IceBreaker 4960J

High-density HPC server solution for large storage demands

Technical Guide
Rev. 1.0

PENGUIN COMPUTING

IceBreaker 4960J
Bulk Storage User's Guide

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Preface

About this Document

This document is intended for system administrators, Penguin Computing representatives, and Penguin Computing authorized service providers who install, configure, and operate the IceBreaker 4960J system.

Contacts

If you have difficulty with any of the procedures included in this manual, see Appendix C, *Contact Us*.

Document Conventions

Convention	Description
	Indicates injury or death is possible if the instructions are not obeyed.
	Indicates risk of electric shock or damage to equipment caused by Electrostatic discharge (ESD).
	Indicates that damage to equipment is possible.
Note:	Provides more information, usually in a procedure.
Bold	Indicates text on equipment. Example: **LEFT**, **RIGHT**, **L**, **R**.
Italic	Indicates a variable, which is a placeholder for actual text the user or system provides. Example: For the latest information and updates please refer to www.penguincomputing.com
Underlined italic, blue	Hyperlink either to location in this document or external website.

Compliance Information

Potential for Radio Frequency Interference (RFI)

USA Federal Communications Commission (FCC)

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 not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at the user's own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. The supplier is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

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, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Restriction of Hazardous Substances (RoHS) Compliance

The product shall comply with all RoHS, Waste Electrical and Electronic Equipment (WEEE), and Registration, Evaluation, Authorization and Restriction of CHemicals (REACH) requirements.

Regulatory Certifications

This product is designed to meet Canadian Standards Association (CSA) standards.

Regulatory Specifications

This product is designed to meet Underwriter Laboratories (UL) and CSA specifications.

Regulations

European Regulations

This equipment is designed to comply with European Regulations EN 55022 Class A: Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipments and EN50082-1: Generic Immunity.

Canadian Regulations

This product is designed to comply with:

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

Revision History

Version Number	Date	Revisions Made in this Version
00.01		Initial release draft outline.
00.08	04 Aug 2014	Added comments from group review.
00.09	05 Aug 2014	Added hyperlinks, made other format corrections.
00.10	06 Aug 2014	Added specs and features.
00.11	06 Aug 2014	Added content to acronyms table. Minor format corrections.
00.12	07 Aug 2014	Minor edits to specs and features.
00.13	07 Aug 2014	Added sample figures. Minor format corrections.
00.14	08 Aug 2014	Added rack installation, HRR carrier R&R, canister R&R instructions.
00.15	08 Aug 2014	Added formatting for instructions and figures. Deleted duplicate compliance section (Appendix C).
00.16	11 Aug 2014	Added comments from group review.
00.17	11 Aug 2014	Added captions to all figures. General format corrections.
00.18	12 Aug 2014	Comments for minor edits.
00.19	12 Aug 2014	Minor edits to format and figure titles.
00.20	12 Aug 2014	Removed references to Jabil brand name.
00.21	20 Aug 2014	Added equipment photos.
00.22	20 Aug 2014	Format corrections. Removed resolved comments. Added xrefs for figures and tables.
00.23	21 Aug 2014	
00.24	22 Aug 2014	Added to legal statements.
00.25	25 Aug 2014	Format corrections. Added pointers to figures. Added index.
00.26	04 Sep 2014	Format corrections. Incorporated redlines. Added xrefs to figures.
00.27	07 Sep 2014	Format corrections. Incorporated redlines. Added photos. Updated acronyms, glossary, and index.
00.28	08 Sep 2014	Format corrections. Incorporated redlines. Added photos. Submitted to Manish and Justin as 90% completion status
00.29	10 Sep 2014	Doc corrections and updates to procedures and figures.
00.30	14 Sep 2011	Format corrections. Incorporated redlines. Updated acronyms, glossary, and index.
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00.32	20 Sep 2014	Format corrections. Added photos. Incorporated redlines.

Version Number	Date	Revisions Made in this Version
00.33	24 Sep 2014	Updates made during engineering review. Added new photos.
00.34	30 Sep 2014	Format corrections. Incorporated redlines. Added C&I figures and tables.
00.35	02 Oct 2014	Updates made during and after engineering review. Added updated photos.
00.36	13 Oct 2014	Updates made after engineering walkthrough. Added updated photos.
00.37	20 Oct 2014	Incorporated redlines. Updated and added new photos. Fixed broken links.
00.38	27 Oct 2014	Incorporated redlines. Added arrows and labels in figures.
00.39	29 Oct 2014	Incorporated comments.
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00.41	04 Nov 2014	Updated acronyms throughout doc, updated list and glossary.
00.42	05 Nov 2014	Brian comments to PDF.
00.43	06 Nov 2014	Incorporated comments, updated index.
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00.45	11 Nov 2014	Brian comments to PDF.
00.46	14 Nov 2014	Incorporated comments.
00.47	14 Nov 2014	Final edits.
01.00	TBD	Initial Release

Reference Documents

American National Standard for Information Technology Serial Attached Small Computer System Interface (SCSI)-3 (SAS-3) T10/BSR INCITS 519 Revision 06, 7 November 2013

Safety Measures

The IceBreaker 4960J MUST be grounded before applying power. Unplug the unit before moving it and/or if it has become damaged in any way. Failure to comply could cause equipment damage, personal injury, or death.

To maintain proper airflow through the system, operate the system with the enclosure top cover closed. Failure to comply could cause equipment damage.

ESD can damage disk drives, boards, and other parts. If possible, perform procedures at an ESD workstation. If that is not possible, provide ESD protection by wearing an antistatic wrist strap attached to chassis. Ground any unpainted metal surface on the server when handling parts. Failure to comply could cause equipment damage.

Contents

Figures

Tables

1. Introduction

1.1 System Overview

IceBreaker 4960J is a rack-mountable, four-unit (4U) High Density Storage System (HDSS) that contains sixty (60) 3.5" hard drive slots. The 4960J Bezel is depicted in *Figure 1* and *Figure 2*. The rear view is shown in *Figure 3*.

Figure 1. **IceBreaker 4960J Bezel Front View**

Figure 2. **IceBreaker 4960J Bezel Detailed Front View**

1.1.1 Features

As depicted in *Figure 3*, IceBreaker 4960J 4U has slots for the following:

Two redundant Storage Bridge Bay (SBB) Canisters

- Four (4) redundant N + 2 950 W Power Supply Units (PSUs)
- Two hot-swappable N + 1 redundant Fan Expansion Modules (FEMs) that are Field Replaceable Units (FRUs)

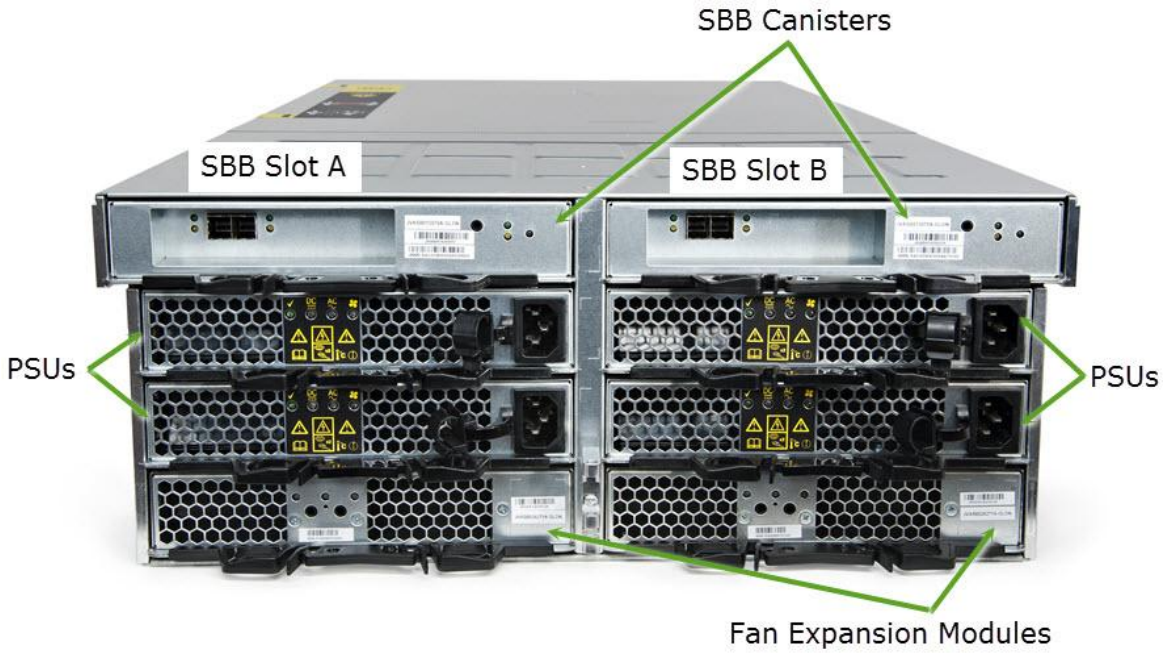

Figure 3. **IceBreaker 4960J Rear View**

IceBreaker 4960J 4U supports attachments of the industry standard Serial Attached Small Computer System Interface (SCSI) (SAS)-3 (SAS-3) Hard Disk Drives (HDDs), connected through the midplane and drive baseboard to the 12 gigabit SAS SBB Controllers. IceBreaker 4960J is SBB 2.0 and SAS-3 compliant. The controller slots, midplane, and PSUs support SBB 2.1.

IceBreaker 4960J 4U enclosure chassis contains:

- Mounting ears
- Drive Activity Panel (DAP)
- Operator Display Panel (ODP)

IceBreaker 4960J 4U includes the following accompanying parts:

- Enclosure chassis with HDD bay (*Figure 4*)
- Mounting rails (*Figure 5*)
- Cable Management Assembly (CMA) (*Figure 6*)
- Sixty (60) drive carrier assemblies capable of handling sixty (60) Large Form Factor (LFF) (3.5") drives
- Rack-mounting screws in a bag
- Velcro straps
- May include other customer-requested items as per the packing list; e.g., power cords or cables, and/or drive carriers

Figure 4. **Enclosure Chassis Showing Hard Disk Drive (HDD) Array**

Figure 5. **IceBreaker 4960J Mounting Rails**

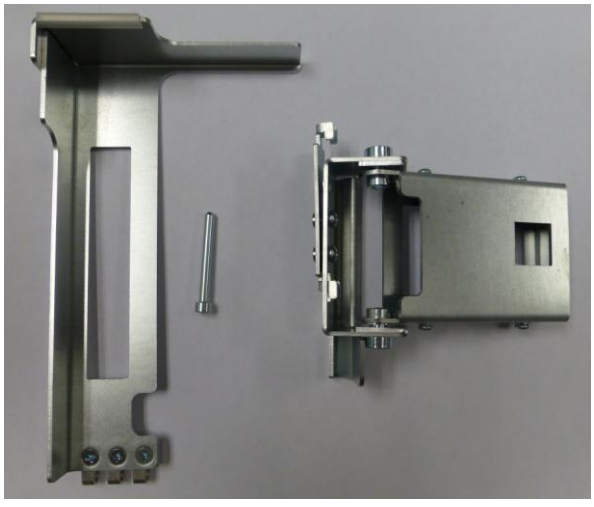

Figure 6. **CMA**

1.1.2 Specifications

Table 1. IceBreaker 4960J Specifications

Materials	Steel, Electrogalvanized, Cold-rolled, Coil (SECC) steel, RoHS compliant
Color	Steel, non-painted main chassis
Cover/Lid	Tool-less removal top cover
Cooling	Two (2) hot-swappable N + 1 FEMs that are FRUs, two (2) blowers per FEM, two (2) blowers in each PSU
SBB Canisters	Two (2) SBB 2.1 standard compliant canisters, 12 gigabit capable, hot-pluggable FRUs
PSUs	Four (4) 2N redundant, 1U hot-swappable, semicustom PSUs, 950 W each
Disk Cage	Sixty (60) drive slots, capable of handling 60 LFF (3.5”) drives.
SMILE	0.3 mm (bowing when installed in rack)
Midplane	Passive midplane Removable from the chassis top after removing rear cover
Ears	Bezel may attach to ears

1.1.3 Unit Dimensions

- IceBreaker 4960J: 6.9” (4U) x 17.6” x 35”

1.1.4 Unit Weight

- IceBreaker 4960J: Weight does not exceed 200 lbs (90.7 kg)

1.1.5 Environmental

Table 2. IceBreaker 4960J Environmental Parameters

Temperature & Humidity		
Operating	5 °C to 40 °C	20 – 80% Non-condensing
Non Operating	0 °C to 70 °C	8 – 80% Non-condensing
Storage	1 °C to 60 °C	5 – 80% Non-condensing
Shipping	-40 °C to 60 °C	5 – 100% Non-condensing, no precipitation
Nominal Operating	20 °C	
Elevated Operational	40 °C	
Altitude		
Operating	0 – 3050 m (0 – 10000 ft)	
Non Operating	-305 – 12192 m (-1000 – 40000 ft)	

2. Installation

2.1 Safety

To avoid serious injury or equipment damage, adhere to the following safeguards:

Use proper equipment to transport the IceBreaker 4960J system to installation location.

Have at least two (2) people lift the IceBreaker 4960J system out of the packing crate.

Wear shoes with no toe openings to avoid being injured by falling tools or equipment.


Avoid touching circuit boards, module connectors, or electrical components; ESD discharges can damage the system.

2.2 Installation Overview

Note: Drives, canisters, and PSUs are removable (see *Paragraph 4.3*), which reduces weight prior to installation.

IceBreaker 4960J installation consists of performing the following:

- Unpacking the unit (*Paragraph 2.2.1*)
- Installing IceBreaker 4960J mounting rails (*Paragraph 2.2.2*)
- Installing unit into rack (*Paragraph 2.2.3*)
- Installing CMA (*Paragraph 2.2.4*)
- Installing disk drives into drive carriers (*Paragraph 2.2.5*)
- Installing IceBreaker 4960J disk drives (*Paragraph 2.2.6*)

2.2.1 Unpacking the Unit

Keep unit enclosed in anti-static wrap until at installation location. Failure to comply could cause equipment damage.

1. Inspect package and unit for signs of damage.

2. Verify contents of box against packing list. The IceBreaker 4960J package should include:
   - Packing list
   - IceBreaker 4960J enclosure (*Figure 1* and *Figure 2*), wrapped in anti-static bag
   - IceBreaker 4960J mounting rails (*Figure 5*)
   - CMA (*Figure 6*)
   - Disk-drive mounting screws in a bag
   - Disk-drive carriers, in the drive, in a package included with the IceBreaker 4960J unit
   - May include other customer-requested items as per the packing list; e.g., power cords, cables, and/or HDD carriers
   - Compact Disk (CD) containing installation instructions
   - List of SAS addresses for the unit

2.2.2 Installing Mounting Rails in Rack

Note: Right-side and left-side mounts are engraved with **RIGHT** and **LEFT**, respectively, on their metal frames (*Figure 5*) to enable correct installation. When viewing rack from the front, the left-side rail mount should be installed on the left side of rack and the right-side rail mount should be installed on right side of rack.

1. At the front of the rack, perform the following steps to install the front side of the left-side or right-side rack mount:
   i. Select rack height for unit insertion.
   ii. Line up rack mount in rack.

iii. Drop metal tabs over rack holes (*Figure 7*).

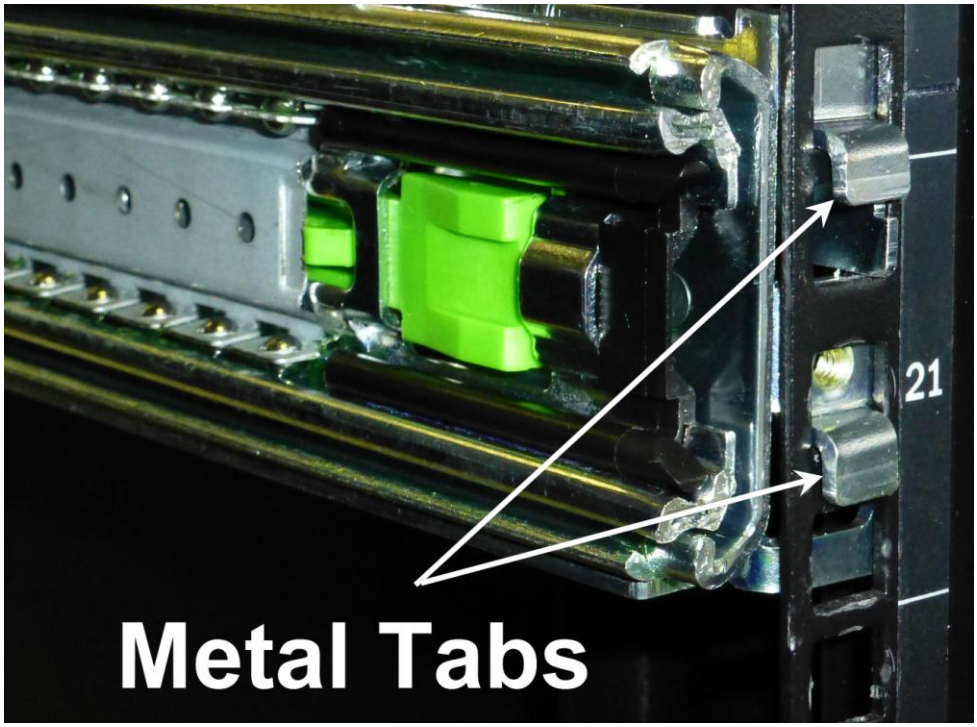

Figure 7. **Metal Tabs**

iv. Ensure locking tab clicks into place (*Figure 8*).

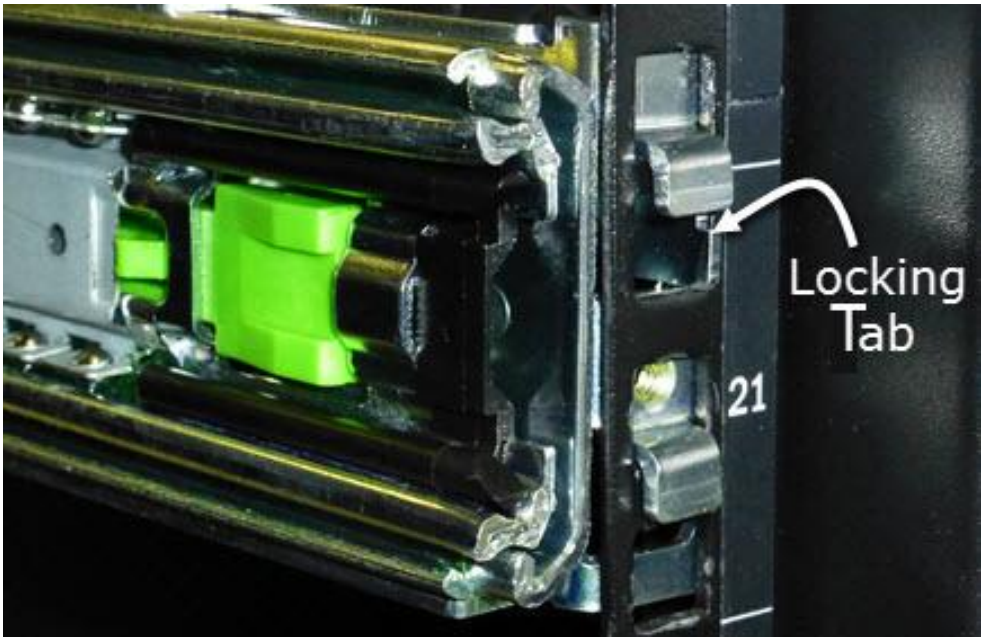

Figure 8. **Rack Mount Locking Tab**

v. Tighten screw using square washer that is provided in accessory kit (*Figure 9*).

Figure 9. **Tightening Rack Mounting Rail Screw**

2. Repeat *Steps i* – *v* for other side of rack.
3. Repeat *Step 1* for the rear of the rack.

2.2.3 Installing Unit into Rack

Perform the following steps to install IceBreaker 4960J 4U into a rack:

Note: The nut bars secure the IceBreaker 4960J system to the rack.

Note: Right-side and left-side nut bars are engraved with **R** and **L**, respectively, on their upper guide pins (*Figure 10*) to enable correct installation. When viewing rack from the front, the left-side nut bar should be installed on the left side of rack and the right-side nut bar should be installed on right side of rack.

1. For either the left-side or right-side nut bar, mount one (1) of the two (2) nut bars (*Figure 10*) into rack directly above the mounting rail (*Figure 11*) using mounting screw with washer to attach to the rack.

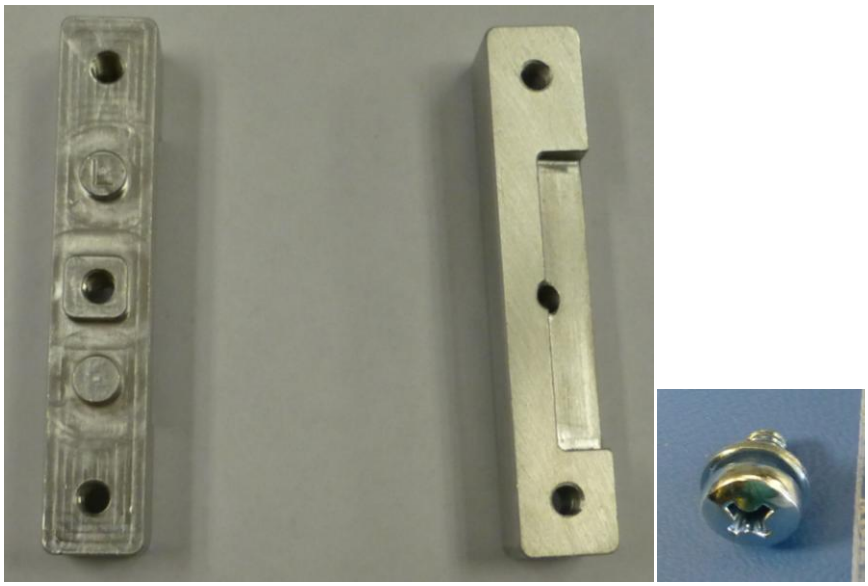

Figure 10. **Nut Bars and Mounting Screw with Washer**

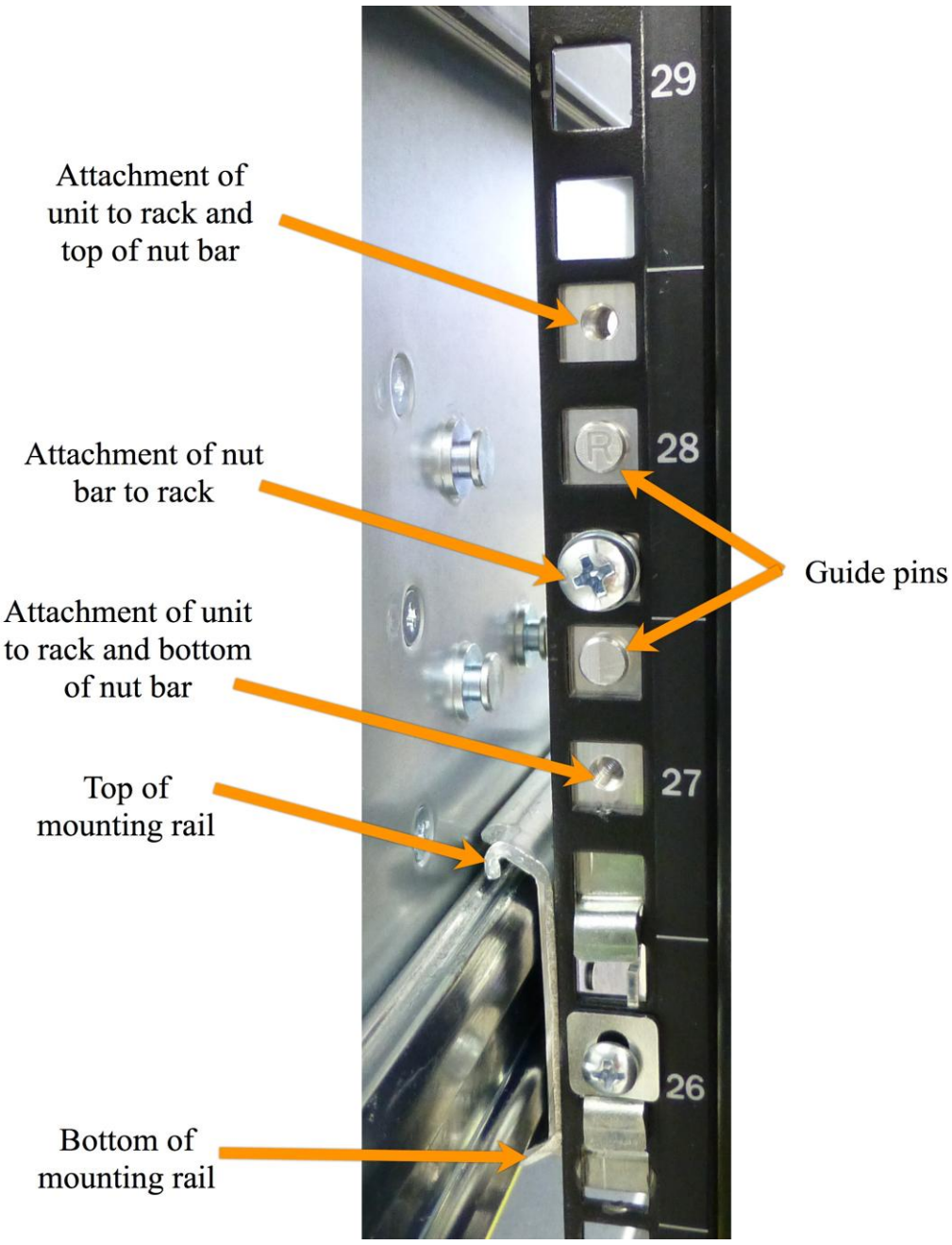

Figure 11. **Nut Bar on Rack**

2. Ensure slide rails are seated in chassis as shown in *Figure 12*.

Warning CAUTION	Ensure middle slider and ball retainer are in correct position (*Figure 12*). Failure to comply may result in personal injury or equipment damage.

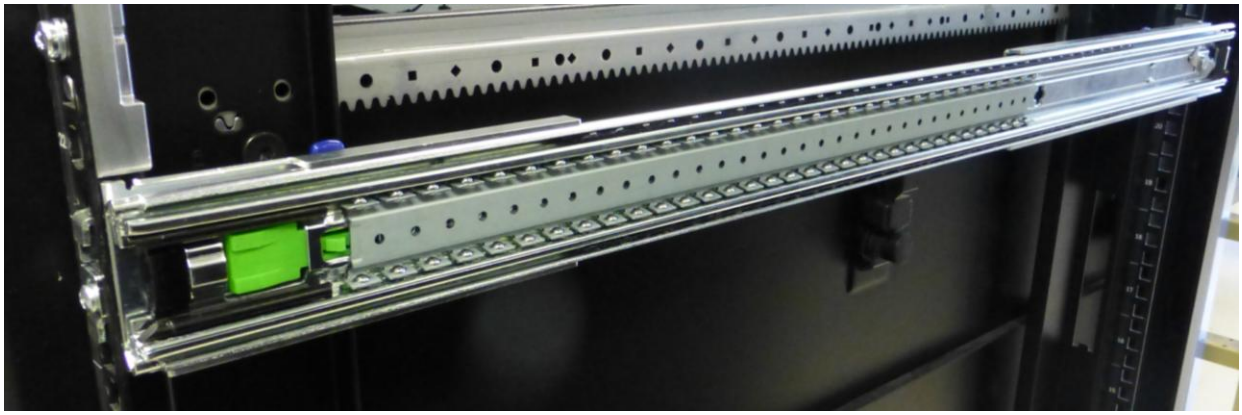

Figure 12. **Rails Pushed into Rack for Chassis Installation**

3. If slide rail extends out of rack, use locking release mechanism (*Figure 13*) to push slide into rack.

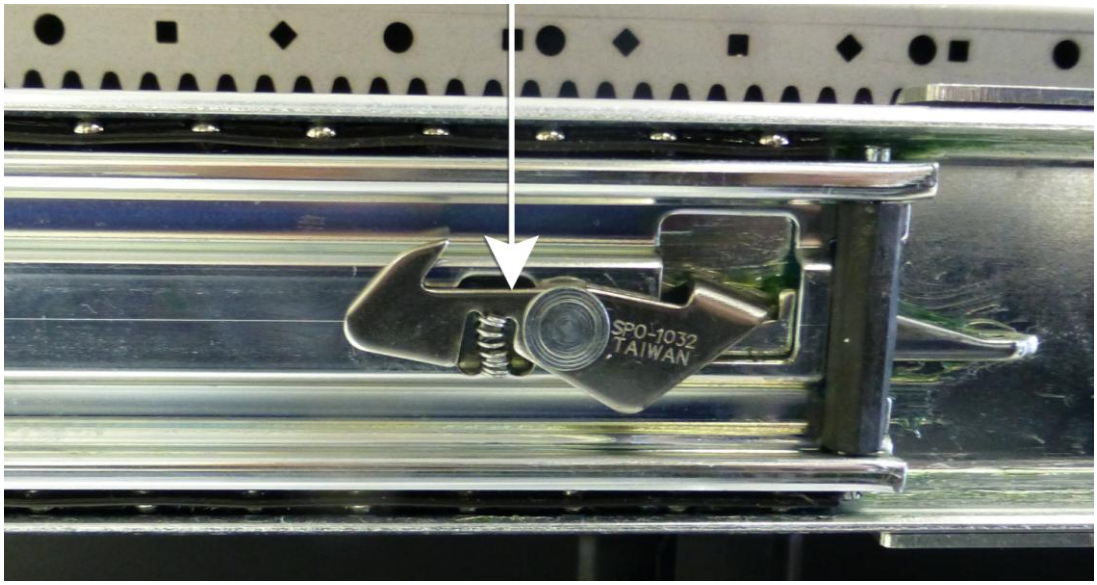

Figure 13. **Middle Slider Locking Release**

Note: The IceBreaker 4960J system is preinstalled with canisters and PSUs.

Recommendation: Remove all canisters and PSUs (see *Paragraphs 4.3.2* and *4.3.3*) prior to installing IceBreaker 4960J chassis into rack

4. Slide IceBreaker 4960J chassis rail into middle rack-mounted rail (*Figure 14*).

Figure 14. **Sliding IceBreaker 4960J Chassis Rail into Middle Rack-Mounted Rail**

5. Push IceBreaker 4960J chassis all the way into the rack until it stops against chassis ears.
6. Push the IceBreaker 4960J chassis latch handle to the lock condition (*Figure 15*).

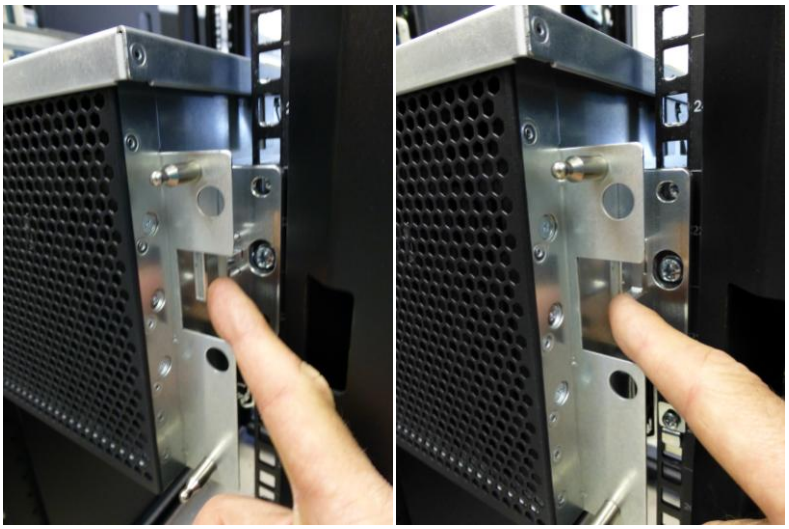

Figure 15. **Pushing IceBreaker 4960J Chassis Latch to the Lock Position**

7. (Optional) At the front of the rack, bolt the IceBreaker 4960J chassis to the rack as follows:

Note: Use of a magnetic screwdriver is helpful for the following steps.

i. Mount either the left or right side of IceBreaker 4960J chassis using two pan screws provided in accessory kit and screw into nut bar (*Figure 16*).

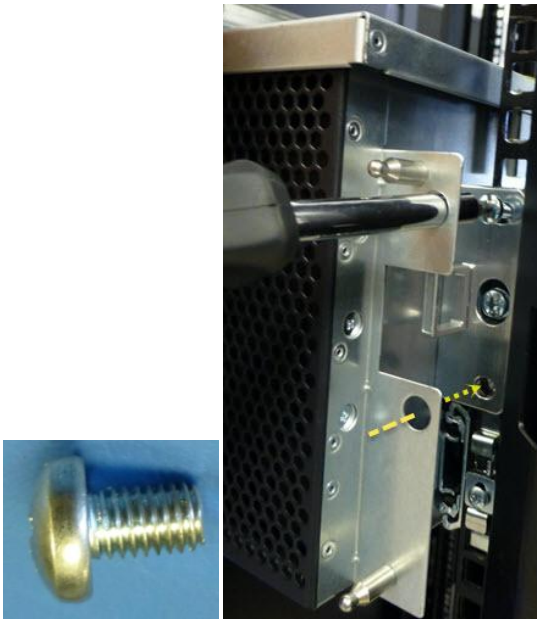

Figure 16. **Mounting Chassis using Pan Screws**

ii. Repeat for other side of IceBreaker 4960J chassis.

2.2.4 Installing the CMA

1. Position CMA mounting bracket at rear of left-side rack mount (*Figure 17*).

Figure 17. **CMA Mounting Bracket Position**

2. Hold CMA bracket on rack (*Figure 18*).

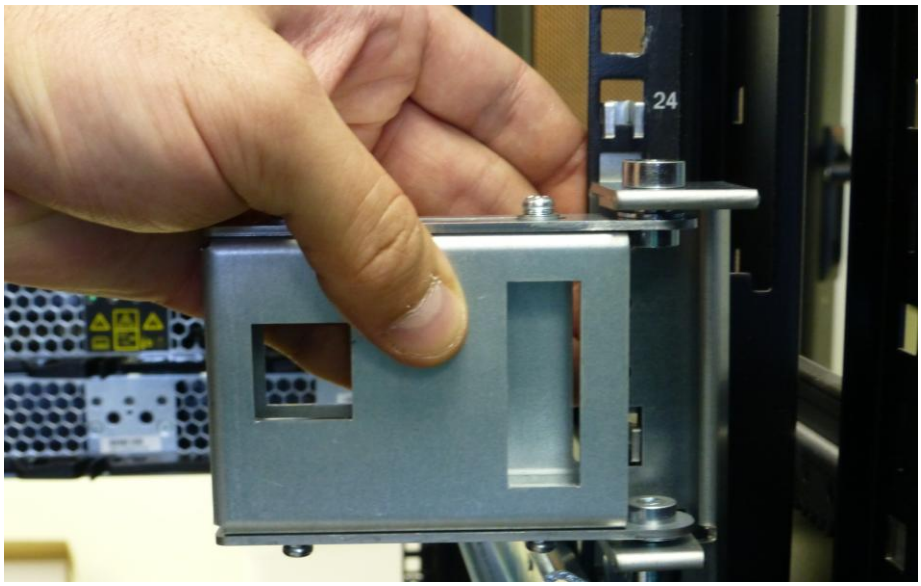

Figure 18. **Holding CMA Mounting Bracket on Rack**

3. Tighten the two screws that are attached to the CMA mounting bracket (*Figure 19*).

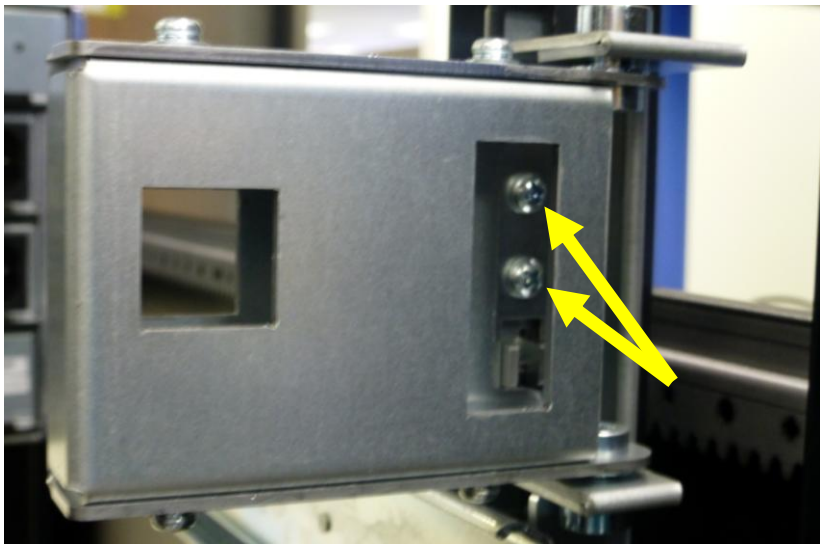

Figure 19. **Attaching CMA Mounting Bracket**

4. Put CMA arm on CMA hinge located on IceBreaker 4960J chassis (*Figure 20*).

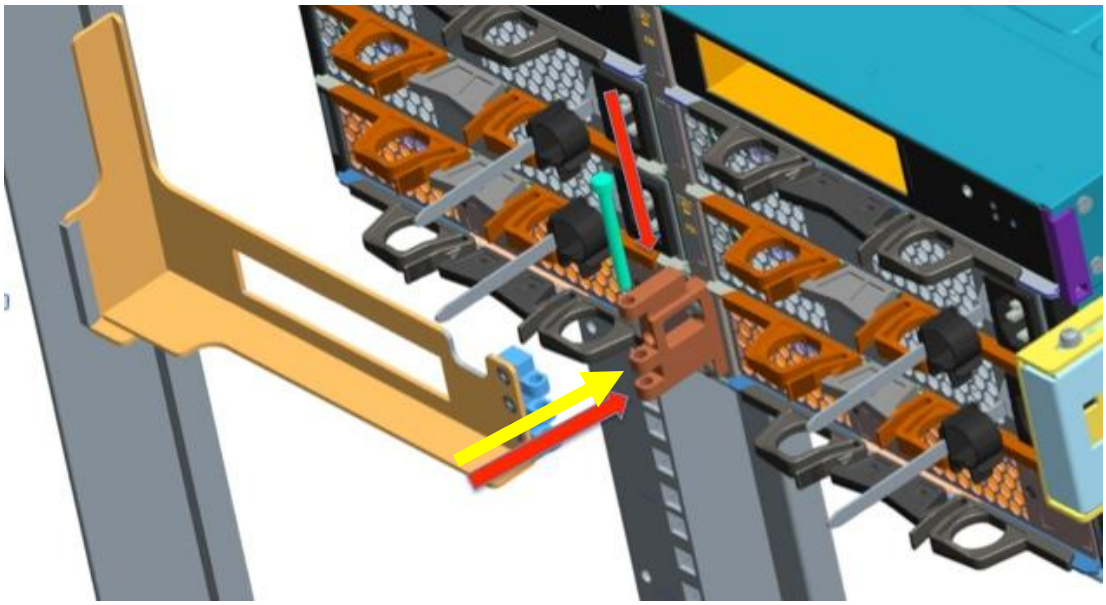

Figure 20. **Putting CMA Arm on CMA Hinge**

5. Mount the CMA arm using pin provided in accessory kit.
6. Add the Velcro strips after cable routing to hold the cables together (*Figure 21*).

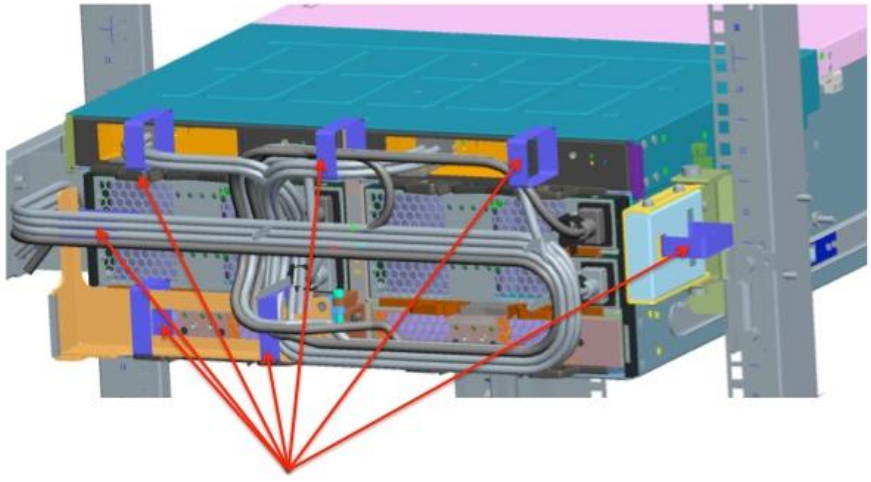

Figure 21. **Attaching Velcro Strips (Shown in Blue) to CMA**

2.2.5 Installing IceBreaker 4960J Disk Drives into Drive Carriers

1. Slide IceBreaker 4960J unit out of rack but leave attached to rack mounts (*Figure 22*).

Figure 22. **Sliding IceBreaker 4960J Unit Out of Rack**

2. Open disk drive bay door using release mechanisms on side of enclosure (*Figure 23*).

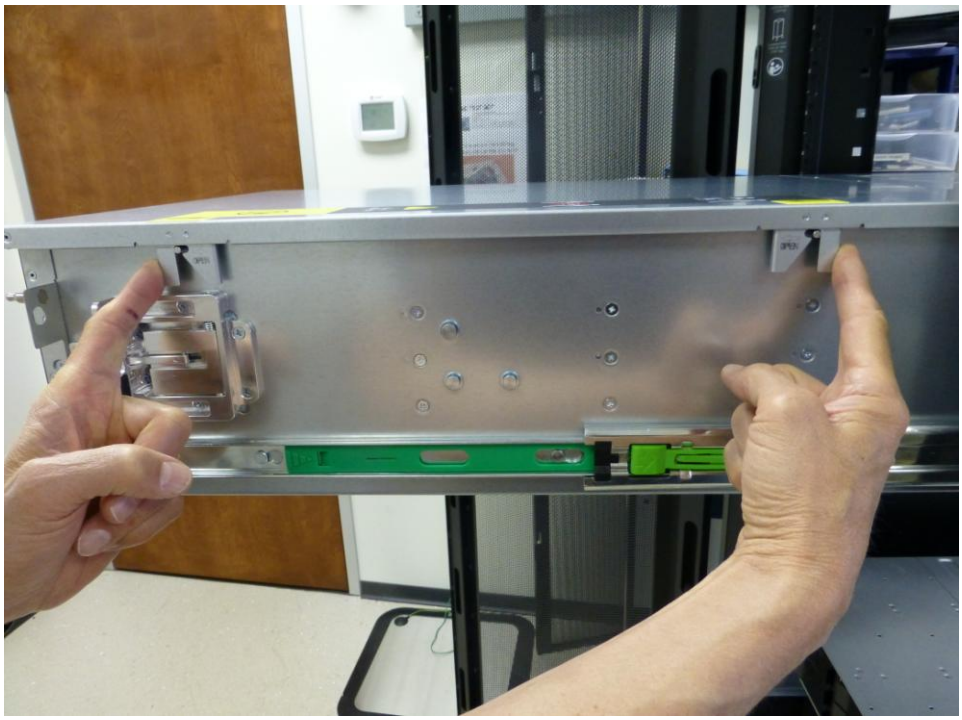

Figure 23. **Opening Disk Drive Bay Door**

3. For each of the IceBreaker 4960J disk drives, install HDD into an empty carrier (*Figure 24*).

Figure 24. **Empty Disk Drive Carrier**

i. Place disk drive in empty carrier (*Figure 25*).

Figure 25. **Disk Drive in Carrier**

ii. Secure disk drive in carrier using four (4) screws provided in accessory kit (*Figure 26*).

Figure 26. **Disk Drive Installed in Carrier**

iii. Ensure drive carrier screws are flush with carrier frame to allow correct installation into drive slot.

2.2.6 Installing IceBreaker 4960J HDD Carrier into Cage Slot

1. Place HDD carrier into HDD cage slot (*Figure 27*).

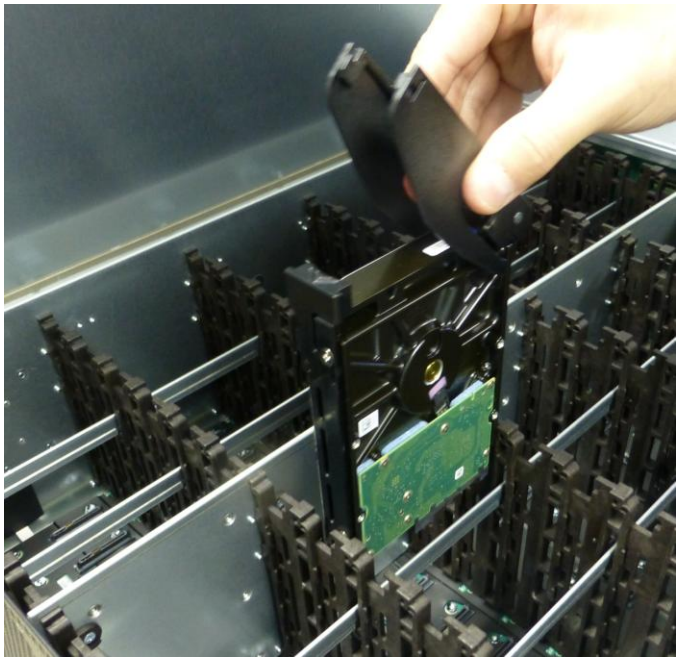

Figure 27. **Placing HDD Carrier into HDD Cage Slot**

2. Close HDD carrier handle (*Figure 28*).

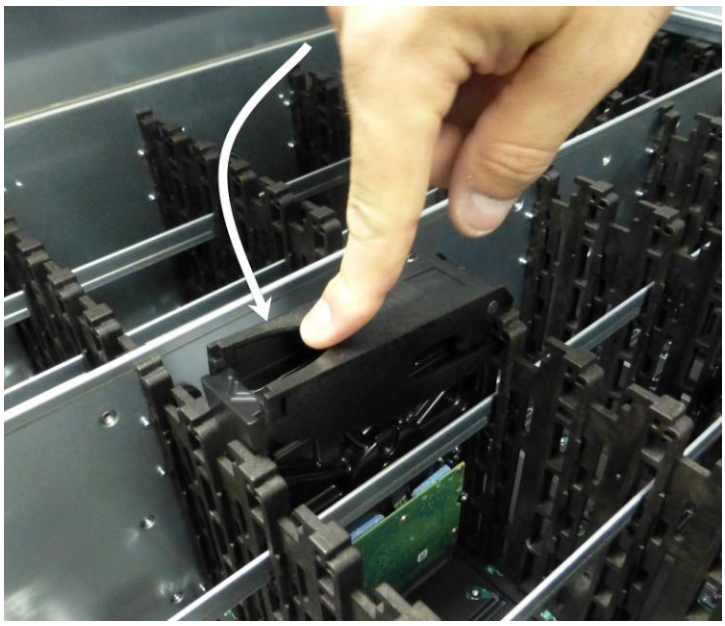

Figure 28. **Closed HDD Carrier Handle**

3. System Configuration

3.1 Network Hardware Connections Setup

The IceBreaker 4960J system connects to a server through a 12/6 Gb SAS Host Bus Adapter (HBA) as shown in *Figure 29* .

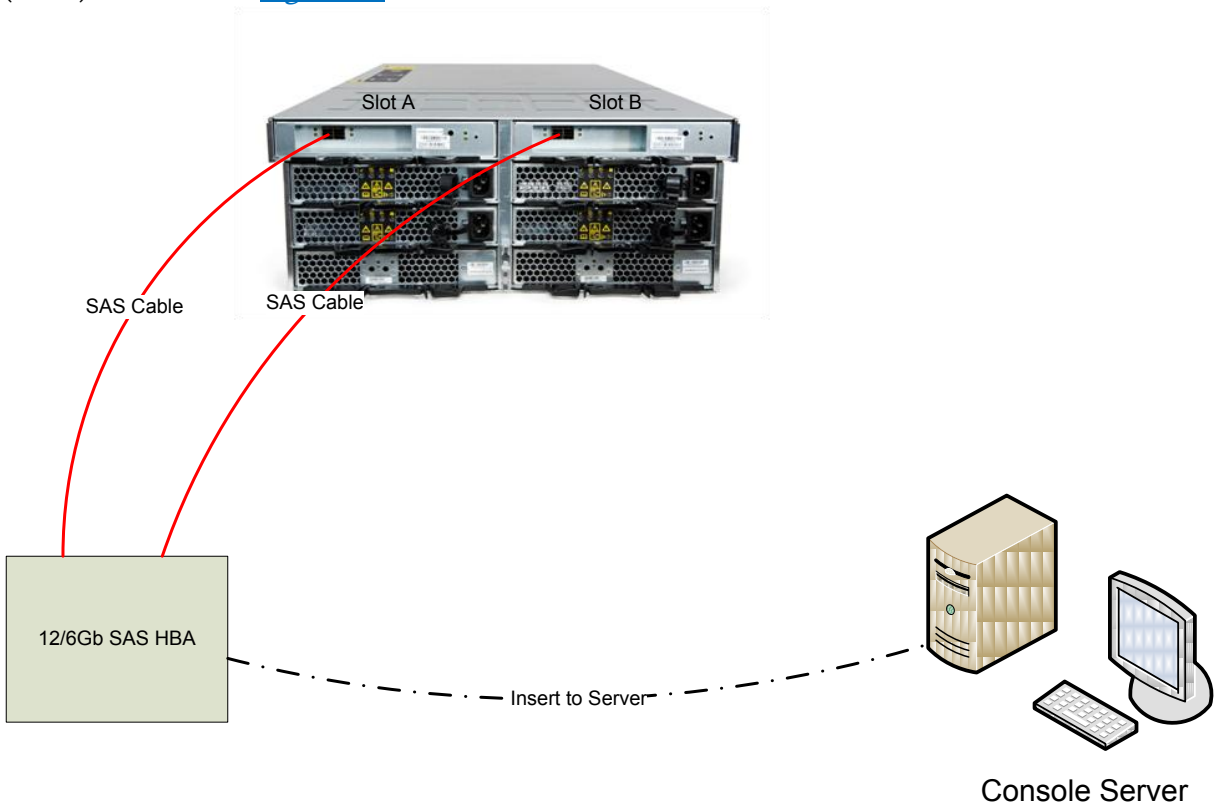

Figure 29. **Connecting to a Server**

Figure 30 shows the connections for a multiple system network.

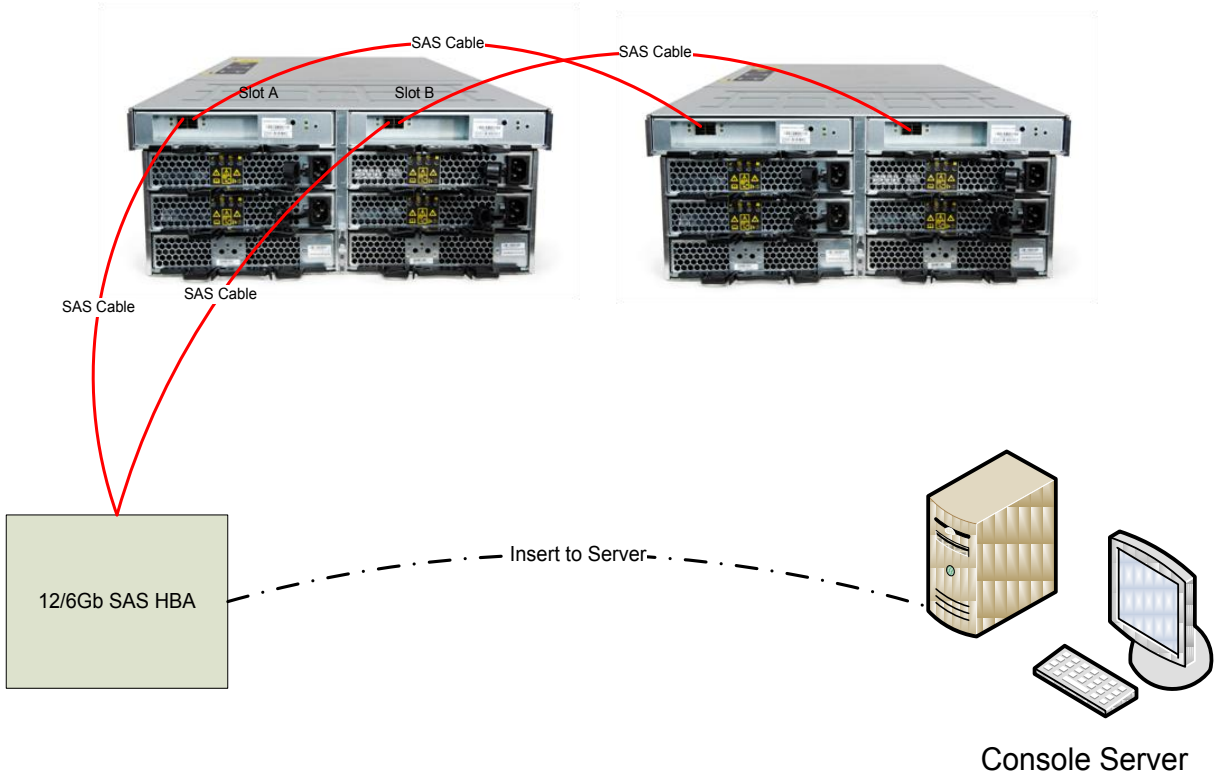

Figure 30. **IceBreaker 4960J Multiple System Network**

Connect the HBA to the left port of IceBreaker 4960J Slot A, and then connect the right port of Slot A to the left port (Slot A) of the next cascaded system, and likewise for Slot B, as depicted in (*Figure 30*).

3.2 Software Connections

A list of SAS addresses should be provided with the IceBreaker 4960J unit. Please call the Penguin Computing technical support team at 1-888-736-4846 if they are not included with the system.

4. Operation and Maintenance (O&M)

4.1 Controls and Indicators (C&I)

4.1.1 IceBreaker 4960J 4U Bezel C&I

Figure 31. **IceBreaker 4960J 4U Bezel C&I**

Table 3. IceBreaker 4960J 4U Bezel C&I

#	Item	Description
1	ODP	Provides system status (see *Paragraph 4.1.2*)
2	DAP	Sixty (60) Light Emitting Diodes (LEDs) that indicate which disks are active in the HDD enclosure array

4.1.2 ODP C&I

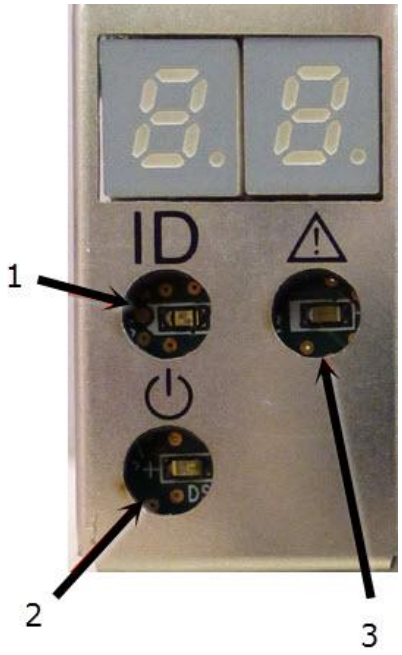

Figure 32. **ODP C&I**

Table 4. ODP C&I

#	Item	Description
1	Blue LED	Enclosure ID light
2	Green LED	Lights to indicate power is on
3	Amber LED	Lights to indicate enclosure fault

4.1.3 SBB Canister C&I

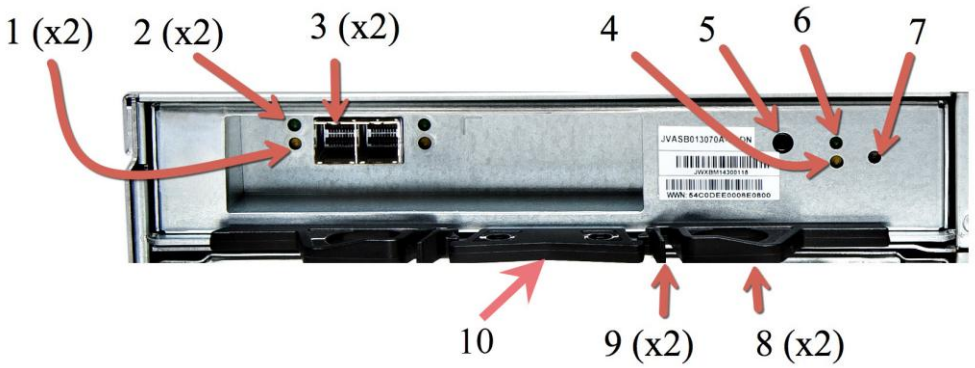

Figure 33. **SBB C&I**

Table 5. SBB C&I

#	Item	Description
1	Amber LED	Lights to indicate SAS connector fault
2	Green LED	Lights to indicate SAS connector system is ready
3	Enclosure jack	MiniSAS HD connection
4	Amber LED	Lights to indicate system fault
5	Audio jack	Server connection point
6	Green LED	Lights to indicate canister power is on
7	Blue LED	Lights to indicate canister ID
8	Locking tab pull ring	Enables canister removal
9	Locking tab	Secures unit in chassis
10	Handle	Provides means to slide unit out from chassis

Note: IceBreaker 4960J has a power-saving feature called Wake on SAS (WoS), which turns off power to the unit when the SBB canisters are not in use. When the canisters are activated, the unit powers up.

4.1.4 PSU C&I

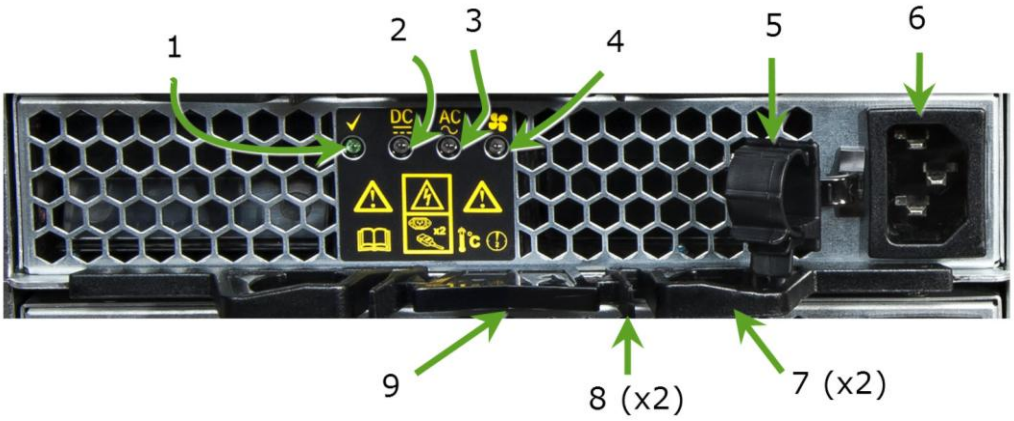

Figure 34. **PSU C&I**

Table 6. PSU C&I

#	Item	Description
1	Green LED	Lights to indicate system is powered on
2	Amber LED	Lights to indicate DC power failure
3	Amber LED	Lights to indicate AC power failure
4	Amber LED	Lights to indicate fan failure
5	Power cord strain relief	Relieves weight of power cords
6	Male power socket	Connection for AC input
7	Locking tab pull ring	Enables canister removal
8	Locking tab	Secures unit in chassis
9	Handle	Provides means to slide unit out from chassis

4.1.5 FEM C&I

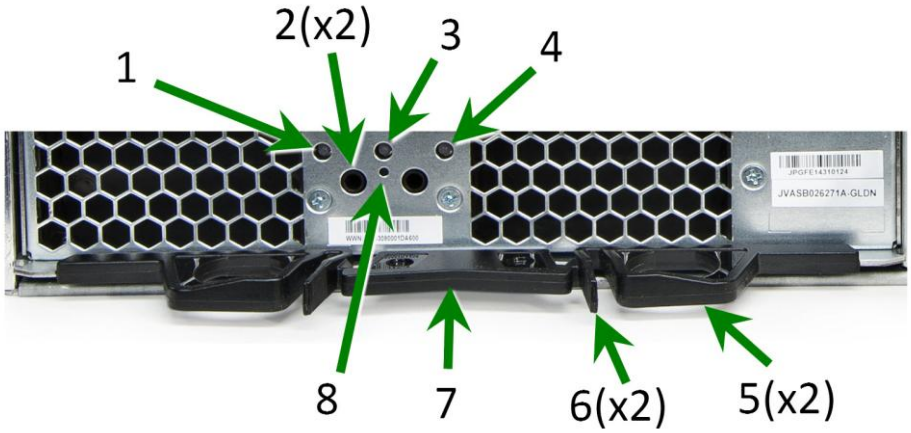

Figure 35. **FEM C&I**

Table 7. FEM C&I

#	Item	Description
1	Green LED	Lights to indicate power is on
2	Audio jack	Server connection point
3	Amber LED	Lights to indicate a fault
4	Blue LED	Lights to indicate enclosure ID
5	Locking tab pull ring	Enables canister removal
6	Locking tab	Secures unit in chassis
7	Handle	Provides means to slide unit out from chassis
8	Pinhole	Not used

4.2 PSU Power Up/Power Down

Note: IceBreaker 4960J has no on/off switch. When deployed in a rack, use the rack-based Power Distribution Assembly (PDA) to turn power to the box on and off. If the IceBreaker 4960J unit is not in a rack, use a power bar with an on/off switch to operate the system.

Note: The IceBreaker 4960J system can operate with only two PSUs powered. The power cords should be attached to at least two PSUs (*Figure 36*).

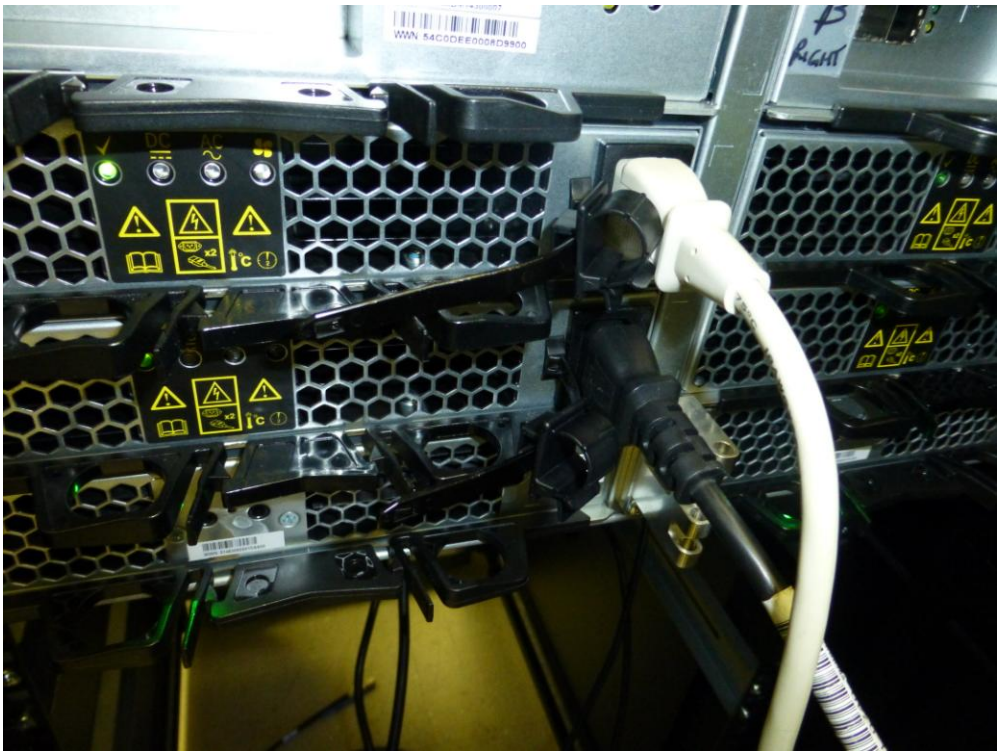

Figure 36. **IceBreaker 4960J System PSUs**

4.2.1 PSU Power Up

1. Before powering up, ensure unused power cord strain relief is not penetrating the PSU grating (*Figure 37*).

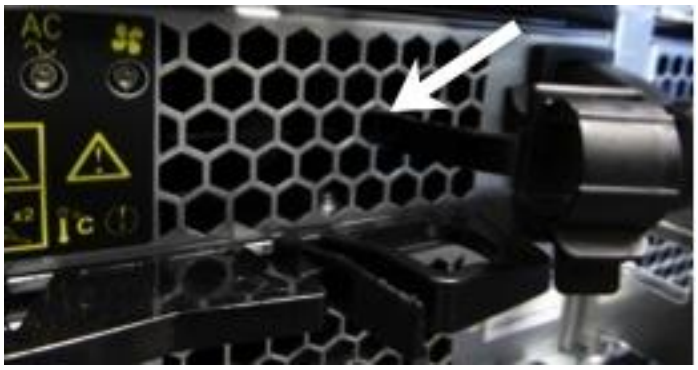

Figure 37. **IceBreaker 4960J PSU Power Cord Strain Relief**

2. Insert power cord into power socket.
3. Put power cord strain relief around cord.
4. Squeeze power cord strain relief to tighten.
5. Turn the IceBreaker 4960J system on using the PDA or power bar on/off switch.

Note: When first powering up the system, including when SBB canisters are hot-plugged, the fan speeds will vary for several seconds as the unit stabilizes. This is normal behavior.

4.2.2 PSU Power Down

Note: If a PSU is turned off or removed from enclosure, the amber LED turns on and the other PSU fan speeds increase.

1. Turn the IceBreaker 4960J system off using the PDA or power bar on/off switch.
2. If removing PSU from system:
   i. Release power cord strain relief.
   ii. Remove power cord from power socket.
   iii. Ensure unused power cord strain relief is not penetrating the PSU grating (*Figure 37*).

4.3 Remove and Replace (R&R) Procedures

4.3.1 HDD Carrier R&R

4.3.1.1 HDD Carrier Removal

1. Release the carrier lock (*Figure 38*).

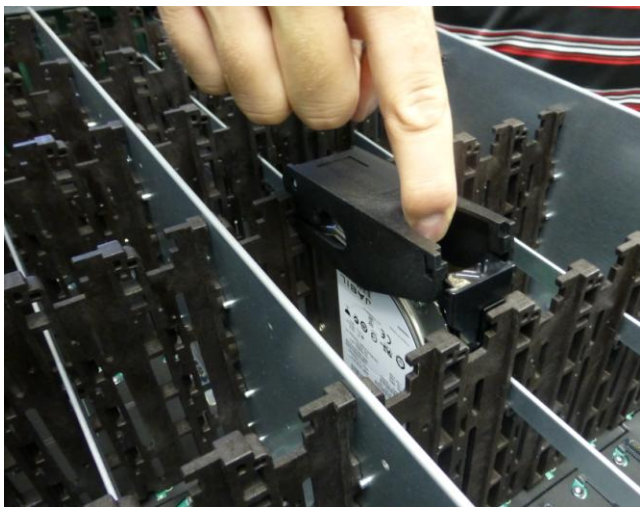

Figure 38. **Releasing HDD Carrier Lock**

2. Open HDD carrier door.
3. Pull HDD carrier from cage slot (*Figure 39*).

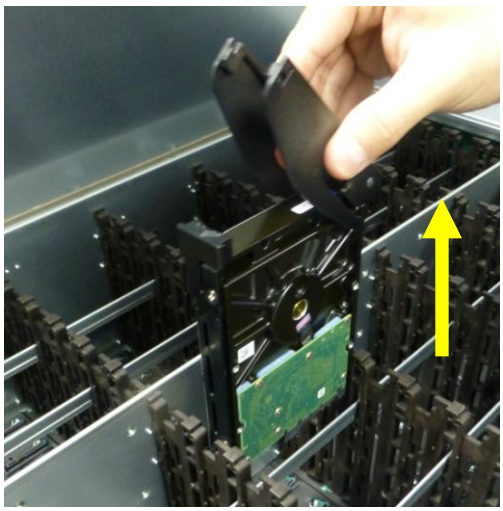

Figure 39. **Removing HDD Carrier from HDD Cage Slot**

4.3.1.2 HDD Carrier Replacement

See *Paragraph 2.2.6*, *Installing IceBreaker 4960JHDD Carrier* into Cage Slot.

4.3.2 SBB Canister R&R

4.3.2.1 SBB Canister Removal

1. Press locking tabs to unlock the canister (see *Paragraph 4.1.3*).
2. With tabs pressed, pull ring handles to disengage canister from locking tabs (*Figure 40*).

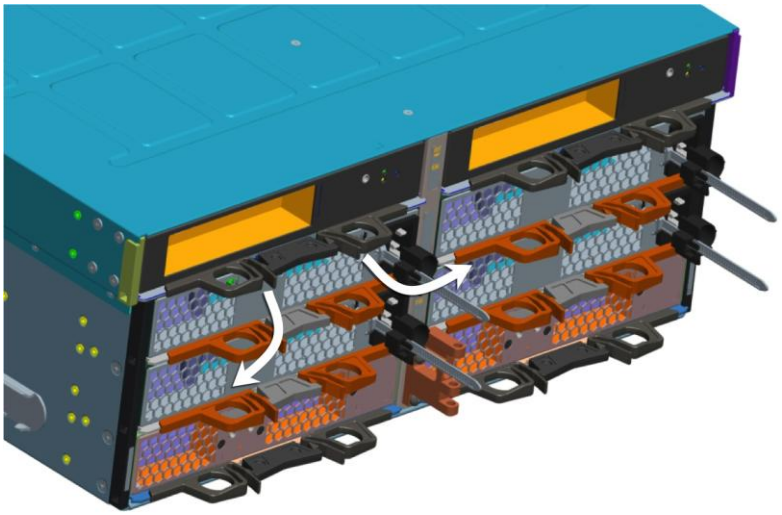

Figure 40. **Opening SBB Canisters**

3. Slide SBB canister out from chassis (*Figure 41*).

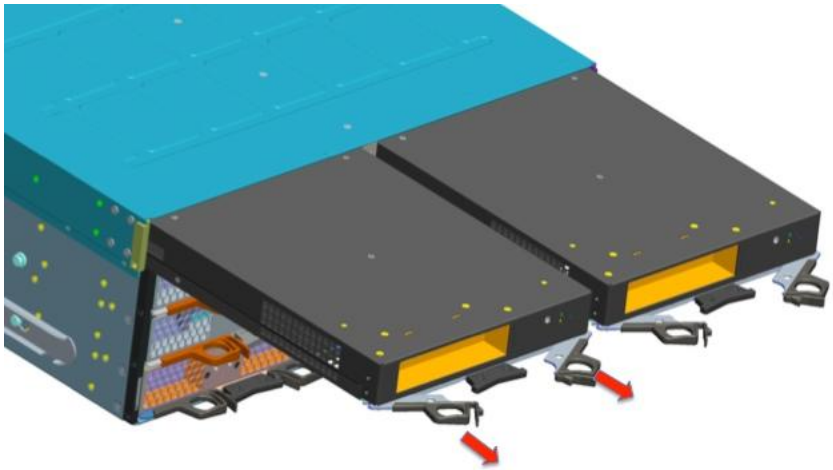

Figure 41. **Removing SBB Canisters**

4.3.2.2 SBB Canister Replacement

1. Insert canister into chassis rear cage slot (*Figure 42*).

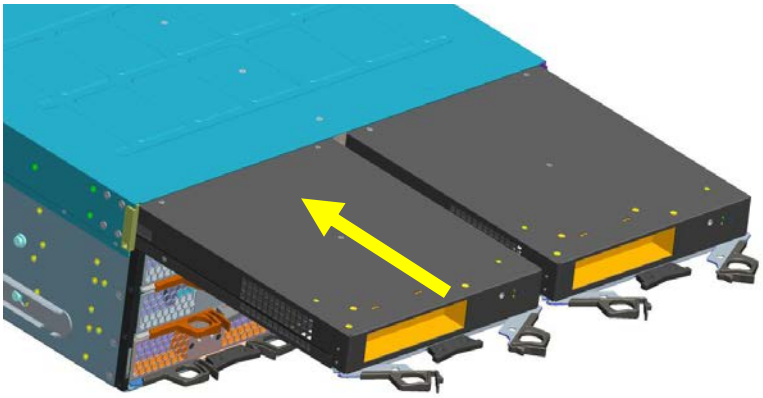

Figure 42. **Inserting Canister into Chassis**

2. Close the canister handles (see *Paragraph 4.1.3*). Locking tabs will click shut when canister is secure.

4.3.3 PSU R&R

Instructions for PSU R&R are identical as those for the SBB Canister (*Paragraph 4.3.2*).

4.4 Troubleshooting Component Failure

If you have difficulty with any of the procedures included in this section, see Appendix D, *Contact Us*.

The SBB canisters, FEMs, and PSUs are hot-pluggable. They can be removed and replaced during box operation. Refer to *Table 8* for solutions to common error conditions.

Note: When a subsystem is hot-plug replaced, particularly one of the FEMs, the fan speeds may change. When one of the FEMs is removed and replaced, the other FEMs fan speed will normally increase to provide air circulation within the system.

Table 8. Faults and Solutions

Error Condition	Recommended Action
ODP amber fault LED on	
SBB canister amber fault LED(s) on	
PSU amber fault LED(s) on	
FEM amber fault LED(s) on	
No SAS addresses	Call the Penguin Computing technical support team.
System will not power on	Ensure system is plugged in.

Appendix A. **Acronyms**

1U	One-Unit
2U	Two-Unit
4U	Four-Unit
AC	Alternating Current
C&I	Controls and Indicators
CMA	Cable Management Assembly
CSA	Canadian Standards Association
DAP	Drive Activity Panel
DC	Direct Current
DDC	Disk Drive Carrier
ESD	Electrostatic Discharge
EU	European Union
FCC	Federal Communications Commission
FEM	Fan Expansion Module
FRU	Field Replaceable Unit
HBA	Host Bus Adaptor
HDD	Hard Disk Drive
HDSS	High Density Storage System
I/O	Input/Output
ID	Identification
LED	Light Emitting Diode
LFF	Large Form Factor
N	Number
O&M	Operation and Maintenance
ODM	Original Design Manufacturer
ODP	Operator Display Panel
PCM	Power and Cooling Module
PDA	Power Distribution Assembly
PRD	Product Requirements Document
PSU	Power Supply Unit
R&R	Remove and Replace
REACH	Registration, Evaluation, Authorization and Restriction of CHemicals
RFI	Radio Frequency Interference
RoHS	Restriction of Hazardous Substances
RPM	Revolutions per Minute
SAS	Serial Attached SCSI

SAS-2	Serial Attached SCSI Generation 2
SAS-3	Serial Attached SCSI Generation 3
SBB	Storage Bridge Bay
SCSI	Small Computer System Interface
SECC	Steel, Electrogalvanized, Cold-rolled, Coil

Appendix B. **Glossary**

Canadian Standards Association (CSA)	CSA is a provider of product testing and certification services for electrical, mechanical, plumbing, gas, and a variety of other products. CSA International certification marks indicate that a product, process or service has been tested to a Canadian or U.S. standard and it meets the requirements of an applicable CSA standard or another recognized document used as a basis for certification.
Electrostatic Discharge (ESD)	The sudden flow of electricity between two electrically charged objects caused by contact, an electrical short, or dielectric breakdown.
Enclosure	Refers to the entrance unit or system.
Large Form Factor (LFF)	3.5” disk drive.
Number (N)+2	"N" refers to the number of required power supplies for the system. "+ 2" stands for the redundancy of the power supplies. In this case there are two redundant power supplies to take over in case two other supplies fail.
R12/XX	Applicable for either R12/12 or R12/24.
Registration, Evaluation, Authorization and Restriction of CHemicals (REACH)	REACH, known as European Community No 1907/2006, are the new European Union (EU) chemicals regulations that were introduced on June 1, 2007 with an implementation deadline of 2018. REACH enforces review of the properties of chemicals, identifying the associated health and environmental risks and ensures that information is communicated to suppliers and downstream users in the EU market. The objective of the REACH regulations is to promote phased substitution of the most dangerous substances.
Restriction of Hazardous Substances (RoHS)	RoHS, also known as Directive 2002/95/EC, originated in the EU and restricts the use of six hazardous materials found in electrical and electronic products. All applicable products in the EU market after July 1, 2006 must pass RoHS compliance. RoHS impacts the entire electronics industry and many electrical products as well.
SMILE	Chassis bowing effect that has a similar configuration to a facial smile
Solid-State Drive (SSD)	Data storage device that uses integrated circuit assemblies as memory to store data.
St***o***rage Bridge Bay (SBB)	A specification that defines mechanical, electrical, and low-level enclosure management requirements for an enclosure controller slot that will support a storage controllers from a variety of independent hardware and system vendors. Any storage controller design based on the SBB specification will be able to fit, connect, and operate within any storage enclosure controller slot design based on the same specification.
Wake on SAS (WoS)	A power-saving feature wherein a system is powered down when the controllers are inactive, and powered back up when the controllers are reactivated.
Waste Electrical and Electronic Equipment (WEEE)	The European Community directive 2002/96/EC on waste electrical and electronic equipment that became European Law in February 2003. The WEEE Directive sets collection, recycling, and recovery targets for all types of electrical goods.

Appendix C. **Contact Us**

Technical Support: 1-888-736-4846

World Wide Web Address: www.penguincomputing.com

Appendix D. **Index**