PLANNING GUIDE

EMC® Symmetrix® VMAX® Family

Physical Planning Guide

October, 2013

Rev 03

This document describes physical planning for EMC® Symmetrix® VMAX® 10K (SN xxx987xxxx), VMAX® 20K, and VMAX® 40K systems with Enginuity™ operating environment. Topics include:

EMC²

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.

Audience

This manual provides physical planning information about EMC® Symmetrix® VMAX® 10K (SN xxx987xxxx), VMAX® 20K, and VMAX® 40K systems running Enginuity™ operating environment. This document is intended for use by customers or EMC representatives who wish to plan the purchase or installation of a Symmetrix system.

Note: The VMAX® 10K (SN xxx987xxxx) is referred to in the rest of the guide as VMAX 10K.

Related documentation and changes

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

General platform documentation

- *EMC Symmetrix VMAX Family Documentation Set* — Contains the hardware platform product guide, physical planning guide, TimeFinder product guide, SRDF product guide, front-end port layout diagrams, best practices guide for AC power connections, unpacking guide, power up and power down procedures, instructions for installing securing kits and silencer kits, and the Data at Rest Encryption deployment guide for the Symmetrix VMAX Family (10K, 20K, and 40K).
- *EMC Symmetrix System Viewer for Desktop and iPad®* — Illustrates the system hardware, incrementally scalable system configurations, and available host connectivity offered for Symmetrix systems.

Where to get help

EMC support, product, and licensing information can be obtained on the EMC Online Support site as described next.

Note: 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.

Product information

For documentation, release notes, software updates, or for information about EMC products, licensing, and service, go to EMC Online Support (registration required) at:

http://support.EMC.com

Technical support

EMC offers a variety of support options.

Support by Product — EMC offers consolidated, product-specific information on the Web at:

https://support.EMC.com/products

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, discussion, relevant Customer Support Forum entries, and a link to EMC Live Chat.

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- North America, Latin America, APJK, Australia, New Zealand: SVC4EMC (800-782-4362) and follow the voice prompts.
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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:

techpubcomments@emc.com

Document change history

Table 1 on page 4 provides a description of document changes based on the operating environment release. The *EMC® Symmetrix® VMAX® Family Arrays with Enginuity™ Operating Environment Release Notes* contain supplemental information about release features.

Table 1 Change history

Revision	Description or change	Enginuity Operating Environment
01	Initial release of combined platforms running Enginuity Operating System.	5876 Q2 2013 SR
02	• Addition of VMAX 10K File and 16 Gb/s Front End I/O module. • Addition of orderable WYE cables to "Power extension cords, connectors, and wiring" on page 74.	5876 Q2 2013 SR
03	• Fixed error on dispersion on page 38.	5876 Q2 2013 SR

Planning overview

When planning the installation site for your Symmetrix system, meet with your EMC Systems Engineer and EMC Customer Engineer to complete the installation planning task sheet and the presite survey. One or more planning sessions may be necessary to finalize all the details related to installation.

The Symmetrix system is designed for installation in a properly equipped data center that provides sufficient physical space, controlled temperature and humidity, proper airflow and ventilation, proper power and grounding, system cable routing facilities, and fire protection.

Table 2 on page 5 describes the responsibilities of EMC personnel and customers at the first planning session.

Table 2 Preinstallation responsibility summary

EMC	Customer
Provide all details necessary for site planning and preparation.	Provide an environment that supports safe installation of the Symmetrix system and promotes its reliable long-term operation.
Symmetrix VMAX 10K systems may be installed in a customer-supplied rack that conforms to the National Electrical Manufacturers Association (NEMA) standard for 19-inch cabinets. If installation includes a customer-supplied rack, identify each branch circuit before installing Symmetrix components.	Complete the *EMC PDU Power Connection Worksheet for Symmetrix in 3rd Party Racks* worksheet with your site electrician to identify each branch circuit before installing Symmetrix components into a 3rd party rack. "VMAX 10K 3rd party racking option" on page 83 provides additional details.
Complete and process the Installation Planning Task Sheet and presite survey in DXCX.	Provide the appropriate connection for ConnectEMC to dial home to the EMC Support Center: • Analog telephone line for modem • Ethernet connection for ESRS • Ethernet connection for ESRS Symmetrix based ESRS Client • Ethernet connection to customers network. Additionally, provide power, cooling and ventilation, humidity control, floor load capability, system placement, and service clearances as required in the data center.
Arrange for shipment and delivery through appropriate method.	Participate in planning sessions as required to ensure a smooth and uncomplicated installation.
Install the system.	Both EMC customer service and the customer are responsible for running various scripts during the entire installation process.

Safe system delivery

The following are considerations that must be taken into account prior to the delivery of the Symmetrix system at your site, including:

- 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.

Transportation and delivery guidelines

Symmetrix systems delivered within the United States or Canada travel by air-ride truck. Each Symmetrix system is protected by custom-designed shipping material, crated, and palletized.

Symmetrix systems delivered internationally normally involve 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 systems. These companies provide the appropriate personnel, floor layments, and any ancillary moving equipment required to facilitate delivery.

Make sure that the moving companies check the *EMC Unpacking Guide* for general guidelines, weights, and dimensions.

IMPORTANT

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

Moving systems up and down inclines

Because the Symmetrix systems are heavier in front, follow these guidelines to prevent tipping when moving the system up and down inclines:

- When moving the cabinet down an incline, the rear 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 requirements

Table 3 on page 7 provides the environmental requirements for shipping and storing a Symmetrix system.

Table 3 Storage environmental requirements

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

Radio Frequency Interference (RFI) requirements

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 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. Table 4 on page 8 can be used as a guideline to check if the cell phone repeater or other intentional radiator device is at a safe distance away from the EMC Corporation equipment.

Table 4 Minimum recommended 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

Table 5 on page 9 through Table 10 on page 12 contain information about Symmetrix system power consumption and heat dissipation.

- All system and storage bay values are calculated based on fully loaded bays.
- The power consumption totals are steady-state maximum operation at 25° C. After the loss and return of AC power, the batteries in the standby power supply (SPS) units go into recharge mode for up to 8 hours and consume 20 percent more power than the totals shown.

Calculations in these tables are intended to provide maximum power and heat dissipation. Ensure that the installation site for the system meets these worst case requirements.

EMC provides the EMC Power Calculator, located at http://powercalculator.emc.com to refine the power and heat figures, shown here, to more closely match your Symmetrix system. Contact your EMC Sales Representative or use the EMC Power Calculator for specific supported configurations.

VMAX 10K systems

Power consumption and heat dissipation values vary based on the number and type of system and storage bays.

Standard storage bays

Table 5 on page 9 shows the power consumption and heat dissipation for Symmetrix VMAX 10K systems with standard storage bays and energy-efficient power supply (EEPS)

Table 5 Power consumption and heat dissipation - energy-efficient power supplies

System configuration description	Total power consumption (kVA)	Heat dissipation (kBtu/Hr)
Storage bay	3.9	12,300
System bay 1	3.9	12,400
System bay 2	4.0	12,800
System bay 3 or System bay 4	3.8	12,000

High density storage bays

Table 6 on page 10 shows the power consumption and heat dissipation for Symmetrix VMAX 10K stems with standard storage bays and standard power supplies.

Note: Depending on your geographical area, the VMAX 10K may support different hardware configurations. Contact your EMC representative for more information.

Table 6 Power consumption and heat dissipation - standard

System configuration description	Total power consumption (kVA)	Heat dissipation (kBtu/Hr)
Storage bay	4.6	14,800
System bay 1	4.5	14,500
System bay 2	4.6	14,900
System bay 3 or System bay 4	4.4	14,200

Table 7 on page 10 shows the power consumption and heat dissipation for systems with high density storage bays.

Table 7 Power consumption and heat dissipation - high density

System configuration description	Total power consumption (kVA)	Heat dissipation (kBtu/Hr)
System bay 1	4.05	12,600
System bay 2	4.15	13,000
System bay 3 or System bay 4	3.95	12,200

Table 8 on page 10 shows the power consumption and heat dissipation for systems with VMAX 10K File components

Table 8 Power consumption and heat dissipation - VMAX 10K File components

System configuration description	Total power consumption (kVA)	Heat dissipation (kBtu/Hr)
System bay 1 with VMAX 10K File components (systems with high density bays)	5.35	16,700
Storage bay with VMAX 10K File components (systems with standard and mixed standard and high density bays)	3.9	12,200

Mixed standard and high density bays

In systems with mixed standard and high density storage bays, power consumption and heat dissipation values will vary based on the number and type of storage bays selected.

VMAX 20K and 40K systems

Table 9 on page 11 shows the power consumption and heat dissipation for Symmetrix VMAX 20 and Symmetrix 40K systems with standard storage bays.

Table 9 Standard storage bay power consumption and heat dissipation

System configuration description	Total power consumption (kVA)	Heat dissipation (Btu/Hr)
Standard storage bay		
VMAX 40K	5.3	16,900
VMAX 20K	6.1	19,800
System bay (fully loaded)		
VMAX 40K	7.2	24,000
VMAX 20K	7.8	26,300
System bay with one storage bay (two engines)		
VMAX 40K	7.5	24,300
VMAX 20K	8.3	27,200
System bay with two storage bays (four engines)		
VMAX 40K	14.5	46,800
VMAX 20K	16.3	53,300
System bay with four storage bays (six engines)		
VMAX 40K	26.8	86,200
VMAX 20K	30.4	99,200
System bay with six storage bays (eight engines)		
VMAX 40K	39.0	125,500
VMAX 20K	44.4	145,100
System bay with seven storage bays (eight engines)		
VMAX 40K	44.3	142,500
VMAX 20K	50.5	164,900
System bay with eight storage bays (eight engines)		
VMAX 40K	49.6	159,400
VMAX 20K	56.6	184,700

Table 10 on page 12 provides the power consumption and heat dissipation for Symmetrix VMAX 20 and Symmetrix VMAX 40K systems with high density storage bays.

Table 10 High density storage bays power consumption and heat dissipation

System configuration description	Total power consumption (kVA)	Heat dissipation (Btu/Hr)
High density storage bay	4.9	15,200
System bay (fully loaded) VMAX 40K VMAX 20K	 7.2 7.8	 24,000 26,300
System bay with one high density storage bay (two engines) VMAX 40K VMAX 20K	 7.1 7.1	 22,700 22,700
System bay with two high density storage bays (four engines) VMAX 40K VMAX 20K	 13.6 13.8	 43,400 44,200
System bay with four high density storage bays (six engines) VMAX 40K VMAX 20K	 25.0 25.4	 79,500 81,000
System bay with six high density storage bays (eight engines) VMAX 40K VMAX 20K	 36.3 37.0	 115,500 117,800
System bay with seven high density storage bays (eight engines) VMAX 40K VMAX 20K	 41.2 41.9	 130,700 133,100
System bay with eight high density storage bays (eight engines) VMAX 40K VMAX 20K	 46.1 46.7	 146,000 148,300

System airflow requirements

Symmetrix systems are flexible and able to cool in a variety of data center cooling environments. Systems are designed for installation:

- On raised or nonraised floors
- In hot aisle/cold aisle arrangements
- In traditional front-to-back orientation (with solid rear doors)
- In fully ducted ceiling return environments.

Symmetrix systems offer solid and perforated door choices, based on system model, and described in "VMAX 10K systems" on page 13 and "VMAX 20K and VMAX 40K systems" on page 15. For data centers with cooling strategies that call for a hot aisle containment design, perforated rear doors are recommended. Where strategies involve directing the air in the hot aisle towards the ceiling, solid doors are preferred.

In all cases, the intent is to provide 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 (PLU). Additional efficiency can be achieved by sequestering the exhaust air completely and ducting directly to a CRAC unit or to the outside.

If the system is installed on a raised floor, EMC recommends the placement of a perforated floor tile in front of each bay, to allow adequate cooling air supply.

VMAX 10K systems

Symmetrix VMAX 10K system and storage bays are available with perforated front and rear doors. Systems with perforated doors draw air from the front door and exhaust through the perforated rear door and top cover. The exhaust air is directed towards the rear in a hot aisle arrangement.

Figure 1 on page 14 shows the air flow of the Symmetrix system in a typical data center cooling environment

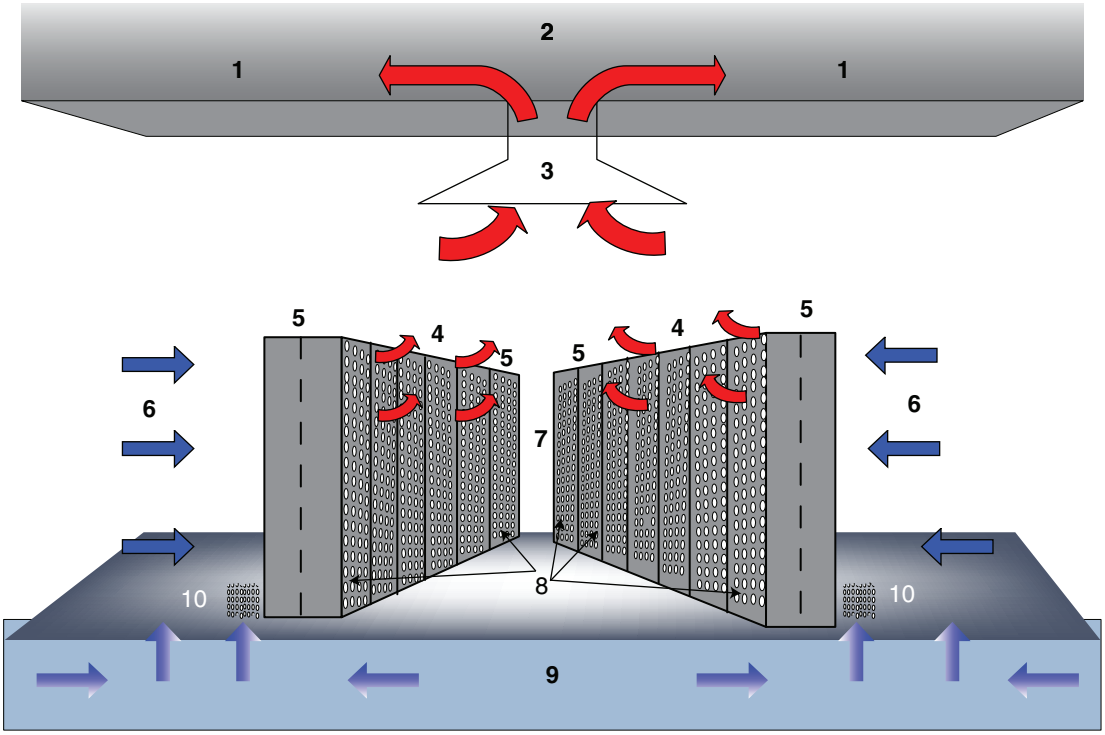


Figure 1 System airflow, VMAX 10K systems

VMAX 20K and VMAX 40K systems

VMAX 20K and 40K systems provide perforated rear doors on system bays, and offer either perforated or solid rear doors on high density and standard storage bays.

- Storage bays with solid rear doors draw air from the front and channel exhaust air towards the ceiling.
- System and storage bays with perforated doors draw air from the front door and exhaust through the perforated rear door and top cover.

Figure 2 on page 15 shows the airflow of a Symmetrix system in a typical data center cooling environment. The configuration in this example includes separated standard storage bays in a hot aisle/cold aisle arrangement.

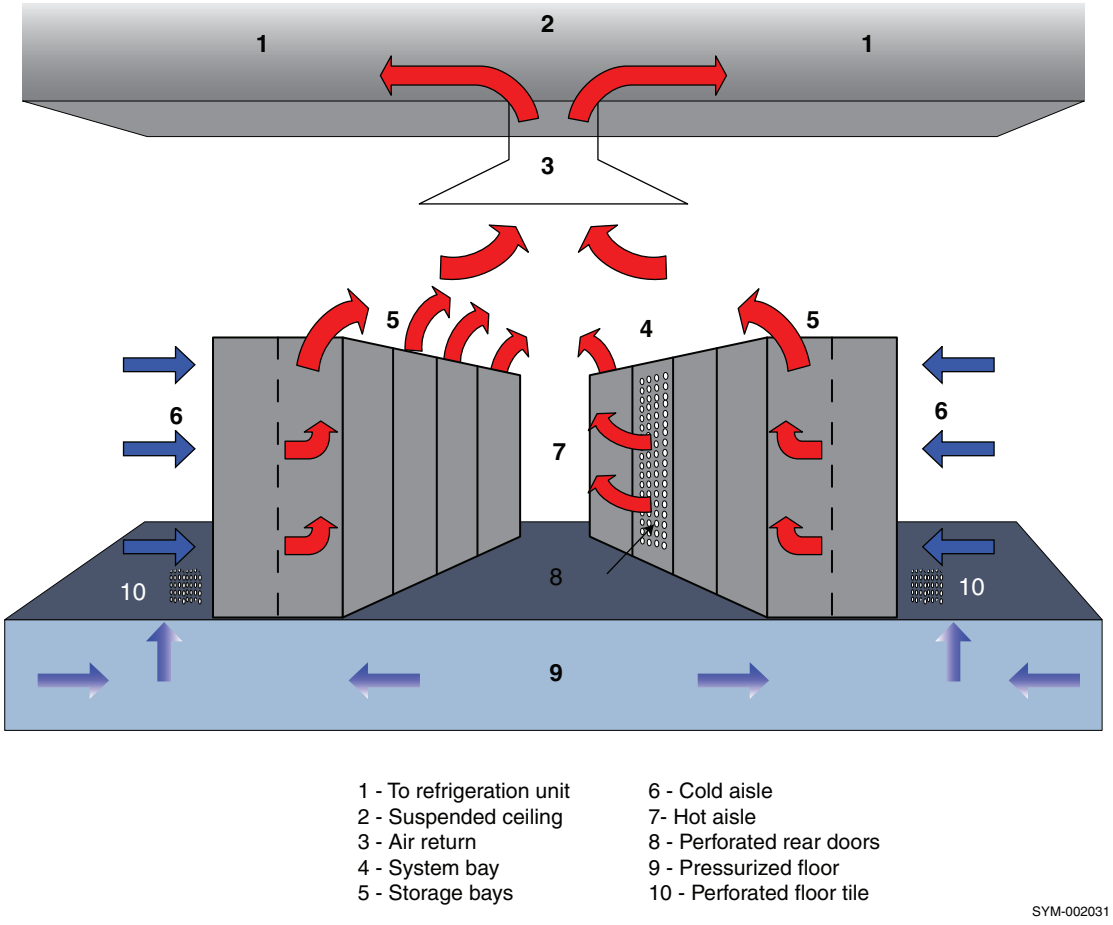


Figure 2 System airflow, VMAX 20K and VMAX 40K systems

Air volume, air quality and temperature

Before the Symmetrix system can be installed, the installation site must meet certain requirements, including:

- Air volume
- Temperature, altitude and humidity
- Air quality.

Air volume specifications

Table 11 on page 16 lists the maximum amount of air volume recommended for the system.

Table 11 Air volume, Symmetrix VMAX 10K, 20K, 40K systems

Bay	English units	Metric (SI) units
Storage bays	1,280 cfm	36 m^3/min
System bay (standard)	1,400 cfm	40 m^3/min
System bay (high density)	1,440 cfm	41 m^3/min

Temperature, altitude, and humidity ranges

Table 12 on page 16 contains the system environmental operating range requirements, including extreme values for temperature and relative humidity.

Table 12 System environmental operating range, Symmetrix VMAX 10K, 20K, 40K systems

Condition	System and storage bays
Operating temperature extremes	50º— 90º F (10º to 32º C)[1]
Operating altitude (at 32º)	7,500 ft (2,286 m)
Operating altitude (maximum)	10,000 ft (3,048 m) 1.1º derating per 1,000 ft
Operating relative humidity extremes	20% to 80% noncondensing
Raised floor environment	Recommended, but not required
Operating rate of temperature change	9º F/Hr (5ºC/Hr)

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

Recommended temperature and humidity

To ensure long-term system reliability, especially in environments where air quality is a concern, EMC recommends operating within the temperature and humidity ranges in Table 13 on page 17. "Air quality requirements" on page 17 provides detailed air quality information.

Table 13 System temperature and humidity, Symmetrix VMAX 10K, 20K, 40K systems

Condition	System and storage bays
Operating temperature range	64º— 75º F (18º to 24º C)
Operating relative humidity range	40 — 55%

Air quality requirements

EMC products 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.

Symmetrix systems 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, Symmetrix systems may vault in order 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), it is recommended to use 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, it is recommended 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

Table 14 on page 18 shows platform shock and vibration maximums for all Symmetrix systems. Levels shown apply to all three axis, and should be measured with an accelerometer in the equipment enclosures within the cabinet.

Table 14 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

Table 15 on page 18 shows the transportation shock and vibration levels (in the vertical direction) for systems mounted on an approved EMC package.

Table 15 Packaged system shock and vibration

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 specifications

Table 16 on page 19 through Table 17 on page 19 list the sound power and sound pressure levels Symmetrix systems.

VMAX 10K systems

Table 16 on page 19 shows the sound power and pressure for a Symmetrix VMAX 10K systems with a fully loaded system bay.

Table 16 Sound power and sound pressure levels, A-weighted

System configuration description	Sound power levels (B) [1]	Sound pressure levels (dB) [2]
System bay (fully loaded)	7.8	61.6

1. A-weighted sound power with.3B correction factor added per ISO9296.
2. Average A-weighted sound pressure measurements of the four bystander positions per ISO7779. Values are calculated but may very slightly between site and configuration.

VMAX 20K and 40K systems

Table 17 on page 19 lists the sound power and sound pressure levels for Symmetrix systems.

Table 17 Sound power and sound pressure levels, A-weighted

System configuration description[1]	Sound power levels (B) [2]	Sound pressure levels (dB) [3]
Standard storage bay	7.8	61.6
High density storage bay	7.6	62.3
System bay	8.0	66.6
System bay and one storage bay[4]	8.2	67.8
System bay and two storage bays[4]	8.4	68.7
System bay and three storage bays[4]	8.5	69.5
System bay and four storage bays[4]	8.5	70.2
System bay and five storage bays[4]	8.6	70.7
System bay and six storage bays[4]	8.7	71.2

1. An optional sound silencer kit is available for the Symmetrix system and is not included in these calculations.
2. A-weighted sound power with.3B correction factor added per ISO9296.
3. Average A-weighted sound pressure measurements of the four bystander positions per ISO7779.
4. Values are calculated, and may vary slightly based on differences between site and configurations.

Environmental acclimation

The Symmetrix system requires a period of time to become acclimated to a data center environment.

Acclimating the system

To prepare the system for data center acclimation:

1. Completely remove all packing material from the system. Packaged accessory (Open Me First) boxes may remain with the system.
2. Dispose of the packing materials appropriately.
3. Move the system into its operating environment and allow the system to stabilize in the new environment for up to 16 hours as listed in Table 18 on page 20. If the operating system environment's temperature and humidity are unknown, then allow the system to stabilize in the new environment for 16 hours.

   Note: EMC recommends opening both the front and rear doors of the system to facilitate environmental stabilization.

4. Do not apply AC power to the system for *at least* the number of hours specified in Table 18 on page 20.

Data acclimation times

Table 18 on page 20 shows required data center acclimation times.

Table 18 Data center acclimation times

Transit / storage environment				**Hours required before applying power (minimum)**	**Conditioned air nominal office / computer room environment ≤ 30% RH)**
Condition	(°F)	(°C)	% RH		
Nominal	68 – 72	20 – 22	‹ 30%	0 - 1	68°F – 72°F
Cool / Damp	‹ 68	‹ 20	≥ 30%	4	‹ 30°C (86°F) ≤ 30% RH
Cold / Dry	‹ 68	‹ 20	‹ 30%		
Hot / Dry	72 – 149	22 – 65	‹ 30%		
Hot / Humid	72 – 149	22 – 65	30 – 45%		
			45 – 60%	8	
			60 – 90%	16	

Note: Temperature and humidity values experienced by the system must be such that condensation does not occur on any system part. Altitude and atmospheric pressure specifications are referenced to a standard day at 58.7°F (14.8°C). Maximum wet bulb temperature is 82°F (28°C).

Planning host connections

VMAX 10K, VMAX 20K and VMAX 40K systems provide Front-End I/O Modules that support Fibre Channel/FCoE/iSCSI for host, SRDF, Recover Point, and Federated Tiered Storage connectivity in open systems environments. VMAX 20K and VMAX 40K systems also provide FICON mainframe host connectivity.

Front End I/O Modules are ordered and configured in sets of two (one pair) or four (two pairs). Configurations with two (one pair) are not supported in all areas. The slots connect to alternate directors. Each Engine supports four I/O modules (two pairs).

FCoE is supported on 10 GbE Front End I/O Modules only. It is not supported on 1 GbE Front End I/O Modules. SRDF is supported over Fibre Channel or Ethernet ports.

Note: The Front-End Port Layout diagram for your system provide additional details about front-end connections.

Host configuration and external connections checklist

Planning the host configuration and external connections involves understanding:

- Front-end host port requirements
- SRDF port requirements
- External array connections
- Transmission mode.

Table 19 on page 21 provides a checklist for host configurations protocols and required ports necessary for each Symmetrix system you are installing. Discuss this information with your EMC Customer Engineer and/or EMC Systems Engineer to plan or expand a Symmetrix system.

Table 19 Host configuration checklist

	Required single mode ports	Required multimode ports
Front end protocol/port		
Fibre Channel		
FICON[1]		
iSCSI/Ethernet/FCoE	N/A	
SRDF protocol/port		
Fibre Channel		
Ethernet		

1. Available on VMAX 20K and VMAX 40K systems

Configuration examples

Front End I/O Modules are installed in slots 3 and 4 on VMAX 10K systems, and slots 4 and 5 on VMAX 20K and VMAX 40K systems.

VMAX 10K systems

Figure 3 on page 22 shows an engine with four Front End I/O Modules (two pairs). One pair, in slot 3, provides eight Fibre Channel ports. The other pair, in slot 4, provides four FCoE or iSCSI ports.

To provide redundancy:

- The Fibre Channel Front End I/O Module in slot 3 (left) connects to the even director, and the Fibre Channel Front End I/O Module in slot 3 (right) connects to the odd director.
- The iSCSI or FCoE Front End I/O Module in slot 4 (left) connects to the even director, and the iSCSI or FCoE Front End I/O Module in slot 4 (right) connects to the odd director.

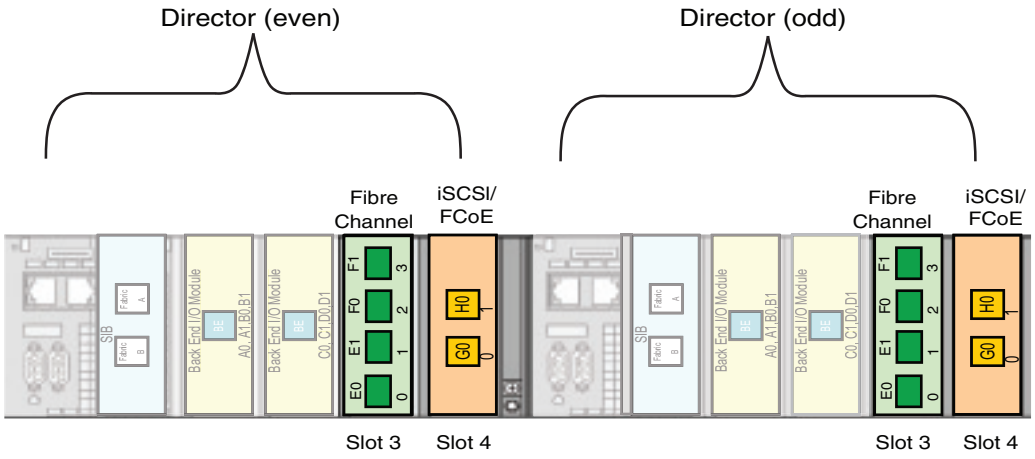


Figure 3 Front End I/O Module configuration, four I/O modules

VMAX 20K or 40K systems

Figure 4 on page 23 shows a fully configured engine that provides eight Fibre Channel multimode ports and four FICON single mode ports. This configuration consists of:

- One I/O model that provides two 4-port Fibre Channel multimode I/O modules. One I/O module is installed in a slot that connects to the odd director. The other is in the slot that connects to the even director.

- One I/O model that provides two 2-port FICON single mode I/O modules. One I/O module is installed in the slot connecting to the odd director. The other is in the slot that connects to the even director.

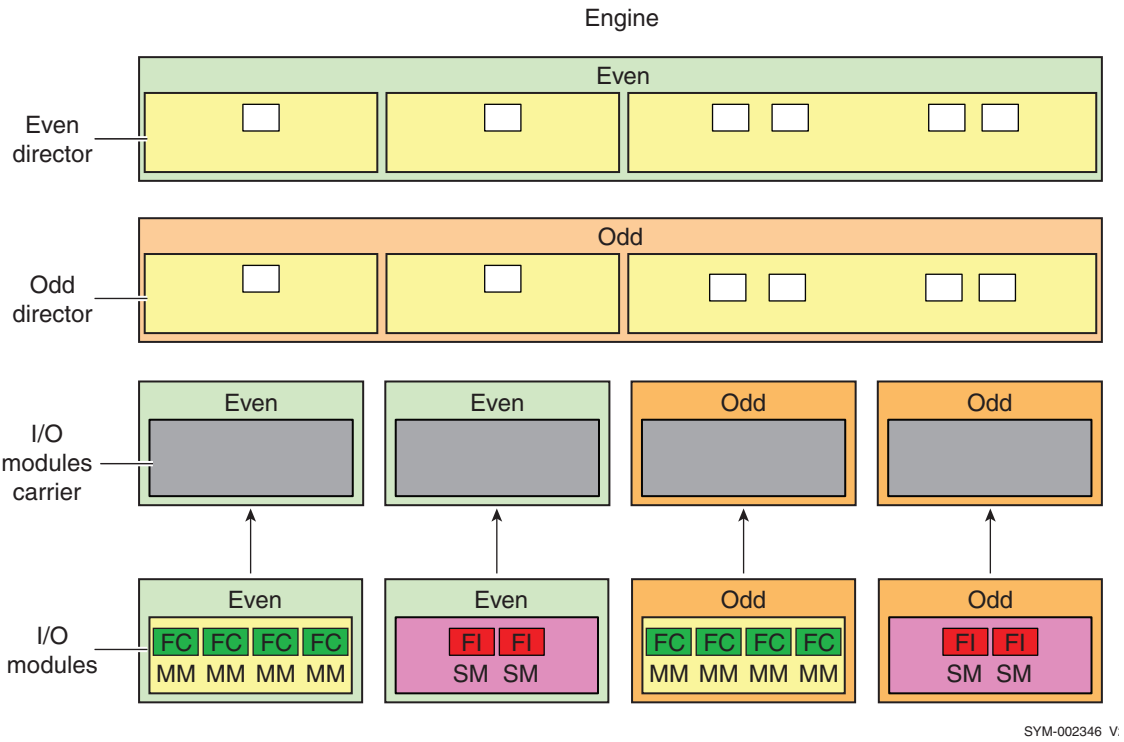


Figure 4 I/O module slot configuration

Fibre Channel SRDF planning

Systems with SRDF over Fibre Channel require special considerations.

Each Fibre Channel SRDF connection requires two Fibre Channel ports. One port supports the Fibre Channel connection. The other port is disabled.

When planning Fibre Channel I/O configurations that provide SRDF support, first select the Fibre Channel models that include the required single or multimode optics. Then allow for the ports that are disabled.

External connections

Symmetrix systems support Federated Tiered Storage (FTS) on open systems which allows the connection of external storage arrays to a Symmetrix system using Fibre Channel front-end I/O modules. FTS requires an Enginuity emulation type (DX) and a pair of front-end Fibre channel ports on each front-end I/O module. The FC ports used by FTS are ports that would otherwise be available for host, SRDF, and RecoverPoint connections.

The Front-End Port Layout diagram related to your system provides details on connections.

Configuration checklists

This section contains checklists that identify the Symmetrix system hardware and host configuration planning tasks for each Symmetrix system and host you plan to configure.

Open systems hardware checklist

Discuss the hardware checklist, shown in Table 20 on page 24, with your EMC account representative. This information is necessary for each Symmetrix system you are installing.

Table 20 Symmetrix checklist for open systems

Symmetrix model	Number
Total number of physical drives to be configured on the Symmetrix system	
Physical drive type (size)	
Number of Front End I/O Modules	

Open systems host checklist

Table 21 on page 24 contains the host configuration checklist.

Table 21 Open systems host checklist

Host configuration requirements	Host 1	Host 2
Host (CPU) vendor and model number.		
Host controller type and model number.		
Memory capacity of host.		
O/S revision level of host.		
I/O rate per second expected per host.		
Type of host adapter (Fibre Channel, iSCSI, FCoE) and its model number.		
Is this a clustered environment? Which one?		
Will devices be shared? Which ones?		
Total number of FC ports for Federated Tiered Storage?		
Total number of host (Fibre Channel, iSCSI, FCoE) connections per host and to which ports will they attach?		
Specify if any narrow host connections are used.		
Number of logical devices needed per host (Fibre Channel, iSCSI, FCoE) path.		
Size of volumes required to be visible to host.[1]		
Total customer-usable data storage required.		
Will host-level mirroring be used, which volumes?		
Will Symmetrix Mirrored (RAID 1) be used, which volumes?		

Table 21 Open systems host checklist (*continued*)

Host configuration requirements	Host 1	Host 2
Will SRDF be used, which volumes?		
Data storage utilization per host.[2]		
Average transfer size of data.		
Using raw devices or file systems?		
Size of file system.		
Will data striping be used? What type of data striping package?		
Partitioning?		
Partition sizes?		
LVM used.[3]		
What major applications are to be run?		
Database used: Oracle/Sysbase/Informix/other?		
Size of database.		
Will RecoverPoint be used? Are there sufficient Fibre Channel ports available for the RecoverPoint Appliances (RPAs)?		
Database release version.		
Supply typical high level database schema and queries.		
Any patches or modifications related to I/O Fibre Channel?		
Additional comments:		

1. This is the volume size needed for each volume visible on the Fibre Channel path.
2. Percentage of available Symmetrix system data capacity used by that host.
3. Special attention is required when using a Logical Volume Manager (LVM) or data striping when using hypervolumes. In general, EMC recommends using data striping on the Symmetrix system. Keep in mind that the larger the granularity of the striping, the less effective it becomes.

Optical multimode cables

Table 22 on page 26 lists the optical multimode 3 (OM3) and optical multimode 4 (OM4) Fibre — 50/125 micron cables for open systems host connectivity that are currently available from EMC.

- OM3 cables are provided for systems with SRDF connectivity over 4 and 8 Gb Fibre Channel I/O modules, or GbE iSCSI/FCOE I/O modules.
- OM4 cables are used for connections with 16 Gbs Fibre Channel I/O modules and support distances of up to 190 m over 8 Gb Fibre Channel and 125m over 16 Gb Fibre Channel modules.

You can use existing OM2 or OM3 cables, but distance is reduced.

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

To obtain OM3 or OM4 cables, contact your local EMC sales representative.

Table 22 OM3 and OM4 Fibre cables — 50/125 micron

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

Mainframe hardware checklist

Discuss the hardware checklist, shown in Table 23 on page 27, with your EMC account representative. This information is necessary for each VMAX 20K or 40K system you are installing.

Table 23 Checklist for mainframe

Description	Number
Total number of physical drives to be configured on the Symmetrix system	
Physical drive technology (size)	
Number of Front-End I/O Modules	

Mainframe host and SRDF cables

EMC provides optical multimode cables (OM3) for VMAX 20K and VMAX 40K systems that require mainframe host and SRDF connectivity.

Table 24 on page 27 lists the Symmetrix system FICON cables currently available from EMC. To obtain these cables, contact your EMC sales representative.

Table 24 FICON 9 micron 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

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

Data center safety and remote support

Adequate fire prevention equipment is required to ensure safety in the data center or computer room.

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

Communication between the EMC Customer Support Center and the Symmetrix system occurs through EMC Secure Remote Support (ESRS). Connectivity is available using:

- EMC Secure Remote Support Gateway software, provided at no charge to any customer with a maintenance agreement. This IP-based remote support software can be run from either:
  - The system's service processor, using the new ESRS IP Solution Device Client
  - A dedicated ESRS gateway server that becomes the conduit for all communications between EMC and the customer site. The Gateway server can be placed in any customer approved location as long as it can communicate with EMC over the Secure Socket Layer (SSL) and with the Policy Manager. Policy Manager software, also provided, allows customers to manage, control, and log gateway actions.
- An optional modem, available from EMC, that uses a regular telephone line or operates with a PBX.

The *EMC Secure Remote Support Gateway Site Planning Guide*, located on EMC Online Support, provides additional information.

Floor load bearing requirements

The Symmetrix system can be installed on raised (preferred) or nonraised floors. The customer must ensure that the raised floor is capable of supporting the system weight specified in "System weights" on page 30.

If the system is installed in a raised floor environment, 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 system 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 800 lb (363 kg) on VMAX 10K systems, and 1,000 lb (453.6 kg) on VMAX 20K and VMAX 40K systems.

Note: Caster weights are measured on a level floor. The front of the system weighs more than the rear of the configuration.

- Floor tiles and stringers must be rated for a minimum static ultimate load of 2,500 lb (1,134 kg) per tile on VMAX 10K systems, and 3,000 lb (1,360.8 kg) on VMAX 20K and VMAX 40K systems.
- Floor tiles must be rated for a minimum of 800 lb (363 kg) rolling load on VMAX 10K systems, and 1,000 lb (453.6 kg) on VMAX 20K and VMAX 40K systems.

  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 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.
- Do not position the system bay or storage bays with more than two casters on a single floor tile. Care should be taken when positioning the bays to make sure that a caster is not moved into a cutout.

  Note: Cutting tiles per specifications as shown in "Dimensions and floor placement" on page 49 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.

System weights

Table 25 on page 30 and Table 27 on page 31 describe the maximum weights for the system bay and storage bay.

System bay weights are calculated based on the number of engines, VMAX 10K File components, and storage bay weights (assume a fully loaded configuration). VMAX 10K systems

Table 25 on page 30 shows weights for VMAX 10K systems.

Table 25 VMAX 10K system weights

Fully configured system	Maximum Weights lb (kg)
Standard system bay	1,550 lb (703 kg)
High density system bay	1, 398 lb (634 kg)
Standard storage bay 1A or 1B	1,160 lb (526 kg)
Maximum configuration, four system bays and two storage bays	8,520 lb (3,864 kg)

VMAX 10K File systems

Table 26 on page 30 shows weights for systems with VMAX 10K File components.

Table 26 VMAX 10K File system weights

Fully configured system	Maximum Weights lb (kg)
System bay 1 with VMAX 10K File components	1, 548 lb (702 kg)
Storage bay 1A with VMAX 10K File components	1,034 lb (479 kg)

VMAX 20K and VMAX 40K systems

Table 27 on page 31 shows the system weights or VMAX 20K and VMAX 40K systems.

Table 27 VMAX 20K and VMAX 40K system weights

System configuration description	VMAX 20K Maximum Weights lb (kg)	VMAX 40K Maximum Weights lb (kg)
System bay (four engines)	1,830 lb (830.0 kg)	1,703 lb (850.0 kg)
System bay (eight engines)	2,774 lb (1,258.3 kg)	2,617 lb (1279 kg)
Standard storage bay [1]	2,278 lb (1,033.3 kg)	2,278 lb (1033.3 kg)
System bay and one standard storage bay (two engines)	3,636 lb (1649.3 kg)	3,681 lb (1670 kg)
High density storage bay[2]	1,674 (759.3 kg)	1,674 lbs (759.3 kg)
System bay and one high density storage bay (two engines)	3,032 (1375 kg)	1,403 lbs (636.3 kg)

1. All standard storage bay weights are calculated for a fully loaded configuration.
2. All high density storage bay weights are calculated for a fully loaded configuration.

Determining load-bearing capacity

Customers must be aware that the load-bearing capacity of the data center floor is not readily ascertainable 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 system 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 system weight specified in "System weights" on page 30.

⚠WARNING

The customer is ultimately responsible for ensuring that the floor of the data center on which the system is to be configured is capable of supporting the system weight, whether the system 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 system, 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 or site floor are capable of supporting the system weight as specified in "System weights" on page 30. The customer assumes all risk and liability associated with such failure.

System space requirements

Planning placement of the Symmetrix on raised or nonraised floors requires:

- Understanding system measurements and physical space requirements
- Understanding system layout options
- Calculating floor space, including requirements for installation and service access.

System bay and storage bay measurements

Physical space requirements for system and storage bays depends on the VMAX model and the type of storage bay.

VMAX 10K systems

Table 28 on page 32 describes physical space requirements for one system bay or storage bay on a VMAX 10K system and storage bays.

Table 28 Physical space requirements

Bay description	Height (in/cm)[1]	Width (in/cm)	Depth (in/cm)	Clearance for Service, airflow Front and Rear Service area (in/cm)
System bay	75 in (190.5 cm)	24 in (61 cm)	42 in (106.7 cm)	42 in (106.7 cm) front/rear 18 in (45.7 cm) top
Storage bay	75 in (190.5 cm)	24 in (61 cm)	42 in (106.7 cm)	42 in (106.7 cm) front/rear 18 in (45.7 cm) top

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

VMAX 20K and 40K systems

Table 28 on page 32 describes physical space requirements for system and storage bays on VMAX 20K and VMAX 40K systems.

Table 29 Physical space requirements

Bay description	Height[1] (in/cm)	Width (in/cm)	Depth (in/cm)	Clearance for Service, airflow Front and Rear Service area (in/cm)
System bay	76 in (194.7 cm)	30 in (76.2 cm)	42 in (106.7 cm)	42 in (106.7 cm) front/rear
Standard storage bay	76 in (194.7 cm)	30 in (76.2 cm)	42 in (106.7 cm)	42 in (106.7 cm) front/rear
High density storage bay	75 in (190.5 cm)	24 in (61 cm)	42 in (106.7 cm)	42 in (106.7 cm) front/rear

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

Multi-bay width measurements

Table 30 on page 33 through Table 32 on page 34 describes width requirements for multi-bay configurations.

VMAX 10K systems

Because system and storage bays have the same dimensions, multi-bay widths on VMAX 10K systems depend on the number of contiguous bay. Table 30 on page 33 shows the width of multi-bay configurations on VMAX 10K systems.

Table 30 Multi-bay width measurements

Bay configurations	Width [1]
System bay or storage bay	24 in (61 cm)
System bay and one storage bay	48.2 in (122.6 cm)
Two system bays and one storage bay	72.4 in (183 cm)
Three system bays and one storage bay	97.6 in (246 cm)
Four system bays and one storage bay	122.8 in (312 cm)
Four system bays and two storage bays	146 in (370 cm)

1. The width measurement includes.25 in. (0.6 cm) typical gap between bays.

VMAX 20K and VMAX 40K

Multi-bay widths on VMAX 20K and VMAX 40K systems depend on the type of storage bays.

Table 30 on page 33 and describes width requirements for multi-bay configurations for system bays with standard storage bays.

Table 31 Multi-bay width measurements - standard

Bay configurations	Width [1]
System bay and one standard storage bay	60.6 in (154.1 cm)
System bay and two standard storage bays	91.1 in (231.4 cm)
System bay and three standard storage bays	121.5 in (308.7 cm)
System bay and four standard storage bays	152 in (368.1 cm)
System bay and five standard storage bays	182.4 in (463.4 cm)
System bay and six standard storage bays	212.9 in (540.8 cm)
System bay and seven standard storage bays	243.3 in (618.1 cm)
System bay and eight standard storage bays	273.8 in (695.5 cm)

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

Table 32 on page 34 describes the width requirement for multi-bay configurations with high density storage bays

Table 32 Multi-bay width measurements - high density

Bay configurations	Width [1]
System bay with one high density storage bays	54.5 in (138.4 cm)
System bay and two high density storage bays	78.6 in (199.7 cm)
System bay and three high density storage bays	102.8 in (261.0 cm)
System bay and four high density storage bays	126.9 in (322.4 cm)
System bay and five high density storage bays	151.1 in (383.7 cm)
System bay and six high density storage bays	175.2 in (445.0 cm)
System bay and seven high density storage bays	199.4 in (506.4 cm)
System bay and eight high density storage bays	223.5 in (567.8 cm)

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

Standard layout options

Systems in a standard layout are arranged in a contiguous row, with a single system bay centrally placed and storage bays positioned on either side.

When planning standard layouts, consider planning for the current system and for future expansion as well.

VMAX 10K systems

Figure 5 on page 35 shows the standard placement of system and storage bays with 15-drive DAE or mixed 15-drive and 25-drive DAE storage bays. This configuration requires side-by-side placement of system and storage bays, and uses standard cables.

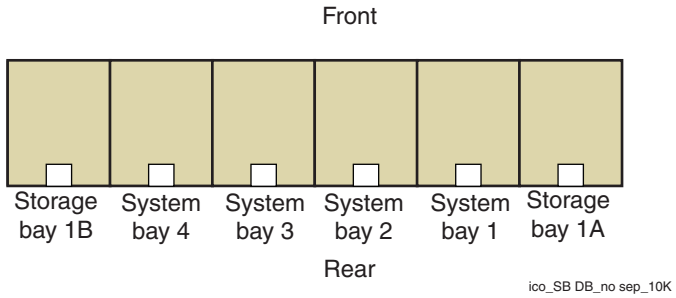


Figure 5 Standard system layout with 15-drive DAE or mixed 15 and 25-drive DAE storage bays

Figure 6 on page 35 shows the standard placement of system and storage bays with all 25-drive DAE storage bays. This configuration does not include storage bay 1A or 1B.

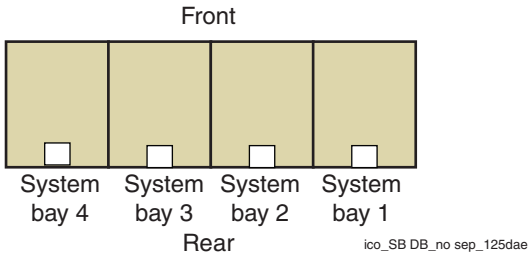


Figure 6 Standard system layout with 25-drive DAE storage bays

VMAX 20K and 40K systems

Figure 7 on page 36 shows the standard placement of a fully loaded system bay with 15-drive DAE storage bays.

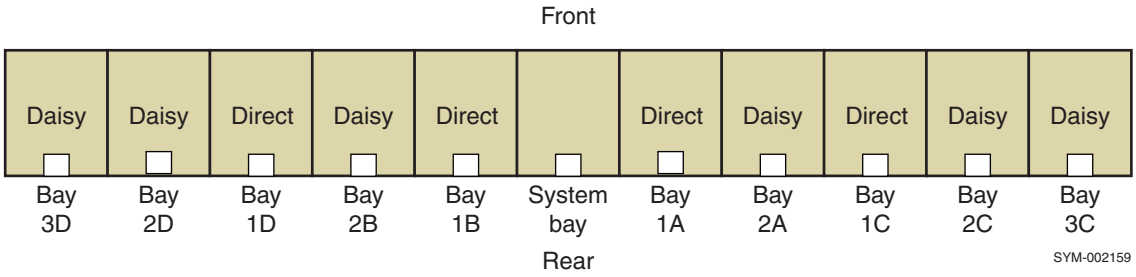


Figure 7 Standard system layout with 15-drive DAE storage bays

Figure 8 on page 36 shows standard placement of a fully loaded system bay with 25-drive DAEs. Systems with 25-drive DAEs support up to eight storage bays.

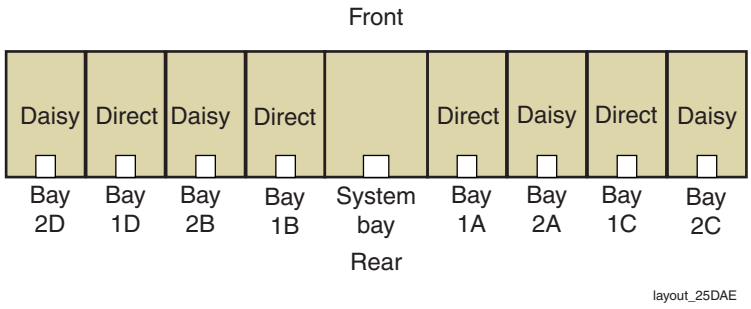


Figure 8 Standard system layout with 25-drive DAE storage bays

Figure 9 on page 36 shows an example of the standard placement of a fully loaded system with mixed 15-drive and 25-drive DAEs.

Each engine supports two standard, two high density, or one standard and one high density storage bay. Standard and high density DAEs are not mixed within a storage bay; each bay contains all standard or all high density drives. Layout vary based on the selection of 15-drive and 25-drive storage bays.

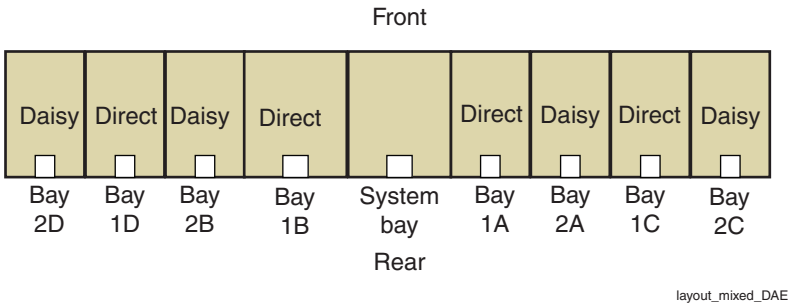


Figure 9 Standard system layout with mixed 15-drive and 25-drive DAE storage bays

Figure 10 on page 37 shows the standard placement of a system with extended drive loops. This configuration is available on VMAX 20K systems only, and does not support high density storage bays.

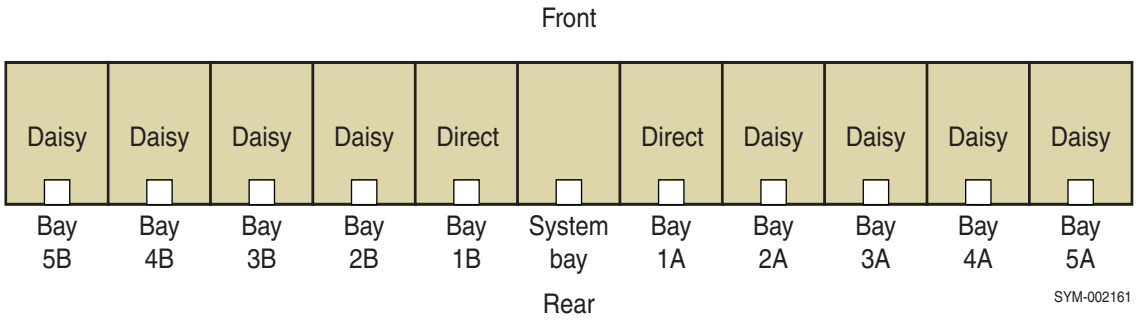


Figure 10 Extended drive loop configuration, no separated bays

Dispersed layout options

Systems in a dispersed layout are separated, or *dispersed*, between the system bays. Longer fabric and Ethernet cables are provided to allow the separated system bay placement.

- VMAX 10K and VMAX 40K systems allow dispersion between system bays.
- Dispersion is not allowed on VMAX 20K systems.

VMAX 10K systems

Symmetrix VMAX 10K systems allow dispersion (separation) between system bay 2 and system bays 3 and 4, as shown in Figure 11 on page 38. Dispersed bay cables provide for a maximum separation distance of 33 feet (10 meters) between system bay 2 and system bay 3 and 4. Actual distances will vary, based on routing strategy (beneath raised floor or overhead), site requirements, and the use of GridRunners or cable troughs.

Dispersed system bay configurations require a special cable kit. The cable kit consists of Ethernet and optical cables each bundled in a protective colored sheath. All cables shipped with the dispersed system bay are tested prior to delivery. Because dispersed bays are not bolted to the adjacent bay, each dispersed bay also includes two side panels.

Optional kits for overhead and under floor routing may also be required. "Overhead cable routing" on page 56 provides details about optional kits and components.

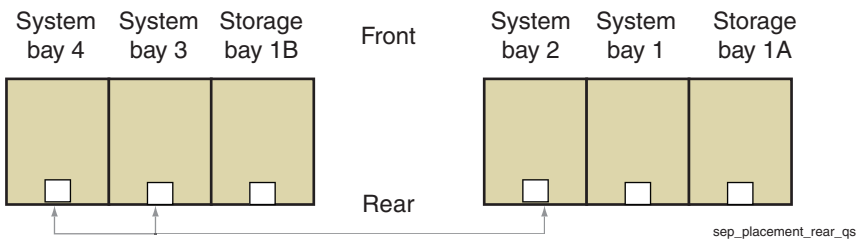


Figure 11 Dispersed system layout with 15-drive DAE or mixed 15 and 25-drive DAE storage bays

Figure 12 on page 38 shows the dispersed placement of system bays with 25-drive DAE storage bays. This configuration does not support storage bay 1A or 1B.

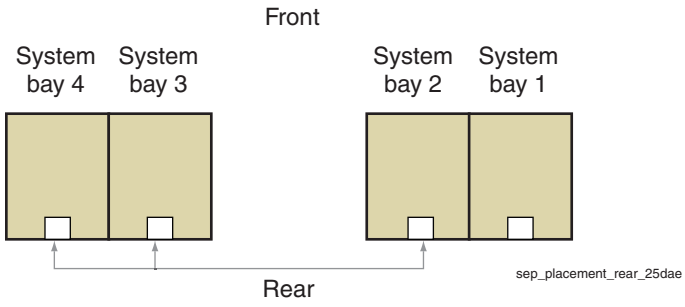


Figure 12 Dispersed system layout with 25-drive DAE storage bays

Dispersed system bays may be orientated front-to-front, back-to-back, side-to-side or front-to-back. When placing system and storage bays:

- Storage bay 1A, if present, is always placed to the left of system bay 1 (front view).
- Storage bay 1B, if present, is always placed to the left of system bay 3.
- All service area clearance distances must be maintained.
- All dispersed bay cables must be routed through an adjacent cabinet, under the raised floor, or overhead. Cables may not be exposed.
- A bay placement diagram and accurate distances between dispersed bays must be submitted.

Figure 13 on page 39 shows placement options for VMAX 10K systems with dispersed system bays.

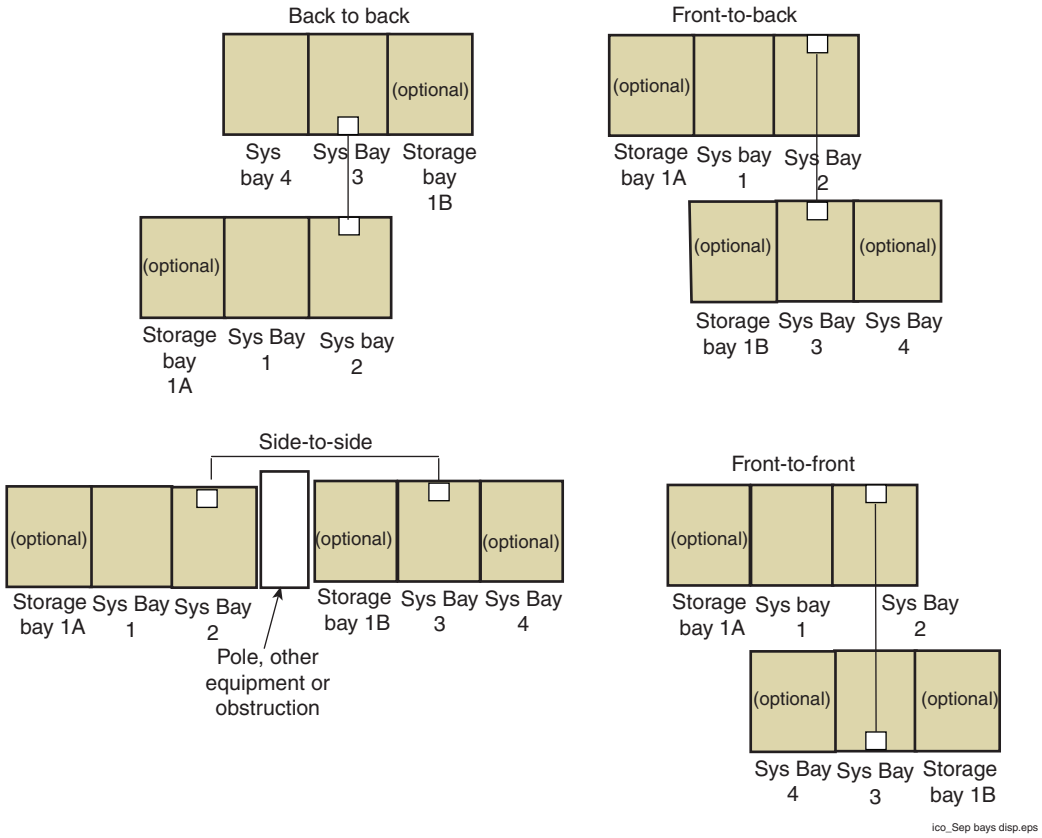


Figure 13 Dispersed system bay layout options

VMAX 40K systems

Symmetrix VMAX 40K systems provide dispersed placement by allowing separation of engines into two system bays. Extended fabric and Ethernet cables, shipped with the configuration, allow dispersed placement of up to 82 feet (25 meters) between the two system bays.

The engines within the bays are dispersed at the third (engine 3), fifth (engine 2), and seventh (engine 1). Systems with dispersed layouts can include 15-drive DAE storage bays, 25-drive DAE storage bays, or a mix of the two.

IMPORTANT

When installing the Optical Cable bundles on dispersed systems, the cables should be pulled to System Bay 2 (from System Bay 1)using the "pull sock" that is installed on one end of the bundle. This action ensures that the bundle is oriented correctly.

Dispersed at the third engine

Figure 14 on page 40 shows the layout of a VMAX 40K system dispersed at the third engine.

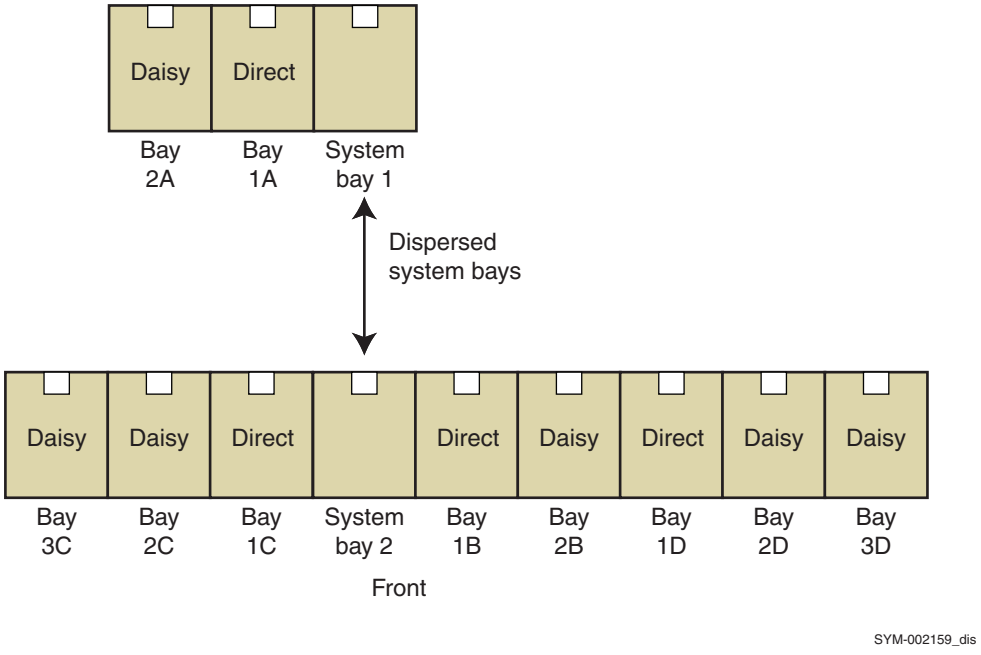


Figure 14 System layout, dispersed at the third engine, standard storage bays

Dispersed at the fifth engine

Figure 15 on page 41 shows the layout VMAX 40K system dispersed at the fifth engine.

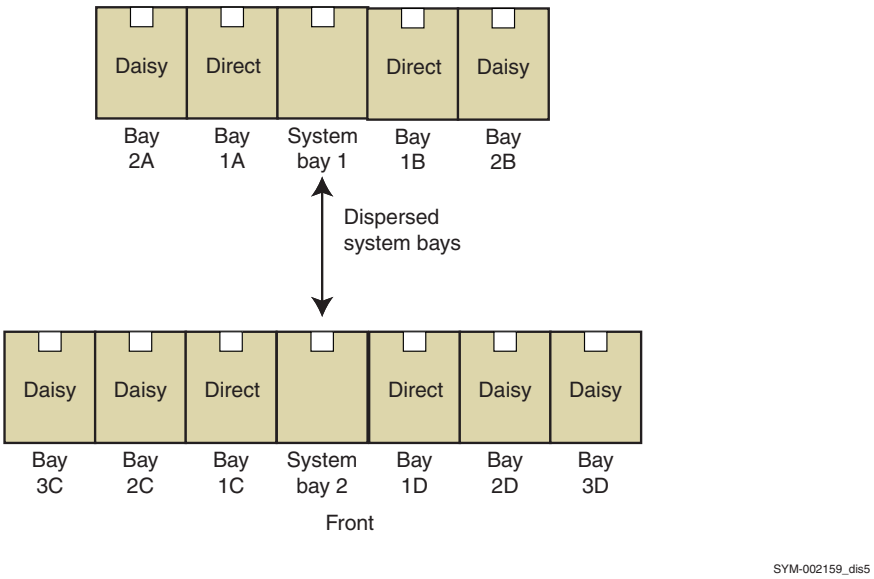


Figure 15 System layout, dispersed at the fifth engine, standard storage bays

Dispersed at the seventh engine

Figure 16 on page 41 shows the layout VMAX 40K system dispersed at the seventh engine.

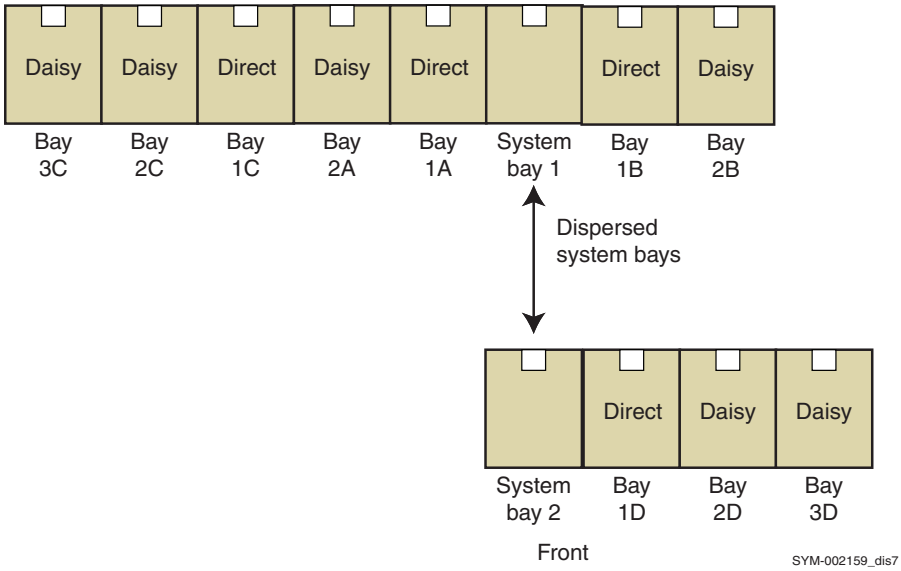


Figure 16 System layout, dispersed at the seventh engine, standard storage bays

Separated storage bays, VMAX 20K and 40K systems

VMAX 20K and VMAX 40K systems allow separated daisy-chain storage bay as an additional placement option. Daisy-chain storage bays that are separated are provided with longer cables, and may be placed up to 12 feet (3.6 meters) away from the adjacent storage bay. Actual separation distance depends on the total cable run (both horizontal and vertical) and is determined based on the customer's configuration, cable routing, and data center design. Separated storage bay layout is available with both standard and high density daisy-chain storage bays.

Separated storage bay configurations require a special storage bay model, available through Channel Express and Direct Express (CX/DX). Storage bays are shipped with extended back-end cable bundles wrapped in pink-colored sheathing to help identify the separated bay. Because separated bays are not adjacent to other bays, each separated bay also includes two side panels.

Standard configurations

Figure 17 on page 42 shows a fully loaded Symmetrix system with a standard layout and standard storage bays.

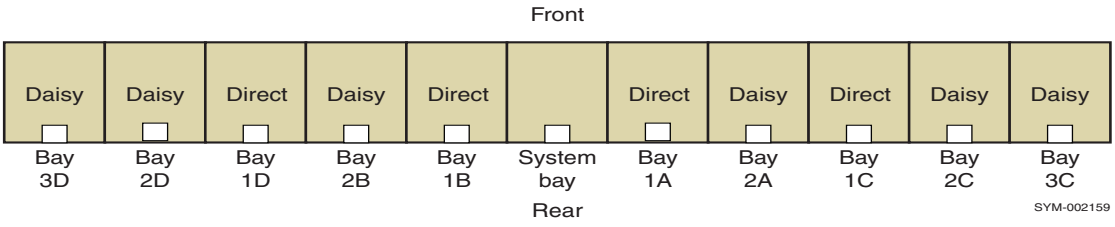


Figure 17 Standard configuration, standard storage bays

Figure 18 on page 42 shows an example of how the standard layout is modified by adding separated storage bays. Systems with dense bays or mixed dense and standard bays will not include bays 3C or 3D.

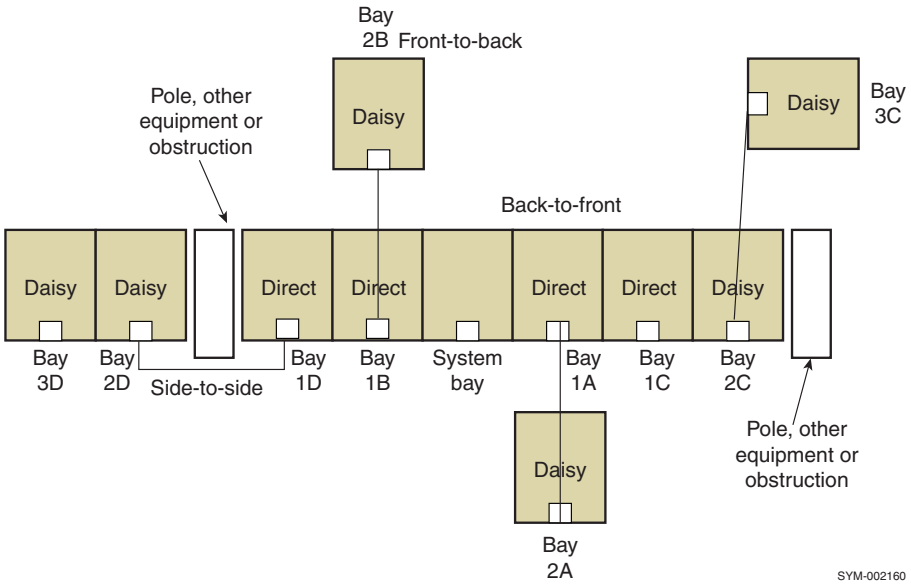


Figure 18 Standard configuration, separated standard storage bays

Extended drive loop configurations

Figure 10 on page 37 shows a fully loaded extended drive loop configuration, supported on VMAX 20K systems.

Note: Dense and mixed standard and dense drives are not supported on extended drive loop configurations.

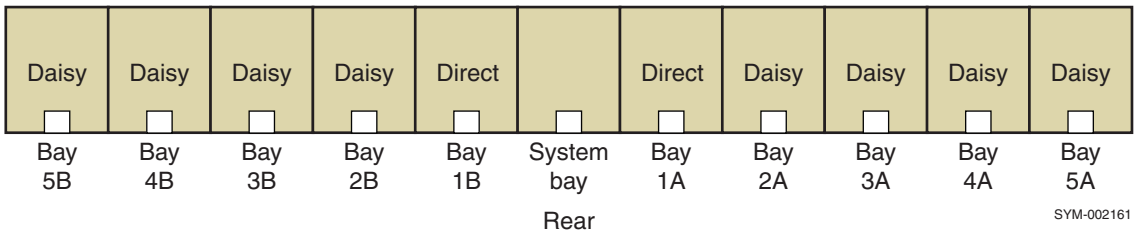


Figure 19 Extended drive loop configuration, no separated bays

Figure 20 on page 43 shows an example of how the extended drive loop configuration in a standard layout is modified by adding separated storage bays.

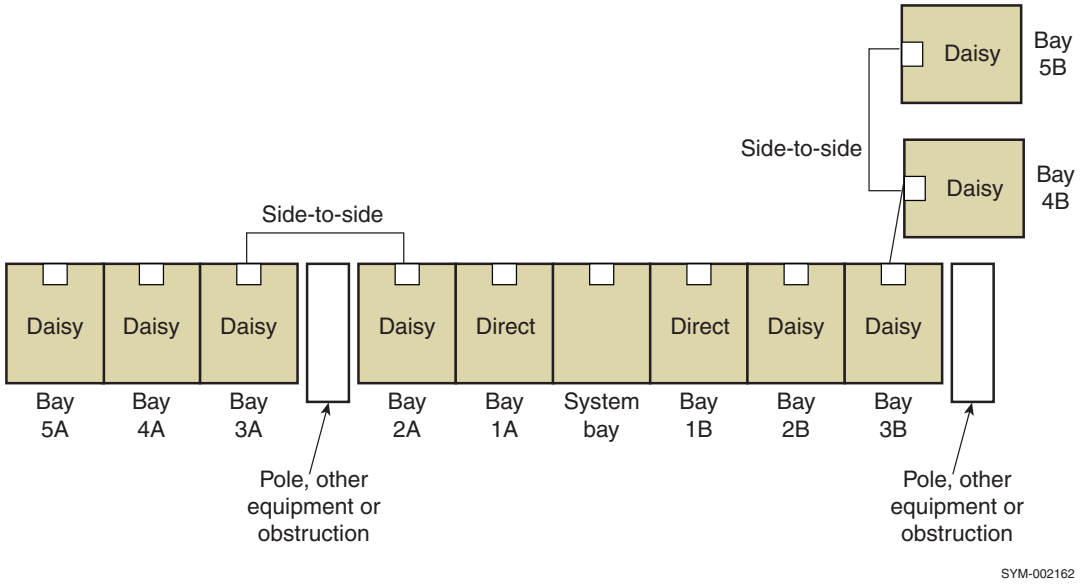


Figure 20 Extended drive loop configuration with separated bays

Dispersed configurations

Symmetrix VMAX 40K systems allow dispersed system bays, which may also include separated storage bays. Figure 21 on page 44 shows an example of a Symmetrix system, separated at the third engine, that includes separated storage bays.

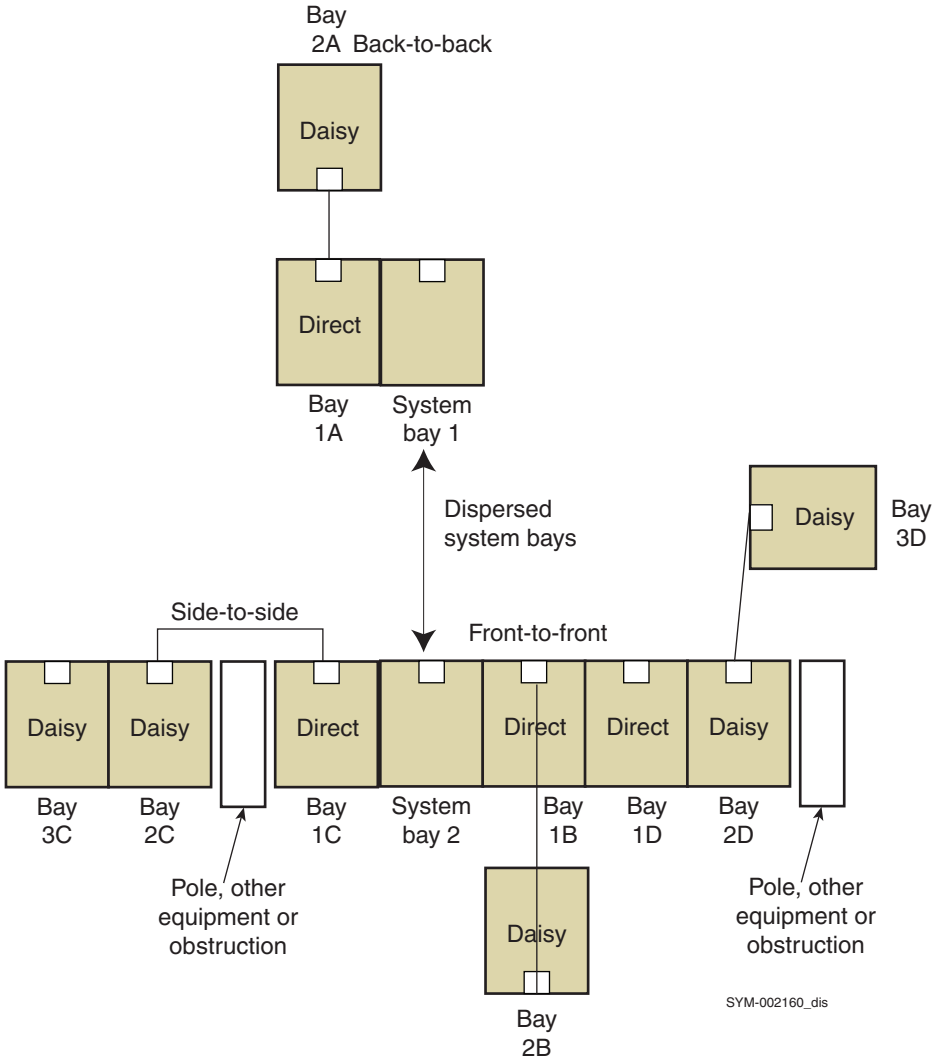


Figure 21 Dispersed system layout with separated storage bay

Storage bay separation, maximum distances

Figure 22 on page 45 illustrates the maximum distances between separated storage bays.

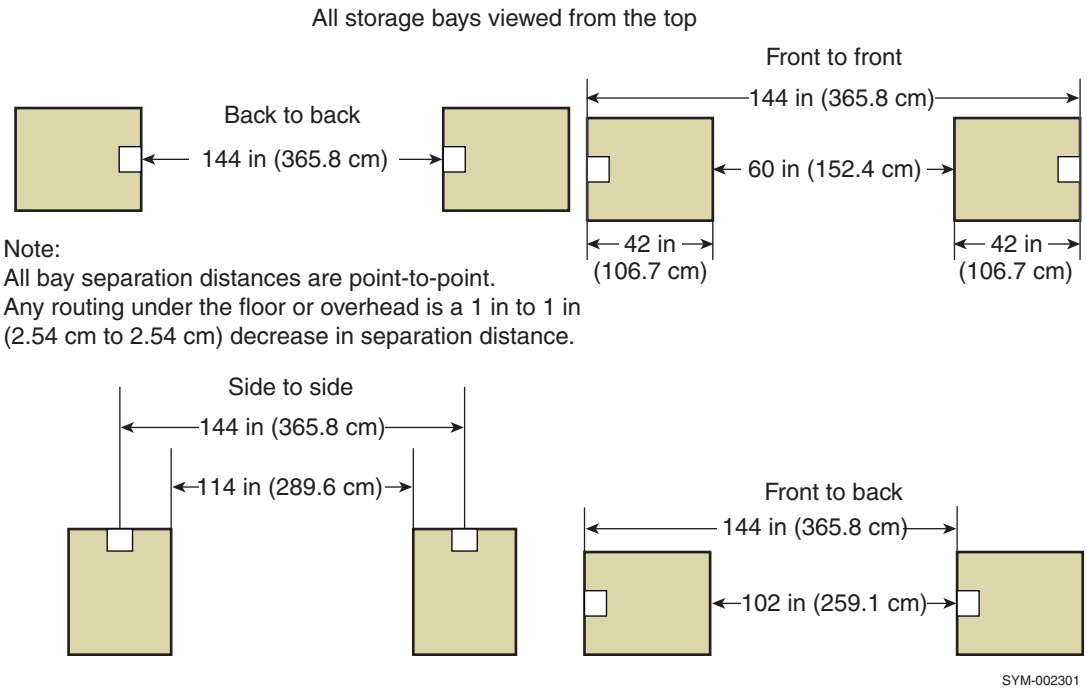


Figure 22 Separated storage bay maximum distances

Placement requirements

The following placement requirements apply to separated storage bays:

- Separated storage bays may not be placed across more than one hot or cold aisle.
- All service area clearance distances must be maintained when locating separated storage bays.
- All separated bay cables must be routed through an adjacent cabinet, under the raised floor, or overhead. Cables may not be exposed.
- Separated bays may be placed side-to-side, back-to-back, front-to-front, and front-to-back.
- Only daisy-chain storage bays can be separated:
  - Standard configuration bays that can be separated are 2A, 2B, 2C, 3C, 2D, and 3D
  - Extended drive loop bays, supported on VMAX 20K systems only, can be separated are 2A, 3A, 4A, 5A and 2B, 3B, 4B, and 5B.
- Direct connect storage bays must be located in the same row as the system bay:
  - Standard configurations - Bays 1C and 1D are located adjacent to bays 2A and 2B respectively, or they can be located immediately adjacent to bays 1A and 1B if bays 2A and 2B have been separated across the hot or cold aisle.
  - Extended drive loop configurations (VMAX 20K systems only) - Bays 1A and 1B are located adjacent to the system bay.

- Separated storage bays should be located on the same side (left or right) as the system bay.
  - Standard configurations with separated bays (front view):
    - Bays 1A, 2A, 1C, 2C and 3C - Left of the system bay.
    - Bays 1B, 2B, 1D, 2D and 3D - Right of the system bay.
  - Extended drive loop configurations, VMAX 20K systems only, with separated bays (front view):
    - Bays 1A, 2A, 3A, 4A and 5A - Left of the system bay.
    - Bays 1B, 2B, 3B, 4B and 5B - Right of the system bay.

    NOTE: Extended drive configurations do not support dense or mixed standard and dense storage bays.

Using a GridRunner and cable trough

Cables that connect separated bays can be routed overhead, using the overhead routing bracket, or routed across the subfloor. When subfloor routing is preferred, longer cables can be laid directly over the subfloor. The 12 ft (3.66 m) allowable separation distances between bays includes both the horizontal distance between bays and the vertical drop to the subfloor.

Figure 23 on page 47 shows separation distances when subfloor routing is preferred.

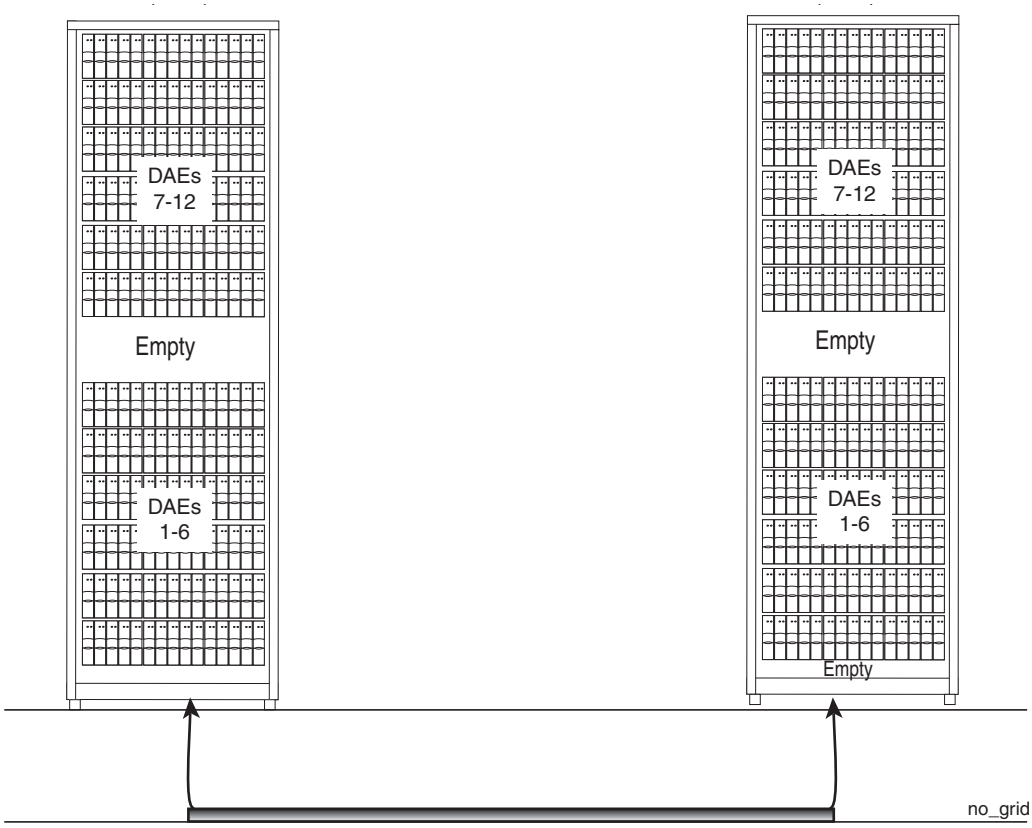


Figure 23 Separated storage bay distances across subfloor

Using an EMC GridRunner and customer-supplied cable trough can help organize and protect subfloor cables that connect separated storage bays. Because GridRunners reduce the vertical drop, using Gridrunners can also increase the distance between the separated bays.

Figure 24 on page 48 shows subfloor cable routing with EMC GridRunners. Each Gridrunner supports four cable bundles. GridRunners are installed with brackets that attach to the stanchions under the raised floor. The brackets can 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, a GridRunner should be installed every 2 meters.

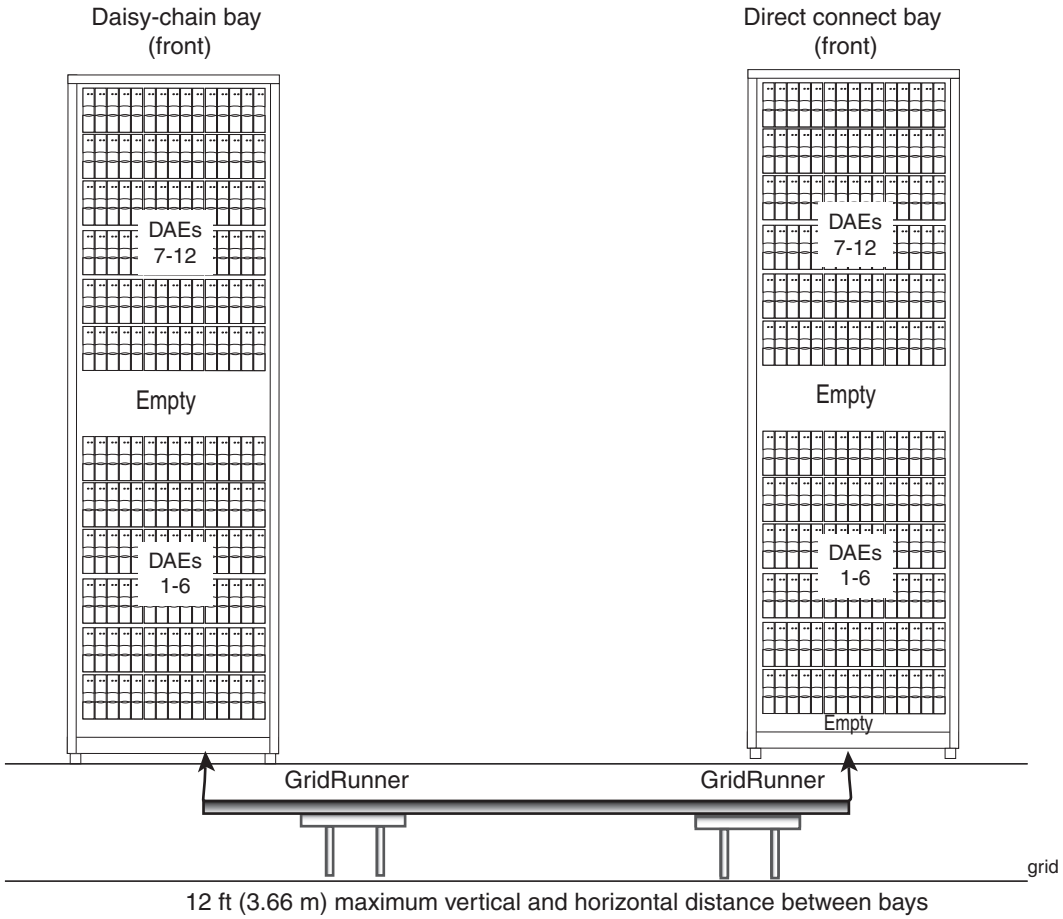


Figure 24 Separated storage bay distances with GridRunner and cable trough

Nonraised floor environments

In a nonraised floor environment, the separated storage bays are installed using an overhead cable routing method (EMC-supplied modified Symmetrix top cover and a customer-supplied overhead cable trough). Table 33 on page 56 describes orderable overhead routing kits.

Dimensions and floor placement

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

VMAX 10K systems

Figure 25 on page 49 shows the dimensions for a VMAX 10K system and storage bay.

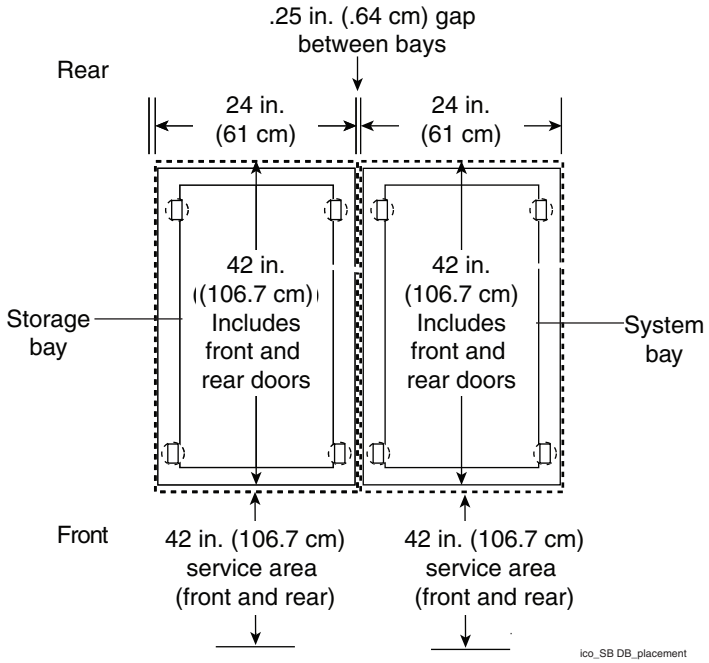
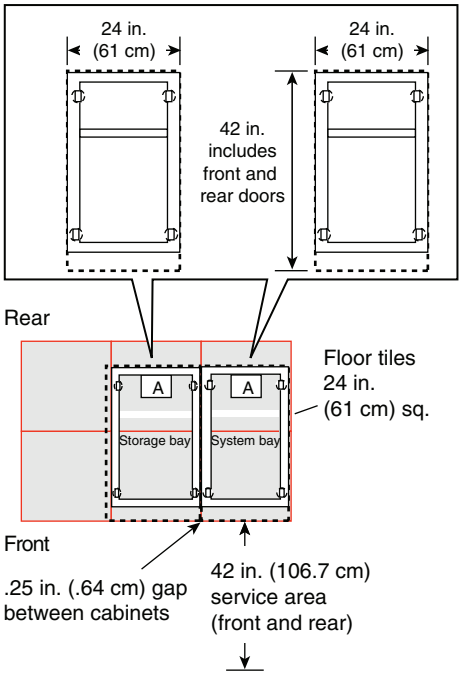


Figure 25 VMAX 10K system and storage bay dimensions

Figure 26 on page 50 shows system placement in a raised floor environment.



Note:

- Typical 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.
- Typical cutouts are 9 in. (22.9 cm) from the front and rear of the tile.
- Typical cutouts are centered on the tiles, 9 in. (22.9 cm) from the front and rear and 8 in. (20.3 cm) from sides.
- There is a .25 in. (.64 cm) gap between bays.
- There is a 42 in. (106.7 cm) service area front and rear on both the storage bay and system bay.

ico_SB DB_floor tile.eps

Figure 26 System and storage bay placement with floor tile cutouts

VMAX 20K or 40K systems

Figure 27 on page 50 shows the dimensions for a Symmetrix system with standard storage bays laid out in a standard configuration.

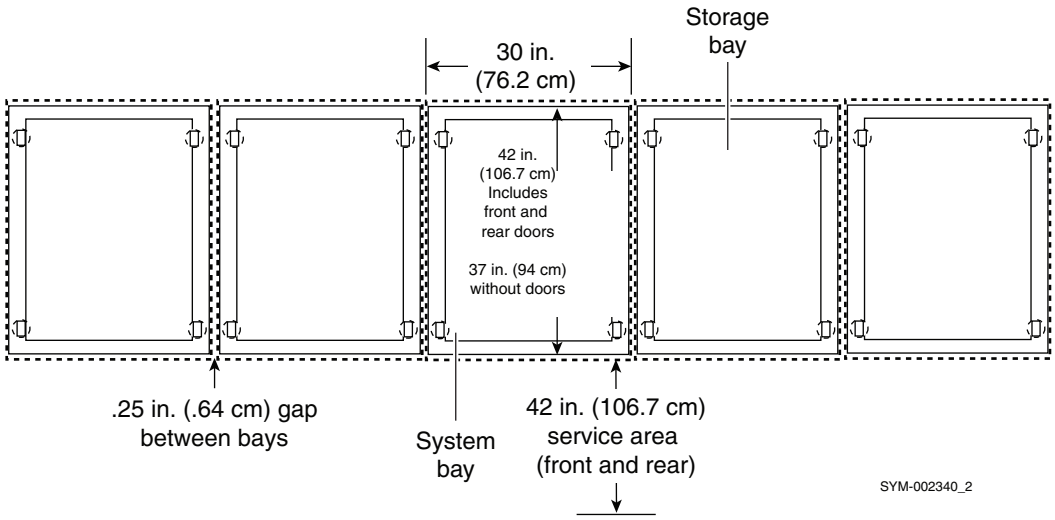
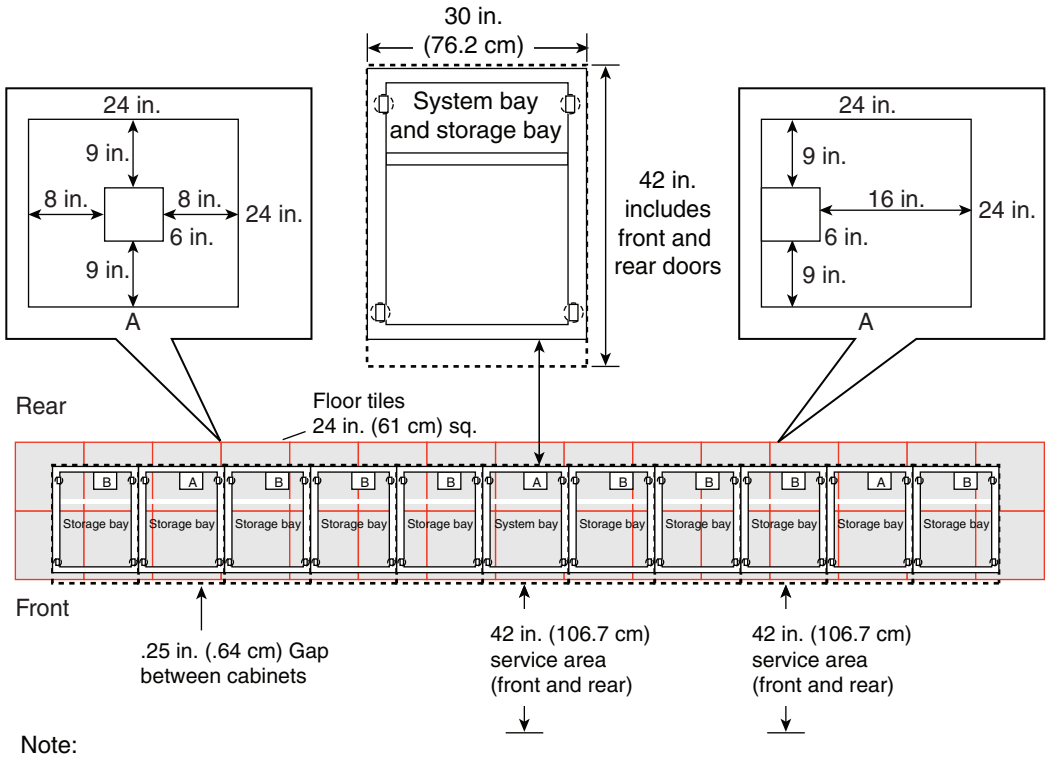


Figure 27 System and standard storage bay dimensions

Figure 28 on page 51 shows the standard layout of a fully loaded Symmetrix system with standard bays on a raised floor with tile cutouts.



Note:

- All tiles are 24 in. (61 cm) by 24 in. (61 cm).
- All cutouts are 8 in. (20.3 cm) by 6 in. (15.2 cm).
- All cutouts are 9 in. (22.9 cm) from the front and rear of the tile.
- All A cutouts are centered on the tiles, 9 in. (22.9 cm) from the front and rear and 8 in. (20.3 cm) from sides.
- All B cutouts are centered from front and rear 9 in. (22.9 cm). One side is on the edge of the tile and the other is 16 in. (40.6 cm) from the side.

SYM-002121_2

Figure 28 System and standard storage bays, placement with floor tile cutouts

Figure 29 on page 52 shows the dimensions for a Symmetrix system with high density storage bays laid out in a standard configuration.

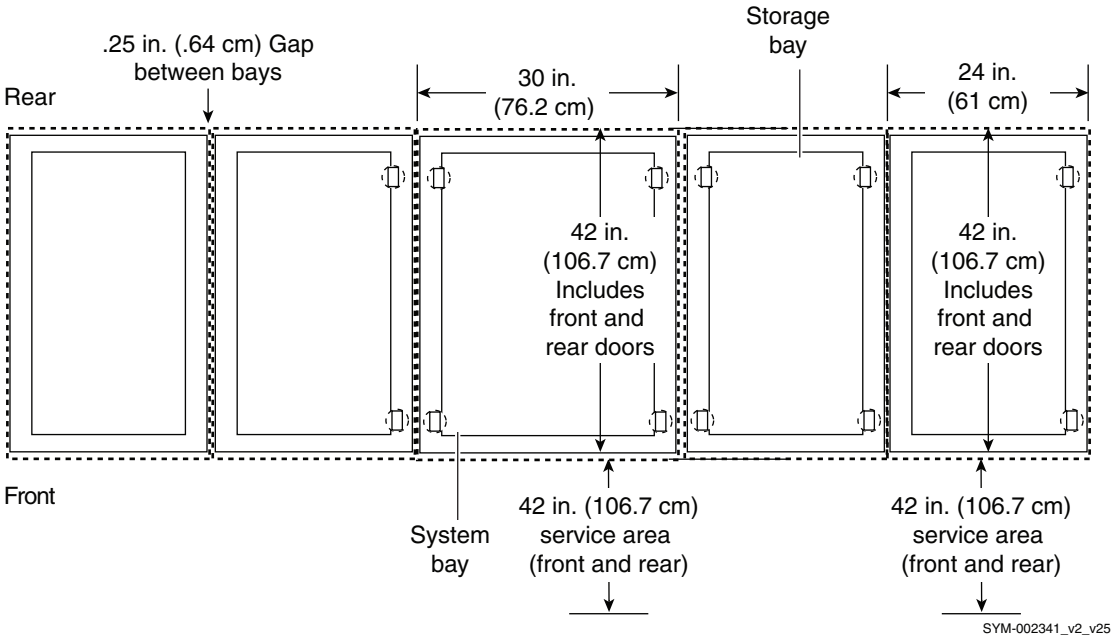
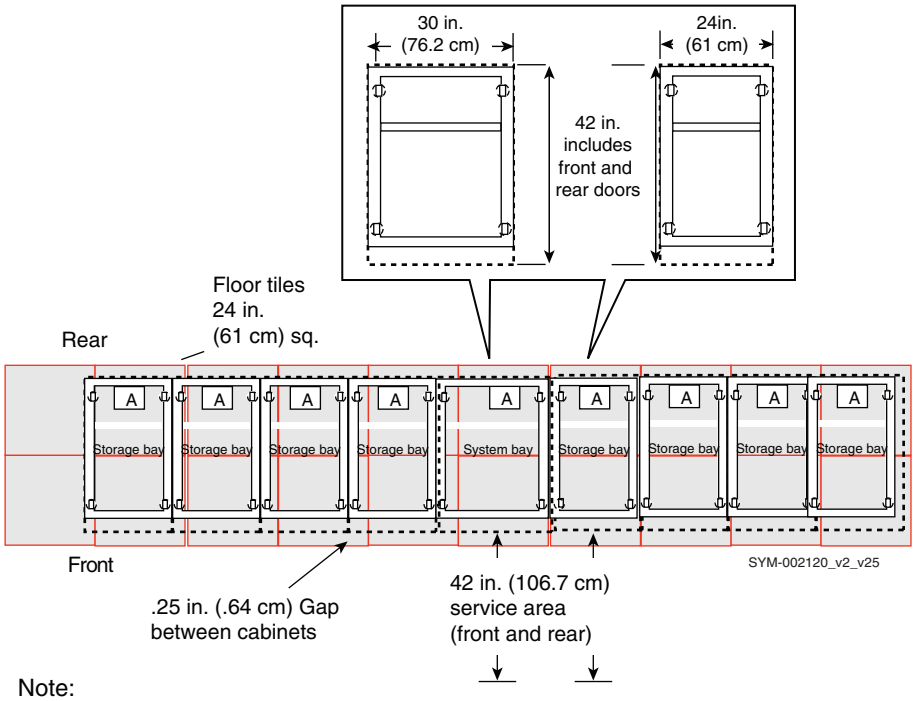


Figure 29 System and high density storage bays, dimensions

Figure 30 on page 53 shows the standard layout of a fully loaded Symmetrix system with high density bays on a raised floor with tile cutouts.



Note:

- Typical 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.
- Typical cutouts are 9 in. (22.9 cm) from the front and rear of the tile.
- Typical cutouts are centered on the tiles, 9 in. (22.9 cm) from the front and rear and 8 in. (20.3 cm) from sides.
- There is a .25 in. (.64 cm) gap between bays.
- There is a 42 in. (106.7 cm) service area front and rear on both the storage bay and system bay.

Figure 30 System and high density storage bays, placement with floor tile cutouts

Figure 31 on page 53 shows an example of the dimensions for a Symmetrix system with a mix of standard and high density storage bays. Layouts will vary based on the selection of storage bays, as described in "VMAX 20K and 40K systems" on page 36.

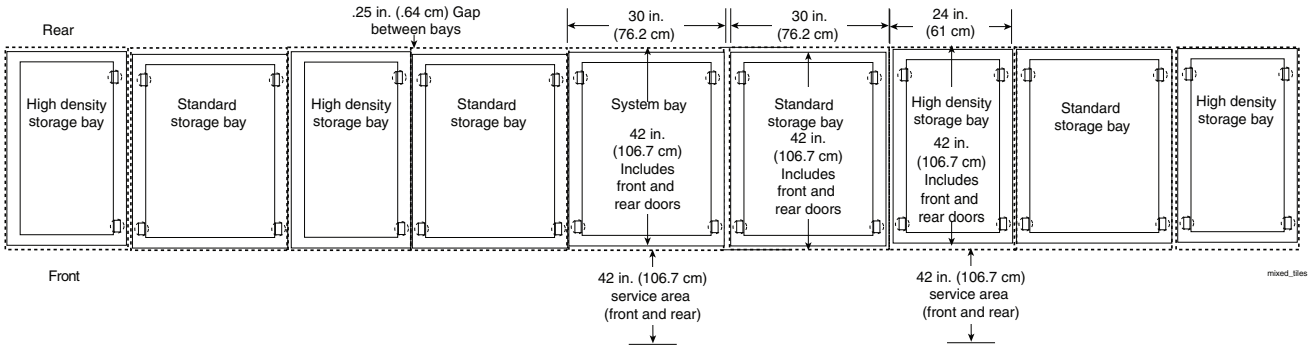
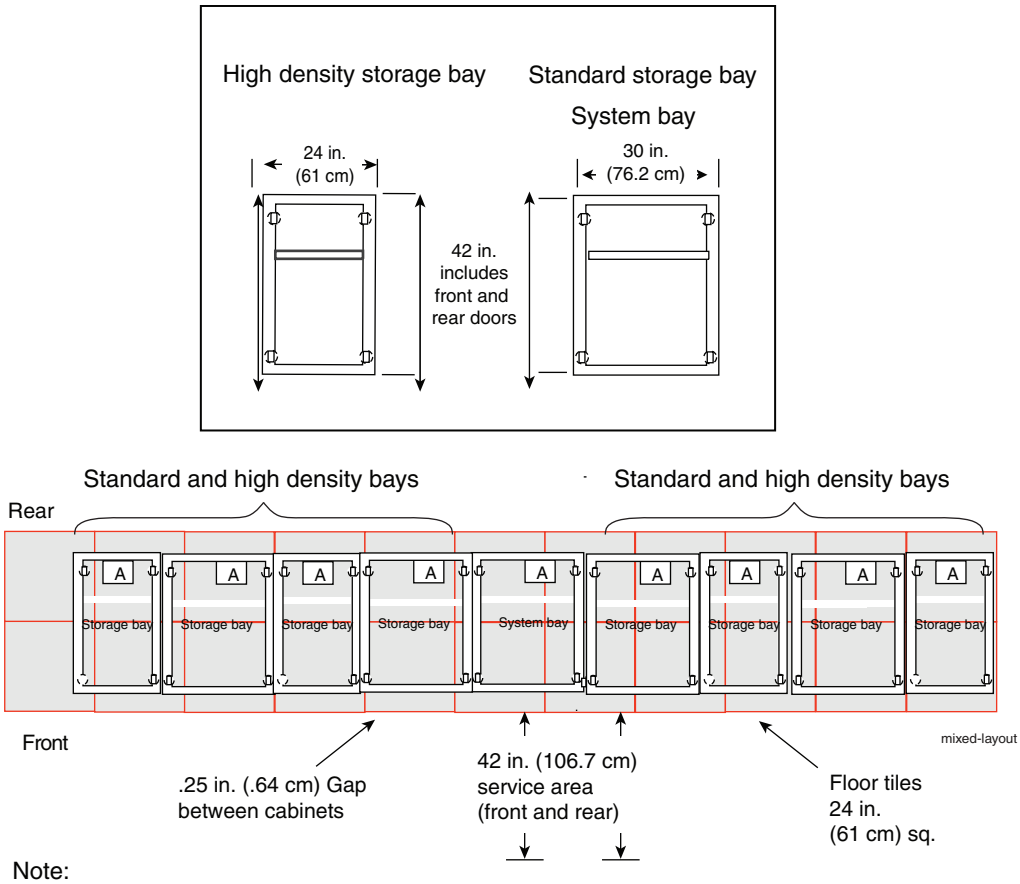


Figure 31 System dimensions, standard and high density bays

Figure 32 on page 54 shows the configuration and placement of the a Symmetrix VMAX 40K system with standard and high density storage bays on a raised floor with tile cut outs. Layouts will vary based system configuration and storage bay selection.



Note:

- Typical 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.
- Typical cutouts are 9 in. (22.9 cm) from the front and rear of the tile.
- Typical cutouts are centered on the tiles, 9 in. (22.9 cm) from the front and rear and 8 in. (20.3 cm) from sides.
- There is a .25 in. (.64 cm) gap between bays.
- There is a 42 in. (106.7 cm) service area front and rear on both the storage bay and system bay.

Figure 32 Standard layout, mixed 15-drive and 25-drive DAE bays with tile cutouts

Caster and leveler dimensions

Figure 33 on page 55 shows caster and leveler dimensions for the system and storage bay.

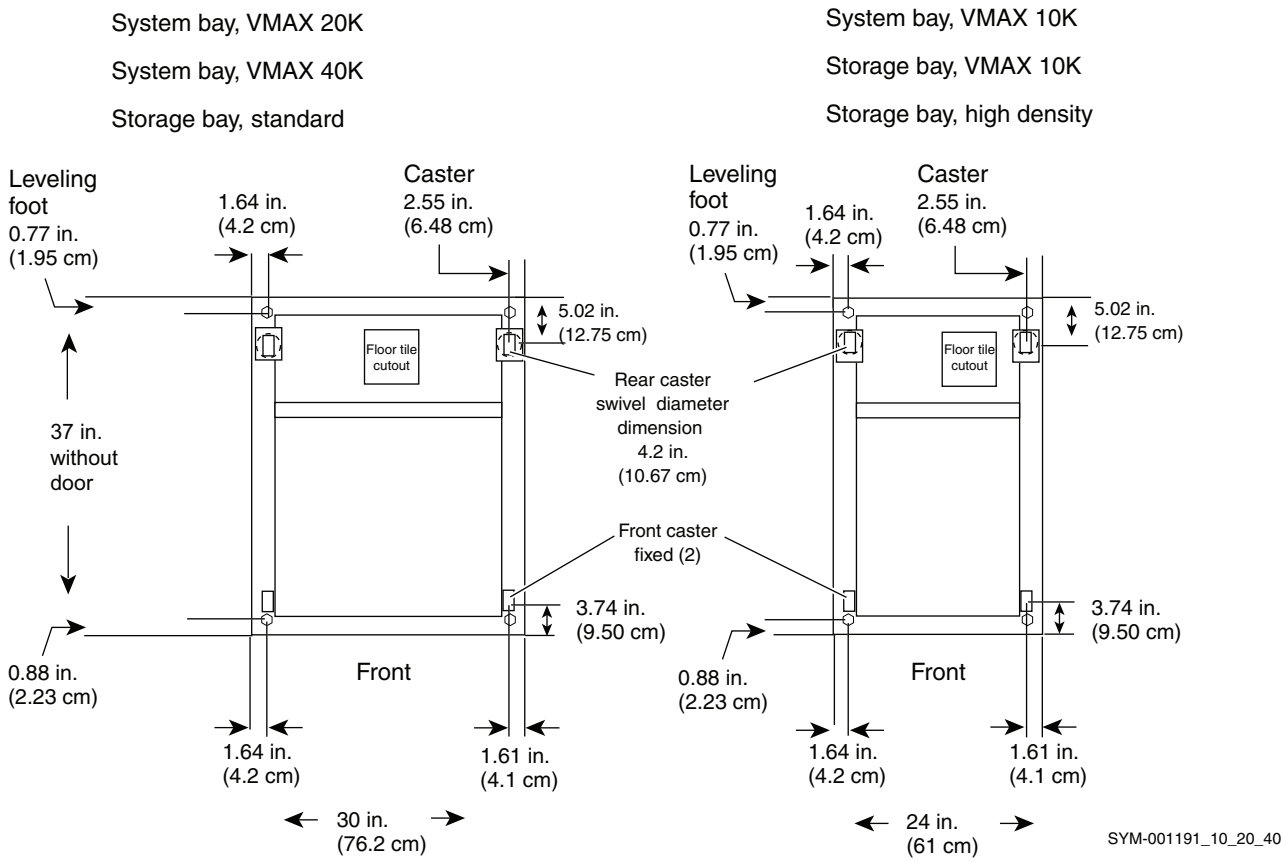


Figure 33 System and storage bay caster and leveler dimensions

Overhead cable routing

When installing a Symmetrix system in nonraised floor (or in some instances on a raised floor) environments, the host cabling and power is handled from overhead using the topside cable routing kit.

Topside routing kit

EMC provides a topside cable routing kit to assist in the management of cable routing into the system.

Table 33 on page 56 provides part number and description information for the topside cable routing kits on VMAX 10K systems.

- Models preceded with the BC prefix are available in China (BC-TOP-KIT)
- Models preceded with the BA prefix are available outside of China (BA-TOP-KIT)

Table 33 Topside cable routing kit, VMAX 10K systems

Description	Model number
VMAX 10K system bay and storage bay	**- TOP-KIT

Table 34 on page 56 provides part number and description information for the topside cable routing kits on VMAX 20K systems.

Table 34 Topside cable routing kits, VMAX 20K systems

Description	Model Number
VMAX 20K system bay	S2-SYS-TOPKIT
VMAX 20K storage bays	S2-DB-TOP-KIT

Table 35 on page 56 provides part number and description information for the topside cable routing kits on VMAX 40K systems.

Table 35 Topside cable routing kits, VMAX 40K systems

Description	Model Number
VMAX 40K system and standard storage bay	SD-DB-TOP-KIT
VMAX 40K high density storage bays	SD-DBT-TOP-KIT

Power cabling

If the customer requires power to be supplied from overhead, EMC recommends the power cables be “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 “Topside routing kit” on page 56, which allow the power cables inside the machine to be routed out through the top. The customer is responsible for meeting all local electrical safety requirements.

System and storage bay power components

Symmetrix system and storage bays provide components that support the following transmission methods:

- North American — Single-phase or three-phase
- International — Single-phase or three-phase
- Australian — Single-phase

The transmission methods available depend on the VMAX 10K, VMAX 20K or VMAX 40K model, as described in "VMAX 10K systems" on page 58 and "VMAX 20K and 40K systems" on page 61.

All storage and system bays within a configuration must use the same power transmission method.

IMPORTANT

If the system or storage bays have been without power six months prior to installation, the lead SPS and UPS modules may have discharged to the point where they will no longer hold a charge. In some extreme cases, these modules may need to be replaced prior to putting the system online. This is due to the batteries having a shelf life of approximately 6 months when not being continuously charged by the charger in the SPS or UPS.

VMAX 10K systems

VMAX 10K systems support North American single-phase, International single-phase, and Australian single-phase power transmission components.

System bay, single-phase

Figure 34 on page 58 shows single-phase power components in a system bay. Power components for single-phase transmission include two PDPs, one for each system bay power zone, and two PDUs.

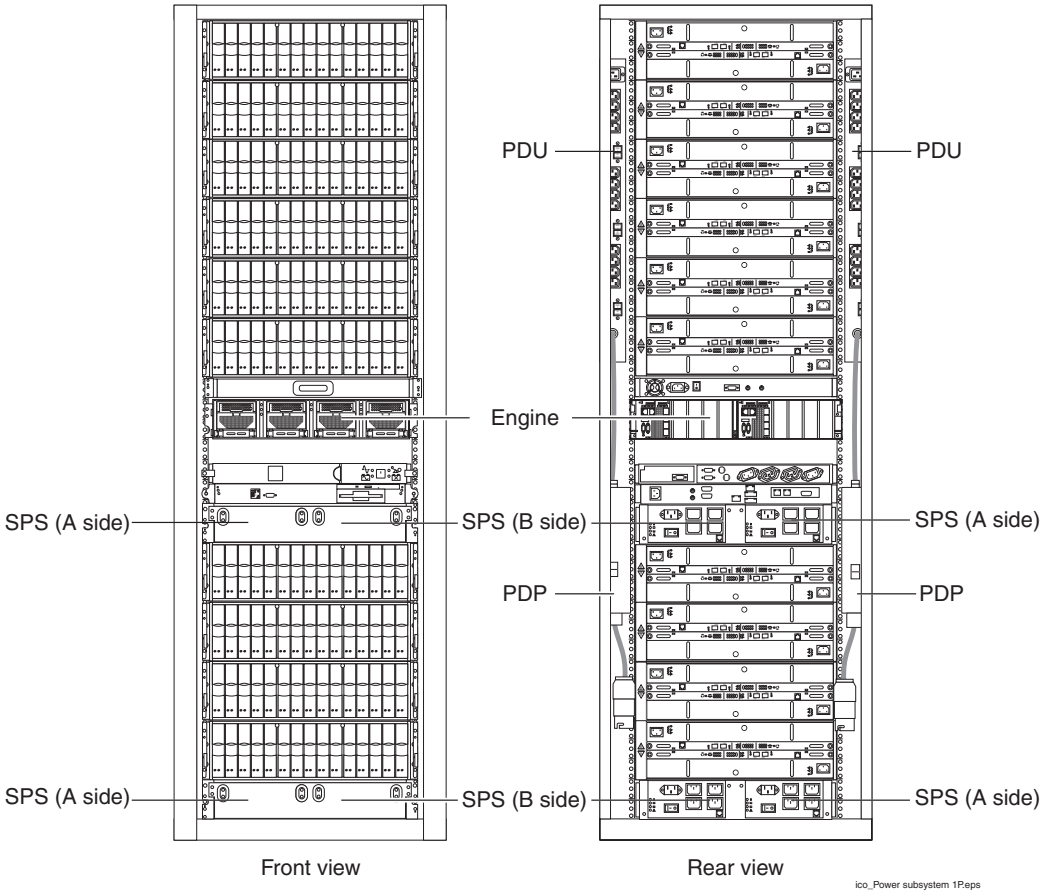


Figure 34 System bay power subsystem, two PDPs (single-phase)

Storage bays, single phase

Figure 35 on page 59 shows single-phase power components in a storage bay. Power components include two PDPs, one for each system bay power zone, and two PDUs. Some storage bays include two additional PDUs (four total) that are used to power the light on the system door.

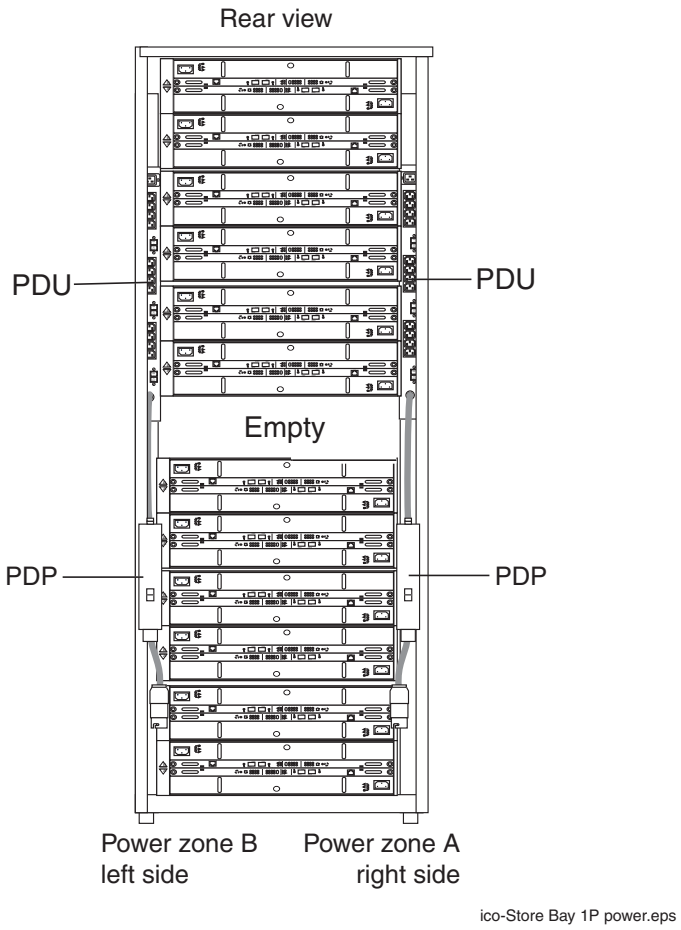


Figure 35 Storage bay power subsystem, two PDPs (single-phase)

System or storage bay, VMAX 10K File components

System or storage bays with VMAX 10K File components use single-phase power transmission, but are provided with two additional PDPs and two additional PDUs, located in the lower half of the bay.

- The upper PDUs and the lower PDPs connect to Symmetrix components
- The lower PDU and upper PDPs connect to VMAX 10K File components.

Figure 36 on page 60 shows power components for VMAX 10K File components.

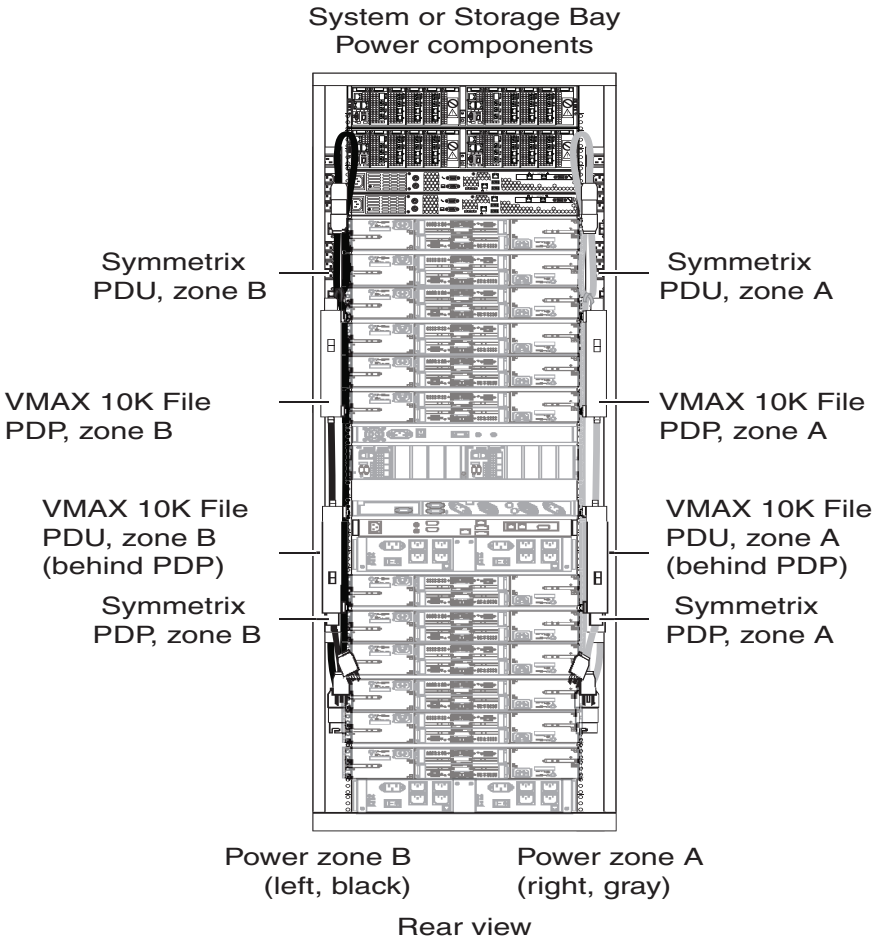


Figure 36 VMAX 10K File power components

VMAX 20K and 40K systems

VMAX 20K and 40K systems support North American (single-phase or three-phase), International (single-phase or three-phase), and Australian single-phase power transmission components.

System bay, single-phase

Figure 37 on page 61 shows an example of single-phase power components in a VMAX 40K system bay. Single-phase power components include four PDPs, two for each system bay power zone, and four PDUs. Single-phase power components are the same in VMAX 20K systems and VMAX 40K systems.

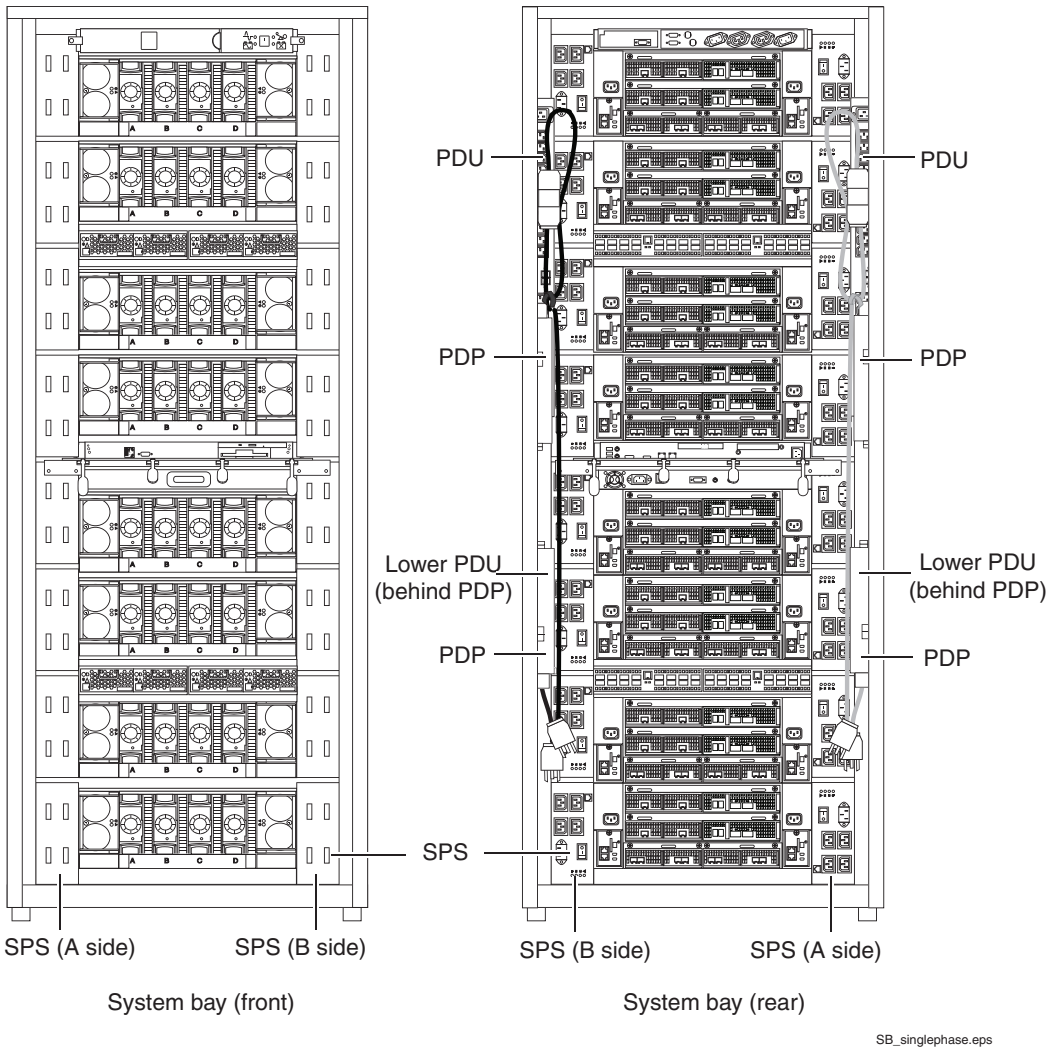


Figure 37 System bay power subsystem, four PDPs (single-phase)

System bay, three-phase

Figure 38 on page 62 shows an example of three-phase power components in a system bay on a VMAX 40K system. Three-phase power components include two PDPs, one for each system bay power zone, and four PDUs. Three-phase power components are the same in VMAX 20K and VMAX 40K systems.

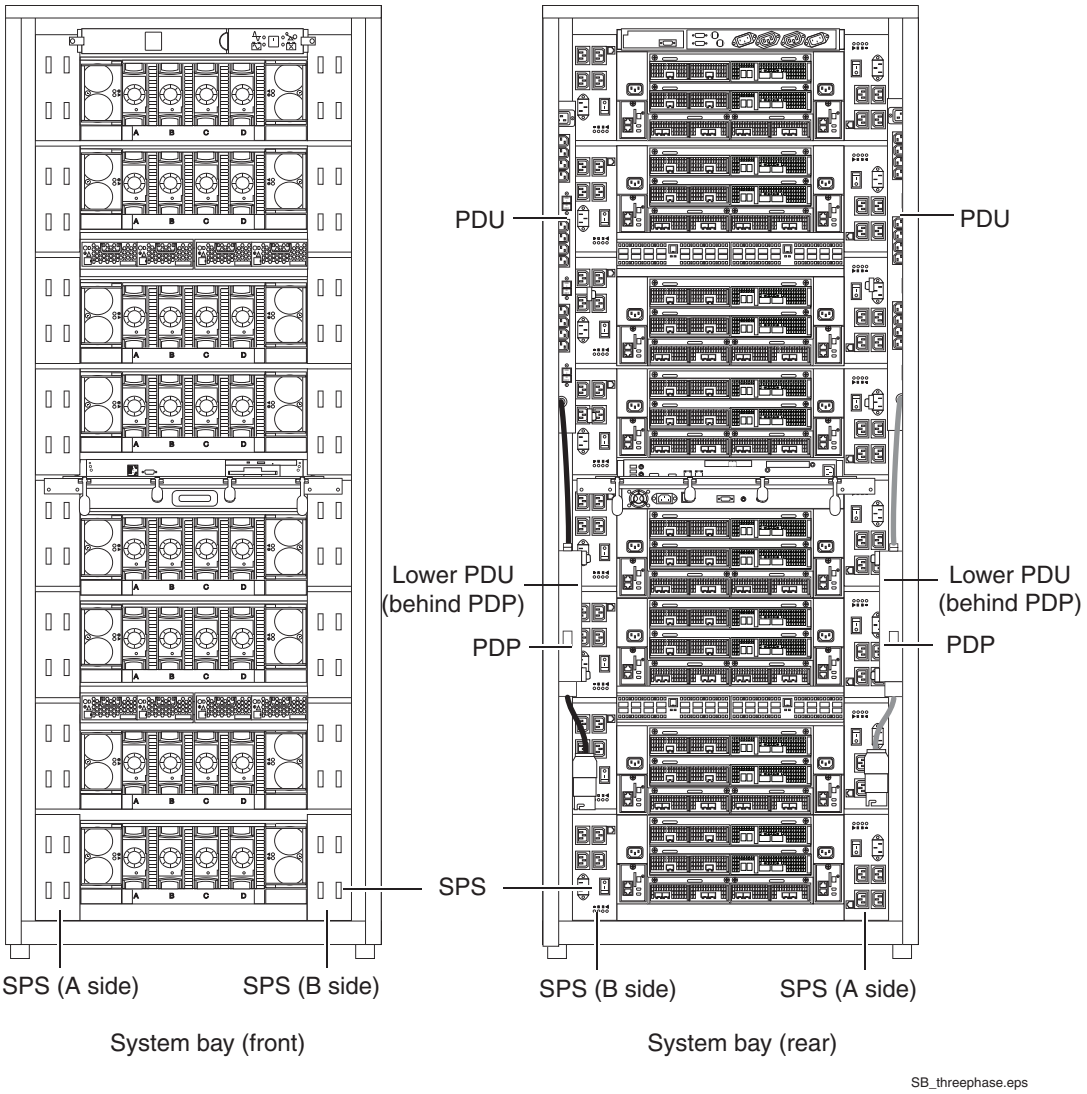


Figure 38 System bay power subsystem, two PDPs (three-phase)

Standard storage bay, single-phase

Figure 39 on page 63 shows single-phase power components in a standard storage bay. Power components include four PDPs, two for each storage bay power zone, and four PDUs.

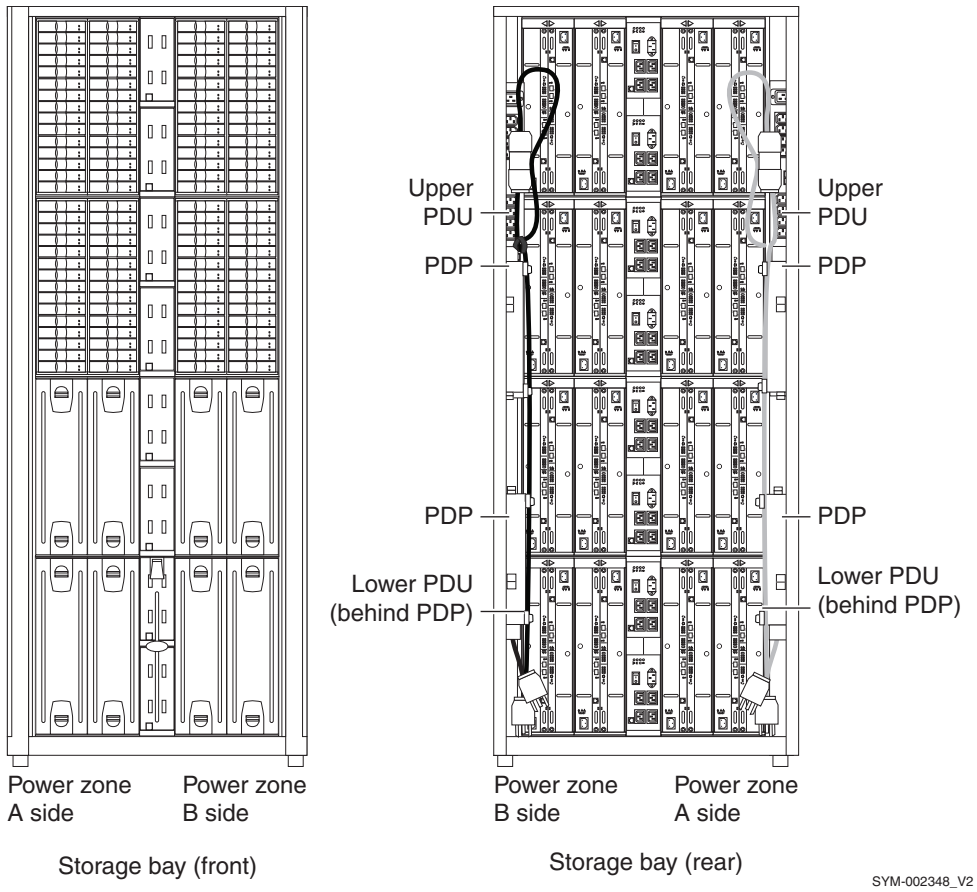


Figure 39 Standard storage bay power subsystem, four PDPs (single-phase)

Standard storage bay, three-phase

Figure 40 on page 64 shows three-phase power components in a standard storage bay. Power components include two PDPs, one for each storage bay power zone, and two PDUs.

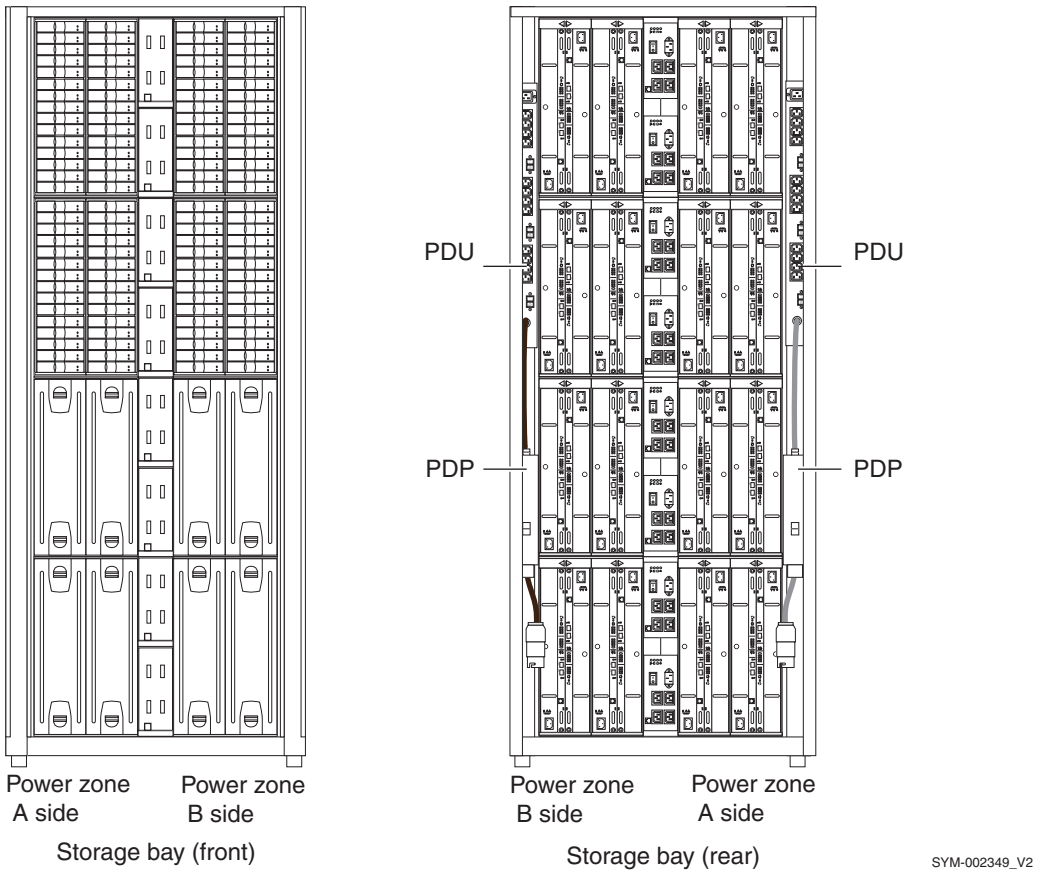


Figure 40 Standard storage bay power subsystem, two PDPs (three-phase)

High density storage bay, single-phase

Figure 41 on page 65 shows single-phase power components in a high density storage bay. Power components include four PDPs, two for each storage bay power zone, and four PDUs.

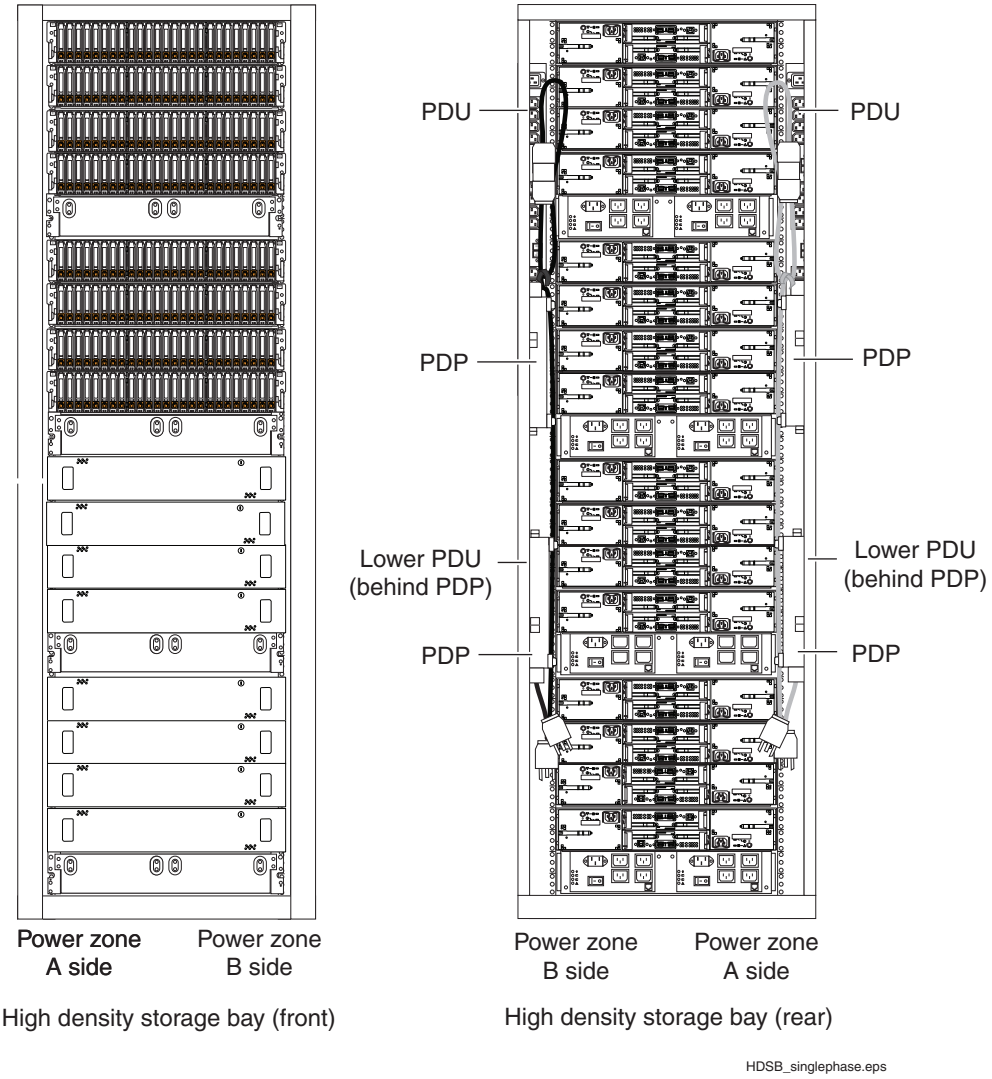


Figure 41 High density storage bay power subsystem, four PDPs (single-phase)

High density storage bay, three-phase

Figure 42 on page 66 shows three-phase power components in a high density storage bay. Power components include two PDPs, one for each storage bay power zone, and two PDUs.

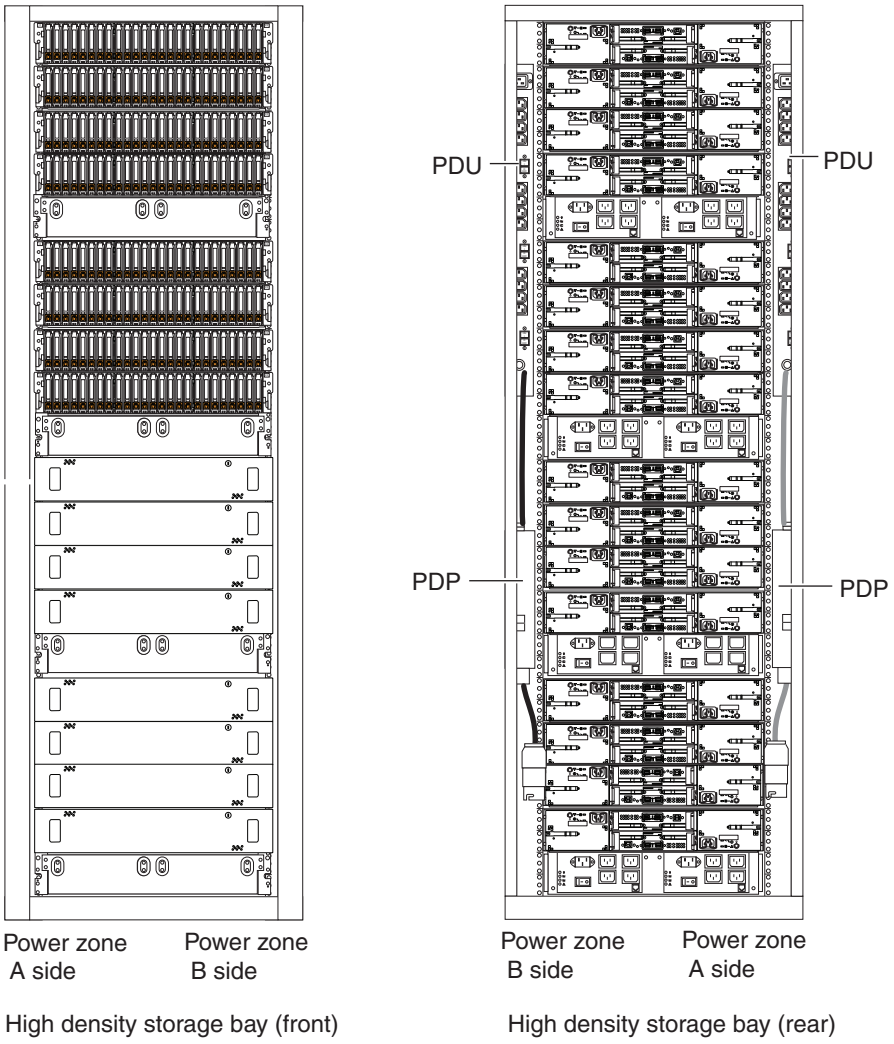


Figure 42 High density storage bay power subsystem, two PDPs, three-phase

Planning the power interface

This section describes electrical specifications for systems installed in North American, International, and Australian sites. Data centers with must conform to the corresponding specification.

Single-phase North American, International, and Australian installation

Table 36 on page 67 contains specifications for North American, International and Australian single-phase power transmission.

Table 36 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 (minimum)		
VMAX 10K system bay VMAX 10K storage bay VMAX 10K system or storage bay with VMAX 10K File components	Two 30 A, single-phase drops per bay Two 30 A, single-phase drops per bay Four 30 A, single-phase drops per bay	Two 32 A, single-phase drops per bay Two 30 A, single-phase drops per bay Four 32 A, single phase drops per bay
VMAX 20K and 40K system bay and storage bay	Four 30 A, single-phase drops per bay	Four 32 A, single-phase drops per bay

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

Three-phase, North American, International

Table 37 on page 67 describes three-phase power specifications.

Table 37 Three-phase AC power

Specification	North American 4 Wire Connection (3 L & 1 G)[1]	International 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	Two 32 A, three-phase drops per bay

1. L = line or phase, N = neutral, G = ground
2. An imbalance of AC input currents may exist on the three-phase power source feeding the Symmetrix system, 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.

Planning dedicated dual power for each Symmetrix bay

Before the Symmetrix system 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 and each storage bay.

The *EMC Best Practices Guide for AC Power Connections (2-PDP Bays)* or the *EMC Best Practices Guide for AC Power Connections (4-PDP Bays)* provides detail site preparation and power connection procedures.

IMPORTANT

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

Basic power connection, 2-PDP and 4-PDP

For single-phase power, systems and storage bays include two power zones with two PDPs in each zone.

For three-phase power, system and storage bays include two power zones with a PDP in each zone.

Extension cords are colored coded. If you have color-coded (black and gray) power extension cables, connect as follows:

- Black extension cables connect to the PDP in zone B
- Gray extension cables connect to the PDP in zone A.

Figure 43 on page 69 and Figure 44 on page 70 illustrate the basic power cabling for a system or storage bay to customer PDU power cabling.

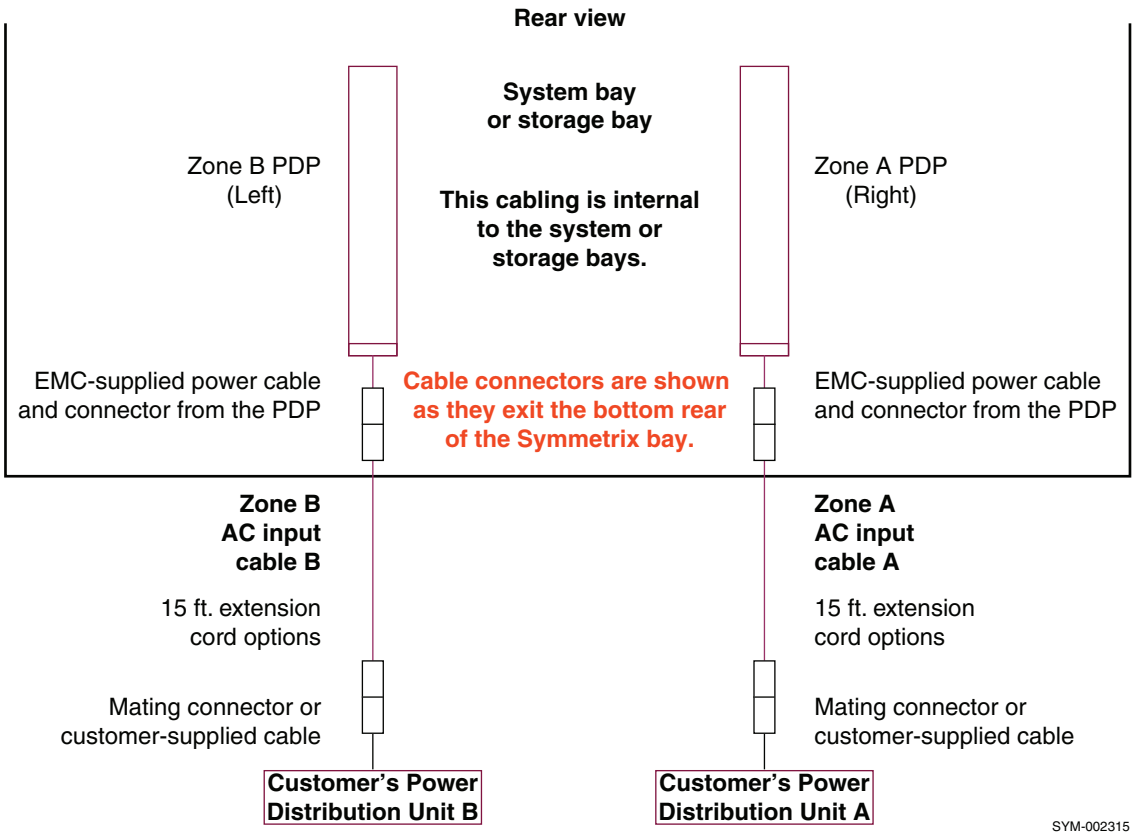


Figure 43 System or storage bay to customer PDU power cabling, 2-PDP

Figure 44 on page 70 illustrates the basic power cabling for a Symmetrix system or storage bay with single-phase power.

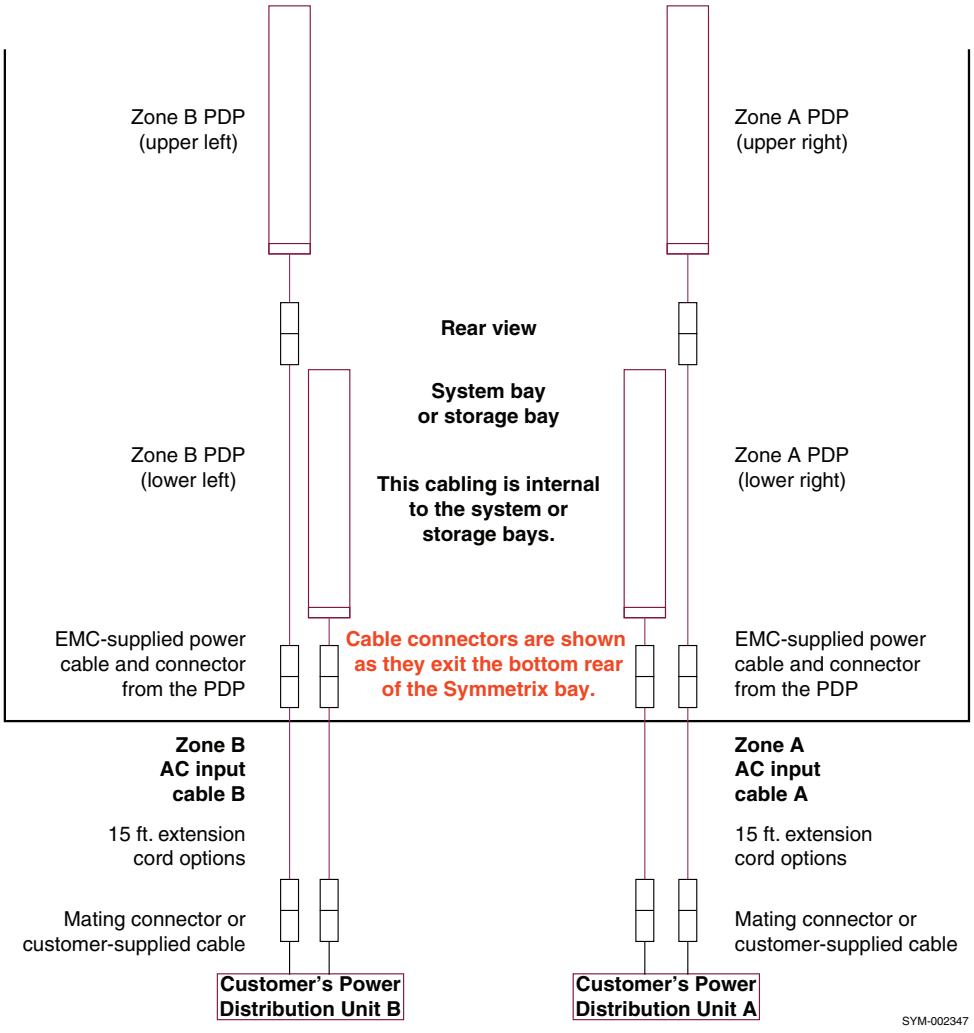


Figure 44 System or storage bay to customer PDU power cabling, 4-PDP

Connecting to AC power sources

Figure 45 on page 71 shows the label attached to each of the power cables exiting the Symmetrix system and storage bay. The label shows the Symmetrix bay *incorrectly* cabled to one power source and *correctly* cabled to two separate independent power sources.

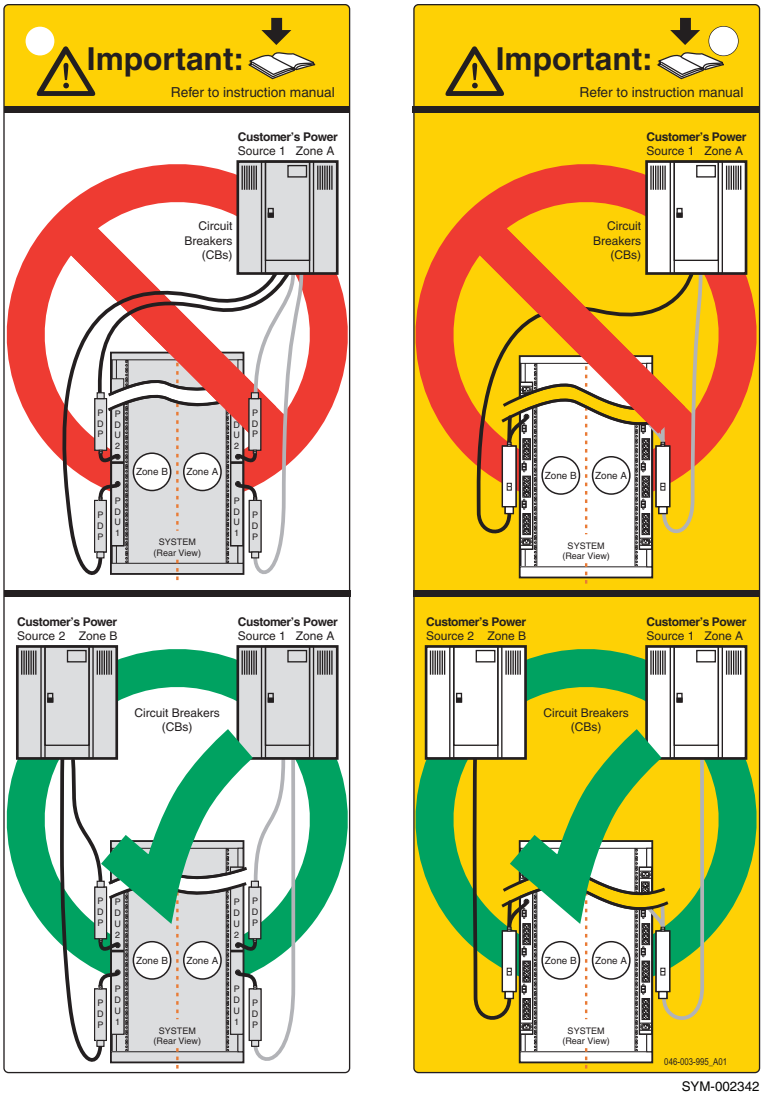


Figure 45 Correct and incorrect connection to redundant power sources

⚠CAUTION

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

This 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 system:

- The EMC Customer Engineer should discuss with the customer the need for validating AC power redundancy at each bay, and that a Data Unavailable (DU) event could occur if these requirements are not met.
- The customer should complete power provisioning with the data center prior to connecting power to the system.
- 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 the bays.
- 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 coding of these power cables can be an option 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 system:
  - 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, as shown in Figure 45 on page 71.
- The EMC Customer Engineer must record the PDU and circuit breaker information for each power drop feeding the system on the *AC Power Configuration Worksheet*.
- 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 testing 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.

Very simply stated, one PDU should never supply both power zone feeds to any one rack of equipment. Figure 45 on page 71 shows the label attached to power cords that shows how to connect to customer power sources.

Choosing a UPS option

The Symmetrix system is capable of supporting two consecutive five-minute power outages before its battery backup unit is depleted. To extend this time period, the customer should consider purchasing a UPS and/or a back up generator from a preferred vendor.

EMC neither offers nor recommends any specific UPS suppliers or product type for its customers. However, EMC uses preferred suppliers for UPS systems in their facilities. Therefore, if you, the customer, are implementing a UPS, EMC recommends the following:

- When you are planning the UPS solution for the Symmetrix system and the host system is presently (or potentially will be) protected with a UPS, the battery backup time you propose for the Symmetrix UPS solution should match that of the host system.
- The Symmetrix system requires independent zone B and zone A power feeds for each bay.
- The UPS should be equipped with an internal output isolation transformer.
- The UPS should be installed as a separately derived AC source using neutral and ground wiring to preserve the (2N) fault tolerance specification of the Symmetrix power system.
- Depending on the power requirements for the Symmetrix system operation, an isolation transformer/stabilizer installed in front of the UPS could buffer the AC utility environmental factors from reaching the Symmetrix system. To determine if an isolation transformer/stabilizer is needed, consult a licensed electrician.

Power extension cords, connectors, and wiring

Each Symmetrix system has two or four PDPs with a power cable affixed to each PDP, and a connector affixed to each power cable.

Extension cord model numbers

EMC uses a prefix, before the model numbers, to identify power cords for VMAX 10K, VMAX 20K and VMAX 40K systems:

- BC — Identifies power cords for VMAX 10K systems in China (*BC*-PW40U-US)
- BA — Identifies power cords for VMAX 10K systems outside of China (*BA*-PW40U-US)
- S2 — Identifies power cords for VMAX 20K systems (*S2*-PW40U-US)
- SD — Identifies power cord for VMAX 40K systems (*SD*-PW40U-US)

Single-phase

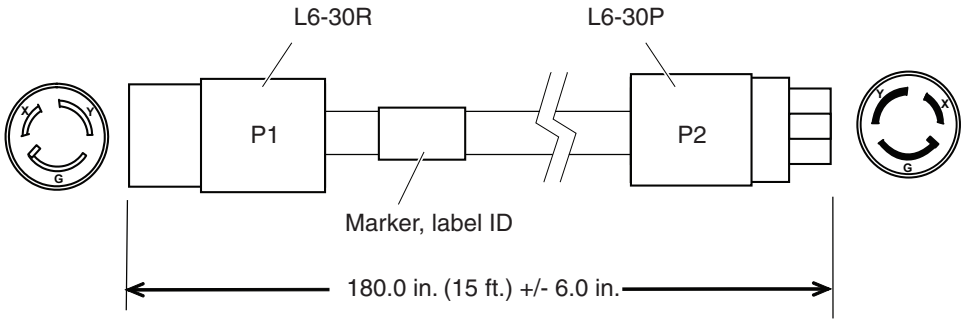
Table 38 on page 74 describes the extension cords and connector options for single-phase power transmission.

Table 38 Extension cords and connectors options – single-phase

Plug on back of EMC system[1]	EMC supplied extension cord EMC model number[2][3]	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 L6-30P	**-PW40U-US Figure 46 on page 75	NEMA L6-30R 	NEMA L6-30P 	NEMA L6-30R 
	**-PW40URUS Figure 47 on page 75	NEMA L6-30R 	Russellstoll 3750DP 	Russellstoll 9C33U0 
	**-PW40UIEC3 Figure 48 on page 76	NEMA L6-30R 	IEC-309 332P6 	IEC-309 332C6 
	**-PW40UASTL Figure 49 on page 76	NEMA L6-30R 	CLIPSAL 56PA332 	CLIPSAL 56CSC332 

1. Four (4) plugs per Symmetrix storage bay and system bay, two (2) plugs per system bay (VMAX 20K and VMAX 40K) and two (2) plugs per system bay and (2) plugs per storage bay (VMAX 10K).
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.

Figure 46 on page 75 through Figure 49 on page 76 provide cable descriptions for customer-to-system wiring for bays with single-phase power transmission

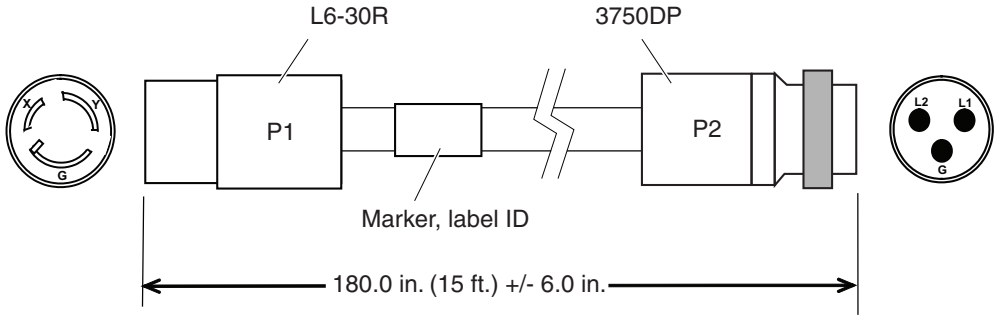


Electrical/wiring specification

Color	From	To	Signal
BLK	P1-X	P2-X	L
WHT	P1-Y	P2-Y	L
GRN	P1-G	P2-G	GND

SYM-002440

Figure 46 PW40U-US, single-phase

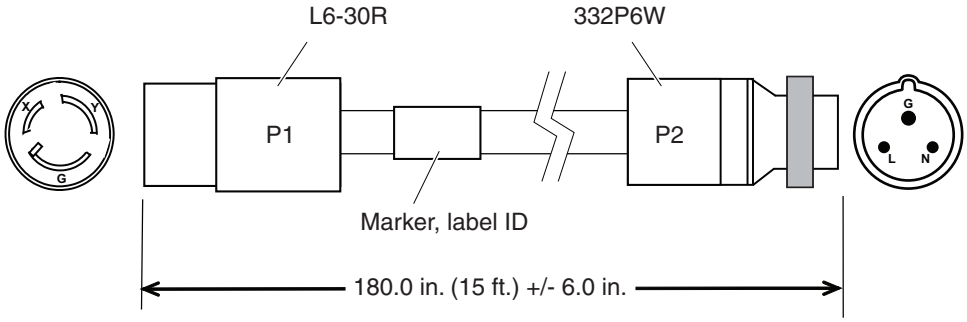


Electrical/wiring specification

Color	From	To	Signal
BLK	P1-X	P2-L1	L
WHT	P1-Y	P2-L2	L
GRN	P1-G	P2-G	GND

SYM-002439

Figure 47 PW40URUS, single-phase

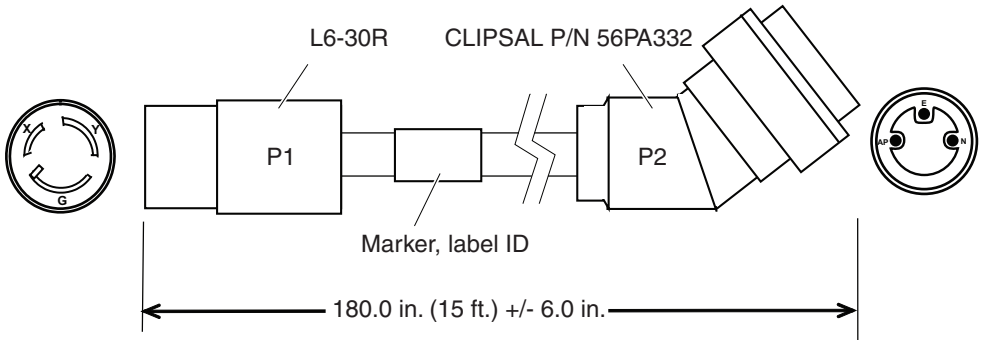


Electrical/wiring specification

Color	From	To	Signal
BRN	P1-X	P2-L	L
BLU	P1-Y	P2-N	N
GRN/YEL	P1-G	P2-G	GND

SYM-002345

Figure 48 PW40UIEC3, single-phase



Electrical/wiring specification

Color	From	To	Signal
BRN	P1-X	P2-AP	L
BLU	P1-Y	P2-N	N
GRN/YEL	P1-G	P2-E	GND

SYM-002344

Figure 49 PW40UASTL, single-phase

Three-phase, international

Table 39 on page 77 describes the extension cords and connector options for three-phase international power transmission.

EMC uses the these prefixes to identify model numbers:

- S2 — Identifies power cords for VMAX 20K systems (*S2*-PW40U-US)
- SD — Identifies power cord for VMAX 40K systems (*SD*-PW40U-US)

Table 39 Extension cords and connectors options – three-phase international

Plug on back of EMC system[1]	EMC supplied extension cord EMC model number[2]	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	**-PC3YAFLE (default)[3] Figure 50 on page 78	ABL Sursum K52.30 	Flying Leads (Europe) 	
	**-PCBL3YAG[b] Figure 51 on page 78	ABL Sursum K52.30 	GARO P432-6 	GARO S432-6 
	**-PC3YAFLA[b] Figure 52 on page 79	ABL Sursum K52.30 	Flying Leads (International) 	

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.

Figure 50 on page 78 through Figure 52 on page 79 provide cable descriptions for customer-to-system wiring for systems that use three-phase international power transmission.

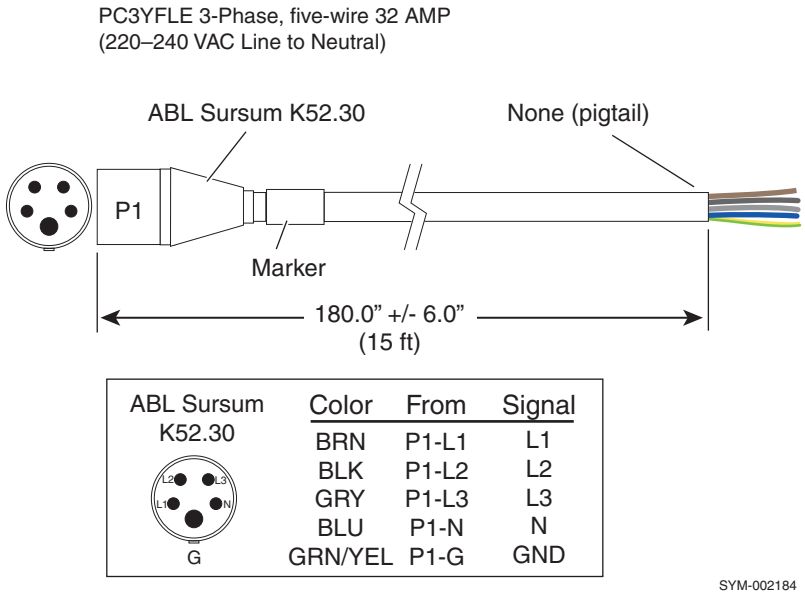


Figure 50 PC3YAFLE, flying leads, three-phase, international

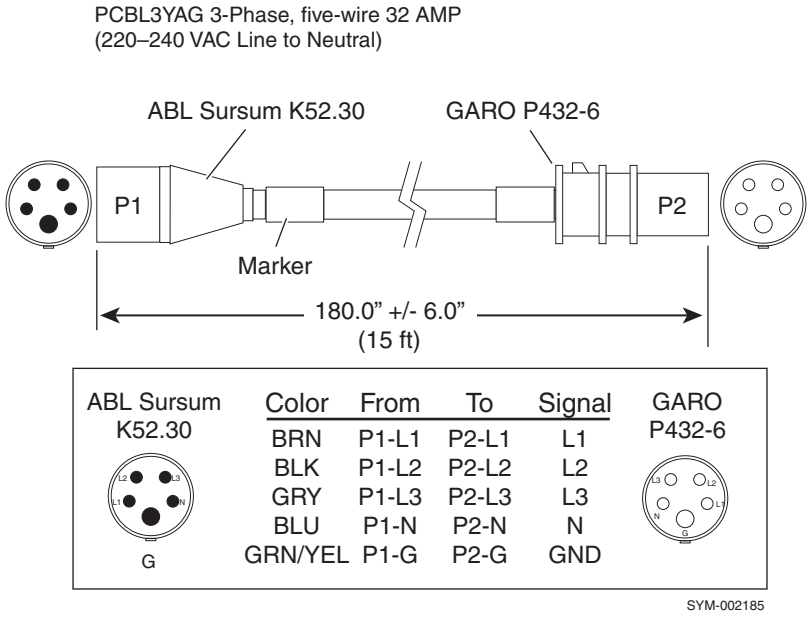


Figure 51 PCBL3YAG, three-phase, international

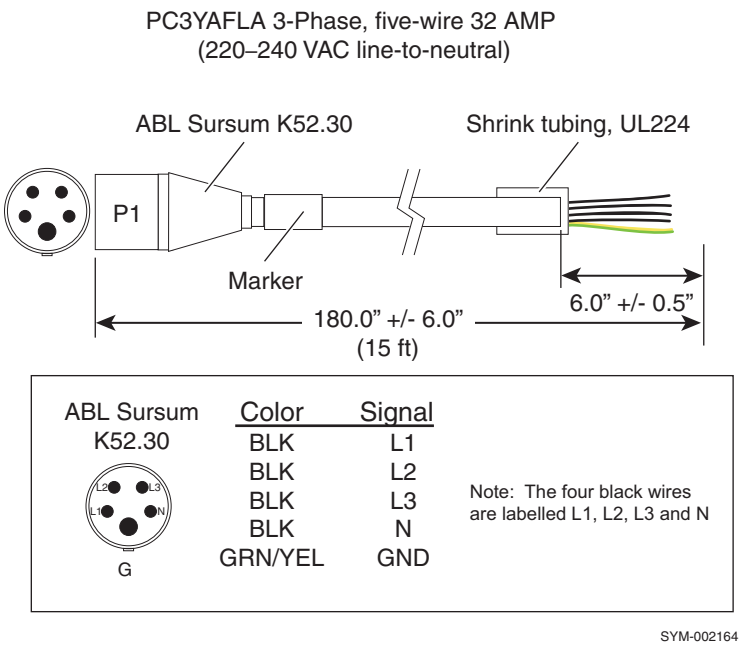


Figure 52 PC3YAFLA, flying leads, three-phase, international

Three-phase, North American

Table 40 on page 79 describes the extension cords and connector options for three-phase North American power transmission. EMC uses theses prefixes to identify model numbers:

- S2 — Identifies power cords for VMAX 20K systems (*S2*-PW40U-US)
- SD — Identifies power cord for VMAX 40K systems (*SD*-PW40U-US)

Table 40 Extension cords and connectors options – three-phase North American

Plug on back of EMC system[1]	EMC supplied extension cord EMC model number[2]	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	**-PCBL3DHR (default)[3] Figure 53 on page 80	Hubbell CS-8364C 	Russellstoll 9P54U2 	Russellstoll 9C54U2  EMC supplied as EMC model number SD-ACON3P-50
	**-PCBL3DHH Figure 54 on page 81	Hubbell CS-8364C 	Hubbell CS-8365C 	Hubbell CS-8364C (customer-supplied) 

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.

Table 41 Extension cords and connectors options – three-phase, domestic 5 wire

Plug on back of EMC system[1]	EMC supplied extension cord EMC model number[2]	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	**-PCBL3YL23P[3] Figure 55 on page 81	Hubbell C530C6S 	NEMA L22-30P 	NEMA L22-30R 
	**-PCBL3YL23P[4] Figure 56 on page 82	Hubbell C530C6S 	NEMA L22-30P 	NEMA L22-30R 

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. The supplied extension cord complies to both UL and European requirements for wire color codes.

Figure 53 on page 80 and Figure 54 on page 81 provide cable descriptions for models that connect bays with three-phase North American power transmission.

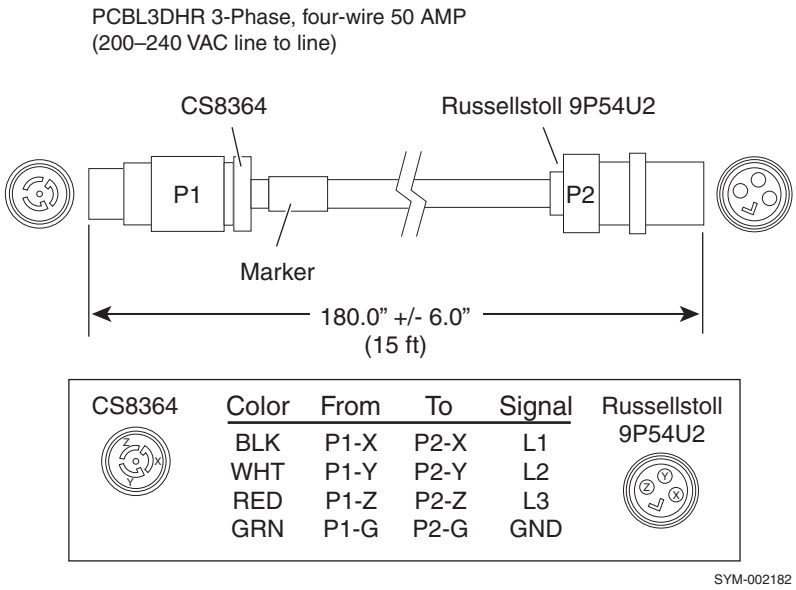


Figure 53 PCBL3DHR, three-phase, North American

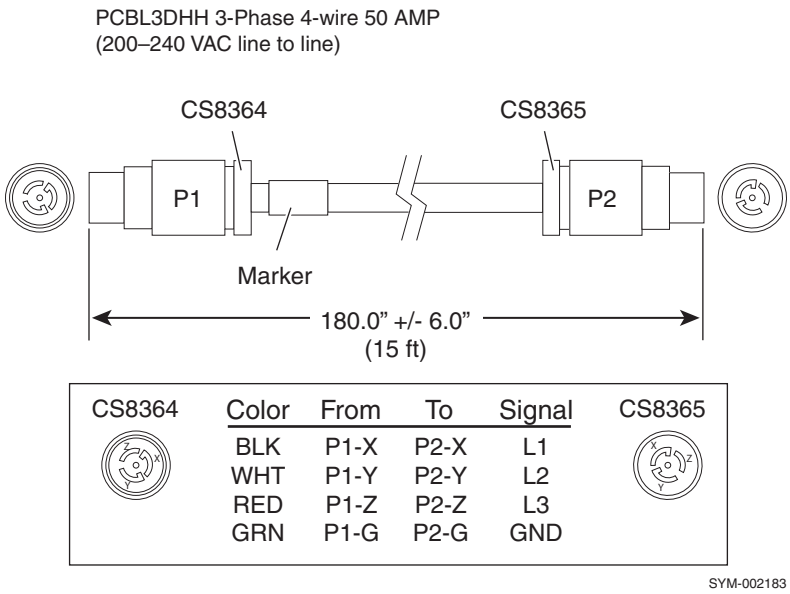
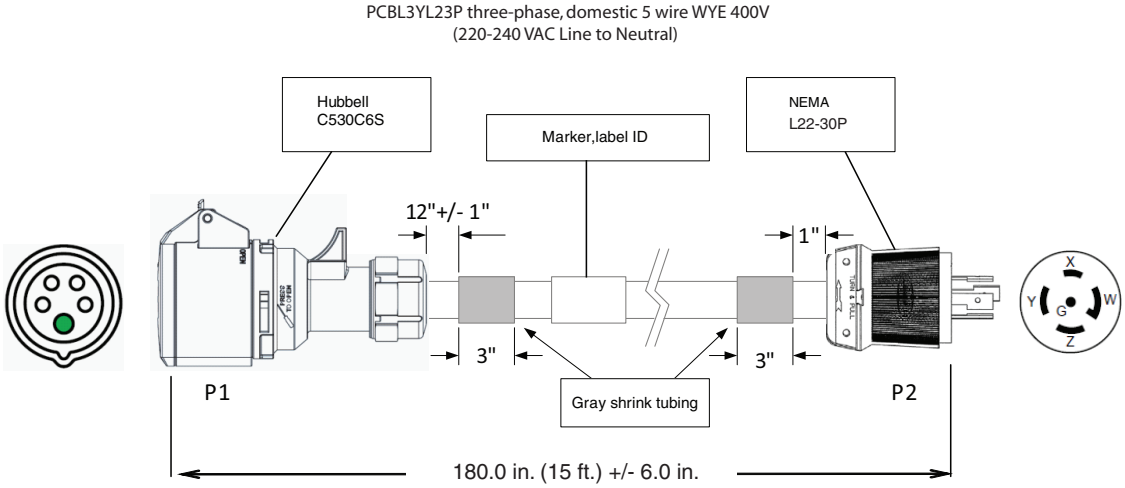


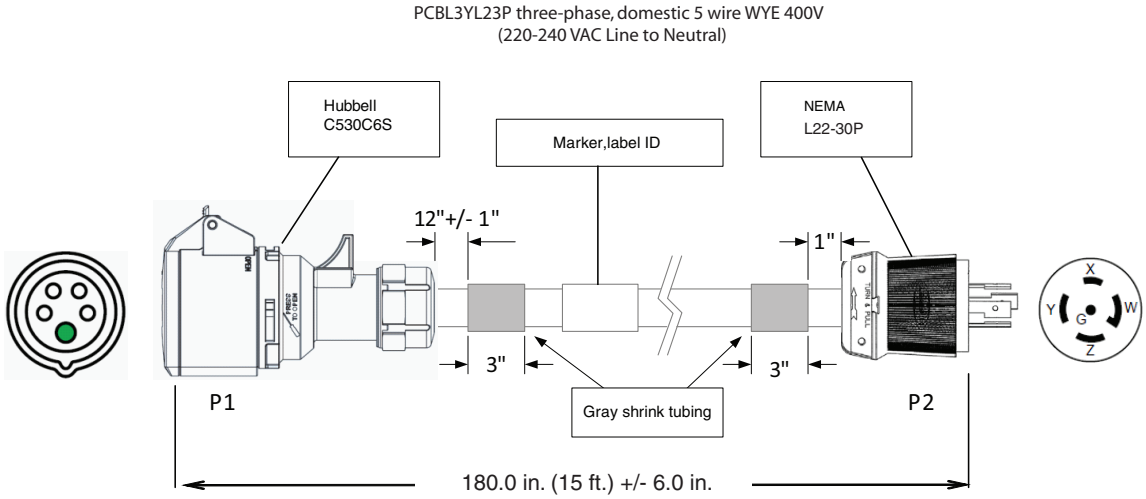
Figure 54 PCBL3DHH, three-phase, North American



Electrical/wiring specification

Color	From (P1)	To (P2)	Signal
BLK1	P1-R1	P2-X	L1
BLK2	P1-S2	P2-Y	L2
BLK3	P1-T3	P2-Z	L3
BLK4	P1-N	P2-N	N
GRN/YLW	P1-G	P2-G	GND

Figure 55 PCBL3YL23P, three-phase, domestic 5 wire



Electrical/wiring specification

Color	From (P1)	To (P2)	Signal
BRN	P1-R1	P2-X	L1
BLK	P1-S2	P2-Y	L2
GRAY	P1-T3	P2-Z	L3
BLUE	P1-N	P2-N	N
GRN/YLW	GND	GND	GND

Figure 56 PCBL3YL23P, three-phase, domestic 5 wire

VMAX 10K 3rd party racking option

Symmetrix VMAX 10K components may be installed in a customer-supplied rack that conforms to the National Electrical Manufacturers Association (NEMA) standard for 19-inch cabinets. This allows customers to install Symmetrix components into a standard rack that conforms to their existing computer room and infrastructure.

Components that are installed in a customer rack are shipped in a fully tested EMC system or storage bay (shipping rack), and installed by EMC customer support engineers. The original shipping rack, when empty, is returned to EMC after the installation is complete.

IMPORTANT

Before you proceed in installing Symmetrix components into a 3rd party rack EMC recommends you first complete the *EMC PDU Power Connection Worksheet for Symmetrix in 3rd Party Racks* worksheet with your site electrician to identify each branch circuit.

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 36 inches front and rear clearance is required to provide adequate airflow and to allow for system service.

Rack requirements

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

- Individual racks must ***ONLY*** contain Symmetrix VMAX 10K and conforming third party PDU and cable management components, and must be empty at the time of installation.
- A separate rack that supports a minimum 1300 lb/590 kg of weight must be provided for each system and storage bay.
- Components and cables installed in customer racks must conform to Symmetrix VMAX 10K configuration rules:
  - Components and cables within a system or storage bay can not be moved to available space in different bay, or to a different location within the same bay.
  - System and storage bays must be properly positioned in accordance with VMAX 10K physical placement rules. Physical separation of racks/bays is not allowed with exception of optical dispersion option for system bays 2 and 3.
- Racks must have a standard 19 inch NEMA rail with a minimum of 40 and a maximum of 44 U of contiguous vertical channel space (1U increments).
- Racks that are longer than 44 U are allowed but must install blanking (filler) panels, available from EMC, to prevent air recirculation.

- Racks must be at least 38 inches deep, and provide 24 to 32 inch front-to-rear rail depth
- Racks with round or square channel openings must support M5 screws that secure EMC rails and components. Clip nuts are provided by EMC as required.
- Rack-to-rack pass-through cable access must be available via removable side panels or adequate pass through openings.
- To ensure proper clearance and air flow to the Symmetrix VMAX 10K components, customer supplied front doors, if used, must include a minimum of 2.5 inch 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 50% (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.

Component requirements for rack option

Table 42 on page 85 to Table 48 on page 87 provide the requirements and descriptions for individual components to be used for 3rd party rack option.

1U UPS, Server, and KVM

Table 42 1U UPS + Server + KVM

Requirement	Description
AC line voltage	200 to 240 V AC ± 10%, single-phase, 47 to 63 Hz
AC line current, internal and pass-through	0.68 A max at 200 V AC
Internal power consumption	135 VA (130 W) max
Heat dissipation	4.68 x 10^5 J/hr (440 Btu/hr), steady state
In-rush current	36 A max for ½ line cycle at 240 V AC
AC inlet type	IEC320-C14 appliance coupler, per power zone
Charge times	6.0 hours max

Engine and 2U SPS

Table 43 Engine + 2 U SPS

Requirement	Description
AC line voltage	200 to 240 V AC ± 10%, single-phase, 47 to 63 Hz
AC line current (operating maximum)	• 3.23 A max at 200 V AC in hi-charge mode • 2.58 A max at 200 V AC in float charge mode
Power consumption (operating maximum)	• 645 VA (580 W) pk in hi-charge mode • 515 VA (460 W) in float charge mode
Heat dissipation (operating maximum)	1.65 x 10^6 J/hr (1,560 Btu/hr), max
In-rush current	40 A max for ½ line cycle, per line cord at 240 V AC
AC protection	20 A circuit breaker
AC inlet type	IEC320-C14 appliance coupler, per power zone
Charge times	5.5 hours max

Engine, MIBEs, and 2U SPS

Table 44 Engine + MIBEs + 2U SPS

Requirement	Description
AC line voltage	200 to 240 V AC ± 10%, single-phase, 47 to 63 Hz
AC line current (operating maximum)	• 4.35 A max at 200 V AC in hi-charge mode • 3.70 A max at 200 V AC in float charge mode
Power consumption (operating maximum)	• 870 VA (800 W) pk in hi-charge mode • 740 VA (675 W) in float charge mode
Heat dissipation (operating maximum)	2.43 x 106 J/hr (2,310 Btu/hr), max
In-rush current	52 A max for ½ line cycle, per line cord at 240 V AC
AC protection	20 A circuit breaker
AC inlet type	IEC320-C14 appliance coupler, per power zone
Charge times	5.5 hours max

Four standard DAEs and 2U SPS

Table 45 Four Standard DAEs + 2U SPS

Requirement	Description
AC line voltage	200 to 240 V AC ± 10%, single-phase, 47 to 63 Hz
AC line current (operating maximum)	• 7.20 A max at 200 V AC in hi-charge mode • 6.55 A max at 200 V AC in float charge mode
Power consumption (operating maximum)	• 1,440 VA (1,335 W) pk in hi-charge mode • 1,310 VA (1,210 W) in float charge mode
Heat dissipation (operating maximum)	4.36 x 10^6 J/hr (4,140 Btu/hr), max
In-rush current	85 A max for ½ line cycle, per line cord at 240 V AC
AC protection	20 A circuit breaker
AC inlet type	IEC320-C14 appliance coupler, per power zone
Charge times	5.5 hours max

Four high density DAEs and 2U SPS

Table 46 Four high density DAEs + 2U SPS

Requirement	Description
AC line voltage	200 to 240 V AC ± 10%, single-phase, 47 to 63 Hz
AC line current (operating maximum)	• 6.35 A max at 200 V AC in hi-charge mode • 5.70 A max at 200 V AC in float charge mode
Power consumption (operating maximum)	• 1,270 VA (1,155 W) pk in hi-charge mode • 1,140 VA (1,030 W) in float charge mode
Heat dissipation (operating maximum)	3.72 x 10^6 J/hr (3,530 Btu/hr), max
In-rush current	85 A max for ½ line cycle, per line cord at 240 V AC
AC protection	20 A circuit breaker
AC inlet type	IEC320-C14 appliance coupler, per power zone
Charge times	5.5 hours max

High density DAE

Table 47 High density DAE[1]

Requirement	Description
AC line voltage	200 to 240 V AC ± 10%, single-phase, 47 to 63 Hz
AC line current (operating maximum)	1.4 A max at 200 VAC
Power consumption (operating maximum)	280 VA (255 W) max
Heat dissipation (operating maximum	9.17 x 10^5 J/hr (870 Btu/hr), max
In-rush current	15 A max for ½ line cycle, per line cord at 240 VAC
AC inlet type	IEC320-C14 appliance coupler, per power zone

1. Ratings assume a fully loaded DAE that includes 2 power supplies, 2 LCC's and 25 disk drives.

Standard DAE

Table 48 Standard DAE[1]

Requirement	Description
AC line voltage	200 to 240 V AC ± 10%, single-phase, 47 to 63 Hz
AC line current (operating maximum)	1.6 A max at 200 VAC
Power consumption (operating maximum)	322 VA (300 W) max
Heat dissipation (operating maximum	1.08 x 10^6 J/hr (1,020 Btu/hr), max
In-rush current	15 A max for ½ line cycle, per line cord at 240 VAC
AC inlet type	IEC320-C14 appliance coupler, per power zone

1. Ratings assume a fully loaded DAE that includes 2 power supplies, 2 LCC's and 15 disk drives.

Power requirements for rack option

Customer racks must include all power distribution equipment and infrastructure, including:

- Carefully plan the connection of VMAX 10K hardware to the available IEC 320-C13 outlets such that the VMAX 10K load current does not exceed the rating of any power distribution circuit breakers. Best practice is the circuit breaker operating current at nominal AC input voltage should not exceed 80% of the circuit breaker rating.

  Refer to Table 42 on page 85 to Table 48 on page 87 for input requirements for each component.

  Refer to Table 50 on page 89 and Table 51 on page 89 for planning the number of connections required to support VMAX 10K components.

- Two independent AC power zones with 4800 VA minimum rating for each zone
- ICE 320-C13 outlets, within each contiguous 40 U space within the enclosure, arranged as follows:

Table 49 Power requirements

Zone and rack parameters	System bay	Storage bay
C13 outlets — zone A	≥ 11	≥ 12
C13 outlets — zone B	≥ 11	≥ 12

- 200-240VAC, 50-60 Hz, available at each IEC 320-C13 outlet
- Ability to simultaneously turn On/Off all IEC C13 outlets within a power zone
- Distance from any component AC inlet connection to its corresponding C13 AC outlet can not exceed 66 inches (66 inches is the maximum AC cable length, including routing / service loop)
- No other equipment loads on power distribution equipment in racks with Symmetrix VMAX 10K equipment

Power distribution equipment for rack option

Table 50 on page 89and Table 51 on page 89 provide outlet connections for standard/mixed density system bays and high density system bays.

IMPORTANT

The power distribution equipment must provide the ability to simultaneously power On/Off all IEC C13 outlets within a zone.

Table 50 Power Distribution Equipment C13 Outlet Connections

	Standard/Mixed Density			
	System Bay 1	System Bay 2	System Bay 3 & 4	Storage Bay
Engine + 2U SPS	1		1	
1U UPS + Server + KVM	1			
Engine + MIBEs + 2U SPS		1		
Four standard or High density DAEs + 2U SPS	1	1	1	
Standard or high density DAE	0, 4, or 6	0, 4, or 6	0, 4, or 6	2 to 12

Table 51 Power Distribution Equipment C13 Outlet Connections

	High Density		
	System Bay 1	System Bay 2	System Bay 3 & 4
Engine + 2U SPS	1		1
1U UPS + Server + KVM	1		
Engine + MIBEs + 2U SPS		1	
Four standard or High density DAEs + 2U SPS	1	1	1
Standard or high density DAE	0, 4, or 8	0, 4, or 8	0, 4, or 8