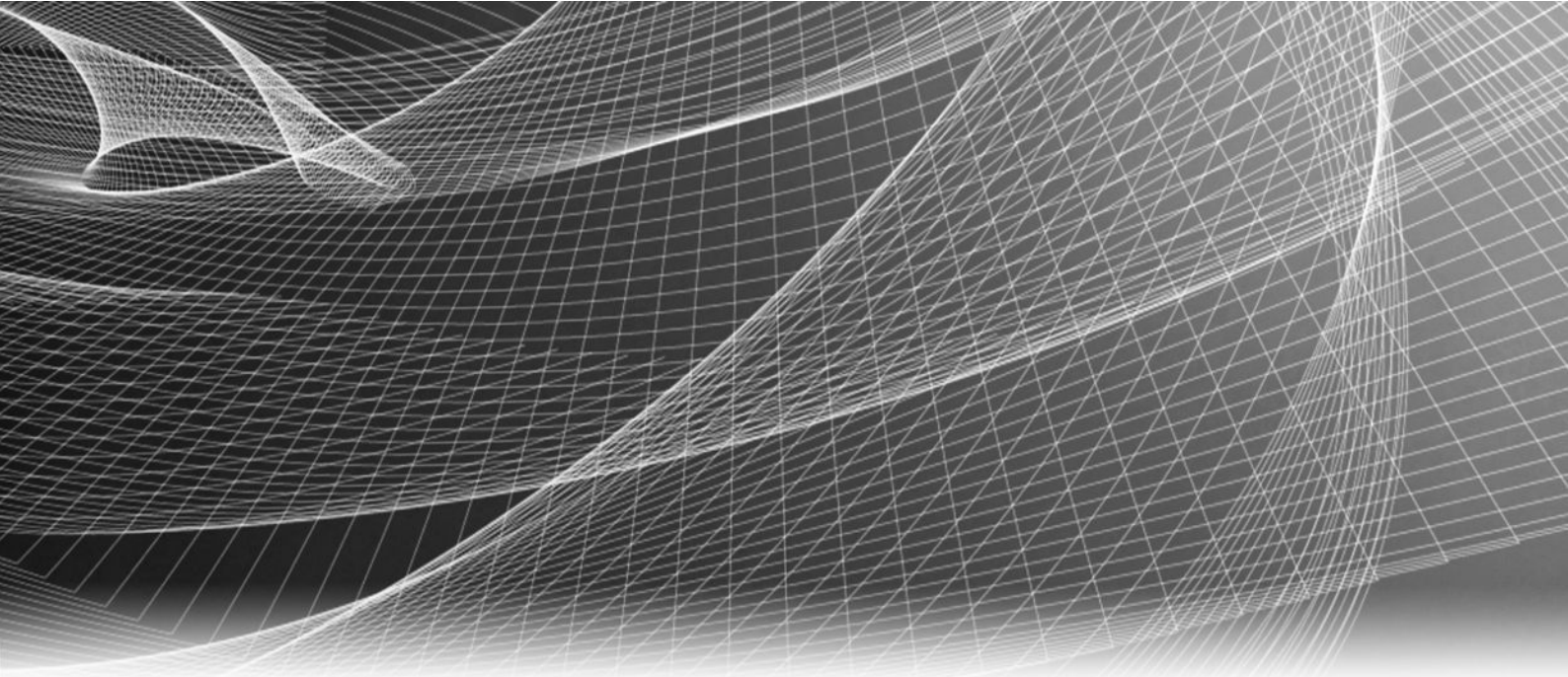




EMC[®] VMAX3[™] Family

VMAX 100K, VMAX 200K, VMAX 400K

Planning Guide

REVISION 3.2

Copyright © 2014-2015 EMC Corporation. All rights reserved. Published in USA.

Published June, 2015

EMC believes the information in this publication is accurate as of its publication date. The information is subject to change without notice.

The information in this publication is provided as is. EMC Corporation makes no representations or warranties of any kind with respect to the information in this publication, and specifically disclaims implied warranties of merchantability or fitness for a particular purpose. Use, copying, and distribution of any EMC software described in this publication requires an applicable software license.

EMC², EMC, and the EMC logo are registered trademarks or trademarks of EMC Corporation in the United States and other countries. All other trademarks used herein are the property of their respective owners.

For the most up-to-date regulatory document for your product line, go to EMC Online Support (<https://support.emc.com>).

EMC Corporation
Hopkinton, Massachusetts 01748-9103
1-508-435-1000 In North America 1-866-464-7381
www.EMC.com

CONTENTS

Figures	5
Tables	7
Preface	9
Revision history.....	12
Chapter 1 Pre-planning tasks	13
Before you begin.....	14
Tasks to review.....	14
Chapter 2 Delivery and transportation	15
Delivery arrangements.....	16
Pre-delivery considerations.....	16
Moving up and down inclines.....	16
Shipping and storage environmental requirements.....	17
Chapter 3 Specifications	19
Radio frequency interference.....	20
Recommended minimum distance from RF emitting device.....	20
Power and heat dissipation.....	20
Airflow.....	21
Air volume, air quality, and temperature.....	22
Air volume specifications.....	23
Temperature, altitude, and humidity ranges.....	23
Temperature and humidity range recommendations.....	23
Air quality requirements.....	23
Shock and vibration.....	24
Sound power and sound pressure.....	25
Hardware acclimation times.....	25
Optical multimode cables.....	26
Open systems host and SRDF connectivity.....	26
Chapter 4 Data center safety and remote support	29
Fire suppressant disclaimer.....	30
Remote support.....	30
Chapter 5 Physical weight and space	33
Floor load-bearing capacity.....	34
Raised floor requirements.....	34
Physical space and weight.....	35

Chapter 6	Position bays	37
	System bay layouts.....	38
	Adjacent layouts, single-engine array.....	39
	Adjacent layouts, dual-engine array.....	40
	Dispersed layouts, single-engine array.....	41
	Dispersed layout, dual-engine array.....	42
	Adjacent and dispersed (mixed) layout	43
	Dimensions for array layouts.....	45
	Tile placement.....	46
	Caster and leveler dimensions.....	47
 Chapter 7	 Power cabling, cords and connectors	 49
	Power distribution unit.....	50
	Wiring configurations.....	51
	Power interface.....	55
	Customer input power cabling.....	55
	Best practices: Power configuration guidelines.....	55
	Power extension cords, connectors, and wiring.....	56
	Single-phase.....	57
	Three-phase (International (Wye))	62
	Three-phase (North American (Delta))	64
	Three-phase (Wye, Domestic)	65
 Chapter 8	 Third party racking option	 69
	Computer room requirements.....	70
	Customer rack requirements.....	71
 Chapter 9	 Optional kits	 73
	Overhead routing kit.....	74
	Dispersion kits.....	74
	Securing kits.....	74
	GridRunner kit and customer-supplied cable trough.....	75
 Appendix A	 Best Practices AC power connections	 77
	Best practices overview for AC power connections.....	78
	Selecting the proper AC power connection procedure.....	79
	Procedure A: Working with customer's electrician onsite.....	80
	Procedure A-1: Customer's electrician.....	81
	Procedure A-2: EMC Customer Engineer.....	82
	Procedure A-3: Customer's electrician.....	85
	Procedure B: Verify and connect.....	86
	Procedure C: Obtain customer verification.....	87
	Labeling the PDUs.....	88
	AC power specifications.....	90

FIGURES

1	Typical airflow in a hot/cold aisle environment.....	22
2	Adjacent layout, single-engine array.....	39
3	Adjacent layout, dual-engine array.....	40
4	Dispersed layout, single-engine array.....	41
5	Dispersed layout, dual-engine, front view.....	42
6	Adjacent and dispersed (mixed) layout, single-engine array.....	43
7	Adjacent and dispersed (mixed) layout, dual-engine array.....	44
8	Layout Dimensions.....	45
9	Placement with floor tiles.....	46
10	Caster and leveler dimensions.....	47
11	Power distribution unit (PDU) without installed wire bales, rear view.....	50
12	Power distribution unit (PDU) with installed wire bales, rear view.....	51
13	Single-phase, horizontal 2U PDU internal wiring.....	52
14	Three-phase (Delta), horizontal 2U PDU internal wiring.....	53
15	Three-phase (Wye), horizontal 2U PDU internal wiring.....	54
16	E-PW40U-US, single-phase.....	59
17	E-PW40URUS, single-phase.....	60
18	E-PW40UIEC3, single-phase.....	60
19	E-PW40UASTL, single-phase.....	61
20	VS3-PW40 L7-30, single-phase.....	61
21	E-PC3YAFLE, flying leads, three-phase, international.....	63
22	E-PCBL3YAG, three-phase, international.....	63
23	E-PCBL3DHR, three-phase, North American, Delta.....	65
24	E-PCBL3DHH, three-phase, North American, Delta.....	65
25	E-PCBL3YL23P, three-phase, domestic (Black and Gray).....	67
26	Customer rack dimension requirements	72
27	Two independent customer-supplied PDUs.....	78
28	Circuit breakers ON — AC power within specification.....	81
29	Circuit breakers OFF — No AC power.....	81
30	Connecting AC power, single-phase.....	82
31	Connecting AC power, three-phase.....	83
32	Power zone connections.....	84
33	PDU label , single-phase and three-phase.....	88
34	Label placement— Customer PDU Information.....	89

TABLES

1	Revision history.....	12
2	Before you begin.....	14
3	Shipping and storage environmental requirements.....	17
4	Minimum distance from RF emitting devices.....	20
5	Power consumption and heat dissipation.....	21
6	Airflow diagram key.....	22
7	Maximum air volume.....	23
8	Environmental operating ranges.....	23
9	Temperature and humidity.....	23
10	Platform shock and vibration.....	24
11	Sound power and sound pressure levels, A-weighted.....	25
12	Hardware acclimation times (systems and components).....	25
13	OM3 and OM4 Fibre cables — 50/125 micron optical cable.....	27
14	Space and weight requirements.....	35
15	Adjacent layout diagram key.....	39
16	Adjacent layout diagram key.....	40
17	Caster and leveler dimensions diagram key.....	47
18	Extension cords and connectors options – single-phase.....	57
19	Extension cords and connectors options – three-phase international (Wye).....	62
20	Extension cords and connectors options – three-phase North American (Delta).....	64
21	Extension cords and connectors options – three-phase Wye, domestic.....	66
22	Overhead routing models.....	74
23	Dispersion kit model numbers.....	74
24	Securing kit models.....	75
25	Procedure options for AC power connection.....	79
26	Label part numbers and location.....	88
27	Single-phase AC power specifications.....	90
28	Three-phase AC power specifications.....	90

Preface

As part of an effort to improve its product lines, EMC periodically releases revisions of its software and hardware. Therefore, some functions described in this document might not be supported by all versions of the software or hardware currently in use. The product release notes provide the most up-to-date information on product features.

Contact your EMC representative if a product does not function properly or does not function as described in this document.

Note

This document was accurate at publication time. New versions of this document might be released on EMC Online Support (<https://support.emc.com>). Check to ensure that you are using the latest version of this document.

Purpose

This document is intended for use by customers and/or EMC representatives who want to plan the purchase and installation of a VMAX3 Family 100K, 200K, 400K.

Audience

This document is intended for use by customers or EMC representatives.

Related documentation

The following documentation portfolios contain documents related to the hardware platform and manuals needed to manage your software and storage system configuration. Also listed are documents for external components which interact with your VMAX3 array.

EMC VMAX3 Family Documentation Set

Contains the product guide, physical planning guide, and power documentation for VMAX3 arrays.

EMC VMAX Family Viewer for Desktop and iPad

Illustrates system hardware, incrementally scalable system configurations, and available host connectivity offered for VMAX arrays.

EMC VMAX3 with HYPERMAX OS Release Notes

Describe new features and any known limitations.

E-Lab™ Interoperability Navigator (ELN)

Provides a web-based interoperability and solution search portal. You can find the ELN at <https://elabnavigator.EMC.com>.

Solve Desktop

Provides links to documentation, procedures for common tasks, and connectivity information for 2-site and 3-site SRDF configurations. To download the Solve Desktop tool, go to EMC Online Support at <https://support.EMC.com> and search for Solve Desktop. Download the Solve Desktop and load the VMAX Family and DMX procedure generator.

Note

You need to authenticate (authorize) your Solve Desktop. After it is installed, familiarize yourself with the information under Help tab.

Special notice conventions used in this document

EMC uses the following conventions for special notices:



Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



Addresses practices not related to personal injury.

Note

Presents information that is important, but not hazard-related.

Typographical conventions

EMC uses the following type style conventions in this document:

Bold	Used for names of interface elements, such as names of windows, dialog boxes, buttons, fields, tab names, key names, and menu paths (what the user specifically selects or clicks)
<i>Italic</i>	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
<i>Monospace italic</i>	Used for variables
Monospace bold	Used for user input
[]	Square brackets enclose optional values
	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 omitted from the example

Where to get help

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

Product information

EMC technical support, documentation, release notes, software updates, or information about EMC products can be obtained on the <https://support.emc.com> site (registration required).

Technical support

To open a service request through the <https://support.emc.com> site, you must have a valid support agreement. Contact your EMC sales representative for details about obtaining a valid support agreement or to answer any questions about your account.

Your comments

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

Revision history

Provides a description of document changes based on the HYPERMAX OS release. The *EMC VMAX3 with HYPERMAX OS Release Notes* contain supplemental information about release features.

Table 1 Revision history

Revision	Description and/or change	HYPERMAX OS
1	First release of the VMAX 100K, 200K, and 400K arrays with EMC HYPERMAX OS 5977.	5977.250.189
2	Update: Dual-engine layout graphic.	5977.250.189
3	Update: Environmental operating ranges table.	5977.250.189
3.1	Update: Customer-to-system 3-phase connectors.	Q2 2015 Service Pack
3.2	New: NOTICE in Best practices overview for AC power connections.	Q2 2015 Service Pack

CHAPTER 1

Pre-planning tasks

This chapter includes:

- [Before you begin](#) 14
- [Tasks to review](#) 14

Before you begin

VMAX3 arrays are designed for installation in data centers that provide:

- Sufficient physical space
- Controlled temperature and humidity
- Airflow and ventilation
- Power and grounding
- System cable routing facilities
- Fire protection

Raised floors are preferred.

To prepare the VMAX3 site, meet with your EMC Systems Engineer and EMC Customer Engineer and determine what is needed to prepare for delivery and installation.

One or more sessions may be necessary to finalize installation plans.

Tasks to review

The following table provides a list of tasks which may be reviewed during the planning process:

Table 2 Before you begin

Task	Comments and/or Provide
Identify power requirements with customer and customer electrician.	External AC power must be supplied from an independent customer-supplied power distribution unit (PDU). EMC recommends that the customer's electrician be available at the installation site for regular and 3rd party racked arrays. Best practices for AC power connections on page 78 provides details.
Complete the <i>Third Party Rack Solution Verification Form</i> for customer-supplied third party rack support.	The EMC representative working the order must: 1. Review Third party racking option on page 69 for more information. 2. Select the desired configuration and select <i>Customer supplied rack</i> option during the DXCX. 3. Complete the <i>Third Party Rack Solution Verification Form</i>.
Complete the <i>Installation Planning Task Sheet</i> and <i>Presite Survey</i> in DXCX.	• Connection for ConnectEMC to dial home to the EMC Support Center. Data center safety and remote support on page 29 provides additional details on remote support. • Power, cooling and ventilation, humidity control, floor load capability, system placement, and service clearances as required in the data center.

CHAPTER 2

Delivery and transportation

This chapter includes:

- [Delivery arrangements](#)16
- [Pre-delivery considerations](#) 16
- [Moving up and down inclines](#) 16
- [Shipping and storage environmental requirements](#) 17

Delivery arrangements

Delivery within the United States or Canada is by air-ride truck with custom-designed shipping material, crate, and pallet. International delivery normally involves air freight.

Unless otherwise instructed, the EMC Traffic Department arranges for delivery directly to the customer's computer room. To ensure successful delivery of the system, EMC has formed partnerships with specially selected moving companies. These companies have moving professionals trained in the proper handling of large, sensitive equipment. These companies provide the appropriate personnel, floor layments, and any ancillary moving equipment required to facilitate delivery. Moving companies should check general guidelines, weights, and dimensions.

NOTICE

Inform EMC of any labor union-based restrictions or security clearance requirements prior to delivery.

Pre-delivery considerations

Take into account the following considerations prior to the delivery at your site:

- Weight capacities of the loading dock, tailgate, and service elevator if delivery is to a floor other than the receiving floor.
- Length and thickness of covering required for floor protection.
- Equipment ramp needed if the receiving floor is not level with computer room floor.

Moving up and down inclines

To prevent tipping when moving up and down inclines, the following guidelines are recommended:

- When moving cabinets, all doors/drawers should be closed.
- When moving the cabinet down an incline, the front of the cabinet must go first.
- When moving the cabinet up an incline, the rear of the bay goes last.

All portions of the bay will clear ramp and threshold slopes up to 1:10 (rise to run ratio), per Code of Federal Regulations — ADA Standards for Accessible Design, 28 CFR Part 36.

Shipping and storage environmental requirements

The following table provides shipping and storing environmental requirements:

Table 3 Shipping and storage environmental requirements

Condition	Setting
Ambient temperature	-40° to 149° F (-40° to 65° C)
Temperature gradient	43.2° F/hr (24° C/hr)
Relative humidity	10% to 90% noncondensing
Maximum altitude	25,000 ft (7619.7 m)

CHAPTER 3

Specifications

This chapter includes:

- [Radio frequency interference](#)..... 20
- [Power and heat dissipation](#)..... 20
- [Airflow](#)..... 21
- [Air volume, air quality, and temperature](#)..... 22
- [Shock and vibration](#)..... 24
- [Sound power and sound pressure](#)..... 25
- [Hardware acclimation times](#)..... 25
- [Optical multimode cables](#)..... 26

Radio frequency interference

Electro-magnetic fields, which include radio frequencies can interfere with the operation of electronic equipment. EMC Corporation products have been certified to withstand radio frequency interference (RFI) in accordance with standard EN61000-4-3. In Data Centers that employ intentional radiators, such as cell phone repeaters, the maximum ambient RF field strength should not exceed 3 Volts /meter.

The field measurements should be taken at multiple points in close proximity to EMC Corporation equipment. It is recommended to consult with an expert prior to installing any emitting device in the Data Center. In addition, it may be necessary to contract an environmental consultant to perform the evaluation of RFI field strength and address the mitigation efforts if high levels of RFI are suspected.

The ambient RFI field strength is inversely proportional to the distance and power level of the emitting device.

Recommended minimum distance from RF emitting device

The following table provides the recommended minimum distances between EMC arrays and RFI emitting equipment. Use these guidelines to verify that cell phone repeaters or other intentional radiator devices are at a safe distance from the EMC Corporation equipment.

Table 4 Minimum distance from RF emitting devices

Repeater power level ^a	Recommended minimum distance
1 Watt	9.84 ft (3 m)
2 Watt	13.12 ft (4 m)
5 Watt	19.69 ft (6 m)
7 Watt	22.97 ft (7 m)
10 Watt	26.25 ft (8 m)
12 Watt	29.53 ft (9 m)
15 Watt	32.81 ft (10 m)

a. Effective Radiated Power (ERP)

Power and heat dissipation

EMC provides the EMC Power Calculator to refine the power and heat figures to more closely match your array.

Contact your EMC Sales Representative or use the EMC Power Calculator for specific supported configurations.

The following table provides calculations of maximum power and heat dissipation.

NOTICE

Power consumption and heat dissipation details vary based on the number of system and storage bays. Ensure that the installation site meets these worst case requirements.

Table 5 Power consumption and heat dissipation

Configuration description ^a	Total power consumption (kVA) ^b	Heat dissipation (Btu/Hr) ²
VMAX 100K		
System bay 1, single-engine	10.8	35,731
System bay 2, single-engine	10.4	34,595
System bay 1, dual-engine	8.8	28,715
System bay 2, dual-engine	N/A	N/A
VMAX 200K		
System bay 1, single-engine	10.9	36,398
System bay 2-4, single-engine	10.6	35,262
System bay 1, dual-engine	9.1	30,048
System bay 2, dual-engine	8.8	28,912
VMAX 400K		
System bay 1, single-engine	11.1	36,936
System bay 2, single-engine	10.7	35,650
System bay 1, dual-engine	9.4	30,975
System bay 2-4, dual-engine	9.0	29,688

a. All values are calculated based on fully loaded bays.

b. If the temperature of the local environment reaches or exceeds 35°C, each DAE and engine in the array increases in power and heat dissipation by the following values:

- DAE120 (2.5 Drives) = 300 VA - 1024 Btu/HR
- DAE60 (3.5 Drives) = 265VA - 904 Btu/HR
- Engine = 80 VA - 273 Btu/HR

The increase in power is caused by the adaptive cooling in each chassis. The increase in power for each chassis in the array should be taken into consideration if the environmental temperature can reach 35°C or higher.

Airflow

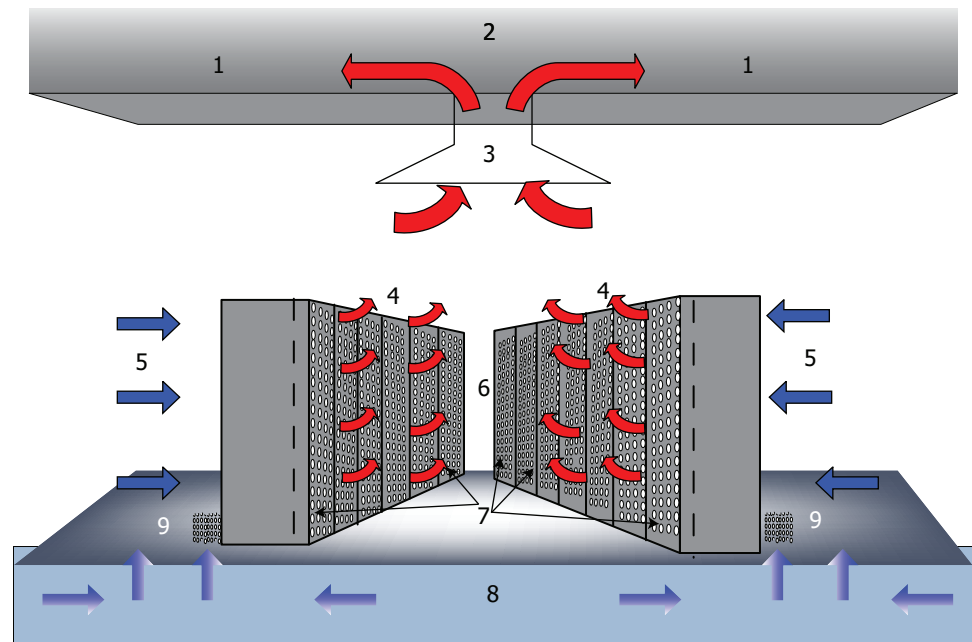
VMAX3 arrays with perforated doors are designed for typical hot aisle/cold aisle data center cooling environments and installation:

- On raised or nonraised floors.
- In hot aisle/cold aisle arrangements.

The airflow provides less mixing of hot and cold air, which can result in a higher return temperature to the computer room air conditioner (CRAC). This promotes better heat transfer outside the building and achieves higher energy efficiency and lower Power Usage Effectiveness (PUE). Additional efficiency can be achieved by sequestering the exhaust air completely and ducting directly to a CRAC unit or to the outside.

EMC recommends the placement of a perforated floor tile in front of each bay to allow adequate cooling air supply when installing on a raised floor.

The following figure shows typical airflow in a hot aisle/ cold aisle environment.

Figure 1 Typical airflow in a hot/cold aisle environment**Table 6** Airflow diagram key

#	Description
1	To refrigeration unit
2	Suspended ceiling
3	Air return
4	System bays (1 to 8 or 1 to 4)
5	Cold aisle
6	Hot aisle
7	Perforated rear doors
8	Pressurized floor
9	Perforated floor tile

Air volume, air quality, and temperature

The installation site must meet certain recommended requirements for air volume, temperature, altitude, and humidity ranges, and air quality.

Air volume specifications

The following table provides the recommended maximum amount of air volume.

Table 7 Maximum air volume

Bay	Units
System bay, single-engine	1,320 cfm (37.5 m ³ /min)
System bay, dual-engine	1,325 cfm (37.4 m ³ /min)

Temperature, altitude, and humidity ranges

The following table provides the recommended environmental operating ranges.

Table 8 Environmental operating ranges

Condition	System
Operating temperature and operating altitude ^a	50° – 90° F (10° to 32° C) at 7,500 ft (2,286 m) 50° – 95° F (10° to 35° C) at 3,317 ft (950 m)
Operating altitude (maximum)	10,000 ft (3,048 m) 1.1° derating per 1,000 ft ^b
Operating relative humidity extremes	20% to 80% noncondensing
Operating rate of temperature change	9° F/Hr (5° C/Hr)
Thermal excursion	122° F (48° C) (up to 24 hours)

a. These values apply to the inlet temperature of any component within the bay.

b. Derating equals an operating temperature of 29.25° C

Temperature and humidity range recommendations

The following table provides the recommended operating and humidity ranges to ensure long-term reliability, especially in environments where air quality is a concern.

Table 9 Temperature and humidity

Condition	System
Operating temperature range	64° – 75° F (18° to 24° C)
Operating relative humidity range	40 – 55%

Air quality requirements

VMAX3 arrays are designed to be consistent with the requirements of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Environmental Standard Handbook and the most current revision of Thermal Guidelines for Data Processing Environments, ASHRAE TC 9.9 2011.

The VMAX3 arrays are best suited for Class 1A Datacom environments, which consist of tightly controlled environmental parameters, including temperature, dew point, relative

humidity and air quality. These facilities house mission critical equipment and are typically fault tolerant, including the air conditioners. In a data center environment, if the air conditioning fails and the temperature is lost, a vault may occur to protect data.

The data center should maintain a cleanliness level as identified in ISO 14664-1, class 8 for particulate dust and pollution control. The air entering the data center should be filtered with a MERV 11 filter or better. The air within the data center should be continuously filtered with a MERV 8 or better filtration system. In addition, efforts should be maintained to prevent conductive particles, such as zinc whiskers, from entering the facility.

The allowable relative humidity level is 20–80% non condensing, however, the recommended operating environment range is 40–55%. For data centers with gaseous contamination, such as high sulfur content, lower temperatures and humidity are recommended to minimize the risk of hardware corrosion and degradation. In general, the humidity fluctuations within the data center should be minimized. It is also recommended that the data center be positively pressured and have air curtains on entry ways to prevent outside air contaminants and humidity from entering the facility.

For facilities below 40% relative humidity (RH), EMC recommends using grounding straps when contacting the equipment to avoid the risk of electrostatic discharge (ESD), which can harm electronic equipment.

Note

As part of an ongoing monitoring process for the corrosiveness of the environment, EMC recommends placing copper and silver coupons (per ISA 71.04-1985, Section 6.1 Reactivity) in airstreams representative of those in the data center. The monthly reactivity rate of the coupons should be less than 300 Angstroms. When monitored reactivity rate is exceeded, the coupon should be analyzed for material species and a corrective mitigation process emplaced.

Shock and vibration

The following table provides the platform shock and vibration maximums and the transportation shock and vibration levels (in the vertical direction).

Note

Levels shown apply to all three axis, and should be measured with an accelerometer in the equipment enclosures within the cabinet.

Table 10 Platform shock and vibration

Platform condition	Response measurement level (should not exceed)
Non operational shock	10 G's, 7 ms duration
Operational shock	3 G's, 11 ms duration
Non operational random vibration	.40 Grms, 5-500Hz, 30 minutes
Operational random vibration	.21 Grms, 5-500Hz, 10 minutes
Packaged system condition	
Transportation shock	10 G's, 12 ms duration
Transportation random vibration	1.15 Grms, 1 hour

Table 10 Platform shock and vibration (continued)

Platform condition	Response measurement level (should not exceed)
Frequency range	1-200 Hz

Sound power and sound pressure

The following table provides the sound power and sound pressure levels.

Table 11 Sound power and sound pressure levels, A-weighted

Configuration	Sound power levels (LWAd) (B) ^a	Sound pressure levels (LpA) (dB) ^b
System bay (max)	7.9	66
System bay (min)	7.6	63

a. Declared noise emissions with .3B correction factor added per ISO9296.

b. Measured at the four bystander positions per ISO7779

Hardware acclimation times

Systems and components must acclimate to the operating environment before applying power. This requires the unpackaged system or component to reside in the operating environment for up to 16 hours in order to thermally stabilize and prevent condensation.

Table 12 Hardware acclimation times (systems and components)

If the last 24 hours of the TRANSIT/STORAGE environment was this:		...and the OPERATING environment is this:	...then let the system or component acclimate in the new environment this many hours:
Temperature	Humidity		
Nominal 68-72°F (20-22°C)	Nominal 40-55% RH	Nominal 68-72°F (20-22°C) 40-55% RH	0-1 hour
Cold <68°F (20°C)	Dry <30% RH	<86°F (30°C)	4 hours
Cold <68°F (20°C)	Damp ≥30% RH	<86°F (30°C)	4 hours
Hot >72°F (22°C)	Dry <30% RH	<86°F (30°C)	4 hours
Hot >72°F (22°C)	Humid 30-45% RH	<86°F (30°C)	4 hours
	Humid 45-60% RH	<86°F (30°C)	8 hours
	Humid ≥60% RH	<86°F (30°C)	16 hours

Table 12 Hardware acclimation times (systems and components) (continued)

If the last 24 hours of the TRANSIT/STORAGE environment was this:	...and the OPERATING environment is this:	...then let the system or component acclimate in the new environment this many hours:
Unknown	<86°F (30°C)	16 hours

NOTICE

- If there are signs of condensation after the recommended acclimation time has passed, allow an additional eight (8) hours to stabilize.
- Systems and components must not experience changes in temperature and humidity that are likely to cause condensation to form on or in that system or component. Do not exceed the shipping and storage temperature gradient of 45°F/hr (25°C/hr).
- Do NOT apply power to the system for at least the number of hours specified in [Table 12 on page 25](#). If the last 24 hours of the transit/storage environment is unknown, then you must allow the system or component 16 hours to stabilize in the new environment.

Optical multimode cables

EMC provides optical multimode 3 (OM3) and optical multimode 4 (OM4) cables for open systems host and SRDF connectivity. To obtain OM3 or OM4 cables, contact your local EMC sales representative.

- OM3 cables are used for SRDF connectivity over: 4, 8, and 10 Gb/s Fibre Channel I/O modules, 10 GbE and 1 GbE I/O modules.
- OM4 cables are used with 16 Gb/s Fibre Channel I/O modules to provide Fibre Channel connection to switches. Distances of up to 190 m over 8 Gb/s Fibre Channel and 125 m over 16 Gb/s Fibre Channel modules are supported.

OM2 or OM3 cables can be used, but distance is reduced.

- OM3 cables support 8 and 10 Gb/s Fibre Channel distances up to 150 m or 16 Gb/s Fibre Channel distances up to 100 m.
- OM2 cables support 8 Gb/s Fibre Channel distances up to 50 m or 10 Gb/s Ethernet up to 82 m.

Note

OM2 cables can be used, but they will not support 8 Gb/s Fibre Channel (SRDF) distances greater than 50 m. For longer distances, use OM3 cables.

Open systems host and SRDF connectivity

The following table provides the OM3 and OM4 cables.

Table 13 OM3 and OM4 Fibre cables — 50/125 micron optical cable

Model number	Description
SYM-OM3-1M	LC-LC, 1 meter
SYM-OM3-3M	LC-LC, 3 meter
SYM-OM3-5M	LC-LC, 5 meter
SYM-OM3-10M	LC-LC, 10 meter
SYM-OM3-30M	LC-LC, 30 meter
SYM-OM3-50M	LC-LC, 50 meter
SYM-OM3-100M	LC-LC, 100 meter
SYM-OM4-1M	LC- LC, 1 meter
SYM-OM4-3M	LC- LC, 3 meter
SYM-OM4-5M	LC- LC, 5 meter
SYM-OM4-10M	LC- LC, 10 meter
SYM-OM4-30M	LC- LC, 30 meter
SYM-OM4-50M	LC- LC, 50 meter
SYM-OM4-100M	LC- LC, 100 meter

CHAPTER 4

Data center safety and remote support

This chapter includes:

- [Fire suppressant disclaimer](#).....30
- [Remote support](#).....30

Fire suppressant disclaimer

Fire prevention equipment in the computer room should always be installed as an added safety measure. A fire suppression system is the responsibility of the customer. Care should be taken by the customer when selecting appropriate fire suppression equipment and agents for their data center. Your insurance underwriter, local fire marshal, and local building inspector are all parties that should be consulted in selecting a fire suppression system that provides the correct level of coverage and protection.

EMC designs and manufactures equipment to internal and external standards that require certain environments for reliable operation. EMC does not make compatibility claims of any kind nor does EMC provide recommendations on fire suppression systems. EMC does recommend that storage equipment not be positioned directly in the path of high pressure gas discharge streams or loud fire sirens so as to minimize the forces and vibration adverse to system integrity.

Note

The previous information is provided on an “as is” basis and provides no representations, warranties, guarantees or obligations on the part of EMC Corporation. This information does not modify the scope of any warranty set forth in the terms and conditions of the basic purchasing agreement between the customer and EMC Corporation.

Remote support

EMC Secure Remote Support (ESRS) is an IP-based, automated, connect home and remote support solution. ESRS is the preferred method of connectivity. EMC recommends using two connections with ESRS for connection to the redundant management module control station (MMCS).

ESRS customers must provide the following:

- An IP network with Internet connectivity.
- Capability to add Gateway Client servers and Policy Manager servers to the customer network.
- Network connectivity between the servers and EMC devices to be managed by ESRS
- Internet connectivity to EMC’s ESRS infrastructure by using outbound ports.
- Network connectivity between ESRS Client(s) and Policy Manager.

Once installed, ESRS monitors your VMAX3 array and automatically notifies EMC Customer Service in the event of a problem. If an error is detected, an EMC support professional utilizes the secure connection to establish a remote support session to diagnose, and if necessary, perform a repair.

EMC Customer Service can use ESRS to:

- Perform downloads of updated software in lieu of a site visit.
- Deliver license entitlements directly to VMAX3 arrays

NOTICE

EMC provides an optional modem that uses a regular telephone line or operates with a PBX. EMC recommends using two connections to the redundant management module control station (MMCS).

The *EMC Secure Remote Support Gateway Site Planning Guide* provides additional information.

CHAPTER 5

Physical weight and space

This chapter includes:

- [Floor load-bearing capacity](#) 34
- [Raised floor requirements](#) 34
- [Physical space and weight](#) 35

Floor load-bearing capacity

VMAX3 arrays can be installed on raised floors. Customers must be aware that the load-bearing capacity of the data center floor is not readily available through a visual inspection of the floor. The only definitive way to ensure that the floor is capable of supporting the load associated with the array is to have a certified architect or the data center design consultant inspect the specifications of the floor to ensure that the floor is capable of supporting the VMAX3 array weight.

CAUTION

- Customers are ultimately responsible for ensuring that the floor of the data center on which the VMAX3 array is to be configured is capable of supporting the array weight, whether the array is configured directly on the data center floor or on a raised floor supported by the data center floor.
 - Failure to comply with these floor loading requirements could result in severe damage to the VMAX3 array, the raised floor, subfloor, site floor and the surrounding infrastructure should the raised floor, subfloor or site floor fail.
 - Notwithstanding anything to the contrary in any agreement between EMC and customer, EMC fully disclaims any and all liability for any damage or injury resulting from customer's failure to ensure that the raised floor, subfloor and/or site floor are capable of supporting the VMAX3 array weight. The customer assumes all risk and liability associated with such failure.
-

Raised floor requirements

EMC recommends the use of 24 x 24 inch heavy-duty, concrete-filled steel floor tiles. If a different size or type of tile is used, the customer must ensure that the tiles have a minimum load rating that is sufficient for supporting the VMAX3 array weight. Ensure proper physical support of the system by following requirements that are based on the use of 24 x 24 in. (61 x 61 cm) heavy-duty, concrete-filled steel floor tiles.

Raised floors must meet the following requirements:

- Floor must be level.
 - Floor tiles and stringers must be rated to withstand concentrated loads of two casters each that weigh up to 700 lb (317.5 kg).
-

Note

Caster weights are measured on a level floor. The front of the VMAX3 array weighs more than the rear of the configuration.

- Floor tiles and stringers must be rated for a minimum static ultimate load of 3,000 lb (1,360.8 kg).
- Floor tiles must be rated for a minimum of 1,000 lb (453.6 kg) on rolling load.
- For floor tiles that do not meet the minimum rolling load rate, EMC recommends the use of coverings, such as plywood, to protect floors during system roll.
- Floor tile cutouts weaken the tile. EMC recommends an additional pedestal mount adjacent to the cutout of a tile. The number and placement of additional pedestal mounts relative to a cutout are to be in accordance with the tile manufacturer's

recommendations. Floor tile deflection should be minimized with additional pedestal mounts.

- Take care when positioning the bays to make sure that a caster is not moved into a cutout. Cutting tiles per specifications ensures the proper caster placement.
- Use or create no more than one floor tile cutout that is no more than 8 in. (20 cm) wide by 6 in. (15 cm) deep in each 24 x 24 in. (61 x 61 cm) floor tile.
- Ensure that the weight of any other objects in the data center does not compromise the structural integrity of the raised floor or the subfloor (nonraised floor) of the data center.

Physical space and weight

The following table provides the physical space, maximum weights, and clearance for service.

Table 14 Space and weight requirements

Bay configurations ^a	Height (in/cm) ^b	Width (in/cm) ^c	Depth (in/cm) ^d	Weight (maximum lbs/kg)
System bay, single-engine	75/190	24/61	47/119	2065/937
System bay, dual-engine	75/190	24/61	47/119	1860/844

- Clearance for service/airflow is the front at 42 in (106.7 cm) front and the rear at 30 in (76.2 cm).
- An additional 18 in (45.7 cm) is recommended for ceiling/top clearance.
- Measurement includes .25 in. (0.6 cm) gap between bays.
- Includes front and rear doors.

CHAPTER 6

Position bays

This chapter includes:

- [System bay layouts](#) 38
- [Dimensions for array layouts](#) 45
- [Tile placement](#) 46
- [Caster and leveler dimensions](#) 47

System bay layouts

The number of bays and the system layout depend on the VMAX3 array model, the customer requirements, and the space and organization of the customer data center.

The single or dual-engine arrays can be placed in the following layouts:

- Adjacent — all bays are positioned side-by-side.
- Dispersed — dispersed layouts are provided with longer MIBE and Ethernet cable bundles that allow 82 ft (25 m) of separation between system bay 1 and system bays 2 through 8.

With dual-engine dispersion, bay placement can be wherever the customer wants in the data center.

Dispersed system bays require dispersed cable and optics kits and one set of side skins for each dispersed system bay in the configuration.

Note

- The routing strategy (beneath raised floor or overhead), site requirements, and the use of GridRunners (optional) or cable troughs can cause the actual distances to vary.
 - GridRunners are used to create a strain relief for all dispersed, under the floor, cable bundles. GridRunners are installed in the locations where the cable bundle enters and exits the area under the raised floor.
-
- Adjacent and dispersed bays (mixed) layouts — allow both adjacent and dispersed layout of either single or dual-engine arrays with adjacent and dispersed bays.

Note

Single and dual-engine arrays cannot be mixed.

Adjacent layouts, single-engine array

On single-engine arrays with adjacent layouts, bays are positioned side-by-side to the right of system bay 1 (front view) and secured with lower brackets.

The following figure shows adjacent layout of a single-engine array.

Figure 2 Adjacent layout, single-engine array

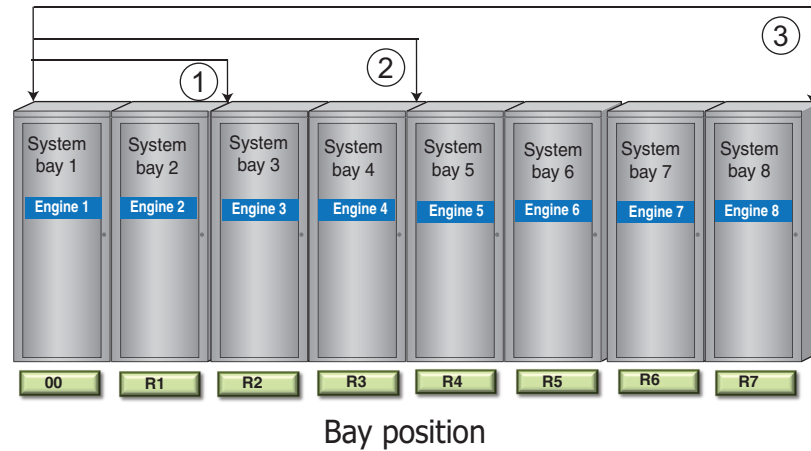


Table 15 Adjacent layout diagram key

#	Description
1	VMAX 100K
2	VMAX 200K
3	VMAX 400K

Adjacent layouts, dual-engine array

Dual-engine systems with adjacent layouts position system bay 1 next to system bay 2, and system bay 3 next to system bay 4.

The following figure shows the adjacent layout of dual-engine arrays by model type.

Figure 3 Adjacent layout, dual-engine array

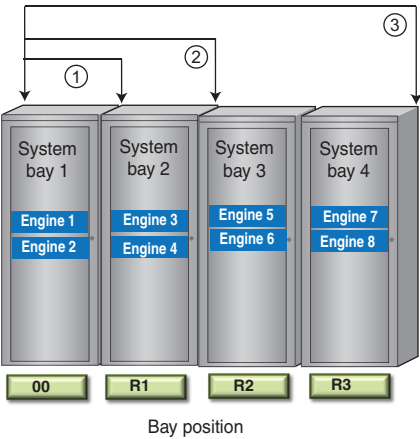


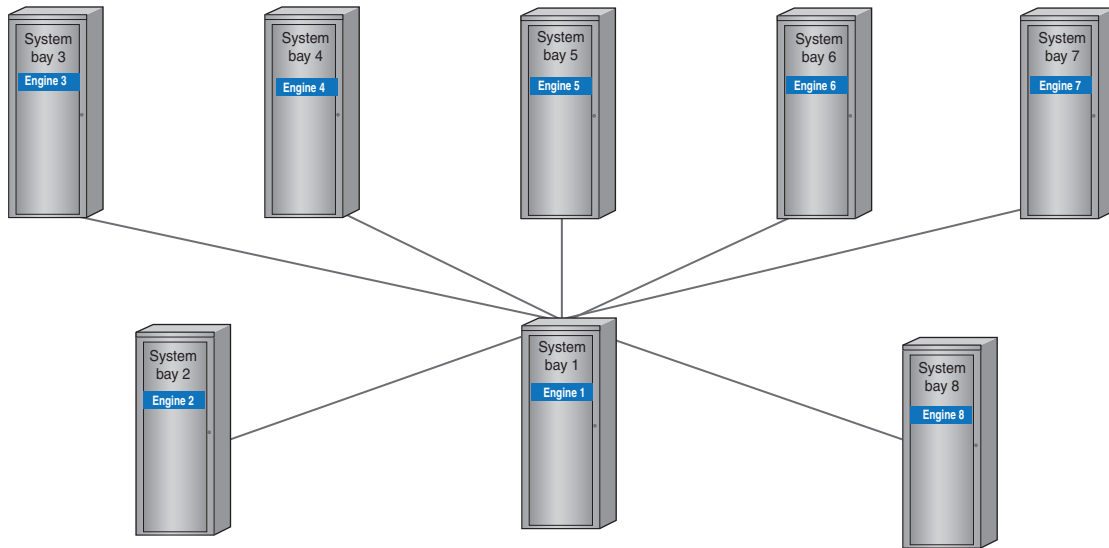
Table 16 Adjacent layout diagram key

#	Description
1	VMAX 100K
2	VMAX 200K
3	VMAX 400K

Dispersed layouts, single-engine array

The following figure shows a single-engine array with eight system bays in a dispersed layout.

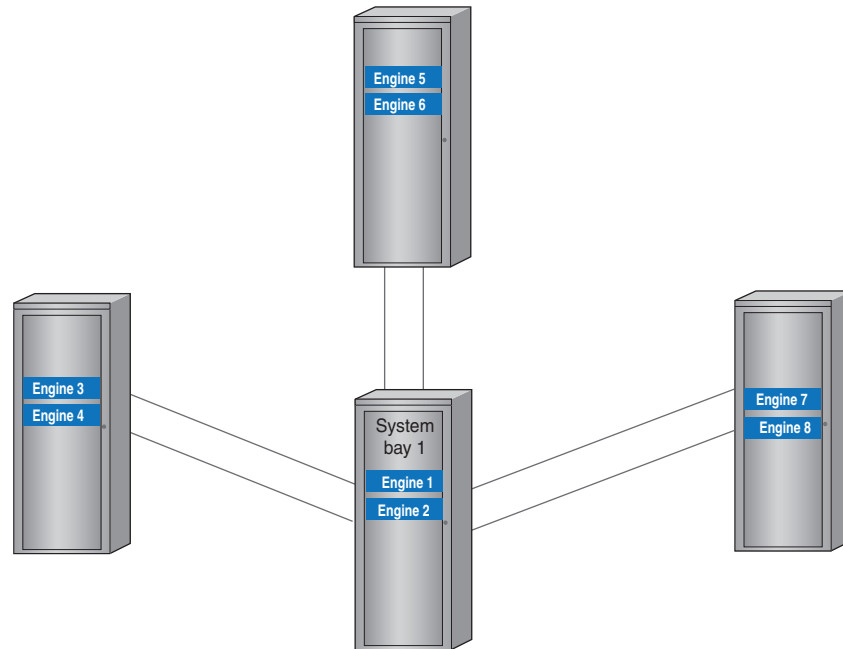
Figure 4 Dispersed layout, single-engine array



Dispersed layout, dual-engine array

The following figure shows a dual-engine dispersed layout.

Figure 5 Dispersed layout, dual-engine, front view

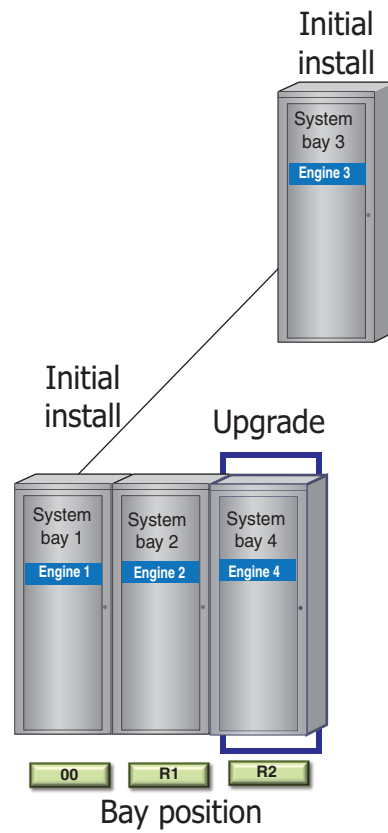


Adjacent and dispersed (mixed) layout

Adjacent and dispersed (mixed) layout, single-engine array

The following figure shows a single-engine array with a mixed layout.

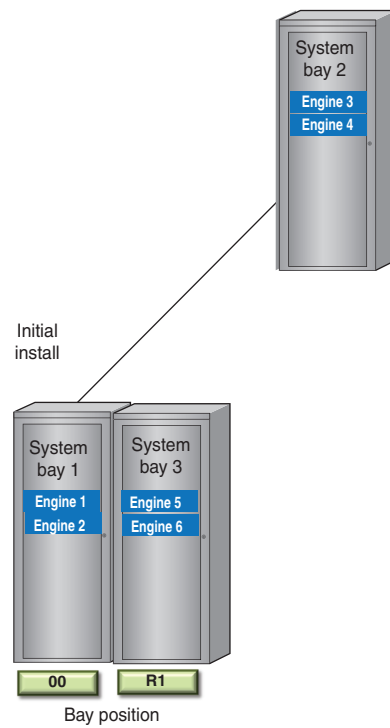
Figure 6 Adjacent and dispersed (mixed) layout, single-engine array



Adjacent and dispersed (mixed) layout, dual-engine array

The following figure shows a dual-engine array with a mixed layout.

Figure 7 Adjacent and dispersed (mixed) layout, dual-engine array



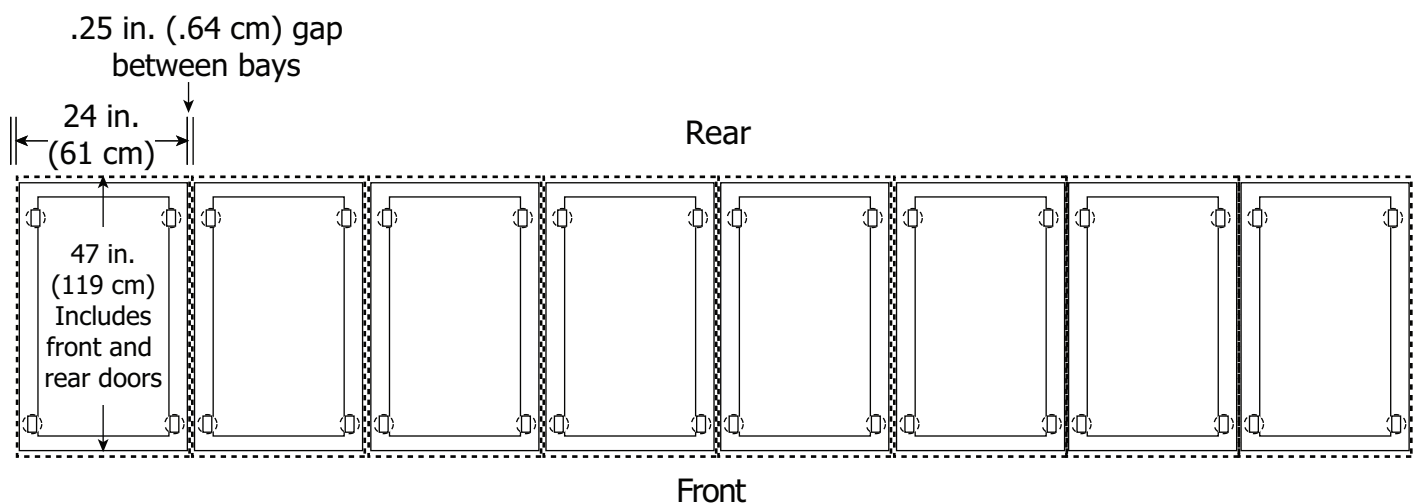
Dimensions for array layouts

Placing arrays in the data center or computer room involves understanding dimensions, planning for cutouts, and ensuring clearance for power and host cables.

- On nonraised floors, cables are routed overhead. An overhead routing bracket is provided to allow easier access of overhead cables into the bay
- On raised floors, cables are routed across the subfloor beneath the tiles.
- Ensure there is a service area of 42 in (106 cm) for the front and 30 in (76 cm) for the rear of both the system bay.

The following figure shows the layout dimensions:

Figure 8 Layout Dimensions



Tile placement

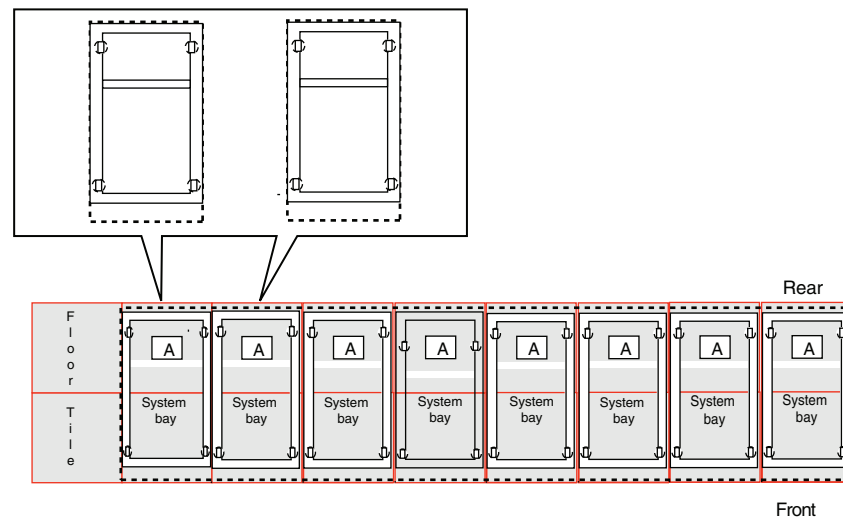
You must understand tile placement to ensure the VMAX3 arrays are positioned properly, and allow sufficient room for service and cable management.

When placing the array, consider the following:

- Typical floor tiles are 24 in. (61 cm) by 24 in. (61 cm).
- Typical cutouts are:
 - 8 in. (20.3 cm) by 6 in. (15.2 cm) maximum.
 - 9 in. (22.9 cm) from the front and rear of the floor tile.
 - Centered on the tiles, 9 in (22.9 cm) from the front and rear and 8 in (20.3) from sides.
- Maintain a .25 in. (.64 cm) gap between bays.
- Service area of 42 in (106 cm) for the front and 30 in (76 cm) for the rear on the system bays.

The following figure provides tile placement information for all VMAX3 arrays (with doors).

Figure 9 Placement with floor tiles



Caster and leveler dimensions

The bay(s) bottom includes four caster wheels. The front wheels are fixed; the two rear casters swivel in a 1.75-in. diameter. Swivel position of the caster wheels determines the load-bearing points on your site floor, but does not affect the cabinet footprint. Once you have positioned, leveled, and stabilized the bay(s), the four leveling feet determine the final load-bearing points on your site floor.

The following figure shows caster and leveler dimensions.

Figure 10 Caster and leveler dimensions

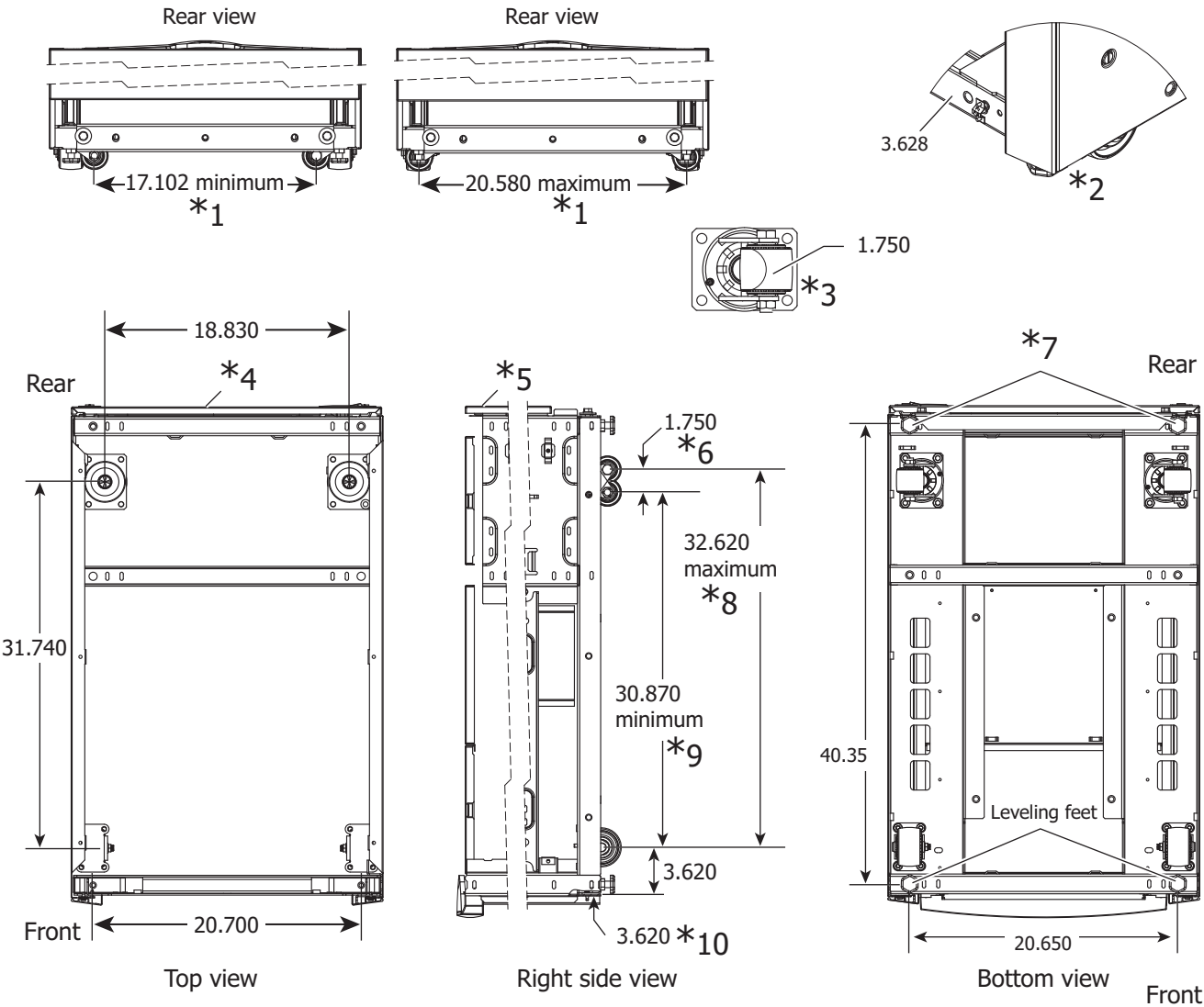


Table 17 Caster and leveler dimensions diagram key

#	Description
*1	Minimum (17.102) and maximum (20.58) distances based on the swivel position of the caster wheel.
*2	Right front corner detail. Dimension (3.628) to the center of caster wheel from surface.

Table 17 Caster and leveler dimensions diagram key (continued)

#	Description
*3	Diameter (1.750) of caster wheel swivel.
*4	Outer surface of rear door.
*5	
*6	Diameter (1.75) of swivel (see detail *3).
*7	Bottom view of leveling feet.
*8	Maximum (32.620) distance based on swivel position of the caster wheel.
*9	Minimum (30.870) distance based on swivel position of the caster wheel.
*10	Distance (3.620) to the center of the caster wheel from the surface (see detail *2).

CHAPTER 7

Power cabling, cords and connectors

This chapter includes:

• Power distribution unit	50
• Wiring configurations	51
• Power interface	55
• Customer input power cabling	55
• Best practices: Power configuration guidelines	55
• Power extension cords, connectors, and wiring	56

Power distribution unit

The VMAX3 array is powered by two power distribution units (PDUs), one PDU for each power zone. PDU A is the primary PDU and PDU B is the redundant PDU, as shown in the figures below.

Both PDUs are mechanically connected together, including mounting brackets, to create a single 2U structure, as shown in the following figures. The PDUs are integrated to support AC-line input connectivity and provide outlets for every component in the bay.

The PDU is available in three wiring configurations that include:

- Single-phase
- Three-phase Delta
- Three-phase Wye

Each PDU provides the following components:

- A total of 24 power outlets for field replaceable units (FRUs). The outlets are divided into six banks with each bank consisting of four IEC 60320 C13 individual AC outlets.
- Each bank of outlets is connected to individual branch circuits that are protected by a single two pole 20 Amp circuit breaker.
- Depending on which PDU option selected there is a different input connector for each PDU.

If the customer requires power to be supplied from overhead, EMC recommends that the power cables are “dropped” down the hinge side, to the bottom, and routed inside the machine. The cables should be dressed to allow all doors to open freely.

A second option is to replace the rear top cover of the bay with the ceiling routing top cover, described in *Overhead routing kit*, which allows the power cables inside the machine to be routed out through the top.

Figure 11 Power distribution unit (PDU) without installed wire bales, rear view



Figure 12 Power distribution unit (PDU) with installed wire bales, rear view



Wiring configurations

The following figures provide single-phase and three-phase wiring configurations.

NOTICE

These figures are used for the redundant PDU in the complete assembly (PDU A and PDU B). Each figure represents half of the independent PDU assembly. The same wiring configurations are used on each PDU.

Figure 13 Single-phase, horizontal 2U PDU internal wiring

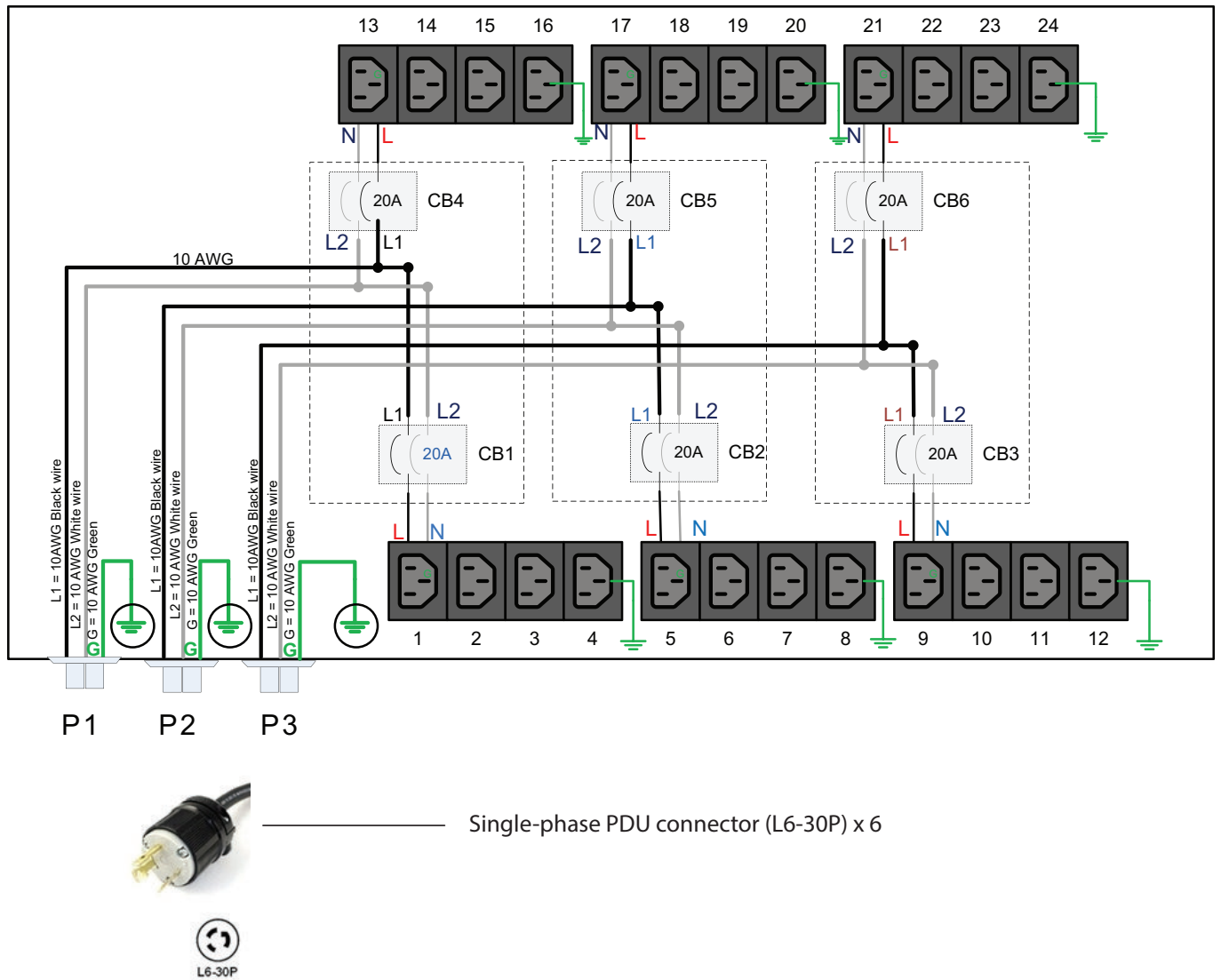


Figure 14 Three-phase (Delta), horizontal 2U PDU internal wiring

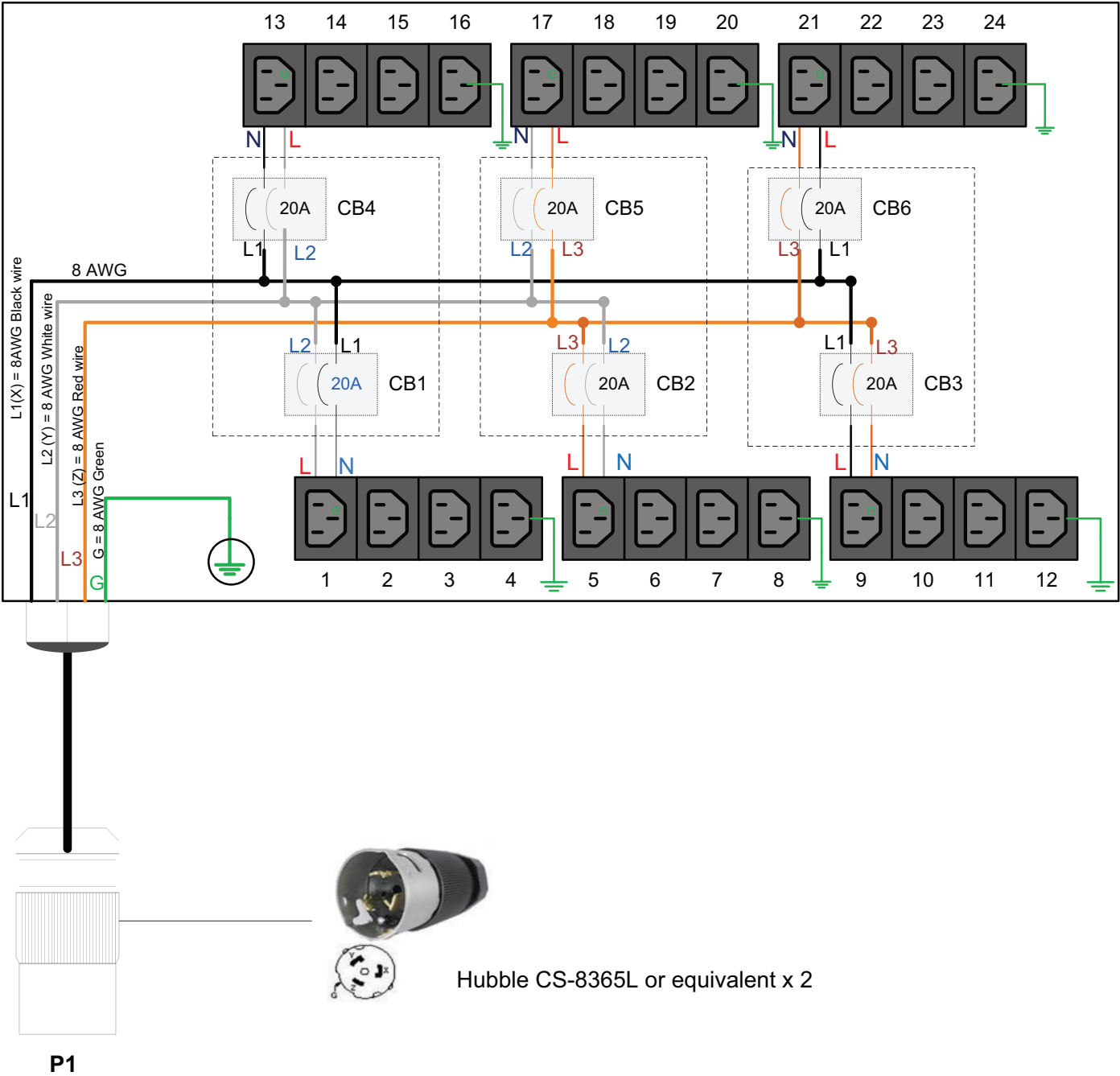
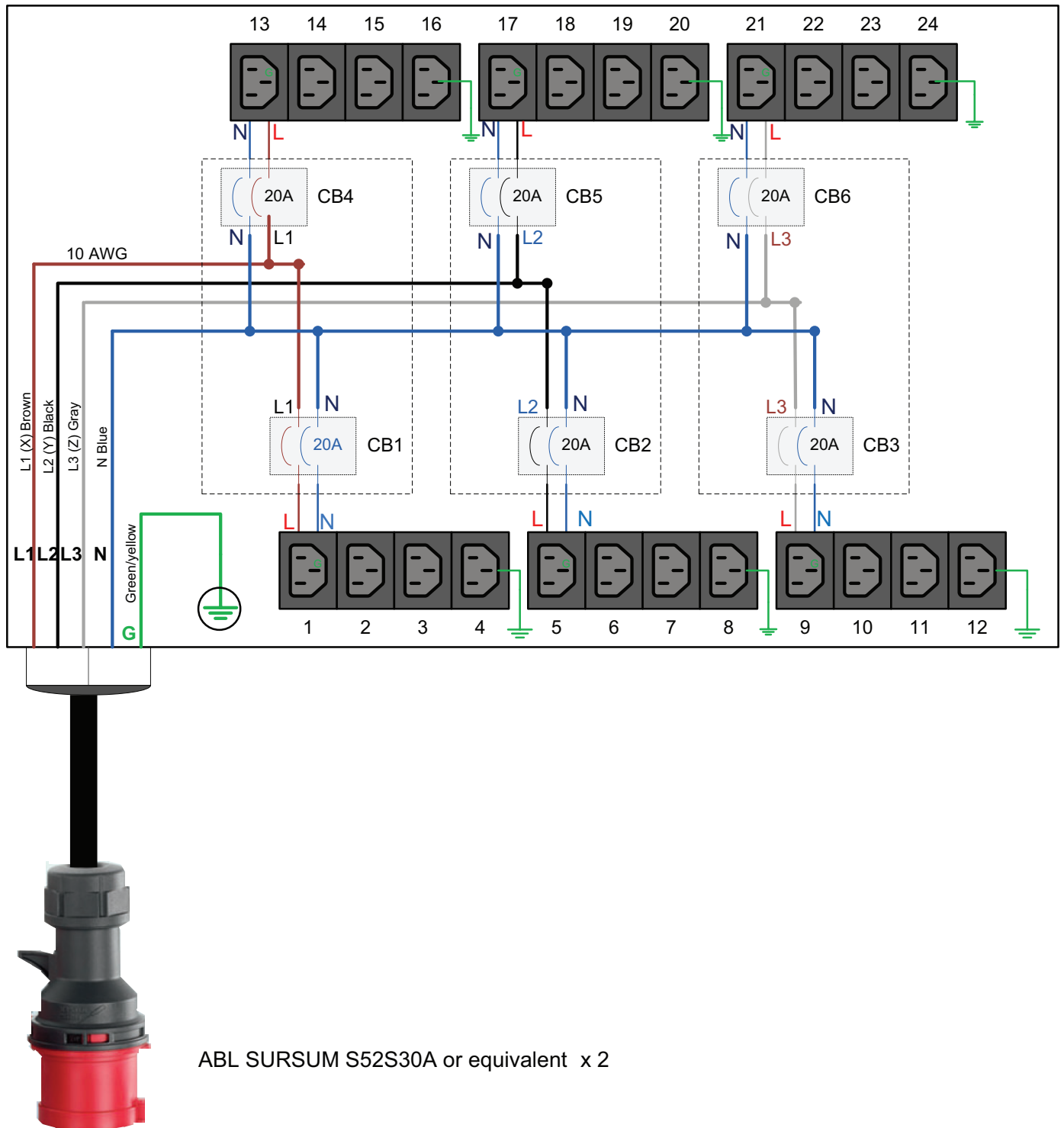


Figure 15 Three-phase (Wye), horizontal 2U PDU internal wiring



P1

Power interface

Data centers must conform to the corresponding specification for arrays installed in North American, International, and Australian sites.

Each VMAX3 bay in a system configuration contains a complete 2U PDU assembly. The PDU assembly is constructed with two electrically individual PDUs.

NOTICE

Customers are responsible for meeting all local electrical safety requirements.

Customer input power cabling

Before the array is delivered, the customer must supply and install the required receptacles on the customer's PDUs for zone A and zone B power for the system bay.

NOTICE

EMC recommends that the customer's electrician be present at installation time to work with the EMC Customer Engineer to verify power redundancy.

Refer to the *EMC VMAX3 Family Best Practices Guide for AC Power Connections* for required items at the customer site.

Best practices: Power configuration guidelines

The following section provides best practice guidelines for evaluating and connecting power, as well as for choosing a UPS component.

Uptime Institute best practices

Follow these best practice guidelines when connecting AC power to the VMAX3:

- The EMC customer engineer (CE) should discuss with the customer the need for validating AC power redundancy at each bay. If the power redundancy requirements are not met in each EMC bay, a Data Unavailable (DU) event could occur.
- The customer should complete power provisioning with the data center prior to connecting power to the VMAX3 array.
- The customer's electrician or facilities representative must verify that the AC voltage is within specification at each of the power drops being fed to each EMC product bay.
- All of the power drops should be labeled to indicate the source of power (PDU) and the specific circuit breakers utilized within each PDU:
 - Color code the power cables to help achieve redundancy.
 - Clearly label the equipment served by each circuit breaker within the customer PDU.
- The electrician or facilities representative must verify that there are two power drops fed from separate redundant PDUs prior to turning on the VMAX3 array:
 - If both power drops to a bay are connected to the same PDU incorrectly, a DU event will result during normal data center maintenance when the PDU is switched off. The label on the power cables depicts the correct connection.
- The electrician should pay particular attention to how each PDU receives power from each UPS within the data center because it is possible to create a scenario where

turning off a UPS for maintenance could cause both power feeds to a single bay to be turned off, creating a DU event.

- The customer's electrician should perform an AC verification test by turning off the individual circuit breakers feeding each power zone within the bay, while the Customer Engineer monitors the LED on the SPS modules to verify that power redundancy has been achieved in each bay.

One PDU should never supply both power zone feeds to any one rack of equipment.

Power extension cords, connectors, and wiring

The following section illustrates a variety of extension cords that offer different interface connector options. The selected cords are used to interface between the customer's power source and each EMC PDU connection.

The amount of cords needed is determined by the number of bays in the array and the type of input power source used (single-phase or three-phase).

Single-phase

The following tables describe the extension cords and connector options for single-phase power transmission.

Table 18 Extension cords and connectors options – single-phase

Plug on each EMC PDU cord ^a	EMC-supplied extension cord/ model number ^{b, c}	EMC Power Cable P/N	EMC-supplied extension cord receptacle (P1) connecting to EMC plug	EMC-supplied extension cord plug (P2) connecting to customer PDU receptacle	Customer PDU receptacle
NEMA L6-30 	E-PW40U-US	038-003-438 (BLK 15FT) 038-003-898 (GRY 15FT) 038-003-479 (BLK 21FT) 038-003-794 (GRY 21FT)	NEMA L6-30R 	NEMA L6-30P 	NEMA L6-30R 
	E-PW40URUS	038-003-441 (BLK 15FT) 038-003-901 (GRY 15FT) 038-003-482 (BLK 21FT) 038-003-797 (GRY 21FT)	NEMA L6-30R 	Russellstoll 3750DP 	Russellstoll 9C33U0 
	E-PW40UIEC3 ^d	038-003-440 (BLK 15FT) 038-003-900 (GRY 15FT) 038-003-481 (BLK 21FT) 038-003-796 (GRY 21FT)	NEMA L6-30R 	IEC-309 332P6 	IEC-309 332C6 
	E-PW40UASTL	038-003-439 (BLK 15FT) 038-003-899 (GRY 15FT) 038-003-480 (BLK 21FT) 038-003-795 (GRY 21FT)	NEMA L6-30R 	CLIPSAL 56PA332 	CLIPSAL 56CSC332 

Table 18 Extension cords and connectors options – single-phase (continued)

Plug on each EMC PDU cord ^a	EMC-supplied extension cord/ model number ^{b, c}	EMC Power Cable P/N	EMC-supplied extension cord receptacle (P1) connecting to EMC plug	EMC-supplied extension cord plug (P2) connecting to customer PDU receptacle	Customer PDU receptacle
	VS3-PW40 L7-30 ^d	038-004-301 (BLK 15FT) 038-004-302 (GRY 15FT) 038-004-303 (BLK 21FT) 038-004-304 (GRY 21FT)	NEMA L6-30R 	NEMA L7-30P 	NEMA L7-30R 

- a. Six (6) plugs per system bay
b. Two (2) cords per model, cord length of 15 feet / 4.57 meters.
c. The EMC ordering system defaults to one of the extension cord models based on the country of installation. The default value can be overridden in the EMC ordering system.
d. The single phase line voltage must be below 250Vac to use these cable assemblies.

Customer-to-system wiring for bays (single-phase)

The following figures provide cable descriptions for customer-to-system wiring for single-phase power transmission.

Note

Each single-phase power cable L (Line), N (Neutral) or L (Line) signal connection depends on the country of use.

Figure 16 E-PW40U-US, single-phase

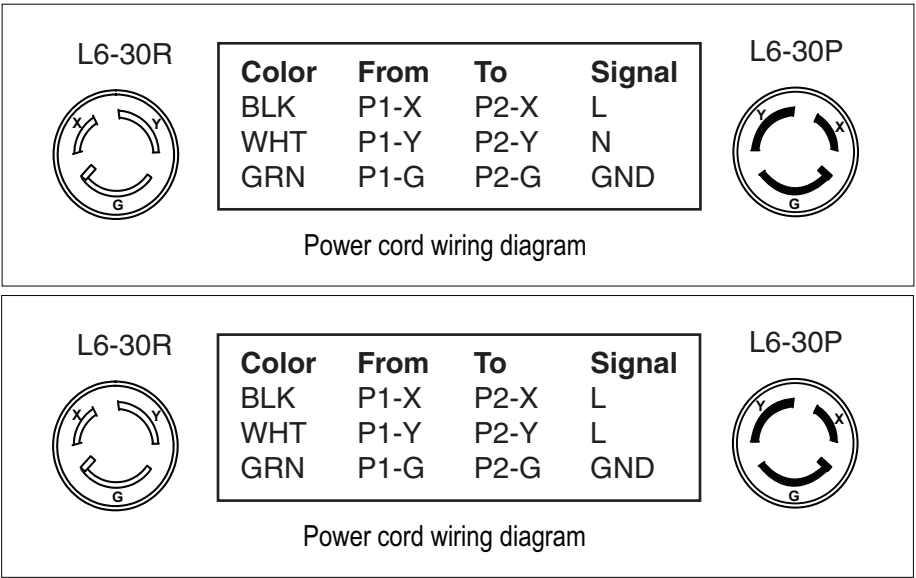
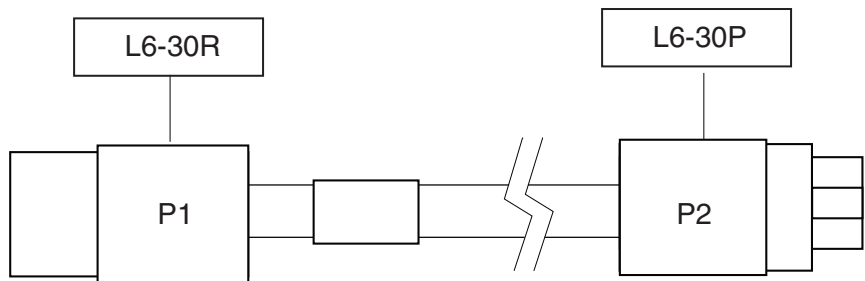


Figure 17 E-PW40URUS, single-phase

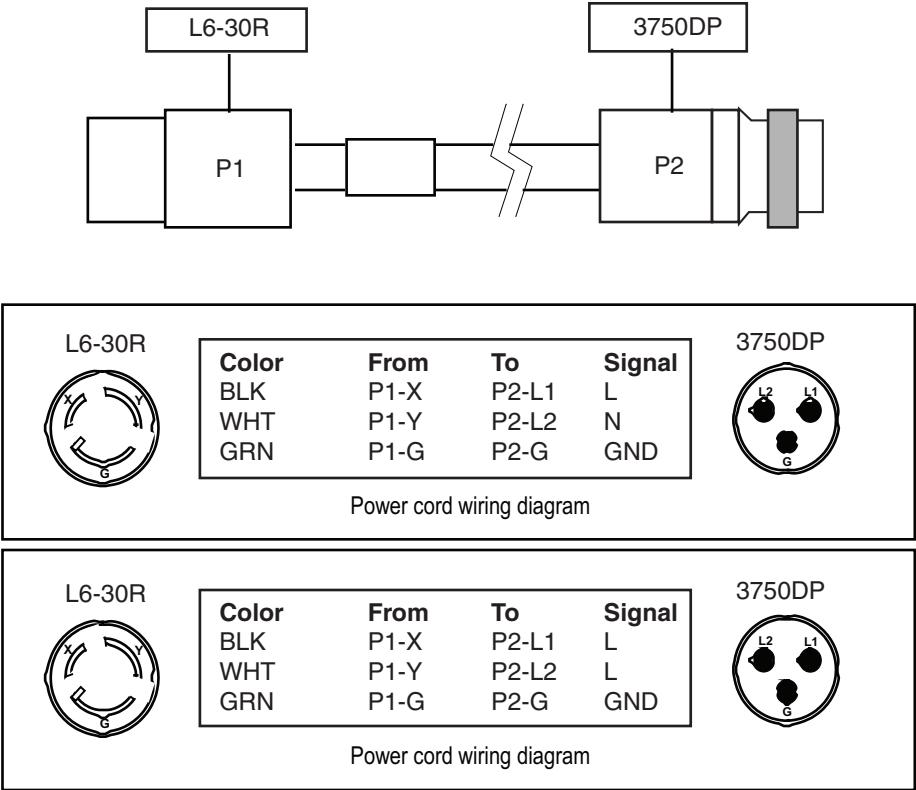


Figure 18 E-PW40UIEC3, single-phase

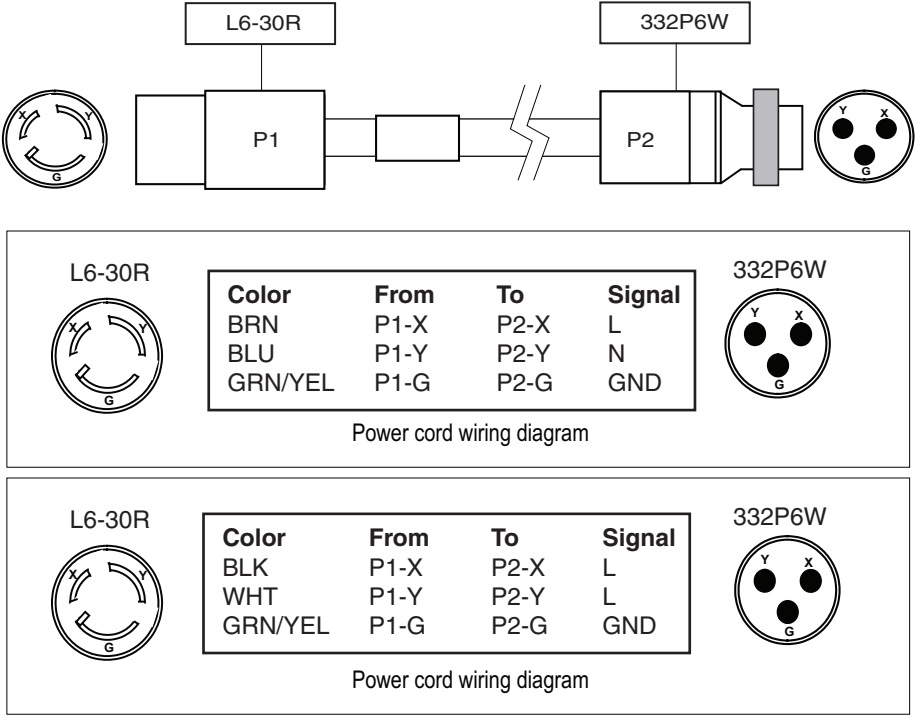


Figure 19 E-PW40UASTL, single-phase

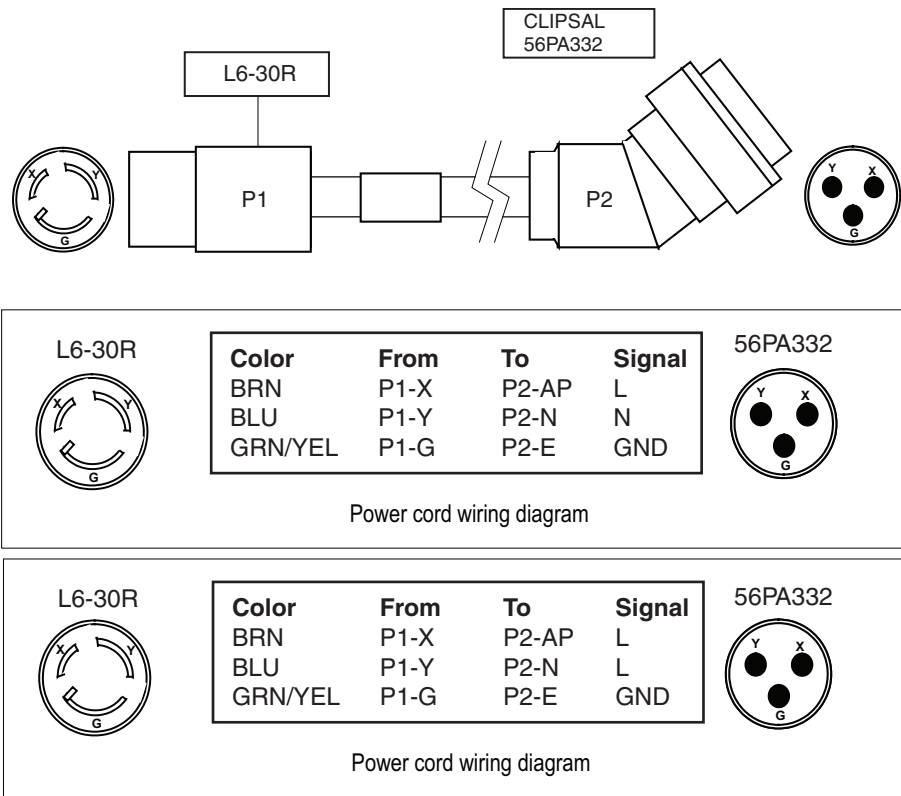
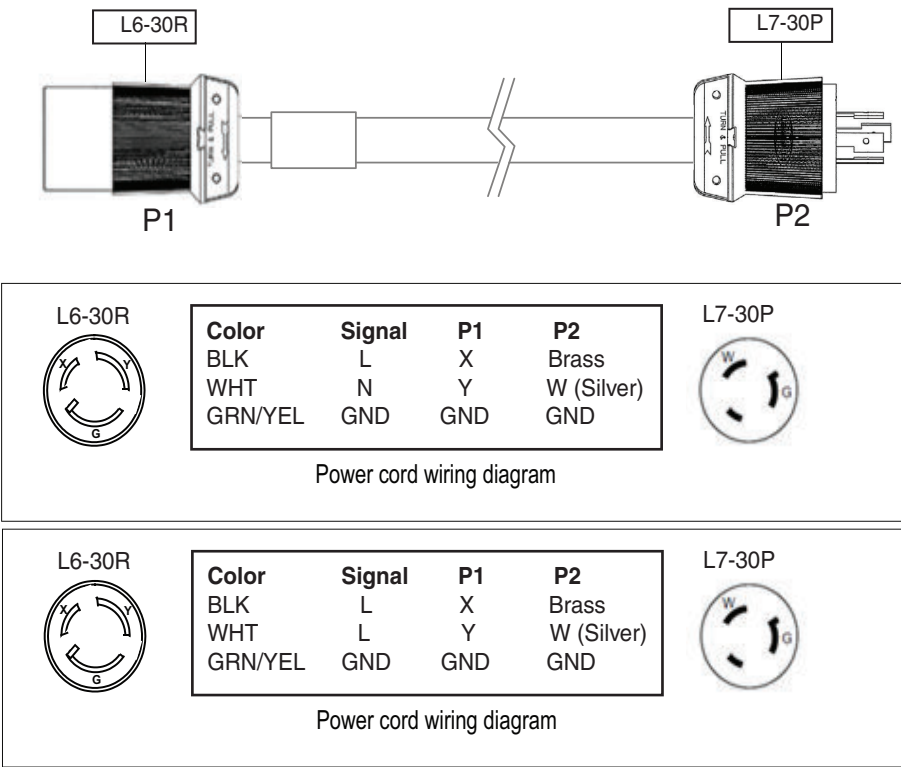


Figure 20 VS3-PW40 L7-30, single-phase



Three-phase (International (Wye))

The following table describes the extension cords and connector for three-phase international (Wye) power transmission.

Table 19 Extension cords and connectors options – three-phase international (Wye)

Plug on each EMC PDU cord ^a	EMC supplied extension cord EMC model number ^b	EMC Power Cable P/N	EMC supplied extension cord receptacle (P1) connecting to EMC plug	EMC supplied extension cord plug (P2) connecting to customer PDU receptacle	Customer PDU receptacle
ABL Sursum S52.30 	E-PC3YAFLE ^c	038-003-274 (BLK 15FT) 038-003-791 (GRY 15FT)	ABL Sursum K52.30 	Flying Leads (International) 	Determined by customer
	E-PCBL3YAG	038-003-273 (BLK 15FT) 038-003-790 (GRY 15FT)	ABL Sursum K52.30 	GARO P432-6S 	GARO S432-6 

a. Two (2) plugs per bay.

b. Two (2) cords per model, cord length of 15 feet / 4.57 meters.

c. The EMC ordering system defaults to one of the extension cord models based on the country of installation. The default value can be overridden in the EMC ordering system.

Customer-to-system wiring (three-phase, International)

The following figures provide cable descriptions for customer-to-system wiring for three-phase international power transmission.

Figure 21 E-PC3YAFLE, flying leads, three-phase, international

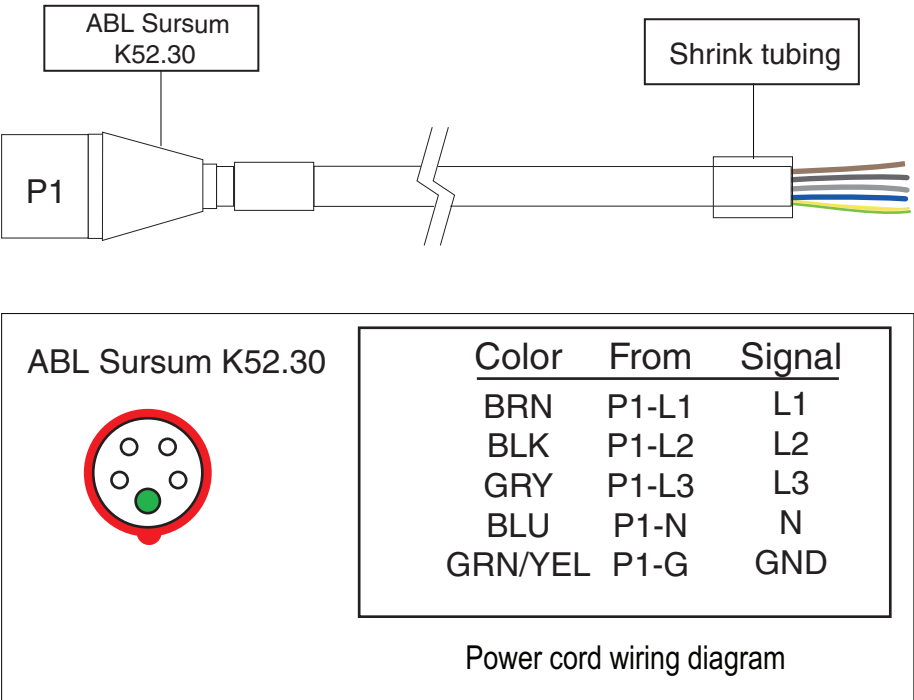
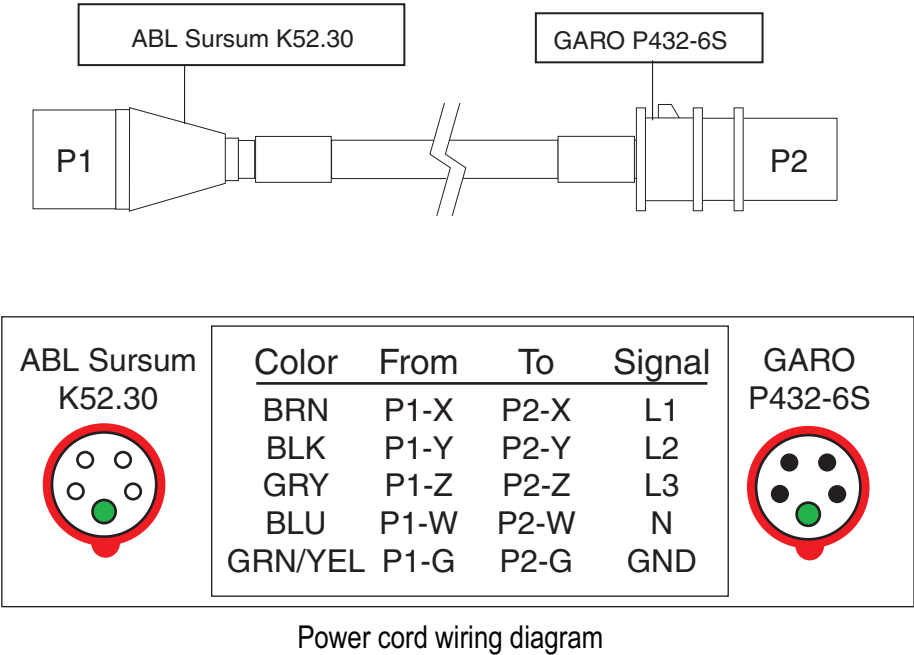


Figure 22 E-PCBL3YAG, three-phase, international



Three-phase (North American (Delta))

The following table describes the extension cords and connector for three-phase North American (Delta) power transmission.

Table 20 Extension cords and connectors options – three-phase North American (Delta)

Plug on each EMC PDU cord ^a	EMC supplied extension cord EMC model number ^b	EMC Power Cable P/N	EMC supplied extension cord receptacle (P1) connecting to EMC plug	EMC supplied extension cord plug (P2) connecting to customer PDU receptacle	Customer PDU receptacle
Hubbell CS-8365C 	E-PCBL3DHR ^c	038-003-272 (BLK 15FT) 038-003-789 (GRY 15FT)	Hubbell CS-8364C 	Russellstoll 9P54U2 	Russellstoll 9C54U2 ^d 
	E-PCBL3DHH	038-003-271 (BLK 15FT) 038-003-788 (GRY 15FT)	Hubbell CS-8364C 	Hubbell CS-8365C 	Hubbell CS-8364C 

- a. Two (2) plugs per bay.
- b. Two (2) cords per model, cord length of 15 feet / 4.57 meters.
- c. The EMC ordering system defaults to one of the extension cord models based on the country of installation. The default value can be overridden in the EMC ordering system.
- d. EMC supplied as EMC model number E-ACON3P-50.

Customer-to-system wiring (three-phase, North American (Delta))

The following figures provide cable descriptions for three-phase North American (Delta) power transmission.

Figure 23 E-PCBL3DHR, three-phase, North American, Delta

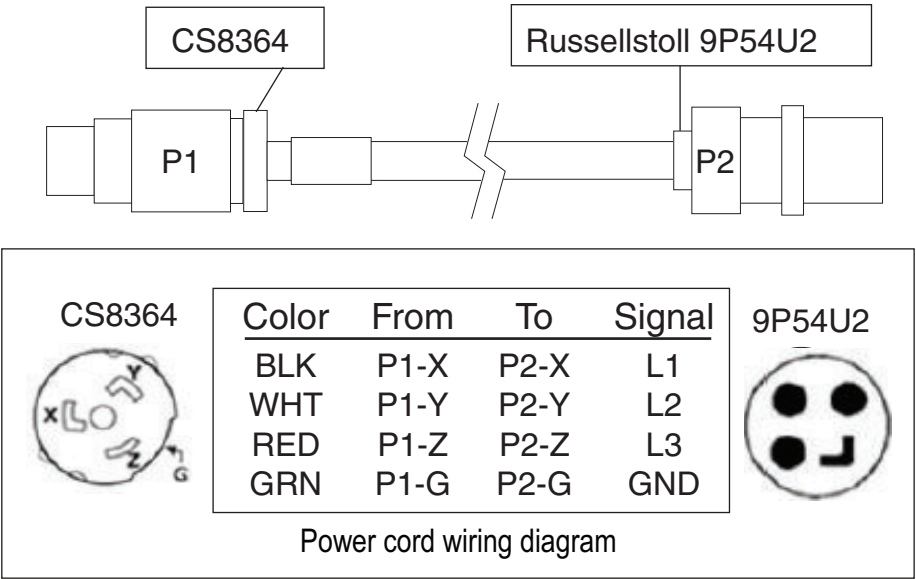
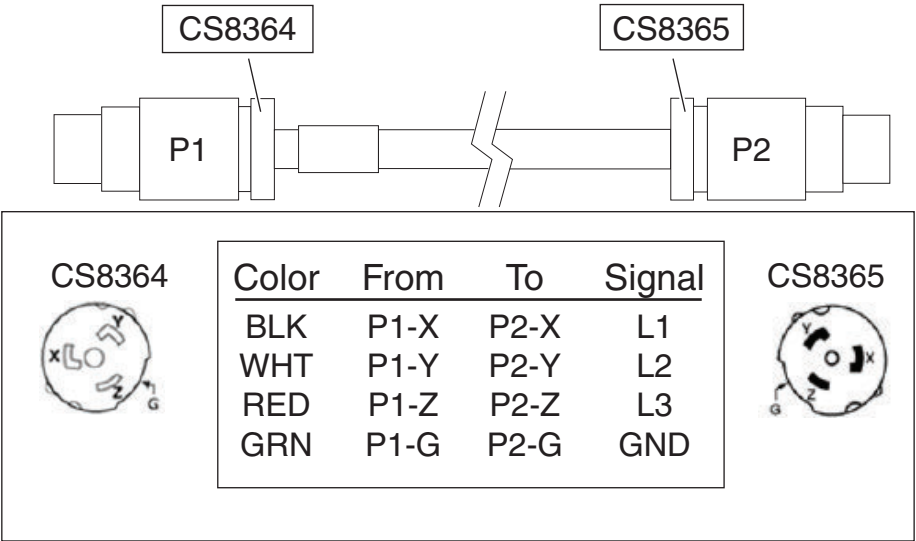


Figure 24 E-PCBL3DHH, three-phase, North American, Delta



Three-phase (Wye, Domestic)

The following table describes the extension cords and connector for three-phase Wye domestic power transmission.

Table 21 Extension cords and connectors options – three-phase Wye, domestic

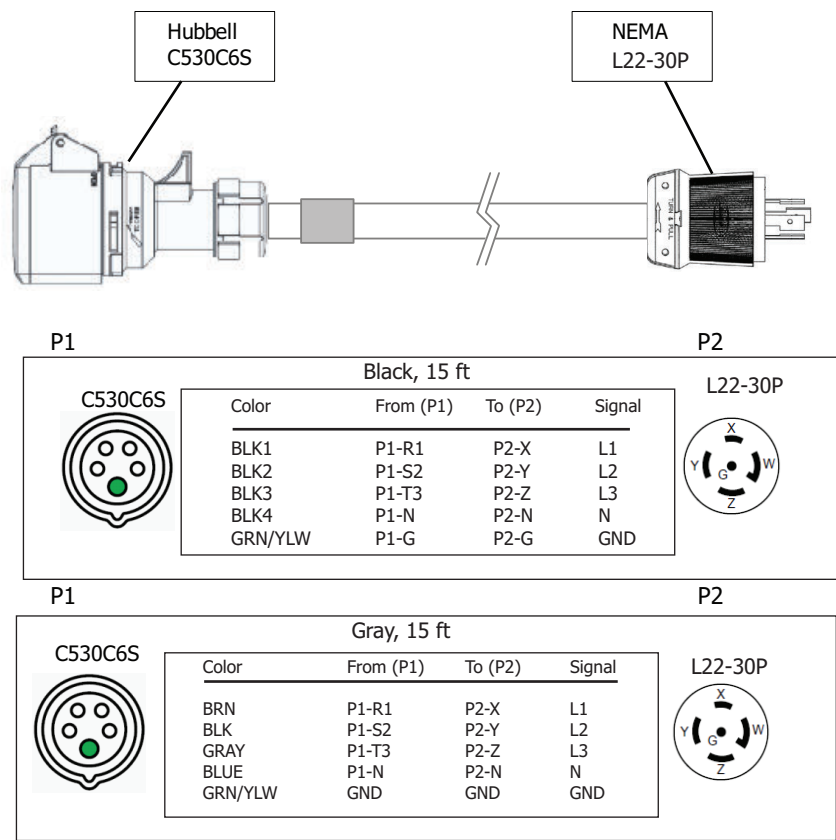
Plug on back of EMC system ^a	EMC supplied extension cord EMC model number ^b	EMC Power Cable P/N	EMC supplied extension cord receptacle (P1) connecting to EMC plug	EMC supplied extension cord plug (P2) connecting to customer PDU receptacle	Customer PDU receptacle
ABL Sursum S52.30 	E-PCBL3YL23P ^{c,d}	038-004-305 (BLK 15FT) 038-004-306 (GRY 15FT)			

- a. Two (2) plugs per bay.
- b. Two (2) cords per model, cord length of 15 feet / 4.57 meters.
- c. The EMC ordering system defaults to one of the extension cord models based on the country of installation. The default value can be overridden in the EMC ordering system.
- d. The line to neutral voltage must be below 250Vac to use these cable assemblies.

Customer-to-system wiring (three-phase, Wye, Domestic)

The following figure provides cable descriptions for models with three-phase Wye domestic power transmission.

Figure 25 E-PCBL3YL23P, three-phase, domestic (Black and Gray)



CHAPTER 8

Third party racking option

This chapter includes:

- [Computer room requirements](#).....70
- [Customer rack requirements](#)..... 71

Computer room requirements

The following computer room requirements provide service access and minimize physical disruption:

- To ensure integrity of cables and connections, do not move racks that are secured (bolted) together after installation.
- A minimum of 42 inches (107 cm) front and 30 inches (76 cm) rear clearance is required to provide adequate airflow and to allow for system service.

Customer rack requirements

The VMAX3 array components are shipped in a fully tested EMC rack and are installed into the customer-supplied rack by EMC customer support engineers only. The original shipping rack, when empty, is returned to EMC after the installation is complete.

To ensure successful installation and secure component placement, customer racks must conform to the following requirements:

- National Electrical Manufacturers Association (NEMA) standard for 19-inch cabinets.
- Individual racks must be empty at the time of installation.
- Threaded hole racks are not supported.
- The cabinet must be in its final location with stabilizing (anti-tip) brackets installed.
- A separate rack that supports a minimum 2000 lb/907 kg of weight must be provided for each system bay.

Note

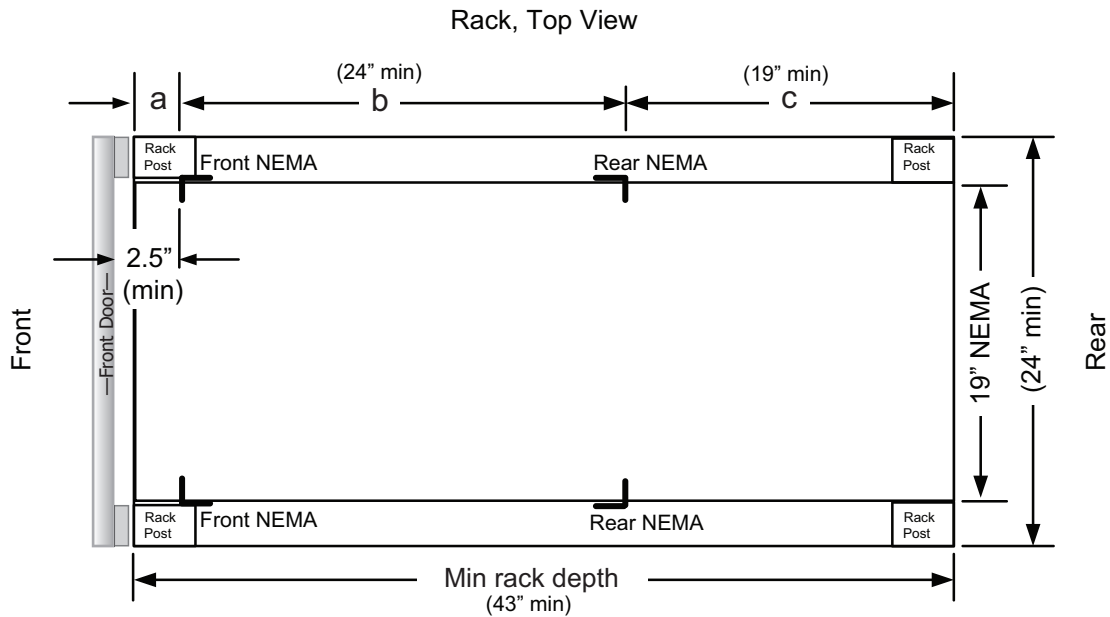
The customer must ensure floor load bearing requirements are met.

- Components and cables installed in customer racks must conform to these configuration rules:
 - Components and cables within a system bay can not be moved to available space in different bay, or to a different location within the same bay.
 - System must be properly positioned in accordance with physical placement rules.
- Internal depth of at least 43 inches (109 cm) with the front and rear doors closed. This measurement is from the front surface of the NEMA rail to the rear door.
- Round or square channel openings must support M5 screws that secure EMC rails and components. Clip nuts are provided by EMC as required.
- Non-dispersed rack-to-rack pass-through cable access at least 3 inches (7.6 cm) in diameter must be available via side panels or horizontal through openings.
- To ensure proper clearance and air flow to the array components, customer supplied front doors and standard bezels, if used, must include a minimum of 2.5 inch (6.3 cm) clearance between the back surface of the door to the front surface of the vertical NEMA rails.

Front and rear doors must also provide:

 - A minimum of 60% (evenly distributed) air perforation openings.
 - Appropriate access for service personnel, with no items that prevent front or rear access to EMC components.
 - Exterior visibility of system LEDs.

Figure 26 Customer rack dimension requirements



a = distance between front surface of rack post and NEMA rail.
 b = distance between NEMA rails; 24" recommended, up to 34" allowed.
 c = distance between rear NEMA rails to interior surface of rear door,
 minimum requirement = 19".

$$\text{Min rack depth} = a + b + c$$

CHAPTER 9

Optional kits

This chapter includes:

- [Overhead routing kit](#).....74
- [Dispersion kits](#)..... 74
- [Securing kits](#)..... 74
- [GridRunner kit and customer-supplied cable trough](#)..... 75

Overhead routing kit

When installing an array in nonraised or raised floor environments, the host cabling and power is handled from overhead using the overhead cable routing kit.

Table 22 Overhead routing models

Model	Description
E-TOP-KIT	Top routing kit
E-BOT-KIT ^a	Bottom routing kit

^a. GridRunner basket for supporting cables beneath the floor for dispersed bays.

Dispersion kits

Each dispersed system bay requires a dispersion kit specific to the bay number. The dispersion kits include a 82 foot (25 m) optical cable and optics for the dispersed engine. When installing a dispersed layout, side skins (E-SKINS) are required.

The following table lists model numbers for new installations and upgrades.

Table 23 Dispersion kit model numbers

Model	Description
E-DSOPTICE2	VMAX VG SYS BAY 2 DSP CBLOPTICS KIT
E-DSOPTICE2U	VMAX VG SYS BAY 2 DSP CBLOPTICS KIT UPG
E-DSOPTICE3	VMAX VG SYS BAY 3 DSP CBLOPTICS KIT
E-DSOPTICE3U	VMAX VG SYS BAY 3 DSP CBLOPTICS KIT UPG
E-DSOPTICE4	VMAX VG SYS BAY 3 DSP CBLOPTICS KIT UPG
E-DSOPTICE4U	VMAX VG SYS BAY 4 DSP CBLOPTICS KIT UPG
E-DSOPTICE5	VMAX VG SYS BAY 5 DSP CBLOPTICS KIT
E-DSOPTICE5U	VMAX VG SYS BAY 5 DSP CBLOPTICS KIT UPG
E-DSOPTICE6	VMAX VG SYS BAY 6 DSP CBLOPTICS KIT
E-DSOPTICE6U	VMAX VG SYS BAY 6 DSP CBLOPTICS KIT UPG
E-DSOPTICE7	VMAX VG SYS BAY 7 DSP CBLOPTICS KIT
E-DSOPTICE7U	VMAX VG SYS BAY 7 DSP CBLOPTICS KIT UPG
E-DSOPTICE8	VMAX VG SYS BAY 8 DSP CBLOPTICS KIT
E-DSOPTICE8U	VMAX VG SYS BAY 8 DSP CBLOPTICS KIT UPG

Securing kits

The Securing Kits contain heavy brackets plus hardware used to attach the brackets to the frames of the system and storagebays. The brackets are attached to the floor using bolts that engage the flooring substructure provided by the customer.

The *EMC VMAX3 Family Securing Kit Installation Guide* provides instructions on how to install.

Table 24 Securing kit models

Model	Description
E-SECURE	Secure kit for single bay
E-SECUREADD	Secure kit for joining bays

GridRunner kit and customer-supplied cable trough

The EMC GridRunner™ bottom routing kit (E-BOT-KIT) and customer-supplied cable troughs can help organize and protect subfloor cables that connect separated bays. GridRunners reduce the vertical drop of the dispersion cables, which may increase the distance between the separated bays.

Each GridRunner supports the cable bundle above the subfloor. GridRunners are installed with brackets that attach to the stanchions under the raised floor. The stanchions are up to one inch in diameter, measured at six inches (15.24 cm) below the raised tiles.

To ensure sufficient support of the cable bundle, a GridRunner should be installed every two meters.

APPENDIX A

Best Practices AC power connections

This chapter includes:

- [Best practices overview for AC power connections](#).....78
- [Selecting the proper AC power connection procedure](#)..... 79
- [Procedure A: Working with customer's electrician onsite](#)..... 80
- [Procedure B: Verify and connect](#).....86
- [Procedure C: Obtain customer verification](#) 87
- [Labeling the PDUs](#)..... 88
- [AC power specifications](#)..... 90

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 [Figure 27 on page 78](#).

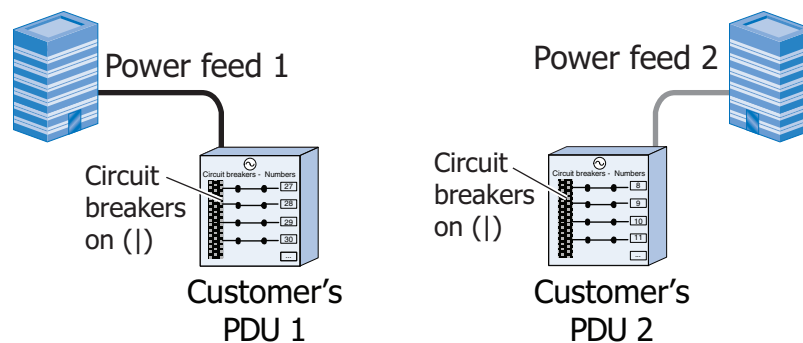
NOTICE

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 VMAX3 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.

NOTICE

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

Figure 27 Two independent customer-supplied PDUs



Selecting the proper AC power connection procedure

EMC Customer Engineer must select the proper AC power connection procedure

[Table 25 on page 79](#) summarizes possible scenarios at the installation site when you are about to connect external AC power to the EMC array. Select the procedure that applies to your situation.

Table 25 Procedure options for AC power connection

If the scenario is...	then use this procedure:
The customer's electrician is available at the installation site.	A ^a , See: Procedure A: Working with customer's electrician onsite on page 80
Access to customer-supplied, labeled, power cables (beneath raised floor or overhead). (And the customer's electrician is NOT available at the installation site.)	B, See: Procedure B: Verify and connect on page 86
Customer-supplied PDU source cables are already plugged into the EMC PDU and you have no access to the customer-supplied, labeled, power cables (beneath raised floor or overhead). (And the customer's electrician is NOT available at the installation site.)	C, See: Procedure C: Obtain customer verification on page 87

^a. Procedure A assures fault tolerant power in the EMC array.

Procedure A: Working with 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 EMC CE and back to the customer's electrician.

- [Procedure A-1: Customer's electrician on page 81](#)
- [Procedure A-2: EMC Customer Engineer on page 82](#)
- [Procedure A-3: Customer's electrician on page 85](#)

Procedure A-1: Customer's electrician

NOTICE

This task is performed by the customer's electrician.

Procedure

1. Verify that the customer-supplied AC source voltage output on each PDU is within the AC power specification shown in [AC power specifications on page 90](#). Measure the voltage output of each power cable as shown in [Figure 28 on page 81](#).
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 [Figure 29 on page 81](#).

Figure 28 Circuit breakers ON — AC power within specification

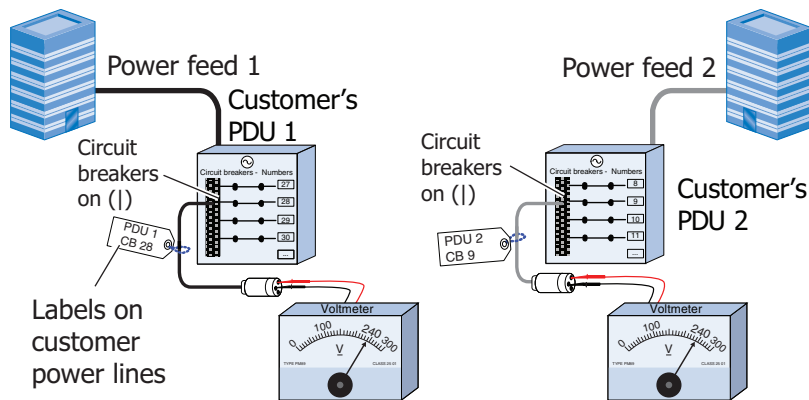
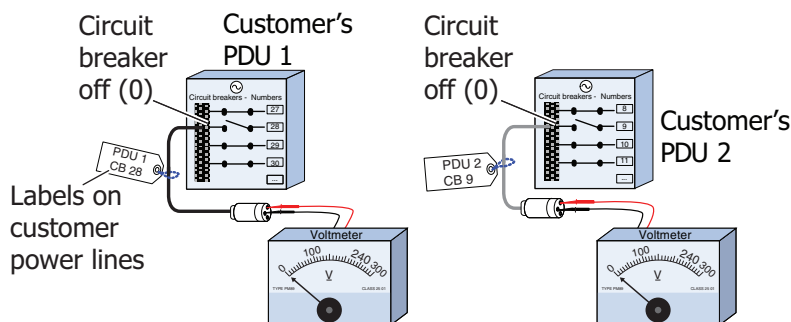


Figure 29 Circuit breakers OFF — No AC power



Procedure A-2: EMC Customer Engineer

NOTICE

This task is performed by the EMC Customer Engineer.

Procedure

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 EMC bay to verify that power zone A and power zone B are powered by a different customer-supplied PDU.
3. If power extension cables are required, connect them to power zone A and power zone B in each bay.

For single-phase, connect customer-supplied PDU power cables to the EMC bay by connecting to the bay's AC input cables for power zone A and power zone B as shown in [Figure 30 on page 82](#).

For three-phase, connect customer-supplied PDU power cables to the EMC bay by connecting to the bay's AC input cables for power zone A and power zone B as shown in [Figure 31 on page 83](#).

Figure 30 Connecting AC power, single-phase

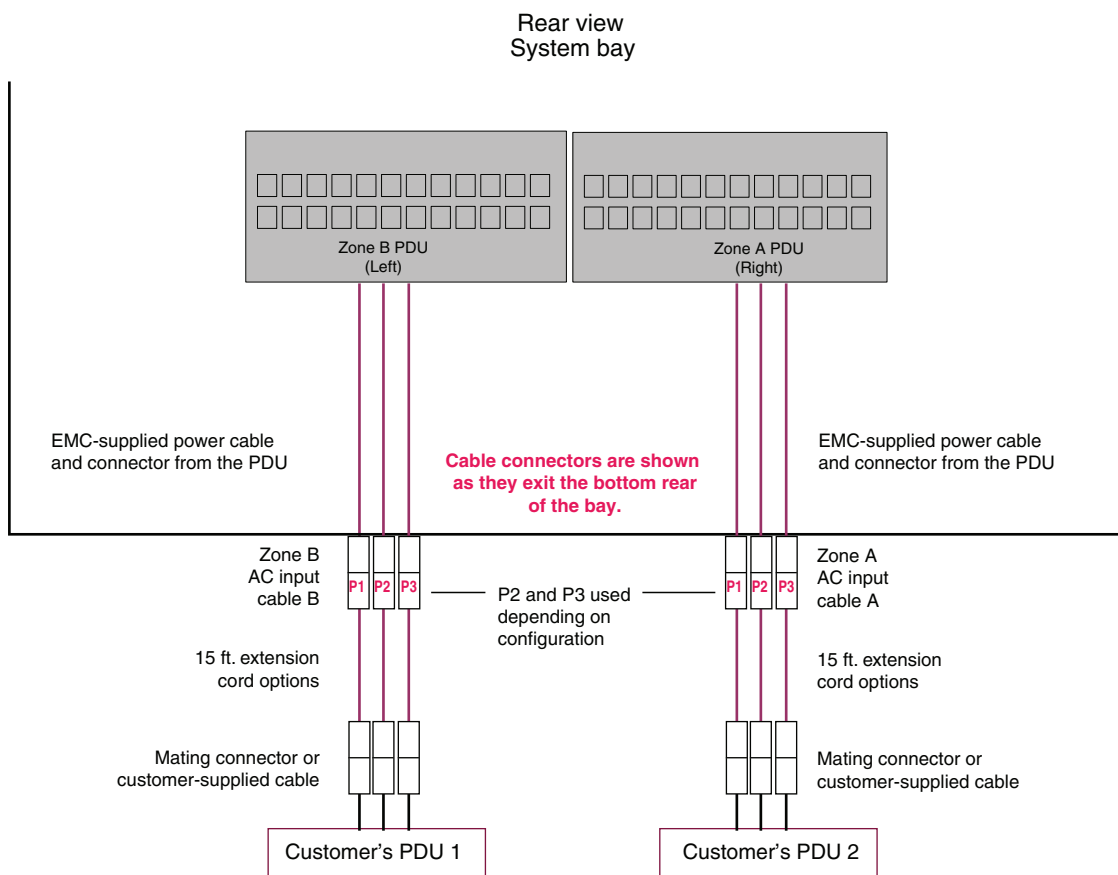
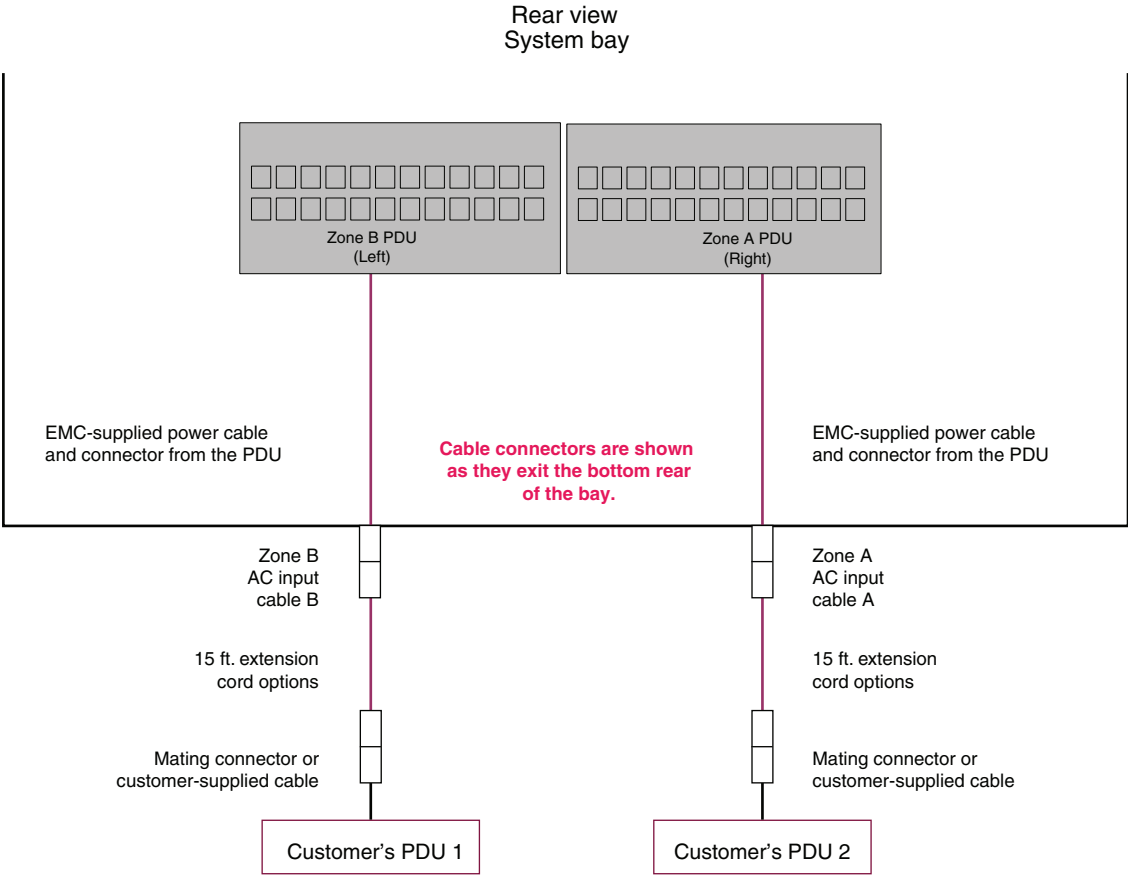


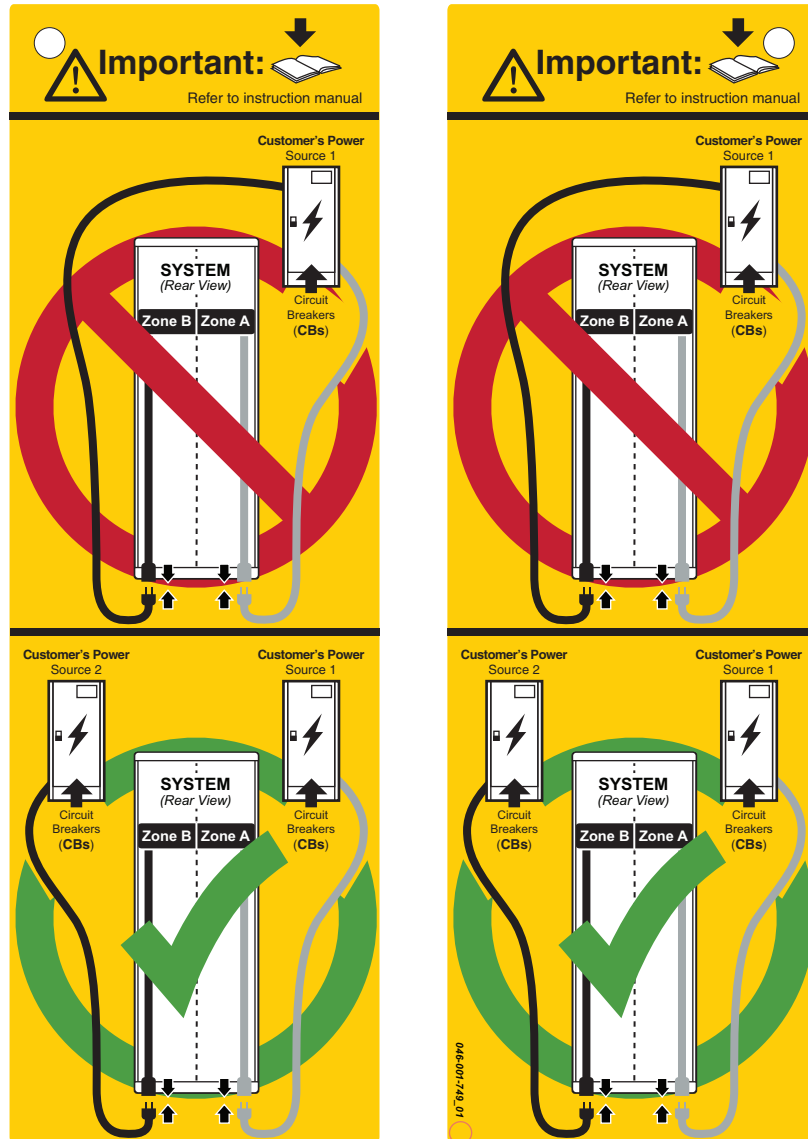
Figure 31 Connecting AC power, three-phase



NOTICE

Do not connect 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 32 Power zone connections



Procedure A-3: Customer's electrician

NOTICE

This task is performed by the customer's electrician.

Procedure

1. Working with the 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.

Note

If all power supply and/or SPS LEDs in a bay are ON or flashing green, the bay is incorrectly wired because the AC power to both EMC power zones is supplied by a single PDU, that is, customer-supplied PDU 2. 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

Note that 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 [Labeling the PDUs on page 88](#).

Procedure B: Verify and connect

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

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

Procedure

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 a copy of [Procedure A: Working with customer's electrician onsite on page 80](#). 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 [Figure 29 on page 81](#) and described in step 1 of [Procedure A-2: EMC Customer Engineer on page 82](#).
3. Compare the numbers on the customer-supplied power cables for each EMC bay to verify that power zone A and power zone B are powered by a different customer-supplied PDU.
4. If power extension cables are required, connect them to power zone A and power zone B in each bay.
5. Connect the customer-supplied power cables to EMC power zones as described in step 3 of [Procedure A-2: EMC Customer Engineer on page 82](#) and shown in [Figure 30 on page 82](#) or [Figure 31 on page 83](#).
6. Record the customer-supplied PDU information as described in step 1 of [Procedure A-2: EMC Customer Engineer on page 82](#).
7. Label the PDUs as described in [Labeling the PDUs on page 88](#).

Procedure C: Obtain customer verification

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

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

Procedure

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 a copy of [Procedure A: Working with customer's electrician onsite on page 80](#). 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-1: Customer's electrician on page 81](#) and label the PDUs as described in [Labeling the PDUs on page 88](#).

Labeling the PDUs

Before you begin

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

- [Procedure A: Working with customer's electrician onsite on page 80](#)
- [Procedure B: Verify and connect on page 86](#)
- [Procedure C: Obtain customer verification on page 87](#)

If necessary, see [Selecting the proper AC power connection procedure on page 79](#) to select the correct procedure.

Table 26 Label part numbers and location

For...	Use PN	Description	Location
All bays	PN 046-001-750	LABEL: CUSTOMER 1P 3P PDU INFO WRITEABLE	OPEN ME FIRST, KIT, PN 106-887-149

Procedure

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

Note

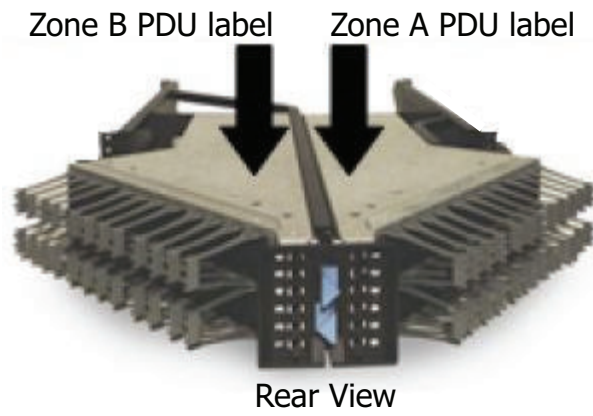
For three-phase power, enter data only in the P1 column.

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

Figure 33 PDU label , single-phase and three-phase

Customer PDU Information						
Power Zone B			Power Zone A			
P1	P2	P3	P1	P2	P3	
PDU _____			PDU _____			
Panel _____			Panel _____			
CB(s) _____			CB(s) _____			

Figure 34 Label placement— Customer PDU Information



AC power specifications

Single-phase AC power

Table 27 Single-phase AC power specifications

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 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	32 A
Power zones	Two	Two
Power requirements at customer site (min)	• Three 30 A, single-phase drops per zone. • Two power zones require 6 drops, each drop rated for 30 A. • PDU A and PDU B require three separate single-phase 30 A drops for each PDU.	
Note ^a — L = line or phase, N= neutral, G= ground		

Three-phase AC power

Table 28 Three-phase AC power specifications

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	32 A
Power zones	Two	Two
Power requirements at customer site (min)	Two 50 A, three-phase drops per bay. • PDU A and PDU B require one separate three-phase Delta 50 A drops for each PDU.	Two 32A, three-phase drops per bay.
Note ^a — L = line or phase, N= neutral, G= ground Note ^b — An imbalance of AC input currents may exist on the three-phase power source feeding the VMAX3 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.		