that each label contains the relevant customer-supplied PDU and circuit breaker numbers. If power cables are not equipped with labels, alert the customer.
2. Compare the numbers on the customer-supplied power cables for each Dell EMC bay to verify that power zone A and power zone B are powered by a different customer-supplied PDU.
3. Do one of the following to connect power zone A and power zone B in each bay. If necessary, use the 15ft extension cords provided by Dell EMC.
   - For single-phase power: Connect customer-supplied PDU power cables to the Dell EMC bay by connecting to the bay's AC input cables for power zone A and power zone B as shown below.

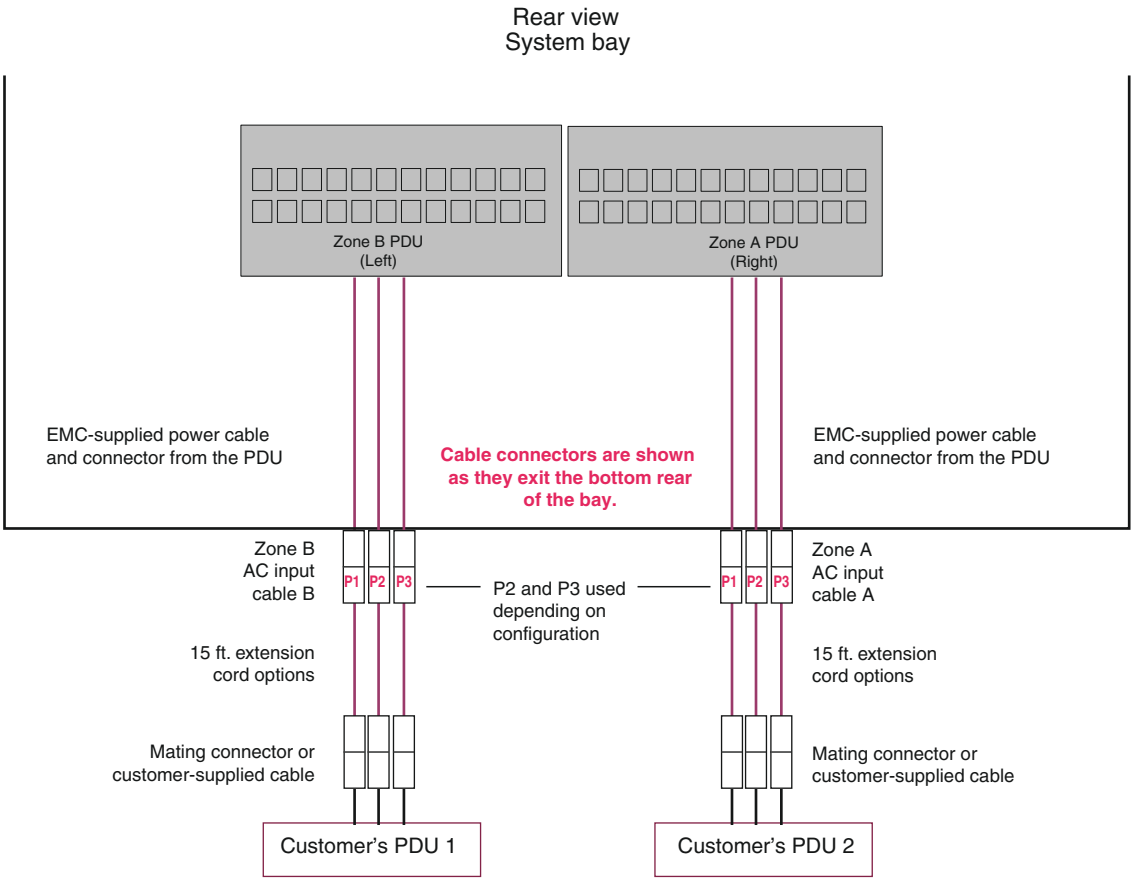

Figure 5. Connecting AC power, single-phase

- For three-phase power: Connect customer-supplied PDU power cables to the Dell EMC bay by connecting to the bay's AC input cables for power zone A and power zone B as shown below.

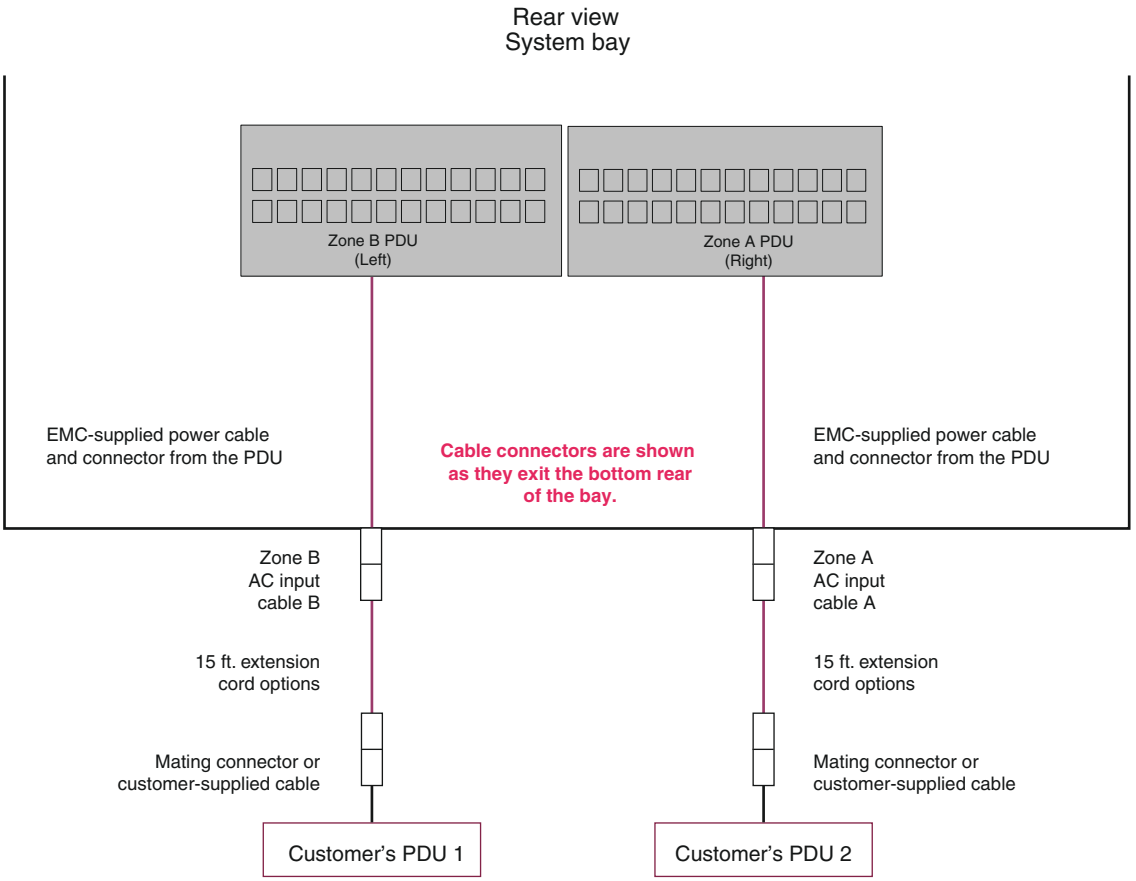

Figure 6. Connecting AC power, three-phase

NOTE: Do not connect Dell EMC bay power zone A and power zone B to the same customer-supplied PDU. The customer will lose power redundancy and risk Data Unavailability (DU) if the PDU fails or is turned off during a maintenance procedure.

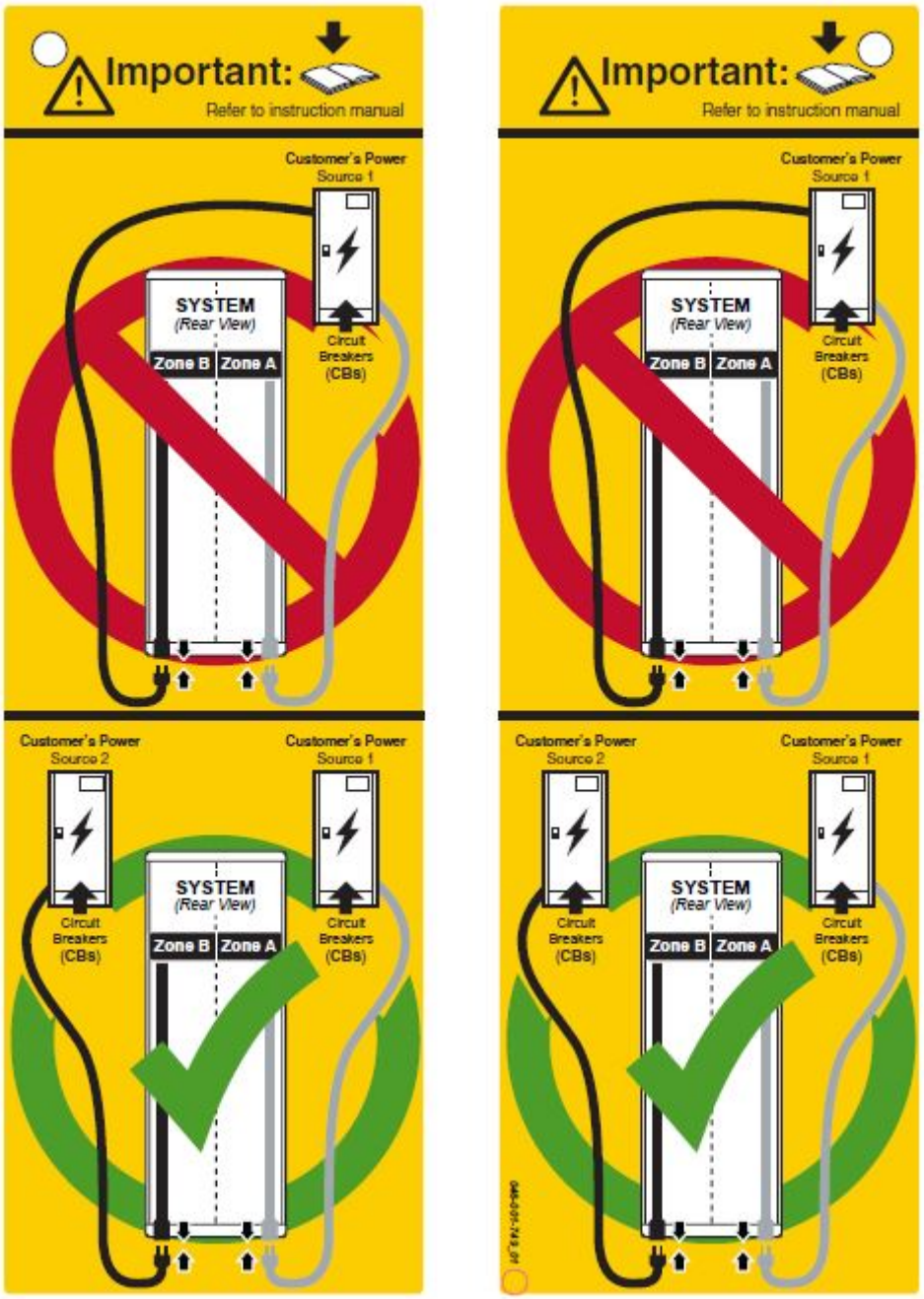

Figure 7. Power zone connections

Procedure A, Task 2: Dell EMC Customer Engineer (VMAX 250F)

Prerequisites

Before connecting power to the system, make sure that the power for both zone A and zone B are turned OFF. This task is performed by the Dell EMC Customer Engineer.

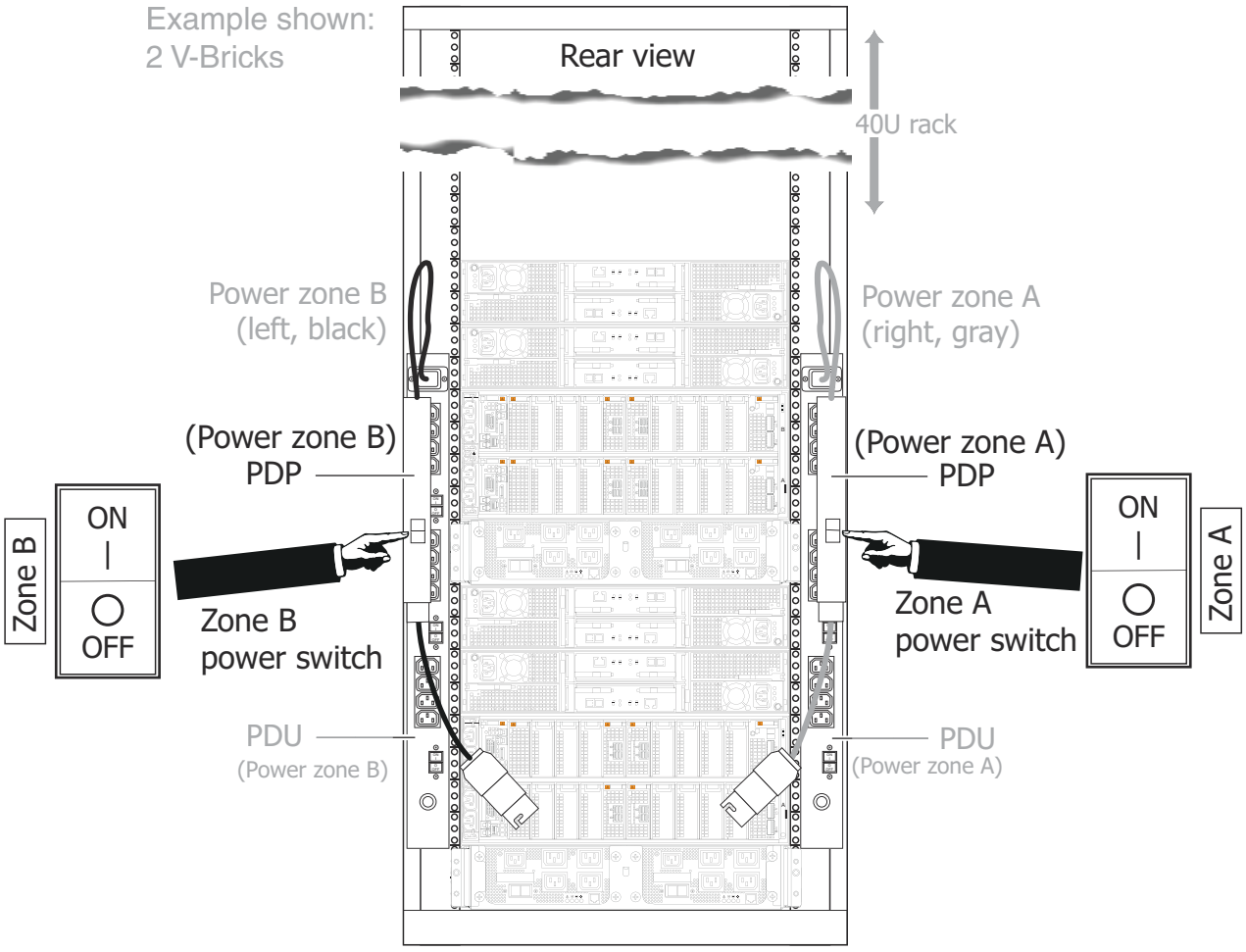

Figure 8. PDP power switches for Zone A and B

Steps

1. Confirm that the customer-supplied power cables are labeled and that each label contains the relevant customer-supplied PDU and circuit breaker numbers. If power cables are not equipped with labels, alert the customer.
2. Compare the numbers on the customer-supplied power cables for each Dell EMC bay to verify that power zone A and power zone B are powered by a different customer-supplied PDU.
3. Do the following to connect power zone A and power zone B in each bay. You must use the 15ft extension cords provided by Dell EMC. To ensure serviceability, make sure there is 2ft (61cm) of cable slack directly under the bay floor-egress. See VMAX 250F customer AC power feed cabling on page 19 for more details.
   - For both single-phase and three-phase, connect customer-supplied PDU power cables to the Dell EMC bay by connecting to the bay's AC input cables for power zone A and power zone B as shown below:

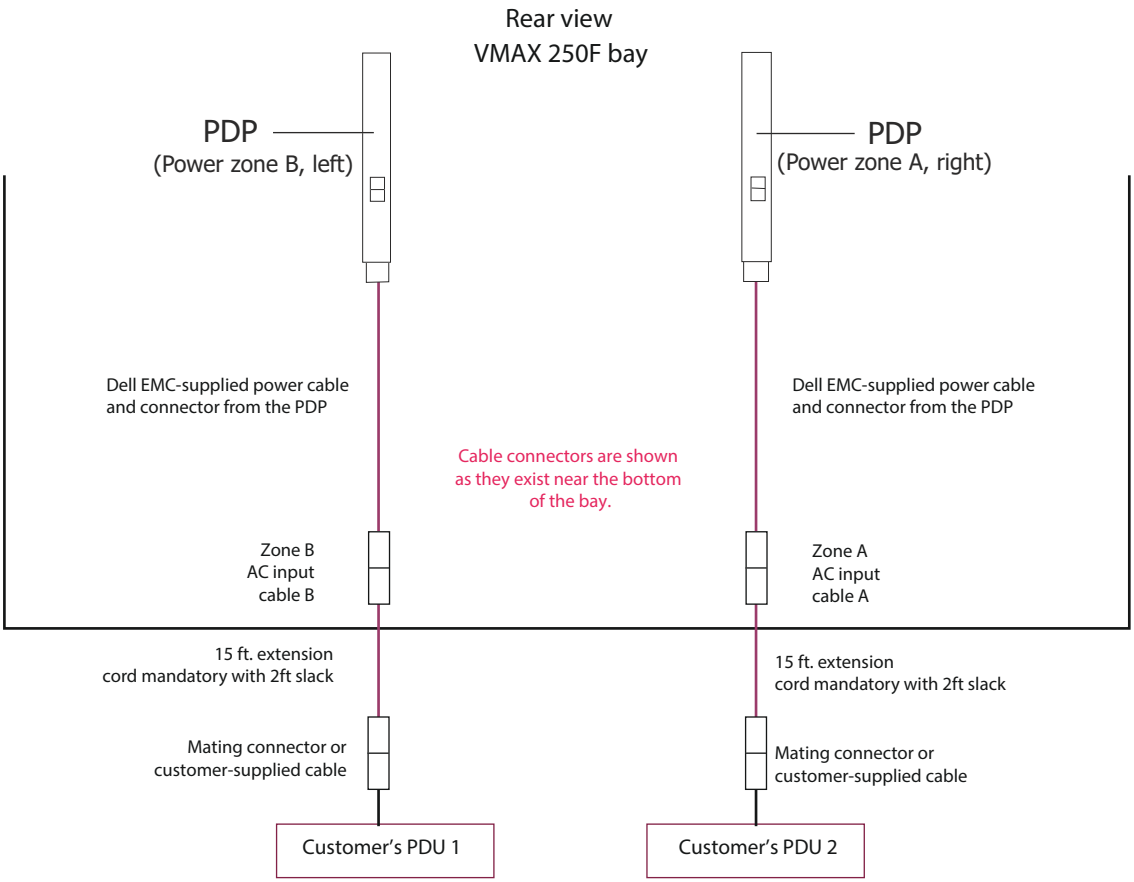

Figure 9. Connecting AC power

NOTE: Do not connect Dell EMC bay power zone A and power zone B to the same customer-supplied PDU. The customer will lose power redundancy and risk Data Unavailability (DU) if the PDU fails or is turned off during a maintenance procedure.

Figure 10. Power zone connections

VMAX 250F customer AC power feed cabling

When connecting customer input power to a VMAX 250F, the Dell EMC-supplied 15ft (4.57m) extension cords must be used and approximately 24in (61cm) of slack must be left directly under the bay floor egress.

NOTE: For power zone-A, use the extension cord with gray sleeves at the ends.

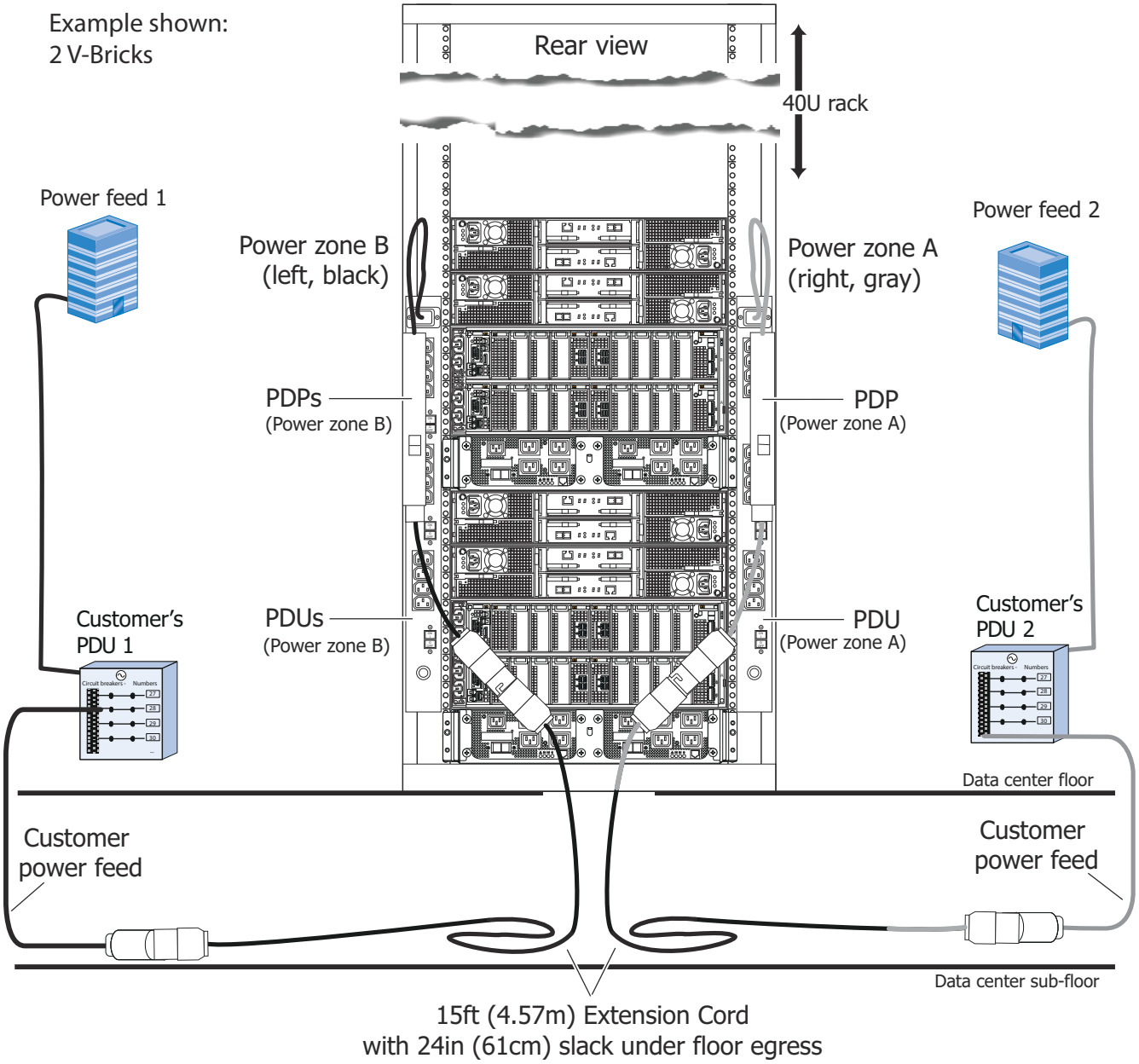

Figure 11. Customer input power cabling for VMAX 250F

Procedure A, Task 3: Customer's electrician

About this task

NOTE: This task is performed by the customer's electrician.

Steps

1. Working with the Dell EMC Customer Engineer, turn ON all the relevant circuit breakers in customer-supplied PDU 2.
   Verify that only power supply and/or SPS LEDs in power zone A are ON or flashing green in every bay in the array.
   CAUTION: The bay is incorrectly wired if all (power zone A and B) power supply and/or SPS LEDs in a bay are ON or flashing green. Check that the AC power to both storage bay power zones is not supplied by a single PDU (customer-supplied PDU 2). The wiring must be corrected before moving on to the next step.
2. Turn OFF the relevant circuit breakers in customer-supplied PDU 2.
   Verify that the power supply and/or SPS LEDs that turned green in the previous step changed from green to OFF and/or flashing yellow. The yellow SPS lights flash for a maximum of 5 minutes.
   NOTE: Power supplies connected to an SPS continue to have green lights ON while the SPS yellow light continues to flash indicating the SPS is providing on-battery power.
3. Repeat step 1 and step 2 for power zone B and customer-supplied PDU 1.
4. Turn ON all the relevant circuit breakers in customer-supplied PDU 1 and customer-supplied PDU 2.
5. Label the PDUs as described in PDU labels on page 22.

Procedure B: Verify and connect

About this task

Perform this procedure if the two conditions listed below are true:

- You have access to customer-supplied, labeled, power cables (beneath raised floor or overhead).
- The customer's electrician is not available at the installation site.

This procedure requires the Dell EMC Customer Engineer to verify that the customer's electrician has complied with power specifications. Once verified, the Dell EMC Customer Engineer makes the required power connections overhead or under the floor.

NOTE: Utilize proper strain relief methods when customer-provided power drops are located overhead or wall-mounted.

Steps

1. Have the customer verify that their electrician has complied with power specifications for voltage levels and redundancy. If the customer cannot verify this, provide them with a copy of Procedure A. Inform the customer that their array may prematurely shut down in the event of a site power issue.
2. Access the labeled, power cables (beneath raised floor or overhead) to verify that the customer-supplied power cables are properly labeled as shown in Circuit breakers OFF — No AC power on page 11 and described in Procedure A, Task 2.
3. Compare the numbers on the customer-supplied power cables for each storage bay to verify that power zone A and power zone B are powered by a different customer-supplied PDU.
4. Connect the customer's PDU AC cables to the storage bay power zones as described in Procedure A, Task 2.
5. Record the customer-supplied PDU information as described in Procedure A, Task 2.
6. Label the PDUs as described in PDU labels on page 22.

Procedure C: Obtain customer verification

About this task

Perform this procedure if the three conditions listed below are true:

- The customer-supplied PDU source cables are already plugged into the storage bay PDU.
- You have no access to the area below the raised floor.
- The customer's electrician is not available at the installation site.

Steps

1. Have the customer verify that their electrician has complied with power specifications for voltage levels and redundancy. If the customer cannot verify this, provide them with a copy of Procedure A. Inform the customer that their array may prematurely shut down in the event of a site power issue.
2. Record the customer-supplied PDU information (AC source voltage) as described in step 1 of Procedure A, Task 1: Customer's electrician on page 11 and label the PDUs as described in PDU labels on page 22.

PDU labels

Before applying labels to the PDUs, one of the following procedures must have been completed:

- Procedure A: Working with the customer's electrician onsite on page 10
- Procedure B: Verify and connect on page 21
- Procedure C: Obtain customer verification on page 22

If necessary, see Selecting the proper AC power connection procedure on page 9 to select the correct procedure.

PDU label part numbers

VMAX 250F

Table 3. VMAX 250F label part numbers

PN	Description	Location
PN 046-003-593	LABEL: CUSTOMER PDU INFORMATION	OPEN ME FIRST KIT, PN 106-887-093

VMAX 450F, VMAX 850F, VMAX 950F

Table 4. VMAX 450F, VMAX 850F, VMAX 950F label part numbers, Dell EMC racks

For...	Use PN	Description	Location
All bays	PN 046-001-750	LABEL: CUSTOMER 1P 3P PDU INFO WRITEABLE	OPEN ME FIRST, KIT, PN 106-887-026

Table 5. VMAX 450F, VMAX 850F, VMAX 950F label part numbers, 3rd party racks

For...	Use PN	Description	Location
System bay 1	PN 046-001-750	LABEL: CUSTOMER 1P 3P PDU INFO WRITEABLE	VMAX AFA EVEREST SB-1 KIT 3RD PARTY, 106-887-171
	PN 046-001-749	PDU Connection Tag	
System bays 2-8	PN 046-001-750	LABEL: CUSTOMER 1P 3P PDU INFO WRITEABLE	VMAX AFA EVEREST SB-1 KIT 3RD PARTY, 106-887-175
	PN 046-001-749	PDU Connection Tag	

VMAX3 Family

Table 6. VMAX3 Family label part numbers, Dell EMC racks

For...	Use PN	Description	Location
All bays	PN 046-001-750	LABEL: CUSTOMER 1P 3P PDU INFO WRITEABLE	OPEN ME FIRST, KIT, PN 106-887-026

Table 7. VMAX3 Family label part numbers, 3rd party racks

For...	Use PN	Description	Location
System bay 1	PN 046-001-750	LABEL: CUSTOMER 1P 3P PDU INFO WRITEABLE	Sys Bay 1 Kit, 106-887-149
	PN 046-001-749	PDU Connection Tag	
System bays 2-8	PN 046-001-750	LABEL: CUSTOMER 1P 3P PDU INFO WRITEABLE	Sys Bay 2-8 Kit, 106-887-150
	PN 046-001-749	PDU Connection Tag	

Applying PDU labels, VMAX 250F

Steps

1. Locate and complete the PDU label.
2. Place the label on the bottom, inner surface of the PDU enclosure for side A and B.

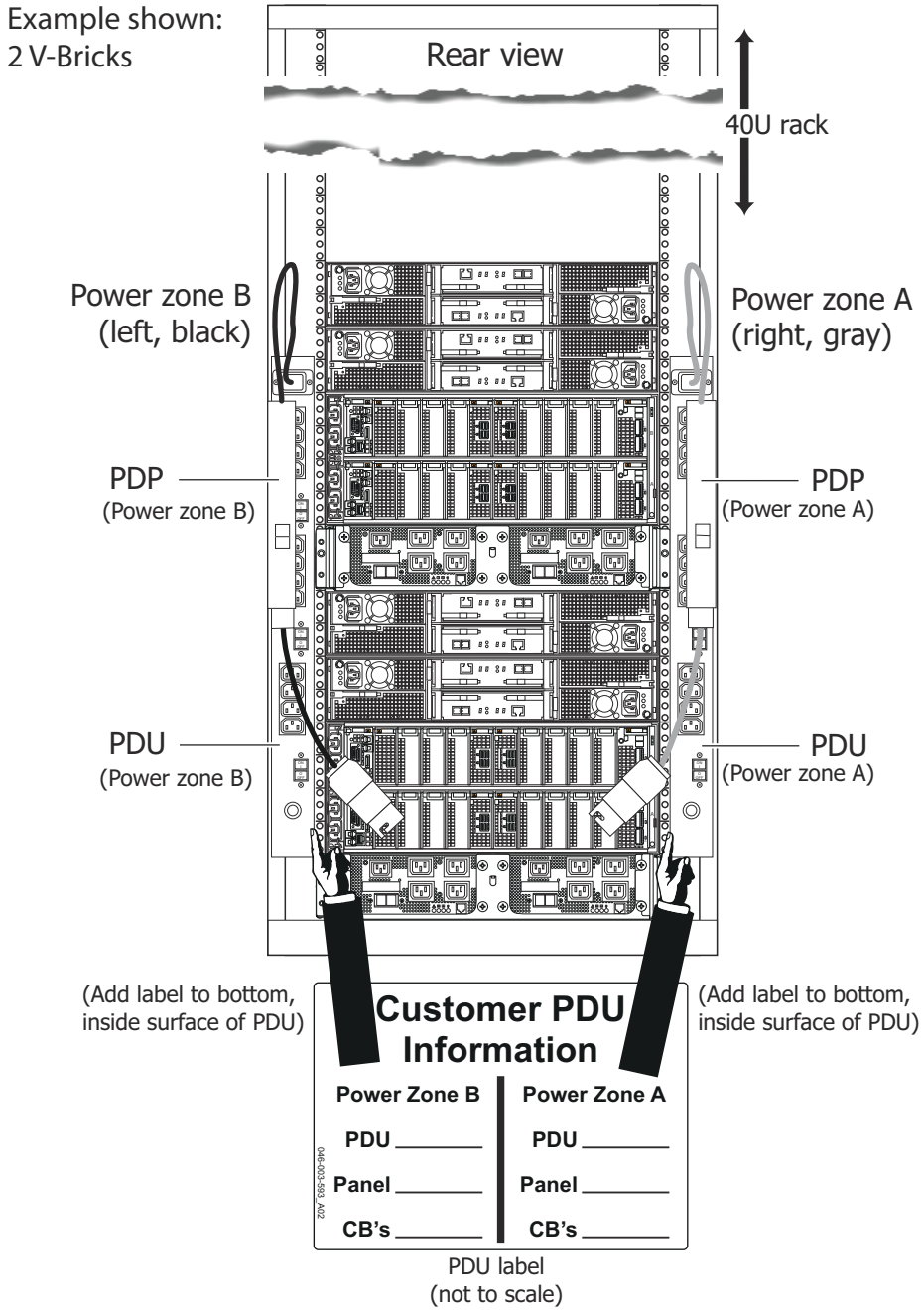

Figure 12. Applying the PDU labels, VMAX 250F

Applying PDU labels, VMAX3 Family, VMAX 450F, VMAX 850F, VMAX 950F

Steps

1. For each bay, locate and complete the PDU label.

   NOTE: For three-phase power, enter data only in the P1 column.

2. Place the label on the top surface of the PDU enclosure for side A and B.

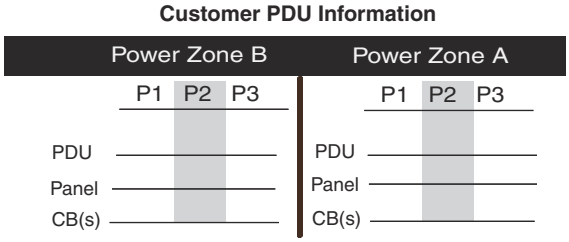

Figure 13. PDU label , single-phase and three-phase

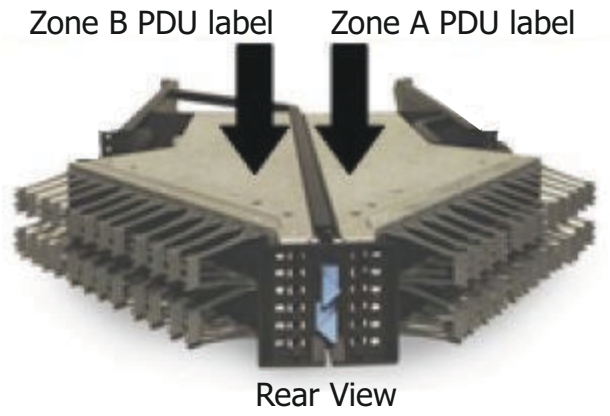

Figure 14. Label placement— Customer PDU Information

3. For 3rd party racks, do one of the following:
   - For three-phase power: Using plastic ties, attach the PDU connection tag to the main AC power cable connected to zone A and B. Place the label close to the plug but on the side of the rack where it will not interfere with any rails.

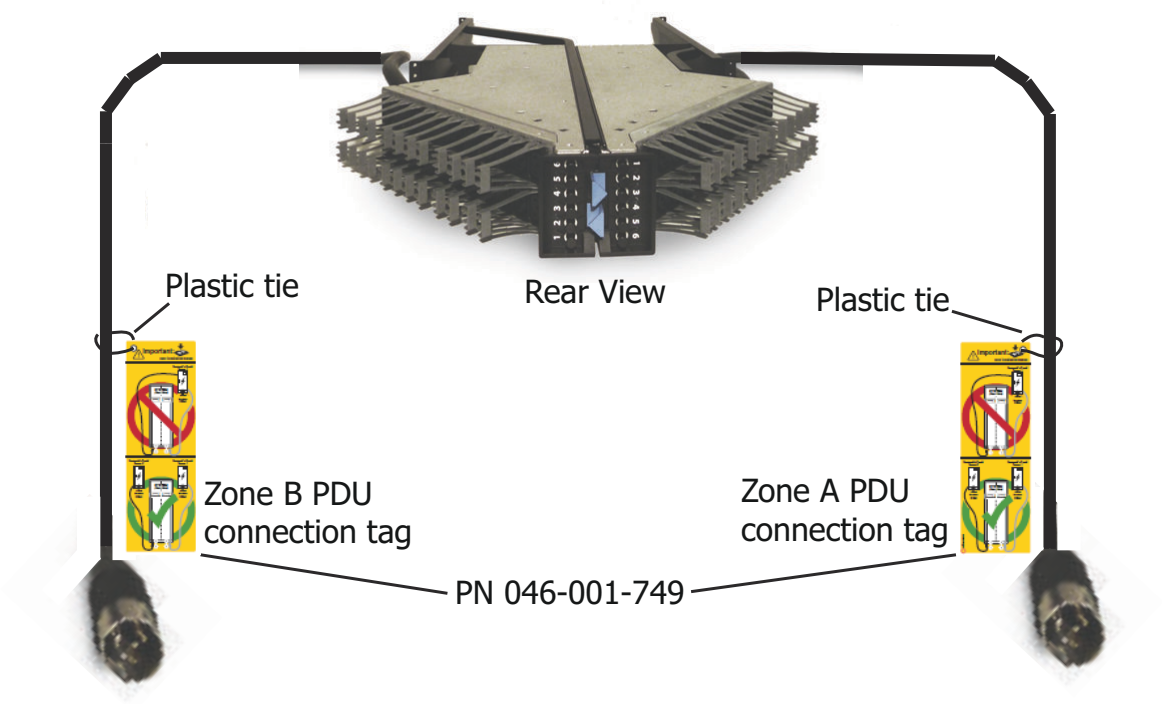

Figure 15. Attaching the PDU connection tag, three-phase

- For single-phase power: Using plastic ties, attach the PDU connection tag to the P1 AC power cable connected to zone A and B. Place the label close to the plug but on the side of the rack where it will not interfere with any rails.

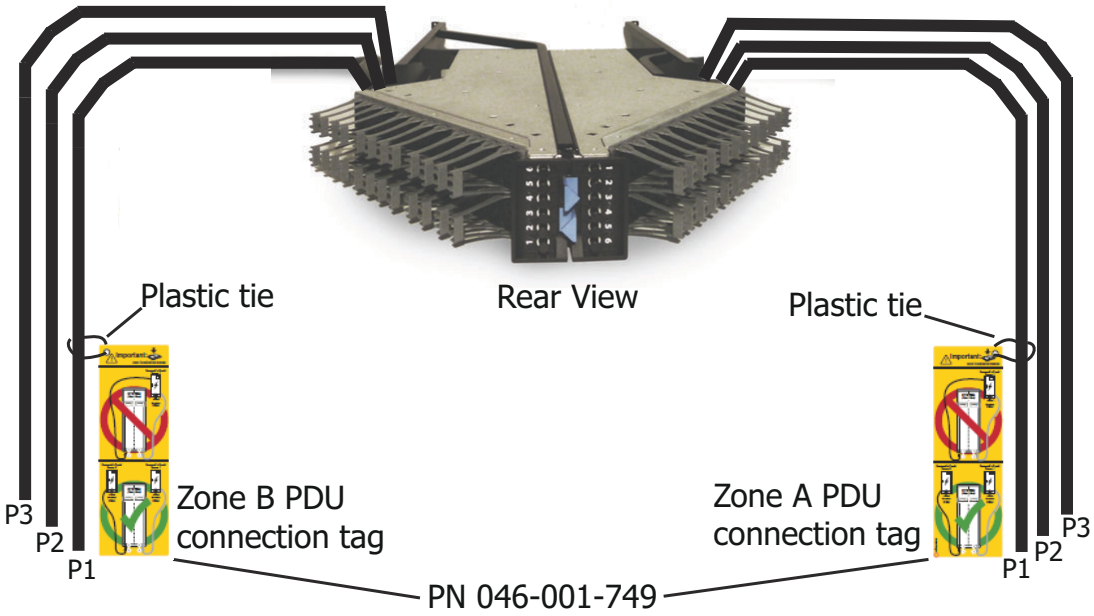

Figure 16. Attaching the PDU connection tag, single-phase

AC power specifications

Table 8. Input power requirements - Single-phase, North American, International, Australian

Specification	North American 3-wire connection (2 L & 1 G)[a]	International and Australian 3-wire connection (1 L & 1 N & 1 G)[a]
Input nominal voltage	200–240 VAC ± 10% L- L nom	220–240 VAC ± 10% L- N nom
Frequency	50–60 Hz	50–60 Hz
Circuit breakers	30 A	30/32 A
Power zones	Two	Two
Minimum power requirements at customer site (VMAX 250F)	• One 30 A or 32 A, single phase drop per zone. • Two power zones require 2 drops, each drop rated for 30 A or 32 A. • Two systems in a Dell EMC rack require 4 drops, each drop rated for 30 A or 32 A.	
Minimum power requirements at customer site (VMAX 450F, VMAX 850F, VMAX 950F)	• Three 30 A or 32 A, single-phase drops per zone. • Two power zones require 6 drops, each drop rated for 30 A or 32 A. • PDU A and PDU B require three separate single-phase 30 A or 32 A drops for each.	

a. L = line or phase, N = neutral, G = ground

Table 9. Input power requirements - Three-phase, North American, International, Australian

Specification	North American 4-wire connection (3 L & 1 G)[a]	International 5-wire connection (3 L & 1 N & 1 G)[a]
Input voltage[b]	200–240 VAC ± 10% L- L nom	220–240 VAC ± 10% L- N nom
Frequency	50–60 Hz	50–60 Hz
Circuit breakers	50 A	30/32 A
Power zones	Two	Two
Minimum power requirements at customer site	One 50 A three-phase line cord per power zone.	One 30 A or 32 A three-phase line cord per power zone.

a. L = line or phase, N = neutral, G = ground
b. An imbalance of AC input currents may exist on the three-phase power source feeding the array, depending on the configuration. The customer's electrician must be alerted to this possible condition to balance the phase-by-phase loading conditions within the customer's data center.