Dell EMC Data Domain DS60 Expansion Shelf

Hardware Guide

D&LLEMC

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Preface

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

Note

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

Purpose

This guide describes the steps to install and configure a Data Domain Expansion Shelf.

Audience

This guide is for trained service personnel who are authorized to install and repair Data Domain systems and end-users who are using this product.

Related Documentation

The following Data Domain system documents provide additional information:

Note

Look for the documents matching the Data Domain Operating System release being used in your environment.

- *DD OS Release Notes Version*
- *DD OS Initial Configuration Guide*
- *DD OS Administration Guide*
- *DD OS Command Reference Guide*
- The Data Domain system installation and setup guides for each of the supported platforms (for example, DD4200 and DD9500)
- For Data Domain Systems that have ES20 shelves installed: *Data Domain ES20 Expansion Shelf Hardware Guide.*
- For Data Domain Systems that have ES30 shelves installed: *Data Domain ES30 Expansion Shelf Hardware Guide.*
- *Data Domain System Safety and Regulatory Information* (P/N 770-0002-0002)

Documents for Installation and Field Replacements

- *Installation and FRU Replacement Guide*

Special Notice Conventions Used in this Document

Data Domain uses the following conventions for special notices:

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

Addresses practices not related to personal injury.

Note

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

Typographical conventions

Data Domain uses the following type style conventions in this document:

Table 1 Typography

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

Technical support

To resolve issues with Data Domain products, contact your contracted support provider or visit us online at https://support.emc.com/.

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 DPAD.Doc.Feedback@emc.com.

Revision history

Table 2 Document revision history

Revision	Date	Document part number/Revision number	Software version	Description
06	June 2018	302-002-100 Rev. 6	6.1	Added the maximum height to install a DS60 shelf to not require a ladder for disk drive replacement operations.
05	June 2017	302-002-100 Rev. 5	6.1	Editorial revisions.
04	October 2016	302-002-100 Rev. 4	6.0	New topics and cabling diagrams as they relate to supporting DD6300, DD6800 and DD9300, andDD9800 systems
03	April 2016	302-002-100 Rev. 3	5.7.1	Updates to the DD4200 and DD7200 supported configurations.
02	March 2016	302-002-100 Rev. 2	5.7.1	Minor updates as they relate to the High Availability (HA) system
01	October 2015	302-002-100 Rev. 1	5.7	Initial publication

CHAPTER 1

DS60 Shelf Installation Overview

Adding DS60 expansion shelves to a Data Domain system increases the storage capacity of the system. The expansion shelves are organized by sets (or chains).

- DD4200, DD4500, and DD7200 systems - Attach up to two expansion shelves per set (chain);
- DD6300 - Supports only one DS60 expansion shelf;
- DD6800 and DD9300 - Attach up to four expansion shelves per set (chain);
- DD9500 and DD9800 systems - Attach up to four DS60 expansion shelves per set (chain).

For details about maximum shelf counts per system and mixing shelves for different systems, refer to the information in Requirements for combining DS60 and ES30 shelves on page 26 for shelf configuration restrictions.

Note

- Data Domain systems that support the DS60 shelves must be running DD OS 5.7 and later.
- For instructions on replacing one of the field replaceable components, see the *DS60 Installation and FRU Replacement Guide* on the Online Support site. You should assume that any printed copy might be out-of-date. Therefore, always check the on-line support portal for the latest version of a document before replacing any part.

This chapter covers the following major topics:

Site requirements

This table lists the DS60 site requirements. See Hardware specifications on page 100 for hardware specifications information.

Table 3 Site requirements

Requirement	DS60 Expansion Shelf
Vertical space in standard 19", 4-post rack	5U including a 1U Cable Managements Tray. Do not use a two-post rack. See the slide rail and installation documentation in the packaging for installing in a rack.
Air conditioning	Air conditioning that can cope with the maximum BTU/hr thermal rating.
Temperature controls	Adequate temperature control with a gradient (change) not to exceed 30° C in an hour.
Front bezel clearance	1.56 inches (4.0 cm) of unobstructed clearance.
Back panel clearance	5 inches (12.7 cm) of unobstructed clearance.
Airflow	In a closed or multi-unit rack, ensure that the unit has adequate airflow. If the equipment is mounted in an enclosed (as opposed to a four-post open rack), the front and rear doors should have 65% minimum open area for airflow. Whether in an open or enclosed rack, use filler panels to prevent hot air re-circulation. The rack design and installation should take into consideration the maximum ambient operating temperature of the equipment, which is 35° C.
Power/grounding	The Power distribution within the rack should provide a safe electrical earth connection. Voltage should be 200-240 VAC; 50 or 60 Hz. Plug four power cords - two from each power supply into separate branch circuit supplies for redundancy—one set of cords from one power supply goes to one branch and the second set of cords from the other power supply goes to a different branch. Each receptacle must be capable of safely supplying 0.94 amps from each power socket or 1.87 amps from each socket in case of a redundant circuit.

Licensing

The appropriate capacity license is required for any added shelf. There are three tiers of storage—active, archive, and cache. A license is purchased and applied to one of these tiers.

Note

Only Data Domain Extended Retention (ER) systems have archive tier storage.

Note

Only Data Domain DD6300, DD6800 and DD9300 systems configured with SSDs, or those systems configured with an FS15 shelf have cache tier storage.

An Expanded-Storage license is required to expand the active tier storage above the amount originally installed. You cannot use additional storage without first applying the appropriate licenses.

Additional licensing information is available in the *Data Domain Operating System Administration Guide* and the *Data Domain Operating System Command Reference Guide*.

DS60 expansion shelf

This section describes the shelf front panel, the status lights visible from the front, the interior layout of the disks, the back panel, and the status lights visible from the rear of the chassis.

Front panel

Figure 1 DS60 front panel

Note

The front LEDs are identified inside the red rectangle.

If there is a problem with the enclosure, the enclosure fault light LED (marked with a triangle with an exclamation mark) is amber. When the shelf is powered on and active, the disk enclosure power LED (marked with a circle with a vertical line) is blue.

Table 4 LED status lights

Light	Quantity	Color	Meaning
Disk Enclosure Power	1	Blue	Power to enclosure is on.
Disk Enclosure Fault	1	Amber	On when any fault condition exists; if the fault is not obvious from a disk or fan module light, look at the back of the disk enclosure.

Note

The individual disk LEDs are only visible when the disk enclosure is opened to verify the disks inside.

For part replacement information, refer to the *DS60 Expansion Shelf Installation and FRU Replacement Guide.*

Disk enclosure interior

The disks are visible when the DS60 is pulled out of the rack and the top cover is removed from the chassis. There are also three fans in the front of the disk enclosure and each fan has a fault LED.

Each disk in the enclosure has two LEDs. The active LED glows blue when the disk is functional. The disk fault LED glows amber when the disk has failed.

Note

The individual disk and fan LEDs are only visible when the disk enclosure is opened to verify the disks inside.

Figure 2 Fans and disk drives inside the disk enclosure

Table 5 LED status lights

Light	Quantity	Color	Meaning
Disk Active **Note** Only visible after the disk enclosure is opened.	1 per disk module	Blue	• No LED when the slot is empty or has a filler module. Also, off when the disk is powered down by command; for example, the result of a temperature fault. • Fast blinking when the SAS drive is powered up but not spinning; this is a normal part of the spin-up sequence, occurring during the spin-up delays of a slot. • On when the drive has power but is not handing any I/O activity (the ready state).

Table 5 LED status lights (continued)

Light	Quantity	Color	Meaning
			• Disk and fan lights are only available when enclosure is removed from the chassis. • Slow blinking when the drive is spinning and handling I/O activity.
Disk Fault **Note** Only visible after the disk enclosure is opened.	1 per disk module	Amber	On when the disk module is faulty, or as an indication to replace the drive.
Fan fault	1 per fan module	Amber	On when the fan module is faulty, or as an indication to replace the fan.

The DD OS software manages the drives in packs (groups) of 15. A top down view of the chassis shows that the disks are arranged in four packs (groups) of 15 drives. The packs are color coded—pack 1 purple, pack 2 is yellow, pack 3 is green, and pack 4 is pink. A pack must have the same size drives. Pack 1 is shown within the red rectangle.

Figure 3 Drives as packs

The next table shows how the drives are distributed by packs (groups) and numbered physically. The bottom of the table represents the front of the shelf

Table 6 Physical drives

Rows	Pack 1	Pack 2	Pack 3	Pack 4
E	0-2	3-5	6-8	9-11
D	0-2	3-5	6-8	9-11
C	0-2	3-5	6-8	9-11
B	0-2	3-5	6-8	9-11
A	0-2	3-5	6-8	9-11

Although the disk numbers are physically 0 to 59, the disks are reported logically by system software commands in two ways:

- A range from 1 to 60, usually reported with the enclosure number (e.g. 3.37)

- The position matrix A-E (1-12)

For part replacement information, refer to the *DS60 Expansion Shelf Installation and FRU Replacement Guide.*

Back panel

The back panel has two dual power supplies and two LCCs (Link Controller Cards).

Figure 4 DS60 back panel

Each controller has 4 SAS ports (laid out as 2 pairs). Standard Data Domain systems, and systems with the licensed HA feature only use ports 0 and 2 on each controller. Ports 1 and 3 typically have a plastic plug blocking the unused ports to make inserting a cable into the correct ports easier.

Note

Please refer to Installing the Shelves on page 17 chapter for details about cabling. The Cabling shelves on page 24 section provides the needed details.

Table 7 Status lights visible from rear of disk enclosure

Light	Quantity	Color	Meaning
Controller power	1 per controller	Green	On when the Controller is powered on.
Controller fault	1 per controller	Amber	On when either the Controller or a SAS connection is faulty. On during power-on self test.
Link active	4 per controller	Blue	On when the host connection is active.
Power supply input voltage	1 per power supply	Green	Input power green when it is working.
Power supply fault*	1 per power supply	Amber	• On when the power supply is faulty or is not receiving AC line voltage. • Flashing when either a multiple blower or ambient over temperature condition has shut off DC power to the system.

The DS60 continues to run with a single power supply and two fans (out of the three fans).

For part replacement information, refer to the *DS60 Installation and FRU Replacement Guide.*

CHAPTER 2

Installing the Shelves

This chapter covers the following major topics:

Expansion shelf cables

Expansion shelves are connected to each other and to the Data Domain controller with qualified cables. The expansion shelf can be connected to supported Data Domain systems only by using SAS (serial-attached SCSI) cables. A Data Domain shelf with qualified disks can be added as an expansion shelf if there are complete drive packs (15 in a pack) in the correct position.

Note

Shelves for other Dell EMC product lines look identical. Check the product numbers when unpacking.

DS60 cables

The DS60 shelves use cables with HD-mini-SAS connectors at both ends to connect the shelves to the controllers that have SAS I/O modules, such as DD4200, DD4500, DD6300, DD6800, DD7200, DD9300, DD9500, and DD9800 systems.

The DS60 connector is referred as the HD-mini-SAS connector and is same as the I/O module connectors. These cables are available in 3M, 4M, and 5M lengths.

Use the appropriate length for the connection you are making. Refer to the specific Installation and Configuration Guide of the shelves for the recommended cable lengths:

- Use the 3-meter cable in the same rack either to connect to a controller or shelf to adjacent shelf.

- Use a 3-meter, 4-meter, or 5-meter cable when a DS60 is in another rack.

Figure 5 HD-mini-SAS connector

Table 8 HD-mini-SAS to mini-SAS cable part numbers

Cable Part Number	Cable Length
038-004-380-01	3M(118 in.)
038-000-212-00	4M (158 in.)

Table 8 HD-mini-SAS to mini-SAS cable part numbers (continued)

Cable Part Number	Cable Length
038-000-214-00	5M (196 in.)

Special cables must be used when attaching an ES30 to a chain with a DS60. Specifically, one HOST (circle) connection and one EXPANSION (diamond) cables are connected between the ES30 LCC and the DS60 LCC connection. Since this is not a common situation, only two expansion cable lengths are available.

Table 9 HD-mini-SAS to ES30 host and ES30 expansion port cable part numbers

Cable Part Number	Cable Type	Cable Length
038-003-810	Host	2M (78 in.)
038-003-813	Host	5M (196 in.)
038-004-108	Expansion	2M (78 in.)
038-004-111	Expansion	5M (196 in.)

The cable connectors must be secured with their latch assembly.

Safety requirements

⚠ WARNING

- **The rack or cabinet should be securely bolted to the floor for personnel safety; if not, it could tip over. If securing the rack to the floor is not feasible, and you have less than a fully populated configuration, for personnel safety you must ensure a low center of gravity.**

- **Data Domain-supplied racks have an interlock that prevents more than one DS60 from being pulled out of the rack at one time. This is not true for customer-supplied racks. Do not pull out more than one DS60 at one time, otherwise there is a much greater risk of the rack tipping.**

The following safety requirements must be considered when the unit is mounted in a rack.

- Ensure that the site requirements have been met. Review the Site requirements on page 10.
- The rack design should incorporate stabilizing features suitable to prevent the rack from tipping or being pushed over during installation or in normal use.
- When loading a rack with the units, fill the rack from the bottom up and empty the rack from the top down.
- The controller must be in the recommended position shown in the diagrams in Requirements for combining DS60 and ES30 shelves on page 26.
- All products in the rack must have front-to-back cooling to prevent air recirculation.
- The rack should have a safe electrical distribution system. It must provide overcurrent protection for the unit and must not be overloaded by the total

number of units installed in the rack. Consideration of the electrical power consumption rating shown on the nameplate should be used when addressing these concerns. For more information see Connecting power on page 57.

Racking and cabling

The shelves are 5U (including 1U for the Cable Management Assembly (CMA)) and a Data Domain controller that supports DS60 shelves are 4U, except for the DD6300, DD6800 and DD9300, which are 2U. For more information, see your Data Domain system hardware overview.

Data Domain has adopted recommended racking guidelines.

To provide the best trade-off in terms of serviceability, system expansion, and cabling, mount the Data Domain controller in the 23U position for the DD4200, DD4500, DD6300, DD6800, DD7200, DD9300, DD9500, and DD9800 systems.

Note

A 5U space is reserved for the controller in the recommended configurations. This is to simplify installation and labeling instructions.

You can connect the 3-meter cable attached to the Data Domain controller to any shelf in the same rack. Install filler panels in unused rack openings.

There are figures showing the various configurations through the remainder of this document. These are guidelines. Other sections define the rules for different systems. All rules must be followed but using a recommended configuration may depend on other restrictions in a specific installation.

After your hardware is installed, route and organize all cables by affixing them to the side of the rack to facilitate servicing.

Although you can plan for growth by leaving empty positions in the rack, this method is safe only if the rack is securely bolted to the floor, or if the resulting configuration has a low center of gravity. When in doubt, do not leave empty spaces, and populate based on the guidelines in this section.

To replace disk drives without a ladder, do not install a DS60 shelf with the top of the unit above 32U in the rack.

Rail kit

The DS60 shelf rail kit includes:

Table 10 Rail information

Rail kit	Rack depth
Slide rail kit, DS60	Rail kit mounting brackets adjust in length from 24 inches to 32 inches to accommodate different rack depths.

Note

For details, see the *DS60 Shelf Installation and FRU Replacement Guide*.

Shelf cabling rules and guidelines

The Data Domain system re-discovers newly configured shelves after it restarts. You can power down the system and re-cable shelves to any other position in a set, or to another set. To take advantage of this flexibility, you need to follow these rules before making any cabling changes:

- Do not exceed the maximum shelf configuration values for your Data Domain system as listed in the table below.

- For redundancy, the two connections from a Data Domain system to a set of shelves must use ports on different SAS IO modules.

- Use the Installation and Setup Guide for your Data Domain system to minimize the chance of a cabling mistake.

- A Data Domain system cannot exceed its maximum raw external shelf capacity, regardless of added shelf capacity.

- ES20 shelves must be on their own chain(s).

- ES20 shelves are only allowed to be connected to DD6300, DD6800 and DD9300, and DD9500 or DD9800 systems to migrate the data using the shelf migration software feature in DD OS 5.7 or later releases.

- ES30 SATA shelves must be on their own chain.

- If ES30 SAS shelves are on the same chain as a DS60, the maximum number of shelves on that chain is 5.

- DD OS 5.7.1 does not support ERSO on DD9500 HA systems.

- DD OS 5.7.1 does not support HA with SATA drives.

Table 11 Shelf configuration supported per Data Domain system for the DS60 shelf

DD system	Memory required (GB)	SAS cards/ port per card	DS60 support (TB)	Max shelves per set	Max number of sets	Max external capacity available (TB)[1]	Max RAW external capacity (TB)
DD4200	128	2x4	SAS 45	1	4	192	240
DD4200 ER [2]	128	4x4	SAS 45	2	8	384	480
DD4500	192	2x4	SAS 45, 60	2	4	288	360
DD4500 ER [2]	192	4x4	SAS 45, 60	2	8	576	720
DD6300 [5, 6]	48 [9]	1x4 [8]	N/A	0	0	48	60
DD6300 w/ Expanded Capacity [5, 6]	96	1x4 [8]	SAS 45, 60 [15]	1	1	144	180
DD6800 [5, 6, 11]	192	2x4	SAS 45, 60	1	1	144	180
DD6800 w/ Expanded Capacity [5, 6]	192	2x4	SAS 45, 60	1	2	288	360

Table 11 Shelf configuration supported per Data Domain system for the DS60 shelf (continued)

DD system	Memory required (GB)	SAS cards/ port per card	DS60 support (TB)	Max shelves per set	Max number of sets	Max external capacity available (TB)[1]	Max RAW external capacity (TB)
DD6800 w/ Expanded Capacity and w/ HA [5, 6]	192	2x4	SAS 45, 60	1	2	288	360
DD6800 w/ Expanded Capacity and w/ ER [5, 6]	192	2x4	SAS 45, 60	2	4	576	720
DD6800 w/ Expanded Capacity and w/ DD Cloud Tier [6, 7]	192	2x4	SAS 45, 60	2	4	288 + 96 for DD Cloud Tier	360 + 120 for DD Cloud Tier
DD6800 w/ Expanded Capacity and w/ DD Cloud Tier and HA [6, 7]	192	2x4	SAS 45, 60	2	4	288 + 96 for DD Cloud Tier	360 + 120 for DD Cloud Tier
DD7200	128	2x4	SAS 45	2	4	288	360
DD7200	256	2x4	SAS 45, 60	2	4	432	540
DD7200 ER [2]	256	4x4	SAS 45, 60	2	8	864	1080
DD9300 [5, 6, 13]	192[14]	2x4	SAS 45, 60	3	4	384	480
DD9300 w/ Expanded Capacity [5, 6, 12]	384	2x4	SAS 45, 60	3	4	720	900
DD9300 w/ Expanded Capacity and w/ HA [5, 6]	384	2x4	SAS 45, 60	3	4	720	900
DD9300 w/ Expanded Capacity and w/ ER [5, 6, 10]	384	2x4	SAS 45, 60	3	4	1440	1800
DD9300 w/ Expanded Capacity and w/ DD Cloud Tier [6, 7]	384	2x4	SAS 45, 60	3	4	720 + 192 for DD Cloud Tier	900 + 240 for DD Cloud Tier
DD9300 w/ Expanded Capacity and w/ HA and DD Cloud Tier [6, 7]	384	2x4	SAS 45, 60	3	4	720 + 192 for DD Cloud Tier	900 + 240 for DD Cloud Tier
DD9500	256	3x4	SAS 45, 60	4	6	432	540
DD9500 Expanded	512	3x4	SAS 45, 60	4	6	864	1080
DD9500 ER [2]	512	4x4	SAS 45, 60	4	8	1728	2160

Table 11 Shelf configuration supported per Data Domain system for the DS60 shelf (continued)

DD system	Memory required (GB)	SAS cards/ port per card	DS60 support (TB)	Max shelves per set	Max number of sets	Max external capacity available (TB)[1]	Max RAW external capacity (TB)
DD9500 HA [3, 4]	512	3x4	SAS 45, 60	4	6	864	1080
DD9500 DD Cloud Tier [6,7]	512	4x4	SAS 45, 60	4	8	864 + 240 for DD Cloud Tier	1080 + 300 for DD Cloud Tier
DD9500 DD Cloud Tier w/ HA [6,7]	512	4x4	SAS 45, 60	4	8	864 + 240 for DD Cloud Tier	1080 + 300 for DD Cloud Tier
DD9800 [5, 6]	256	3x4	SAS 45, 60	4	6	504	630
DD9800 w/ HA[5, 6]	256	3x4	SAS 45, 60	4	6	504	630
DD9800[5, 6]	768	3x4	SAS 45, 60	4	6	1008	1260
DD9800 w/HA [5, 6]	768	3x4	SAS 45, 60	4	6	1008	1260
DD9800 ER [5, 6]	768	4x4	SAS 45, 60	4	8	2016	2520
DD9800 DD Cloud Tier [5, 6]	768	4x4	SAS 45, 60	5	8	1008 + 240 for DD Cloud Tier	1260 + 300 for DD Cloud Tier
DD9800 DD Cloud Tier w/ HA [5, 6, 7]	768	4x4	SAS 45, 60	5	8	1008 + 240 for DD Cloud Tier	1260 + 300 for DD Cloud Tier

Note

An entry of 45 corresponds to DS60-3 models and an entry of 60 corresponds to DS60-4 models.

1. This column only counts drives that have user data in the shelves. For example, a DS604-240 has 192TB.

2. With Extended Retention software.

3. DD OS 5.7.1 does not support ERSO on DD9500 HA systems.

4. DD OS 5.7.1 does not support HA with SATA drives.

5. With DD OS 6.0 & SSD.

6. Only available with DD OS 6.0.

7. With DD Cloud Tier Storage.

8. One SAS card is optional and must be ordered with external SAS shelf order. Duel paths from this single SAS card to external shelves are required.

9. DD6300 base configuration does not support DS60 additional capacity; must have memory configuration of 96GB.

10. Max number of DS60-4 180 is 10 to maximize DD9300 ER capacity.

11. DD6800 base configuration has the same configuration as the DD6800 Expanded. Maximum capacity is limited by capacity license.

12. DD9300Expanded supports five DS60 maximum.

13. DD9300 base support 2.5 DS60-4 180 x 2 plus DS60-2 90, if a half-filled DS60 is necessary.

14. While it is 192GB, it is a different memory DIMM configuration compared to DD6800's 192GB.

15. The DS60 will have a maximum of 45 4Tb drives.

Installing or adding DS60 shelves

Refer to the table and related information in Shelf cabling rules and guidelines on page 21 for shelf configuration restrictions.

Ports

Depending on the model, a Data Domain system has two to four quad-port SAS IO modules installed. The DS60 shelf has two controllers. Each DS60 controller has four ports, labeled 0, 1, 2, and 3 (right to left).

See Data Domain-Specific Installation on page 81 for SAS IO module and port locations.

Cabling shelves

Note

Before cabling the shelves, physically install all shelves in the racks. Refer to the rail kit installation instructions included in the DS60 Installation and FRU Replacement Guide.

Ports on SAS I/O modules in the Data Domain system connect directly to a host port of the shelf controller. For redundancy, you will create dual paths by connecting a port on one SAS IO module to port 0 on controller A of the (usually lowest in the rack) DS60. Port 2 on that controller is connected to Port 0 of the next DS60 in the set. A port on a different SAS IO Module is connected to port 0 of controller B of the last (usually highest) DS60 in the set. In the unlikely event that any single shelf becomes completely disconnected from power or SAS cables, the Data Domain controller still has a connection path to all the remaining shelves.

There are two kinds of configurations: one shelf in a set or multiple shelves in a set.

For HA pairs, connect ports on the standby node to match the cabling of the primary node, so that the same port on both nodes connects to the same DS60. The cable from the primary node connects to port 0 of LCC A on the first DS60, and the cable from the standby node connects to port 2 of LCC B on the first DS60. For the last DS60, the cable from the primary node connects to port 0 of LCC B, and the cable from the standby node connects to port 2 of LCC A.

Cable a set that consists of one shelf

Procedure

1. Make a connection from one of the SAS I/O module of the Data Domain system to the Port 0 on Controller A using a DD cable.

2. Make a second connection from a different SAS I/O module of the Data Domain system to the Port 0 on Controller B using a DD cable.

Note

The port to shelf cabling is different for each controller. Cabling details such as I/O port numbers can be found in the installation and configuration guide of your Data Domain system.

Cable a set that contains multiple shelves

Procedure

1. Connect one SAS I/O module (for example, SAS I/O module 6 Port 0) on the Data Domain system to the controller A's port 0 of the bottom of the DS60 using HD-mini-SAS cable.

2. Using another SAS I/O module (for example, SAS I/O module 3 Port 0), connect a SAS port to the top shelf controller B's host port 0 using HD-mini-SAS cable.

3. Cable the DS60 together by connecting Controller A Port 2 of the lower DS60 to Controller A port 0 of the next. The connect Controller B Port 0 of the lower DS60 to Controller B port 2 of the next. Continue this for all of the DS60 in the set.

Note

- Whenever you add a shelf to an existing set, remove the SAS I/O cable and re-connect it to the current top/bottom shelf. The SAS I/O cables are always connected to the top and bottom shelves in the set. Add shelves in the installation order for your controller.

- For redundancy, always cable Shelf Controller A to Shelf Controller A, and Shelf Controller B to Shelf Controller B to create independent duplicate paths.

- Unused controller ports 1 and 3 have plastic fillers. This helps ensure correct connections and makes it easier to install the cables. When replacing a DS60 controller, remove the fillers from the old and install in ports 1 and 3 of the new controller.

Figure 6 on page 26 shows a cabling example for a DD9500 system. For Set 1, the I/O 6 port of the system 0 is connected to the LCC A port 0 of the bottom shelf, I/O 3 port 0 is connected to the LCC B port 0 of the top shelf and bottom shelf LCC A port 2 is connected to top shelf LCC B port 0, and top shelf LCC B port 2 is connected to bottom shelf LCC B port 0.

Figure 6 Shelf Cabling Connections
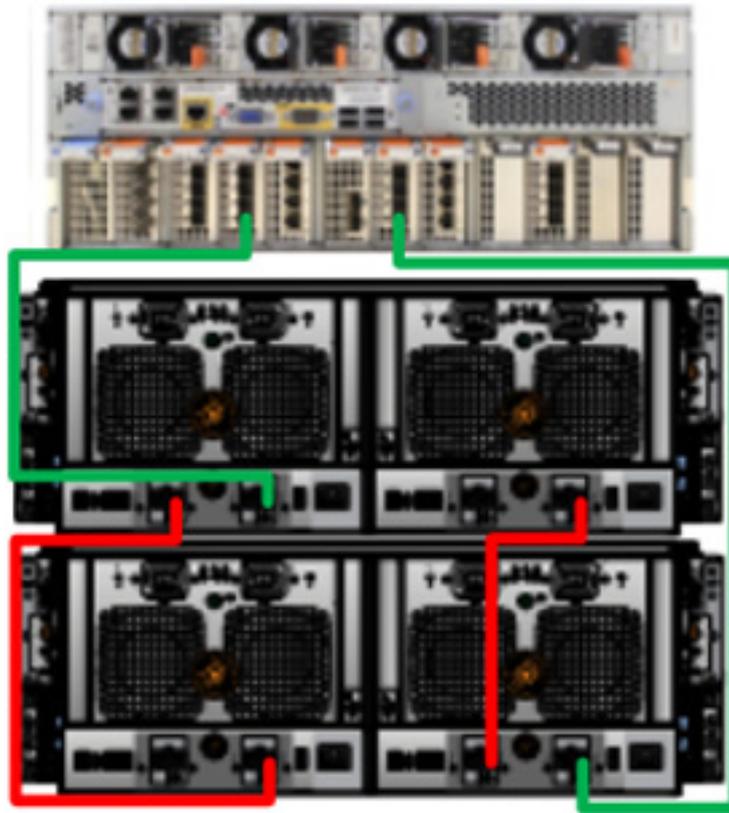
Note

SAS I/O cards are labeled on the back of the DD9500. The ports are labeled 0,1, 2, and 3. Cabling for each port is represented by a different color.

Requirements for combining DS60 and ES30 shelves

Note

ES20 shelves are only allowed to be connected to DD6300, DD6800 and DD9300, and DD9500 or DD9800 systems to migrate the data using the shelf migration software feature in DD OS 5.7 or later releases.

Some of the DS60 configurations described in the following sections also include ES30 shelves for DD Cloud Tier metadata, or FS15 shelves for HA.

Note

For HA pairs that have one or more ES30/FS15 shelves, the primary and standby nodes use different cables to connect to ES30/FS15 shelves. The primary node uses ES30/FS15 HOST (circle) connections, and the standby node uses ES30/FS15 EXPANSION (diamond) connections.

Refer to the table and associated information in Shelf cabling rules and guidelines on page 21 for shelf configuration restrictions. See the cabling instructions in this section that apply to your Data Domain system.

- DD4200, DD4500, and DD7200 systems - up to two DS60 expansion shelves per set (chain)

- DD6300 systems - only support one DS60

- DD6800 and DD9300 systems - can support up to four shelves per set (chain)

- DD9500 and DD9800 systems - up to four DS60 expansion shelves per set (chain)

Besides the set limitations documented above for a Data Domain system, the following guidelines provide further recommendation for combing shelves:

- Data Domain recommends a shelf set consist of either all DS60 or all ES30 shelves. A set with a mixture of DS60 and ES30 shelves is more complex to cable, and requires special cables. If you mix shelves in a set, the maximum number of mixed shelves in a set is five and there should be a maximum of three DS60 shelves in the set.

Note

For redundancy, a shelf set is connected to two separate SAS I/O modules on the Data Domain controller, and all of the shelves within a set are connected to each other via dual paths.

DD4200, DD4500, and DD7200 cabling

There are a few rules that must be followed when adding a mixture of DS60 and other shelf types to your system.

⚠ CAUTION

If a system does not follow all these rules, it is not a legitimate configuration.

Prerequisites:

- You cannot exceed the maximum amount of usable capacity displayed in cabling table for each system.

- You cannot exceed the maximum number of shelves displayed in cabling table for each system.

- You cannot connect more than two DS60 shelves in a single set.

Table 12 Minimum and maximum configurations

System	Appliance maximum	Minimum appliance shelf count
DD4200	192 TB	1
DD4500	288 TB	1
DD7200	384 TB	1

Mixing DS60, ES30, and ES20 shelves:

The non-Extended Retention versions of these systems all support four chains.

Extra planning and reconfiguration may be required to add DS60 shelves to system with ES20 shelves, ES30 SATA shelves, or a combination of shelves.

- The ES20 shelves must be on their own set. Minimize the ES20 set count by combining up to four ES20s per set.

- ES30 SATA shelves must also be on their own sets. Minimize the ES30 set count by combining up to five ES30s per set. If required, combine up to seven ES30 SAS shelves per set to minimize the set count.

- A set can contain a maximum of two DS60 shelves and, if required because of other restrictions, add ES30 SAS shelves up to a maximum of five shelves in that set.
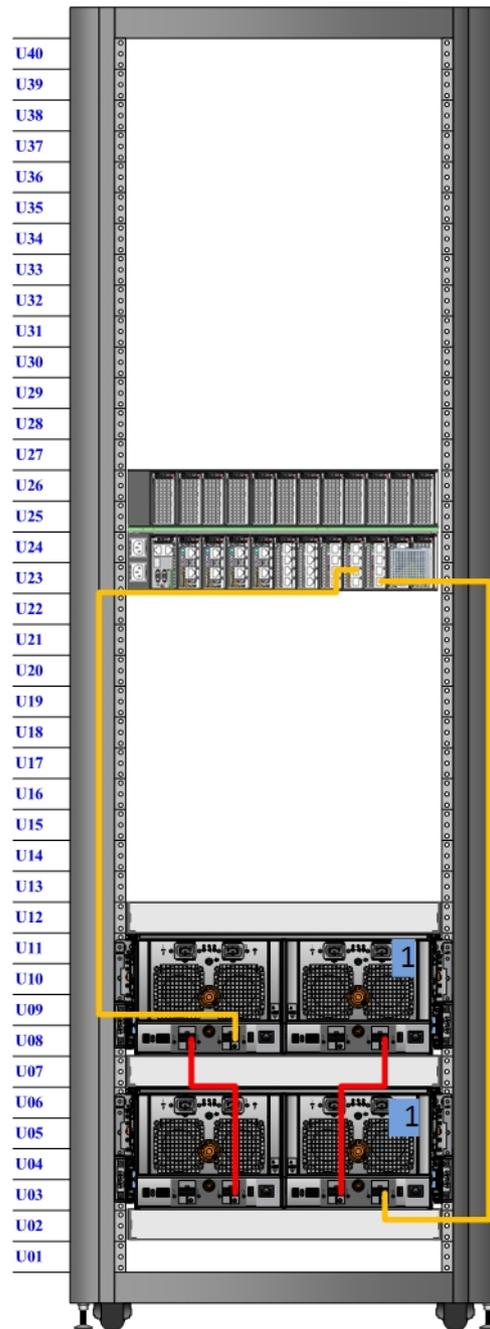
Note

The configuration rules apply also to Extended Retention systems.

The following figures show cabling for base systems and systems with the Extended Retention software.

Note

It is recommended that the DS60 shelf with the greater number of drives should always be placed in the bottom position.

Figure 7 Recommended cabling for DD4200 (3TB drives)

Note

One DS60 shelf can have 60 drives and the second DS60 shelf can have 15 drives.

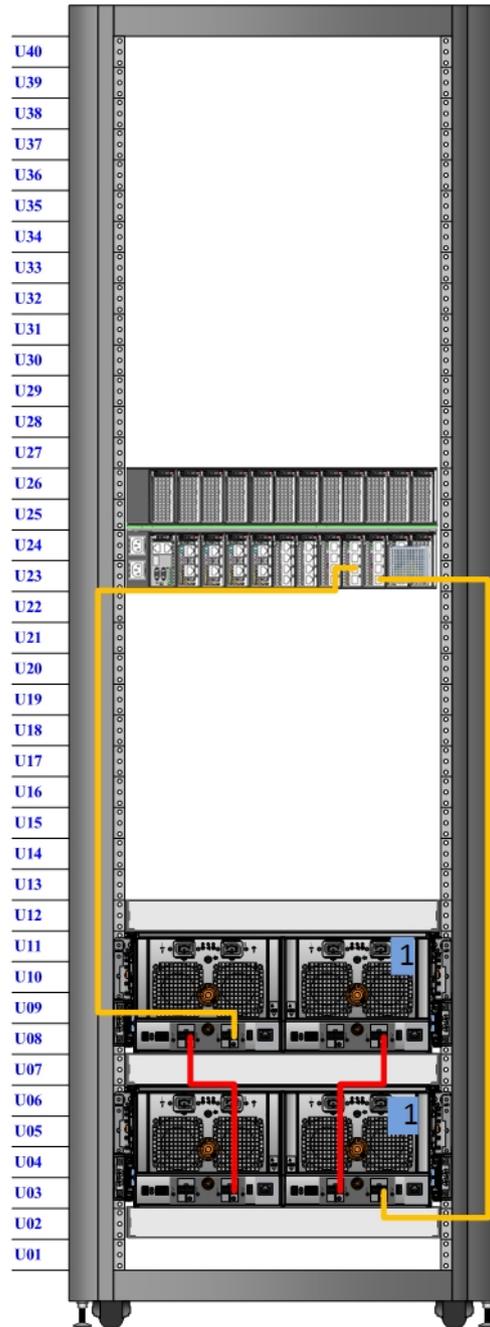**Figure 8** Recommended cabling for DD4200 (3TB drives) with Extended Retention Software

Note

With four shelves, two DS60 shelves can have 60 drives each and the other DS60 shelves can only have 15 drives each. It is also possible to configure two full DS60 shelves and one DS60 shelf with 30 drives.

Figure 9 Recommended cabling for DD4500 (3TB drives)

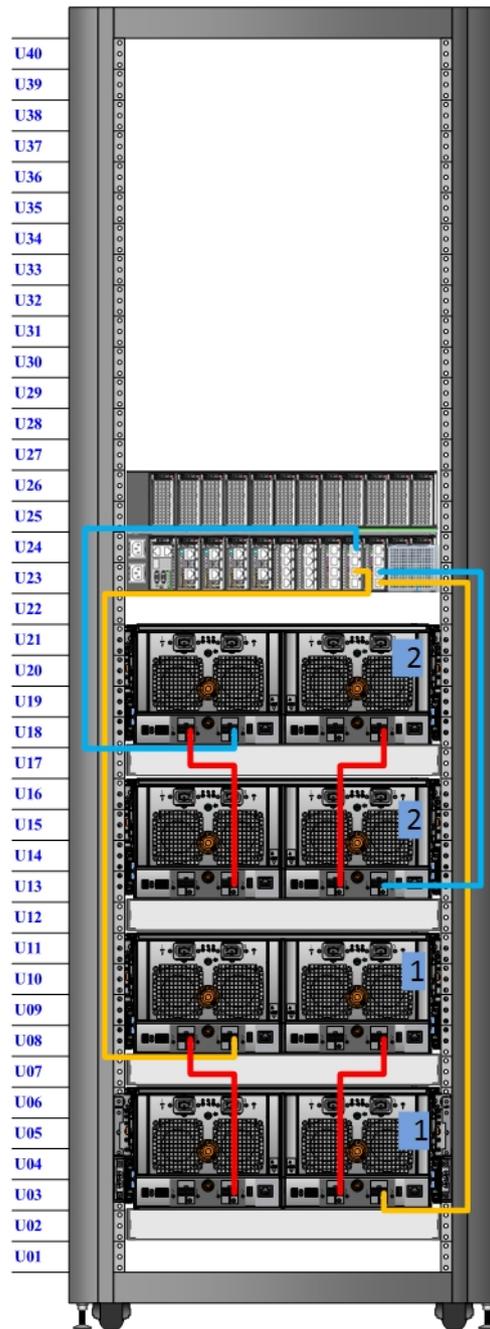**Figure 10** Recommended cabling for DD4500 (3TB drives) with Extended Retention software

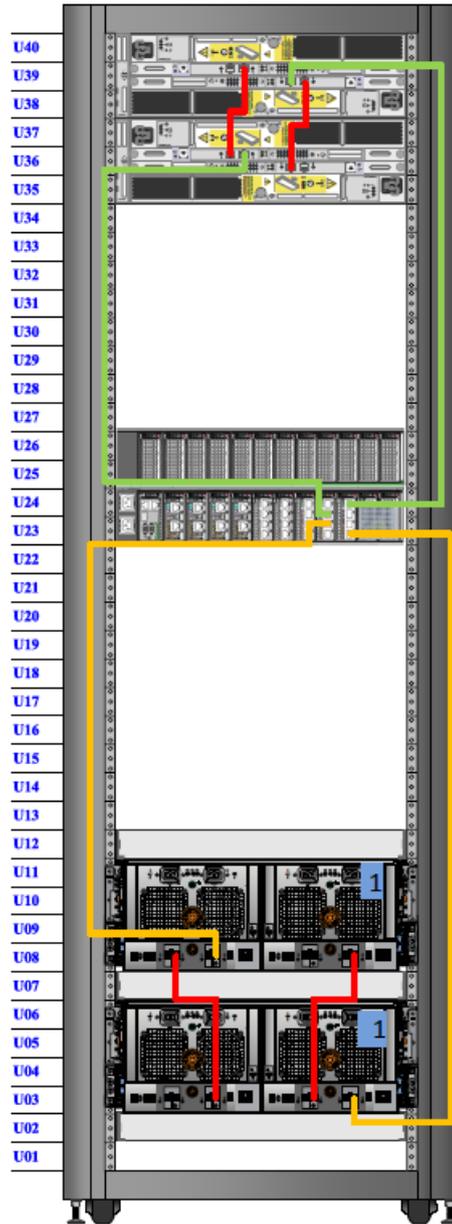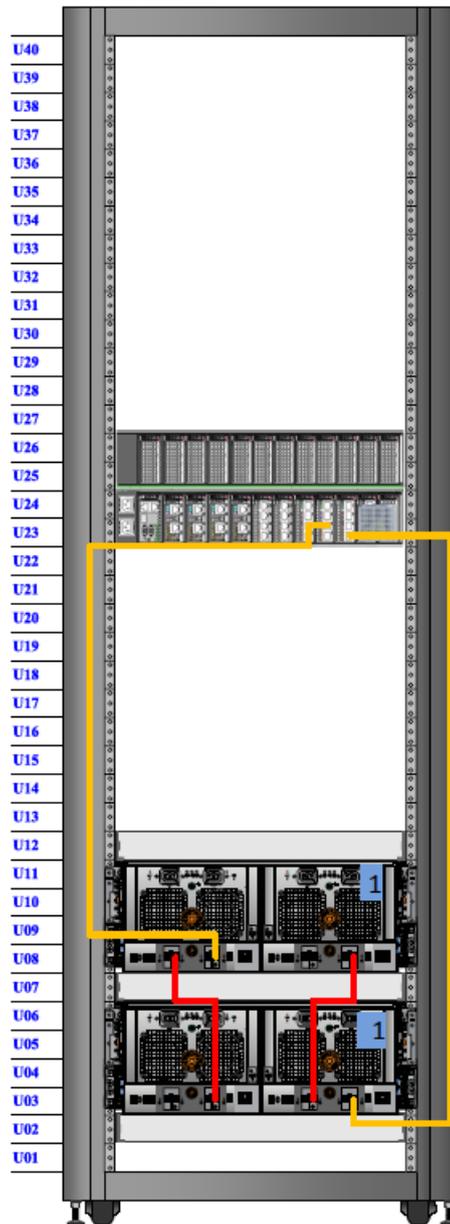**Figure 11** Recommended cabling for DD4500 with DD Cloud Tier

Figure 12 Recommended cabling for DD4500 (4TB drives)

Note

DS60 shelf 2 will only have 30 drives.

Figure 13 Recommended cabling for DD4500 (4TB drives) with Extended Retention software

Note

All three of the DS60 shelves will be full.

Figure 14 Recommended cabling for DD7200 (3TB drives)
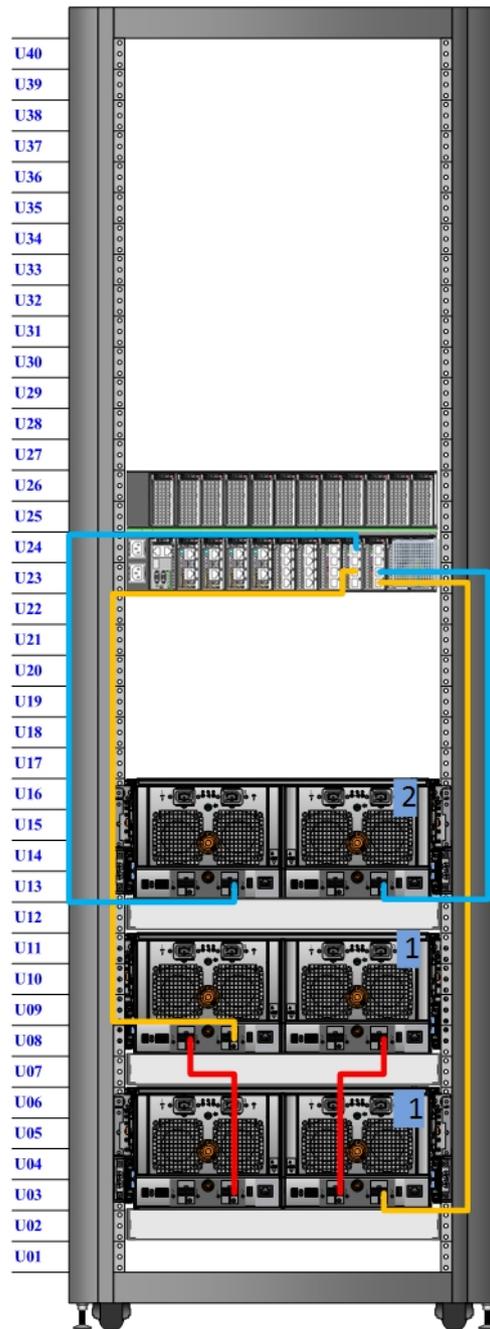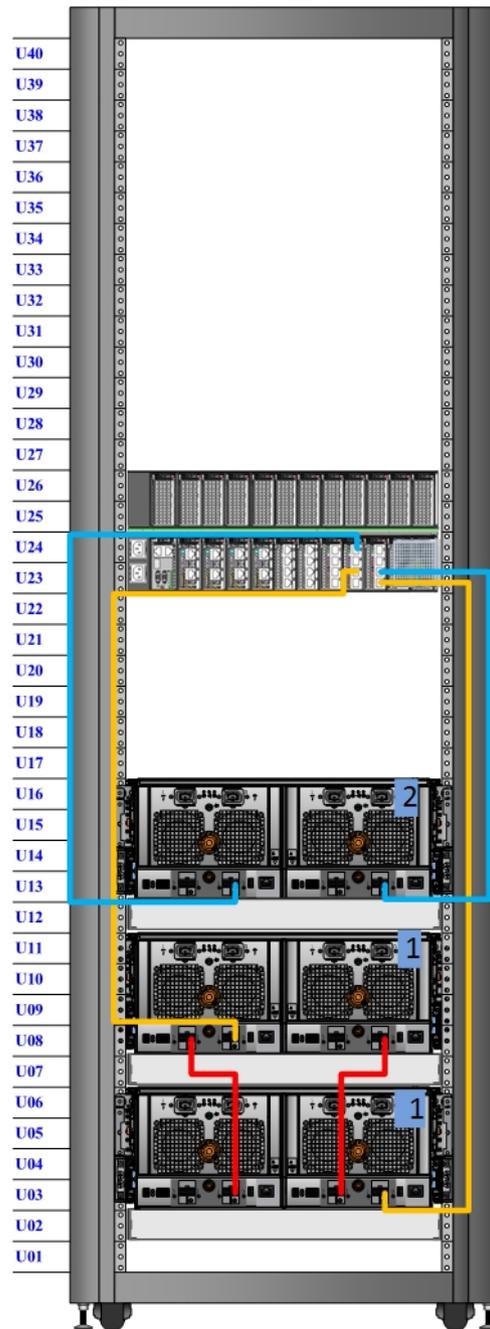
Figure 15 Recommended cabling for DD7200 (4TB drives)

Note

Two DS60 shelves can have 60 drives and the third DS60 shelf can only have 15 drives.

Figure 16 Recommended cabling for DD7200 (3TB drives) with Extended Retention software
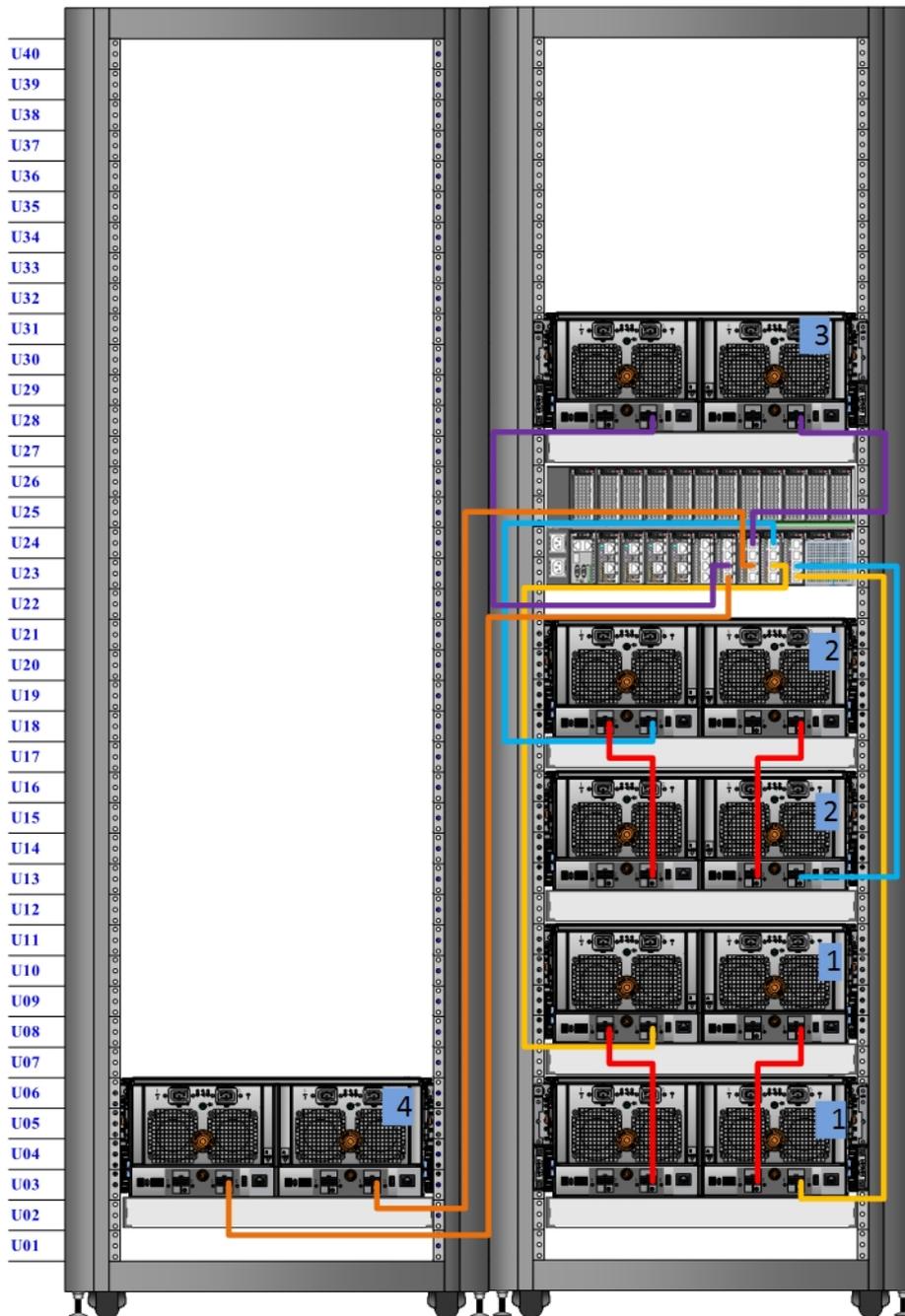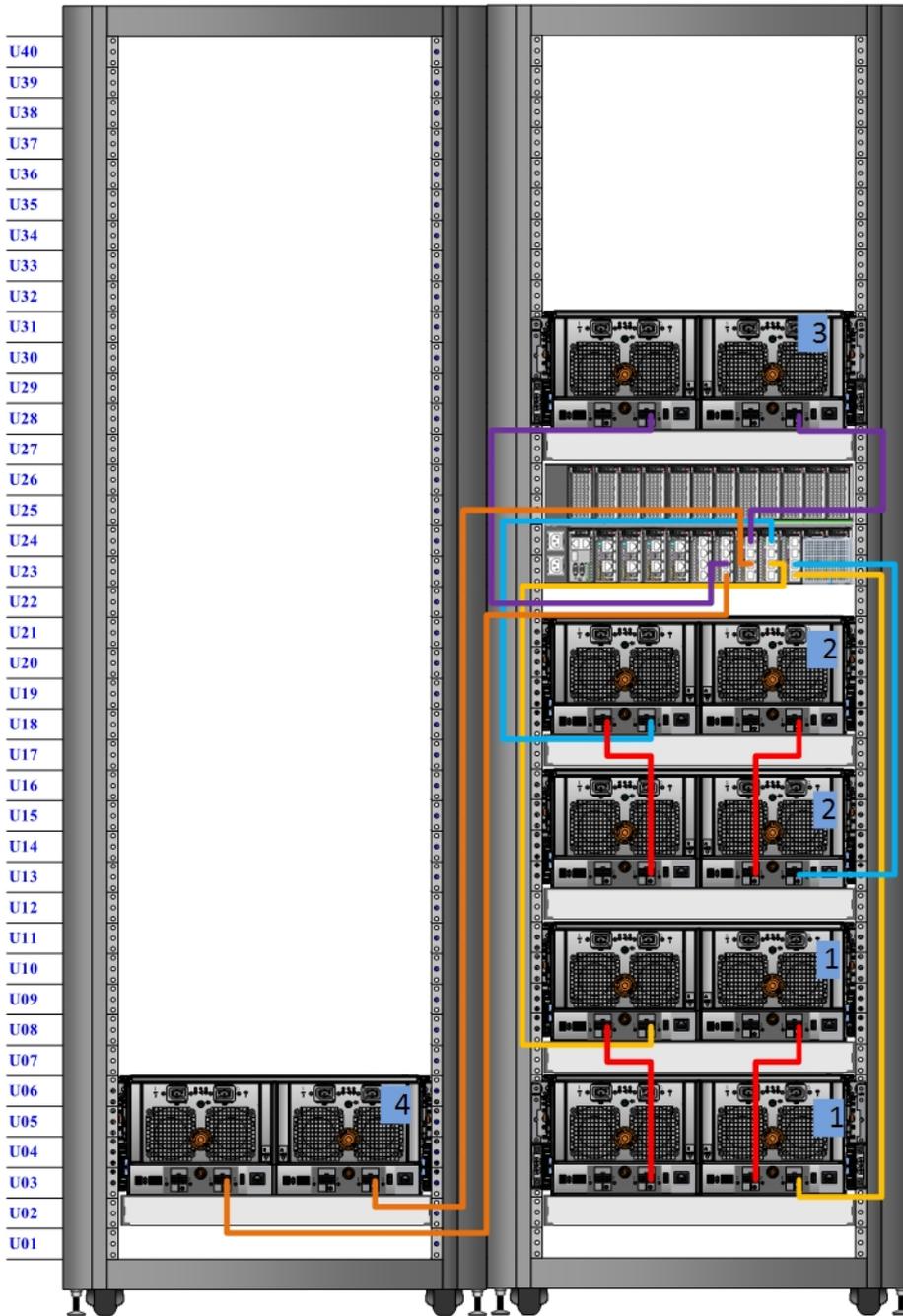
Figure 17 Recommended cabling for DD7200 with DD Cloud Tier

Figure 18 Recommended cabling for DD7200 (4TB drives) with Extended Retention software

Note

Four DS60 shelves have 60 drives each and two DS60 shelves have 15 drives each.

DD6300, DD6800 and DD9300 cabling

There are a few rules that must be followed when adding a mixture of DS60 and other shelf types to your system.

⚠ CAUTION

If a system does not follow all these rules, it is not a legitimate configuration.

Prerequisites:

- You cannot exceed the maximum amount of raw capacity displayed in cabling table for each system.
- You cannot exceed the maximum number of shelves displayed in cabling table for each system.
- You cannot connect more than three DS60 shelves in a single set.

Table 13 Minimum configurations

System	Appliance maximum	Minimum appliance DS60 shelf count
DD6300	144 TB	0
DD6800	144 TB	2
DD6800 w/ High Availability (HA)	288 TB	2 (plus 1 FS15 for SSD cache)
DD6800 w/ Extended Retention (ER)	576 TB	2
DD6800 w/ DD Cloud Tier	384 TB (96 TB for DD Cloud Tier)	2 (plus 2 ES30s for DD Cloud Tier)
DD6800 w/ HA and DD Cloud Tier	384 TB (96 TB for DD Cloud Tier)	2 (plus 1 FS15 for SSD cache, and 2 ES30s for DD Cloud Tier)
DD9300	384 TB	3
DD9300 w/ HA	720 TB	3 (plus 1 FS15 for SSD cache)
DD9300 w/ ER	1440 TB	3
DD9300 w/ DD Cloud Tier	912 TB (192 TB for DD Cloud Tier)	3 (plus 4 ES30s or 1 DS60 for DD Cloud Tier)
DD9300 w/ HA and DD Cloud Tier	912 TB (192 TB for DD Cloud Tier)	4 (plus 1 FS15 for SSD cache, and 4 ES30s or 1 DS60 for DD Cloud Tier)

1. DS60 will only be partially filled.

The following figures show cabling for base systems and systems with the Extended Retention software option (ERSO).

Note

A DD Cloud Tier system shares the ERSO cabling configuration; however, DD Cloud Tier has a lower maximum.

Note

It is recommended that the shelf with the greater number of drives should always be placed in the bottom position.
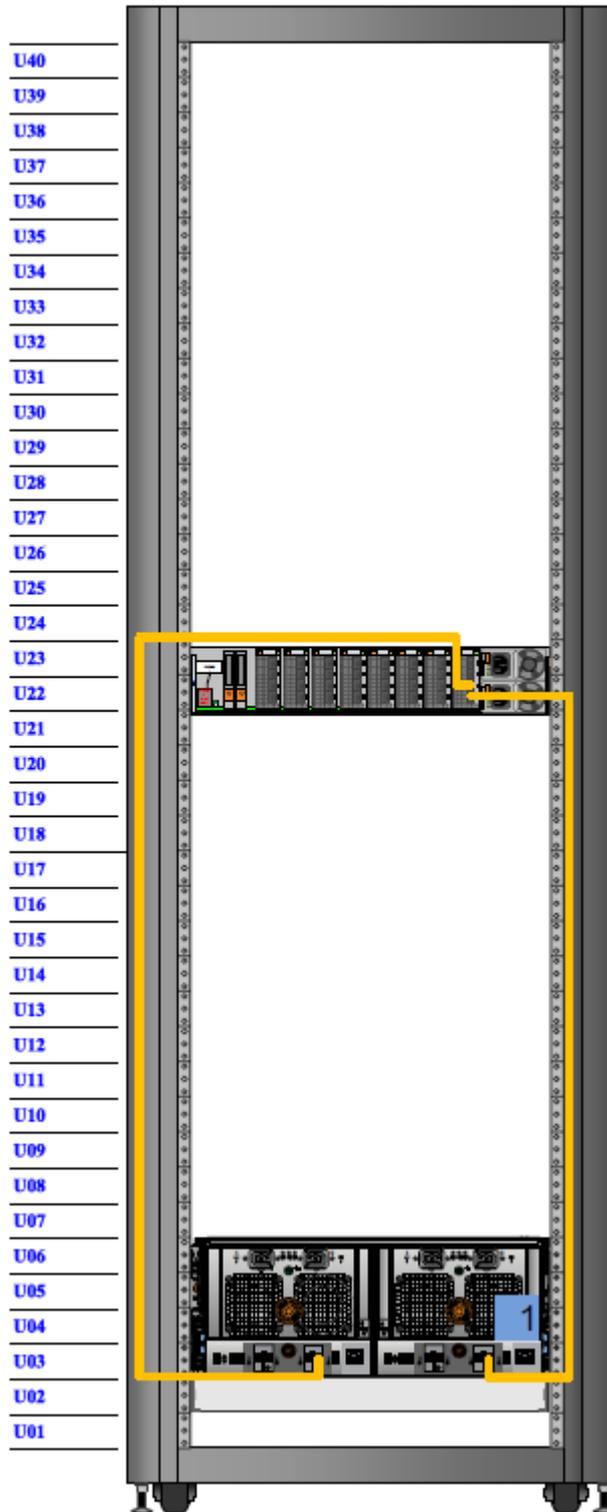
Note

DD6300 only supports one DS60.

Note

DD6300 only has one SAS SLIC and all DS60 connections are made to that single SAS SLIC.

The cabling diagrams in this section show the maximum configurations for the DD6300, DD6800, and DD9300 systems. Not all systems will have all the disk shelves shown in the diagrams.

Figure 19 DD6300

Note

DD6300 only has one SAS SLIC and all DS60 connections are made to that single SAS SLIC.
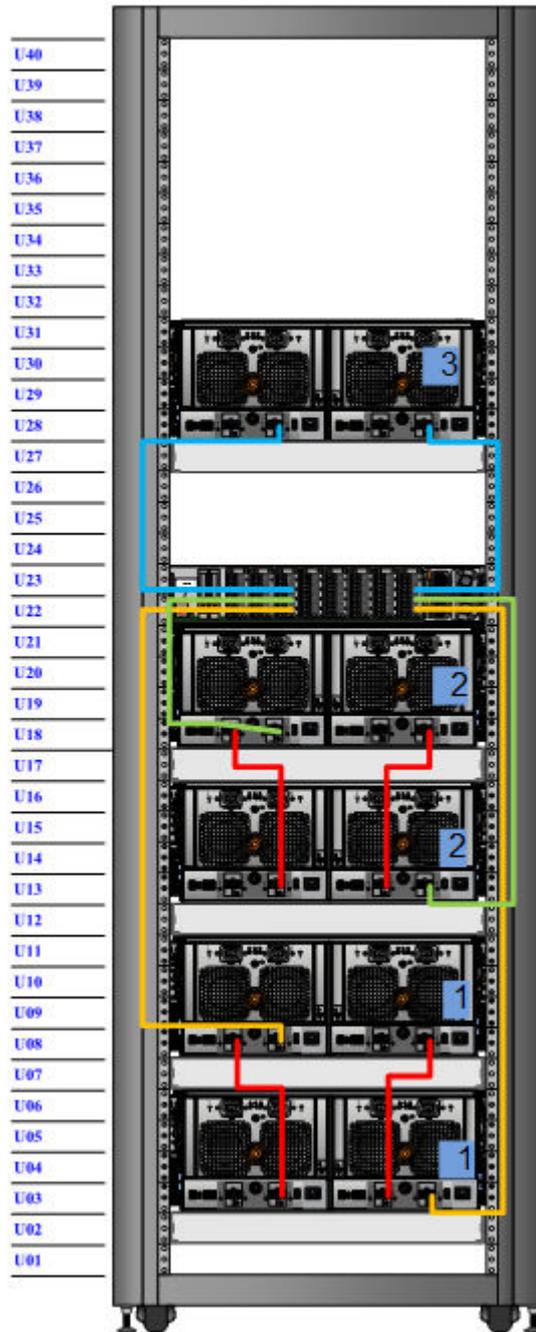
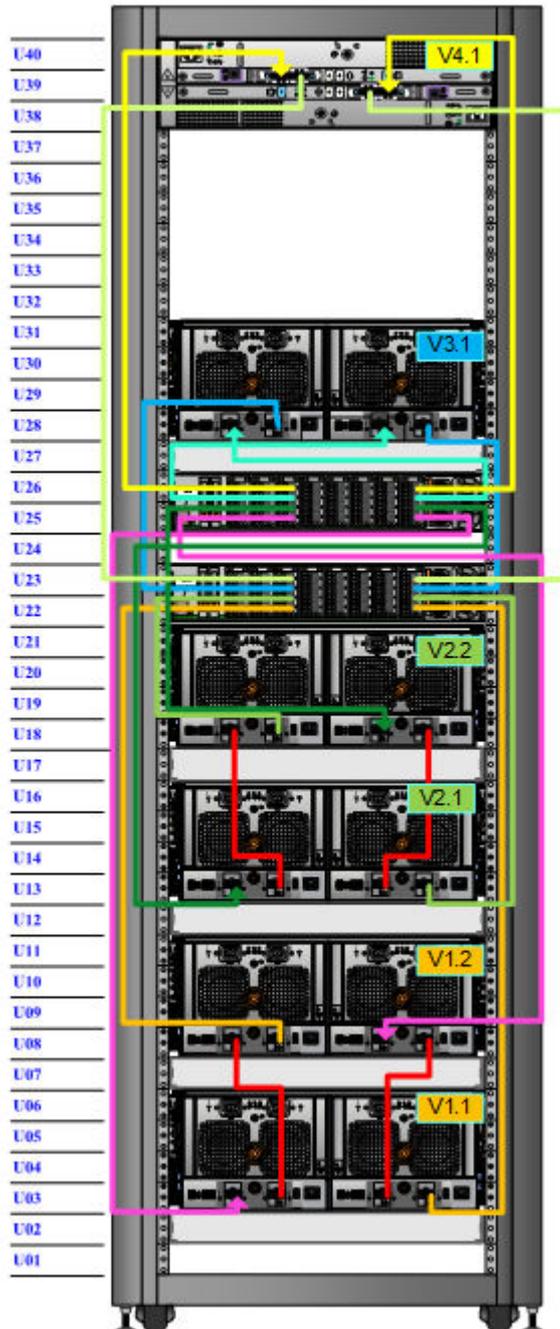**Figure 20** DD6800 and DD9300

Figure 21 DD6800 and DD9300 with HA

Figure 22 DD6800 with DD Cloud Tier

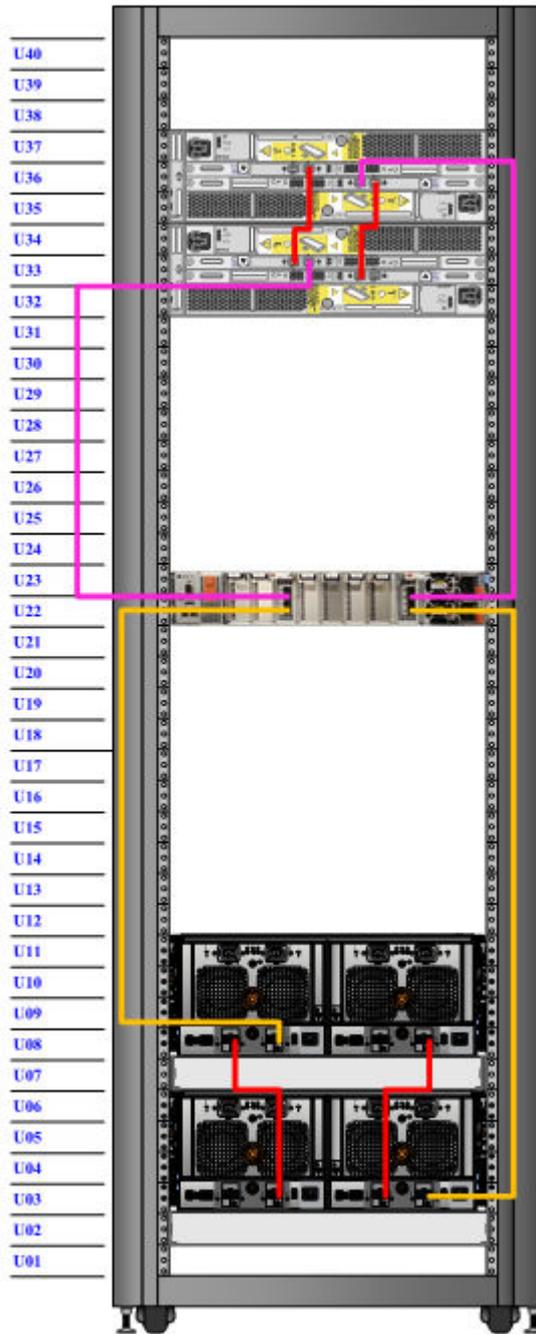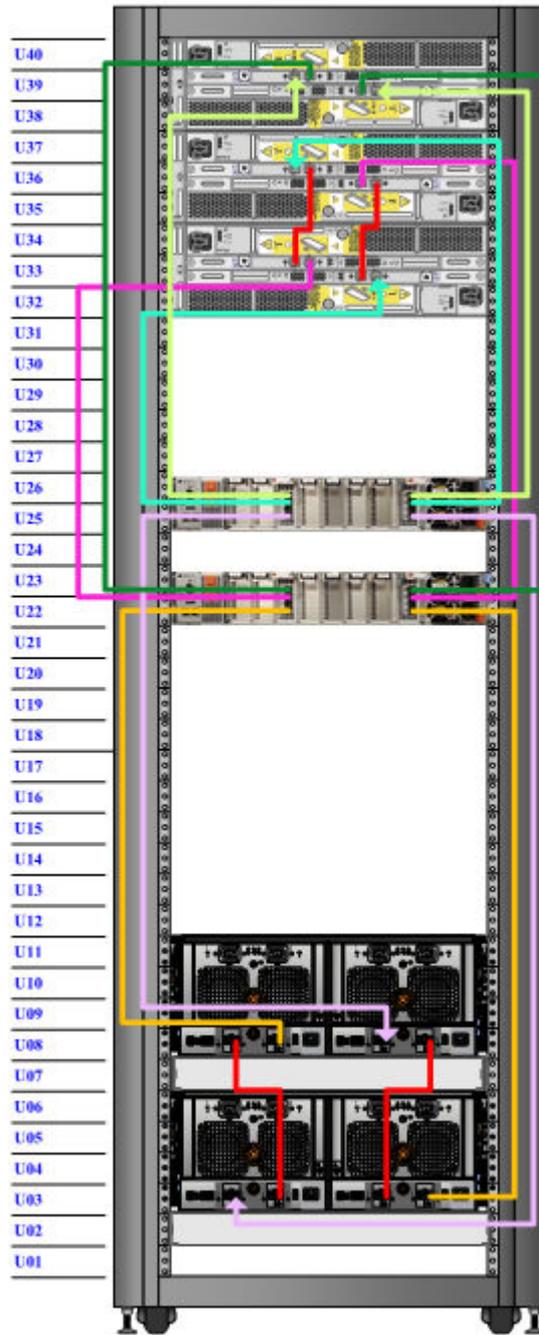**Figure 23** DD6800 with HA and DD Cloud Tier

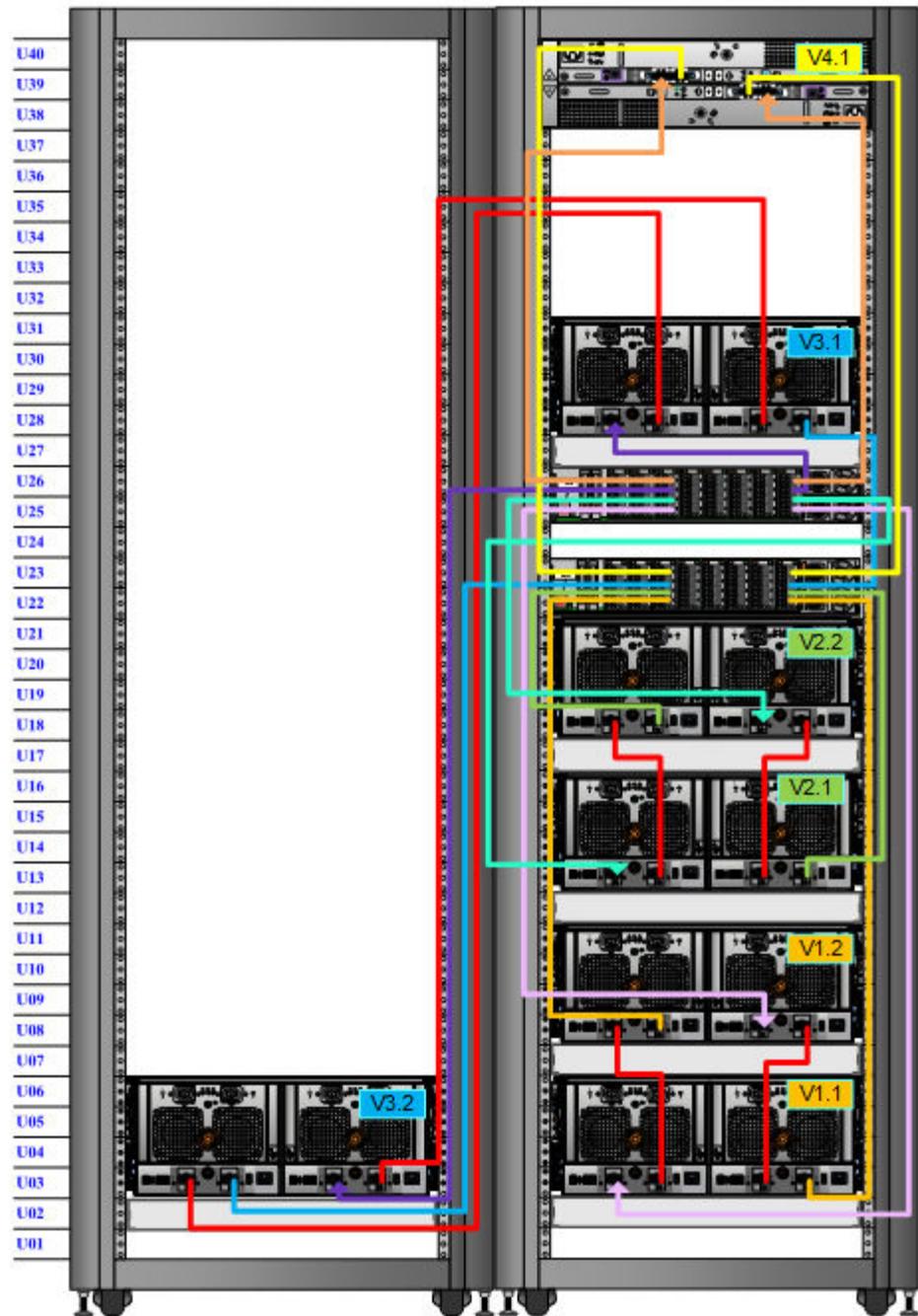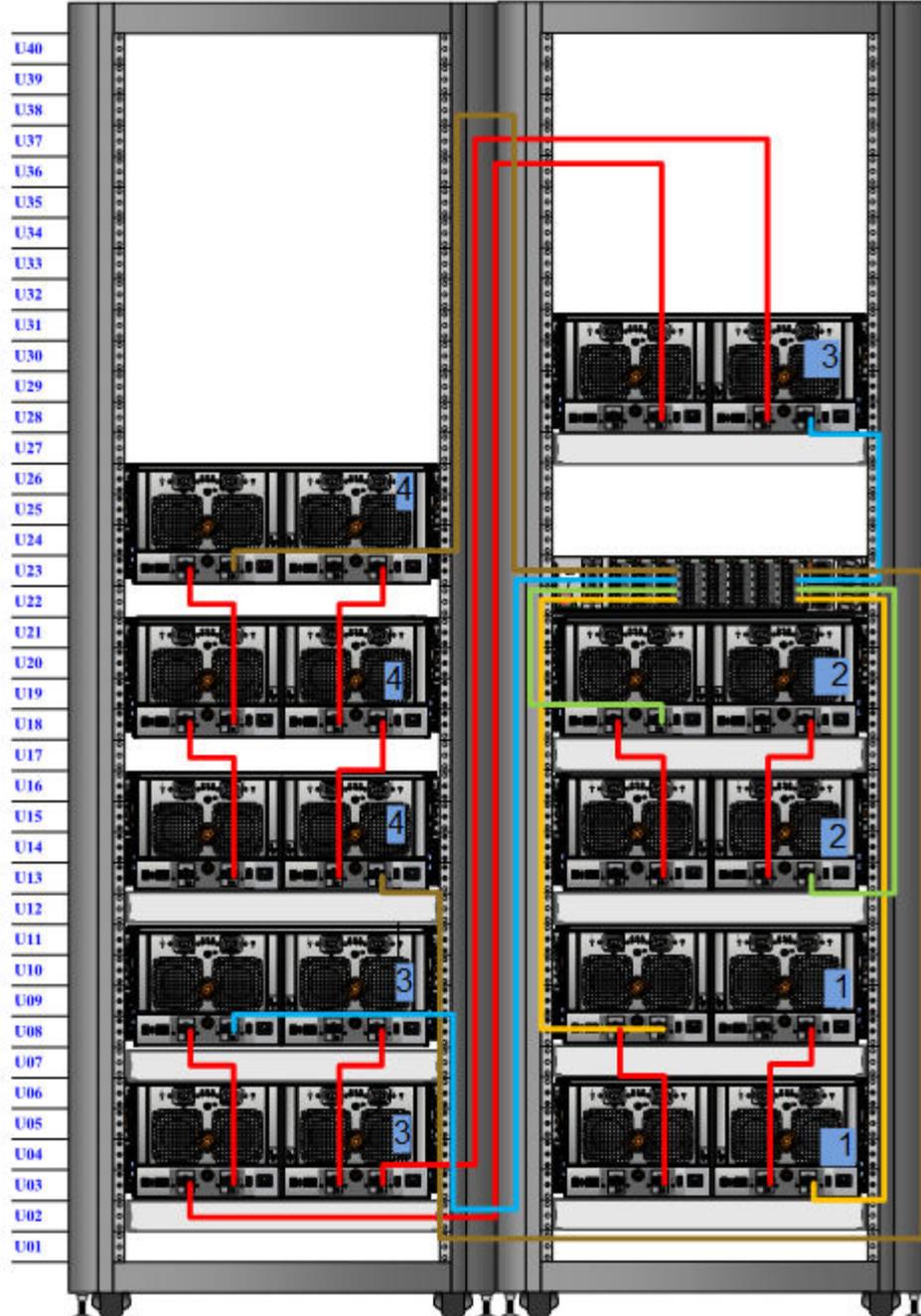**Figure 24** DD9300 with DD Cloud Tier or HA and DD Cloud Tier

Figure 25 DD6800 and DD9300 with ERSO

DD9500 and DD9800 cabling

There are a few rules that must be followed when adding a mixture of DS60 and ES30 SAS shelves to your system.

⚠ **CAUTION**

If a system installation does not follow all these rules, it is not a legitimate configuration.

Prerequisites

- Follow the minimum and maximum shelf capacity configuration provided in the table.
- You cannot exceed the maximum amount of raw capacity displayed in cabling table for each system.
- You cannot exceed the maximum number of shelves displayed in cabling table for each system.
- You cannot connect more than four DS60 shelves in a single set.

Table 14 Minimum and maximum configurations

System	Appliance maximum	Minimum DS60 appliance shelf count	Maximum DS60 shelf count
DD9500	864 TB usable	1	6
DD9500 Extended Retention (ER)	1728 TB usable	1	12
DD9500 High Availability (HA)	864 TB usable	1	6
DD9500 DD Cloud Tier	864 TB usable + 2x in the cloud	2 (plus 5 ES30s, or 1 DS60 and 1 ES30 for DD Cloud Tier)	7 (plus 5 ES30s, or 1 DS60 and 1 ES30 for DD Cloud Tier)
DD9800	1008 TB usable	2 (plus 1 FS15 for SSD cache)	7 (plus 1 FS15 for SSD cache)
DD9800 Extended Retention (ER)	2016 TB usable	2 (plus 1 FS15 for SSD cache)	14 (plus 1 FS15 for SSD cache)
DD9800 High Availability (HA)	1008 TB usable	2 (plus 1 FS15 for SSD cache)	7 (plus 1 FS15 for SSD cache)
DD9800 DD Cloud Tier	1008 TB usable + 2x in the cloud	3 (plus 1 FS15 for SSD cache, and 5 ES30s or 1 DS60 and 1 ES30 for DD Cloud Tier)	8 (plus 1 FS15 for SSD cache, and 5 ES30s or 1 DS60 and 1 ES30 for DD Cloud Tier)

The DD9500 base (non-Extended Retention) and HA systems support six chains.

The following figures show cabling for base systems, HA systems, and systems with the Extended Retention or DD Cloud Tier software option.

Note

The DD9500 system running DD OS 5.6 does not support any ES20 shelves.

Note

In DD OS 5.7 and later releases, ES20 shelves are supported on a DD9500 system only during the period required for shelf migration of the data to another shelf.

Extra planning and reconfiguration may be required to add DS60 shelves to system with ES20 shelves, ES30 SATA shelves, or a combination. ES20 shelves must be on their own set. Minimize the ES20 set count by combining up to four ES20s per set.

The ES20s are only supported in a DD9500 system for as long as it takes Shelf Migration software to allow them to be removed from the system.

ES30 SATA shelves must also be on their own sets. Minimize the ES30 set count by combining up to five ES30s per set. If necessary, combine up to seven ES30 SAS shelves per set to minimize the set count. A set can contain a maximum of four DS60s and, if required because of other restrictions, add ES30 SAS shelves up to a maximum of five total shelves in that set.

This process also applies to Extended Retention systems.

Note

The racks are filled from the bottom to the top.

The cabling diagrams in this section show the maximum configurations for the DD9500 and DD9800 systems. Not all systems will have all the disk shelves shown in the diagrams.

DD9500 systems will not have the FS15 shelf.

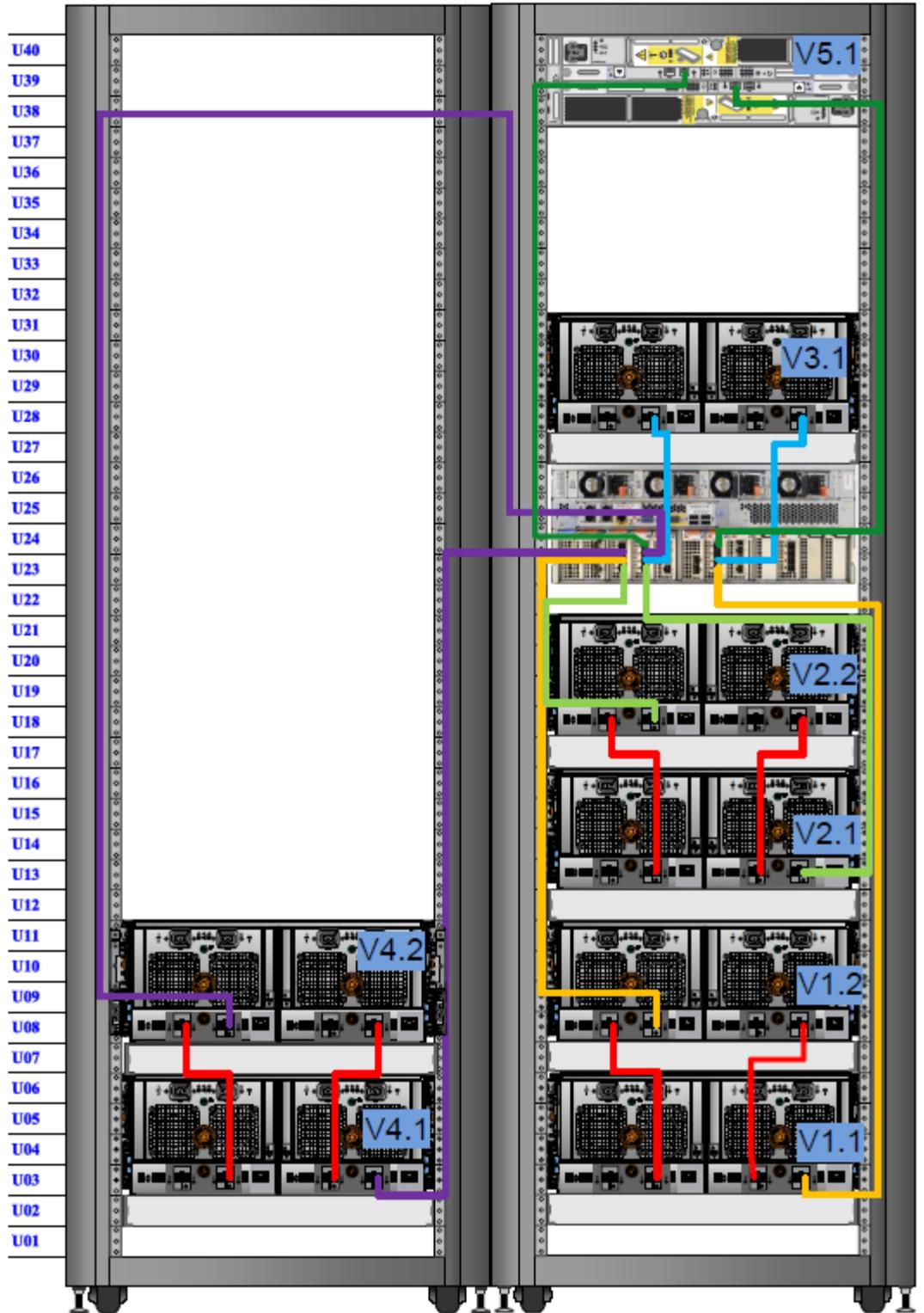**Figure 26** Cabling for base DD9500 and DD9800 systems

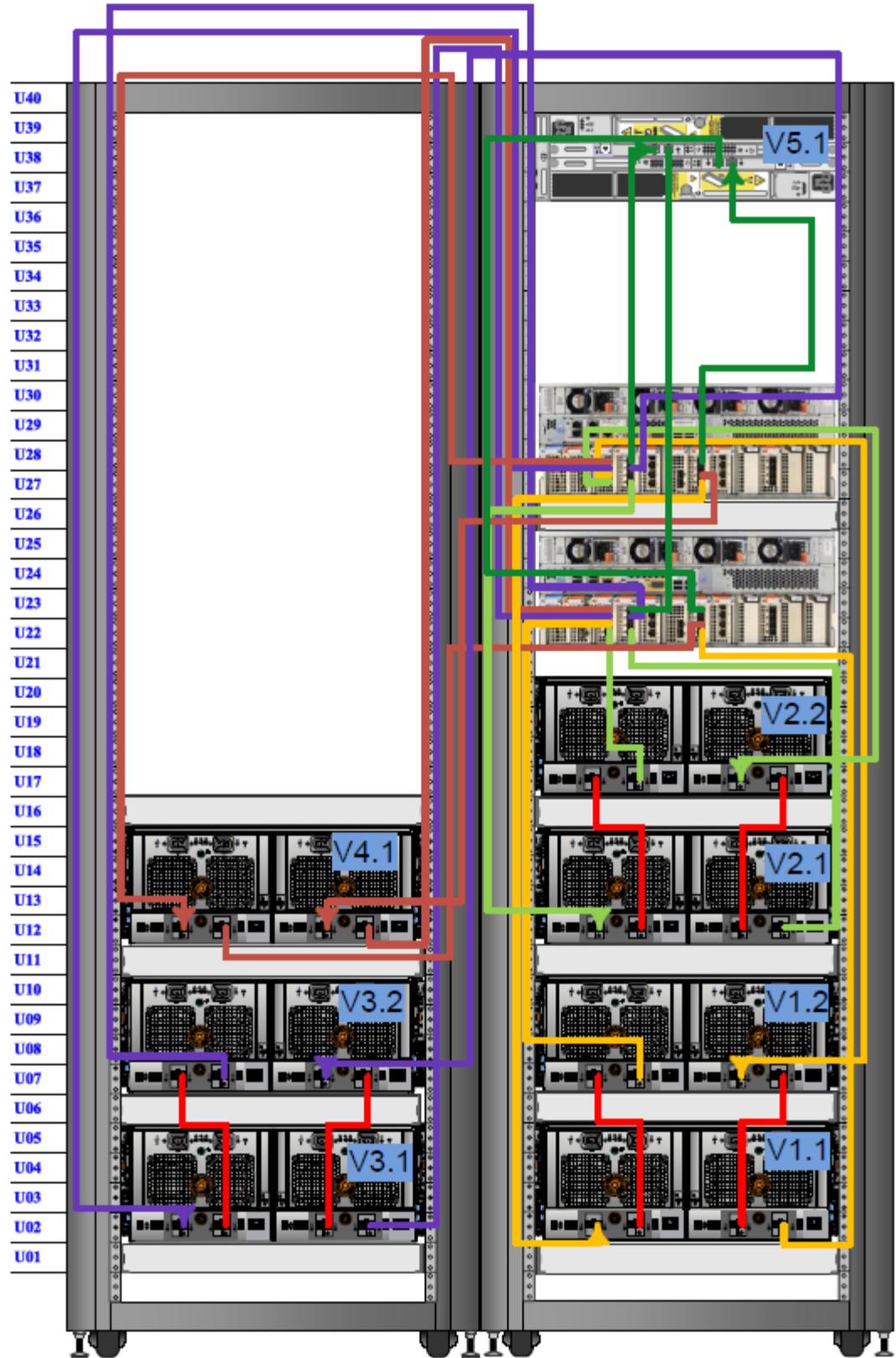**Figure 27** Cabling for HA DD9500 and DD9800systems

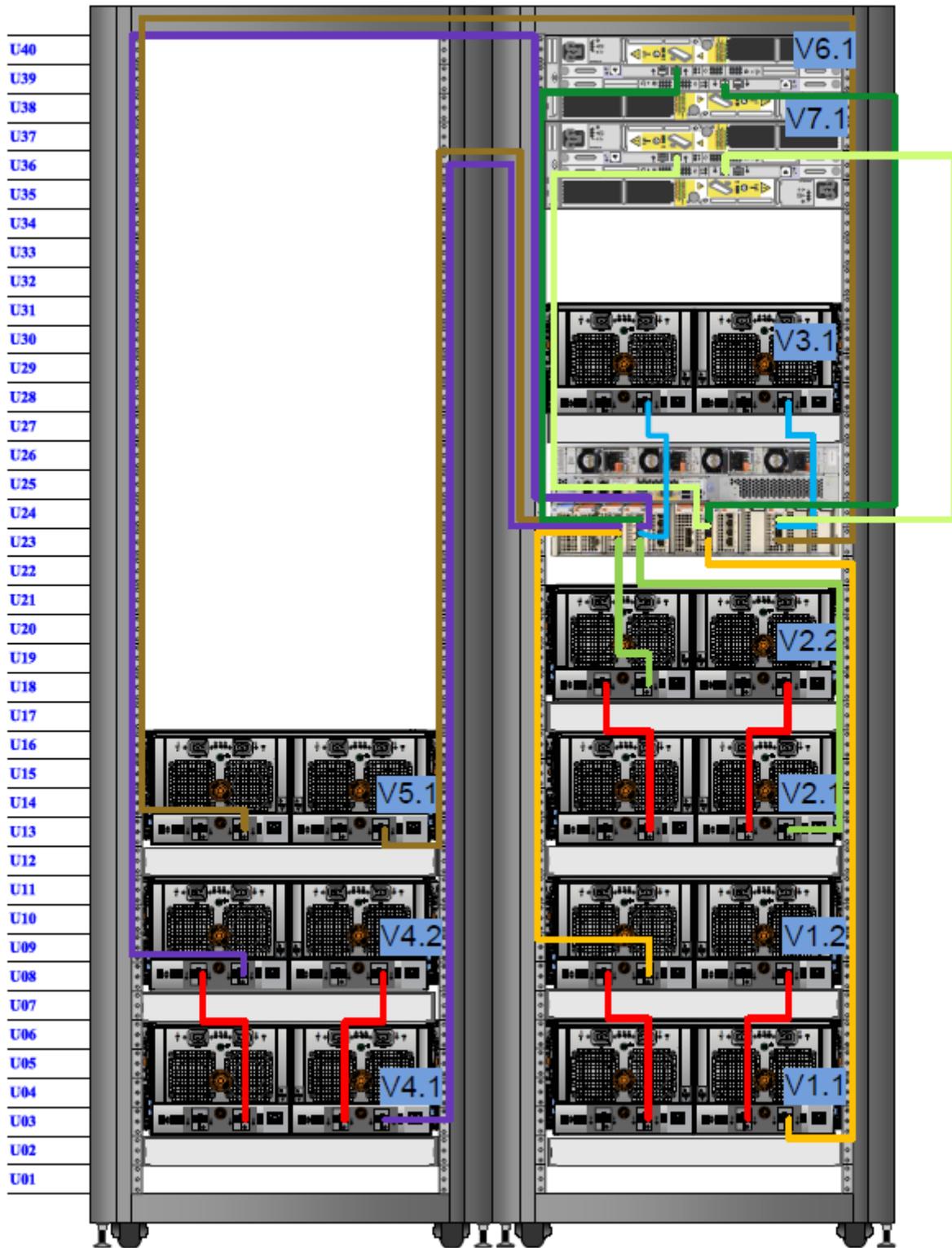**Figure 28** Cabling for DD9500 and DD9800 systems with DD Cloud Tier

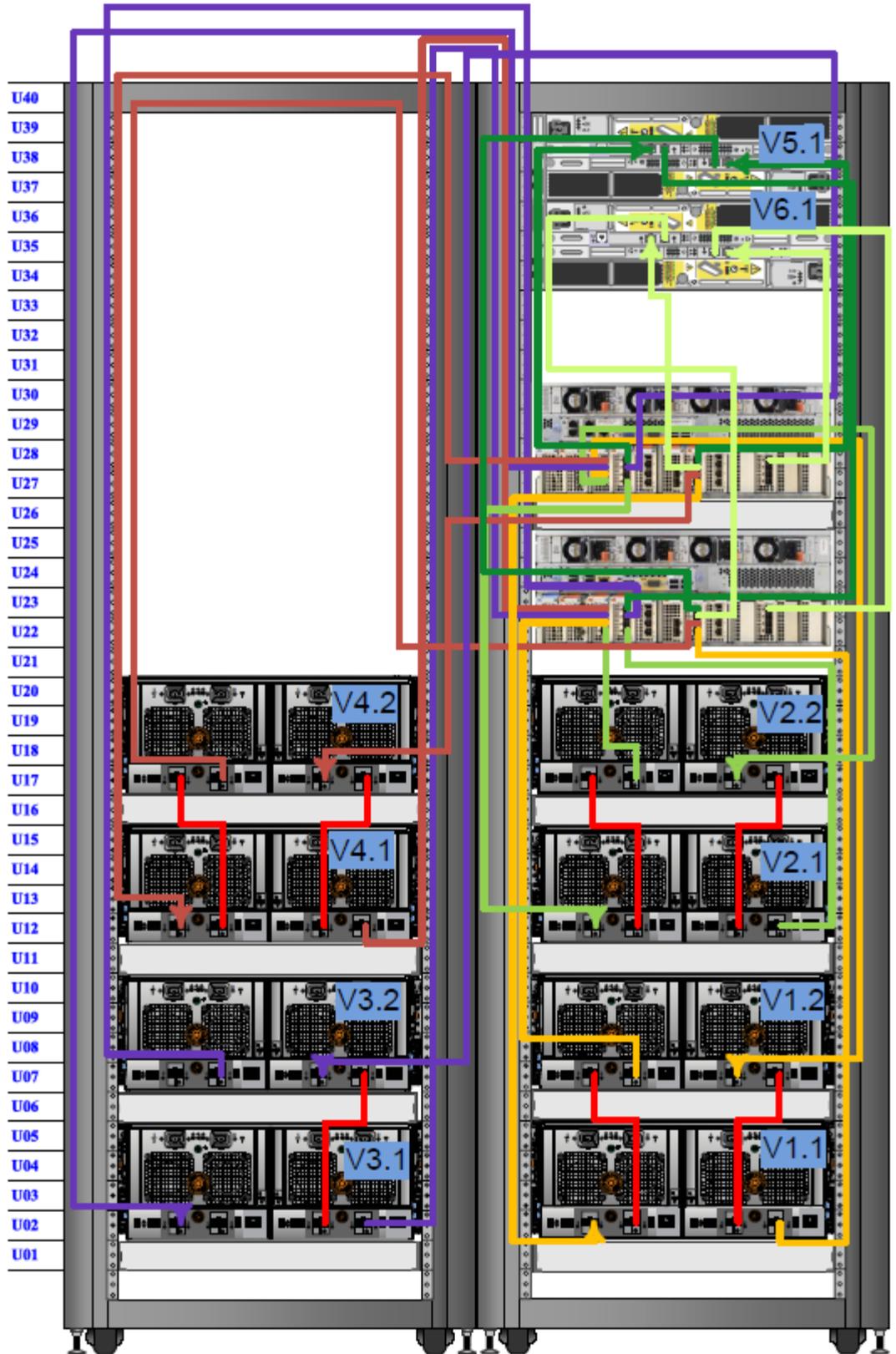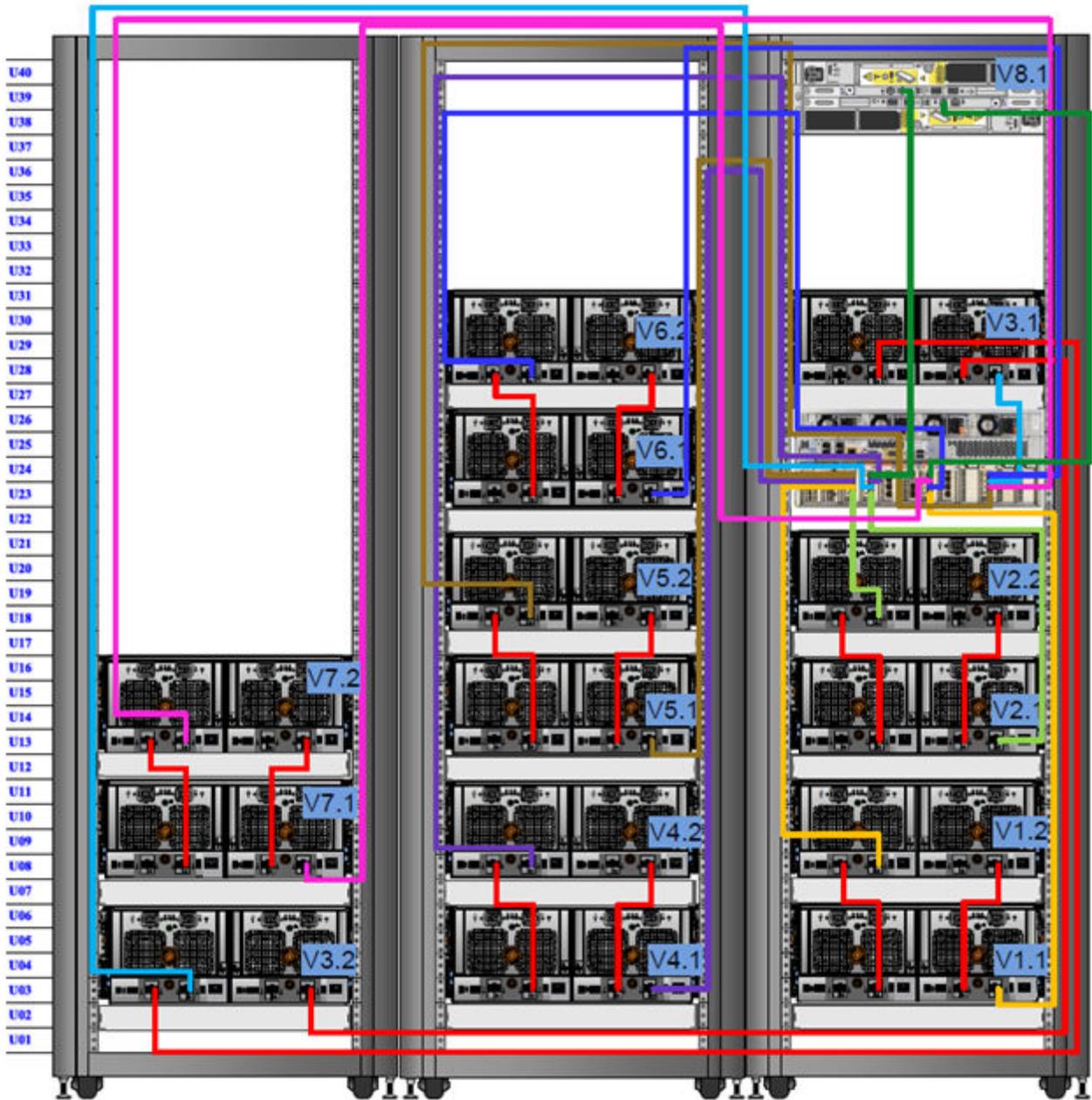**Figure 29** Cabling for HA DD9500 and DD9800 systems with DD Cloud Tier

Figure 30 Cabling for DD9500 and DD9800 systems with ERSO

Connecting power

> **⚠ CAUTION**
>
> **When configuring a system, do not power on the Data Domain controller until you have powered on all of its attached shelves.**

See the figures in this section that display recommended power connections for several Data Domain systems.

Do not connect the power cables until all of the shelf cables have been properly connected.

For redundant power distribution, use different Power Distribution Units (PDUs) to power each side of the rack. The power supplies in each DS60 shelves are capable of operating on 200-240 VAC, 50 Hz or 60 Hz power.

To ensure redundant AC power, each power supply of the DS60 must be fed from a different PDU, and each PDU must be connected to a separate AC circuit. Each DS60 power supply has two power cords.

> **Note**
>
> • The voltage used is specific to the site and country of installation.
>
> • Vertical PDUs, also known as 0U PDUs, and the power plugs in non-Data Domain racks often interfere with DS60s. In that case, rack-mounted PDUs, usually at the bottom or top of the rack, are required.

See the Power Calculator to determine total system power requirements: https://powercalculator.emc.com/PC3/.

• Do not exceed the current capacity of the power distribution unit by adding more products than it can support.

• For safety of personnel and to insure proper functioning of systems, it is recommended that each AC circuit of the power distribution unit have a double pole AC breaker system.

> **⚠ CAUTION**
>
> **Ensure that the PDU can handle the overall power load.**

• The rack's electrical distribution and earth ground bonding must meet the requirements of UL 60950-1 and IEC 60950-1, and local electrical safety building codes.

• The PDUs must have a sufficient quantity of single-phase power outlets with an earth ground conductor (safety ground). A safe electrical earth ground connection must be provided to each power cord.

Each DS60 ships with four 66" and four 160" C13/C14 PDU power cords. The shorter power cords are used for vertical (0U) PDUs, and the longer power cords can reach anywhere in a rack to connect to a different PDU. The C13 (IEC-60320-C13) side connects to the DS60 power supply, and the C14 (IEC-60320-C14) side connects to most PDUs.

Figure 31 C14 (left) and C13 (right) power cords
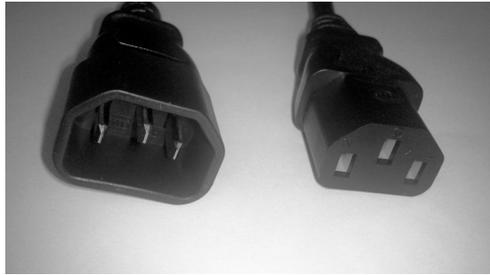
Attach the power supplies

Before you begin

If multiple racks are used, complete the cabling of all shelves in all racks before applying power.

Procedure

1. Install the Data Domain controller and the DS60 shelves in the rack or racks with the PDUs.

2. Cable the expansion shelves to the controller and to each other as described in Shelf cabling rules and guidelines on page 21.

3. Ensure the rack is grounded before connecting AC power from the main circuit.

4. Attach the power supplies on the rear panel of the Data Domain controller to separate PDUs for redundant power distribution, one on each side of the rack.

   The DS60 powers on immediately after you attach one of the power supplies on the rear panel of the shelf to a PDU with power.

Single phase power connections for 40U-P (current racks)

The following figures show single phase power connections for several Data Domain systems.

Figure 32 Recommended single phase power connections for the DD4200, DD4500, and DD7200 systems
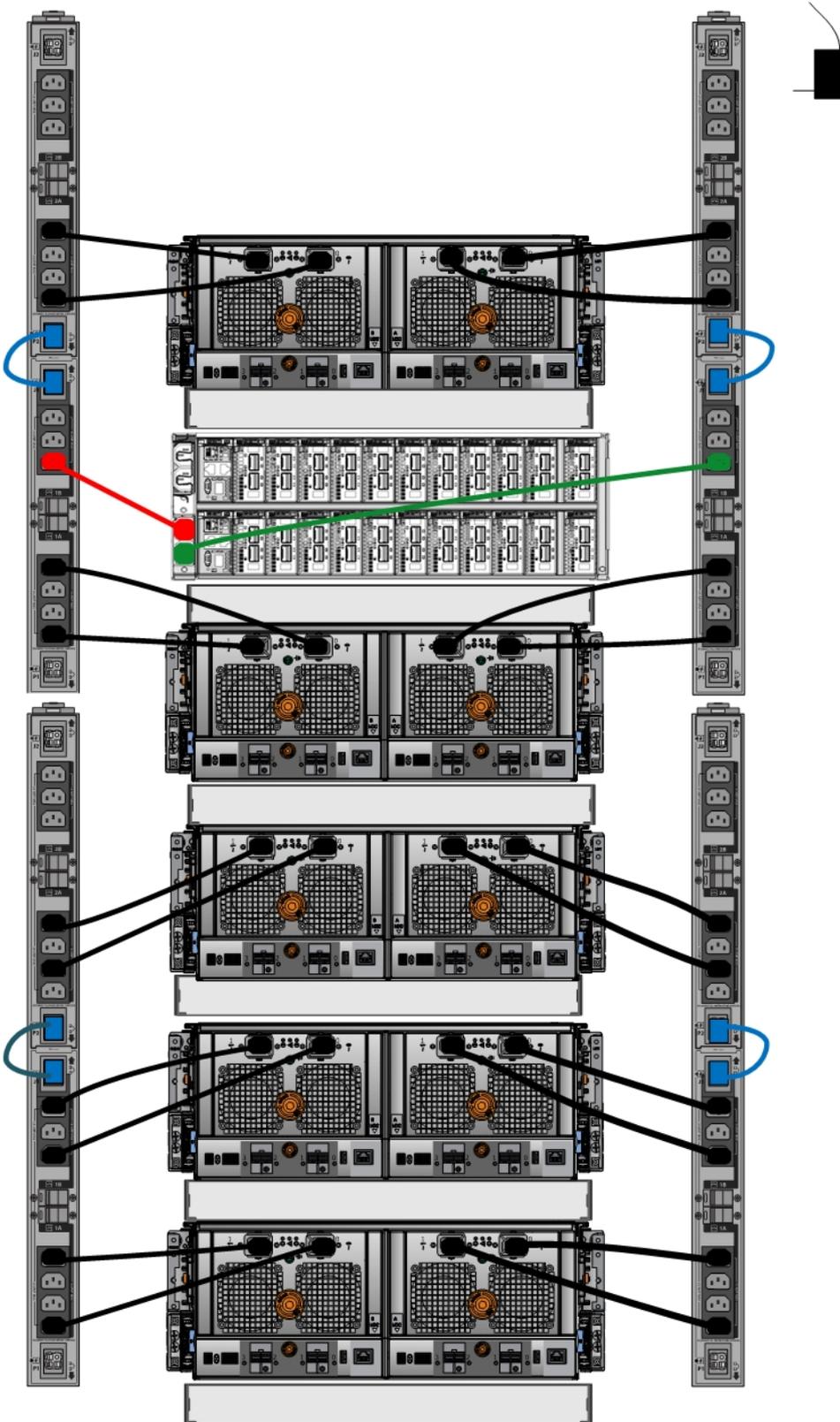
Figure 33 Recommended single phase power connections for the DD9300

Figure 34 Recommended single phase power connections for DD9300 with HA

Figure 35 Recommended single phase power connections for DD9800

Figure 36 Recommended single phase cabling for DD9800 with HA
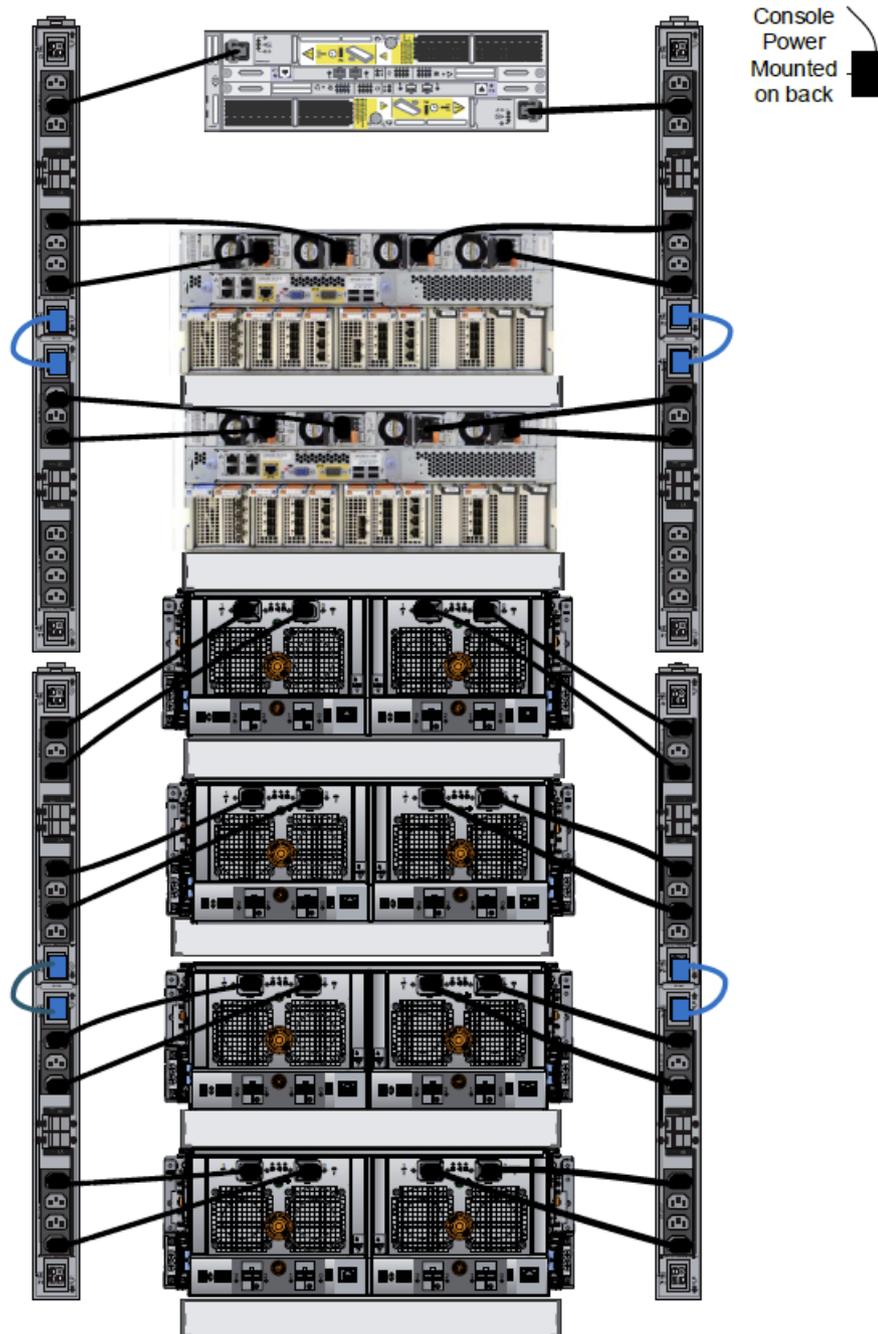
Note

Single phase PDU with two DD9500 units, four DS60 shelves, and one FS15 shelf requires two power cords on each PDU pair.

Figure 37 Recommended single phase power connections for the DS60 (full-racked)
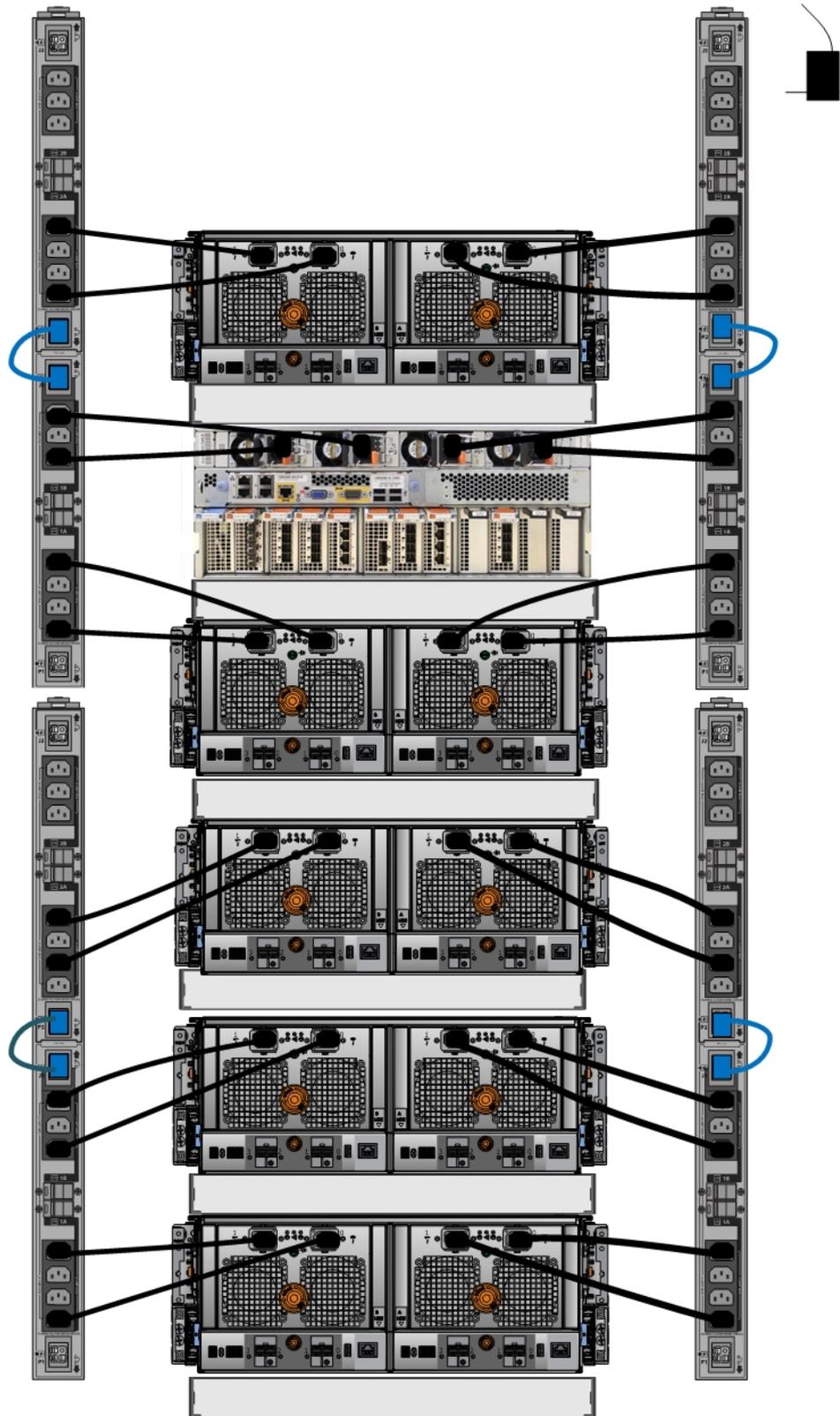
Figure 37 Recommended single phase power connections for the DS60 (full-racked) (continued)

Note

Single phase PDU with one DD9500 and five DS60 shelves requires two power cords on each PDU pair.

3-phase power connections for 40U-P (current racks)

Some environments use 3-phase power for 40U-P racks used for several Data Domain systems. In those situations it is desirable to balance the current draw across all 3 phases. The recommended 3-phase power cabling attempts to do that, but an optimal configuration is dependent on the specific installation. The following figures show recommended 3-phase power connections for several Data Domain systems.

Note

The next few diagrams show recommended 3-phase delta power connections.

Figure 38 Recommended 3-phase delta power connections for the DS60 expansion shelves (full-racked)
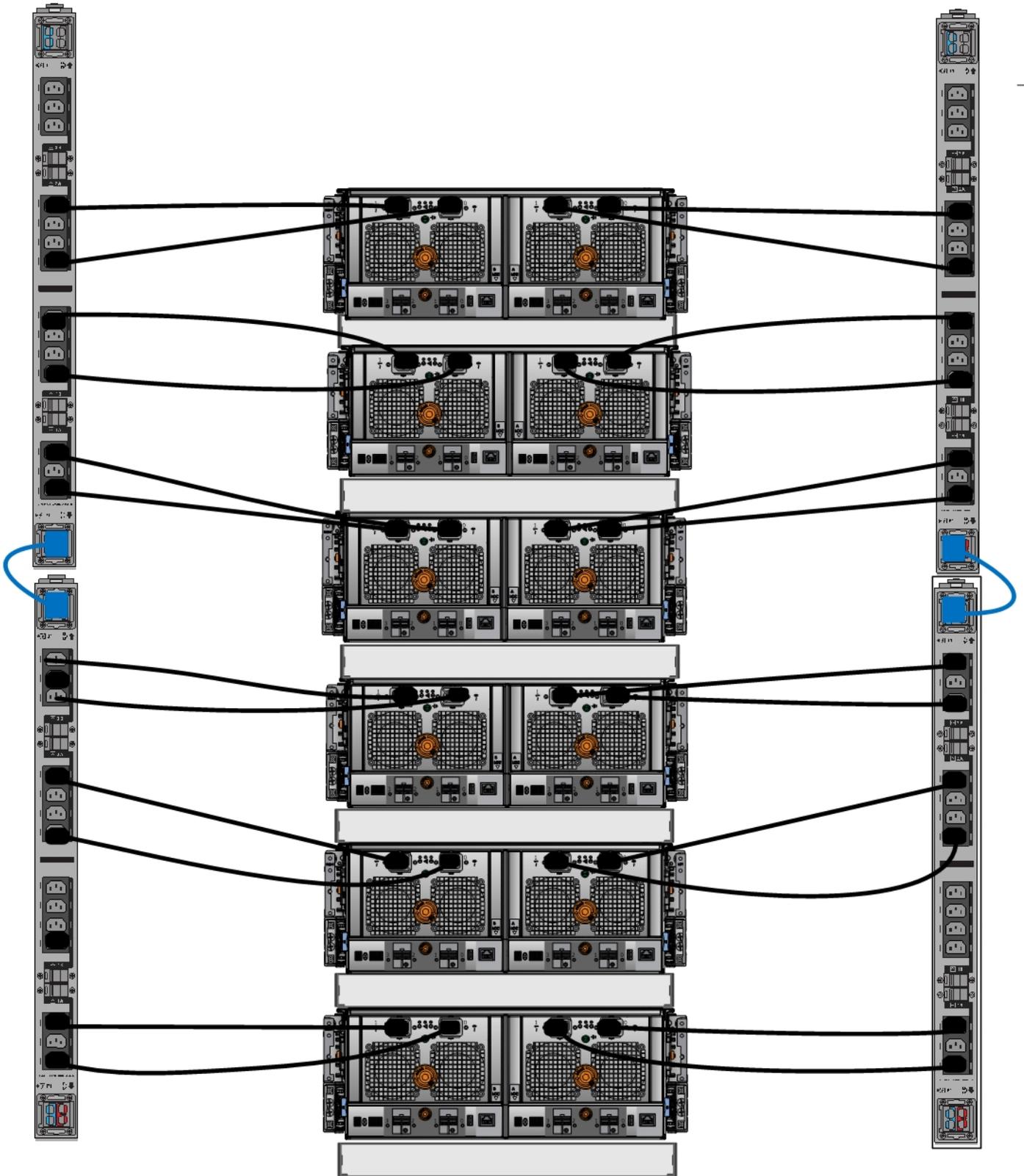
Figure 39 Recommended 3-phase delta power connections for DD4200, DD4500, and DD7200 systems
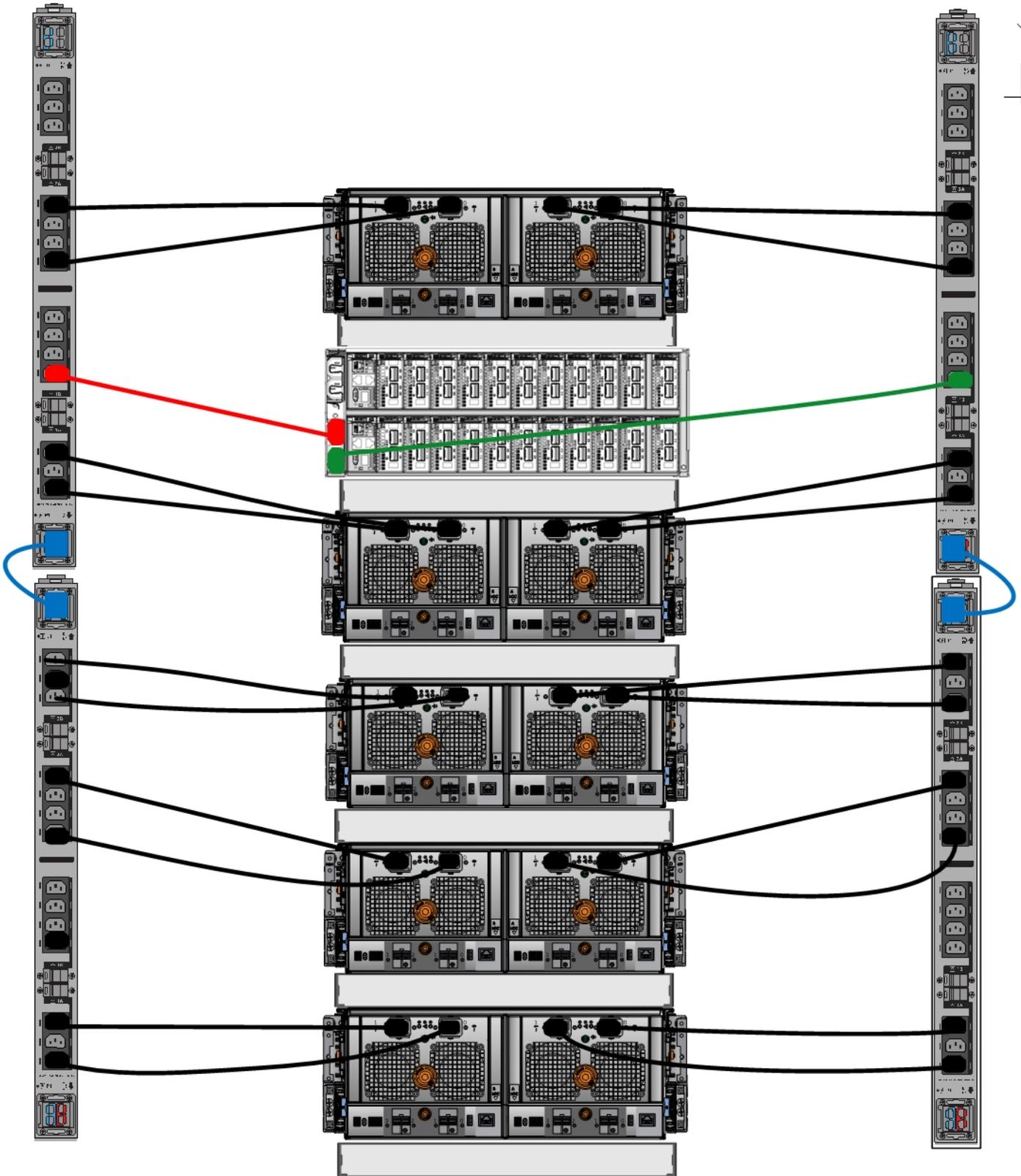
Figure 40 Recommended 3-phase delta power connections for DD9300
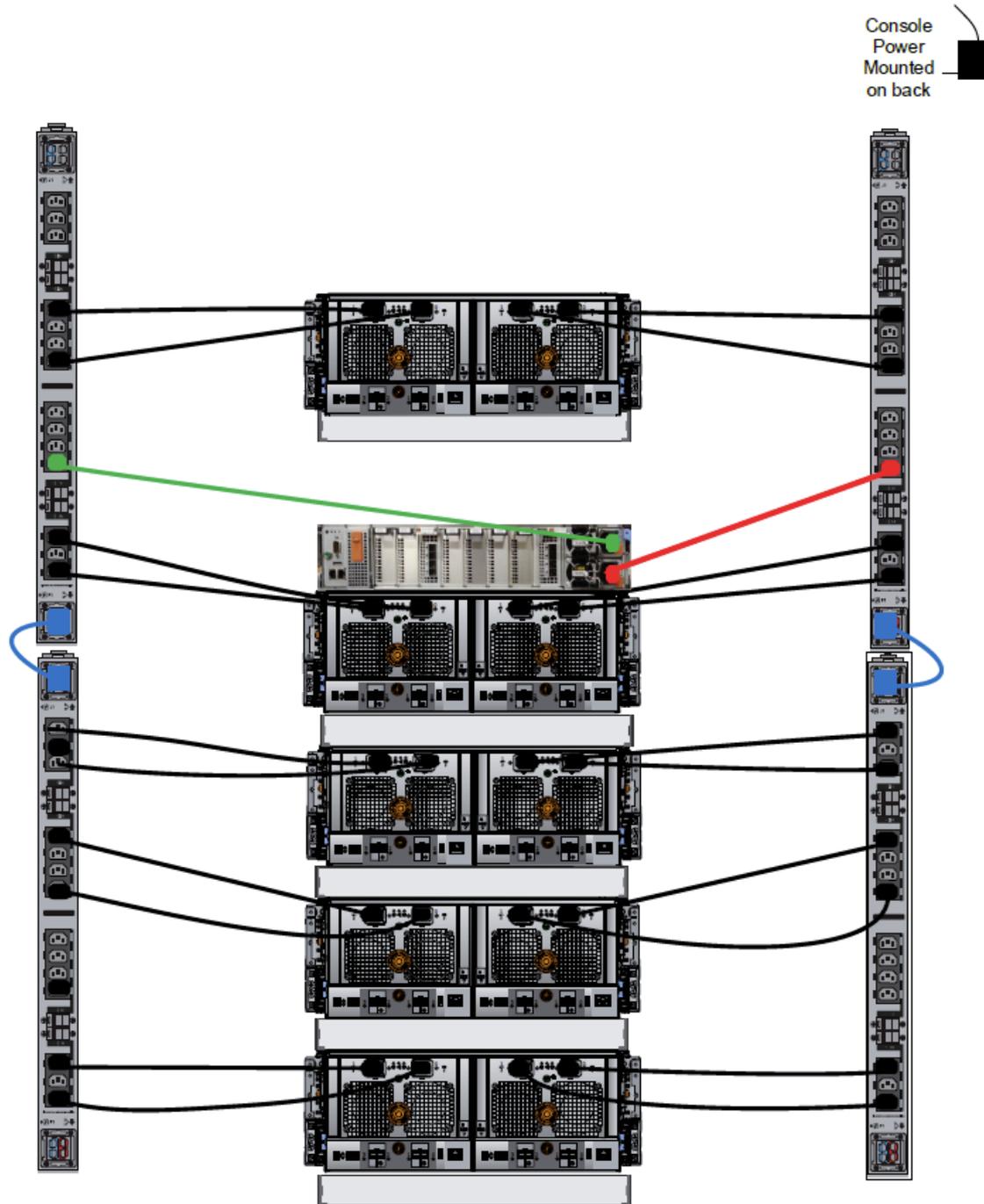
Figure 41 Recommended 3-phase delta power connections for DD9300 with HA
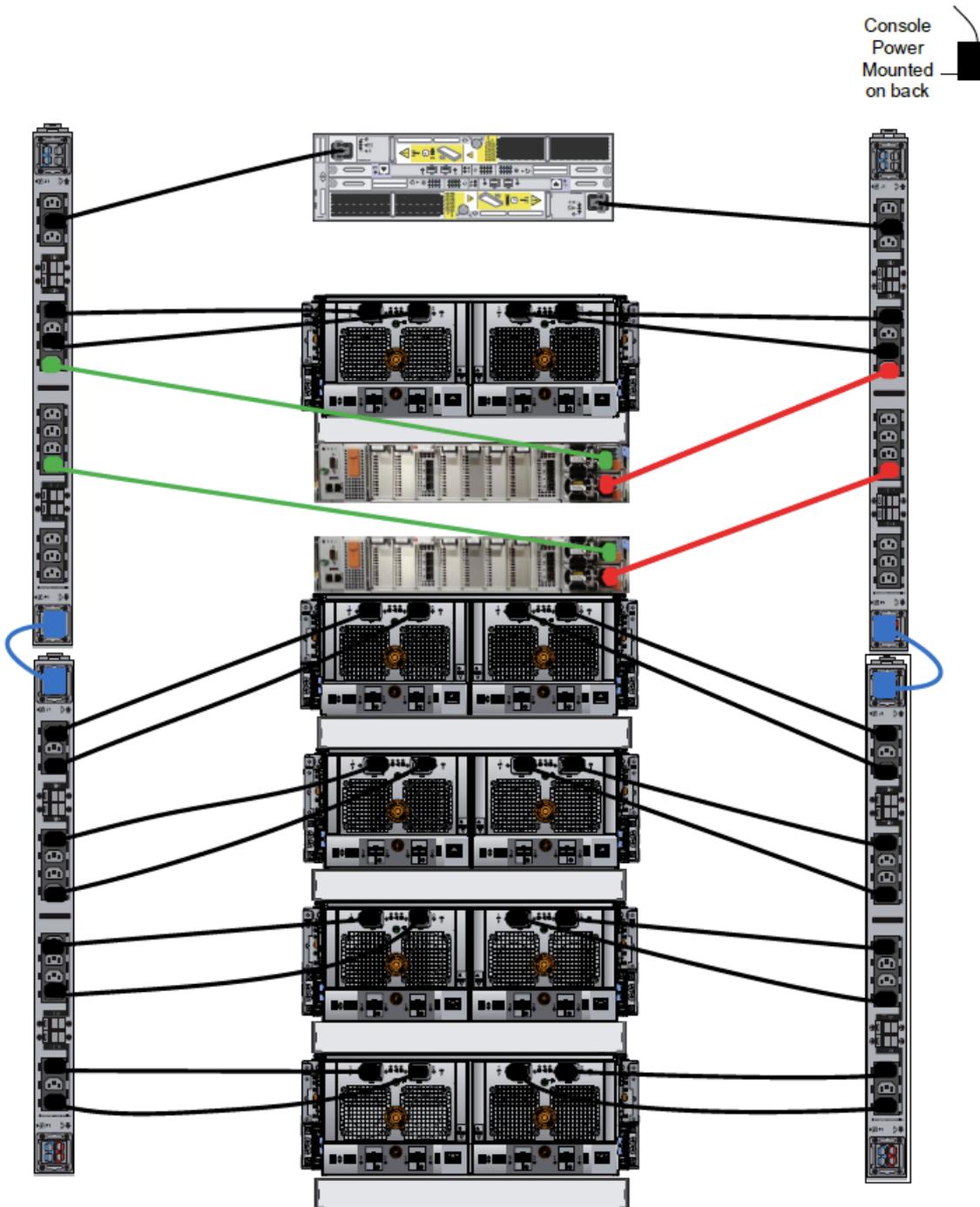
Figure 42 Recommended 3-phase delta power connections for DD9500 system
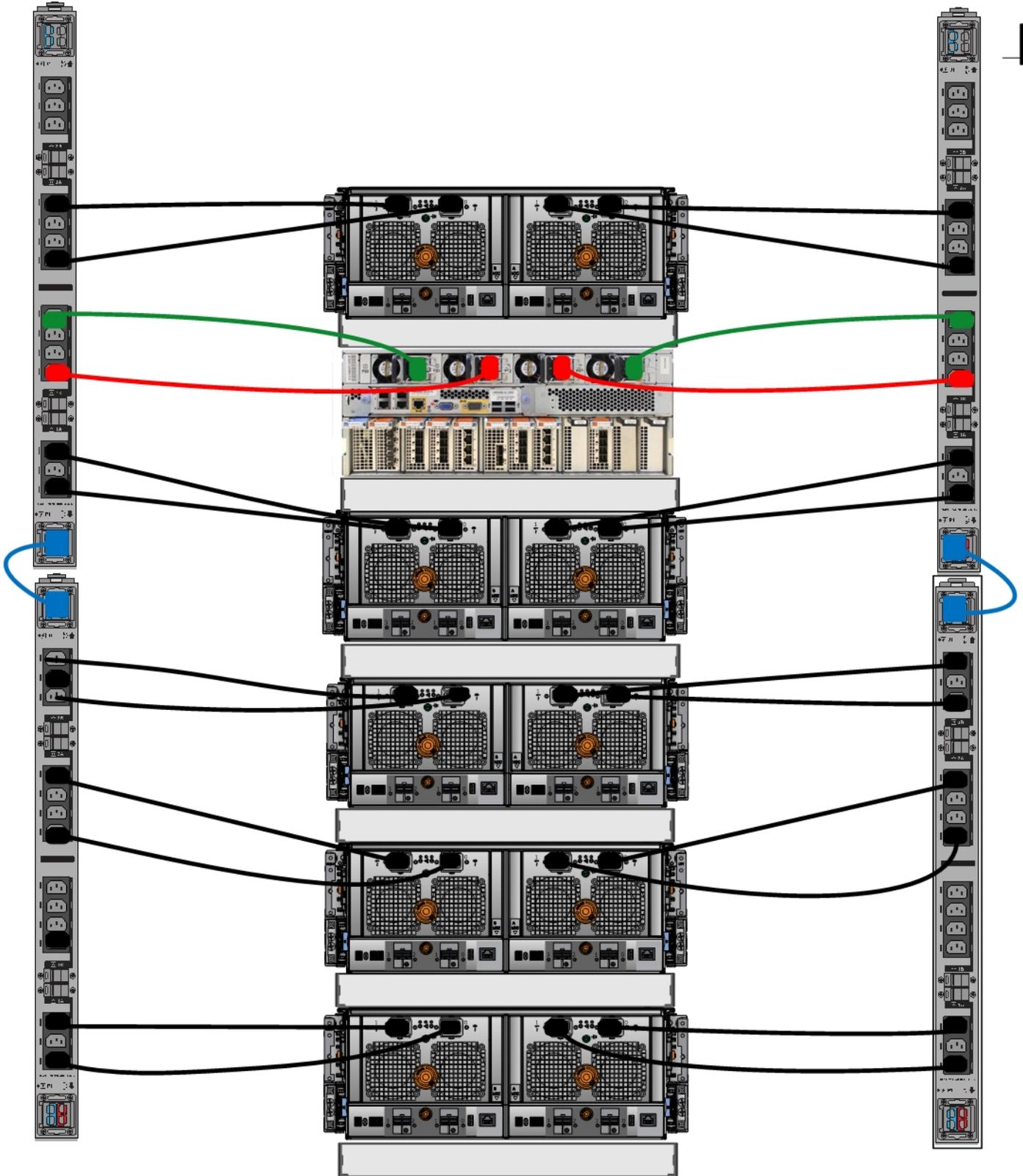
Figure 43 Recommended 3-phase delta power connections for DD9800
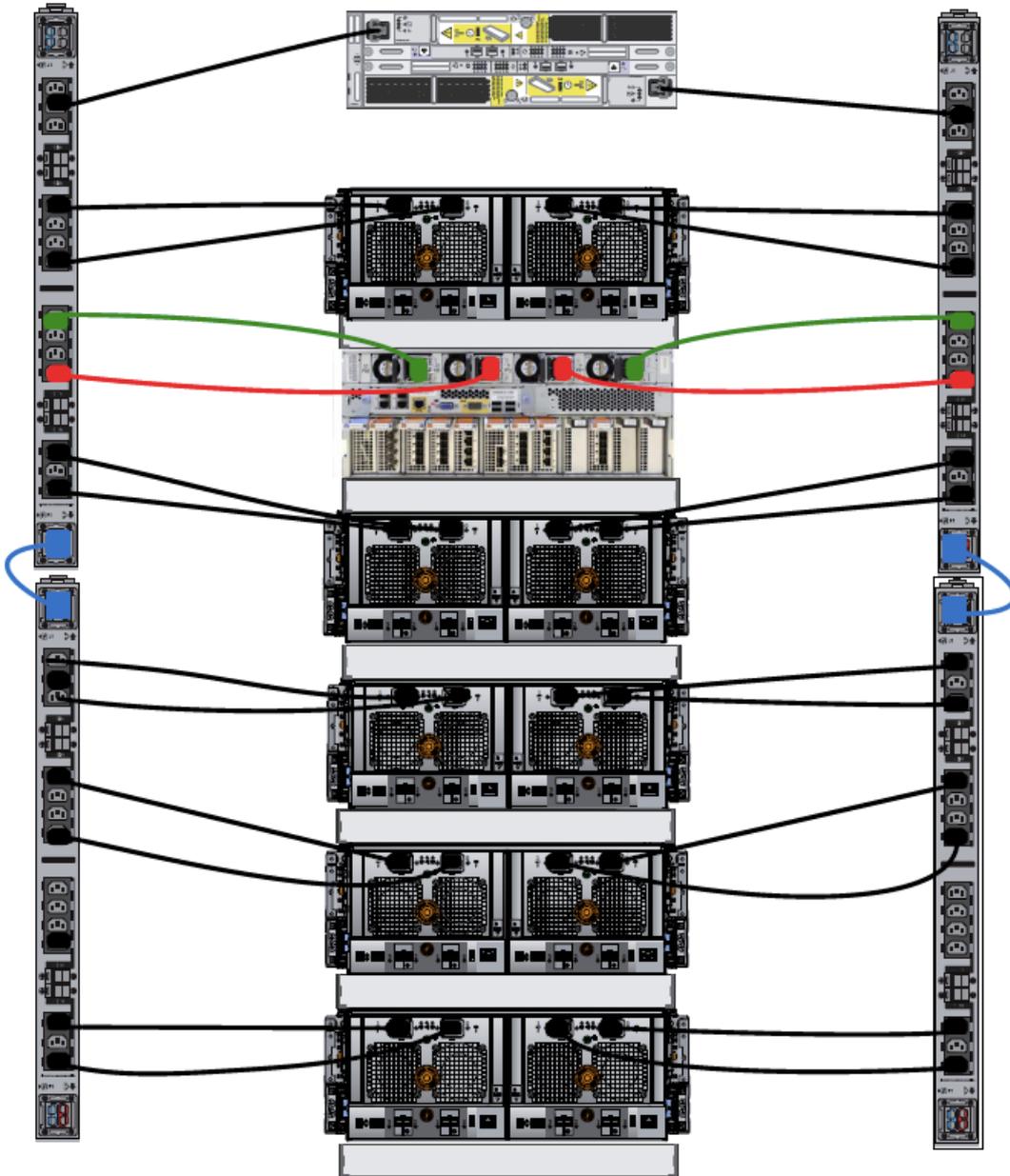
Figure 44 Recommended 3-phase delta power connections for DD9800 with HA
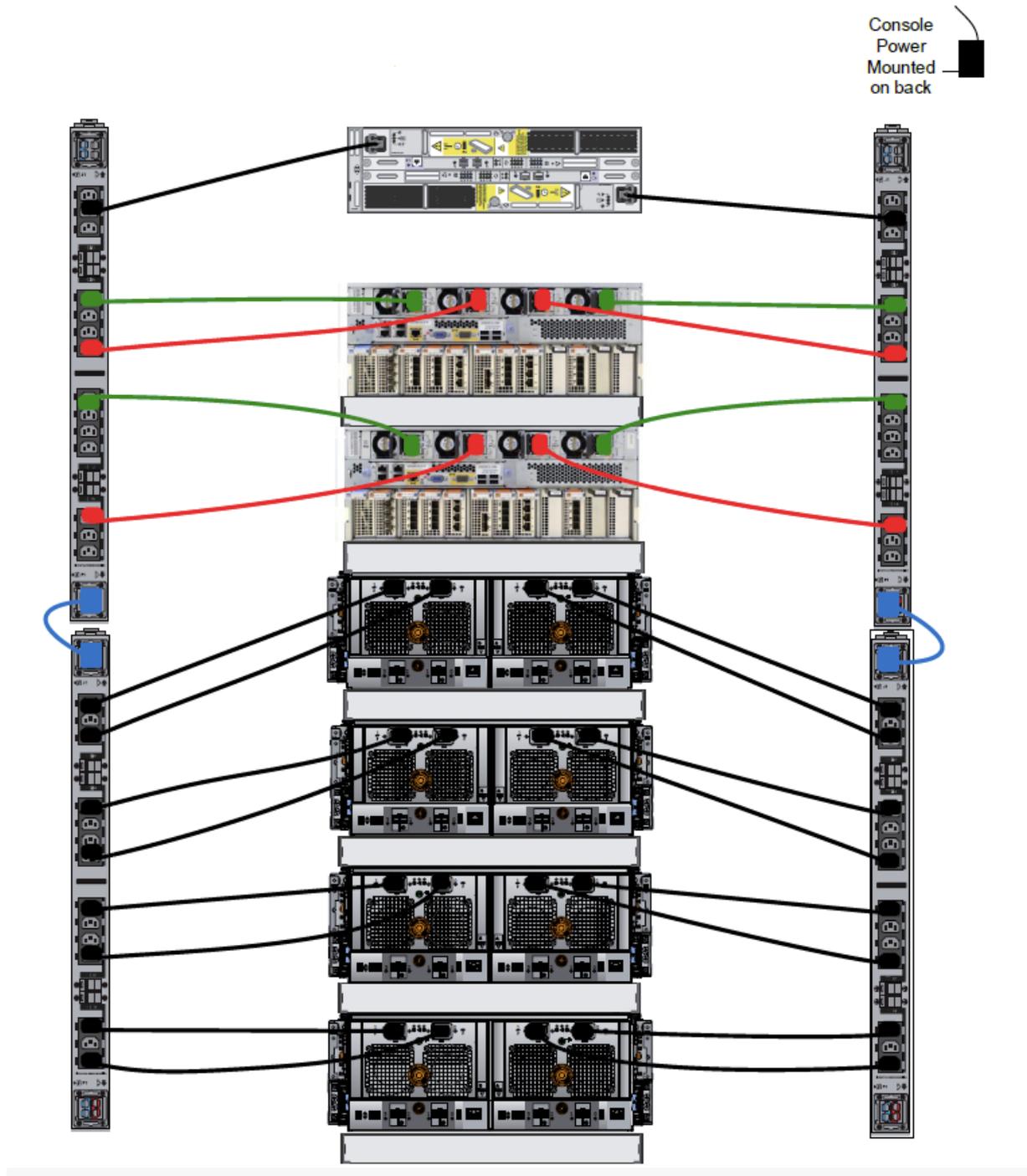
Note

The next few diagrams show recommended 3-phase wye power connections.

Figure 45 Recommended 3-phase wye power connections for the DS60 expansion shelves (full-racked)
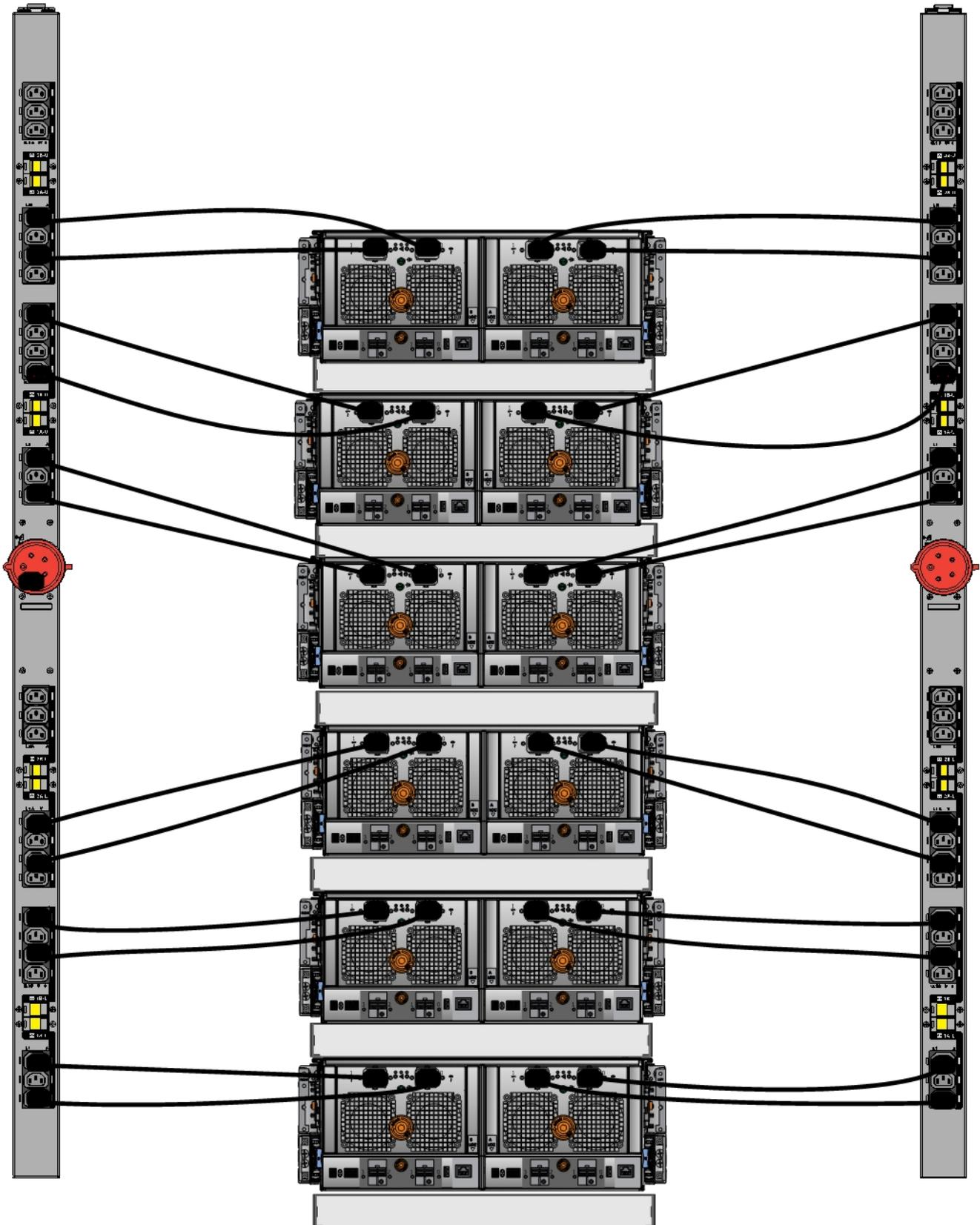
Figure 46 Recommended 3-phase wye power connections for DD4200, DD4500, and DD7200 systems
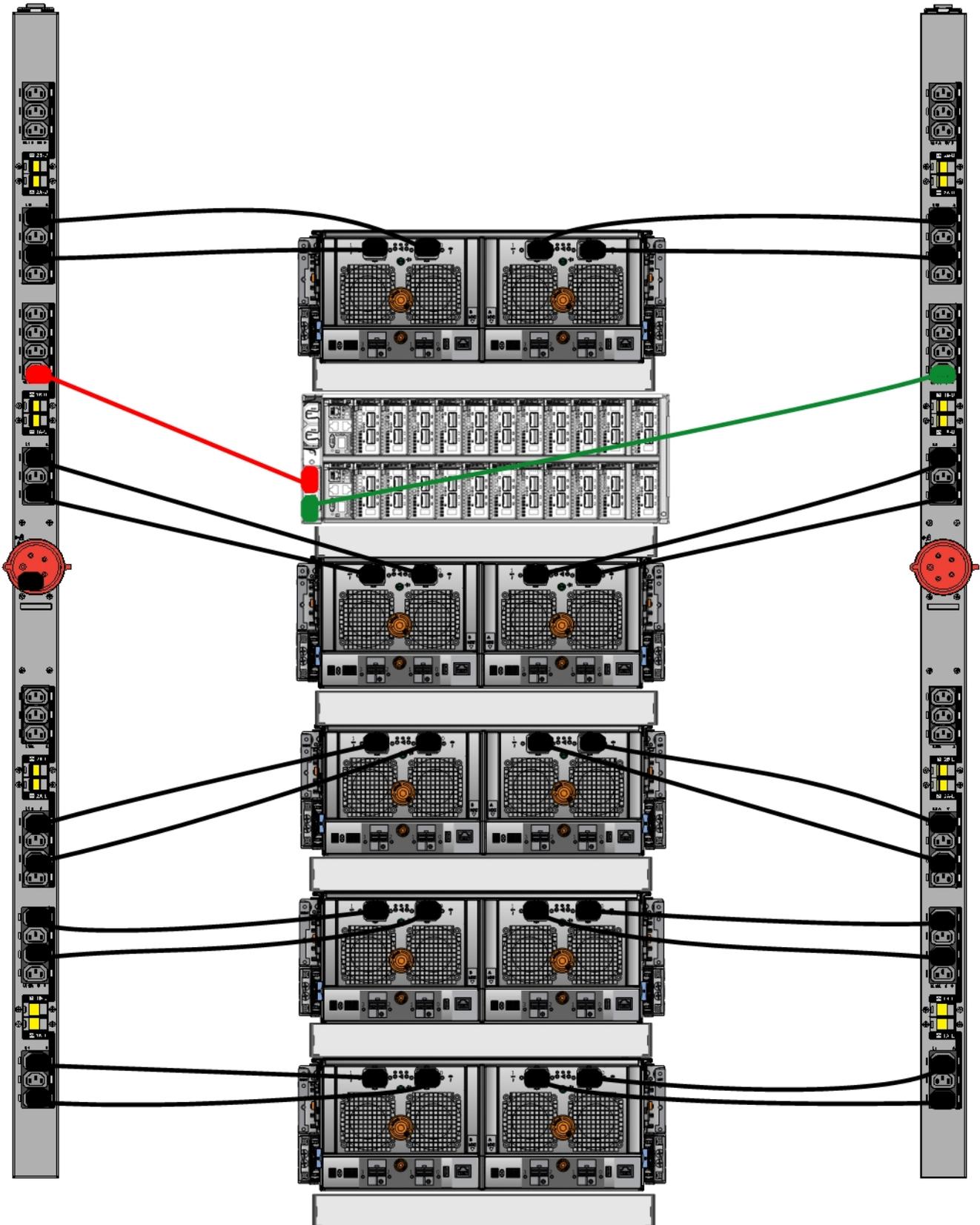
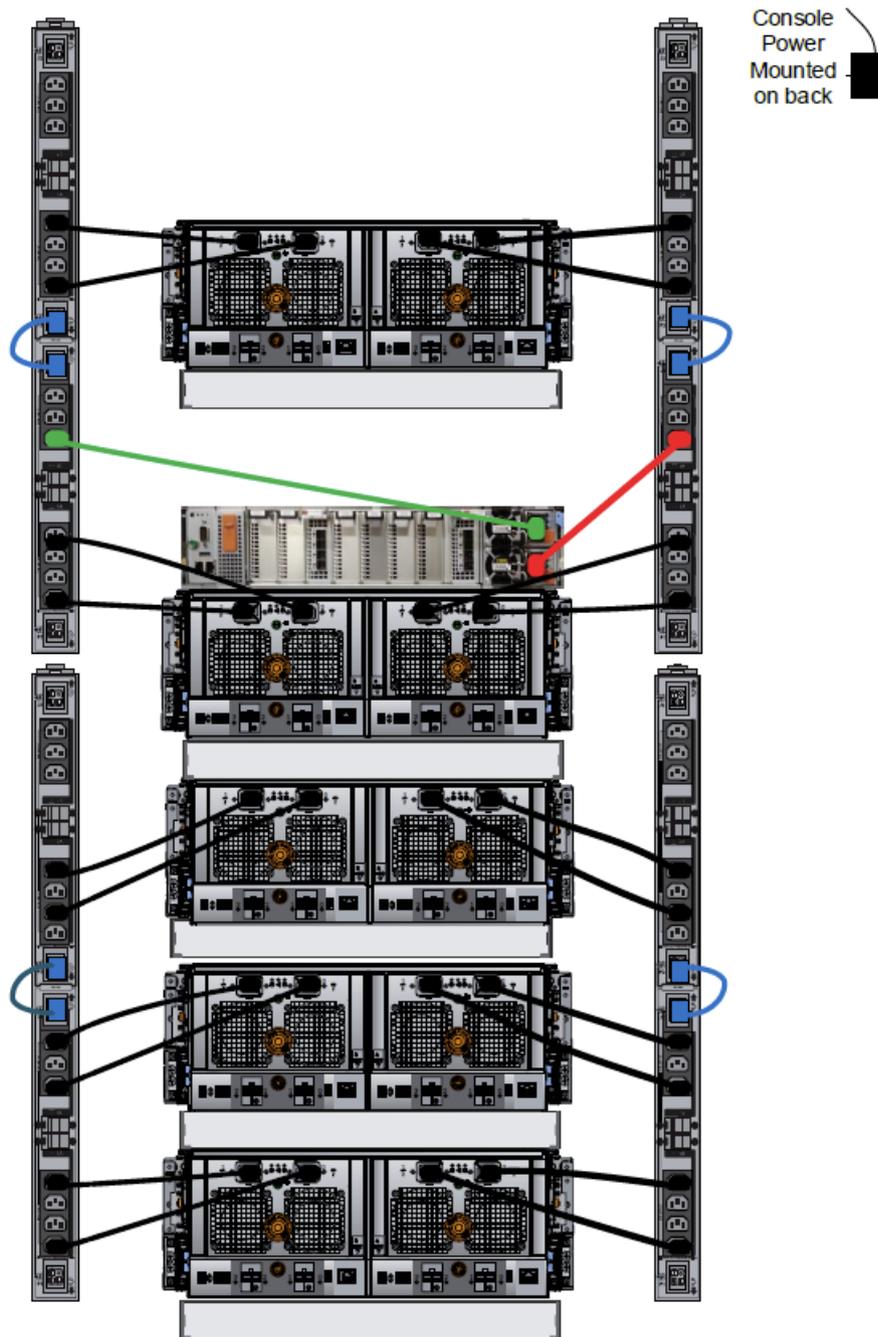Figure 47 Recommended 3-phase wye power connections for DD9300
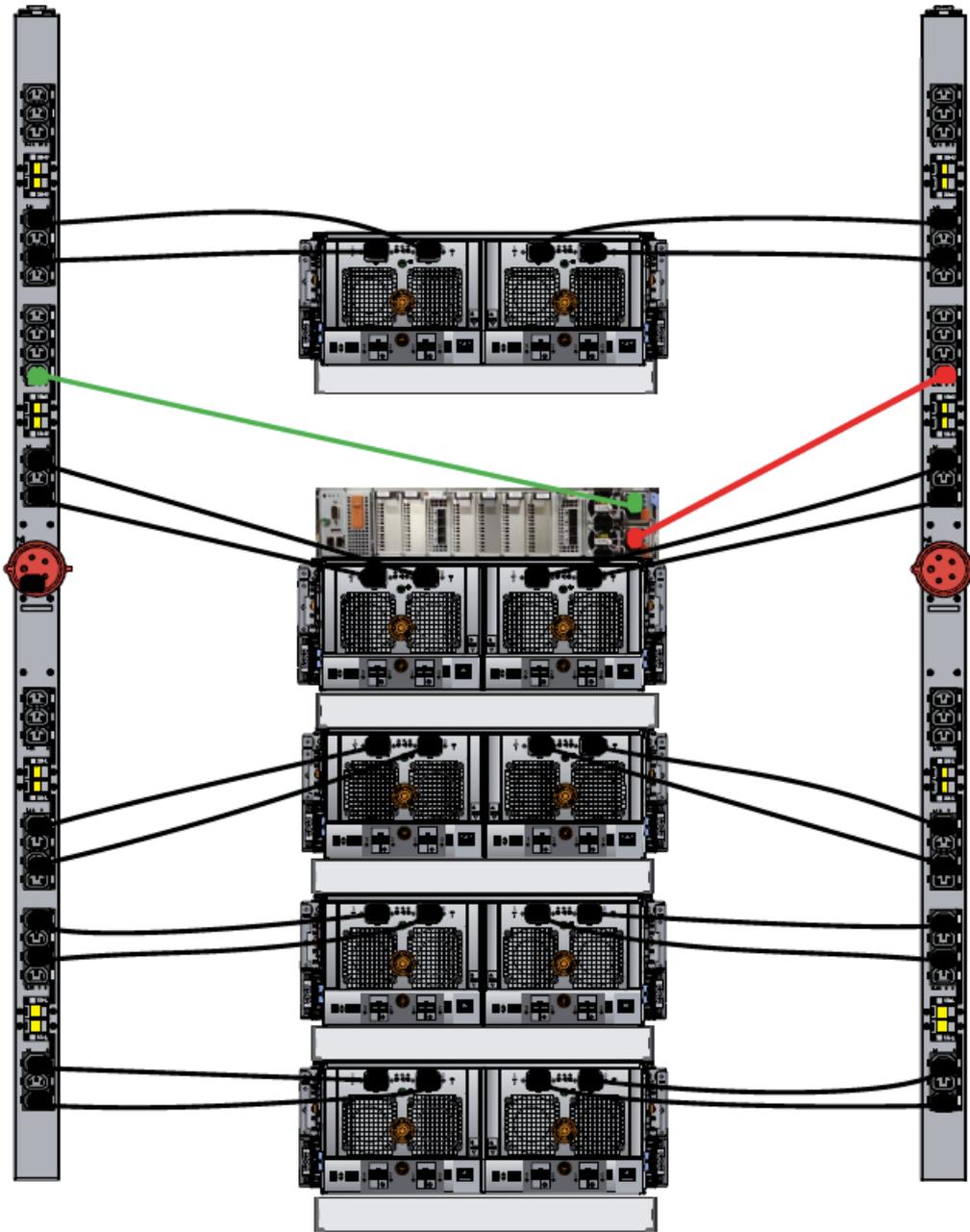
Figure 48 Recommended 3-phase wye power connections for DD9300 with HA
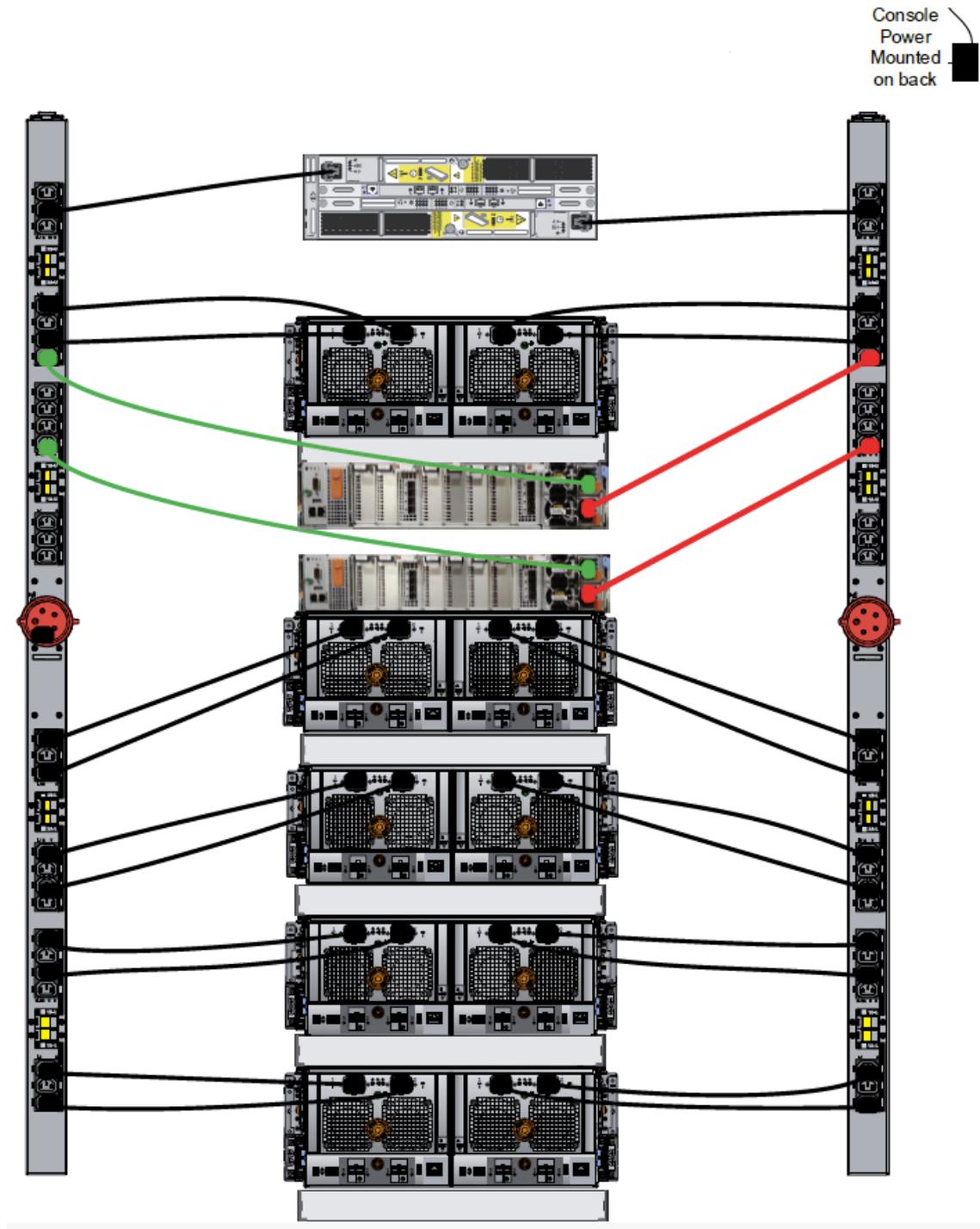
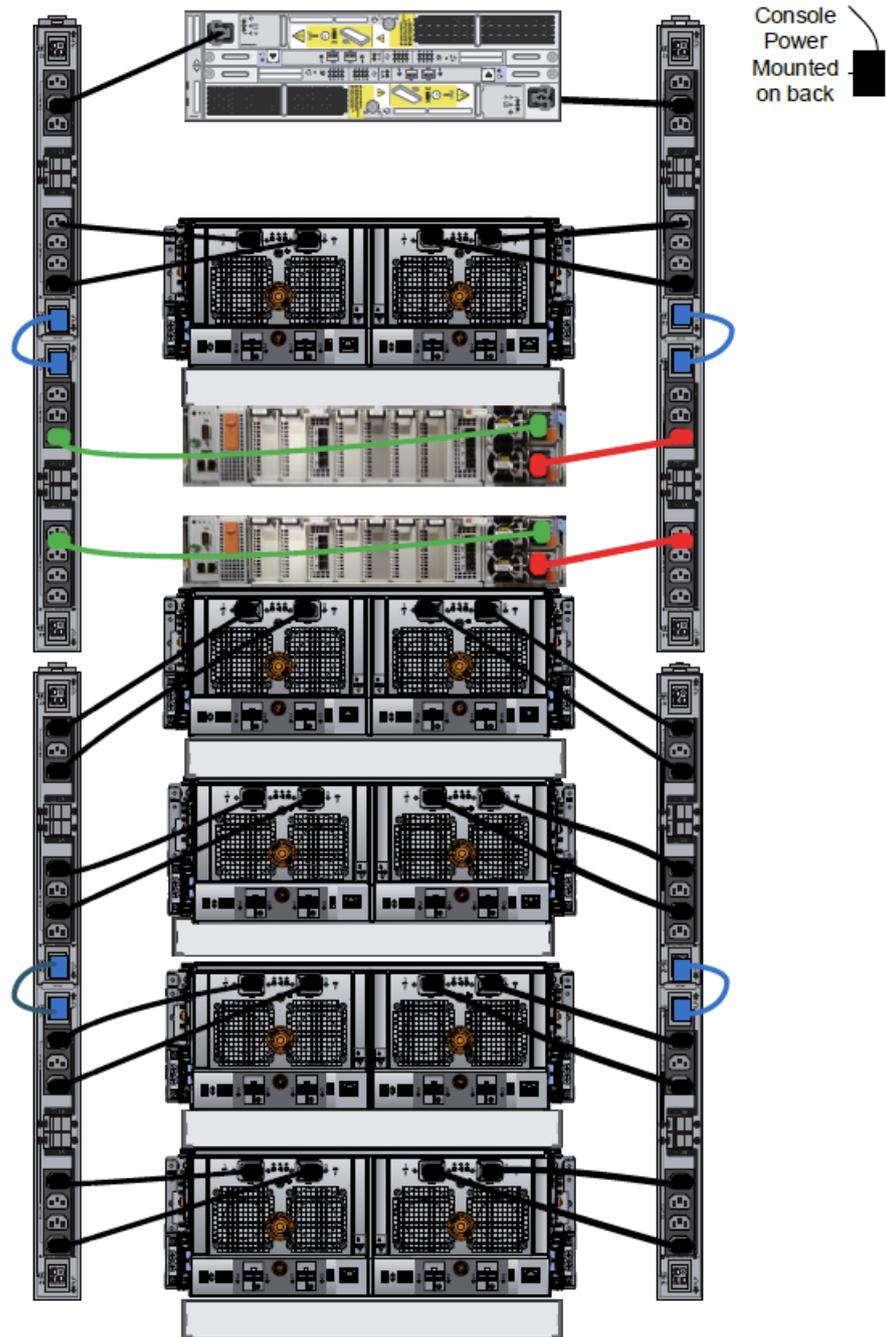**Figure 49** Recommended 3-phase wye power connections for DD9500 system
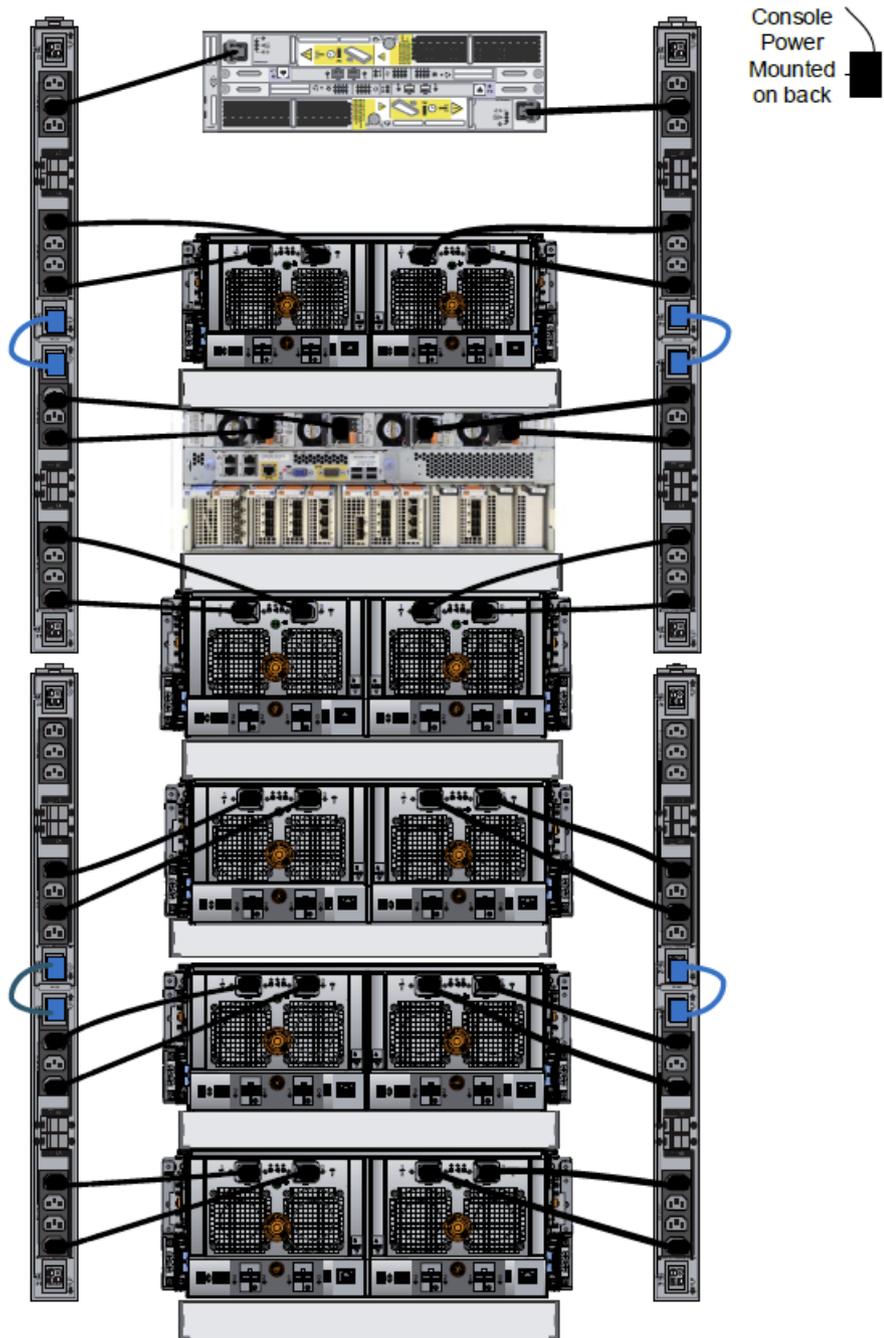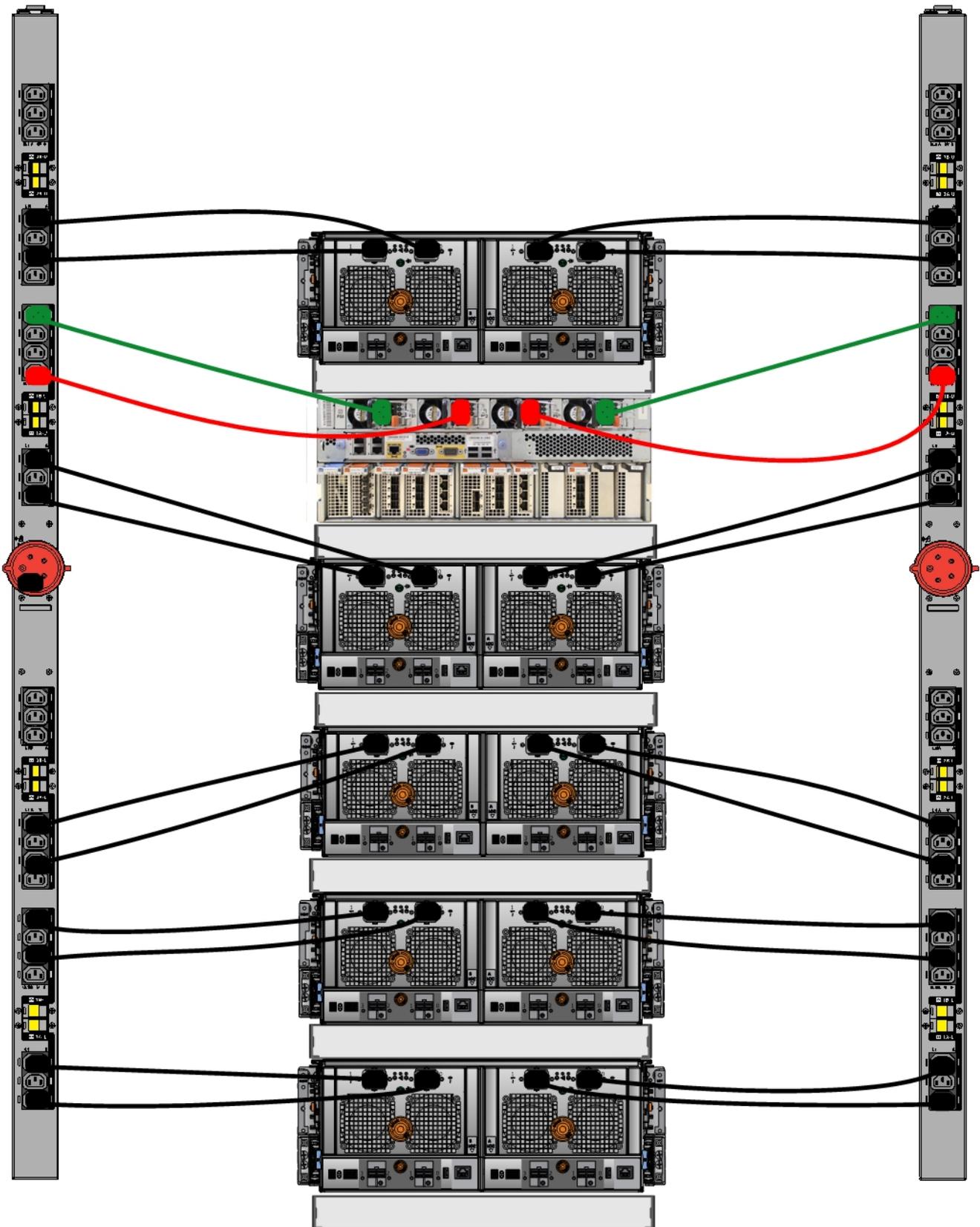
Figure 50 Recommended 3-phase wye power connections for DD9800
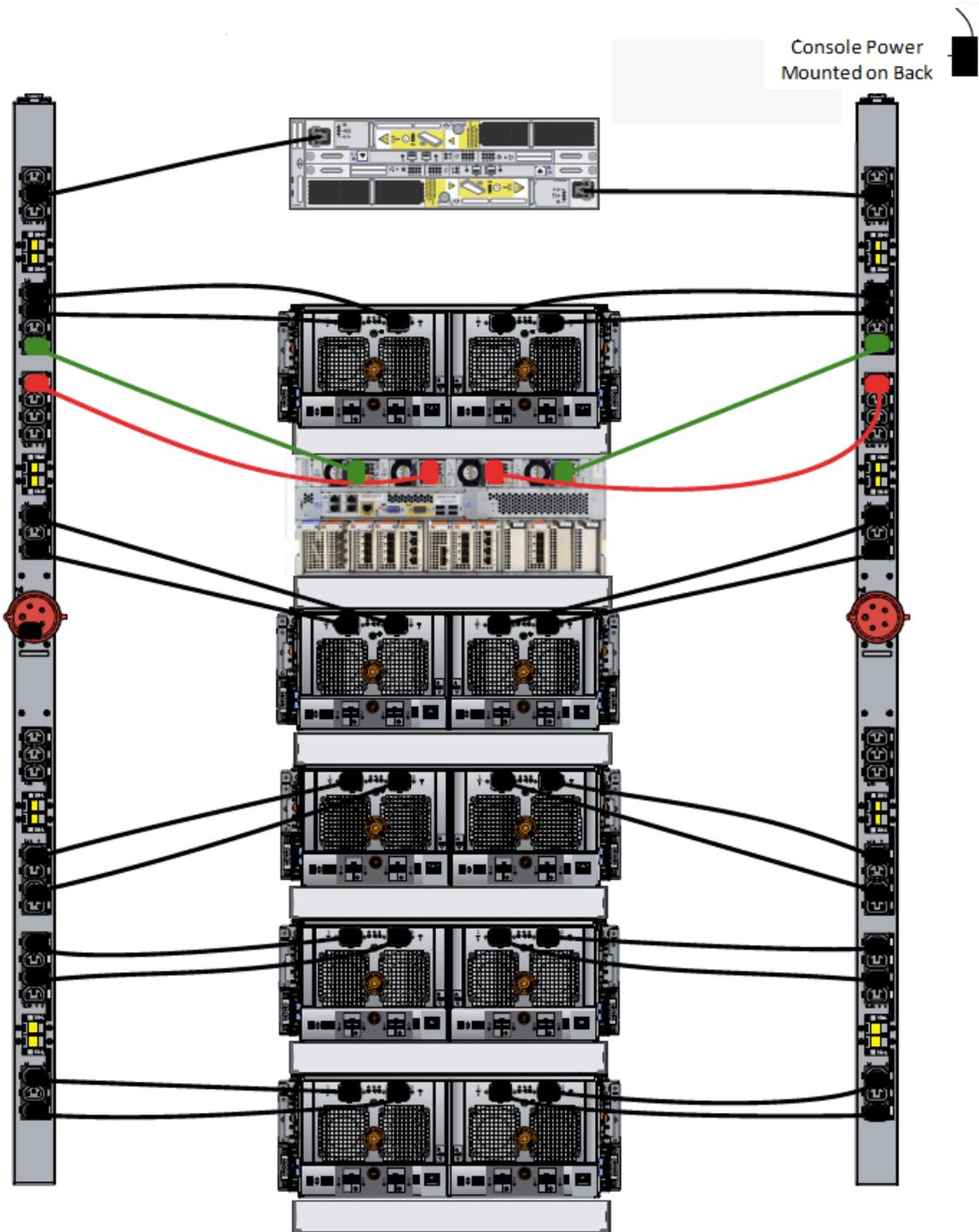
Figure 51 Recommended 3-phase wye power connections for DD9800 with HA

Installing the Shelves
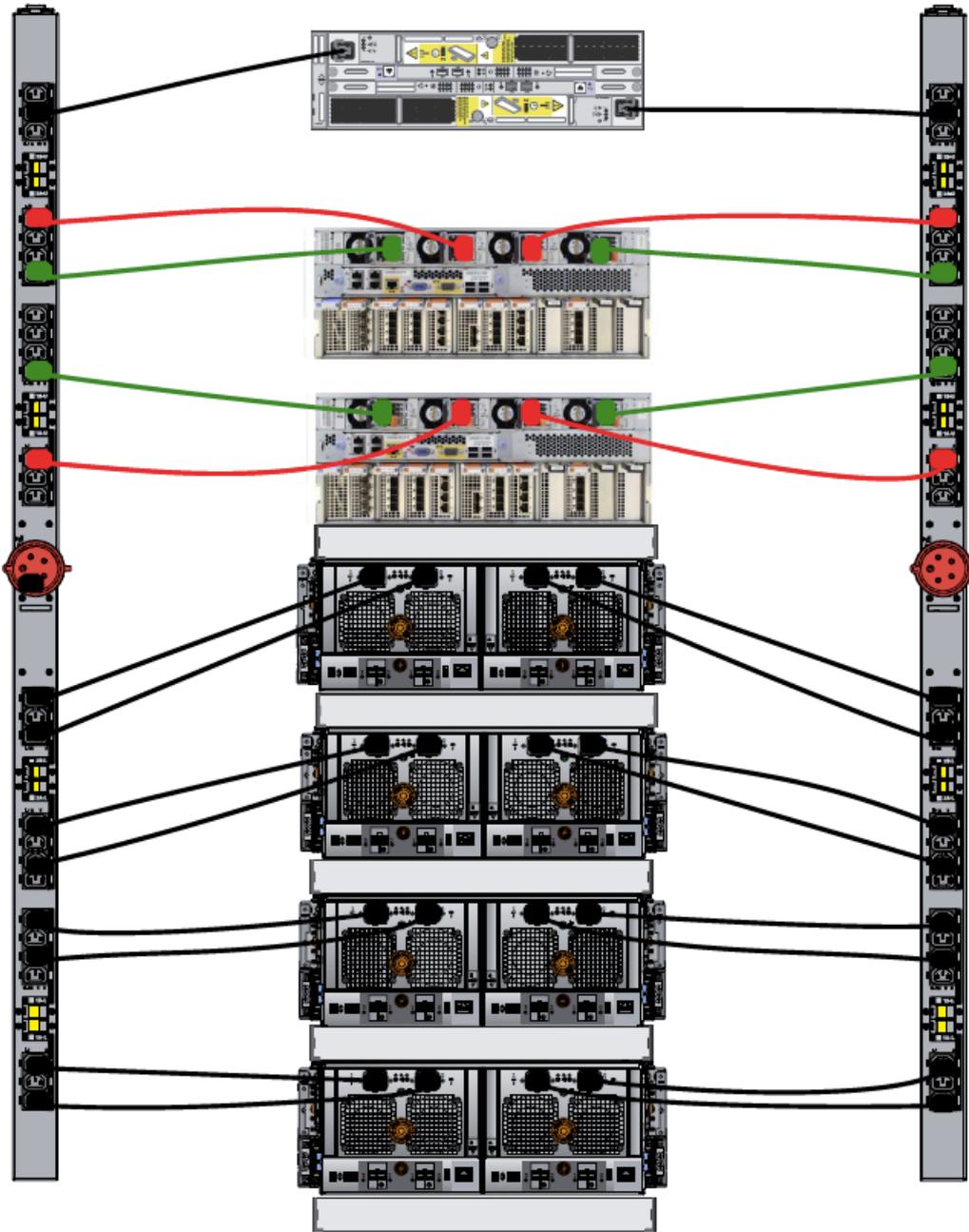
CHAPTER 3

Data Domain-Specific Installation

This chapter shows the SAS I/O module and port location for each Data Domain system that supports the DS60 shelves. See the appropriate description for your Data Domain system.

This chapter covers the following major topics:

DD4200, DD4500, and DD7200 systems

The management module is located on the far left side when facing the back of the system, in slot Management A. The management module contains one external LAN connection for management access to the system processor (SP) module. One micro DB-9 connector is included to provide the console. A USB port is provided for use during service of the system to allow booting from a USB flash device.

All systems contain 9 (0-8) available I/O module slots. Depending on the system, there can be up to 6 Ethernet modules, 4 Fibre Channel modules, or 4 SAS modules in a system.

For I/O modules containing multiple ports, the bottom port is numbered as zero (0) with numbers increasing going upward.

Figure 52 Rear view (systems without Extended Retention software option or DD Cloud Tier)
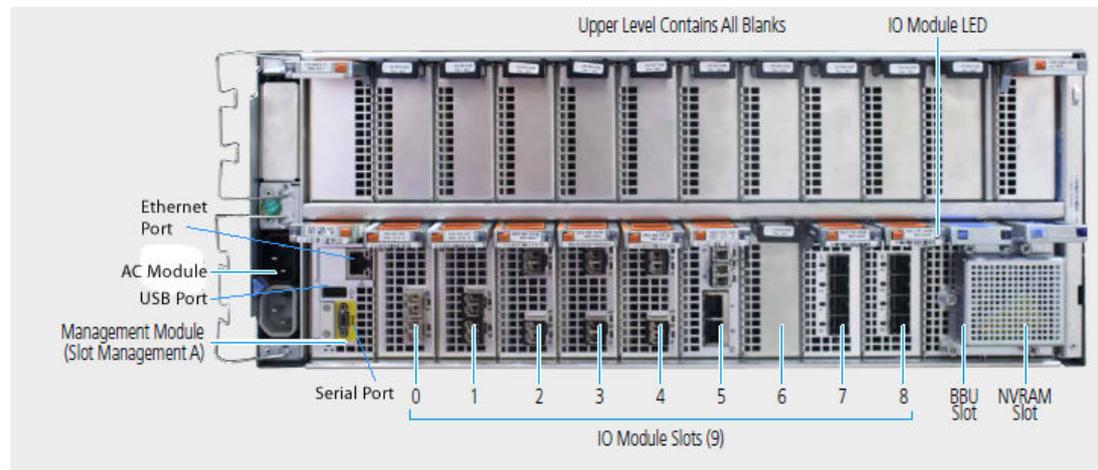
Note

Slots 7 and 8 are used for SAS I/O modules for systems without Extended Retention or DD Cloud Tier.

Figure 53 Rear view (systems with Extended Retention software option or DD Cloud Tier)
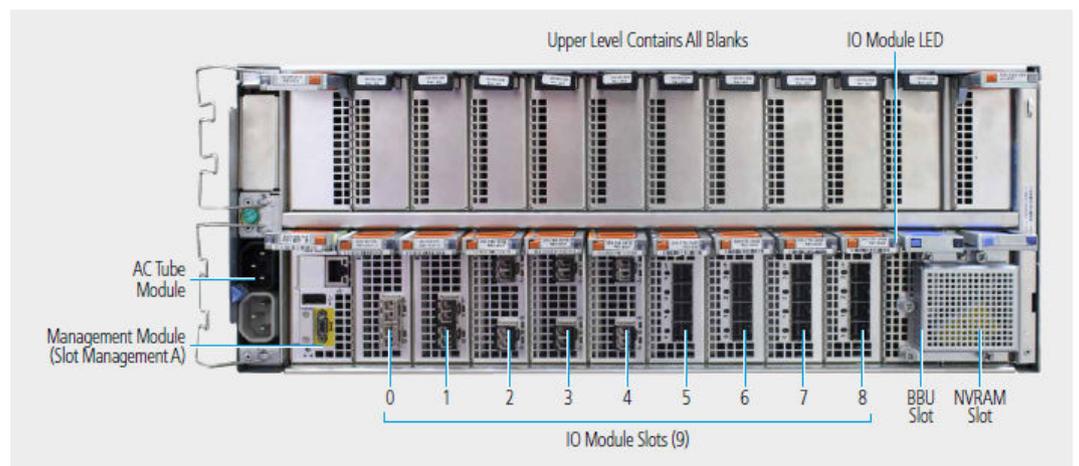
Figure 53 Rear view (systems with Extended Retention software option or DD Cloud Tier) (continued)

Note

Slots 5 and 8 are used for SAS I/O modules for systems with Extended Retention or DD Cloud Tier.

DD6300, DD6800 and DD9300 systems

DD6300, DD6800 and DD9300 Onboard IO is on the left of the rear side of the SP. A DB-9 port is used as a serial console, and a USB 2.0 compliant port is for performing DDOS upgrades. There are two 1000BaseT network port; the left port connects to a dedicated BMC service port, and the right port is a general purpose embedded 1GBE host interface port .

DD6300, DD6800 and DD9300 have eight SLIC slots (0-7) and are 8-lane PCIe Gen3 with an assigned specific functionality. The non-optional SAS, NVRAM, and 10GBaseT SLICs are allocated to fixed slots. The optional Host Interface SLICs are used for front end networking and fibre channel connections.

Figure 54 Rear view and SLIC slot numbering
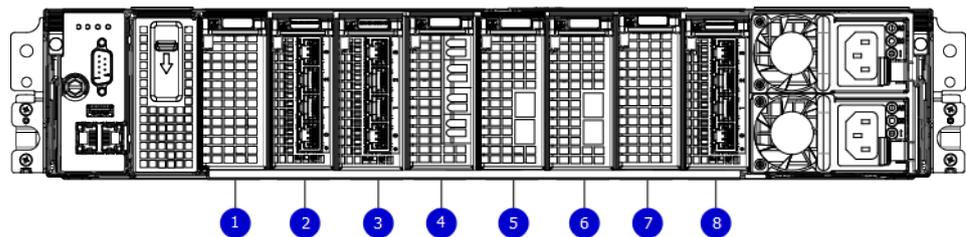
1. Slot 0
2. Slot 1
3. Slot 2
4. Slot 3
5. Slot 4
6. Slot 5
7. Slot 6
8. Slot 7

Note

Slots 2 and 7 are used for SAS I/O modules. DD6300 systems use only slot 7 when the SAS module is needed.

Table 15 DD6300, DD6800 and DD9300 I/O module slot assignments

Slot Number	DD6300	DD6800	DD9300
0	NVRAM	NVRAM	NVRAM

Table 15 DD6300, DD6800 and DD9300 I/O module slot assignments (continued)

Slot Number	DD6300	DD6800	DD9300
1	10GbE	10GbE	10GbE
2	Reserved	SAS	SAS
3	SAS	SAS	SAS
4	FC, Ethernet or empty	FC, Ethernet or empty	FC, Ethernet or empty
5	FC, Ethernet or empty	FC, Ethernet or empty	FC, Ethernet or empty
6	FC, Ethernet or empty	FC, Ethernet or empty	FC, Ethernet or empty
7	Empty	SAS	SAS

DD9500 and DD9800 systems

In the rear of the system, the top section contains the 4 power supply units. In the middle of the section, on the left, is serial number tag location. To the right of the serial number tag location is the management module. The lower section contains the NVRAM and the I/O modules numbered 0 through 11 from left to right.

I/O module slot assignments

The following figure shows the location of the NVRAM and I/O modules.

Figure 55 Location of NVRAM and I/O modules
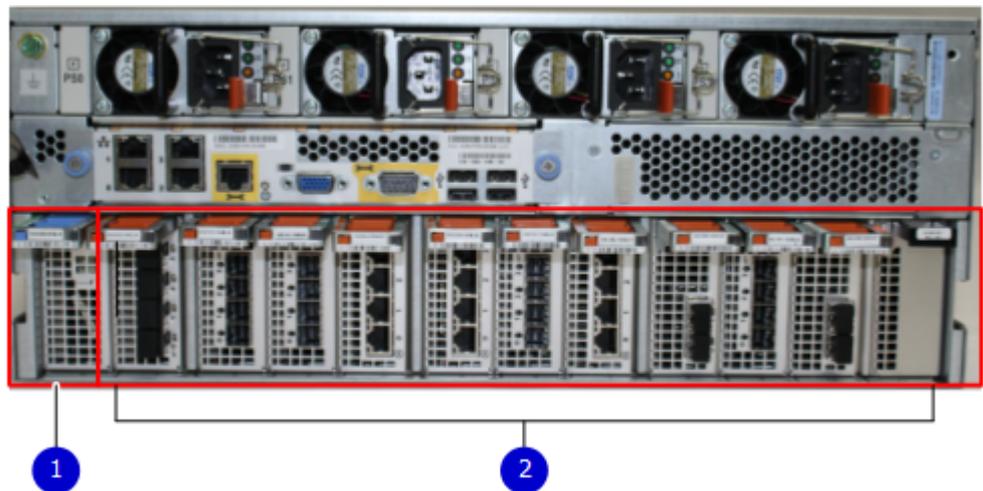
1. NVRAM module—slot 0
2. I/O modules—slots 1 to 11 (See the I/O module slot assignments table.)

The table shows the I/O module slot assignments for the DD9500 and DD9800 systems. Each type of I/O module is restricted to certain slots.

The I/O module slot assignments for the DD9500 and DD9800 systems are the same.

Table 16 DD9500 and DD9800 I/O module slot assignments

Slot	Base configuration	HA	ER or DD Cloud Tier	DD Cloud Tier and HA
0	NVRAM	NVRAM	NVRAM	NVRAM
1	Fibre Channel (FC), Ethernet or empty	Fibre Channel (FC), Ethernet or empty	Fibre Channel (FC), Ethernet or empty	Fibre Channel (FC), Ethernet or empty
2	SAS	SAS	SAS	SAS
3	SAS	SAS	SAS	SAS
4	FC, Ethernet or empty	FC, Ethernet or empty	FC, Ethernet or empty	FC, Ethernet or empty
5	FC, Ethernet or empty	FC, Ethernet or empty	FC, Ethernet or empty	FC, Ethernet or empty
6	SAS	SAS	SAS	SAS
7	FC, Ethernet or empty	FC, Ethernet or empty	FC, Ethernet or empty	FC, Ethernet or empty
8	FC, Ethernet or empty	FC, Ethernet or empty	FC, Ethernet or empty	FC, Ethernet or empty
9	Not available (contains a filler)	Not available (contains a filler)	SAS	SAS
10	FC, Ethernet or empty	FC, Ethernet or empty	FC, Ethernet or empty	FC, Ethernet or empty
11	FC, Ethernet or empty	10 Gb optical Ethernet for interconnect between the primary and standby nodes in the HA pair.	FC, Ethernet or empty	10 Gb optical Ethernet for interconnect between the primary and standby nodes in the HA pair.

CHAPTER 4

Post-Installation Tasks

After you have installed and cabled the shelves in their racks, follow the instructions in this chapter to complete the setup. This chapter covers these major topics:

Power on sequence

The DS60 and later shelves do not have a power-on button. The power cable must be connected to a live power source in order for a shelf to be powered on.

Verify the Operation of the New Shelves

Note

The Data Domain system re-discovers newly configured shelves after it restarts.

Connect power to shelves

Procedure

1. With the main power source off, connect an AC power cord (included with the shelf) to the shelf's power connector.

2. Secure the power cord with the retention bails at each connection. The bails prevent the power cord from pulling out of the connections.

3. Repeat for each of the shelves.

4. Turn on the power source. When a shelf is powered on and functioning properly:

   - The shelf's power LED is green.

   - Each controller's power LED is green.

5. Verify that there are no amber (fault) LEDs.

   - If the Power Supply Fault LED is steady amber, the power supply is faulty or is not receiving AC line voltage. If it is flashing, either a multiple blower or ambient over-temperature condition has shut off DC power to the system.

   - If the Controller Fault LED is amber, either the controller or SAS connection is faulty.

   a. If there are amber LEDs, reseat or replace the power cable and check the LEDs again.

   b. Reseat the SAS cables. If there is still a problem, use different SAS cables.

   c. Reseat the controller module.

   d. If the connection still has a problem, you need to replace the controller module on either or both ends of the connection. The shelf controller modules are shown in the figure.

   Figure 56 Back Panel: Shelf Controllers

   [new figure to come]

6. If there are no amber LEDs, wait a few minutes after the final shelf was powered on before restarting the Data Domain system.

Note

If you are simply replacing an expansion shelf, there is no need to restart the Data Domain system.

7. Restart the Data Domain system. As the system boots up, the HOST/ EXPANSION LEDs on the shelf controller ports that are connected to the SAS I/O module in the Data Domain system change from off to blue or green.

If any of these LEDs stays off or is not running at normal speed, it means there is a problem in the connection between the system and the shelf. See the section DS60 expansion shelf on page 11 for more information. Reseat or replace the cable and check the LEDs again. If the connection still has a problem, replace the controller module or the SAS I/O module.

Verifying shelf installation

The Data Domain system recognizes all data storage (system and attached shelves) as part of a single file system volume.

⚠ WARNING

- **Do not remove or disconnect a shelf that has been added earlier. If a shelf is disconnected, the file system volume is immediately disabled and all data in the volume is lost.**

- **To re-enable a shelf, reconnect the shelf or transfer the disks from the shelf to another empty shelf chassis and connect.**

- **If the data on a shelf is not available to the file system volume, the volume cannot be recovered.**

- **Unless the same disks are available to the file system, the DD OS must be re-installed as directed by your contracted service provider or Online Support site, http://support.emc.com.**

Procedure

1. After installing the new shelves, check the status of the SAS I/O module by entering the `disk port show summary` command:

```
# disk port show summary
Port   Connection   Link      Connected       Status
       Type         Speed     Enclosure IDs
----   ----------   -------   -------------   -------
5a     SAS                                    offline
5b     SAS                                    offline
5c     SAS                                    offline
5d     SAS                                    offline
6a     SAS                                    offline
6b     SAS                                    offline
6c     SAS                                    offline
6d     SAS                                    offline
7a     SAS          24 Gbps   5               online
7b     SAS          24 Gbps   6               online
7c     SAS          24 Gbps   4               online
7d     SAS          24 Gbps   2, 3            online
8a     SAS          24 Gbps   5               online
8b     SAS          24 Gbps   6               online
8c     SAS          24 Gbps   4               online
8d     SAS          24 Gbps   2, 3            online
```

The output shows:

- The `offline` status for each SAS connection, such as 5a, 5b, 5c, and so on.

- The `online` status for each SAS connection, such as `7a`, `7b`, `7c`, and so on.

Note

After the shelves have been connected, the same command also displays the connected enclosure IDs for each port. Then the status changes to `online`.

2. After adding any enclosure/disk drives, enter the `disk show state` command to verify the disk state.

```
# disk show state
Enclosure      Disk
  Row(disk-id)    1   2   3   4   5   6   7   8   9   10  11  12  13  14  15
--------------    ------------------------------------------------
1                 .   .   .   .
2                 U   U   U   U   U   U   U   U   U   U   U   U   U   U   U
3                 |--------|--------|--------|--------|
                  | Pack 1 | Pack 2 | Pack 3 | Pack 4 |
     E(49-60)     |U   U   U |U   U   U |U   U   U |U   U   U |
     D(37-48)     |U   U   U |U   U   U |U   U   U |U   U   U |
     C(25-36)     |U   U   U |U   U   U |U   U   U |U   U   U |
     B(13-24)     |U   U   U |U   U   U |U   U   U |U   U   U |
     A( 1-12)     |U   U   U |U   U   U |U   U   U |U   U   U |
                  |--------|--------|--------|--------|
4                 |--------|--------|--------|--------|
                  | Pack 1 | Pack 2 | Pack 3 | Pack 4 |
     E(49-60)     |U   U   U |U   U   U |U   U   U |U   U   U |
     D(37-48)     |U   U   U |U   U   U |U   U   U |U   U   U |
     C(25-36)     |U   U   U |U   U   U |U   U   U |U   U   U |
     B(13-24)     |U   U   U |U   U   U |U   U   U |U   U   U |
     A( 1-12)     |U   U   U |U   U   U |U   U   U |U   U   U |
                  |--------|--------|--------|--------|
--------------    ------------------------------------------------

Legend    State           Count
------    ------------    -----
.         In Use Disks    3
U         Unknown Disks   135
------    ------------    -----
Total 138 disks
```

Note

Enclosure 1 is a Data Domain head unit, enclosure 2 is an ES30 shelf, and enclosure 3 is a DS60 shelf. All disks of the newly installed shelf are in `U` state.

3. Verify that the Data Domain system recognizes each attached enclosure/shelf by entering the `enclosure show summary` command:

```
# enclosure show summary
Enclosure  Model No.  Serial No.       State   OEM     OEM      Capacity
                                               Name    Value
--------   ---------  --------------   ------  ------  -------  --------
1          DD7200     FCNME134200123   Online                   3 Slots
2          DS60       JWXCD143700040   Online                   60 Slots
3          DS60       JWXCD143600036   Online                   60 Slots
4          ES30       APM00111103491   Online                   15 Slots
5          ES30       APM00133421015   Online                   15 Slots
6          ES30       APM00111103544   Online                   15 Slots
--------   ---------  --------------   ------  ------  -------  --------
6 enclosures present.
```

The output shows each recognized enclosure ID, Data Domain system model number, serial number, and slot capacity.

4. To verify that the system is in good running condition and shows no errors, enter the `enclosure show topology` command:

```
# enclosure show topology
Port      enc.ctrl.port        enc.ctrl.port
----   -   ------------    -   ------------
5a
5b
5c
5d
6a
6b
6c
6d
7a     >    5.B.H: 5.B.E
7b     >    6.A.H: 6.A.E
7c     >    4.B.H: 4.B.E
7d     >    2.A.H: 2.A.E    >    3.A.H: 3.A.E
8a     >    5.A.H: 5.A.E
8b     >    6.B.H: 6.B.E
8c     >    4.A.H: 4.A.E
8d     >    3.B.H: 3.B.E    >    2.B.H: 2.B.E
----   -   ------------    -   ------------
Encl   WWN                 Serial #
----   ---------------     --------------
2      N/A                 JWXCD143700040
3      N/A                 JWXCD143600036
4      N/A                 APM00111103491
5      N/A                 APM00133421015
6      N/A                 APM00111103544
----   ---------------     --------------
Error Message:
----------------
No error detected
----------------
ES20 rear view:
                  CONTROLLER-B  CONTROLLER-A   OP-PANEL
+-------------------------------------------------------+
|                 |     E     |      H     |       |    |
|                 |           |            |       |    |
|                 |     H     |      E     |       |    |
+-------------------------------------------------------+

ES30 rear view:

+-------------------------------------------------------+
CONTROLLER-B |         E
H                                     |

+-------------------------------------------------------+

+-------------------------------------------------------+
CONTROLLER-A |                                        H
E         |

+-------------------------------------------------------+
```

Understanding the DS60 disk mappings

The 60 disks contained in a DS60 shelf are divided into four disk packs of 15 disks each. Table 17 on page 92 shows the logical layout of a single disk pack.

Table 17 Disk pack layout

13	14	15
10	11	12
7	8	9
4	5	6
1	2	3

Table 18 on page 92 shows the layout of all 60 disks within the DS60 shelf, and how the disks are divided into the four disk packs.

Table 18 DS60 disk layout

Disk pack 1			Disk pack 2			Disk pack 3			Disk pack 4		
49	50	51	52	53	54	55	56	57	58	59	60
37	38	39	40	41	42	43	44	45	46	47	48
25	26	27	28	29	30	31	32	33	34	35	36
13	14	15	16	17	18	19	20	21	22	23	24
1	2	3	4	5	6	7	8	9	10	11	12

Add shelf capacity licenses

Apply appropriate shelf capacity licenses for all shelves as needed.

Add storage license

Each storage shelf requires one or more shelf capacity license depending on the pack/ packs (DD OS software manages the drives in packs of 15). This license is specific for either active or Extended Retention tier usage of the shelf.

Note

DD6300, DD6800 and DD9300, and DD9800 systems can only be licensed through the Electronic Licensing and Management System (ELMS). Refer to the applicable *Data Domain Operating System Release Notes* for the most up-to-date information on product features, software updates, software compatibility guides, and information about Data Domain products, licensing, and service.

An Expanded-Storage license is required when expanding the capacity of the active tier beyond the entry capacity. Please check the *Data Domain Operating System Administration Guide* for the DD OS you are using to determine if the Expanded-Storage license is required.

Procedure

1. To add the first shelf capacity license, enter the `license add` command followed by one license key, separated with a space. For example:

```
# license add xxxx-xxxx-xxxx-xxxx-xxxx-xxxx-xx
Added "xxxx-xxxx-xxxx-xxxx-xxxx-xxxx-xx" : CAPACITY-ACTIVE feature for 32.7 TiB
capacity DS60
```

2. To add the second shelf capacity license, enter the `license add` command followed by second license key, separated with a space. For example:

```
# license add xxxx-xxxx-xxxx-xxxx-xxxx-xxxx-xx
Added "xxxx-xxxx-xxxx-xxxx-xxxx-xxxx-xx" : CAPACITY-ACTIVE feature for 32.7 TiB
capacity DS60
```

3. Enter the `storage add tier active enclosure` *enclosure-id* command for each enclosure that is to be added to a tier. The following output example displays Enclosure 3:

```
# storage add tier active enclosure 3

Checking storage requirements...done
Adding enclosure 3:1 to the active tier...Enclosure 3:1 successfully added to the
active tier.
Adding enclosure 3:2 to the active tier...Enclosure 3:2 successfully added to the
active tier.
Enclosure 3:3
**** Could not add storage:
        Exceeded licensed capacity limit for active tier.
        Need DS60 CAPACITY-ACTIVE license for at least 36TB (32.7TiB) capacity.

Enclosure 3:4
**** Could not add storage:
        Exceeded licensed capacity limit for active tier.
        Need DS60 CAPACITY-ACTIVE license for at least 36TB (32.7TiB) capacity.


Updating system information...is done

Successfully added: 3:1 3:2  done
```

And for a Data Domain system with Extended Retention:

```
# storage add tier archive enclosure enclosure-id
```

Note

In a single-node Data Domain system, storage devices are added to the active tier by default. In a DD Extended Retention system, you must specify the active or archive tier.

Specifying an *enclosure-id* makes all disks in the enclosure available to the tier. This is the preferred method of adding storage to a Data Domain system. To use this option, all disks in the enclosure must be in the unknown state.

---

4. After adding storage, enter the `disk show state` command to verify the disk state.

```
# disk show state
Enclosure      Disk
  Row(disk-id)   1  2  3  4  5  6  7  8  9  10 11 12 13 14 15
--------------   ----------------------------------------------
1                .  .  .
2                U  U  U  U  U  U  U  U  U  U  U  U  U  U  U
3                |--------|--------|--------|--------|
                 | Pack 1 | Pack 2 | Pack 3 | Pack 4 |
      E(49-60)   |v  v  v |v  v  v |U  U  U |U  U  U |
      D(37-48)   |v  v  v |v  v  v |U  U  U |U  U  U |
      C(25-36)   |v  v  v |v  v  v |U  U  U |U  U  U |
      B(13-24)   |v  v  v |v  v  v |U  U  U |U  U  U |
      A( 1-12)   |v  v  v |v  v  v |U  U  U |U  U  U |

                 |--------|--------|--------|--------|
4                |--------|--------|--------|--------|
                 | Pack 1 | Pack 2 | Pack 3 | Pack 4 |
      E(49-60)   |U  U  U |U  U  U |U  U  U |U  U  U |
```

```
            D(37-48)      |U  U  U |U  U  U |U  U  U |U  U  U |
            C(25-36)      |U  U  U |U  U  U |U  U  U |U  U  U |
            B(13-24)      |U  U  U |U  U  U |U  U  U |U  U  U |
            A( 1-12)      |U  U  U |U  U  U |U  U  U |U  U  U |
                          |--------|--------|--------|--------|
      --------------      ------------------------------------------

      Legend   State           Count
      ------   -------------   -----
      .        In Use Disks      3
      v        Available Disks  30
      U        Unknown Disks   105
      ------   -------------   -----
      Total 138 disks
```

Note

All newly added disks are in `v` state

Note

You can add two more licences to the storage shelf if you have the required drives.

---

5. To add the third shelf capacity license, enter the `license add` command followed by one license key, separated with a space. For example:

```
# license add xxxx-xxxx-xxxx-xxxx-xxxx-xxxx-xx
Added "xxxx-xxxx-xxxx-xxxx-xxxx-xxxx-xx" : CAPACITY-ACTIVE feature for 32.7 TiB
capacity DS60
```

6. To add the fourth shelf capacity license, enter the `license add` command followed by one license key, separated with a space. For example:

```
# license add xxxx-xxxx-xxxx-xxxx-xxxx-xxxx-xx
Added "xxxx-xxxx-xxxx-xxxx-xxxx-xxxx-xx" : CAPACITY-ACTIVE feature for 32.7 TiB
capacity DS60
```

7. Enter the `license show` command to verify the licenses for the storage shelf.

```
# license show
Feature : CAPACITY-ACTIVE
------------------------
##   License Key                        Model   Capacity*
--   -----------------------------      -----   ---------
1    xxxx-xxxx-xxxx-xxxx-xxxx-xxxx-xx   DS60     32.7 TiB
2    xxxx-xxxx-xxxx-xxxx-xxxx-xxxx-xx   DS60     32.7 TiB
3    xxxx-xxxx-xxxx-xxxx-xxxx-xxxx-xx   DS60     32.7 TiB
4    xxxx-xxxx-xxxx-xxxx-xxxx-xxxx-xx   DS60     32.7 TiB
--   -----------------------------      -----   ---------
Licensed Active Tier Capacity: 130.9 TiB*

* Depending on the hardware platform, usable filesystem
capacities may vary.
```

8. Enter the `storage add tier` **active** **enclosure** *enclosure-id* command to add all four packs on the storage shelf. The following output example displays:

```
# storage add tier active enclosure 3

Checking storage requirements...done
Adding enclosure 3:1 to the active tier...Enclosure 3:1 successfully added to the
active tier.
Adding enclosure 3:2 to the active tier...Enclosure 3:2 successfully added to the
active tier.
Adding enclosure 3:3 to the active tier...Enclosure 3:3 successfully added to the
active tier.
```

```
Adding enclosure 3:4 to the active tier...Enclosure 3:4 successfully added to the
active tier.

Updating system information...done

Successfully added: 3:1 3:2 3:3 3:4   done
```

9. After adding all four licences, enter the `disk show state` command to verify the disk state:

```
# disk show state
Enclosure      Disk
  Row(disk-id)   1  2  3  4  5  6  7  8  9  10 11 12 13 14 15
--------------   ----------------------------------------------
1                      .   .   .
2                U  U  U  U  U  U  U  U  U  U  U  U  U  U  U
3                |--------|--------|--------|--------|
                 | Pack 1 | Pack 2 | Pack 3 | Pack 4 |
      E(49-60)   |v   v   v |v   v   v |v   v   v |v   v   v |
      D(37-48)   |v   v   v |v   v   v |v   v   v |v   v   v |
      C(25-36)   |v   v   v |v   v   v |v   v   v |v   v   v |
      B(13-24)   |v   v   v |v   v   v |v   v   v |v   v   v |
      A( 1-12)   |v   v   v |v   v   v |v   v   v |v   v   v |

                 |--------|--------|--------|--------|
4                |--------|--------|--------|--------|
                 | Pack 1 | Pack 2 | Pack 3 | Pack 4 |
      E(49-60)   |U  U  U |U  U  U |U  U  U |U  U  U |
      D(37-48)   |U  U  U |U  U  U |U  U  U |U  U  U |
      C(25-36)   |U  U  U |U  U  U |U  U  U |U  U  U |
      B(13-24)   |U  U  U |U  U  U |U  U  U |U  U  U |
      A( 1-12)   |U  U  U |U  U  U |U  U  U |U  U  U |
                 |--------|--------|--------|--------|
--------------   ----------------------------------------------

Legend   State            Count
------   -------------    -----
.        In Use Disks        3
v        Available Disks    60
U        Unknown Disks      75
------   -------------    -----
Total 138 disks
```

Note

All newly added disks are in `v` state.

10. Repeat the above steps to add licenses to other shelves.

Add enclosure disks to the volume

Procedure

1. When prompted, enter your sysadmin password.

2. Enter the `storage show all` command to display the RAID groups for each shelf:

```
# storage show all
Active tier details:
Disk         Disks                                Count   Disk       Additional
Group                                                     Size       Information
-----------  ------------------------------       -----   --------   -----------
dg1          5.1-5.14                             14      3.6 TiB
```

```
dg3            2.4-2.6, 2.16-2.18, 2.28-2.30,   14      2.7 TiB
               2.40-2.42, 2.53-2.54
dg4            4.1-4.14                          14      1.8 TiB
dg5            6.1-6.14                          14      1.8 TiB
(spare)        2.52                              1       2.7 TiB
(spare)        5.15                              1       3.6 TiB
(available)    4.15                              1       1.8 TiB
(available)    6.15                              1       1.8 TiB
-----------    -----------------------------    -----   --------   -----------

Current active tier size: 120.0 TiB
Active tier maximum capacity: 261.9 TiB

Storage addable disks:
Disk       Disks                              Count   Disk      Enclosure   Shelf Capacity
Additional
Type                                                  Size      Model       License Needed
Information
---------  -----------------------------      -----   --------  -------     --------------
-----------
(unknown)  2.1-2.3, 2.13-2.15, 2.25-2.27,      15     2.7 TiB   DS60        32.7 TiB
pack 1
           2.37-2.39, 2.49-2.51
(unknown)  2.7-2.9, 2.19-2.21, 2.31-2.33,      15     2.7 TiB   DS60        32.7 TiB
pack 3
           2.43-2.45, 2.55-2.57
(unknown)  2.10-2.12, 2.22-2.24, 2.34-2.36,    15     2.7 TiB   DS60        32.7 TiB
pack 4
           2.46-2.48, 2.58-2.60
(unknown)  3.1-3.3, 3.13-3.15, 3.25-3.27,      15     2.7 TiB   DS60        32.7 TiB
pack 1
           3.37-3.39, 3.49-3.51
(unknown)  3.4-3.6, 3.16-3.18, 3.28-3.30,      15     2.7 TiB   DS60        32.7 TiB
pack 2
           3.40-3.42, 3.52-3.54
(unknown)  3.7-3.9, 3.19-3.21, 3.31-3.33,      15     2.7 TiB   DS60        32.7 TiB
pack 3
           3.43-3.45, 3.55-3.57
(unknown)  3.10-3.12, 3.22-3.24, 3.34-3.36,    15     2.7 TiB   DS60        32.7 TiB
pack 4
           3.46-3.48, 3.58-3.60
---------  -----------------------------      -----   --------  --------  --------------
-----------

Shelf Capacity License:
License          Model   Total       Used        Remaining
--------------   -----   ---------   --------    ---------
CAPACITY-ACTIVE  ES30    109.1 TiB   87.3 TiB    21.8 TiB
CAPACITY-ACTIVE  DS60    152.7 TiB   32.7 TiB    120.0 TiB
--------------   -----   ---------   --------    ---------
```

One disk in a shelf is a spare disk. The rest should report that they are `available`.

3. Enter the `filesys expand` command to allow the file system to use these enclosure disks:

```
# filesys expand
```

4. Enter the `filesys enable` command to enable the file system:

```
# filesys enable
```

5. Enter the `disk show state` command to verify the disks:

```
# disk show state
Enclosure        Disk
  Row(disk-id)     1  2  3  4  5  6  7  8  9  10 11 12 13 14 15
--------------   ---------------------------------------------
1                         .  .  .
```

```
2                          U  U  U  U  U  U  U  U  U  U  U  U  U  U  U
3                |--------|--------|--------|--------|
                 | Pack 1 | Pack 2 | Pack 3 | Pack 4 |
     E(49-60)    |v  v  v |v  v  v |v  v  v |v  v  v |
     D(37-48)    |v  v  v |v  v  v |v  v  v |v  v  v |
     C(25-36)    |v  v  v |v  v  v |v  v  v |v  v  v |
     B(13-24)    |v  v  v |v  v  v |v  v  v |v  v  v |
     A( 1-12)    |v  v  v |v  v  v |v  v  v |v  v  v |

                 |--------|--------|--------|--------|
4                |--------|--------|--------|--------|
                 | Pack 1 | Pack 2 | Pack 3 | Pack 4 |
     E(49-60)    |U  U  U |U  U  U |U  U  U |U  U  U |
     D(37-48)    |U  U  U |U  U  U |U  U  U |U  U  U |
     C(25-36)    |U  U  U |U  U  U |U  U  U |U  U  U |
     B(13-24)    |U  U  U |U  U  U |U  U  U |U  U  U |
     A( 1-12)    |U  U  U |U  U  U |U  U  U |U  U  U |
                 |--------|--------|--------|--------|
--------------   --------------------------------------------

Legend   State          Count
------   -------------  -----
.        In Use Disks     3
v        Available Disks 60
U        Unknown Disks   75
------   -------------  -----
Total 138 disks
```

APPENDIX A

Hardware Specifications

This appendix contains the following topic:

Hardware specifications

Note

All ratings assume a fully configured DS60 shelves.

Table 19 Hardware specifications

Specification	Description
AC line voltage	200 to 240 Vac ± 10%, single-phase, 47 to 63 Hz
AC line current (operating maximum)	4.9 A max at 200 Vac
Power consumption (operating maximum)	980 VA (931W) max
Power factor	0.95 min at full load, low voltage
Heat dissipation (operating maximum)	3.36×10^6 J/hr, (3177 Btu/hr) max
Dimensions (rack mounted)	• Height: 8.75 in (22.23 cm) 5U (4U plus 1U cable management tray). • Width including rails: 17.50 in (44.45 cm) • Depth (chassis only): 34.5 in (87.63 cm) • Maximum depth (fully configured): 36.4 in (92.46 cm)
Shelf weight	• Without FRUs installed: 55.0 lb (24.7 kg) • With FRUs installed: 225.0 lb (102 kg)
Operating temperature	• Ambient temperature: 41º F to 104º F (5º C to 40º C) • Temperature gradient: 18º F/hr (10º C/hr) • Relative humidity extremes: 20% to 80% noncondensing
Recommended operating relative humidity	40% to 55% noncondensing
Operating elevation	-50 to 7500 ft (-16 to 2300 m)
Non-operating (shipping and storage) temperature	• Ambient temperature: -40º F to 149º F (-40º C to 65º F) • Temperature gradient: 45º F/hr (25ºC/hr) • Relative humidity: 10% to 90% noncondensing • Elevation: -50 to 35,000 ft (-16 to 10,600 m)