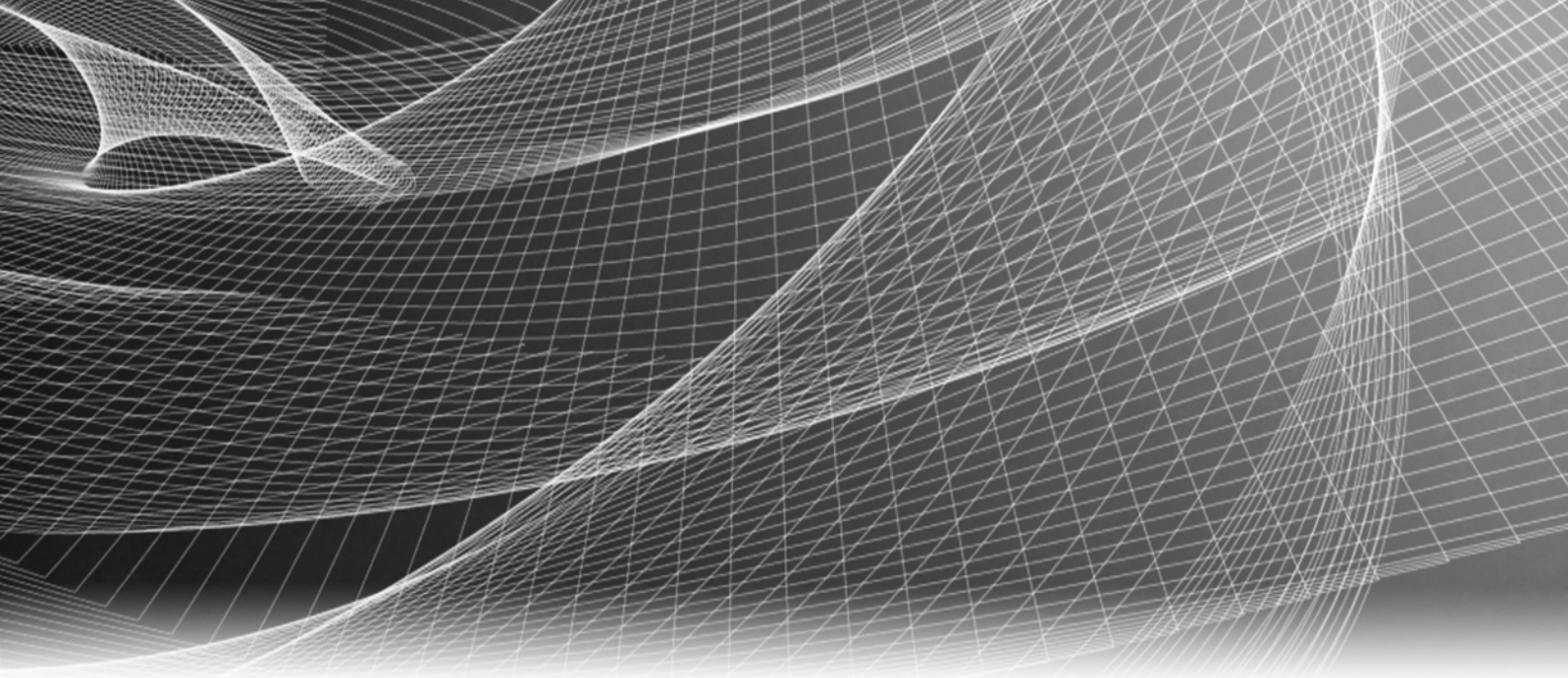




EMC[®] VMAX[®] Family

VMAX 100K, 200K, 400K

Planning Guide

Rev 01

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Published September, 2014

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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/products>. Check to ensure that you are using the latest version of this document.

Audience

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

Related documentation

The following documentation portfolio contains documents needed to manage your software and storage array configuration.

- ◆ *EMC VMAX Family (100K, 200K and 400K) Documentation Set* — Contains the product guide, physical planning guide, and power documentation for the VMAX arrays.
- ◆ *EMC VMAX Family Viewer for Desktop and iPad®* — Illustrates VMAX hardware, and array configurations.
- ◆ *EMC VMAX 100K, 200K, and 400K arrays with HYPERMAX OS Release Notes* — Describes new features and any known limitations.
- ◆ *E-Lab Interoperability Navigator (ELN)* — 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](https://support.EMC.com) at <https://support.EMC.com> and search for Solve Desktop. Download the Solve Desktop and load the VMAX Family and DMX procedure generator.

NOTICE

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

Conventions used in this document

EMC uses the following conventions for special notices:



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



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



CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



NOTICE is used to address practices not related to personal injury.

Note: A note presents information that is important, but not hazard-related.

Typographical conventions

EMC uses the following type style conventions in this document:

Normal

Used in running (nonprocedural) text for:

- Names of interface elements, such as names of windows, dialog boxes, buttons, fields, and menus
- Names of resources, attributes, pools, Boolean expressions, buttons, DQL statements, keywords, clauses, environment variables, functions, and utilities
- URLs, pathnames, filenames, directory names, computer names, links, groups, service keys, file systems, and notifications

Bold

Used in running (nonprocedural) text for names of commands, daemons, options, programs, processes, services, applications, utilities, kernels, notifications, system calls, and man pages

Used in procedures for:

- Names of interface elements, such as names of windows, dialog boxes, buttons, fields, and menus
- What the user specifically selects, clicks, presses, or types

Italic

Used in all text (including procedures) for:

- Full titles of publications referenced in text
- Emphasis, for example, a new term
- Variables

Courier

Used for:

- System output, such as an error message or script
- URLs, complete paths, filenames, prompts, and syntax when shown outside of running text

Courier bold

Used for specific user input, such as commands

<i>Courier italic</i>	Used in procedures for: • Variables on the command line • User input variables
< >	Angle brackets enclose parameter or variable values supplied by the user
[]	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 technical support, documentation, release notes, software updates, or information about EMC products can be obtained on the [EMC Online Support](#) site (registration required).

To open a service request through the [EMC Online Support](#) 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.

Technical support

EMC offers a variety of support options.

Support by Product — EMC offers consolidated, product-specific information.

The Support by Product web pages offer quick links to Documentation, White Papers, Advisories (such as frequently used Knowledgebase articles), and Downloads, as well as more dynamic content, such as presentations, discussions, relevant Customer Support Forum entries, and a link to EMC Live Chat.

EMC Live Chat — Open a Chat or instant message session with an EMC Support Engineer.

Your comments

Your suggestions will help us continue to improve the accuracy, organization, and overall quality of the user publications. Send your opinions of this document to:

VMAXContentFeedback@emc.com

Document change history

The following table provides a description of document changes based on the HYPERMAX OS release. The *EMC VMAX 100K, 200K, and 400K arrays with HYPERMAX OS Release Notes* contain information on new features and known limitations.

Table 1 Document Change History

Version	Description	Operating system
01	First release of the VMAX 100K, 200K, and 400K arrays with EMC HYPERMAX OS 5977.	HYPERMAX OS 5977

CHAPTER 1

Pre-planning tasks

This chapter describes pre-planning tasks.

Topics include:

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

Before you begin

The VMAX arrays are designed for installation in a properly equipped data center (raised (preferred) or nonraised floors that provides sufficient physical space, controlled temperature and humidity, airflow and ventilation, power and grounding, system cable routing facilities, and fire protection.

When planning the installation site, meet with your EMC systems Engineer and EMC Customer Engineer to determine what is needed to prepare for the delivery and installation of the array. One or more planning sessions may be necessary to finalize all the details related to installation.

Tasks to review

The following table provides a list of tasks which maybe 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). It is recommended that the customer's electrician be available at the installation site for regular and 3 rd party racked arrays. “Best Practices AC power connections” on page 47 provides details.
Complete <i>Third Party Rack Solution Verification</i> form for customer-supplied third party rack support.	The EMC representative working the order must: 1. Review “Third party racking option” on page 75 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</i> form.
Complete Installation Planning Task Sheet and Presite Survey 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 describes the delivery transportation requirements.

Topics include:

- ◆ 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.

IMPORTANT

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 describes recommended specifications.

Topics include:

- ◆ Radio frequency interference..... 20
- ◆ Power and heat dissipation 21
- ◆ Airflow 22
- ◆ Air volume, air quality and temperature..... 23
- ◆ Shock and vibration 25
- ◆ Sound power and sound pressure 25
- ◆ Hardware acclimation times 26
- ◆ Optical multimode cables 27

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.

The following table provides the recommended minimum distances and can be used as a guideline to check if cell phone repeaters or other intentional radiator devices are at a safe distance away from EMC Corporation equipment.

Table 4 Distance from RF emitting device

Repeater power level ¹	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)

1. 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.

IMPORTANT

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

Table 5 Power consumption and heat dissipation

Configuration description ¹	Total power consumption (kVA) ²	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 2-8, 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

1. All values are calculated based on fully loaded bays.
2. 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

VMAX 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.

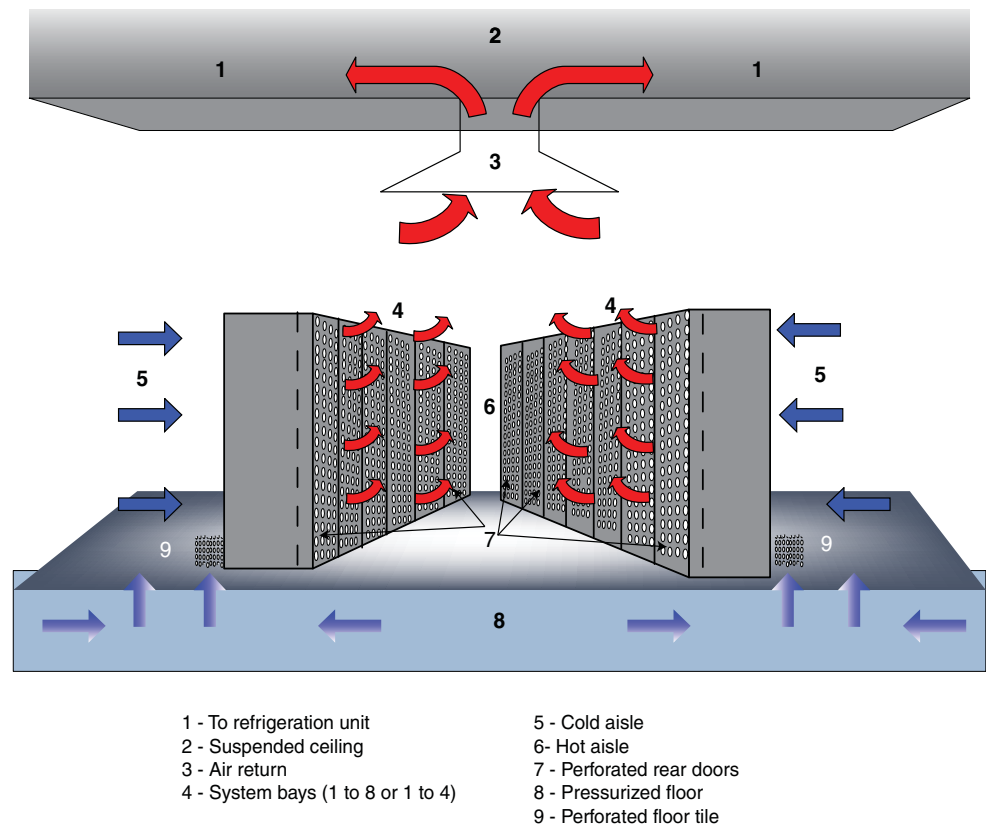


Figure 1 Typical airflow in a hot aisle/ cold aisle environment

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 6 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 7 Environmental operating ranges

Condition	System
Operating temperature and operating altitude ¹	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 ²
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)

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

2. 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 8 Temperature and humidity

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

Air quality requirements

VMAX 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 VMAX 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 to place 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 9 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	Response measurement level (should not exceed)
Transportation shock	10 G's, 12 ms duration
Transportation random vibration	1.15 Grms, 1 hour Frequency range 1-200 Hz

Sound power and sound pressure

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

Table 10 Sound power and sound pressure levels, A-weighted

Configuration	Sound power levels (LWAd) (B) ¹	Sound pressure levels (LpA) (dB) ²
System bay (max)	7.9	66
System bay (min)	7.6	63

1. Declared noise emissions with .3B correction factor added per ISO9296.
2. Measured at the four bystander positions per ISO7779.

Hardware acclimation times

VMAX arrays 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.

The following table can be used to determine the precise amount of stabilization time required.

Table 11 Hardware acclimation

If the last 24 hours of the TRANSIT/STORAGE environment was this:		...and the OPERATING environment is this	...then let the array 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
Cold <68° F (20° C)	Dry <30% RH	<86°F (30°C)	4
Cold <68° F (20° C)	Damp ≥ 30% RH	<86°F (30°C)	4
Hot >72° F (22° C)	Dry < 30% RH	<86°F (30°C)	4
Hot >72° F (22° C)	Humid 30-45% RH	<86°F (30°C)	4
	Humid 45-60% RH	<86°F (30°C)	8
	Humid ≥ 60% RH	<86°F (30°C)	16
Unknown		<86°F (30°C)	16

NOTICE

If there are signs of condensation after the recommended acclimation time has passed, allow an additional eight (8) hours to stabilize.

VMAX arrays 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. 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 provided for SRDF connectivity over 4, 8 Fibre Channel I/O modules, or 10GbE or 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 and support distances of up to 190 m over 8 Gb/s Fibre Channel and 125 m over 16 Gb/s Fibre Channel modules.

You can use existing OM2 or OM3 cables, 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: You can use OM2 cables, however they will not support 8 Gb/s Fibre Channel (SRDF) distances greater than 50 m. For longer distances, you must use OM3 cables.

Open systems host and SRDF connectivity

The following table provides the OM3 and OM4 cables.

Table 12 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 discusses the requirements for fire prevention equipment and remote support.

Topics include:

- ◆ [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 so as to minimize the forces and vibration during the discharge.

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 and 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.
- The capability to add Gateway Client servers and Policy Manager servers to your 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 VMAX 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.

ESRS is also used to deliver license entitlements directly onto the VMAX array for a when an upgrade orders is processed, a serial number is provided, and an ESRS connection is present.

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

NOTICE

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

CHAPTER 5

Physical weight and space

This chapter discusses floor capacity, physical space and weights.

Topics include:

- ◆ Floor load-bearing capacity 34
- ◆ Raised floors requirements 34
- ◆ Physical space and weight 35

Floor load-bearing capacity

VMAX 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 and that the only definitive way to ensure that the floor is capable of supporting the load associated with the VMAX 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 VMAX array weight.

CAUTION

The customer is ultimately responsible for ensuring that the floor of the data center on which the VMAX array is to be configured is capable of supporting the VMAX array weight, whether the VMAX 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 VMAX 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 VMAX array weight. The customer assumes all risk and liability associated with such failure.

Raised floors 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 VMAX array weight. Ensure proper physical support of the VMAX array 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 VMAX 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 VMAX array roll.

- ◆ Floor tile cutouts will weaken the tile. An additional pedestal mount adjacent to the cutout of a tile is recommended. 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.
- ◆ Care should be taken when positioning the bays to make sure that a caster is not moved into a cutout. Cutting tiles per specifications as shown in [“Dimensions for array layouts” on page 43](#) ensures the proper caster placement.
- ◆ Use or create no more than one floor tile cutout that is no more than 8 in. (20.3 cm) wide by 6 in. (15.2 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 13 Space and weight requirements

Bay configurations ¹	Height (in/cm) ²	Width (in/cm) ³	Depth (in/cm) ⁴	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

1. Clearance for service/airflow is the front at 42 in (106.7 cm) front and the rear at 30 in (76.2 cm).

2. An additional 18 in (45.7 cm) is recommended for ceiling/top clearance.

3. Measurement includes .25 in. (0.6 cm) gap between bays.

4. Includes front and rear doors.

CHAPTER 6

Position bays

This chapter describes layouts to position the VMAX array at the customer site.

Topics include:

- ◆ System layouts..... 38
- ◆ Dimensions for array layouts 43
- ◆ Tile placement 44
- ◆ Caster and leveler dimensions 46

System layouts

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

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

- ◆ “Adjacent layouts, single-engine array” and “Adjacent layouts, dual-engine array” — all bays are positioned side-by-side.
- ◆ “Dispersed layout, single-engine array” and “Dispersed layout, dual-engine array” — 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 whenever 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.

- ◆ “Adjacent and dispersed (mixed) layout, single-engine array” and “Adjacent and dispersed (mixed) layout, dual-engine array” — allows adjacent and dispersed layout of either single or dual-engine arrays with adjacent and dispersed bays.

NOTICE

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 callouts are used to identify the VMAX array model:

Table 14 Model identification callouts

Callouts	Array model
1	100K
2	200K
3	400K

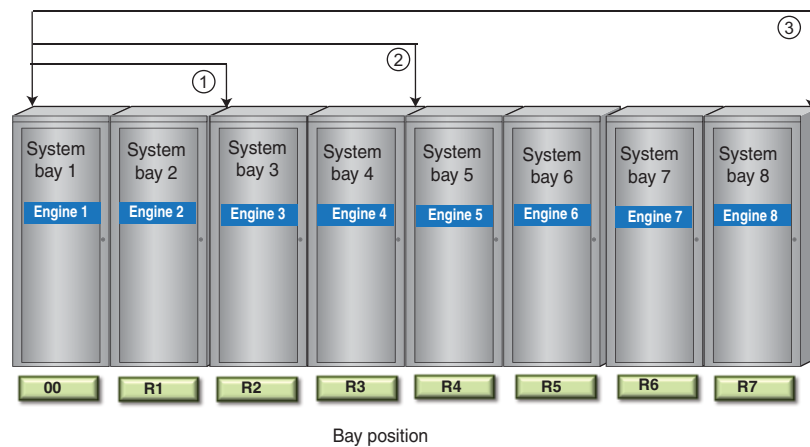


Figure 2 Adjacent layouts, single-engine, front view

Adjacent layouts, dual-engine array

Dual-engine arrays 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 with dual-engines.

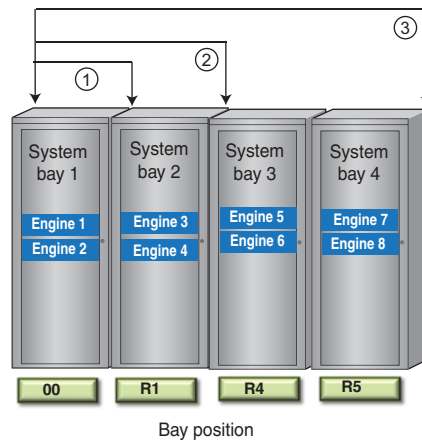


Figure 3 Adjacent layouts, dual-engine, front view

Dispersed layout, single-engine array

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

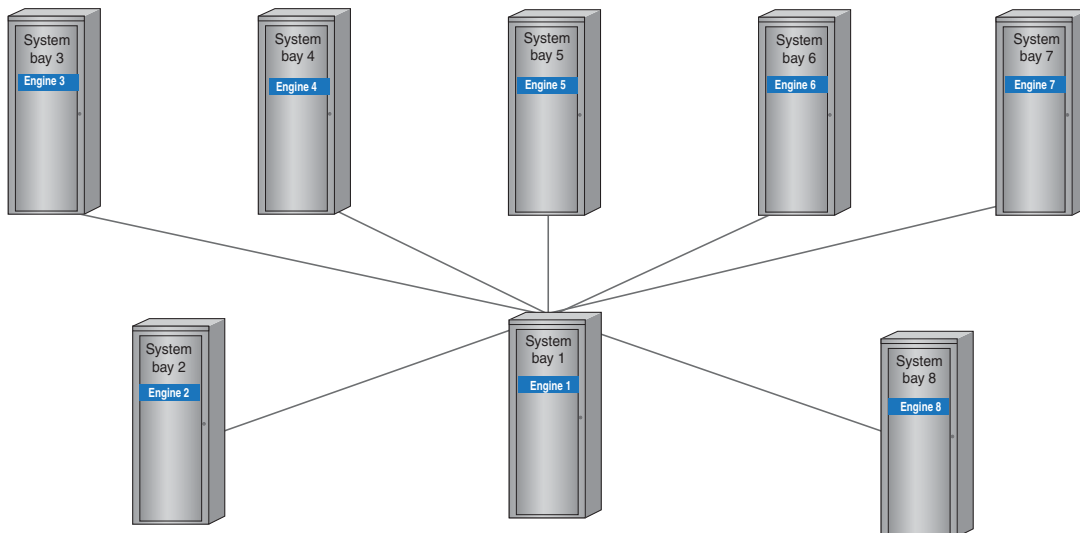


Figure 4 Dispersed layout, single-engine, front view

Dispersed layout, dual-engine array

The following figure shows a dual-engine dispersed layout.

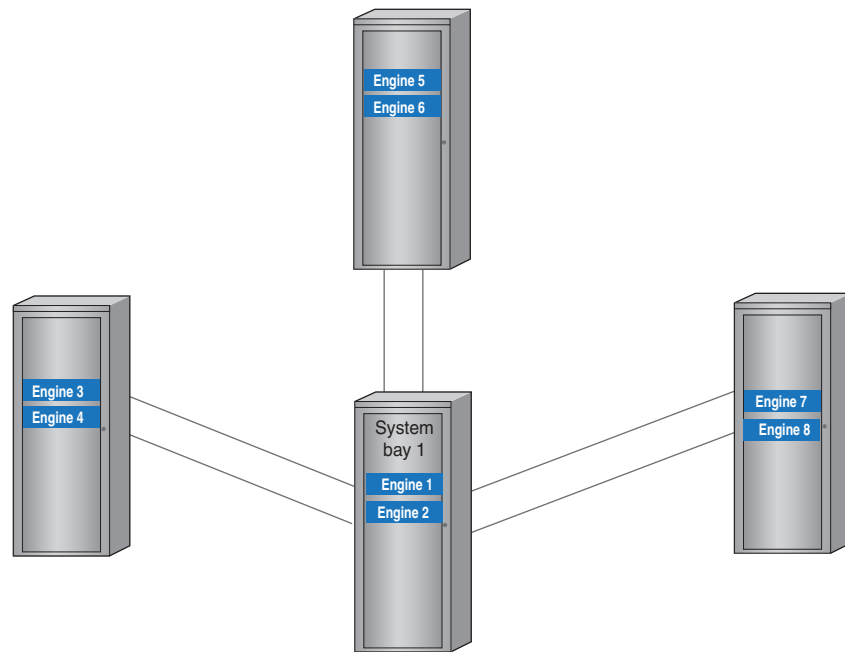


Figure 5 Dispersed layout, dual-engine, front view

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

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

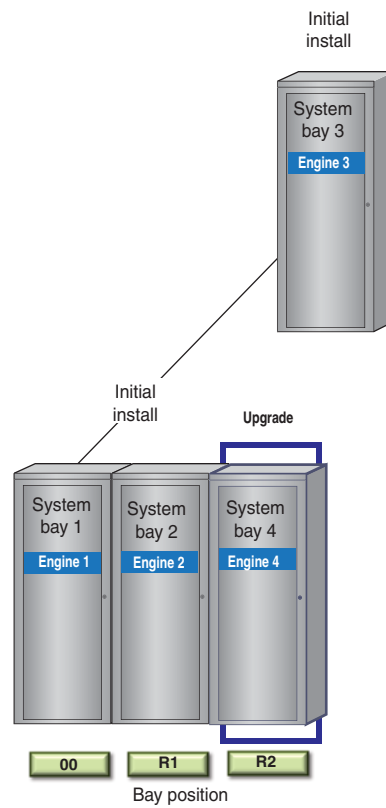


Figure 6 Adjacent and dispersed (mixed) layout, single-engine

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

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

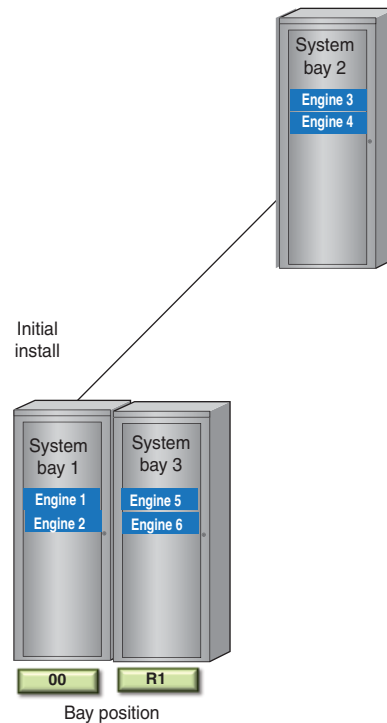


Figure 7 Adjacent and dispersed (mixed) layout, dual-engine

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 the system bay.

The following figure shows the layout dimensions.

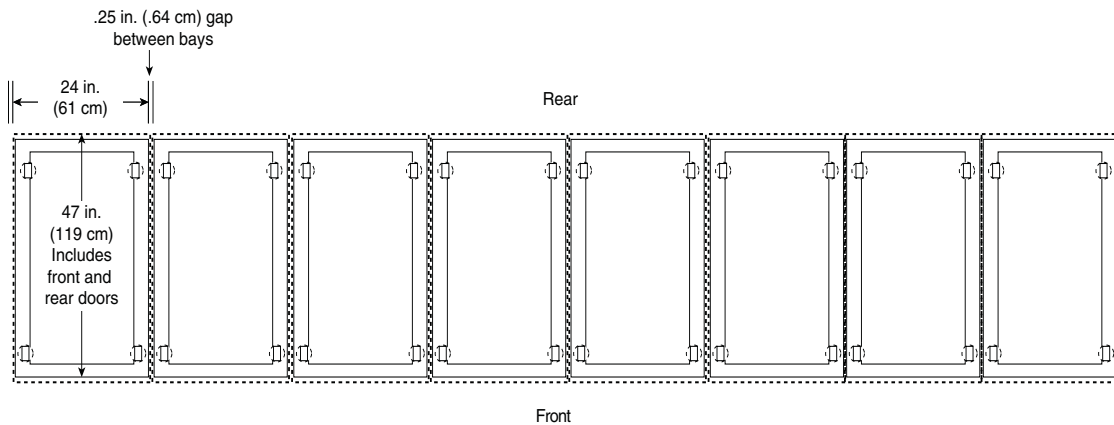


Figure 8 Layout dimensions

Tile placement

You must understand tile placement to ensure that VMAX 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
- ◆ .25 in. (.64 cm) gap between bays
- ◆ Ensure there is a service area of 42 in (106 cm) for the front and 30 in (76 cm) for the rear of the system bay

The following figure shows array placement with floor tile cutouts.

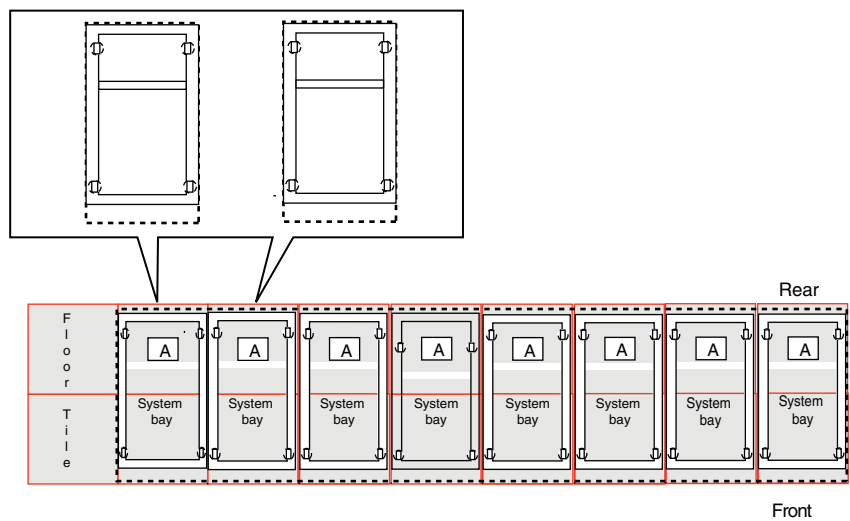


Figure 9 Placement with floor tile cutouts

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.

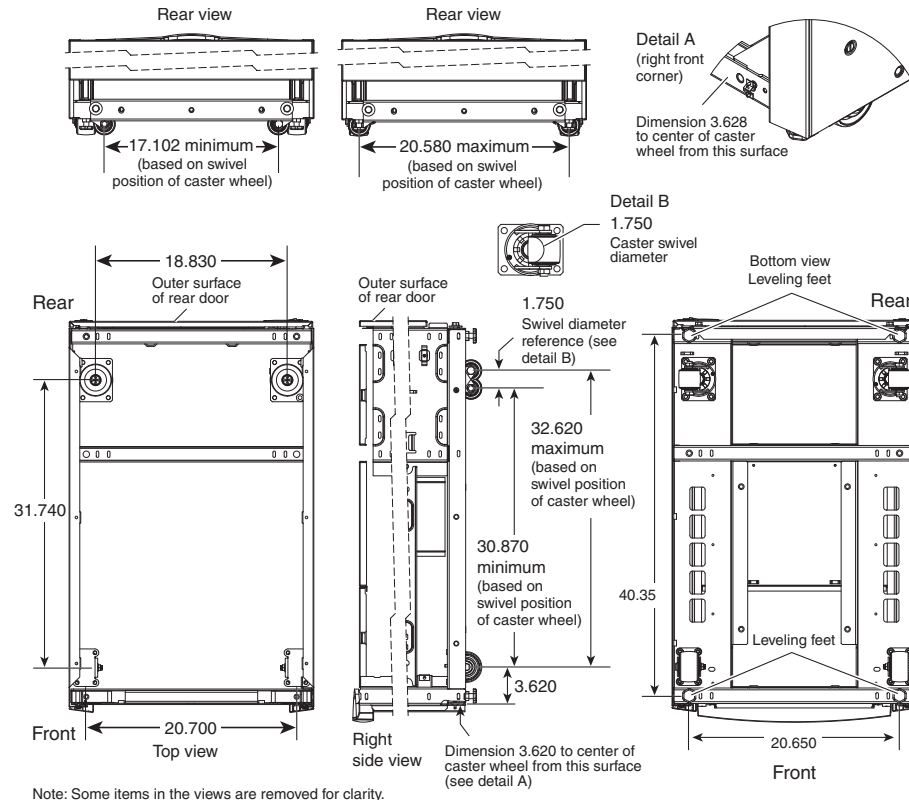


Figure 10 Caster and leveler dimensions.

CHAPTER 7

Best Practices AC power connections

This chapter describes the recommended EMC best practices for AC power connections to a customer-supplied power distribution unit (PDU).

Topics include:

- ◆ Before connecting 48
- ◆ Selecting the proper AC power connection procedure 48
- ◆ Procedure A: Working with customer electrician onsite 49
- ◆ Procedure B: Verify and connect 51
- ◆ Procedure C: Obtain customer verification 52
- ◆ Labeling the PDUs 52

Before connecting

To assure fault tolerant power, external AC power must be supplied from an independent customer-supplied power distribution unit (PDU) as shown in [Figure 11](#).

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.

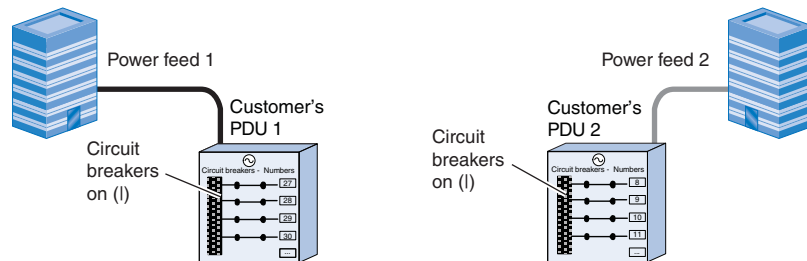


Figure 11 Two independent customer-supplied PDUs

Selecting the proper AC power connection procedure

EMC Customer Engineer must select the proper AC power connection procedure. The following table 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 15 Selecting the proper procedure

	Procedure
Customer's electrician is available at the installation site.	A ¹
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
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

1. Procedure A assures fault tolerant power in the EMC array.

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

Procedure A-1: Customer's Electrician

1. Verify that the customer supplied AC source voltage output on each PDU is within the AC power specification shown in [Table 16 on page 59](#) and [Table 17 on page 60](#). Measure the voltage output of each power cable as shown in the following figure.
2. Turn OFF all the relevant circuit breakers in customer-supplied PDU 1 and customer-supplied PDU 2.

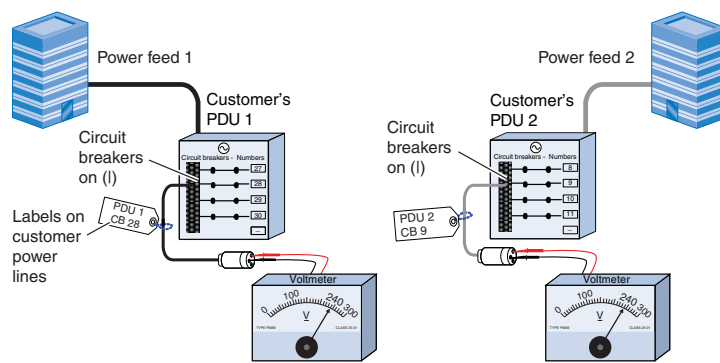


Figure 12 Circuit breakers ON — AC power within specification

3. Verify that the customer-supplied power cables connected to PDU 1 and PDU 2 have no power as shown in the following figure.

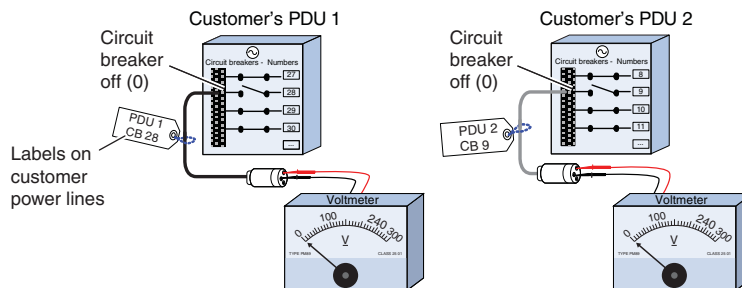


Figure 13 Circuit breakers OFF — No AC power

Procedure A-2: EMC Customer Engineer

NOTICE

This task is performed by the EMC Customer Engineer.

1. Confirm that the customer-supplied power cables are labeled and that each label contains the relevant customer-supplied PDU and the 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.
 - a. If 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 as shown in [Figure 21 on page 62](#)
 - b. If 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 20 on page 61](#).

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 22 on page 63](#) provides an example of the power zone connections label.

Procedure A-3: Customer's Electrician

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 change from green to OFF and/or flashing yellow. The yellow SPS lights flash for a maximum of 5 minutes.

Note: The 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 steps 1 and 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.”](#)

Procedure B: Verify and connect

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

- ◆ You have access to customer-supplied power cables labels (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 and make the required power connections under the floor.

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 electrician onsite”](#) to make them understand that their array may prematurely shut down in the event of a site power issue.
2. Access to customer-supplied power cables labels (beneath raised floor or overhead) and make sure they are properly labeled as shown in [Figure 13 on page 49](#) and described in [“Procedure A-2: EMC Customer Engineer.”](#)
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 [“Procedure A-2: EMC Customer Engineer”](#) and shown in [Figure 21 on page 62](#).
6. Record the customer-supplied PDU information as described in [“Procedure A-2: EMC Customer Engineer.”](#)
7. Label the PDUs as described in [“Labeling the PDUs.”](#)

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.
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-1: Customer’s Electrician”](#) to make them understand that their array may prematurely shut down in the event of a site power issue.
 2. Record the customer-supplied PDU information as described in of [“Procedure A-2: EMC Customer Engineer.”](#)
 3. Label the PDUs as described in [“Labeling the PDUs.”](#)

Labeling the PDUs

Once you have completed one of the above procedures, complete the PDU label as follows:

1. For each bay, locate and complete the customer PDU information.
2. Place the labels on the PDU cases for power zone A and power zone B.

NOTICE

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

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

Figure 14 PDU label

CHAPTER 8

Power cabling, cords and connectors

This chapter describes the power distribution unit, power cabling, and cords and connectors.

Topics include:

- ◆ Power distribution unit..... 54
- ◆ Wiring configurations 55
- ◆ Power interface 59
- ◆ Customer input power cabling..... 60
- ◆ Best practice power configuration guidelines 64
- ◆ Power extension cords, connectors, and wiring 65

Power distribution unit

The VMAX 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 [Figure 15](#) and [Figure 16](#).

Both PDUs are mechanically connected together, including mounting brackets, to create a single 2U structure, as shown in [Figure 15](#) and [Figure 16](#). 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, [Figure 17, “Single-phase, horizontal 2U PDU internal wiring”](#)
- ◆ Three-phase Delta, [Figure 18, “Three-phase \(Delta\), horizontal 2U PDU internal wiring”](#)
- ◆ Three-phase Wye, [Figure 19, “Three-phase \(Wye\), horizontal 2U PDU internal wiring”](#)

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 allow the power cables inside the machine to be routed out through the top.

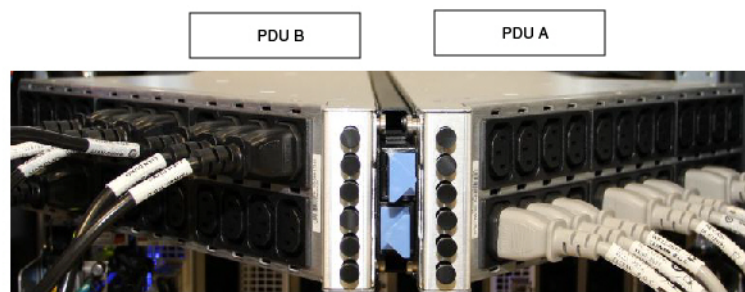


Figure 15 Power distribution unit (PDU) without installed wire bales, rear view

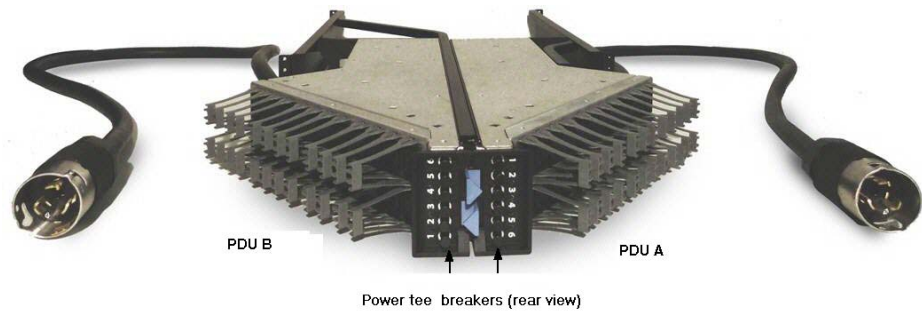


Figure 16 Example of a Power distribution unit (PDU) with installed wire bales, rear view

Wiring configurations

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

NOTICE

[Figure 17](#) to [Figure 19](#) 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.

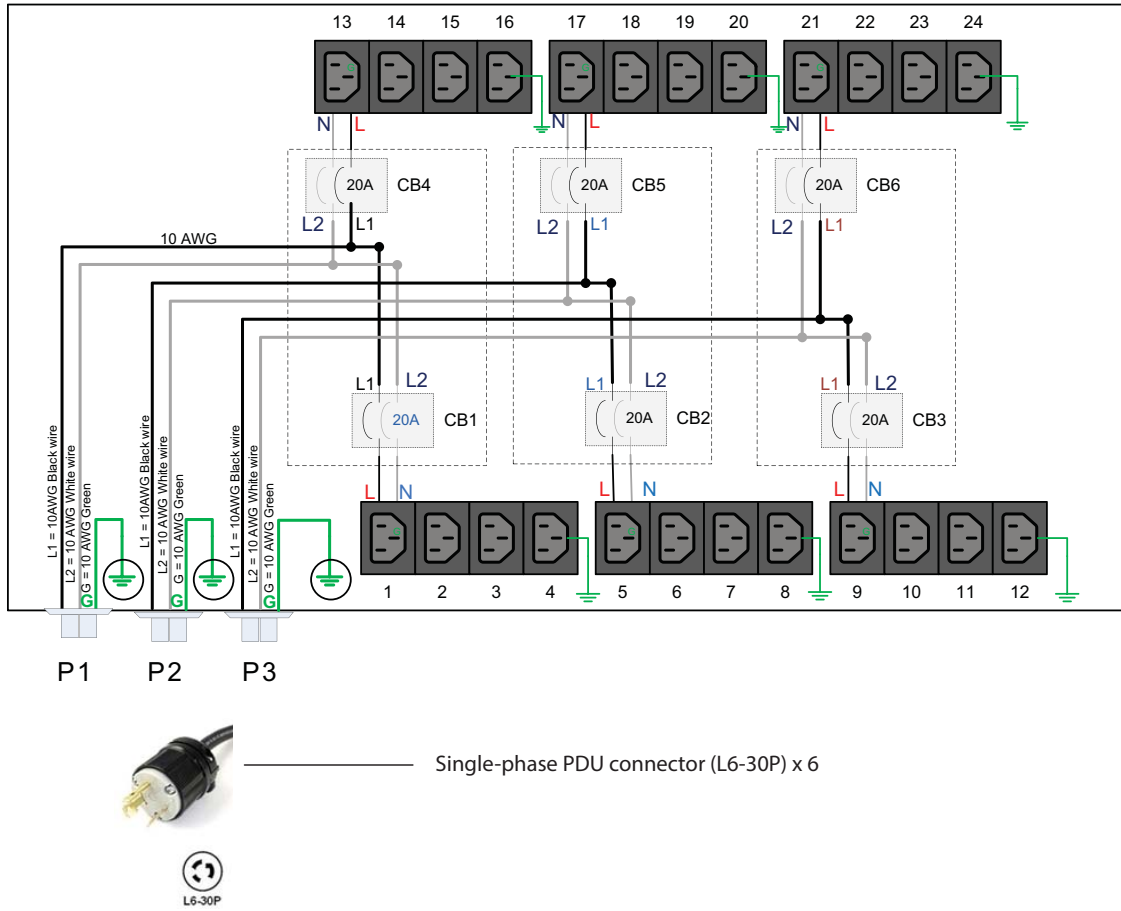


Figure 17 Single-phase, horizontal 2U PDU internal wiring

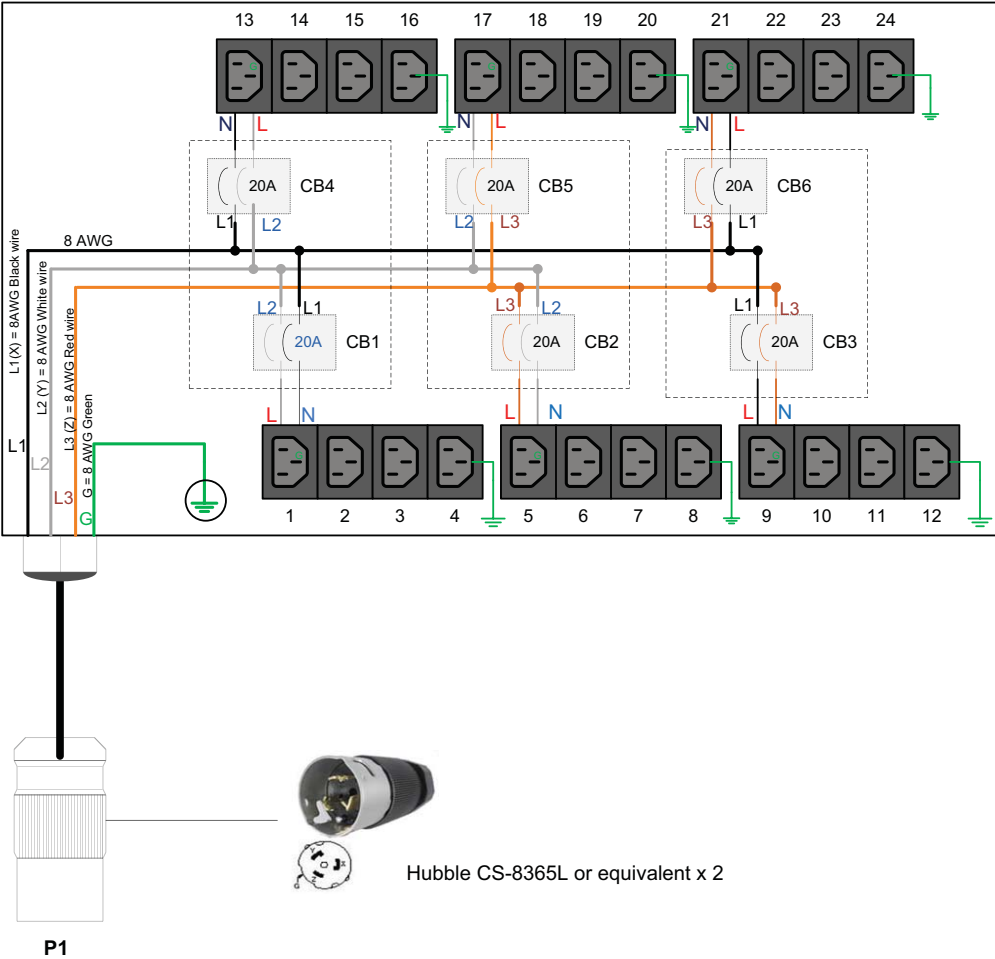


Figure 18 Three-phase (Delta), horizontal 2U PDU internal wiring

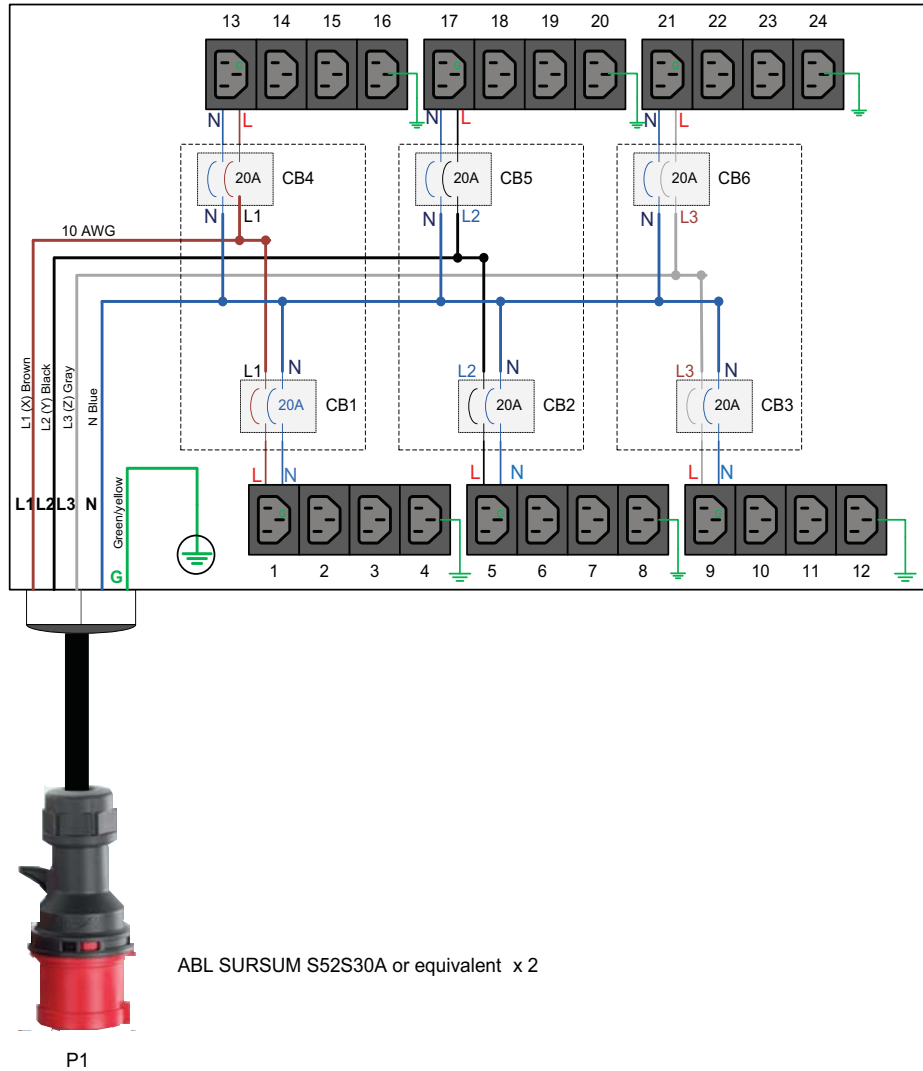


Figure 19 Three-phase (Wye), horizontal 2U PDU internal wiring

Power interface

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

Each VMAX bay in a array configuration contains a complete 2U PDU assembly. The PDU assembly is constructed with two electrically individual PDUs. Refer to [Figure 16 on page 55](#), and the wiring configurations shown in [Figure 17 on page 56](#), [Figure 18 on page 57](#), and [Figure 19 on page 58](#).

NOTICE

The customer is responsible for meeting all local electrical safety requirements.

Single-phase (North American, International, and Australian)

The following table provides the specifications for North American, International and Australian single-phase power transmission.

Table 16 Single-phase AC power

Specification	North American 3 wire connection (2 L & 1 G) ¹	International and Australian 3 wire connection (1 L & 1 N & 1 G) ¹
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	32 A
Power zones	Two	Two
Power requirements at customer site (min)	- Three 30A, single phase drops per zone. - Two power zones require 6 drops, each drop rated for 30A Note: PDU A and PDU B require three separate single phase 30A drops for each PDU. Refer to Table 18 on page 65 for PDU interface cord connection options.	

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

Three-phase (North American, International and Australian)

The following table provides specifications for North American, International and Australian three-phase power transmission.

Table 17 Three-phase AC power

Specification	North American (Delta) 4 Wire Connection (3 L & 1 G) ¹	International (Wye) 5 Wire Connection (3 L & 1 N & 1 G) ¹
Input voltage ²	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 Note: PDU A and PDU B require one separate three-phase Delta 50 A drop for each PDU. Refer to Table 20 on page 71 for PDU interface cord connection options	Two 32 A, three-phase drops per bay Note: PDU A and PDU B require one separate three-phase Wye 32A drop for each PDU. Refer to Table 19 on page 69 and Table 21 on page 73 for PDU interface cord connection options

1. L = line phase, N = neutral, G = ground

2. 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

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.

IMPORTANT

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

Customer input power cabling, single-phase

The following figure shows the customer single-phase input power cabling.

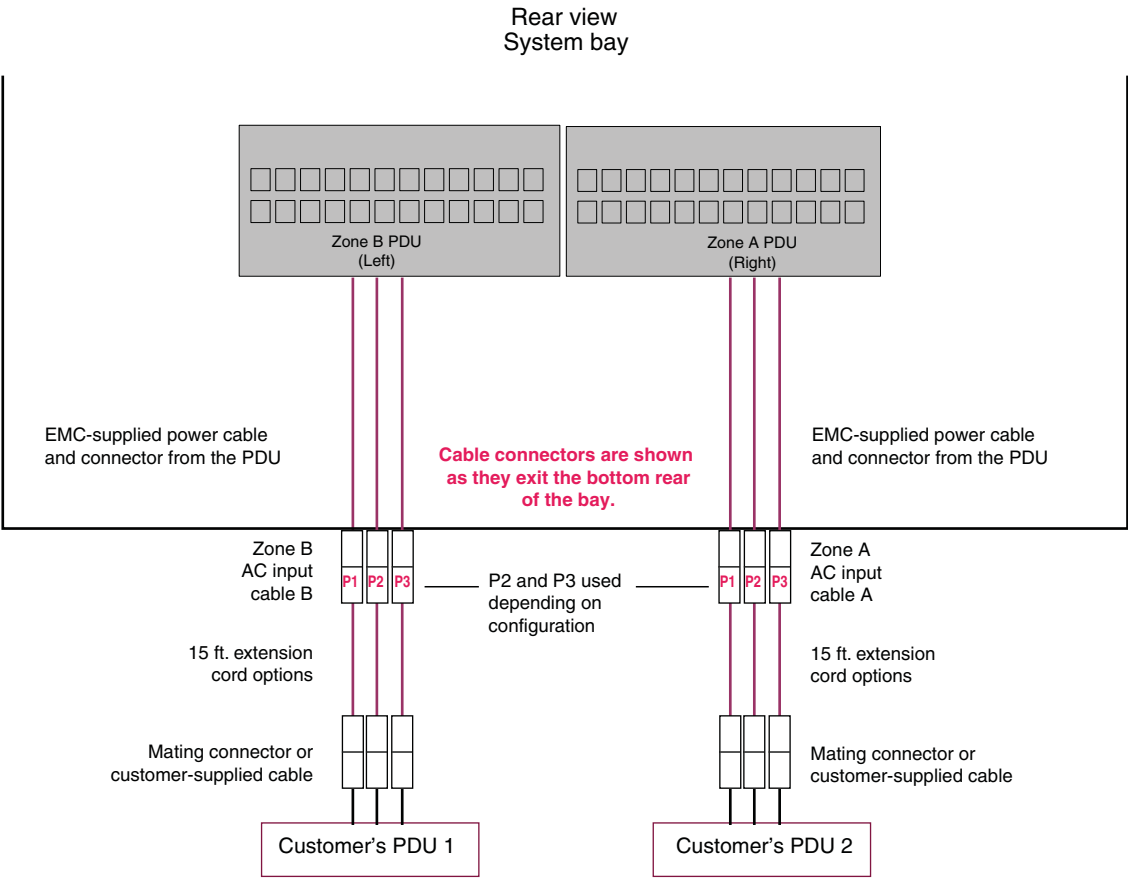


Figure 20 Customer input power cabling, single-phase

Customer input power cabling, three-phase (Wye or Delta)

The following figure shows the customer three-phase (Wye or Delta) input power cabling.

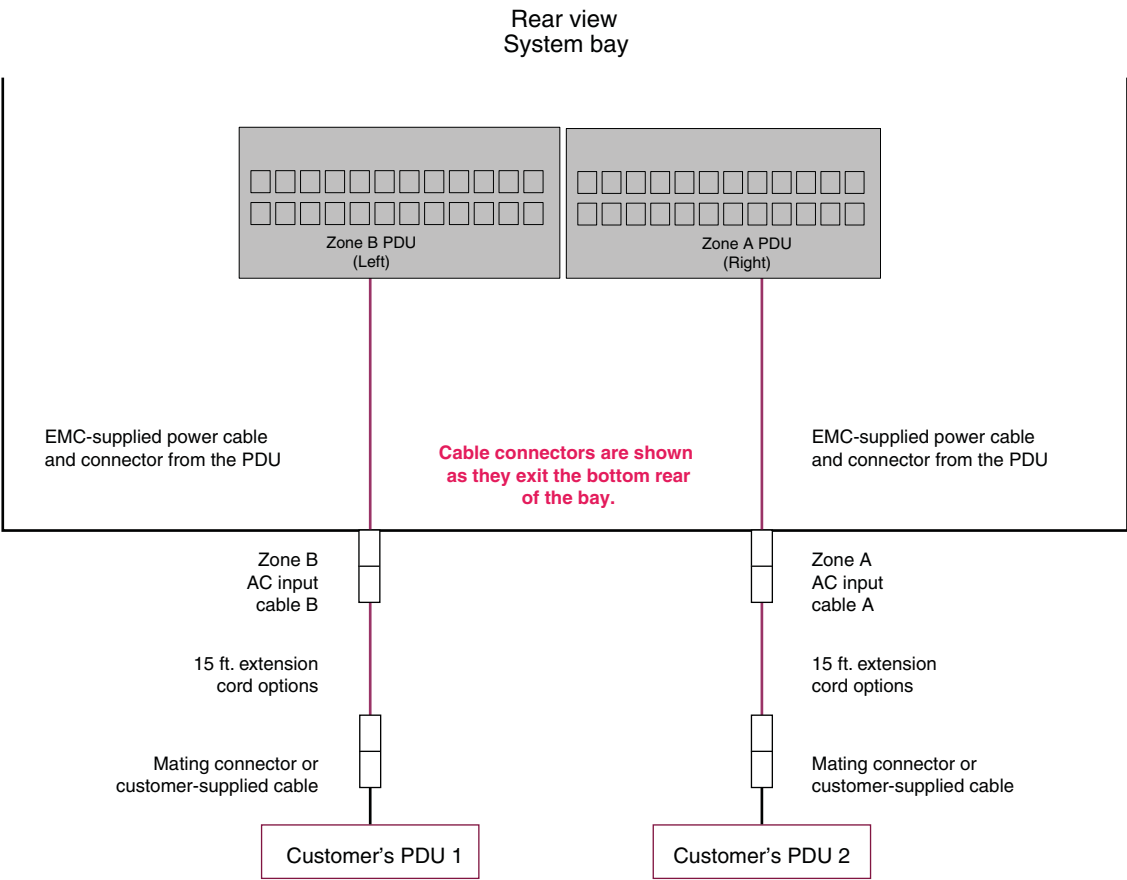


Figure 21 Customer input power cabling, three-phase (Wye or Delta)

AC power source connections

The following figure shows the label attached to each of the power cables exiting the system bay. The label shows the bay *incorrectly* cabled to one power source and *correctly* cabled to two separate independent power sources.

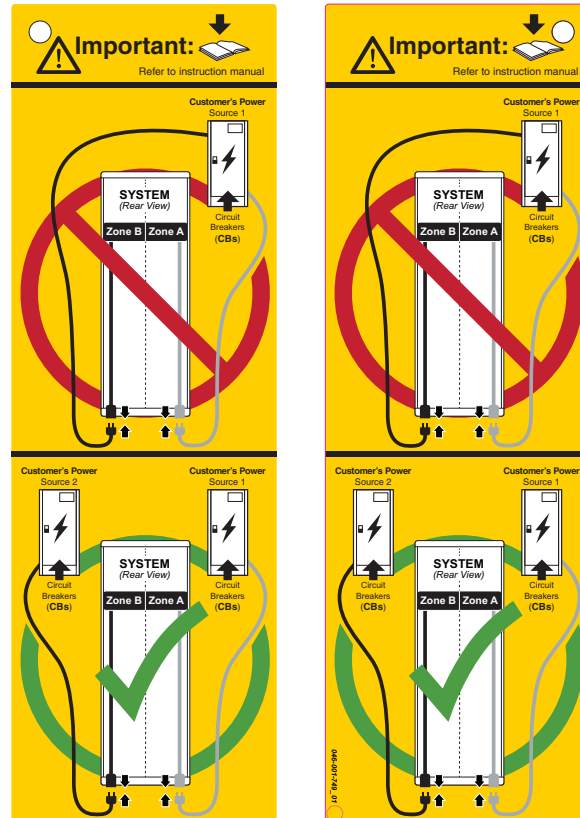


Figure 22 Correct and incorrect connection to redundant power sources

NOTICE

Two separate customer site PDUs are required. Failure to provide power from separate, independent PDUs could result in data unavailability.

Best practice 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 VMAX array:

- ◆ 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 VMAX 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 VMAX 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 ([Figure 17 on page 56](#) to [Figure 19 on page 58](#)).

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) as shown in [Figure 20 on page 61](#) and [Figure 21 on page 62](#).

Single-phase

The following table describes 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 ¹	EMC supplied extension cord EMC model number ²³	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 Figure 23 on page 66	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 Figure 24 on page 67	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 Figure 25 on page 67	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 Figure 26 on page 68	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 
	VS3-PW40 L7-30 Figure 27 on page 68	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 

1. Six (6) plugs per system bay,
2. Two (2) cords per model, cord length of 15 feet / 4.57 meters.
3. 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 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.

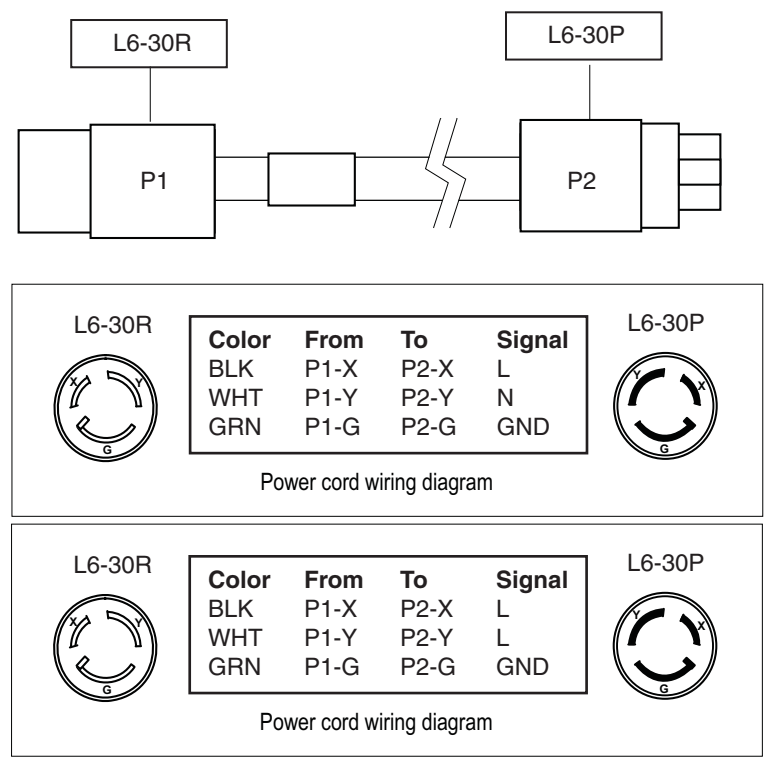


Figure 23 E-PW40U-US, single-phase

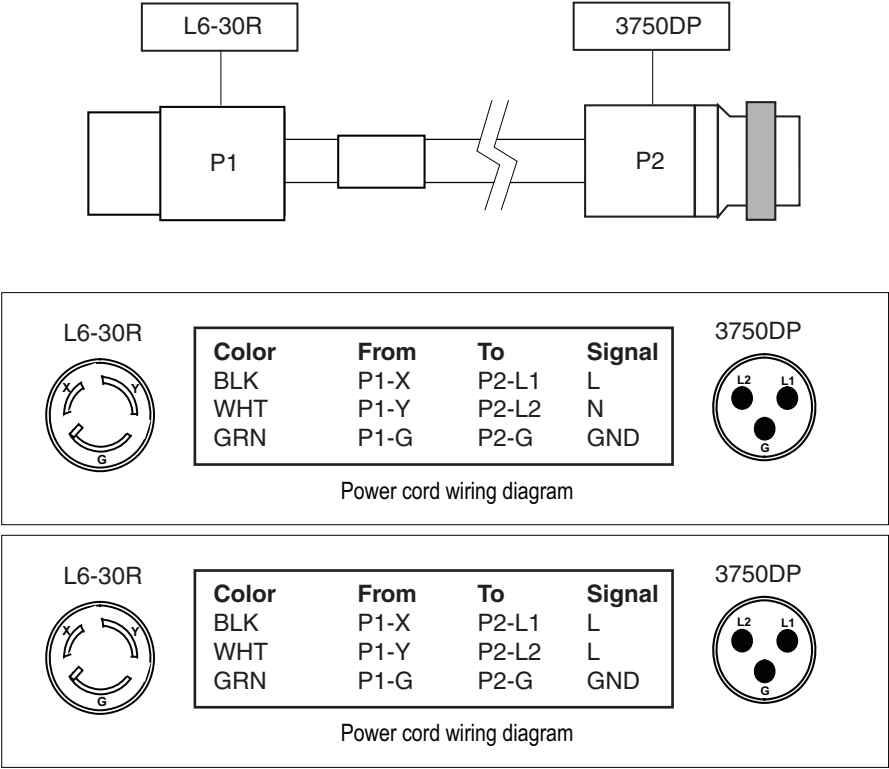


Figure 24 E-PW40URUS, single-phase

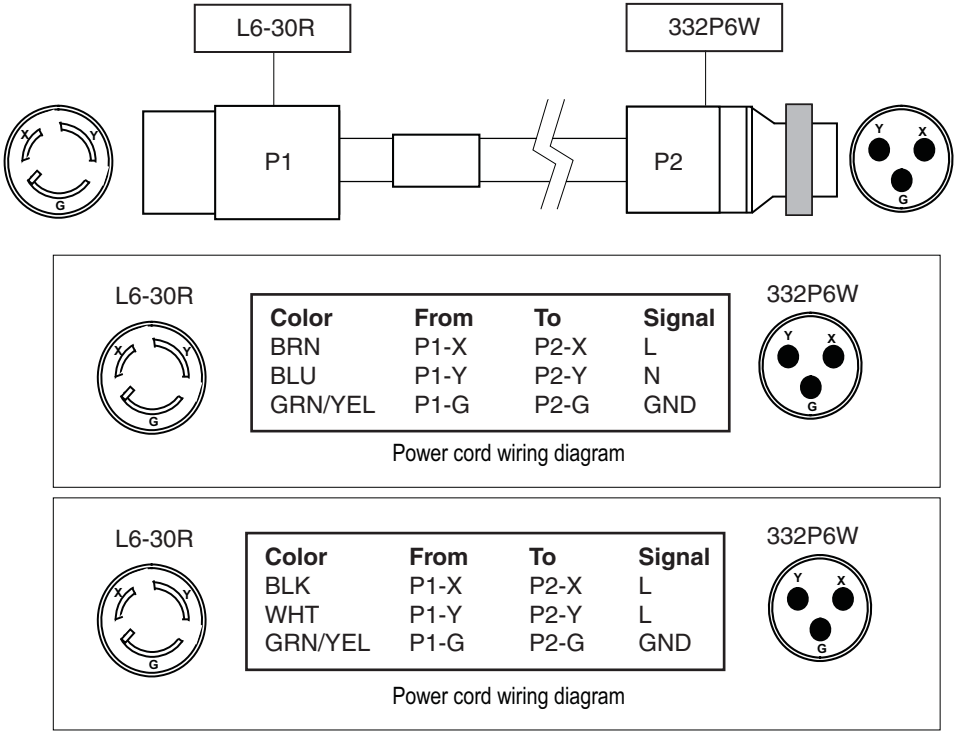


Figure 25 E-PW40UIEC3, single-phase

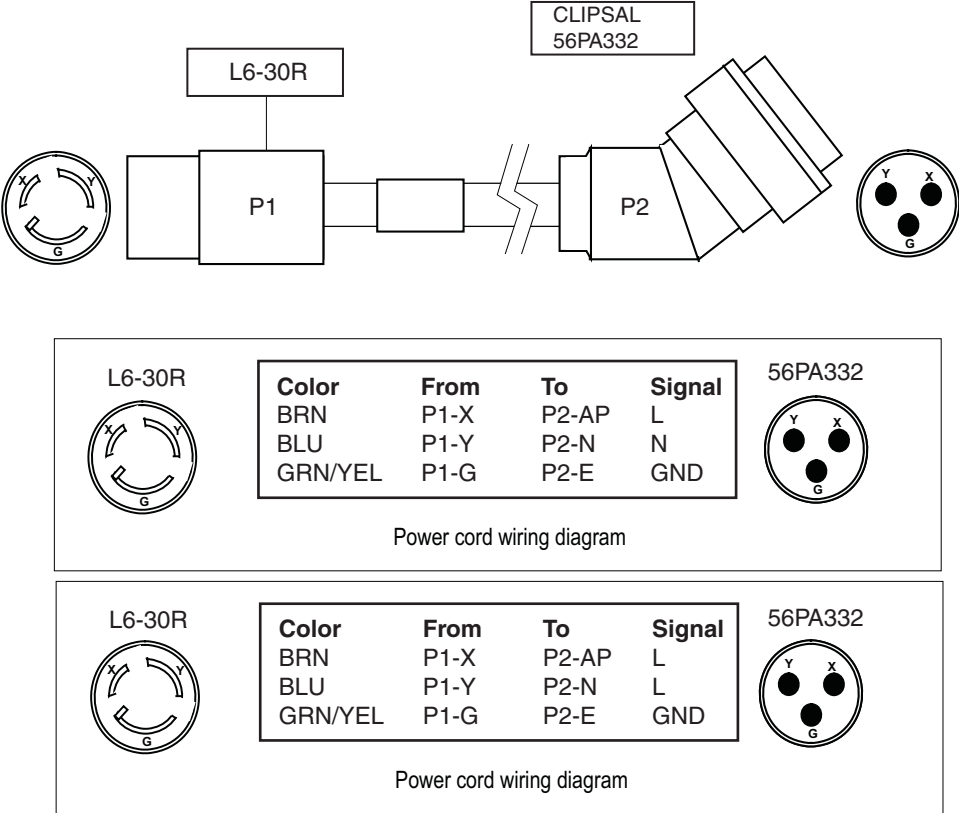


Figure 26 E-PW40UASTL, single-phase

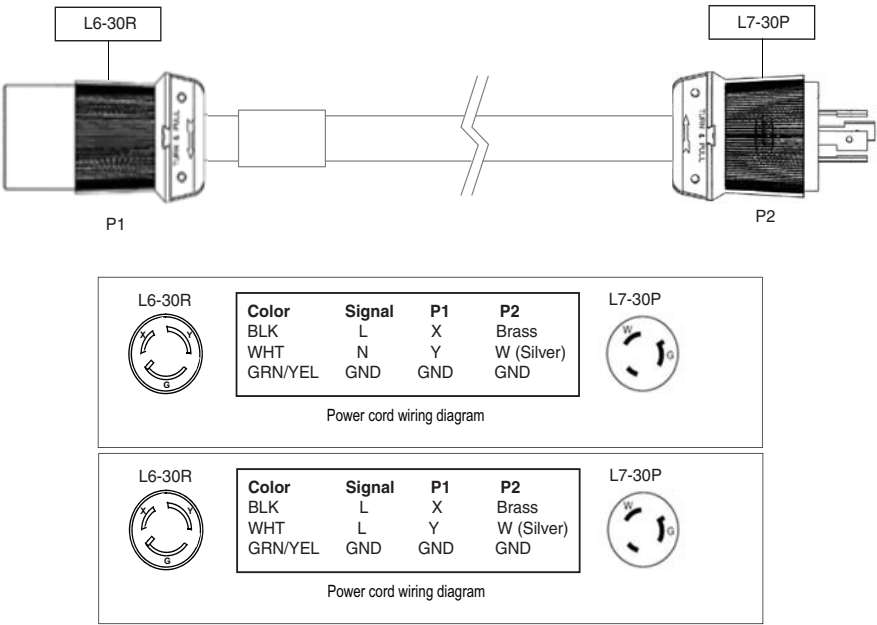


Figure 27 VS3-PW40 L7-30, single-phase

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 ¹	EMC supplied extension cord EMC model number ²	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 ³ Figure 28 on page 70	038-003-274 (BLK 15FT) 038-003-791 (GRY 15FT)	ABL Sursum K52.30 	Flying Leads (International) 	Determined by customer
	E-PCBL3YAG Figure 29 on page 70	038-003-273 (BLK 15FT) 038-003-790 (GRY 15FT)	ABL Sursum K52.30 	GARO P432-6S 	GARO S432-6 
	E-PC3YAFLA Figure 30 on page 71	038-003-275 (BLK 15FT) 038-003-792 (GRY 15FT)	ABL Sursum K52.30 	Flying Leads (N. America) 	Determined by customer

1. Two (2) plugs per bay.
2. Two (2) cords per model, cord length of 15 feet / 4.57 meters.
3. 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.

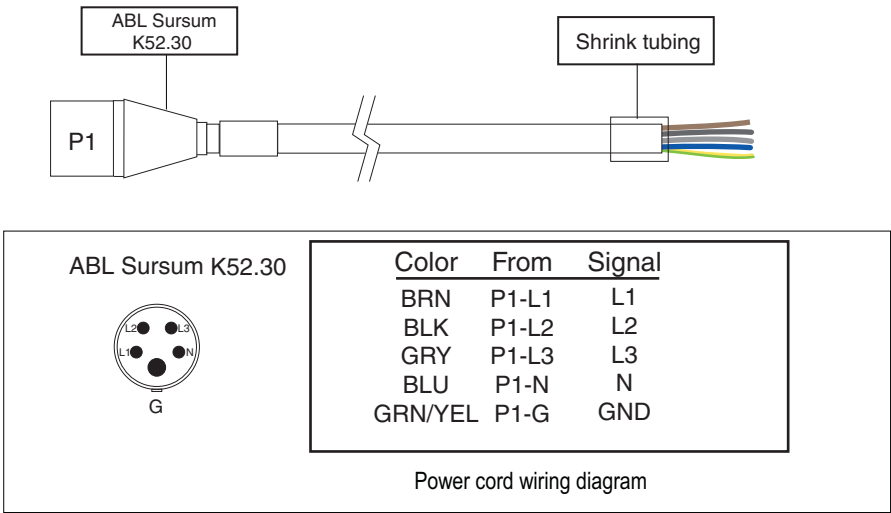


Figure 28 E-PC3YAFLE, flying leads, three-phase, international

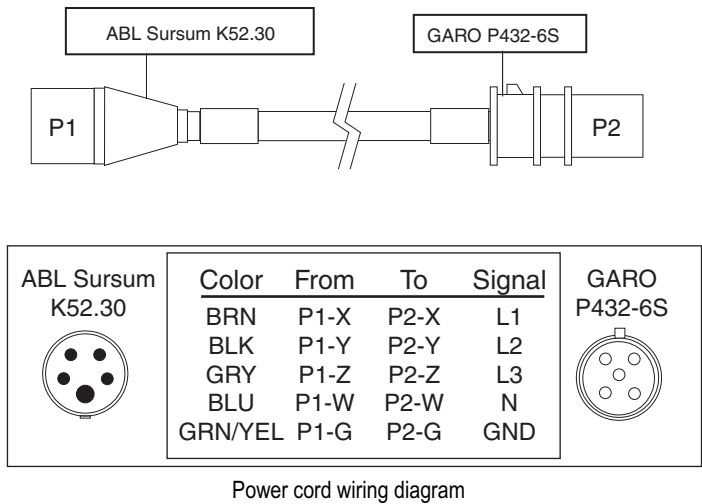


Figure 29 E-PCBL3YAG, three-phase, international

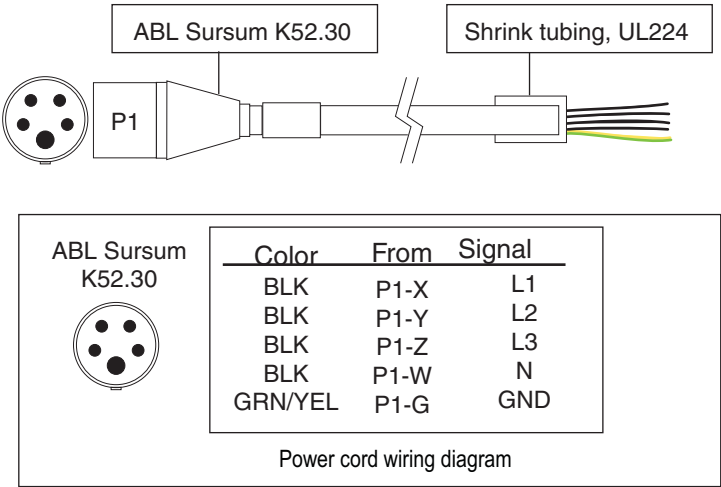


Figure 30 E-PC3YAFLA, flying leads, three-phase, international

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 ¹	EMC supplied extension cord EMC model number ²	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
	E-PCBL3DHR ³ Figure 31 on page 72	038-003-272 (BLK 15FT) 038-003-789 (GRY 15FT)			
	E-PCBL3DHH Figure 32 on page 72	038-003-271 (BLK 15FT) 038-003-788 (GRY 15FT)			

- 1. Two (2) plugs per bay.
- 2. Two (2) cords per model, cord length of 15 feet / 4.57 meters.
- 3. 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.
- 4. 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.

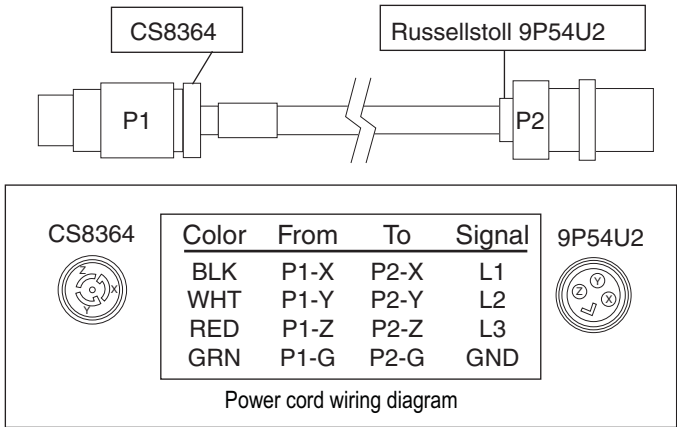


Figure 31 E-PCBL3DHR, three-phase, North American, Delta

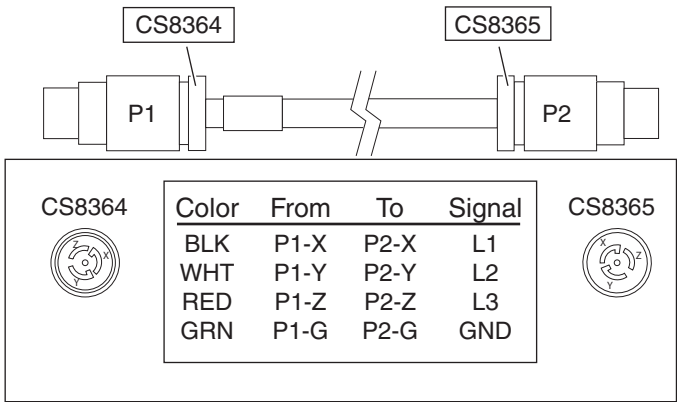


Figure 32 E-PCBL3DHH, three-phase, North American, Delta

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 array ¹	EMC supplied extension cord EMC model number ²	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 ³ Figure 33 on page 74	038-004-305 (BLK 15FT) 038-004-306 (GRY 15FT)			

1. Two (2) plugs per bay.
2. Two (2) cords per model, cord length of 15 feet / 4.57 meters.
3. 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, Wye and Domestic)

The following figures provide cable descriptions for models with three-phase Wye domestic power transmission.

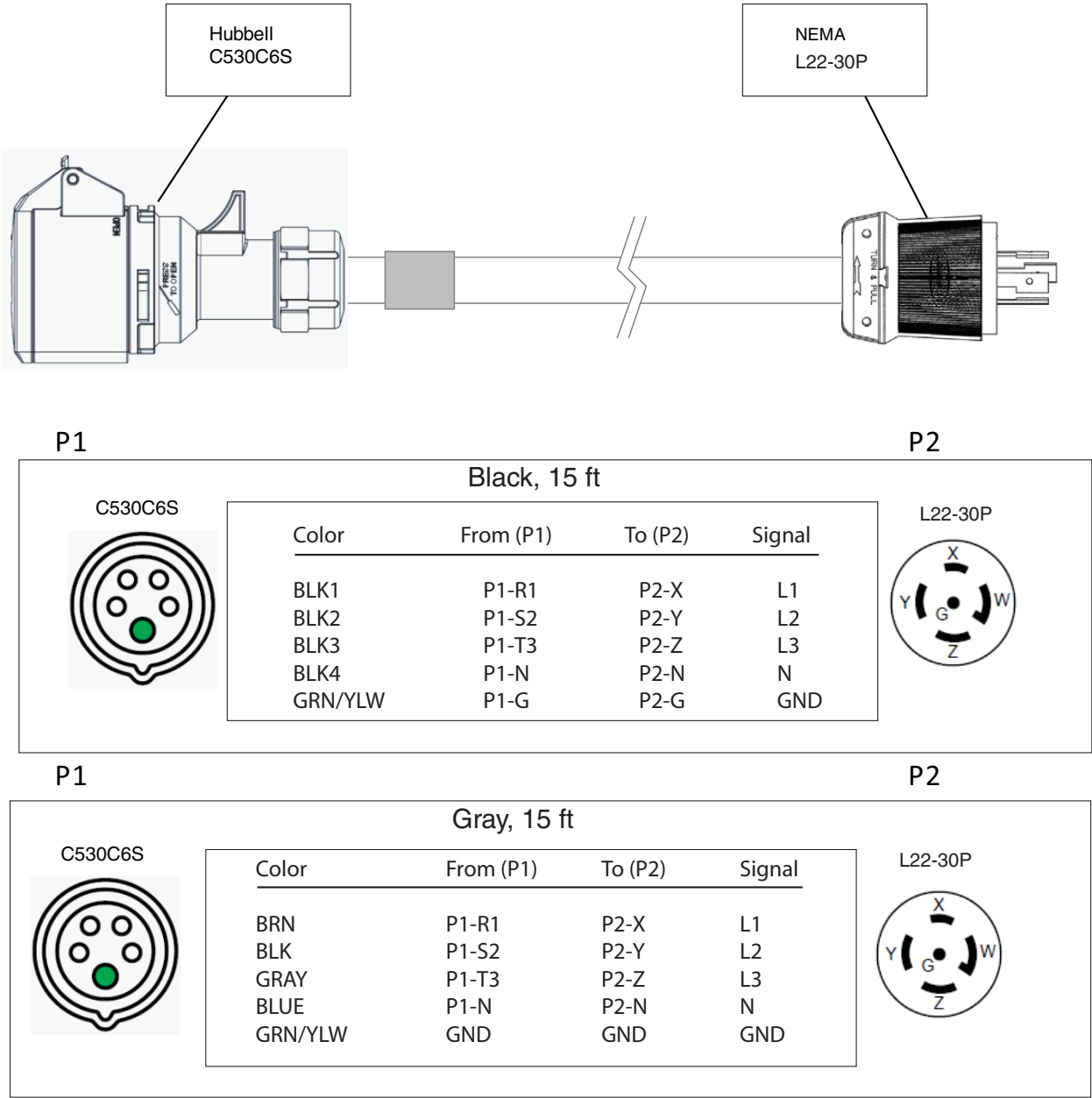


Figure 33 E-PCBL3YL23P, three-phase, domestic (black and gray)

CHAPTER 9

Third party racking option

This chapter describes the third party racking option.

Topics include:

- ◆ Computer room requirements..... 76
- ◆ Rack requirements 76

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 (76.2 cm) rear clearance is required to provide adequate airflow and to allow for system service.

NOTICE

The customer is ultimately responsible for ensuring that the data center environment meets the specifications and/or requirements outlined in this guide before proceeding with the third party racking option.

The completion of the *Third Party Rack Solution Verification* form at the time of ordering is mandatory to ensure compliance.

Rack requirements

The VMAX array components are shipped in a fully tested EMC rack, and are installed by 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 as described in [“Floor load-bearing capacity”](#).

- ◆ 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.

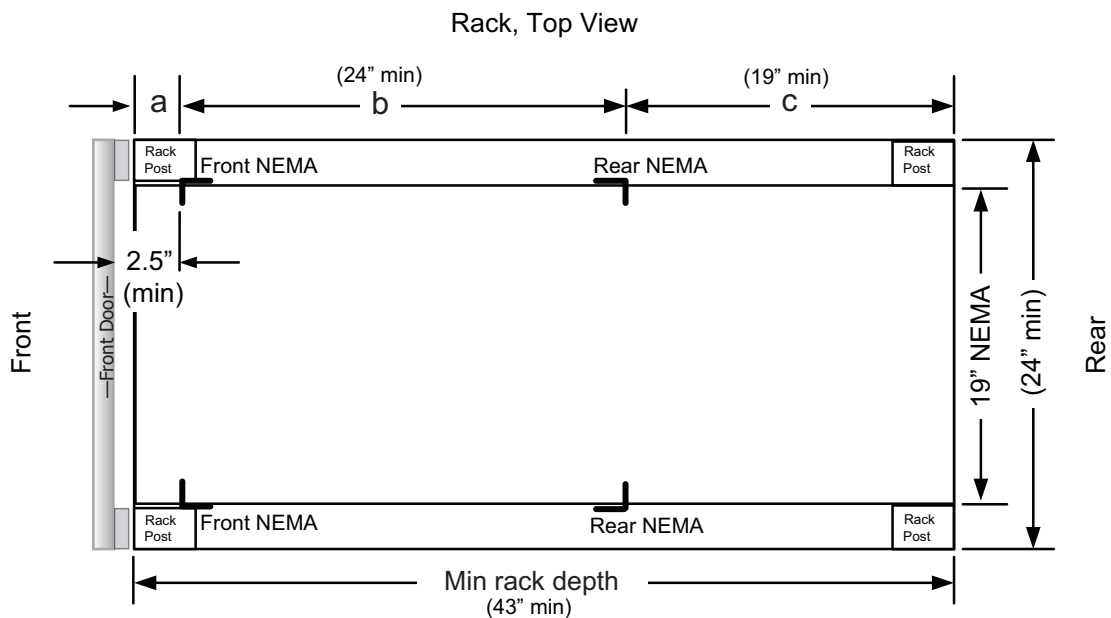
- ◆ Non-dispersed rack-to-rack pass-through cable access at least 3 inches (7.6 cm) in diameter must be available via side panels or horizontal through openings.
- ◆ To ensure proper clearance and air flow to the array components, customer supplied front doors and standard bezels, if used, must include 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.

Customer rack dimension requirements

The following figure illustrates the 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".

Min rack depth = a + b + c

Figure 34 Rack requirements

Third party racking option

CHAPTER 10

Optional kits

This chapter discusses the optional kits provided by EMC.

Topics include:

- ◆ Overhead routing kit 80
- ◆ Dispersion kits 80
- ◆ Securing kits 81
- ◆ GridRunner kit and customer-supplied cable trough 81

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 ¹	Bottom routing kit

1. 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 for the dispersed engine and for the MIBE in system bay 1. 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 4 DSP CBLOPTICS KIT
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 bays. The brackets are attached to the floor using bolts that engage the flooring substructure provided by the customer.

The *EMC VMAX 100K, 200K, 400K Family Securing Kit Installation Guide* provides instructions on how to install.

Table 24 Securing kits models

Model	Kit contents
E-SECURE (Secure kit for single bay)	• (2) ANTI-MOVE BRACKET, front/rear (floor) securing brackets, short • (2) SEISMIC RESTRAINT BRACKET, right/left (floor) securing brackets, long • (12) BLACK OXIDE STEEL EXTRA THICK FLAT WASHER • (12) SCREW.HEX CAP.GRADE 8.BLACK OXIDE, 3/8-1
E-SECUREADD (Secure kit for joining bays)	• (2) ANTI-MOVE BRACKET, front/rear (floor) securing brackets, short • (1) JOINING BRACKET; M TO M OR T TO T. (Top) • (6) BLACK OXIDE STEEL EXTRA THICK FLAT WASHER • (6) SCREW.HEX CAP.GRADE 8.BLACK OXIDE, 3/8-1 • (4) SCREW,HEX CAP,GRADE 8,BLACK OXIDE,1/2 13 • (4) BLACK OXIDE STEEL EXTRA THICK FLAT WASHER

GridRunner kit and customer-supplied cable trough

Using an EMC GridRunner™ (E-BOT-KIT, bottom routing kit) and customer-supplied cable trough can help organize and protect subfloor cables that connect separated bays. Because GridRunners reduce the vertical drop of the dispersion cables, using them can also increase the distance between the separated bays.

Each Gridrunner supports the cable bundle above the subfloor and are installed with brackets that attach to the stanchions under the raised floor. The brackets attach to stanchions that 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.

