User Guide

4U60 Storage Enclosure G460-J-12

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Revision History

Date	Revision	Comment
October 2015	Revision 1.0	Initial version
November 2015	Revision 1.1	Updates to content

1 Document Summary

The following chapter defines the *scope*, *intended audience*, and *references* related to the 4U60 Storage Enclosure System Specification Document.

1.1 Scope

The following document provides the user specifications, descriptions, installation concepts, operations, and troubleshooting. This document displays the basics for the user facing procedures and information necessary to understand and operate the 4U60 Storage Enclosure enclosure.

1.2 Intended Audience

The following document is intended for users that require a better understanding of the hardware, firmware, software involved in the 4U60 Storage Enclosure. The information also provides a better understanding of the process in which the Mechanical developers, SI engineers, and Product Validation engineers require.

1.3 References

- *System Specification Guide*
- *Installation Guide*
- *Agency Document*
- *Safety and Regulatory Guide*

2 For More Information

The following chapter identifies the contact information for support on the 4U60 Storage Enclosure.

2.1 Points of Contact

For further assistance with an HGST product, contact Cloud Infrastructure Business Unit (CIBU) support. Please be prepared to provide the following information: Serial Number (S/N), product name, model number, and a brief description of the issue.

Telephone:

Region	Telephone Numbers	Support Hours and Additional Information
United States/International	1-408-717-7766	24 hours a day, 7 days a week
North America	1-844-717-7766	24 hours a day, 7 days a week Toll-free

Email:
support@hgst.com

Website:
www.hgst.com/support

3 Product Overview

The following chapter provides a product overview of the 4U60 Storage Enclosure.

3.1 Introduction

The 4U60 Storage Enclosure is a 4U, high-density Hard Disk Drive (HDD) enclosure. The enclosure is designed to house up to a full configuration of 60 Ultrastar He8 helium drives and to maximize the performance of these drives, under all operating conditions.

The system contains the following high level features:

Table 1: High Level Features Specifications

Hardware	Details	Number of Component
4U Storage enclosure	4U rack-mounted storage enclosure with slide rail and cable management assembly	1
Canisters Slots	2U half-width SAS Expander Canister–JBOD application (12G version)	2
Power Interface Board	Connects the power supplies to the drive board	1
Drive Board	• Connects the power supplies (with integrated fans) via power interface board, drives, and ESM. • Fully compliant with SAS 3.0 specification for operation up to 12Gbps.	1
3.5-inch HDD with carrier	• **Configuration**: 60 disk drives contained within top accessible chassis. • Hot swappable • Two status LEDs per drive slot, Activity and Fault • Ejector handle allows for easy installation and removal of HDDs	60 Ultrastar He8 helium HDDs
Power Supply Unit (PSU)	• 2U half-width dual 1+1 redundant, 1650W AC power supplies • 200 ~ 240 VAC (1650W) input, 47Hz – 63Hz • +12V and +5V outputs with +5V standby power • 2 integrated fans powered by redundant power rail • Compliant with 80 Plus efficiency Gold level • +/- 5% Voltage margin control on 5V and 12V rails • Trouble history implementation • 5v and 12v DC output at 1650W	2
Fans	• N+1 redundant cooling • any one fan can fail and the system will continue to operate	4 (2 in each PSU)

3.2 Mechanical Concept

The mechanical design of the 4U60 Storage Enclosure system is cost-effective, highly reliable, and supports hot-swapping of components (such as, power supplies and IOMs). All other components, interface drive boards, are not hot-swappable. System maintenance should be scheduled when the entire enclosure can be taken offline to replace non-redundant, failed components.

The following is a list of the Minimum component revisions:

Table 2: Minimum Component Revisions

Minimum Component Revisions	
Chassis	1EX0082
I/O Module (ESM)	1EX0080
Power Supply Unit	1EX0081
HDD With carrier	1EX0083
Rail Kit	1EX0106
Cable Management Assembly	1EX0107

4 Disclaimers

The following chapter describes the Regulatory Statement of Compliance, Safety Compliance, and Electromagnetic Compatibility Agency Requirements for the 4U60 Storage Enclosure.

4.1 Regulatory Statement

Product Name: **4U60 Storage Enclosure**
Regulatory Model: **G460-J-12**
Electromagnetic Compatibility Emissions: **Class A**

This product has been tested and evaluated as Information Technology Equipment (ITE) at accredited third-party laboratories for all safety, emissions and immunity testing required for the countries and regions where the product is marketed and sold. The product has been verified as compliant with the latest applicable standards, regulations and directives for those regions/countries. The suitability of this product for other product categories other than ITE, may require further evaluation.

The product is labeled with a unique regulatory model and regulatory type that is printed on the label and affixed to every unit. The label will provide traceability to the regulatory approvals listed in this document. The document applies to any product that bears the regulatory model and type names including marketing names other than those listed in this document.

4.1.1 Restricted Access Location

The HGST 4U60 Storage Enclosure is intended for installation in a server room or computer room where at least one of the following conditions apply:

- access can only be gained by **service persons** or by **users** who have been instructed about the restrictions applied to the location and about any precautions that shall be taken and/or
- access is through the use of a **tool** or lock and key, or other means of security, and is controlled by the authority responsible for the location.

4.1.2 Safety Compliance

The following table outlines how the 4U60 Storage Enclosure is designed to pass the product safety requirements:

Table 3: Product Safety Compliance

Country/Region	Authority or Mark	Standard	Status
Australia/New Zealand	CB report, CB certificate	AS/NZS 60950.1	TBD
Canada/North America	NRTL	CSA C22.22 No. 60950-1-07	In Progress
Customs Union/Russia, Kazakhstan, Belarus, Armenia	EAC	TR CU 004/2011	TBD
European Union	CE	EN 60950-1	In Progress
International		IEC60950, CB report and Certificate to include all country national deviations	In Progress
United States/North America	NRTL	UL 60950-1	TBD
Mexico	NYCE or NOM	NOM-019-SCFI-1998	TBD
Brazil	INMETRO	IEC 60950-1	TBD

Country/Region	Authority or Mark	Standard	Status
Taiwan	BSMI	CNS14336	TBD
Ukraine	UKrTEST or equivalent	4467-1:2005	TBD
Moldova	INSM	SM SR EN60950-1	TBD
Serbia	KVALITET	SRPS EN60950:2010	TBD
India	BIS	IS 13252 (Part 1):2010	TBD

4.1.3 Electromagnetic Compatibility Agency Requirements

The following table outlines how the 4U60 Storage Enclosure is being designed to comply with the Electromagnetic Compatibility agency requirements:

Table 4: Product Electromagnetic Compatibility/Immunity Compliance

Country/Region	Authority or Mark	Standard	Status
Australia/New Zealand	C-tick or A-tick	AS/NZS CISPR22	In Progress
Canada/North America	Industry Canada	ICES-003	In Progress
Customs Union/Russia, Kazakhstan, Belarus, Armenia	EAC	TR CU 020/2011	In Progress
European Union	CE	EN55022, EN55024 including EN61000-3-2, EN61000-3-3	In Progress
International		CISPR22, CISPR24	In Progress
Japan	VCCI	V-3:2014	In Progress
United States/North America	FCC	FCC Part 15	In Progress
Taiwan	BSMI	CNS13438	In Progress
Korea	MSIP	KN22, KN24	In Progress
Ukraine	UKrTEST or equivalent	4467-1:2005	In Progress
Serbia	KVALITET	CISPR22	In Progress
Brazil	INMETRO		In Progress

5 Technical Specifications

The following chapter describes the technical specifications related to the 4U60 Storage Enclosure and the location in which it is to be installed.

5.1 Enclosure Environmental Requirements

The enclosure based upon the drive maximum environmental specifications will be designed around the following environmental requirements:

Table 5: Non-operating Environmental Requirements

Non-operating	**4U60 Storage Enclosure**
Temperature	-40°C to 70°C
Temperature Gradient	30°C per hour
Temperature De-rating	1°C per 300m above 3000m
Relative Humidity	8% to 90% non-condensing
Relative Humidity Gradient	30% per hour maximum
Altitude	-300m to 12,000m de-rated 300m per 1°C above 40°C
Altitude Gradient	22860m per hour maximum

Table 6: Operational Environmental Requirements

Operational	**4U60 Storage Enclosure**
Temperature	5°C to 40°C
Temperature Gradient	20°C per hour
Temperature De-rating	1°C per 125m above 950m
Relative Humidity	8% to 90% non-condensing
Relative Humidity Gradient	30% per hour maximum
Altitude	-300m to 3048m

5.2 Rack Requirements

The rack mount requirements are based on the 4U standards. Rack spaces are equipped to give the enclosure ample power and connectivity allowing them to perform as expected. They also provide effective airflow, cooling for the devices, and allow for easy access for routine maintenance.

The following table displays the 4U standard measurement for mounting the 4U60 Storage Enclosure:

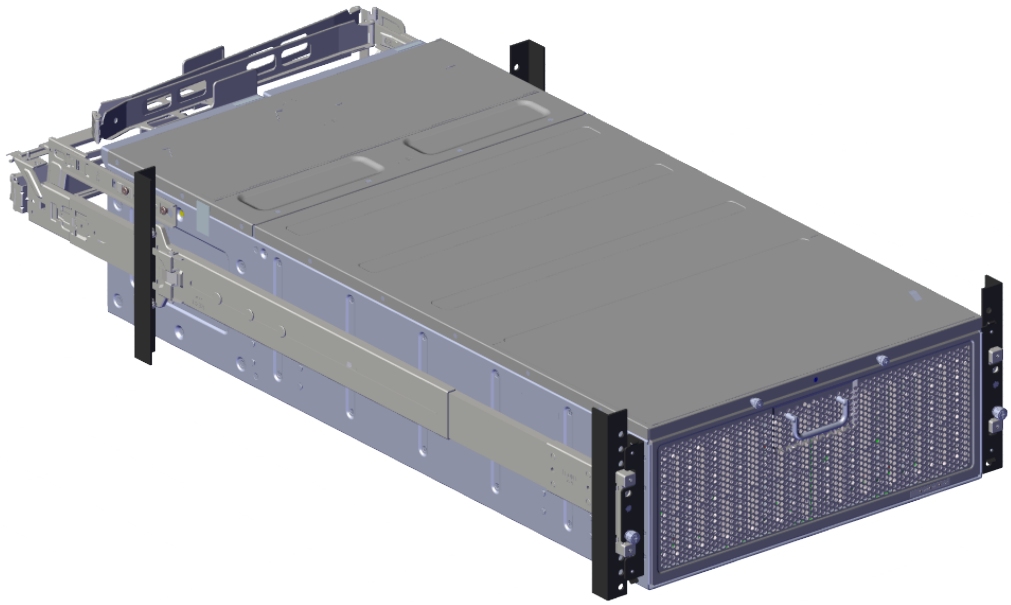
Table 7: Physical Specifications

Physical (Chassis)	
Height	6.88 inches (174.8 mm)

Physical (Chassis)	
Width	16.69 inches (424 mm)
Depth	33.5 inches (850 mm)
Weight	198 lbs (89.81 Kg) (with drives installed)

For proper rack installation of the 4U60 Storage Enclosure, please mount the enclosure according to the following drawing:

Figure 1: Assembly in the Rack



5.3 Alternating Current Input

The following table describes the A/C Input specification for the 4U60 Storage Enclosure enclosure.

Table 8: Power Specifications

Power	
Alternating Current (AC) Power Supply (per power supply, 2 total)	
Wattage	1650W 80 + Gold rated
Voltage	200–240VAC (1650W max), auto-ranging, 50/60 Hz
Maximum inrush current	After AC power is applied to the power supply, any initial inrush current surge or spike of **10** milliseconds or less must not exceed **45** amps peak.

5.4 Host Connectivity

Connect the 4U60 Storage Enclosure to the host, using high quality miniSAS HD cables.

The following table displays the list of power cables approved by HGST:

Table 9: Approved Power Cables

Type	Part Number	Dimension (overmold)	Length
BIZlink Technology Inc.	BC314-BC313-1.5M-UL	C13 to C14	1.5 meters
Celestica San Jose	R0893-C0011-01	C13 to C14	1.5 meters
Well Shin Technology CO LTD	0096-0011	C13 to C14	1.5 meters

The following table displays the list of SAS cables approved by HGST:

Table 10: Approved SAS Cables

Type	Part Number	Length
Elpeus HD Mini-SAS (SFF-8644) to QSFP+(SFF-8436)	SAS2-44361-2	2 meters
Elpeus HD Mini-SAS (SFF-8644) to QSFP+(SFF-8436)	SAS2-44361-3	3 meters
Elpeus HD Mini-SAS (SFF-8644) to QSFP+(SFF-8436)	SAS2-44362-5	5 meters

The following table displays the list of Expansion cables approved by HGST:

Table 11: Expansion Cables

Type	Part Number	Length
Elpeus SFP+(SFF-8436) to QSFP+(SFF-8436), 2m	CB22322-2	2 meters

5.5 Airflow Consideration

The user needs to ensure both the front and rear of the 4U60 Storage Enclosure stay clear of any materials that may block or disrupt the airflow in any way. Disrupting the airflow can cause the enclosure to run the fans at an excessive RPM, and in the worst case, start to shut down the system due to an overheating event.

The following rack airflow principles should be considered for best results:

- Controlled air conditioners that are located in the facility where the enclosure will be installed.
- The airflow in and out of the equipment must not be restricted.

5.5.1 Cooling the Enclosure

The 4U60 Storage Enclosure has an advanced thermal algorithm that monitors all of the temperature sensors in the system. The enclosure makes adjustments to the fan speeds based upon the thermal sensors. The fan algorithm takes into account the component and the warning and critical threshold limits set by SES. If any temperature sensor gets to the warning limit, the fans speeds will increase to cool the component. If the critical threshold is crossed for a determinate amount of time, the system will begin to shut down components in order to prevent damage. If the enclosure encounters low temperatures, the system will reduce fan speed in an attempt to conserve power and not over-cool the enclosure.

This algorithm is agnostic to effects of altitude and humidity. The algorithm simply works based on temperatures within the system with emphasis on reducing power consumption.

5.6 Grounding the Enclosure

The enclosure is designed to ground all components to the chassis base with the use of a properly grounded receptacle. Ensure that there is sufficient electrical and mechanical connection from the chassis base to the rack rails, and that the rack itself is tied to earth ground.

The unit must be grounded in accordance with all local/regional and national electrical codes.

5.6.1 Electrostatic Discharge

The enclosure is designed to dissipate all electrostatic discharges to the chassis base. Ensure that there is sufficient electrical and mechanical connection from the chassis base to the rack rails, and that the rack itself is tied to earth ground. It is recommend that suitable ESD precautions be observed during installation and service operations

6 SCSI Enclosure Services

The following chapter describes the overall functionality of SES within the 4U60 Storage Enclosure.

6.1 SCSI Enclosure Services

The 4U60 Storage Enclosure provides enclosure management capabilities in-band through the MiniSAS HD ports using SCSI Enclosure Services (SES). The management functions are performed with SCSI commands, which are targeted at the Input/Ouput controller's embedded SCSI Enclosure Processor (SEP) device. The 4U60 Storage Enclosure SES command set allows management clients to observe and control the functionality of the enclosure itself, as well as various management entities associated with the enclosure, including the embedded controller, disk drives, power supplies, fans, and connectors.

7 Hard Drives

The following chapter describes defines the qualified hard drives for the 4U60 Storage Enclosure.

7.1 Qualified Hard Drives

The SEP examines the Inquiry data of all attached drives to determine if they are a supported type.

The enclosure uses the following approved hard disk drives:

Table 12: 4U60 Storage Enclosure Qualified Hard Drives

Model	Family	Capacity	Format
HUH7280xxALN60y	Ultrastar He8 helium	8TB	SAS 4KN SE
HUH7280xxALE60y	Ultrastar He8 helium	8TB	SAS 512e SE
HUH7280xxAL420y	Ultrastar He8 helium	8TB	SAS 4KN SE
HUH7280xxAL520y	Ultrastar He8 helium	8TB	SAS 512e SE

The SEP rejects the use of unsupported drive types. If the drive is found to not be a supported drive type, the drive is powered down. The SES Page 02 Array Device Slot instance corresponding to an unsupported SAS drive is reported with an Element Status Code of **Unrecoverable**.

The 4U60 Storage Enclosure does not support SATA drives. In the event that a SATA drive is installed, the expander does not enable the physical layer to link to the drive. No attempt at SSP discovery is made. The SES Page 02 Array Device Slot instance corresponding to a SATA drive is reported with an Element Status Code of **Critical**.

8 Installing the 4U60 Storage Enclosure

The following chapter instructs you on how to install the 4U60 Storage Enclosure.

8.1 Identification of Assembled Enclosure

The following figure displays the major components of an assembled enclosure:

Figure 2: Identification of Assembled Enclosure

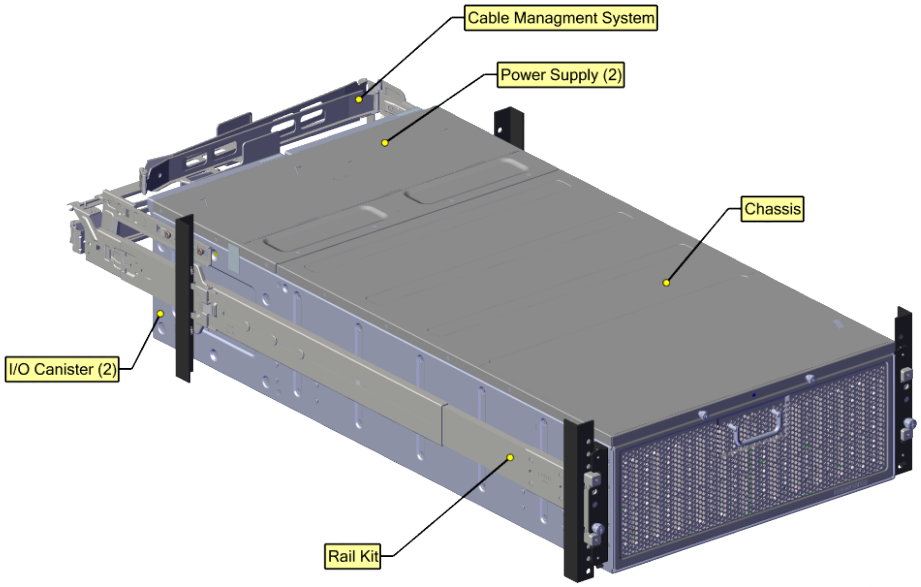


Figure 3: Identification of Assembled Enclosure (Rear)

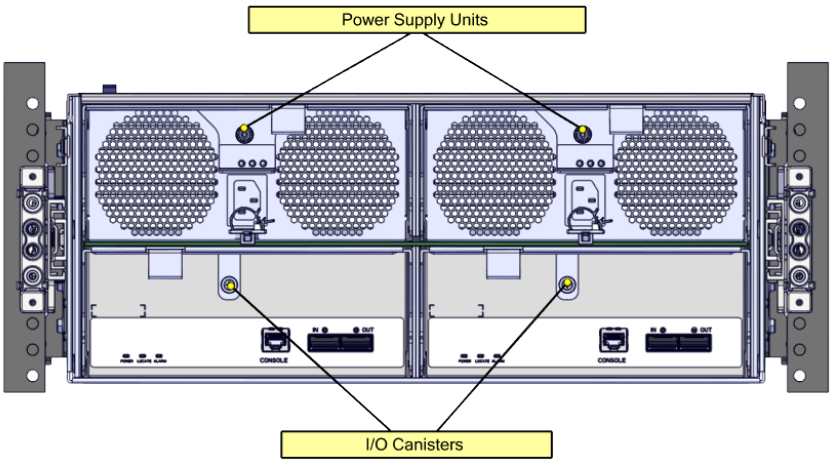
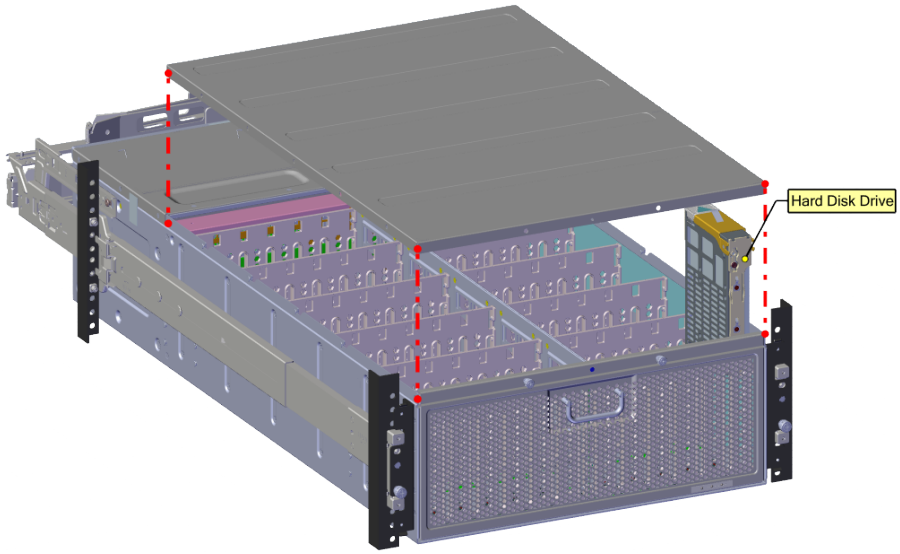


Figure 4: Identification of Assembled Enclosure (Hard Drive Assembly)



8.2 Attaching the Slide Rails to the Chassis

For the installation of the rail kit, the following hardware is required:

Note: While handling ESD sensitive components, it is recommend that you are using proper ESD equipment.

Table 13: Slide Rail Hardware

Part Description	Quantity
Chassis	1
Rack mount rails	2
M4 truss-head machine screws	6

The following table lists the required tool needed to attach the slide rails to the chassis:

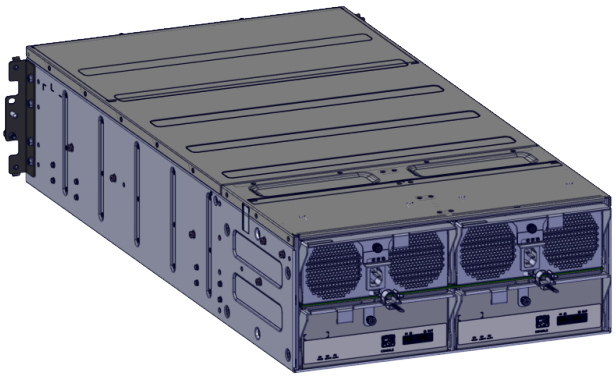
Table 14: Required Tools for Attaching the Slide Rails

Number 2 Phillips-head screwdriver with torque measuring capabilities

To install the slide rails into the chassis, do the following:

1. Remove the chassis from the box.

Figure 5: Chassis

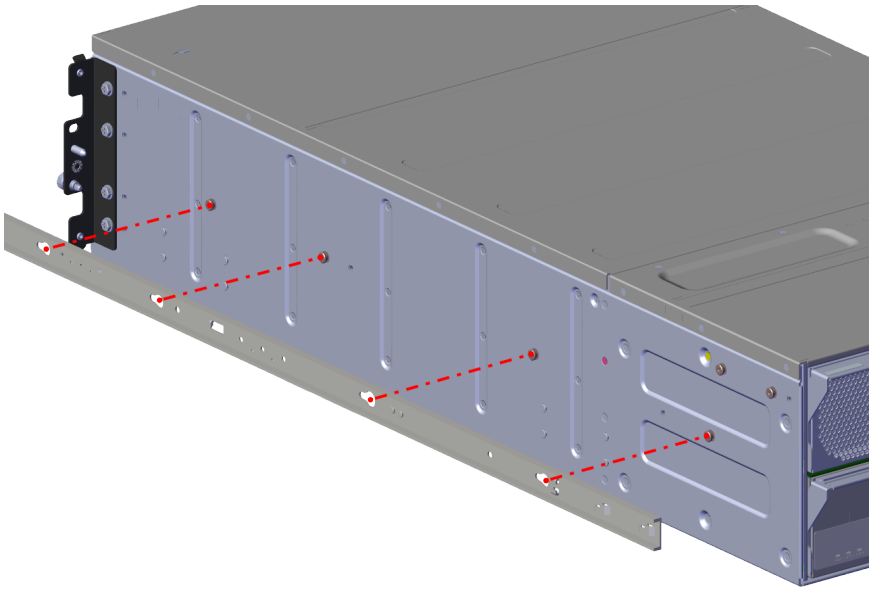


Note: Ensure that you put the chassis in sturdy location that is free of any hardware that may damage the components.

2. Line up the inner rail over the lower set of T-standoffs.

Note: Ensure the inner rail stamp marked **Front** is pointing towards the front of the enclosure.

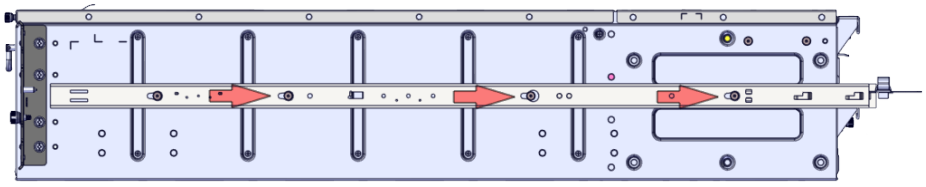
Figure 6: Lining up the Inner Rail



3. To lock the inner rail into place, slide the inner rail towards the rear of the chassis.

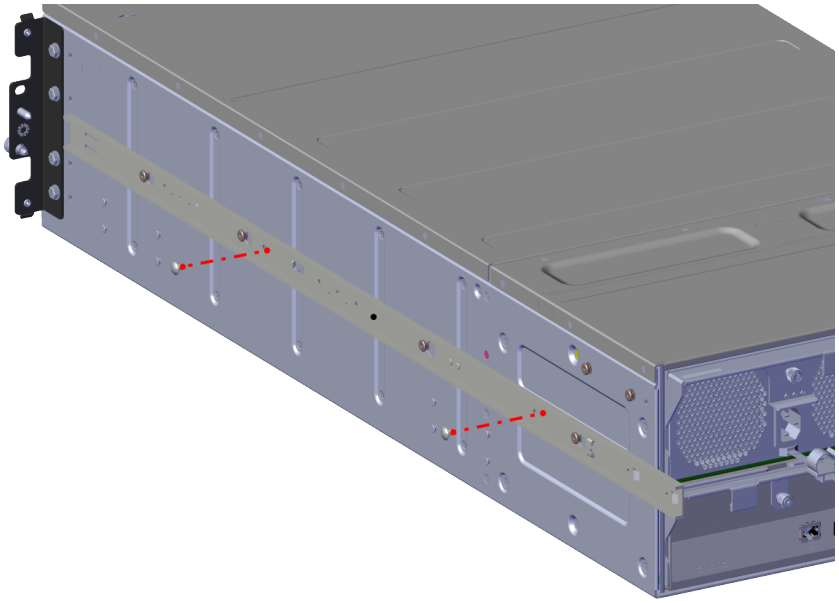
Note: The clip closest to the rear of the chassis will make an audible click when you slide the rail into place.

Figure 7: Locking Inner Rail



4. Using the **M4 truss-head** screws, attach the inner rail to the chassis.

Figure 8: Attaching the Inner Rail



Note: Each side contains **3**, **M4 truss-head** screws.

5. Verify that the screws have been tightened until snug.
6. Follow the same procedure to install the remaining inner rail.

Attention: The remaining parts of rack mount rails will be used in a later portion of the installation. Please store in a safe place until needed.

8.3 Attaching the Cable Management Assembly Brackets to the Chassis

For the installation of the cable management assembly (CMA) brackets, the following hardware is required:

Note: While handling ESD sensitive components, it is recommend that you are using proper ESD equipment.

Table 15: CMA Brackets Hardware

Part Description	Quantity
Chassis	1
Cable management system brackets	2

The following table lists the required tool needed to attach the CMA brackets to the chassis:

Table 16: Required Tools for Attaching the CMA Brackets

None

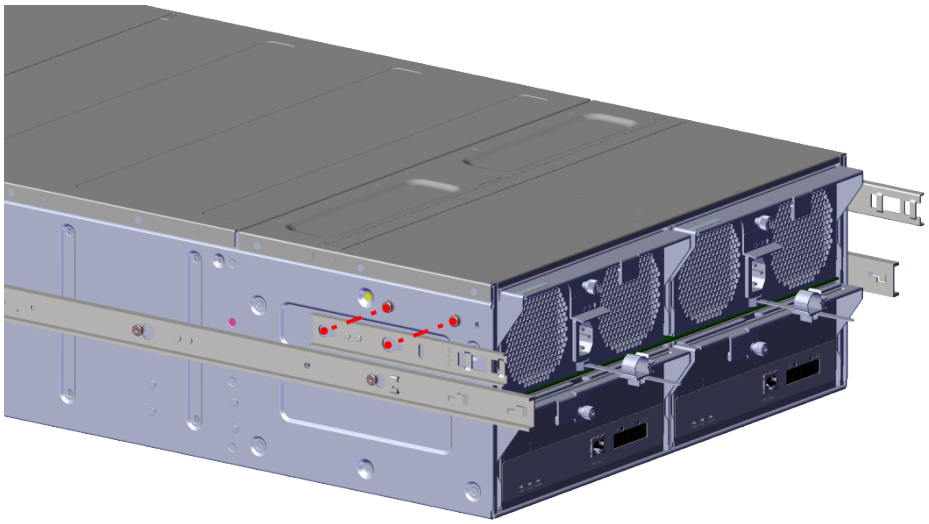
To attach the CMA brackets to the chassis, do the following:

1. Remove the CMA brackets from the box.

   Figure 9: Cable Management Assembly Brackets

2. On the chassis, line up the CMA bracket over the upper set of T-standoffs.

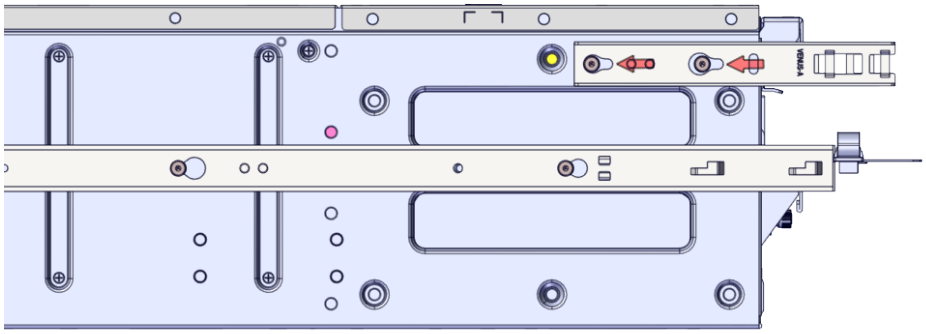
   Figure 10: Lining up the Cable Management System Brackets



3. Press the CMA bracket into the chassis wall and slide the inner rail towards the front of the chassis.

> **Note:** The clip closest to the rear of the chassis will make an audible click when you slide the rail into place.

Figure 11: Locking the Cable Management System Brackets



4. Follow the same procedure to install the remaining CMA bracket.

8.4 Installing the Rail Kit

For the installation of the rack mount rails in into the rack, the following hardware is required:

> **Note:** While handling ESD sensitive components, it is recommend that you are using proper ESD equipment.

Table 17: Rail Kit Hardware

Part Description	Quantity
Rack mount rails	2
Cage Nuts	4
Hex flange Phillips head screw	4

For the installation of the rack mount rails into the rack, the following tools are required:

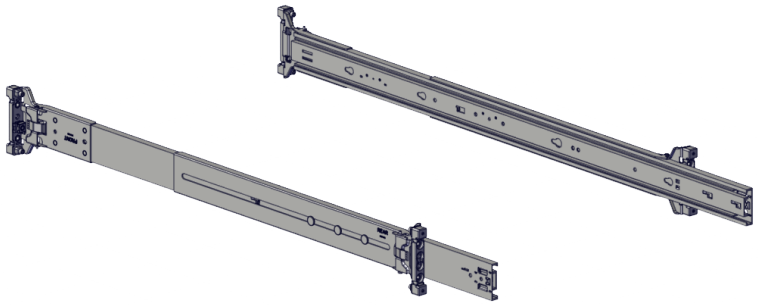
Table 18: Required Tools for Installing the Rail Kit

Number 2 Phillips-head screwdriver with torque measuring capabilities
Level

To install the rack mount rails into the rack, do the following:

1. Remove the rail kit from the box and unpack hardware contained within the packaging.

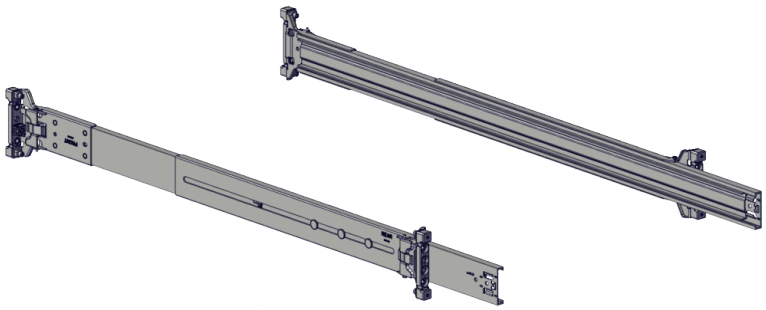
Figure 12: Rail Kit



2. From the outside of the rack mount rail, fully extend the inner rail.

> **Note:** The outside of the rail is identified by the rack mount rail labeling.

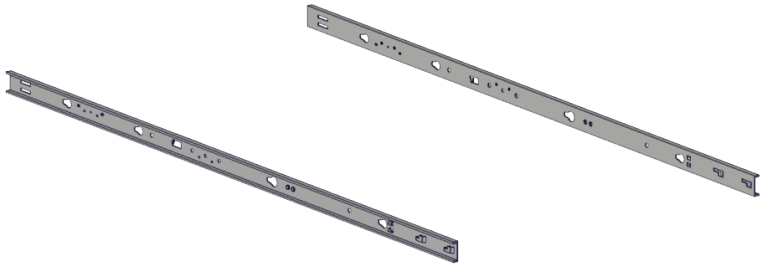
Figure 13: Rack Mount Rail



3. From the inner rail, slide the white button and pull the inner rail out of the rack mount rails.

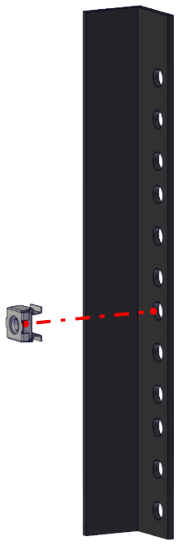
Note: The white button contains an arrow depicting the direction the button should be slid.

Figure 14: Inner Rail



4. Determine the 4U location in which you would like to install the enclosure.
5. From the inside of the rack frame, clip the cage nuts into the holes in which you will install the rack mount rails over.

Figure 15: Installing Cage Nuts



Note: Ensure that the holes line up with those on the rack mount rails. The holes are one on top of the other.

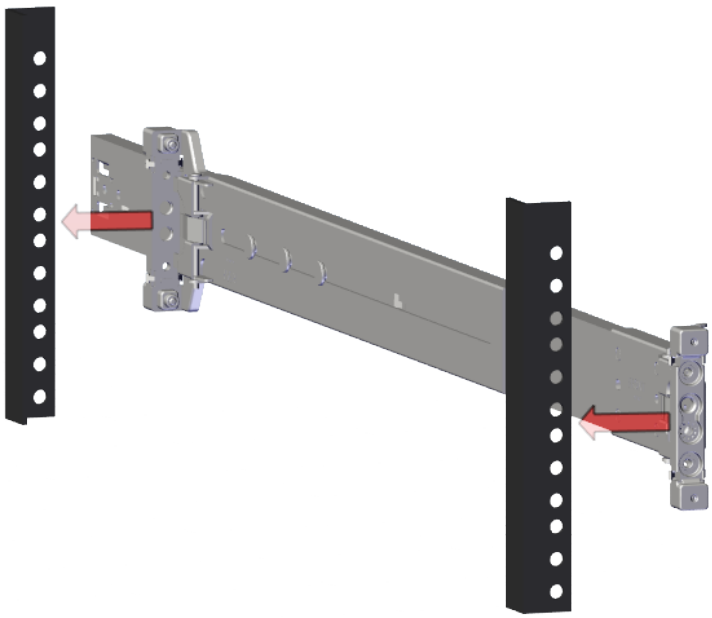
Attention: The unit also ships with slide on cage nuts that may be used if the rack frame only contains round holes.

6. From previous installation steps, locate the remaining parts rack mount rails.
7. On the rack mount rails, locate the end labeled **FRONT**.

8. Line up the front of the rack mount rail with the 4U location you prefer to install the enclosure.

> **Note:** The rack mount rails may by elongated by simply sliding the rear portion of the rail.

Figure 16: Lining Up the Rack Mount Rails



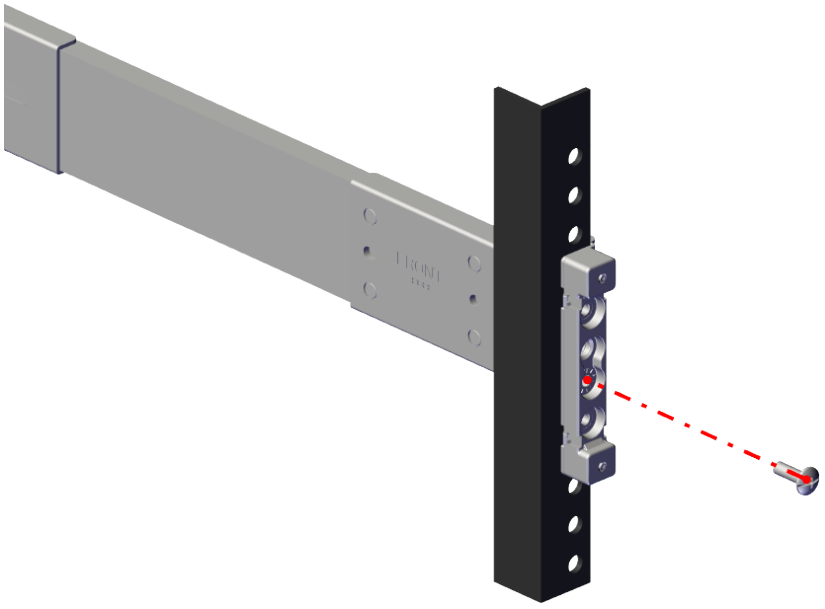
9. Snap the front and rear ends into the rack over the cage nuts.

Figure 17: Snapping the Rack Mount Rails into the Rack

10. Using a level, verify that the rack mount rail is level.

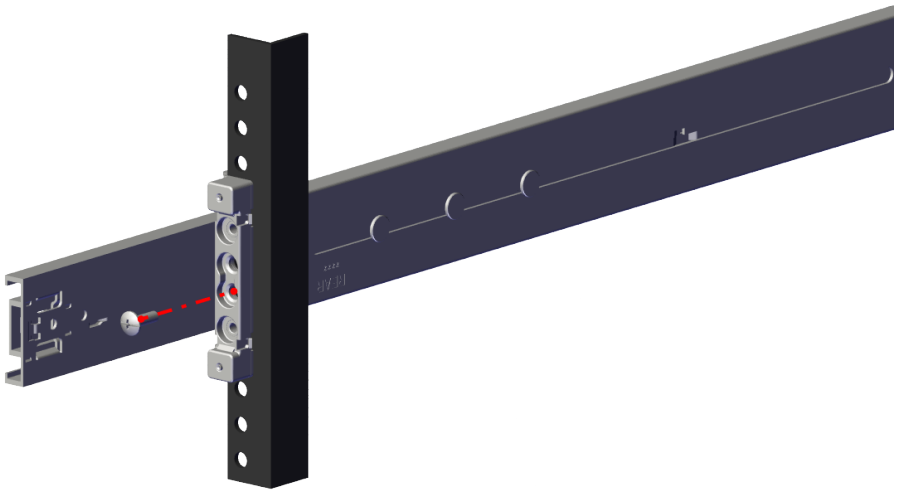
11. From the front of the rack, attach the rack mount rail into place using **one Hex flange Phillips head** screw.

Figure 18: Attaching the Rack Mount Rails (Front)



12. From the rear of the rack, attach the rack mount rail into place using **one Hex flange Phillips head** screw.

Figure 19: Attaching the Rack Mount Rails (Rear)



13. Using a level, verify that the rack mount rail is level.
14. Verify that the screws have been tightened until snug.
15. Follow the same procedure to install the remaining rack mount rail.

8.5 Installing the Chassis

For the installation of the chassis, the following hardware is required:

Note: While handling ESD sensitive components, it is recommend that you are using proper ESD equipment.

Table 19: Chassis Hardware

Part Description	Quantity
Chassis	1

For the installation of the chassis, the following tools are required:

Table 20: Required Tools for Installing the Chassis

None

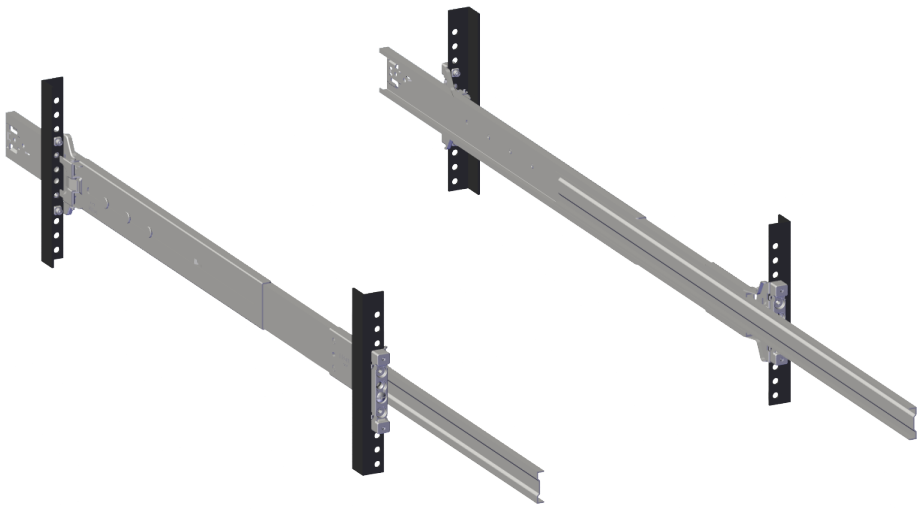
Attention: It is highly recommended that you install the chassis with the assistance of three additional persons.

Tip: Verify that the rack meets the size specifications before installing.

To install the chassis, do the following:

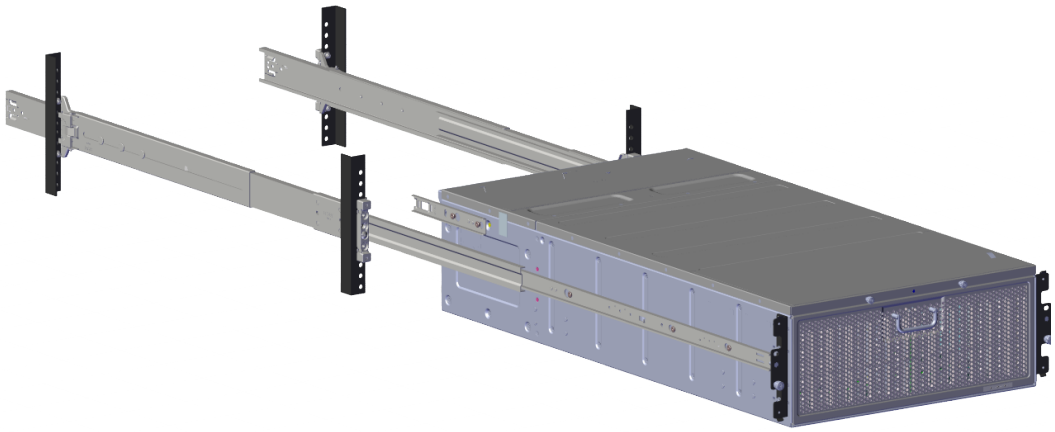
1. From the rack, fully extend the rack mount rails.

   Figure 20: Fully Extended Rack Mount Rails



2. Line up the slide rails on the chassis with the extended rack mount rails.

Figure 21: Lining up the Chassis on the Rack Mount Rails



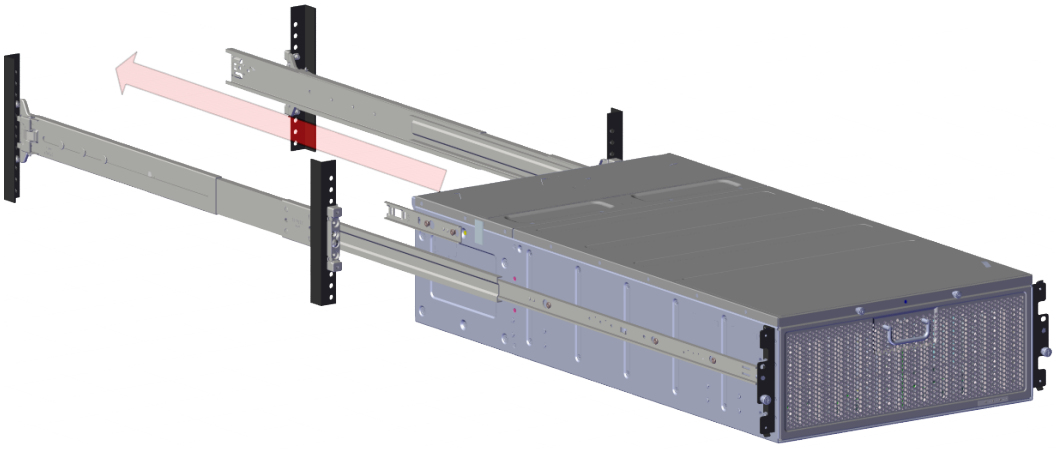
3. Push the chassis until you hear an audible click.
   The inner rails are locked into the rack mount rails.
4. From the side of the rack mount rails, slide the blue button and push the chassis towards the rack.

Note:

- Ensure you slide the blue button on both rails.
- The blue button can be slid either towards the front or rear to unlock the rack mount rails.

5. Push the chassis into the rack mount rails until the chassis is fully seated into the rack.

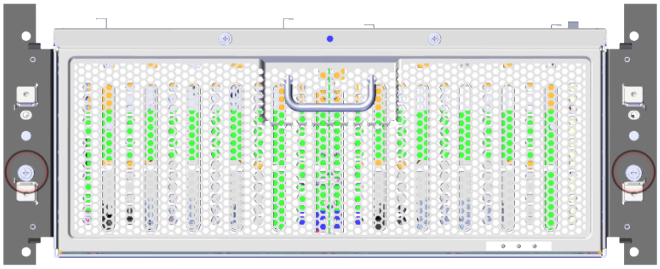
Figure 22: Sliding the Chassis into the Rack



Note: If you are met with any resistance while completing this step, verify that the slide rails and rack mount rails are properly lined up.

6. To secure the chassis in the seated position, press and turn the thumb screw counterclockwise until they are tight.

Figure 23: Tightening Chassis Thumb Screws



7. Repeat the previous step for the remaining side.

8.6 Installing the Cable Management Assembly

For the installation of the cable management assembly (CMA), the following hardware is required:

Note: While handling ESD sensitive components, it is recommend that you are using proper ESD equipment.

Table 21: CMA Hardware

Part Description	Quantity
Cable Management Assembly	2 arms

For the installation of the cable management assembly, the following tools are required:

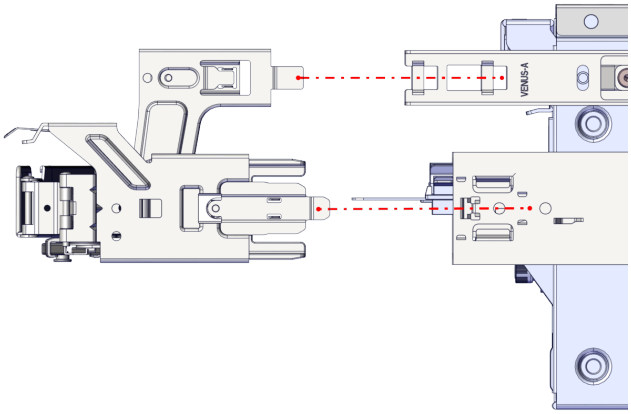
Table 22: Required Tools for Installing the CMA

None

To install the CMA, do the following:

1. Locate the CMA arm labeled **Lower**.
2. Press the lower CMA into the slide rail and CMA bracket on the chassis until you hear an audible click from the top and bottom inserts.

Figure 24: Installing the Lower Cable Management Assembly



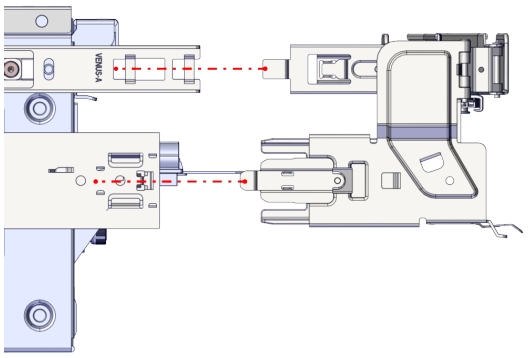
Note:

- The top tab should slide into the inside middle hole on the CMA bracket.
- When facing the rear of the enclosure, the lower CMA arm will be installed into the right side of the enclosure.
- When attaching the upper portion of the CMA, ensure that the front tab is inserted into the inside middle hole and the second tab is insert into the inside first hole on the CMA bracket.

3. Swing the CMA arm away from the enclosure.
4. Locate the CMA arm labeled **Upper**.

5. Press the upper CMA into the slide rail and CMA bracket on the chassis until you hear an audible click from the top and bottom inserts.

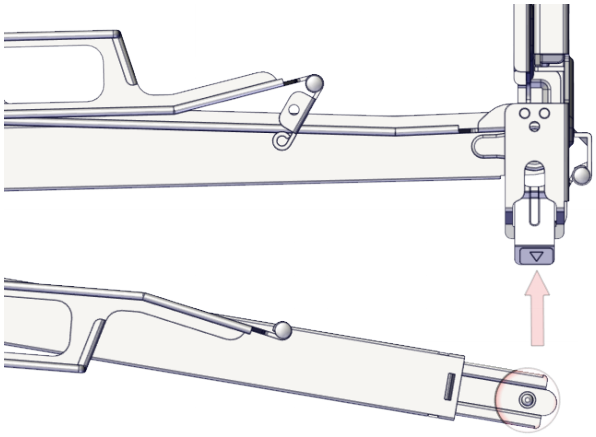
Figure 25: Installing the Upper Cable Management System



- When facing the rear of the enclosure, the upper CMA arm will be installed into the left side of the enclosure.
- When attaching the upper portion of the CMA, ensure that the front tab is inserted into the inside middle hole and the second tab is insert into the inside first hole on the CMA bracket.

6. From the **Lower** cable management system arm, line up the CMA handle with the CMA snap location.

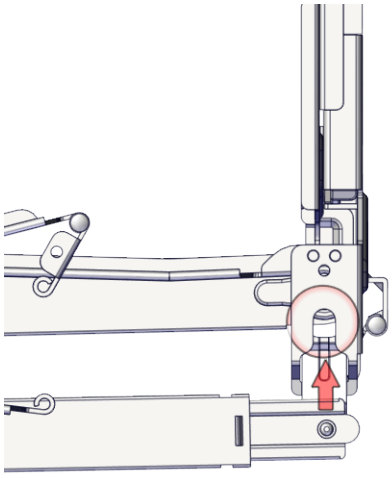
Figure 26: Snapping the Lower CSM Handle into the Upper Snap Location



Note: The CMA snap location for the **Lower** arm is attached to the **Upper** CMA arm.

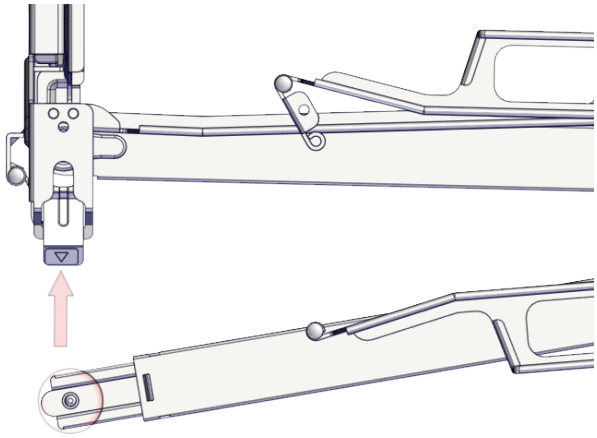
7. Press the CMA handle firmly into the snap location until you hear an audible click.

Figure 27: Securing the Lower CMA Handle within the Upper Snap Location



8. From the **Upper** CMA arm, line up the CMA handle with the CMA snap location.

Figure 28: Snapping the Upper CMA Handle into the Lower Snap Location

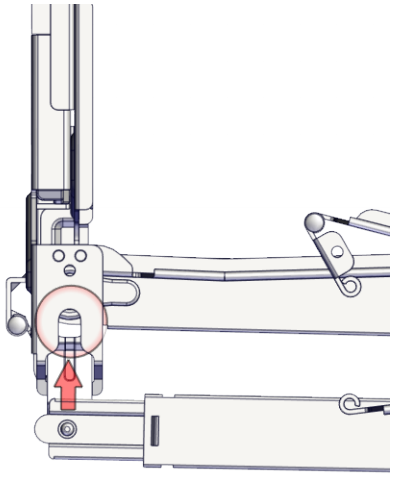


Note: The CMA snap location for the **Upper** arm is attached to the **Lower** CMA arm.

---

9. Press the CMA handle firmly into the snap location until you hear an audible click.

Figure 29: Securing the Upper CMA Handle within the Lower Snap Location



10. Verify both arms are securely attached to the CMA bracket and rail kit.
11. Verify both CMA handles are securely attached to the CMA snap locations.

8.7 Installing the HD Mini-SAS Cables

To install the HD Mini-SAS Cables, the following hardware is required:

Note: While handling ESD sensitive components, it is recommend that you are using proper ESD equipment.

Table 23: HD Mini-SAS Cable Hardware

Part Description	Quantity
HD Mini-SAS Cables	2

The following table lists the required tool needed to uninstall the hard disk drives:

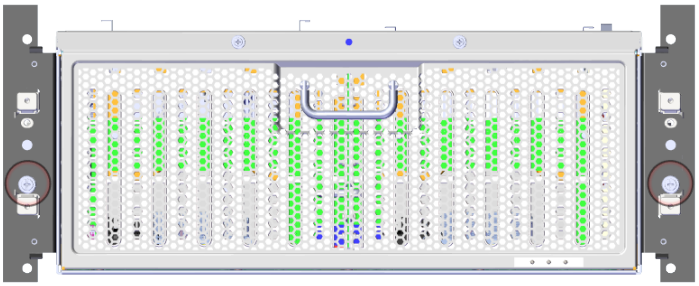
Table 24: Required Tools for Installing the HD Mini-SAS Cables

None

To install the HD Mini-SAS Cables, do the following:

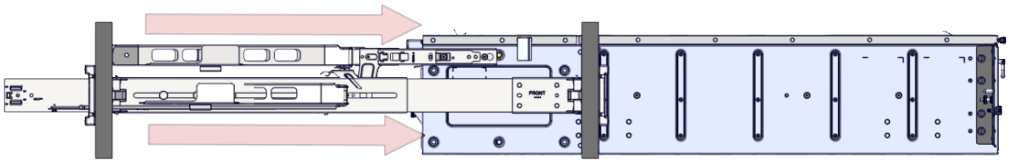
1. From the enclosure, turn the thumbscrews that secure the enclosure in the rack counterclockwise.

Figure 30: Enclosure Thumb Screws (Counterclockwise)



2. From the enclosure handle, pull the enclosure out until the rail kit is fully extended.

Figure 31: Extended Enclosure



3. From the rear of the enclosure, plug the HD Mini-SAS cable into the Enclosure Storage Module (ESM).
4. Loosely run the cable through the cable management assembly (CMA).

Note: By the CMA design, the cables are intended to be installed into the CMA arm on the side of the PSU or EMS.

5. At the elbow of the CMA, ensure you leave about two inches of slack in the cable.
6. Using Velcro straps, attach the cable to the CMA.
7. To ensure the cable has the proper amount of slack, push the enclosure into the rack.

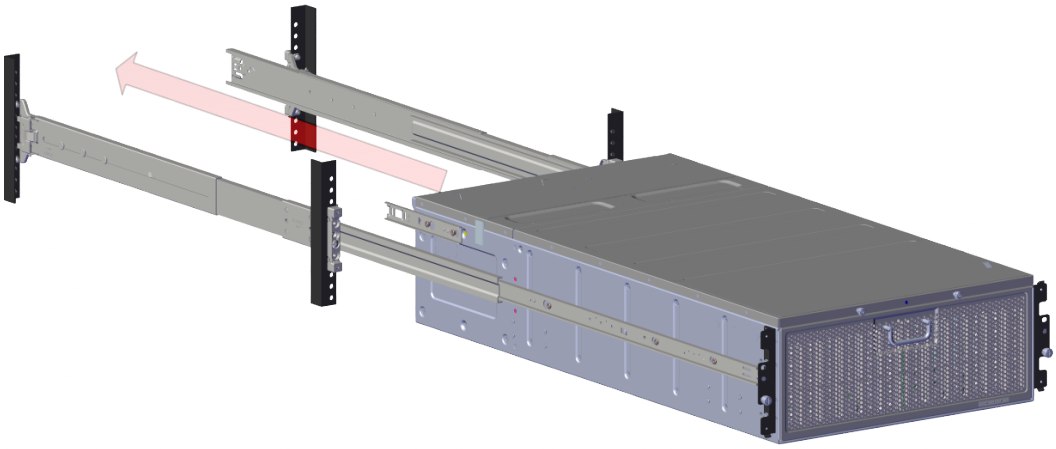
Note:

- If the cables appear to be **too tight**, increase the amount of slack in the cable.

- If the cables appear to be **too loose**, decrease the amount of slack in the cable.

8. Follow the same procedure, on the opposite side, to install the remaining HD Mini-SAS cable.
9. Push the chassis into the rack mount rails until the chassis is fully seated into the rack.

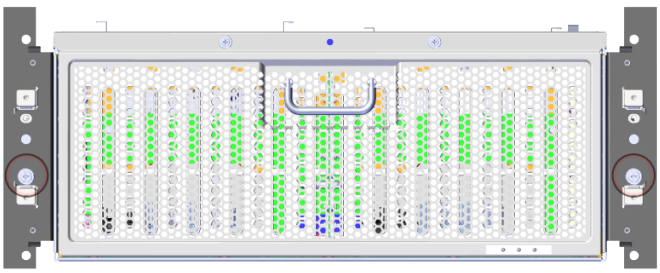
Figure 32: Sliding the Chassis into the Rack



Note: If you are met with any resistance while completing this step, verify that the slide rails and rack mount rails are properly lined up.

10. To secure the chassis in the seated position, press and turn the thumb screw counterclockwise until they are tight.

Figure 33: Tightening Chassis Thumb Screws



8.8 Installing the Power Cords

To install the power cords, the following hardware is required:

Note: While handling ESD sensitive components, it is recommend that you are using proper ESD equipment.

Table 25: Power Cord Hardware

Part Description	Quantity
Power Cords	2

The following table lists the required tools needed to install the power cords:

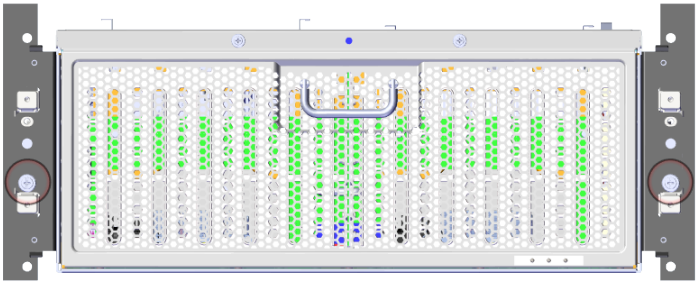
Table 26: Required Tools for Installing the Power Cords

None

To install the Power Cords, do the following:

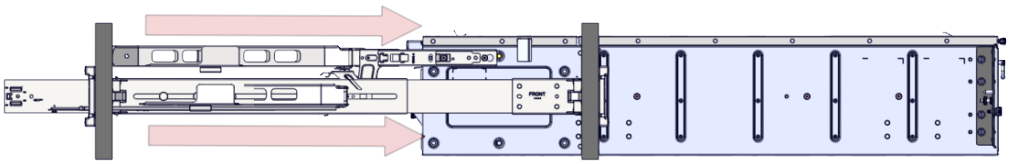
1. From the enclosure, turn the thumbscrews that secure the enclosure in the rack counterclockwise.

Figure 34: Enclosure Thumb Screws (Counterclockwise)



2. From the enclosure handle, pull the enclosure out until the rail kit is fully extended.

Figure 35: Extended Enclosure



3. From the rear of the enclosure, plug the power cord into the Power Supply Unit (PSU).
4. Loosely run the power cord through the cable management assembly (CMA).

Note: By the CMA design, the cables are intended to be installed into the CMA arm on the side of the PSU or EMS.

---

5. At the elbow of the CMA, ensure you leave about two inches of slack in the power cord.
6. Using Velcro straps, attach the cable to the CMA.
7. To ensure the power cord has the proper amount of slack, push the enclosure into the rack.

Note:

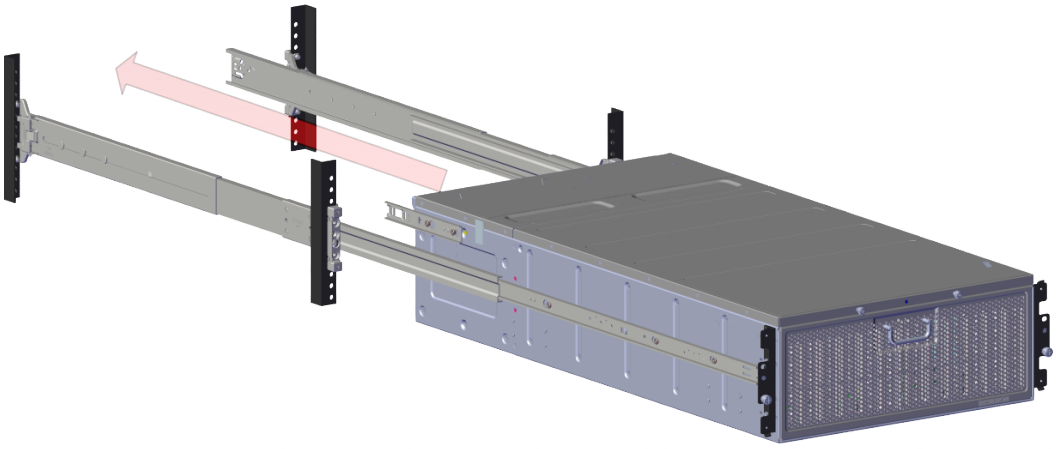
- If the cables appear to be **too tight**, increase the amount of slack in the cable.
- If the cables appear to be **too loose**, decrease the amount of slack in the cable.

---

8. Follow the same procedure, on the opposite side, to install the remaining power cord.

9. Push the chassis into the rack mount rails until the chassis is fully seated into the rack.

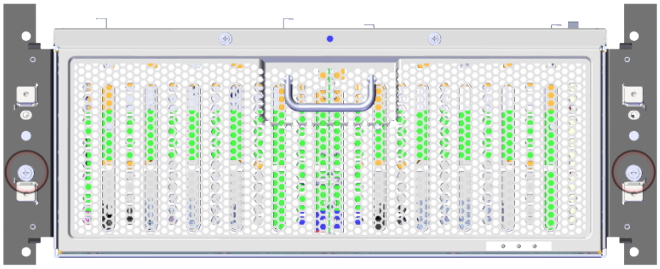
Figure 36: Sliding the Chassis into the Rack



Note: If you are met with any resistance while completing this step, verify that the slide rails and rack mount rails are properly lined up.

10. To secure the chassis in the seated position, press and turn the thumb screw counterclockwise until they are tight.

Figure 37: Tightening Chassis Thumb Screws



8.9 Installing the Expansion Cable

To install the expansion cable, the following hardware is required:

Note: While handling ESD sensitive components, it is recommend that you are using proper ESD equipment.

Table 27: Expansion Cable Hardware

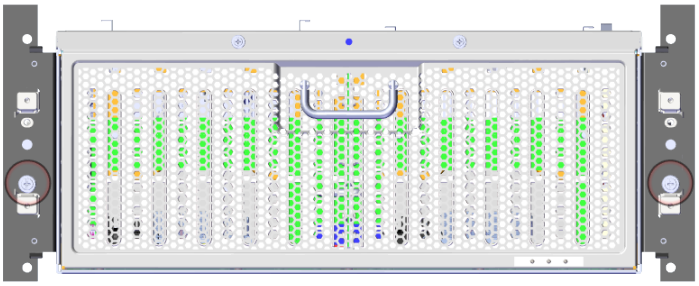
Part Description	Quantity
Expansion Cable	1 per system expansion **Note:** A maximum of **4** systems can be connected together.

To install the expansion cable, do the following:

Note: To complete the following steps, you must have at least **2** enclosures installed. Repeat the steps as necessary, up to a maximum of **4** times.

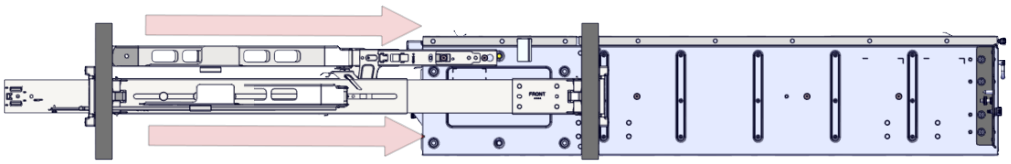
1. From the enclosure, turn the thumbscrews that secure the enclosure in the rack counterclockwise.

Figure 38: Enclosure Thumb Screws (Counterclockwise)



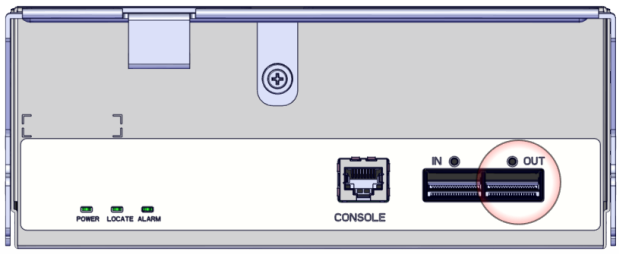
2. From the enclosure handle, pull the enclosure out until the rail kit is fully extended.

Figure 39: Extended Enclosure



3. From the rear of the enclosure, plug the expansion cable into the ESM port labeled **Out**.

Figure 40: Enclosure Storage Module (Out)



4. Loosely run the power cord through the cable management assembly (CMA).

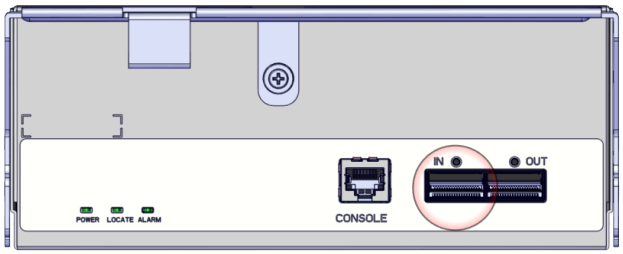
> **Note:** By the CMA design, the cables are intended to be installed into the CMA arm on the side of the PSU or EMS.

5. At the elbow of the CMA, ensure you leave about two inches of slack in the power cord.
6. Using Velcro straps, attach the cable to the CMA.
7. To ensure the expansion cable has the proper amount of slack, push the enclosure into the rack.

> **Note:**
>
> - If the cables appear to be **too tight**, increase the amount of slack in the cable.
> - If the cables appear to be **too loose**, decrease the amount of slack in the cable.

8. Once the expansion cable has been run through the CMA, verify the other enclosure that you want to connect to is in range of the cable.
9. Follow the same procedure, to run the expansion cable through the second enclosure's CMA.
10. Plug the expansion cable into the port labeled **In**.

Figure 41: Enclosure Storage Module (In)



8.10 (Optional) Uninstalling the Hard Disk Drives

Important: This task is only required if you do not have the proper lifting equipment to install the fully populated chassis.

To uninstall the hard disk drives (HDD), the following hardware is required:

Note: Ensure that the HDDs are stored in safe area that provides ESD protection.

Table 28: HDD Hardware

Part Description	Quantity
Hard Disk Drive with Carrier	60

The following table lists the required tool needed to uninstall the hard disk drives:

Table 29: Required Tools for Uninstalling the HDD

None

To uninstall the HDDs, do the following:

Note:

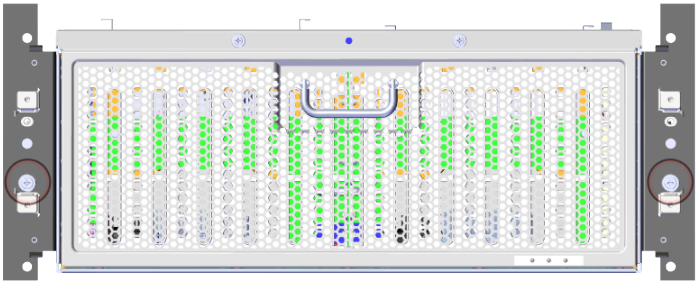
- This task may be completed only if the HDDs have been installed.

- It is highly recommended that you store the HDDs in a safe location.

---

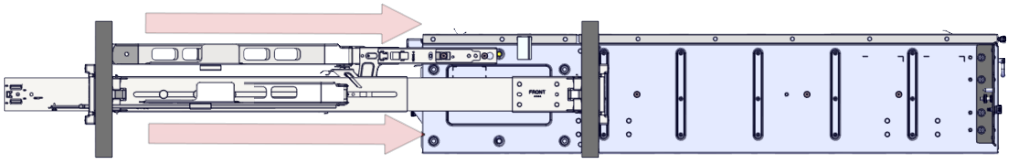
1. From the enclosure, turn the thumbscrews that secure the enclosure in the rack counterclockwise.

Figure 42: Enclosure Thumb Screws (Counterclockwise)



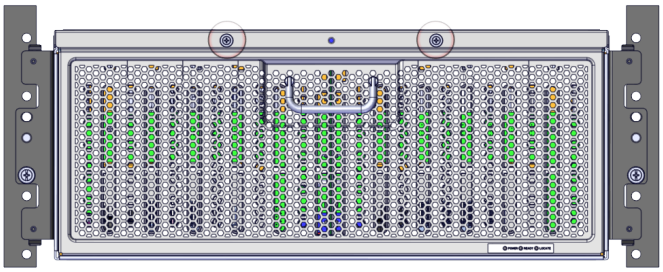
2. From the enclosure handle, pull the enclosure out until the rail kit is fully extended.

Figure 43: Extended Enclosure



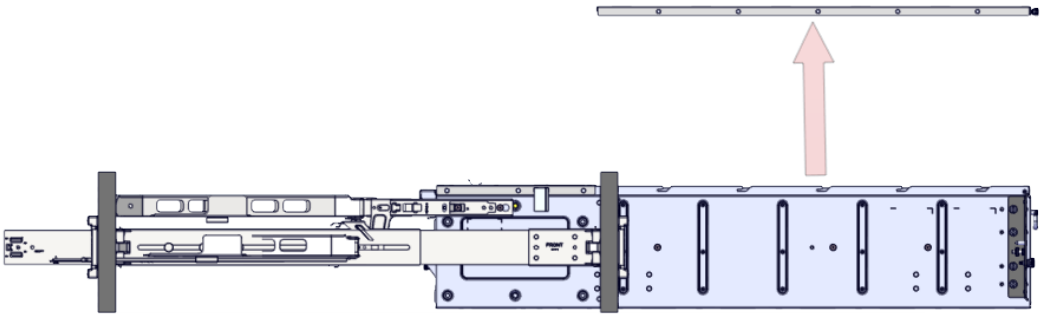
3. From the top of the enclosure, locate the thumb screws securing the lid of the enclosure.

Figure 44: Enclosure Cover Thumb Screws (Counterclockwise)



4. Turn the thumb screws counterclockwise until the cover is unsecured from the chassis.
5. Slide the cover towards the front of the enclosure.
6. Pull the cover off of the enclosure.

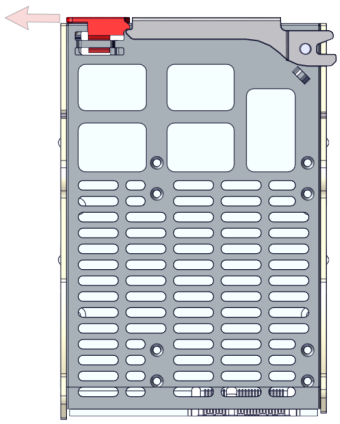
Figure 45: Removing the Enclosure Cover



Note: To avoid damage to the cover, store in a safe location.

7. From the first HDD, slide the HDD carrier slider towards the rear of the enclosure.

Figure 46: Hard Disk Drive Carrier Slider

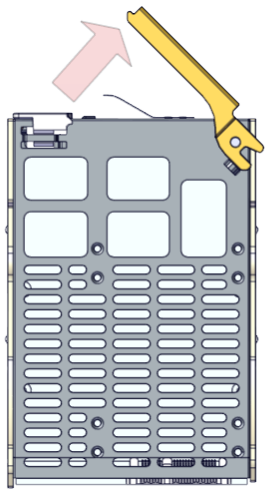


Note:

- The HDD carrier will give audible click the carrier handle will release.
- It is highly recommended to begin with HDD **00** and work up in numerical order.

8. Lift the HDD carrier handle until it stops.

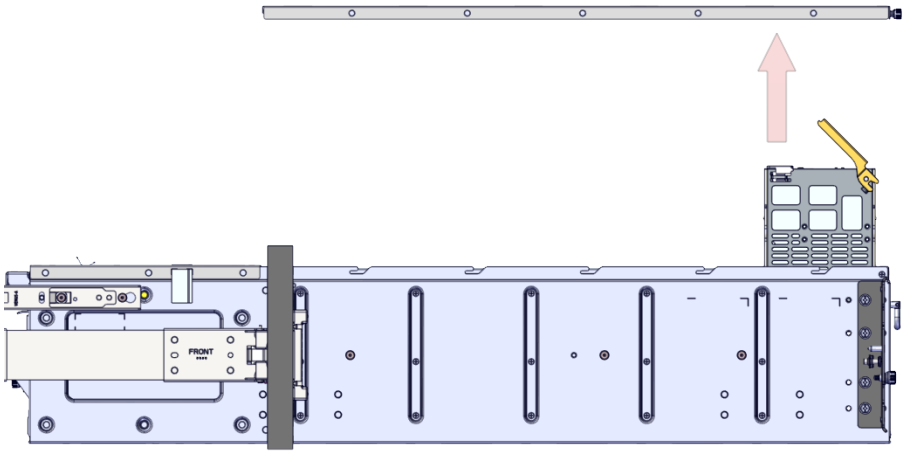
Figure 47: Hard Disk Drive Carrier Handle



Note: The HDD carrier lid should open until about a 45 degree angle.

9. From the carrier handle, pull the hard drive up and out of the enclosure.

Figure 48: Removing the Hard Disk Drive



10. Store the HDDs in a safe location until you are ready to reinstall.

> **Note:** It is highly recommended to store the HDDs in numerical order.

11. Follow the same procedure to uninstall the remaining HDDs.

8.11 (Optional) Installing the Hard Disk Drives

> **Important:** This task is only required if you do not have the proper lifting equipment to install the fully populated chassis. This task assumes that you have uninstalled the hard disk drives and need to reinstall the hard disk drives into the chassis contained in a rack.

To install the hard disk drives (HDD), the following hardware is required:

> **Note:** Ensure that the HDDs are stored in safe area that provides ESD protection.

Table 30: HDD Hardware

Part Description	Quantity
Hard Disk Drive with Carrier	60

The following table lists the required tool needed to install the hard disk drives:

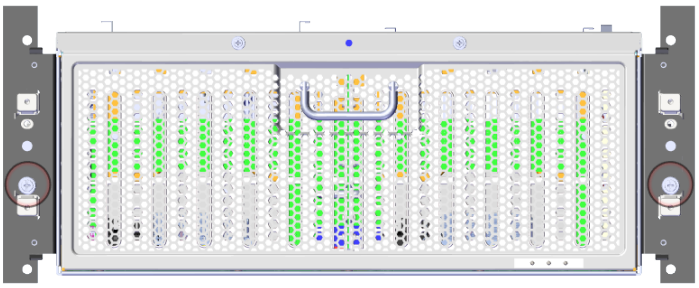
Table 31: Required Tools for Installing the HDDs

None

To install the hard disk drives, do the following:

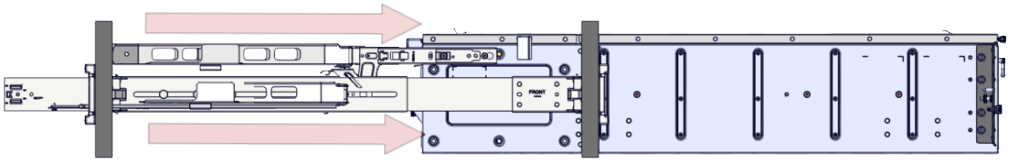
1. From the enclosure, turn the thumbscrews that secure the enclosure in the rack counterclockwise.

   Figure 49: Enclosure Thumb Screws (Counterclockwise)



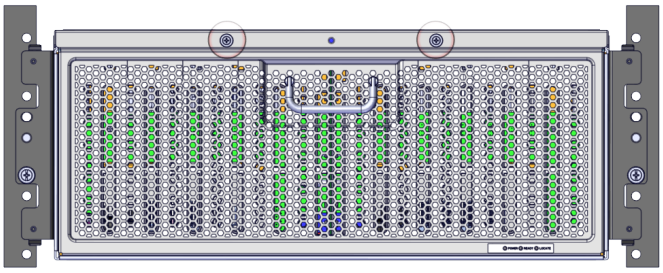
2. From the enclosure handle, pull the enclosure out until the rail kit is fully extended.

   Figure 50: Extended Enclosure



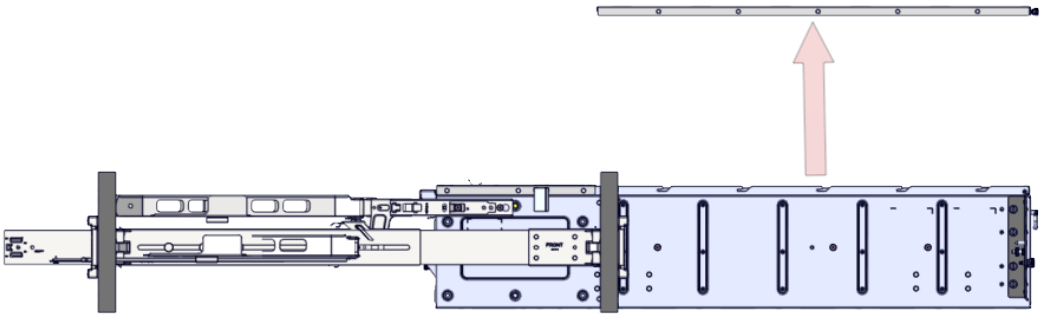
3. From the top of the enclosure, locate the thumb screws securing the lid of the enclosure.

Figure 51: Enclosure Cover Thumb Screws (Counterclockwise)



4. Turn the thumb screws counterclockwise until the cover is unsecured from the chassis.
5. Slide the cover towards the front of the enclosure.
6. Pull the cover off of the enclosure.

Figure 52: Removing the Enclosure Cover



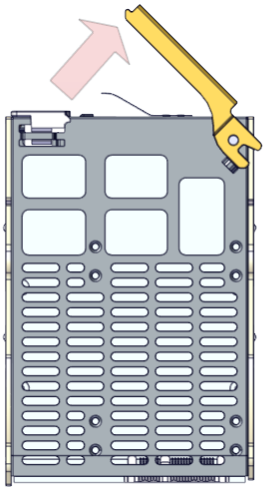
Note: To avoid damage to the cover, store in a safe location.

7. Unpack the replacement HDD.
8. From the enclosure, locate the drive bay labeled **00**.
9. Line up the HDD with the connector on the board.

Note: Ensure that the arrow on the HDD carrier is pointing towards the rear of the enclosure.

10. Using the HDD carrier slider button, push the HDD into the drive bay.

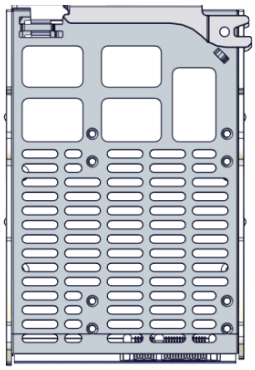
Figure 53: Hard Disk Drive Carrier Handle



Note: The HDD carrier handle should open until about a 45 degree angle.

11. Once the HDD stops, push the HDD carrier handle until it is latched.

Figure 54: Latched Hard Disk Drive Carrier Handle

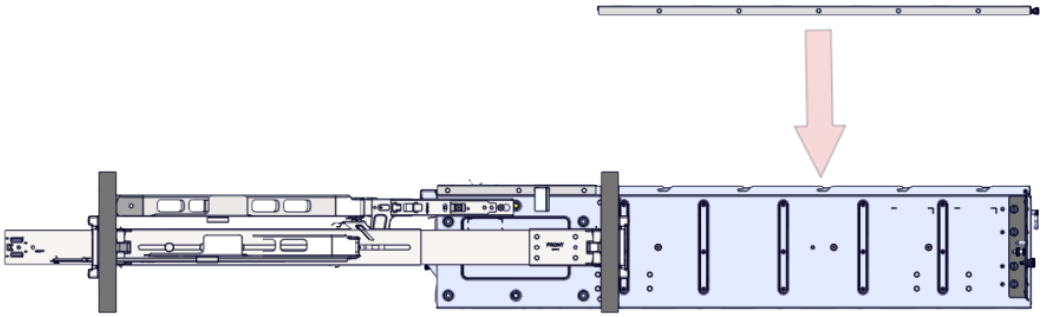


Note: The latch will give an audible click when properly seated.

12. Locate the chassis cover that had been stored away.

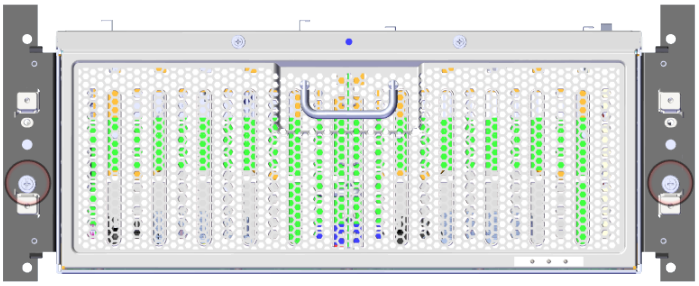
13. Place the chassis cover over the drive bay.

Figure 55: Chassis Cover Installation



14. Slide the chassis cover towards the rear of the chassis until fully seated.
15. From the front of the enclosure, on the chassis cover. turn the thumb screws clockwise.
16. From the front of the rack, push the enclosure into the rack until fully seated.
17. From the front of the enclosure, turn the thumb screws that secure the enclosure in the rack clockwise.

Figure 56: Enclosure Thumb Screws (Counterclockwise)



18. Verify that the thumb screws have been tightened until snug.

9 Customer Replaceable Units

The following chapter describes the Customer Replaceable Units for the 4U60 Storage Enclosure.

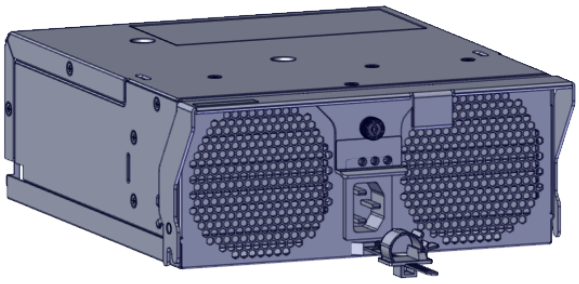
Note: Refer to the Customer Replaceable Unit Guide for detailed instructions on how to replace customer replaceable units.

9.1 Power Supply Unit

The 4U60 Storage Enclosure contains two redundant power supply units (PSU).

Note: The PSU is a hot swappable component.

Figure 57: Power Supply Unit

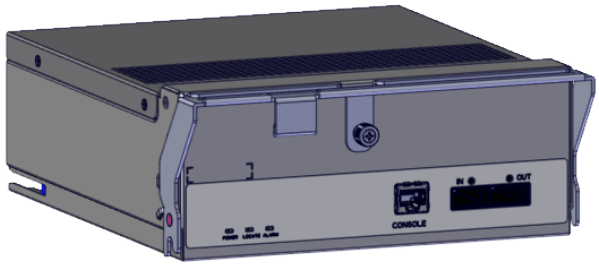


9.2 Enclosure Storage Module

The 4U60 Storage Enclosure contains two Enclosure Storage Modules (ESM).

Note: The ESM is a hot swappable component.

Figure 58: Enclosure Storage Module

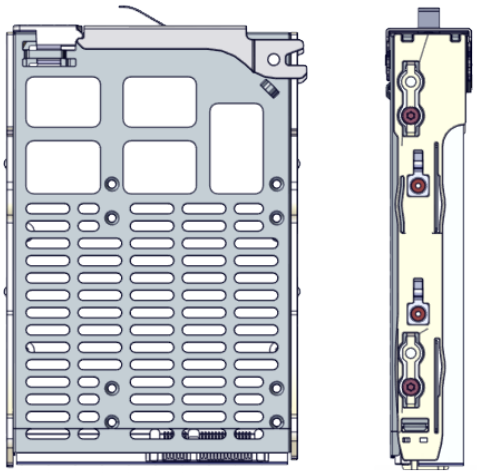


9.3 Hard Disk Drive

The 4U60 Storage Enclosure contains 60 Ultrastar He8 helium HDDs.

Note: The HDDs are hot swappable components.

Figure 59: Hard Disk Drive



The following table displays the list of approved hard disk drives for the 4U60 Storage Enclosure:

Table 32: 4U60 Storage Enclosure Qualified Hard Drives

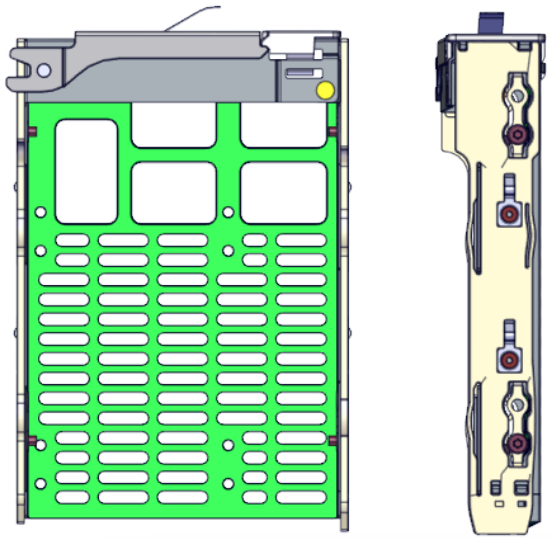
Model	Family	Capacity	Format
HUH7280xxALN60y	Ultrastar He8 helium	8TB	SAS 4KN SE
HUH7280xxALE60y	Ultrastar He8 helium	8TB	SAS 512e SE
HUH7280xxAL420y	Ultrastar He8 helium	8TB	SAS 4KN SE
HUH7280xxAL520y	Ultrastar He8 helium	8TB	SAS 512e SE

9.3.1 Hard Disk Drive Carrier

The 4U60 Storage Enclosure contains 60 HDD carriers.

Note: The HDD carriers are hot swappable components.

Figure 60: Hard Disk Drive Carrier

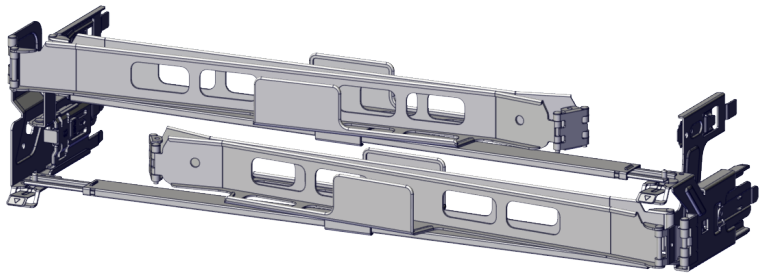


9.4 Cable Management Assembly

The 4U60 Storage Enclosure contains a cable management assembly (CMA) that includes an upper and lower arm.

Note: The CMA is designed to cable the enclosure to meet the needs of your specific configuration.

Figure 61: Cable Management Assembly



9.5 Power Cords

The 4U60 Storage Enclosure contains a power cord for each of the two PSUs.

Note: It is highly recommended that you use the power cords that have been approved for this particular enclosure.

9.6 HD Mini-SAS Cables

The 4U60 Storage Enclosure contains an HD Mini-SAS cable for each of the two ESMs.

Note: It is highly recommended that you use the HD Mini-SAS cables that have been approved for this particular enclosure.

9.7 Expansion Cables

The 4U60 Storage Enclosure has the option to utilize expansion cables to allow for the connection of up to **four** enclosures.

Note: It is highly recommended that you use the Expansion cables that have been approved for this particular enclosure.

9.8 Chassis

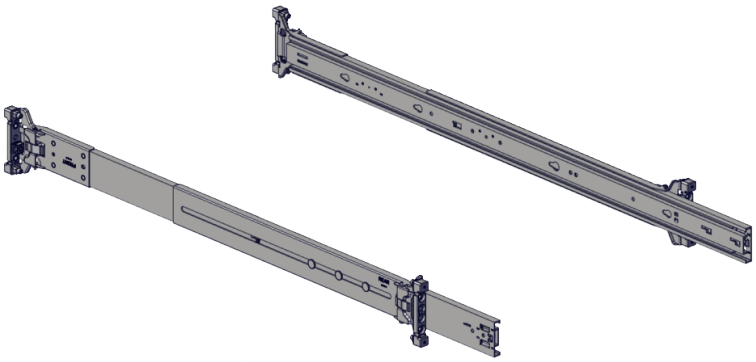
The 4U60 Storage Enclosure chassis houses the all of the components that allow for the enclosure to function. During the chassis replacement, it is highly recommended that you remove and store the functioning components in a safe place.

Figure 62: Chassis

9.9 Rail Kit

The 4U60 Storage Enclosure is installed into the rack using a rail kit. The rail kit is designed to clip into the rack before attach with screws. This allows for ease of installation and adjustment. The chassis and all other component will need to be removed in order to replace the component.

Figure 63: Rail Kit



10 Operating the 4U60 Storage Enclosure

The following chapter describes the operation of the 4U60 Storage Enclosure.

10.1 Before You Begin

Ensure that you have all of proper cabling to connect to the enclosure. The enclosure is designed to be installed into a rack, not assembled on a bench top. Connect all of the cables, and turn on and boot host or control node server. Connect the power to the ; it will come on and boot without any interaction from the user.

10.2 Power On/Off

The does not have an external power switch, the enclosure is powered on by plugging power cords into the power supplies. Once powered on, the enclosure automatically powers up and spins up all disk drives located in all attached sleds. While the enclosure is running, disk drives may be powered off or powered back on using the SES command set.

For a complete description of how to use the SES command set to power drives on and off, see the Family Enclosure Services Document.

10.2.1 Power On: All At Once

There is a persistence setting in the VPD that the SEP will use to determine the desired power state, give a power failure, or intentional shut down of the storage.

The persistence contains the following settings:

1. Power on, with all drives turned on (default)
2. Power on, with all drives off
3. Stay in low standby until user intervention commands over SES come on

10.2.2 Power On: Drive By Drive

The power on drive by drive option, turns on the system PSUs, but leaves all drives turned off. Once this occurs, the user may then, turn drives on as needed.

10.2.3 Power On: Low Power Mode

The low power mode keeps the system in standby until an SES command is sent to turn on the enclosure.

10.3 Verifying the Drives

To verify the drives, do the following:

Using SG Utilities, type the following command **Sg_scan –a -s -v** .
A list of device SCSI results appear.

11 Component and Visual Indicator Identification

The following chapter describes the component and visual indicator identification.

11.1 Visual Indicator Identification

The 4U60 Storage Enclosure displays the following visual indicators:

- **Chassis**
  - 1 Green—Chassis operational
  - 1 Red—Chassis nonoperational
  - 1 Amber—Chassis locate
- Enclosure Storage Module (one set of LEDs per ESM, 2 sets total)
  Main LEDs:
  - 1 Green—Power on
  - 1 Red—ESM Error
  - 1 Amber—ESM locate, controlled by host via SES

  QSFP+ uplink and downlink ports:
  - On (Green)—link established with any or all SAS ports within the connector that are linked
  - Off—Loss of link on all of the SAS ports within the connector
- **PSU** (one set of LEDs per PSU, 2 sets total)
  - RYD Green—Displays the output +12V and +5V are normal with in specification
  - ACIN Green—Displays the input AC voltage is with in specification
  - ALM Amber—Displays the PSU report a fault
- **HDD**
  - 1 Green—Power on and connected
  - 1 Red—
    - Solid: HDD Error
    - Blinking: HDD Locate

11.2 SCSI Enclosure Services Page 02

The SCSI Send Diagnostic and Receive Diagnostic Results commands can be addressed to a specific **SES element** in the enclosure. There are many different element codes, such as Page 02, defined to cover a wide range of devices. Page 02h refers to the control and status of the enclosures PSUs, HDDs, ESMs, and sensors.

Note: Refer to the SCSI Enclosure Services documentation for more information on SES Page 02.

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12 Safety and Regulatory

The following chapter provides safety and regulatory information for the 4U60 Storage Enclosure.

12.1 Optimizing Location

Failure to recognize the importance of optimally locating your product and failure to protect against electrostatic discharge (ESD) when handling your product can result in lowered system performance or system failure.

Do not position the unit in an environment that has extreme high temperatures or extreme low temperatures. Be aware of the proximity of the unit to heaters, radiators, and air conditioners.

Position the unit so that there is adequate space around it for proper cooling and ventilation. Consult the product documentation for spacing information.

Keep the unit away from direct strong magnetic fields, excessive dust, and electronic/electrical equipment that generate electrical noise.

12.2 Safety Warnings and Cautions

To avoid personal injury or property damage, before you begin installing the product, read, observe, and adhere to all of the following safety instructions and information. The following safety symbols may be used throughout the documentation and may be marked on the product and/or the product packaging.

CAUTION Indicates the presence of a hazard that may cause minor personal injury or property damage if the CAUTION is ignored.

WARNING Indicates the presence of a hazard that may result in serious personal injury if the WARNING is ignored.

Indicates potential hazard if indicated information is ignored.

Indicates shock hazards that result in serious injury or death if safety instructions are not followed.

Indicates do not touch fan blades, may result in injury.

Indicates disconnect all power sources before servicing.

12.3 Electrostatic Discharge

CAUTION

Electrostatic discharge can harm delicate components inside HGST products.

Electrostatic discharge (ESD) is a discharge of stored static electricity that can damage equipment and impair electrical circuitry. It occurs when electronic components are improperly handled and can result in complete or intermittent failures.

Wear an ESD wrist strap for installation, service and maintenance to prevent damage to components in the product. Ensure the antistatic wrist strap is attached to a chassis ground (any unpainted metal surface). If possible, keep one hand on the frame when you install or remove an ESD-sensitive part.

Before moving ESD-sensitive parts place them in ESD static-protective bags until you are ready to install the part.

12.4 Rackmountable Systems

CAUTION

Always install rack rails and storage enclosure according to 4U60 Storage Enclosure product documentation. Follow all cautions, warnings, labels, and instructions provided within the rackmount instructions.

Reliable earthing of rack-mounted equipment should be maintained.

If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature (Tma) specified by the manufacturer.

Observe the maximum rated ambient temperature, which is specified in the product documentation.

For safe operation of the equipment, installation of the equipment in a rack should be such that the amount of air flow is not impeded so that the safe operation of the equipment is not compromised.

12.5 Power Connections

Be aware of the ampere limit on any power supply or extension cables being used. The total ampere rating being pulled on a circuit by all devices combined should not exceed 80% of the maximum limit for the circuit.

CAUTION The power outlet must be easily accessible close to the unit.

Always use properly grounded, unmodified electrical outlets and cables. Ensure all outlets and cables are rated to supply the proper voltage and current.

This unit has more than one power supply connection; both power cords must be removed from the power supplies to completely remove power from the unit. There is no switch or other disconnect device.

12.6 Power Cords

Use only tested and approved power cords to connect to properly grounded power outlets or insulated sockets of the rack's internal power supply.

If an AC power cord was not provided with your product, purchase one that is approved for use in your country or region.

CAUTION To avoid electrical shock or fire, check the power cord(s) that will be used with the product as follows:

- The power cord must have an electrical rating that is greater than that of the electrical current rating marked on the product.
- Do not attempt to modify or use the AC power cord(s) if they are not the exact type required to fit into the grounded electrical outlets.
- The power supply cord(s) must be plugged into socket-outlet(s) that is /are provided with a suitable earth ground.
- The power supply cord(s) is / are the main disconnect device to AC power. The socket outlet(s) must be near the equipment and readily accessible for disconnection.

12.7 Safety and Service

All maintenance and service actions appropriate to the end-users are described in the product documentation. All other servicing should be referred to a HGST-authorized service technician.

To avoid shock hazard, turn off power to the unit by unplugging both power cords before servicing the unit. Use extreme caution around the chassis because potentially harmful voltages are present.

When replacing a hot-plug power supply, unplug the power cord to the power supply being replaced before removing it from the 4U60 Storage Enclosure.

The power supply in this product contains no user-serviceable parts. Do not open the power supply. Hazardous voltage, current and energy levels are present inside the power supply. Return to manufacturer for servicing.

Use caution when accessing part of the product that are labeled as potential shock hazards, hazardous access to moving parts such as fan blades or caution labels.

13 HGST Regulatory Statements

The following chapter provides regulatory statements for the 4U60 Storage Enclosure.

HGST Storage Enclosures are marked to indicate compliance to various country and regional standards.

Note: *Potential equipment damage:* Operation of this equipment with cables that are not properly shielded and not correctly grounded may cause interference to other electronic equipment and result in violation of Class A legal requirements. Changes or modifications to this equipment that are not expressly approved in advance by HGST will void the warranty. In addition, changes or modifications to this equipment might cause it to create harmful interference.

13.1 FCC Class A Notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if it is not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Any modifications made to this device that are not approved by HGST may void the authority granted to the user by the FCC to operate equipment.

13.2 FCC Verification Statement (USA)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates and can radiate radio frequency energy, and if not installed and used in accordance with the 4U60 Storage Enclosure User Guide, it may cause harmful interference to radio communications.

13.3 ICES-003 Class A Notice—Avis NMB-003, Classe A

This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numerique de la classe A est conforme à la norme NMB-003 du Canada.

13.4 CE Notices (European Union), Class A ITE

Marking by the symbol indicates compliance of this system to the applicable Council Directives of the European Union, including the Electromagnetic Compatibility Directive (2004/108/EC) and the Low Voltage Directive (2006/95/EC). A "Declaration of Conformity" in accordance with the applicable directives has been made and is on file at HGST Europe.

13.5 Europe (CE Declaration of Conformity)

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the interference-causing equipment standard entitled "Digital Apparatus," ICES-003 of the Canadian Department of Communications.

Cet appareil numérique respecte les limites bruits radioélectriques applicables aux appareils numériques de Classe A prescrites dans la norme sur le matériel brouilleur: "Appareils Numériques", NMB-003 édictée par le Ministre Canadian des Communications.

13.6 Japanese Compliance Statement, Class A ITE

The following Japanese compliance statement pertains to VCCI EMI regulations:

この装置は、クラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。 VCCI－A

English translation:

This is a Class A product based on the Technical Requirement of the Voluntary Control Council for Interference by Information Technology (VCCI). In a domestic environment, this product may cause radio interference, in which case the user may be required to take corrective actions.

13.7 Taiwan Warning Label Statement, Class A ITE

警告使用者:

此為甲類資訊技術設備，於居住環境中使用時，

可能會造成射頻擾動，在此種情況下，使用者會

被要求採取某些適當的對策。

English translation:

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take adequate measures.

13.8 KCC Notice (Republic of Korea Only), Class A ITE

기 종 별	사 용 자 안 내 문
A급 기기 (업무용 정보통신기기)	이 기기는 업무용으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며 만약 잘못 판매 또는 구입하였을 때에는 가정용으로 교환하시기 바랍니다.

English translation:

Please note that this device has been approved for business purposes with regard to electromagnetic interference. If you find that this device is not suitable for your use, you may exchange it for a non-business device.

4U60 Storage Enclosure Glossary

A

AC	**Alternating Current**
ACMA	**Australian Communications and Media Authority**

Top of A | Top of Glossary

B

BIOS	**Basic Input/Output System**
BIS	**Business Information System**
BIST	**Built-In Self-Test**
BMC	**Baseboard Management Controller**
BOM	**Bill of Materials**
BSMI	**Bureau of Standards, Metrology and Inspection**

Top of B | Top of Glossary

C

CDB	**Computer Data Bus**
CLI	**Command Line Interface**
CS	**Climate Saver**

Top of C | Top of Glossary

D

DC	**Direct Current**
DL	**Device Server or Device** 4U60 Storage Enclosure controller serving the virtual disk LUNs. It is not referring to the HDD however the HDD may perform some of the functions on its behalf.

Top of D | Top of Glossary

E

EC	**Engineering Change**
EEPROM	**Electrically Erasable Programmable Read-Only Memory**
EMC	Electromagnetic Compatibility
EMI	**Electromagnetic Interference**
ESD	**Electrostatic Discharge**
EVPD	**Enable Vital Product Data**

Top of E | Top of Glossary

F

FCC	**Federal Communications Commission**
FRU	**Field Replaceable Unit**
FW	**Firmware**

Top of F | Top of Glossary

G

GBE	**Gigabit Ethernet**
GPIO	**General-Purpose Input/Output**
GUI	**Graphical User Interface**

Top of G | Top of Glossary

H

HD	**Hard Drive**
HDD	**Hard Disk Drive**

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I

ICT	**In-circuit Test**
IEC	**International Electrotechnical Commission**
I/O	**Input/Output**
IOC	**Input/Output Controller**
IOM	**I/O Module**
IPMI	**Intelligent Platform Management Interface**

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J

JBOD	**Just a Bunch of Disks**

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L

LED	**Light-Emitting Diode**
LPC	**Low Pin Count**

LPH	**Low Profile Hybrid**
LUN	**Logical Unit Number**

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M

MAC	**Media Access Control**
miniSAS	**Mini Statistical Analysis System**

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O

OS	**Operating System**
OUI	**Organizationally Unique Identifier**

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P

PCB	**Printed Circuit Boards**
PCI	**Peripheral Component Interconnect**
PDB	**Power Distribution Board**
PDU	**Power Distribution Unit**
PMBus	**Power Management Bus**
POST	**Power On Self Test**
PSU	**Power Supply Unit**
PHY	**Physical Layer**
PWM	**Pulse-Width Modulation**
PWR	**Power**

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R

ROC	**Recovery Oriented Computing**
RTC	**Real Time Clock**

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S

SAS	**Serial Attached SCSI**
SATA	**Serial Advanced Technology Attachment**

SBB	**Storage Bridge Bay**
SCSI	**Small Computer System Interface**
SDK	**Software Development Kit**
SEP	**SCSI Enclosure Processor**
SES	**SCSI Enclosure Services**
SMART	**Self-Monitoring, Analysis and Reporting Technology**
SMP	**Server Message Block**
SMB	**Server Message Block**
SPI	**Serial Peripheral Interface**
SSP	**Serial SCSI Protocol**

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T

TCA	**Telecommunications Computing Architecture**

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U

UART	**Universal Asynchronous Receiver/Transmitter**

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V

VBOD	**Virtualized Bunch of Disks**
VD	**Virtual Disk** A Virtual Disk is utilized for storing user data. There is a 1-to-1 relationship between the Virtual Disk and the Physical Disk presented by the 4U60 Storage Enclosure controller
VPD	**Vital Product Data** The serial number and identification that is stored persistently by the controller.

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W

WOL	**Wake On LAN**
WOS	**Wake On SAS**

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X

XDP **XML Data Package**

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