

IBM System x
GPFS Storage Server

*Installation, User's, and Maintenance
Guide*



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Note

Before using this information and the product it supports, read the information in "Safety note" on page ix and "Notices" on page 103.

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Safety

The caution and danger statements in this document can be referenced in the multilingual *IBM® Safety Information* document that is provided with your GSS. Each caution and danger statement is numbered for easy reference to the corresponding statement in the translated document.

- **Danger:** These statements indicate situations that can be potentially lethal or extremely hazardous to you. A danger statement is placed just before the description of a potentially lethal or extremely hazardous procedure, step, or situation.
- **Caution:** These statements indicate situations that can be potentially hazardous to you. A caution statement is placed just before the description of a potentially hazardous procedure step or situation.
- **Attention:** These notices indicate possible damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.

Before installing this product, read the following danger and caution notices.

Safety note

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الأمنية

Antes de instalar este produto, leia as Informações de Segurança.

在安装本产品之前，请仔细阅读 **Safety Information**
(安全信息)。

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet kohdasta Safety Information.

Avant d'installer ce produit, lisez les consignes de sécurité.

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

Πριν εγκαταστήσετε το προϊόν αυτό, διαβάστε τις πληροφορίες ασφάλειας (safety information).

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza.

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

Пред да се инсталира овој продукт, прочитајте информацијата за безбедност.

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பெரிய அளவு
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பெரிய அளவு

Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

Przed zainstalowaniem tego produktu, należy zapoznać się z książką "Informacje dotyczące bezpieczeństwa" (Safety Information).

Antes de instalar este produto, leia as Informações sobre Segurança.

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si pečítajte Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto, lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

ཐོན་ཁུངས་འདི་བདེ་སྤྱད་མ་བྱས་གོང་། རྒྱུ་རྒྱུ་ཡིན་གཟབ་
བྱ་འདྲ་མཉམ་ཡིན་པའི་འོད་མེར་བལྟ་དགོས།

Bu ürünü kurmadan önce güvenlik bilgilerini okuyun.

مەزكۇر مەھسۇلاتنى ئورنىتىشتىن بۇرۇن بىخەتەرلىك ئۇچۇرلىرىنى ئوقۇپ چىقىڭ.

Safety statements

These statements provide the caution and danger information that is used in this documentation.

Important:

Each caution and danger statement in this documentation is labeled with a number. This number is used to cross reference an English-language caution or danger statement with translated versions of the caution or danger statement in the *Safety Information* document.

For example, if a caution statement is labeled “Statement 1,” translations for that caution statement are in the *Safety Information* document under “Statement 1.”

Be sure to read all caution and danger statements in this documentation before you perform the procedures. Read any additional safety information that comes with your system or optional device before you install the device.

Statement 1



DANGER

Electrical current from power, telephone, and communication cables is hazardous.

To avoid a shock hazard:

- Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.
- Connect all power cords to a properly wired and grounded electrical outlet.
- Connect to properly wired outlets any equipment that will be attached to this product.
- When possible, use one hand only to connect or disconnect signal cables.
- Never turn on any equipment when there is evidence of fire, water, or structural damage.
- Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.
- Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.

To Connect:

1. Turn everything OFF.
2. First, attach all cables to devices.
3. Attach signal cables to connectors.
4. Attach power cords to outlet.
5. Turn device ON.

To Disconnect:

1. Turn everything OFF.
2. First, remove power cords from outlet.
3. Remove signal cables from connectors.
4. Remove all cables from devices.

Statement 2



CAUTION:

When replacing the lithium battery, use only IBM Part Number 33F8354 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- Throw or immerse into water
- Heat to more than 100°C (212°F)
- Repair or disassemble

Dispose of the battery as required by local ordinances or regulations.

Statement 3



CAUTION:

When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.
- Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.



DANGER

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Class 1 Laser Product
Laser Klasse 1
Laser Klass 1
Luokan 1 Laserlaite
Appareil À Laser de Classe 1

Statement 4



≥ 18 kg (39.7 lb)



≥ 32 kg (70.5 lb)



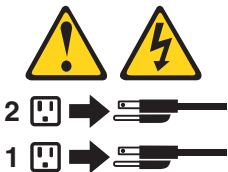
≥ 55 kg (121.2 lb)

CAUTION:
Use safe practices when lifting.

Statement 5



CAUTION:
The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



Statement 6



CAUTION:
If you install a strain-relief bracket option over the end of the power cord that is connected to the device, you must connect the other end of the power cord to an easily accessible power source.

Statement 7



CAUTION:

If the device has doors, be sure to remove or secure the doors before moving or lifting the device to avoid personal injury. The doors will not support the weight of the device.

Statement 8



CAUTION:

Never remove the cover on a power supply or any part that has the following label attached.



Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

Statement 9



CAUTION:

To avoid personal injury, disconnect the hot-swap fan cables before removing the fan from the device.

Statement 10



CAUTION:

Do not place any object weighing more than 82 kg (180 lb) on top of rack-mounted devices.



>82 kg (180 lb)

Statement 11



CAUTION:

The following label indicates sharp edges, corners, or joints nearby.



Statement 12



CAUTION:

The following label indicates a hot surface nearby.



Statement 13



DANGER

Overloading a branch circuit is potentially a fire hazard and a shock hazard under certain conditions. To avoid these hazards, ensure that your system electrical requirements do not exceed branch circuit protection requirements. Refer to the information that is provided with your device for electrical specifications.

Statement 14



CAUTION:

Hazardous voltage, current, and energy levels might be present. Only a qualified service technician is authorized to remove the covers where the following label is attached.



Statement 15



CAUTION:

Make sure that the rack is secured properly to avoid tipping when the server unit is extended.

Statement 16



CAUTION:

Some accessory or option board outputs exceed Class 2 or limited power source limits and must be installed with appropriate interconnecting cabling in accordance with the national electric code.

Statement 17



CAUTION:

The following label indicates moving parts nearby.



Statement 18



CAUTION:

To reduce the risk of electric shock or energy hazards:

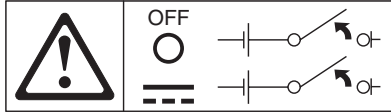
- This equipment must be installed by trained service personnel in a restricted-access location, as defined by the NEC and IEC 60950, Third Edition, The Standard for Safety of Information Technology Equipment.
- Connect the equipment to a reliably grounded safety extra low voltage (SELV) source. An SELV source is a secondary circuit that is designed so that normal and single fault conditions do not cause the voltages to exceed a safe level (60 V direct current).
- The branch circuit overcurrent protection must be rated at a minimum of 5 A to a maximum of 15 A.
- Use 14 American Wire Gauge (AWG) or 2.5 mm² copper conductor only, not exceeding 3 meters in length.
- Torque the wiring-terminal screws to 12 inch-pounds (1.4 newton-meters).
- Incorporate a readily available approved and rated disconnect device in the field wiring.

Statement 19



CAUTION:

The power-control button on the device does not turn off the electrical current supplied to the device. The device also might have more than one connection to dc power. To remove all electrical current from the device, ensure that all connections to dc power are disconnected at the dc power input terminals.



Statement 20



CAUTION:

To avoid personal injury, before lifting the unit, remove all the blades to reduce the weight.

Statement 21



CAUTION:

Hazardous energy is present when the blade is connected to the power source. Always replace the blade cover before installing the blade.

Statement 22



CAUTION:

To reduce the risk of electric shock or energy hazards:

- This equipment must be installed by trained service personnel in a restricted-access location, as defined by the NEC and IEC 60950, Third Edition, The Standard for Safety of Information Technology Equipment.
- Connect the equipment to a reliably grounded safety extra low voltage (SELV) source. An SELV source is a secondary circuit that is designed so that normal and single fault conditions do not cause the voltages to exceed a safe level (60 V direct current).
- The branch circuit overcurrent protection must be rated at a minimum of 13 A to a maximum of 15 A.
- Use 16 American Wire Gauge (AWG) or 1.3 mm² copper conductor only, not exceeding 3 meters in length.
- Torque the wiring-terminal screws to 12 inch-pounds (1.4 newton-meters).
- Incorporate a readily available approved and rated disconnect device in the field wiring.

Statement 23



CAUTION:

Do not place any object weighing more than 50 kg (110 lb) on top of rack-mounted devices.



>50 kg (110 lb)

Statement 24



CAUTION:

To reduce the risk of electric shock or energy hazards:

- This equipment must be installed by trained service personnel in a restricted-access location, as defined by the NEC and IEC 60950, Third Edition, The Standard for Safety of Information Technology Equipment.
- Connect the equipment to a reliably grounded safety extra low voltage (SELV) source. An SELV source is a secondary circuit that is designed so that normal and single fault conditions do not cause the voltages to exceed a safe level (60 V direct current).
- The branch circuit overcurrent protection must be rated at a minimum of 12 A to a maximum of 15 A.
- Use 14 American Wire Gauge (AWG) or 2.5 mm² copper conductor only, not exceeding 3 meters in length.
- Torque the wiring-terminal screws to 12 inch-pounds (1.4 newton-meters).
- Incorporate a readily available approved and rated disconnect device in the field wiring.

Statement 25



CAUTION:

This product contains a Class 1M laser. Do not view directly with optical instruments.

Statement 26



CAUTION:

Do not place any object on top of rack-mounted devices.



Statement 27



CAUTION:
Hazardous moving parts are nearby.



Statement 28



CAUTION:
The battery is a lithium ion battery. To avoid possible explosion, do not burn the battery. Exchange it only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call.

Statement 29



CAUTION:
This equipment is designed to permit the connection of the earthed conductor of the dc supply circuit to the earthing conductor at the equipment. If this connection is made, all of the following conditions must be met:

- This equipment shall be connected directly to the dc supply system earthing electrode conductor or to a bonding jumper from an earthing terminal bar or bus to which the dc supply system earthing electrode conductor is connected.
- This equipment shall be located in the same immediate area (such as, adjacent cabinets) as any other equipment that has a connection between the earthed conductor of the same dc supply circuit and the earthing conductor, and also the point of earthing of the dc system. The dc system shall not be earthed elsewhere.
- The dc supply source shall be located within the same premises as this equipment.
- Switching or disconnecting devices shall not be in the earthed circuit conductor between the dc source and the point of connection of the earthing electrode conductor.

Statement 30



CAUTION:

To reduce the risk of electric shock or energy hazards:

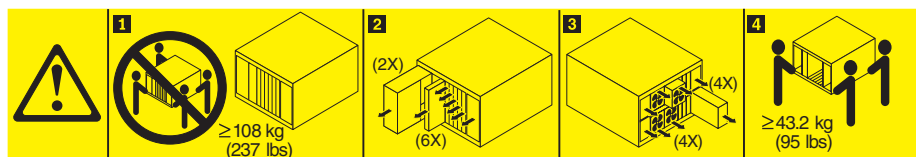
- This equipment must be installed by trained service personnel in a restricted-access location, as defined by the NEC and IEC 60950-1, First Edition, The Standard for Safety of Information Technology Equipment.
- Connect the equipment to a reliably grounded safety extra low voltage (SELV) source. An SELV source is a secondary circuit that is designed so that normal and single fault conditions do not cause the voltages to exceed a safe level (60 V direct current).
- The branch circuit overcurrent protection must be rated 20 A.
- Use 12 American Wire Gauge (AWG) or 2.5 mm² copper conductor only, not exceeding 4.5 meters in length.
- Incorporate a readily available approved and rated disconnect device in the field wiring.

Statement 32



CAUTION:

To avoid personal injury, before lifting the unit, remove all the blades, power supplies, and removable modules to reduce the weight.

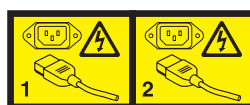


Statement 33



CAUTION:

This device does not provide a power control button. Removing power supply modules or turning off the server blades does not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



Statement 37



DANGER

When you populate a rack cabinet, adhere to the following guidelines:

- Always lower the leveling pads on the rack cabinet.
- Always install the stabilizer brackets on the rack cabinet.
- Always install the heaviest devices in the bottom of the rack cabinet.
- Do not extend multiple devices from the rack cabinet simultaneously, unless the rack-mounting instructions direct you to do so. Multiple devices extended into the service position can cause your rack cabinet to tip.
- If you are not using the IBM 9308 rack cabinet, securely anchor the rack cabinet to ensure its stability.

Rack Safety Information, Statement 2



DANGER

- Always lower the leveling pads on the rack cabinet.
- Always install stabilizer brackets on the rack cabinet.
- Always install servers and optional devices starting from the bottom of the rack cabinet.
- Always install the heaviest devices in the bottom of the rack cabinet.



CAUTION:

This unit has more than one power source. To remove all power from the unit, all dc MAINS must be disconnected.



Cable Warning

WARNING: Handling the cord on this product or cords associated with accessories sold with this product, will expose you to lead, a chemical known to the State of California to cause cancer, and birth defects or other reproductive harm. **Wash hands after handling.**

Guidelines for trained service technicians

This section contains information for trained service technicians.

Inspecting for unsafe conditions

Use this information to help you identify potential unsafe conditions in an IBM product that you are working on.

Each IBM product, as it was designed and manufactured, has required safety items to protect users and service technicians from injury. The information in this section addresses only those items. Use good judgment to identify potential unsafe conditions that might be caused by non-IBM alterations or attachment of non-IBM features or optional devices that are not addressed in this section. If you identify an unsafe condition, you must determine how serious the hazard is and whether you must correct the problem before you work on the product.

Consider the following conditions and the safety hazards that they present:

- Electrical hazards, especially primary power. Primary voltage on the frame can cause serious or fatal electrical shock.
- Explosive hazards, such as a damaged CRT face or a bulging capacitor.
- Mechanical hazards, such as loose or missing hardware.

To inspect the product for potential unsafe conditions, complete the following steps:

1. Make sure that the power is off and the power cords are disconnected.
2. Make sure that the exterior cover is not damaged, loose, or broken, and observe any sharp edges.
3. Check the power cords:
 - Make sure that the third-wire ground connector is in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and the frame ground.
 - Make sure that the power cords are the correct type.
 - Make sure that the insulation is not frayed or worn.
4. Remove the cover.
5. Check for any obvious non-IBM alterations. Use good judgment as to the safety of any non-IBM alterations.
6. Check inside the system for any obvious unsafe conditions, such as metal filings, contamination, water or other liquid, or signs of fire or smoke damage.
7. Check for worn, frayed, or pinched cables.
8. Make sure that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

Guidelines for servicing electrical equipment

Observe these guidelines when you service electrical equipment.

- Check the area for electrical hazards such as moist floors, nongrounded power extension cords, and missing safety grounds.
- Use only approved tools and test equipment. Some hand tools have handles that are covered with a soft material that does not provide insulation from live electrical current.
- Regularly inspect and maintain your electrical hand tools for safe operational condition. Do not use worn or broken tools or testers.
- Do not touch the reflective surface of a dental mirror to a live electrical circuit. The surface is conductive and can cause personal injury or equipment damage if it touches a live electrical circuit.
- Some rubber floor mats contain small conductive fibers to decrease electrostatic discharge. Do not use this type of mat to protect yourself from electrical shock.
- Do not work alone under hazardous conditions or near equipment that has hazardous voltages.

- Locate the emergency power-off (EPO) switch, disconnecting switch, or electrical outlet so that you can turn off the power quickly in the event of an electrical accident.
- Disconnect all power before you perform a mechanical inspection, work near power supplies, or remove or install main units.
- Before you work on the equipment, disconnect the power cord. If you cannot disconnect the power cord, have the customer power-off the wall box that supplies power to the equipment and lock the wall box in the off position.
- Never assume that power has been disconnected from a circuit. Check it to make sure that it has been disconnected.
- If you have to work on equipment that has exposed electrical circuits, observe the following precautions:
 - Make sure that another person who is familiar with the power-off controls is near you and is available to turn off the power if necessary.
 - When you work with powered-on electrical equipment, use only one hand. Keep the other hand in your pocket or behind your back to avoid creating a complete circuit that could cause an electrical shock.
 - When you use a tester, set the controls correctly and use the approved probe leads and accessories for that tester.
 - Stand on a suitable rubber mat to insulate you from grounds such as metal floor strips and equipment frames.
- Use extreme care when you measure high voltages.
- To ensure proper grounding of components such as power supplies, pumps, blowers, fans, and motor generators, do not service these components outside of their normal operating locations.
- If an electrical accident occurs, use caution, turn off the power, and send another person to get medical aid.

About this information

This document provides instructions for installing and customizing the configuration of your IBM GPFS Storage Server (GSS). It also provides maintenance procedures and troubleshooting information.

Who should read this information

This information is intended for system operators and service technicians who have extensive knowledge of Serial Attached SCSI (SAS) and network technology.

Prerequisite and related information

For information about the IBM GPFS Storage Server (GSS) and IBM General Parallel File System (GPFS), see the GSS and GPFS information on IBM Knowledge Center (<http://www.ibm.com/support/knowledgecenter/SSFKCN/welcome>).

For firmware updates, go to the Fix Central website (<http://www.ibm.com/support/fixcentral>).

Chapter 1. Introducing the GPFS Storage Server

This section describes the components, features, and operating specifications of the IBM GPFS Storage Server (GSS).

The GPFS Storage Server is a high-performance, GPFS network storage disk (NSD) solution that is made up of one or more *GSS building blocks*.

Each GSS 2.0 building block contains the following hardware and software components:

- IBM System x x3650 M4 servers
 - 128 GB of memory, with the option to upgrade to 256 GB
 - 2 x 300GB 6Gbps 10k rpm SAS hard disk drives (HDDs) for hosting the operating system
 - ServeRAID M5100 Series 1GB Flash/RAID 5 Upgrade for IBM System x (A1WY)
 - Networking options
 - Mellanox ConnectX-3 VPI Dual-port InfiniBand FDR / 40Gb Ethernet adapter (A2YF)
 - Mellanox ConnectX-3 non-VPI Dual-port 10Gb Ethernet adapter (A2ZQ)
 - LSI 9206-16e Quad-port 6Gbps SAS adapter (A3F2), with an additional LSI 9201-16e Quad-port 6Gbps SAS adapter as backup
- For information about adapter combinations and slot placements, see “Server network adapter placements” on page 49.
- Operating system: Red Hat Enterprise Linux (RHEL) 6.5
- One of the following sets of LSI disk enclosures:
 - LSI DE6600 disk enclosures (60 drive slots)
 - 0796-011/HC1 (58 x 2 TB HDDs)
 - 0796-012/HC2 (58 x 2 TB HDDs) + (2 x 200GB SSDs)
 - 0796-013/HC3 (58 x 3 TB HDDs)
 - 0796-014/HC4 (58 x 3 TB HDDs) + (2 x 200GB SSDs)
 - 0796-015/HC5 (58 x 4 TB HDDs)
 - 0796-016/HC6 (58 x 4 TB HDDs) + (2 x 200GB SSDs)
 - LSI DE5600 disk enclosures (24 drive slots)
 - 0796-017/HC7 (24 x 200GB 2.5-inch SSDs)
 - 0796-018/HC8 (24 x 800GB 2.5-inch SSDs)
 - 0796-019/HC9 (24 x 1.2TB 2.5-inch HDDs)
 - 0796-020/HCA (22 x 1.2TB 2.5-inch HDDs) + (2 x 200GB 2.5-inch SSDs)
- IBM General Parallel File System (GPFS) 4.1

GPFS Storage Server features

Table 1 summarizes the features of the GPFS Storage Server. For a list of the operating specifications, such as weight, height, and heat output, see “Specifications” on page 16.

Table 1. GSS features

General • Modular components: – Environmental service modules (ESMs) – Power supplies – Fan assembly – High-capacity disk drives	Storage enclosure • ESMs: – 100 Mbps Ethernet debugging port – Seven-segment display • Power supply: – Two hot-swap 1755-watt (200 - 240 V ac) standard – Provides redundant power
Technology • Support for up to: – 238 disk drives (Model 24) – 354 disk drives (Model 26) • Storage capacity: 200 GB to 4 TB per drive • Redundant ESMs, power supply, and fan assemblies • Hot-swap technology for power supply • Support for the following RAID codes: 3Way Mirroring, 4Way Mirroring, 8+2p Reed Solomon, 8+3p Reed Solomon	
• User interface – Built-in power, activity, and fault LEDs, identification labeling on components, rear LEDs, and connectors – Easy-to-replace drives, power supplies, fan assemblies, and ESMs	

Building block configurations

This section includes details about GPFS Storage Server configurations that consist of the DE6600 SAS JBOD 60-drive enclosure the DE5600 SAS JBOD 24-drive enclosure. .

GPFS Model 24 configurations that support 3.5-inch 6 Gbps NL-SAS options

The following homogeneous building-block configurations include 3.5-inch 6 Gbps nearline SAS (NL-SAS) HDDs.

- GPFS Model 24 configuration 1 consists of:
 - 2 TB 3.5-inch 6 Gbps NL-SAS HDDs
 - One 0796-HC2 enclosure and three 0796-HC1 enclosures
- GPFS Model 24 configuration 2 consists of:
 - 3 TB 3.5-inch 6 Gbps NL-SAS HDDs
 - One 0796-HC4 enclosure and three 0796-HC3 enclosures
- GPFS Model 24 configuration 3 consists of:
 - 4 TB 3.5-inch 6 Gbps NL-SAS HDDs
 - One 0796-HC6 enclosure and three 0796-HC5 enclosures

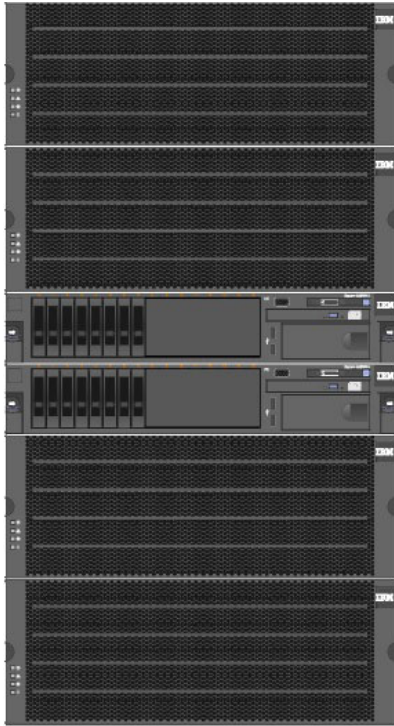


Figure 1. A GSS Model 24 configuration with 3.5-inch 6 Gbps NL-SAS HDDs

GSS Model 24 configurations that support 2.5-inch 6 Gbps SAS SSD options

The following homogeneous building-block configurations include 2.5-inch 6 Gbps SAS solid-state drives (SSDs).

- GSS Model 24 configuration 4 consists of:
One, two or four DE5600-200 enclosures, in which all 24 drive slots are populated with 200GB 2.5-inch 6 Gbps SAS SSDs
- GSS Model 24 configuration 5 consists of:
One, two or four DE5600-800 enclosures, in which all 24 drive slots are populated with 800GB 2.5-inch 6 Gbps SAS SSDs

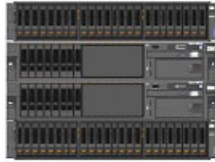


Figure 2. GSS Model 24 configurations with 2.5-inch 6 Gbps SAS SSDs

GSS Model 24 configurations that support 1.2 TB 2.5-inch 10k rpm 6 Gbps SAS HDD options

The following homogeneous building-block configuration includes 1.2 TB 2.5-inch 10k rpm 6 Gbps SAS HDDs.

GSS Model 24 configuration 6 consists of:

- One DE5600-2-22 enclosure, in which drive slot 1 and drive slot 24 are populated with 200 GB 2.5-inch SAS SSDs and drive slots 2 through 23 are populated with 1.2 TB 2.5-inch 10k rpm 6 Gbps SAS HDDs
- Three DE5600-24 enclosures, in which all 24 drive slots are populated with 1.2 TB 2.5-inch 10k rpm 6 Gbps SAS HDDs



Figure 3. A GSS Model 24 configuration with 1.2 TB 2.5-inch 10k rpm 6 Gbps SAS HDDs

GSS Model 26 configurations that support 3.5-inch 6 Gbps NL-SAS options

The following homogeneous building-block configurations include 3.5-inch 6 Gbps NL-SAS HDDs.

- GSS Model 26 configuration 1 consists of:
 - 2 TB 3.5-inch 6 Gbps NL-SAS HDDs
 - One 0796-HC2 enclosure and five 0796-HC1 enclosures
- GSS Model 26 configuration 2 consists of:
 - 3 TB 3.5-inch 6 Gbps NL-SAS HDDs
 - One 0796-HC4 enclosure and five 0796-HC3 enclosures
- GSS Model 26 configuration 3 consists of:
 - 4 TB 3.5-inch 6 Gbps NL-SAS HDDs
 - One 0796-HC6 enclosure and five 0796-HC5 enclosures

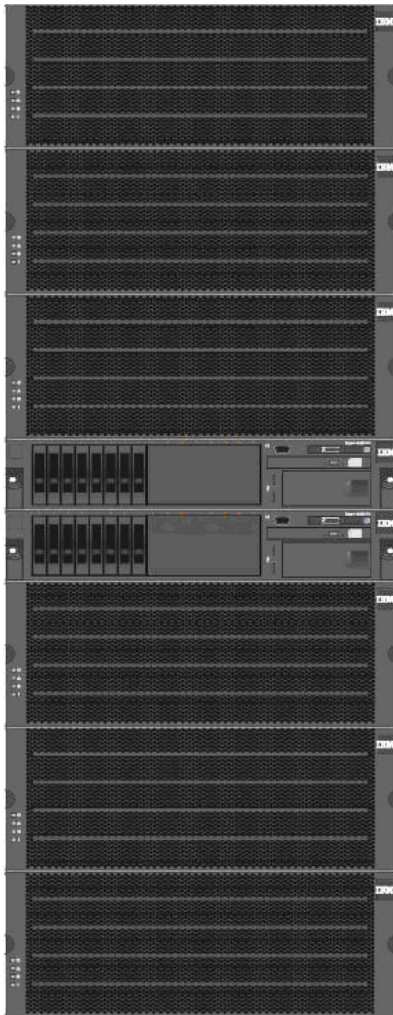


Figure 4. A GSS Model 26 configuration with 3.5-inch 6 Gbps NL-SAS HDDs

GSS Model 26 configurations that support 1.2 TB 2.5-inch 10k rpm 6 Gbps SAS HDD options

The following homogeneous building-block configuration includes 1.2 TB 2.5-inch 10k rpm 6 Gbps SAS HDDs.

GSS Model 26 configuration 4 consists of:

- One DE5600-2-22 enclosure, in which drive slot 1 and drive slot 24 are populated with 200 GB 2.5-inch SAS SSDs and drive slots 2 through 23 are populated with 1.2 TB 2.5-inch 10k rpm 6 Gbps SAS HDDs
- Five DE5600-24 enclosures, in which all 24 drive slots are populated with 1.2 TB 2.5-inch 10k rpm 6 Gbps SAS HDDs



Figure 5. A GSS Model 26 configuration with 1.2 TB 2.5-inch 10k rpm 6 Gbps SAS HDDs

The GSS storage enclosures

This section describes the GPFS Storage Server storage enclosures in more detail.

DE6600 storage enclosures include the following field replaceable units (FRUs), which are accessible from the front or back of the enclosure:

- Five drive drawers, including the right and left cable chains
- 58 spinning disk drives
- Two solid-state drives (optional)
- Two environmental service modules (ESMs)
- Two power supplies
- Two fan assemblies.

DE5600 storage enclosures include the following field replaceable units (FRUs), which are accessible from the front or back of the enclosure:

- 24 disk drives
- Two solid-state drives (optional)
- Two environmental service modules (ESMs)
- Two power supplies
- Two fan assemblies.

You can use the hot-swap features of the GPFS Storage Server to remove and replace power supplies without turning off the storage enclosure. You can maintain the availability of your system while a hot-swap device is removed, installed, or replaced.

For a complete list of field replaceable units (FRUs) and FRU part numbers for the GSS storage enclosures, see the *Service Component Guide Supporting IBM Intelligent Cluster and iDataPlex, 14A Release v1.0* (http://public.dhe.ibm.com/systems/support/system_x_pdf/14a_comp_guide_v1.0.pdf).

Note: Most of the hardware-specific instructions in this document apply to 4U storage enclosures. The general principles apply to 2U storage enclosures.

The LSI DE6600 storage enclosure

The LSI DE6600 is a 4U rack-mountable storage enclosure that supports two environmental service modules (ESM). The standard DE6600 ESMs have two 6 Gbps x 4 SAS host interface ports. The supported host interface card is a two-port 6 Gbps SAS adapter.

The DE6600: a front view



Figure 6. A front view of the DE6600

Figure 22 on page 30 shows a DE6600 enclosure without the front bezel in place.

The DE6600: a back view

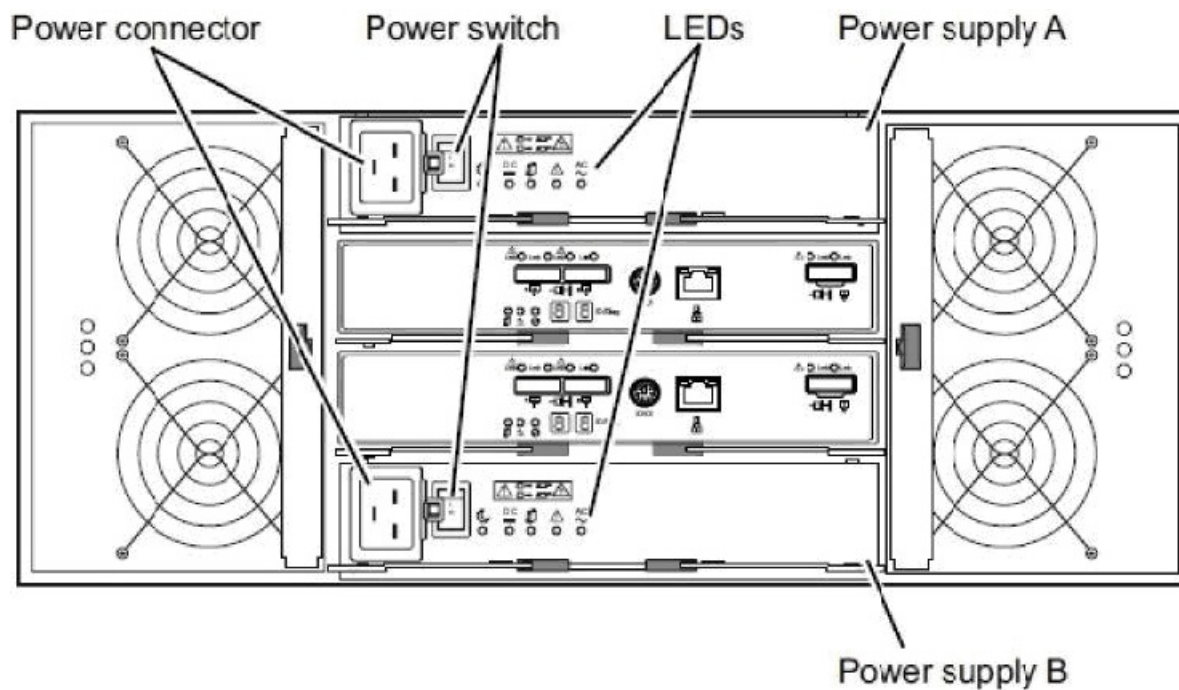


Figure 7. A back view of the DE6600

The DE6600: drive drawer mapping

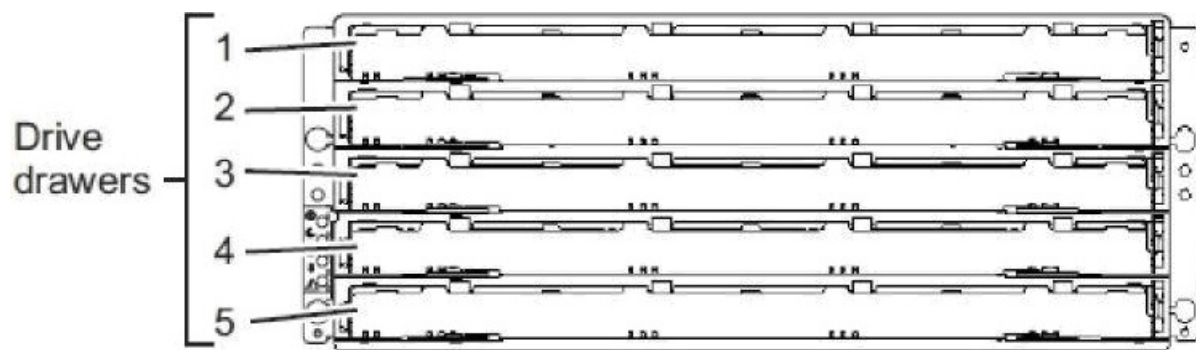


Figure 8. Drive drawer mapping for the DE6600

The DE6600: disk drive mapping

The DE6600 maps installed disk drives in the order shown in the following figure. When installing drives, the front row must be installed first. The drives are ordered as follows:

- Front-row drives: 1, 4, 7, 10
- Middle-row drives: 2, 5, 8, 11
- Last-row drives: 3, 6, 9, 12

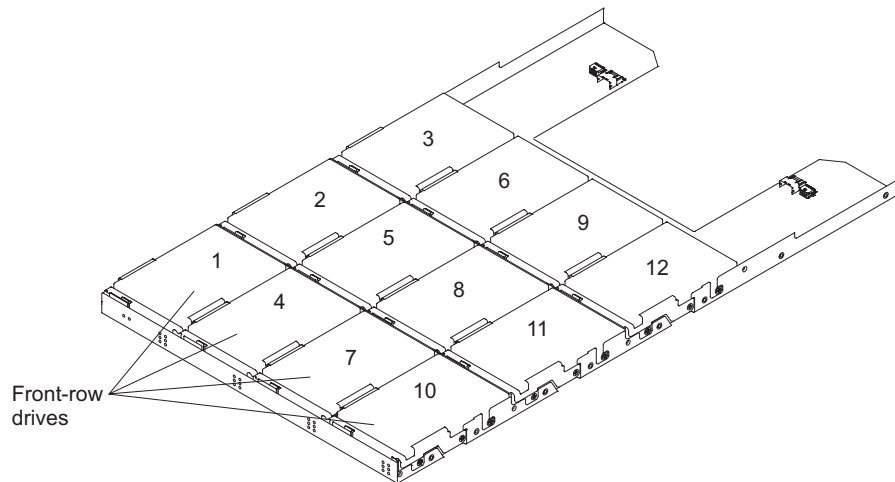


Figure 9. Disk drive mapping for the DE6600

The following figure shows the drive mapping and population of a DE6600 with 58 HDDs.

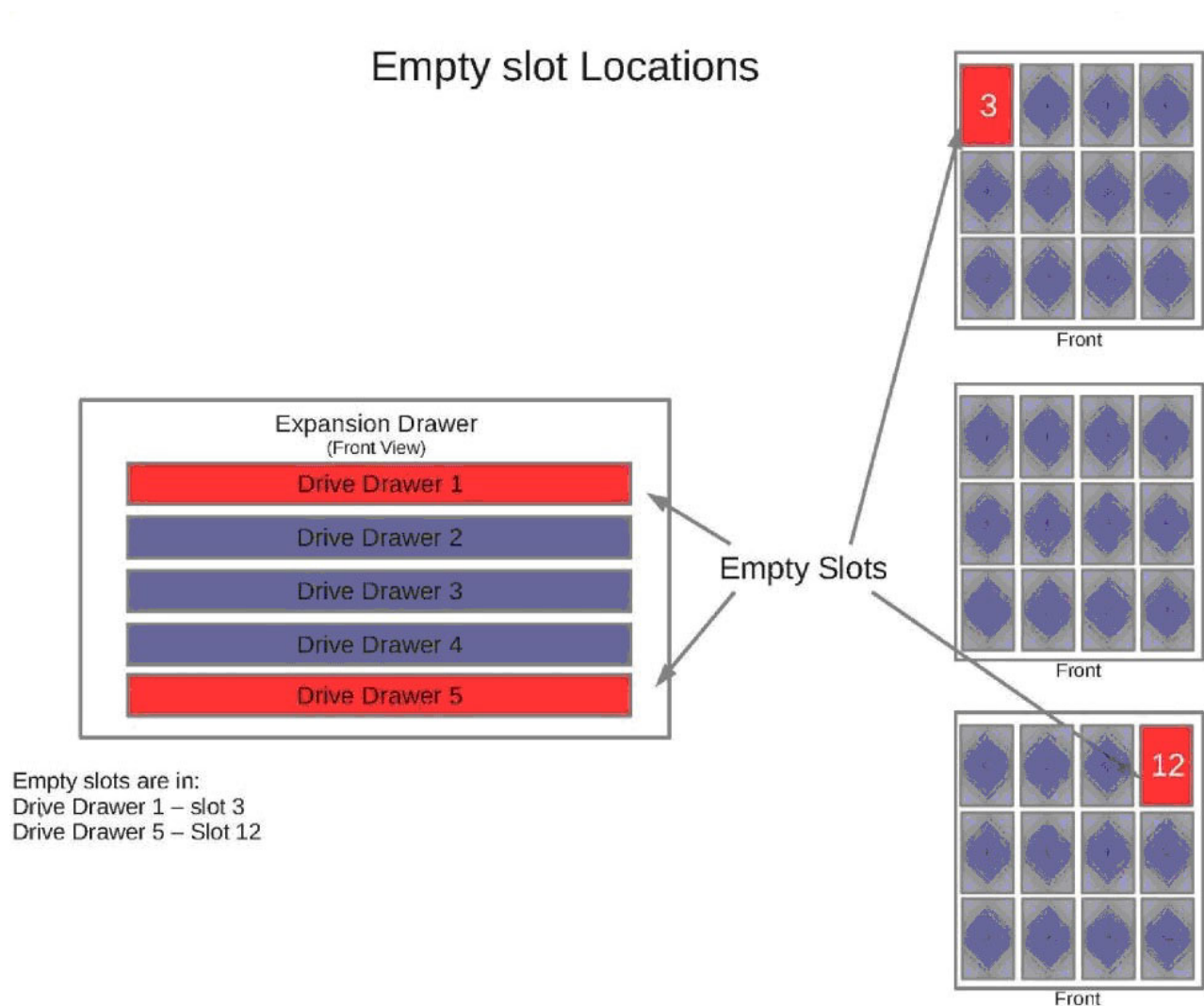


Figure 10. DE6600 disk population with 58 HDDs

The following figure shows the drive mapping and population of a DE6600 with 58 HDDs and two SSDs.

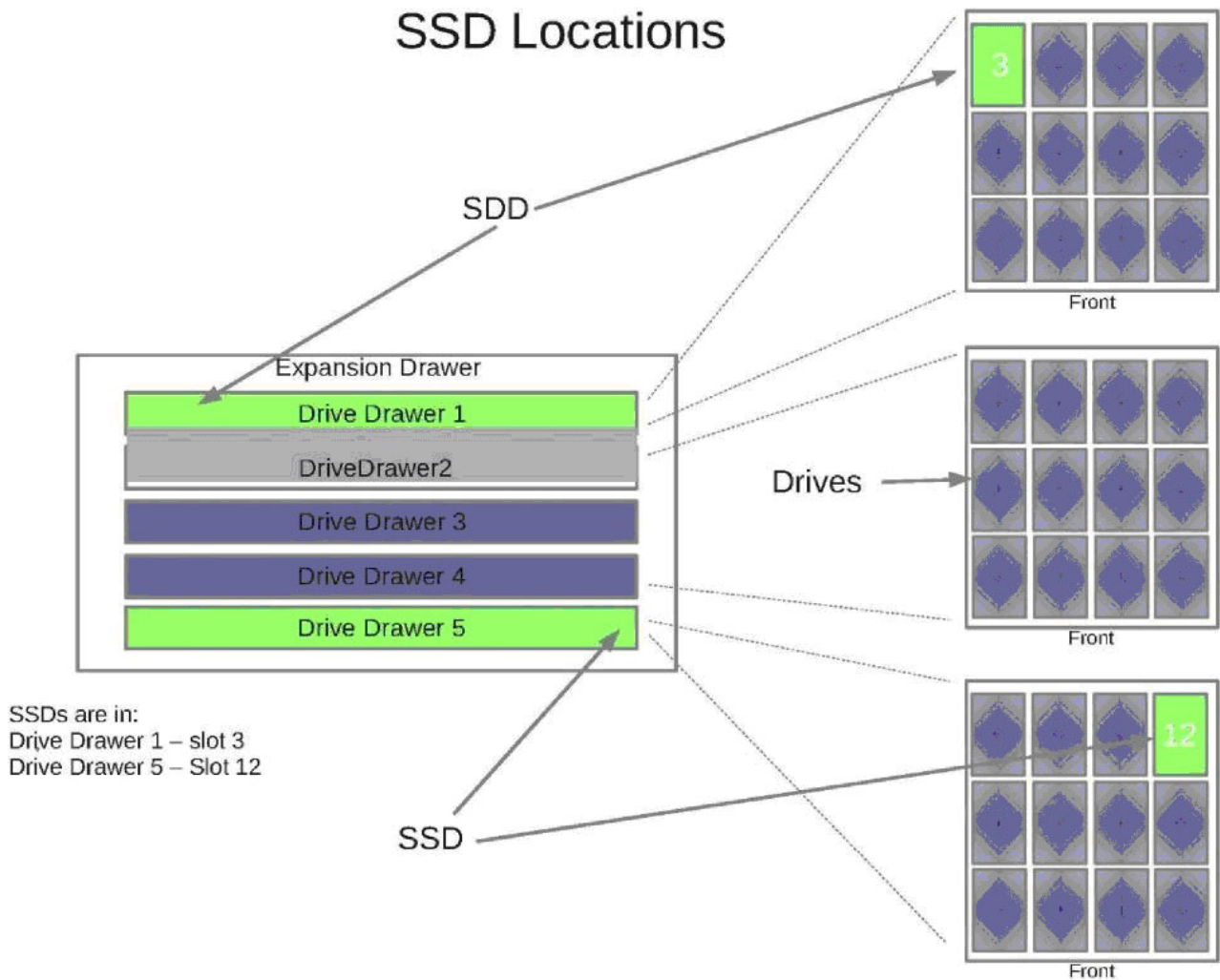


Figure 11. DE6600 disk population with 58 HDDs and two SSDs

Hardware specifications

Table 2. DE6600 hardware specifications

Feature	Specification
Interface options	• 10-gigabit Ethernet • 40-gigabit Ethernet • InfiniBand • SAS
Supported drives	• 2 TB • 3 TB • 4 TB
Form factor	4U
Fan assemblies	2
Power supplies	2
ESMs	2

Power and environmental specifications

Table 3. DE6600 power specifications

Specification	Value
Maximum power	1,222 W
Operating temperature	10 to 40 degrees C (50 to 104 degrees F)
Heat output	4,030 BTUs per hour

Physical specifications

Table 4. DE6600 physical specifications

Specification	Value
Height	7.0 inches (17.78 cm)
Width	19 inches (48.26 cm)
Depth	32.5 inches (82.55 cm)
Weight (maximum)	232 lbs (105.2 kg)

The LSI DE5600 storage enclosure

The LSI DE5600 is a 2U rack-mountable storage enclosure that supports two environmental service modules (ESMs). The standard DE5600 ESMs have two 6 Gbps x 4 SAS host interface ports. The supported host interface card is a two-port 6 Gbps SAS adapter.

A front view of the DE5600 enclosure follows:



Figure 12. DE5600: front view

Here is a depiction of a 2U drawer with SSDs in slots 1 through 24:

Table 5. A 2U drawer - configuration 1

s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14	s15	s16	s17	s18	s19	s20	s21	s22	s23	s24
----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Here is a depiction of a 2U drawer with SSDs in slots 1 and 24 and HDDs in slots 2 through 23:

Table 6. A 2U drawer - configuration 2

s1	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13	d14	d15	d16	d17	d18	d19	d20	d21	d22	s2
----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----

Hardware specifications

Table 7. DE5600 hardware specifications

Feature	Specification
Interface options	• 10-gigabit Ethernet • 40-gigabit Ethernet • InfiniBand • SAS
Supported drives	• 2.5-inch 200 GB SSDs • 2.5-inch 800 GB SSDs • 2.5-inch 1.2 TB HDDs (10k rpm)
Form factor	2U
Fan assemblies	2
Power supplies	2
ESMs	2

Power and environmental specifications

Table 8. DE5600 power specifications

Specification	Value
Maximum power	240 W
Operating temperature	10 to 40 degrees C (50 to 104 degrees F)
Heat output	821 BTU/hr

Physical specifications

Table 9. DE5600 physical specifications

Specification	Value
Height	3.47 inches (8.81 cm)
Width	19 inches (48.26 cm)
Depth	19.6 inches (49.78 cm)
Weight (maximum)	57.32 lb (26 kg)

Drive drawers

DE6600 storage enclosures have five removable drive drawers that are accessible from the front of the enclosure, as shown in Figure 13 on page 13.

Note: Drive drawers might be also referred to as drive trays in other publications.

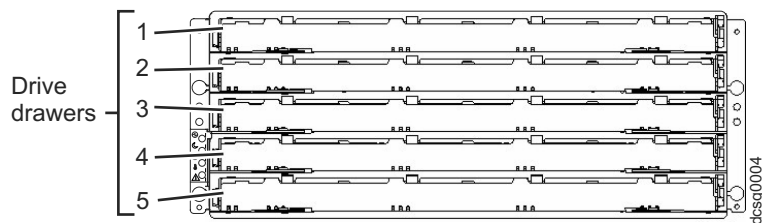


Figure 13. A view of the removable drive drawers

Each drive drawer can contain up to 12 disk drives. With the drive drawers fully populated, the enclosure can support up to 60 disk drives, as shown in Figure 14.

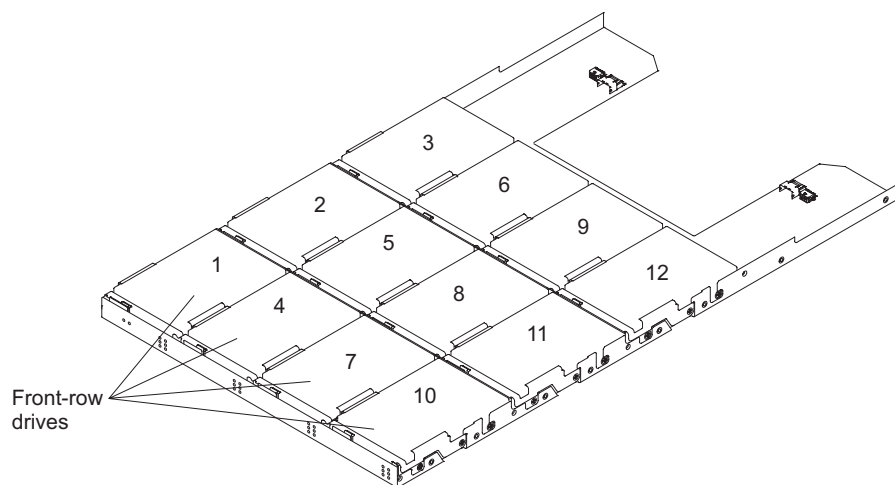


Figure 14. A view of a single drive drawer

Important: The installation order in each drive drawer is from left to right in rows. To ensure sufficient airflow throughout the drive drawers, bays 1, 4, 7, and 10 (the front-row bays) in each drive drawer must be populated. Therefore, the enclosure must be configured with a minimum of 20 drives. Bay numbers are indicated on an overlay on the front of each drive drawer. Make sure the four drives in each row are next to each other. The long edge of each drive must touch the drive next to it.

Disk drives

A storage enclosure supports up to 60 disk drives in five drive drawers that are accessible from the front of the enclosure.

There are no serviceable parts in a disk drive; if a disk drive fails, it must be replaced. When you replace a disk drive, be sure to order and install the correct type of disk drive.

For information about drive replacement, see Chapter 7, “Replacing components,” on page 75

Environmental service modules (ESMs)

A storage enclosure has two redundant ESM units, which can be hot-swapped. The ESMs are at the back of the enclosure. The ESM in SBB A is called ESM A, while the ESM in SBB B is called ESM B. One ESM continues to operate if the other ESM fails.

Note: To preserve the optimal airflow, do not remove a failed ESM FRU from the chassis until you are ready to replace it with a new FRU.

The ESMs contain the enclosure control logic, interface ports, and LEDs. Each ESM has two 6 Gbps x4 SAS In ports and a single 6 Gbps x4 SAS Out port. The SAS In ports are used to connect the ESM to another ESM. The SAS Out port is used to cascade that ESM to another enclosure. The use of both ports on each ESM results in a redundant drive connection.

Figure 15 shows the location of the SAS In and SAS Out ports on the ESMs.

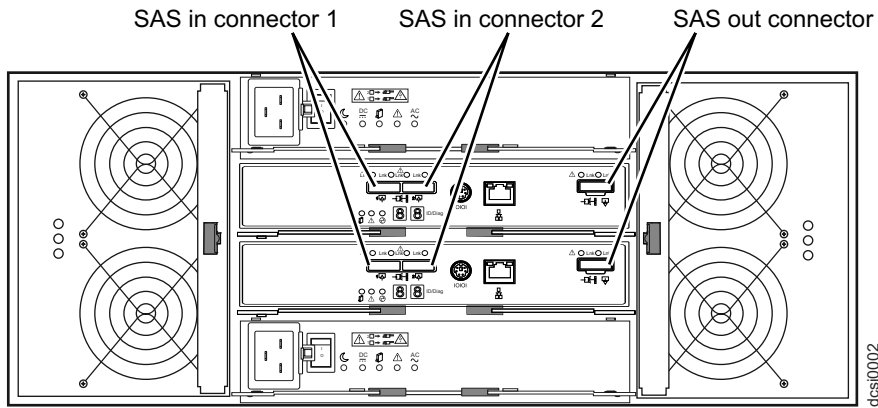


Figure 15. ESM SAS port locations

Enclosure ID

Each ESM contains two seven-segment numeric LED displays. These LEDs provide enclosure identification and diagnostic data.

Figure 16 shows the seven-segment numeric display on the GSS. For more information about the enclosure ID, see “Enclosure ID settings” on page 50 or “Seven-segment numeric display LEDs” on page 61.

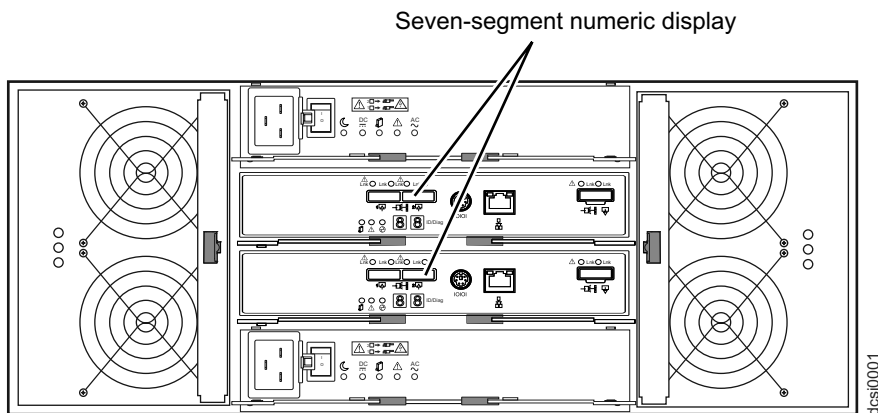


Figure 16. Seven-segment numeric display on the ESM

Power supplies

The enclosure has two removable power supplies that provide power to the internal components. If one power supply malfunctions or is turned off, the other power supply maintains electrical power to the enclosure.

Note: To preserve the optimal airflow, do not remove a failed power supply from the chassis until you are ready to replace it with a new power supply.

Figure 17 shows the power supply controls, LEDs, and connectors.

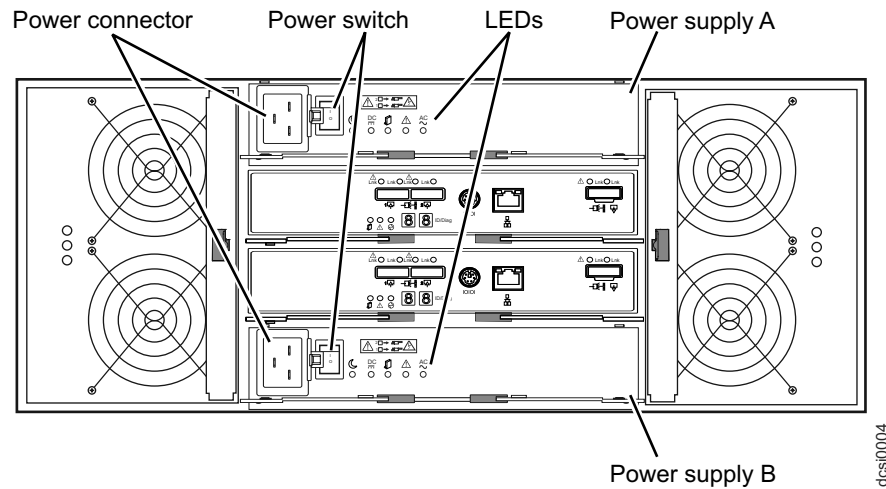


Figure 17. Power supply components

Fan assemblies

The enclosure has two removable fan assemblies. Each fan assembly contains two fans. The fan assemblies draw air through the enclosure from front to back across the drives. The fans provide redundant cooling, which means that if one of the fans fails, the remaining fan assembly continues to provide sufficient cooling to operate the enclosure. The fans operate at maximum speed under the following conditions:

- During the first few minutes after power is applied to the enclosure
- When one of the drive drawers is pulled out or is not in the closed and latched position
- When one of the fan assemblies fails or is removed from the enclosure

Note: To preserve optimal airflow, do not remove a failed fan assembly from the chassis until you are ready to replace it with a new fan assembly.

Figure 18 on page 16 shows the locations of the fan assemblies. See “Fan assembly LEDs” on page 58 for information about the fan assembly status LEDs.

Note: Although both fan assemblies (left and right) are identical, they are seated in the enclosure in opposite directions. If the fan assembly cannot be fully inserted in the fan assembly bay, rotate it 180 degrees and reinsert it. There are notches on the top and bottom of the fan assembly bay. Make sure that the slits on the top and bottom of the fan assembly align with these two notches before the fan assembly is fully inserted in the fan bay.

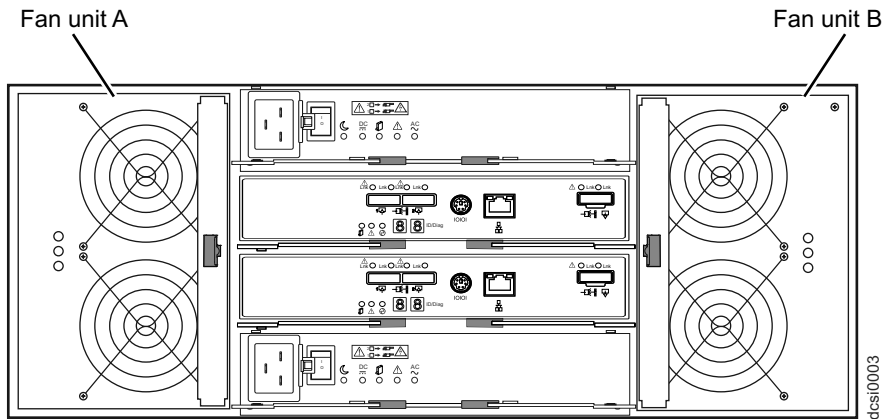


Figure 18. Fan assembly components

Figure 19 shows the airflow through the enclosure.

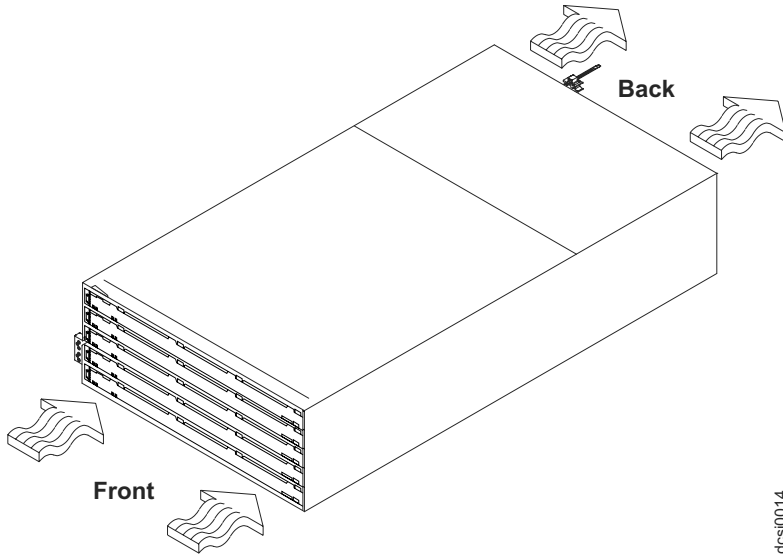


Figure 19. Enclosure airflow

Specifications

This section provides site specifications for the GPFS Storage Server.

Before you install the GPFS Storage Server, make sure the installation site meets these requirements, or prepare the site so that it meets these requirements. Preparations might involve meeting area requirements, environmental requirements, and electrical requirements for enclosure installation, service, and operation.

Area requirements

The floor space at the installation site must be strong enough to support the weight of the GPFS Storage Server and associated equipment, have sufficient space to install, operate, and service the storage enclosures, and have sufficient ventilation.

Dimensions

The GPFS Storage Server conforms to the 19-inch rack standard. Table 10 shows the dimensions of the GSS with all of its components.

Table 10. GSS dimensions

Height	Width	Depth ¹
6.93 in. (17.6 cm)	19 in. (48.3 cm)	34.1 in. (86.6 cm)
¹ Enclosure full depth including a cable bend radius of 2.7 inches is 36.8 inches (93.5 cm).		

Weight

The total weight of the enclosure depends on the configuration of the unit. Table 11 lists the maximum, empty, and shipping weights of the GSS in different configurations.

Table 11. GSS weights

Unit	Weight		
	Maximum ¹	Empty ²	Shipping ³
GPFS Storage Server	102.1 kg (225.2 lb)	57.5 kg (126.8 lb)	100 kg (220 lb)
¹ Chassis with all FRUs and 60 drives. ² Chassis without drives but with midplane and all FRUs. ³ Includes the GSS, support rails, power cords, publications, 20 drives, shipping material, and the pallet.			

Table 12 lists the weight of each component.

Table 12. GSS component weights

Unit	Weight
Enclosure with midplane only (all FRUs removed)	19.5 kg (43 lb)
Drive drawer (includes cable chains but no drives)	5.2 kg (11.5 lb)
Power supply	2.5 kg (5.5 lb)
Fan assembly	1.1 kg (2.4 lb)
ESM	1.5 kg (3.4 lb)

Shipping dimensions

The GPFS Storage Server is shipped on a pallet. Table 13 lists shipping carton dimensions.

Table 13. GSS shipping carton dimensions

Width	Depth	Height ¹
24 in. (61 cm)	39.75 in. (101 cm)	29.5 in. (74.9 cm)
¹ The height shown includes the height of the pallet.		

Environmental requirements and specifications

This section contains information about the environmental requirements and specifications for the enclosure, including temperature and humidity, altitude, airflow and heat dissipation, shock and vibration requirements, and acoustic noise levels.

Temperature and humidity

The following table lists the acceptable temperature and humidity ranges for the GSS when it is in storage or in transit.

Note: Substantial deviations from the suggested operating range, in either direction, if sustained for extended periods of time, expose the unit to greater risk of failure from external causes.

Table 14. Temperature and humidity requirements for enclosure when in storage or in transit

Condition	Parameter	Requirement
Temperature	Operating range	10°C - 35°C (50°F - 95°F)
	Maximum rate of change	10°C (18°F) per hour
	Storage range	-10°C - 65°C (14°F - 149°F)
	Maximum rate of change	15°C (27°F) per hour
	Transit range	-40°C to 65°C (-40°F to 149°F)
	Maximum rate of change	20°C (36°F) per hour
Relative humidity (no condensation)	Operating range	20% to 80%
	Storage range	10% to 90%
	Transit range	5% to 95%
	Maximum dew point	26°C (79°F)
	Maximum gradient	10% per hour

Altitude

The following table lists the altitudes at which the GSS can be operated, stored, and shipped.

Table 15. Altitude ranges

Environment	Altitude
Operating	30.5 m (100 ft) below sea level to 3000 m (9,840 ft) above sea level
Storage	30.5 m (100 ft) below sea level to 3000 m (9,840 ft) above sea level
Transit	30.5 m (100 ft) below sea level to 12,000 m (40,000 ft) above sea level

Airflow and heat dissipation

The following figure shows the intended airflow for a GSS storage enclosure.

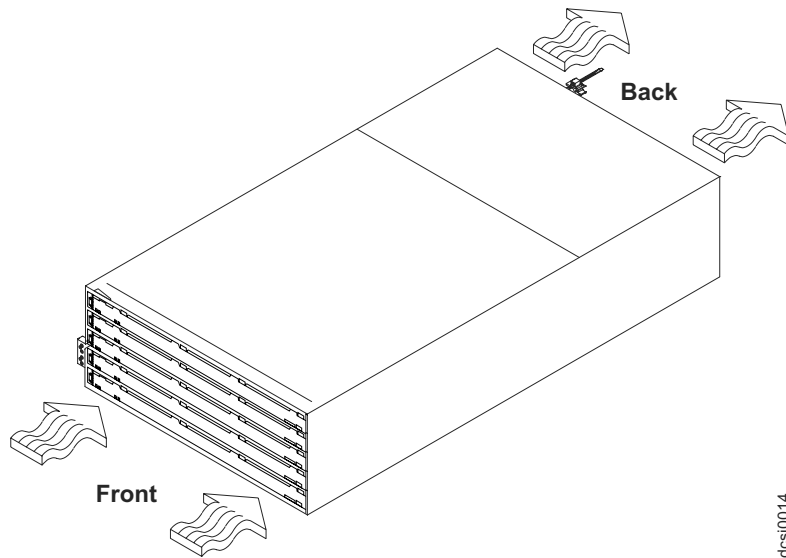


Figure 20. Airflow through a GSS storage enclosure

Allow at least 30 inches in front of the GSS and at least 24 inches behind the GSS for service clearance, ventilation, and heat dissipation.

The following table lists the kVA, watts, and Btu calculations. These values assume that the power supplies have an 88% efficiency and a power factor of 0.99. These tabulated power and heat dissipation values are typical for the storage subsystem. Maximum configuration units are typically operated at higher data rates, have larger random access memory (RAM) capacities, or have different host interface boards.

Table 16. Power and heat dissipation

Parameter	kVA	Watts (ac)	Btu per hour
GSS	.895	802	2736

Shock and vibration requirements

Operational shock: The GSS can withstand the following shock. Subjecting the equipment to a single shock pulse with the following characteristics simulates this level of shock:

- Velocity change: 20 inches per second
- Wave form: 1/2 sine, 10 g @ 5ms

Operational vibration (random): While the GSS is in its normal operating position, it continues operating when it is subjected to a random vibration test using the criteria shown in the following table. This test uses the indicated spectral power density for 30 minutes in each of the three axes.

Table 17. Random vibration power spectral density

Hz	5	17	150	200	500
g^2/Hz	9.0×10^{-5}	3.0×10^{-4}	3.0×10^{-4}	9.0×10^{-5}	9.0×10^{-5}

Acoustic noise

The following table lists the maximum sound levels that are emitted by the GSS.

Table 18. GSS sound levels

Measurement	Level
Sound power (normal operation)	7.0 bels

These levels are measured in controlled acoustical environments according to ISO 7779 and are reported in accordance with ISO 9296. The declared sound power levels indicate an upper limit, below which a large portion of machines operate. Sound pressure levels in your location might exceed the average 1-meter values stated because of room reflections and other nearby noise.

Electrical requirements

This section provides information about site power and wiring, storage subsystem ac power requirements, and power cord routing instructions.

Consider the following factors when you prepare the installation site:

- **Protective ground:** Site wiring must include a protective ground connection to the ac power source.

Note: Protective ground is also known as safety ground or chassis ground.

- **Circuit overloading:** Power circuits and associated circuit breakers must provide sufficient power and overload protection. To prevent possible damage to the unit, isolate its power source from large switching loads (such as air conditioning motors, elevator motors, and factory loads).
- **Power failures:** If power fails, the unit automatically performs a power-up recovery sequence without operator intervention after power is restored.

Attention: The GSS does not support 90-136 V ac. It supports 200-240 V ac sources only. Make sure that the ac input is appropriate for the GSS before you turn on the power switches.

Table 19. GSS ac power requirements

AC power requirements	Range
Nominal voltage	180 - 264 V ac
Frequency (hertz)	50 - 60 Hz
Idle current	4.27 A ^{a,b}
Maximum operating current	4.10 A ^a
Maximum surge current	7.82 A ^a
^a . Typical voltage: 220 V ac, 50 Hz	
^b . While the system is idle, it still performs background data scrubbing on all the drives. However, during regular I/O, the system benefits from cache, which uses less power.	

Note: The GSS power supplies have C20 power inlets.

Power and site wiring requirements for models with power supply and fan units

The enclosure uses wide-ranging redundant power supplies that automatically accommodate voltages to the power source. The power supplies operate within the ranges specified in Table 19. The power supplies meet standard voltage requirements for both domestic (inside USA) and international (outside USA) operations. They use standard industrial wiring with line-to-neutral or line-to-line power connections.

The agency voltage and current ratings for the GSS are 200 V ac - 240 V ac and 7.56 A - 6.30 A.

Power recovery after a power failure: After normal power is restored, the GSS performs power-up recovery procedures automatically without operator intervention.

Power cords and receptacles: The GSS comes with two IEC C19 to C14 jumper cords or two IEC C19 to C20 jumper cords. The C19 plug connects to the GSS power supply, and the other end is used to connect to the rack PDU outlets. It does not come with the power cords that can be used to connect it directly to an electrical outlet in the destination country. You must purchase the power cords that are applicable for use in a typical outlet in the destination country.

Heat output, airflow, and cooling

See “Airflow and heat dissipation” on page 18 for heat output, airflow, and cooling specifications.

Note: In general, disk subsystem reliability tends to decrease as the ambient temperature of the environment in which it is being used increases.

When racks that contain many enclosures are to be installed together, the following requirements must be met to make sure the enclosures are cooled adequately:

- Air enters at the front of the rack and leaves at the back. To prevent the air that is leaving the rack from entering the intake of other devices, position the racks in alternate rows, back-to-back, and front-to-front. This arrangement is known as *cold aisle and hot aisle* and is shown in the following illustration.

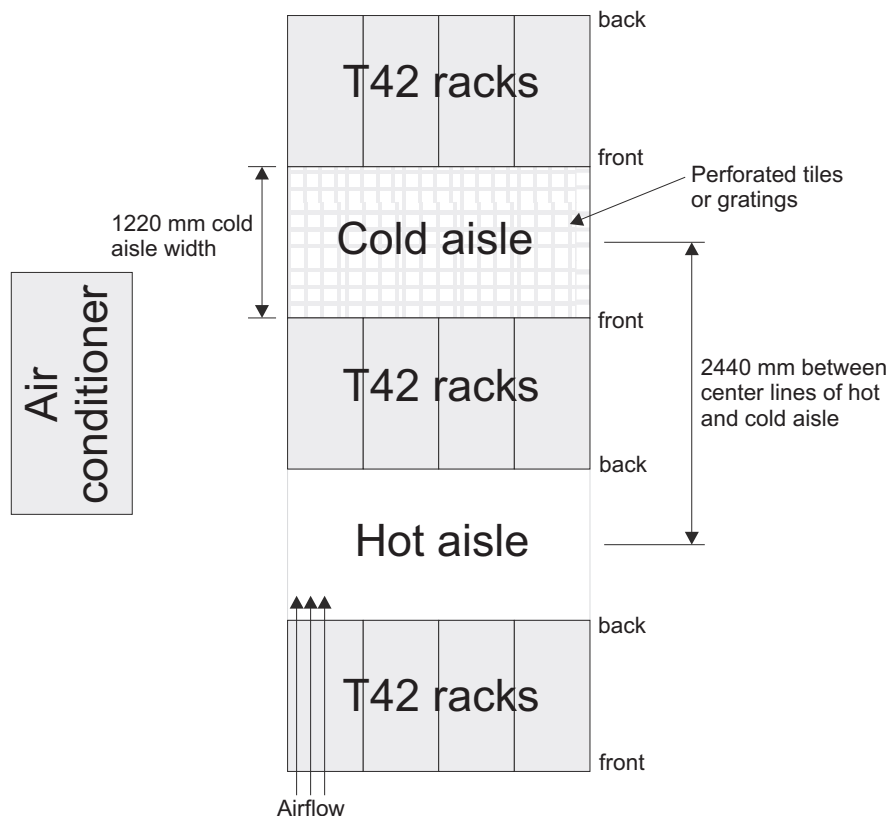


Figure 21. A sample cold aisle / hot aisle rack configuration

- Where racks are in rows, each rack must touch the rack that is next to it to reduce the amount of hot air that can flow around from the back of the rack into the intakes of the devices that are in that rack. You must use Suite Attach Kits to completely seal any gaps that remain between the racks. For details about Suite Attach Kits, contact your marketing representative.

- Where racks are in rows front-to-front or back-to-back, a gap of at least 1220 mm (48 in.) must separate the rows across the cold aisle.
- To ensure correct airflow in each rack, the rack filler plates must be installed in unused positions. Also, all the gaps in the front of the racks must be sealed, including the gaps between the enclosures.

Chapter 2. Installation prerequisites

The latest drive and ESM firmware must be installed to ensure optimal functionality, manageability, and reliability. You can find the latest hardware, firmware, and software on the Fix Central website (<http://www.ibm.com/support/fixcentral>).

To determine the firmware versions in the GPFS Storage Server, use the **mmfsfirmware** command. See the *IBM GPFS Administration and Programming Reference* for more information.

Table 20 shows the prerequisites you need to install to use GSS 2.0.

Table 20. Installation prerequisites

Prerequisite	Version	Where to get it	Notes
Drive firmware		Included in the gpfs.gss.firmware-4.1.0-0.x86_64.rpm package	
ESM firmware		Included in the gpfs.gss.firmware-4.1.0-0.x86_64.rpm package	
GPFS	4.1 (or later)	Included with GSS 2.0	Includes these software packages for GSS: • gpfs.gnr-4.1.0-1.x86_64.rpm • gpfs.platform-4.1.0-1.x86_64.rpm • gpfs.gss.firmware-4.1.0-0.x86_64.rpm
GSS GUI	1.0 (or later)	Included with GSS 2.0	See “Installing the GSS GUI” on page 53 for more information.
IBM Security Key Lifecycle Manager (ISKLM)	2.5.0.1 (or later)	IBM Passport Advantage	For GPFS encryption. Used as a remote key management (RKM) server to store master encryption keys (MEKs). Required for GPFS Advanced Edition.
Red Hat Enterprise Linux (RHEL)	6.5 (or later)	Included with GSS 2.0 (on the x3650 m4 servers), or go to the RHEL website (https://access.redhat.com/site/products/red-hat-enterprise-linux/)	
Extreme Cloud Administration Toolkit (xCAT)	2.8.4 (or later)	The xCAT website (http://sourceforge.net/apps/mediawiki/xcat/index.php?title=Download_xCAT)	Use xCAT as a GSS provisioning and management tool. A dedicated xCAT server requires RHEL 6.5.

After the firmware RPM is installed, use the **mmchfirmware** command to update the firmware. See the *GPFS Administration and Programming Reference* for more information.

The ESM firmware and drive firmware can be loaded while GPFS is active, but the firmware will load much faster if GPFS has been shut down.

Chapter 3. Installing the GPFS Storage Server

This section provides information that you need to prepare the GPFS Storage Server and its components for installation in a rack cabinet. Read “Installation overview” before you begin installing the GPFS Storage Server and its components.

Installation overview

The GPFS Storage Server must be installed and serviced only by qualified IBM service representatives. The GPFS Storage Server and its components can be ordered preinstalled in the rack, or they can be added to an existing rack. A minimum of two people are required for a safe installation.

Attention: See “Safety” on page ix for general safety instructions.



CAUTION:

1. It takes two specially trained IBM personnel with a lifting device to safely lift this unit.
2. Before you install the GSS, verify that the additional weight of the chassis does not exceed the rack's weight limit or unbalance the rack cabinet. When you calculate the additional weight, include the weights of all components that can potentially be added, to avoid overloading in the future.

Ordering the lift tool

Note: The lift tool is required only when you install the GPFS Storage Server and its components or when you install or remove the the GPFS Storage Server and its components from a rack. Make sure that the lift tool is available at the location at the time of the installation. The ordering procedures for the lift tool vary depending on your location. Contact your regional marketing representative for information about these procedures.

World trade locations

The following ordering procedures are for world trade locations:

- Order the lift tool by using the parts order system, as with any other part.
- Use the lift tool part number, 09P2481, when you order.
- Do not record parts usage.
- Return the lift tool to the parts center after you complete the installation or removal.

United States locations

In the United States, call UPS Logistics at 800-528-6070 to order the lift tool, or go to the TSS/Test Equipment Service Center website at <http://pokgsa.ibm.com/~tstesc/public/> for additional information.

Note:

1. For the SSR branch and territory, the United States cannot order the lift tool through the parts order system. UPS Logistics is used to ship and return the lift tool. Use the lift tool part number, 09P2481, when you order.

2. The TSS/Test Equipment Service Center website can be accessed only by IBM employees with access to the IBM intranet.
3. When you order the lift tool, you receive an 18-inch load plate.

You must provide the following information when you order the lift tool:

- Phone number and customer contact
- Account code: 98577
- Time and date of delivery
- Accurate destination address with zip code
- Time and date of return pickup

Failure to provide this information might delay the completion of the order request and the shipping request. You must return the lift tool at the time that was scheduled with UPS Logistics. If you need to change the scheduled return time or date, contact UPS Logistics. You are responsible for ensuring that all of the paperwork and components are packed and restored in the lift tool shipping container. Make sure that the lift tool is functioning properly before you release the tool to UPS Logistics for return. You are accountable for the lift tool until UPS Logistics picks it up for return delivery to their parts storage facility. Contact your branch office tools coordinator or your region specialist if you have any questions or concerns.

Installation sequence

This section lists the steps for installing GSS storage enclosures.

The installation consists of the following tasks:

1. Preparing the installation site and the rack. See “Preparing the site” on page 28 and “Preparing the rack” on page 28.
2. Unpacking the storage enclosure and other hardware from the shipping box. See “Unpacking the shipping box” on page 29.



Attention:

- a. Because of the size and weight of the storage enclosure as shipped, a lift tool and two trained service technicians are required to push the storage enclosure out of its custom-designed package and onto the lift tool. If a lift tool is not available, see Appendix B, “DE6600 component weights,” on page 101 for additional information.
- b. Before you move or relocate a rack that contains storage enclosures, see “Relocating a storage enclosure” on page 50 for additional information.

Note: For more information about how to use a lift tool, see the documentation that comes with the lift tool.

3. Installing the support rails in the rack. See “Installing the support rails” on page 31.
4. Installing a storage enclosure in the rack. See “Installing the storage enclosure in a rack” on page 36.
5. Installing disk drives in the storage enclosure. See “Installing disk drives” on page 38.
6. Installing additional storage enclosures. (Repeat tasks 2 through 5.)
7. Connecting the storage enclosures to 240 V ac sources. See “Cabling the power supply” on page 47.
8. Cabling the GSS to the storage enclosures. See “Cabling the storage enclosure” on page 43.
9. Powering on the GSS. See “Powering on the GPFS Storage Server” on page 52.

10. Upgrading the ESM firmware. See Chapter 2, “Installation prerequisites,” on page 23 for more information.
11. Installing the GSS GUI. See “Installing the GSS GUI” on page 53.

Handling static-sensitive devices

Attention: Static electricity can damage the GSS and other electronic devices. To avoid damage, keep static-sensitive devices in their static-protective packages until you are ready to install them.

To reduce the possibility of electrostatic discharge, follow these precautions:

- Limit your movement, so that it does not cause static electricity to build up around you.
- Wear an antistatic wrist strap when you install or replace any component.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed printed circuitry.
- Do not leave the device where others can handle and damage it.
- While the device is still in its static-protective package, touch it to an *unpainted* metal surface on any grounded rack component for at least two seconds. This drains static electricity from the package and from your body.
- Remove the device from its package and install it directly into your system unit without setting it down. If it is necessary to set down the device, put it back into its static-protective package. Do not place the device on a metal surface.
- Take additional care when you handle devices during cold weather. Heating reduces indoor humidity and increases static electricity.

Preparing for installation

Before you install the storage enclosure, create a detailed plan of how the storage enclosure will be used in your storage configuration. The plan should include determining RAID levels, failover requirements, operating systems to be used, and total storage capacity requirements.

Complete the following steps to prepare the storage enclosure for installation in a rack:

1. Prepare the site according to the area, environmental, power, and site requirements. For more information, see “Specifications” on page 16.
2. Move the storage enclosure to the site.



Attention:

- a. Because of the size and weight of the storage enclosure as shipped, a lift tool and two trained service technicians are required to push the storage enclosure out of its custom-designed package and onto the lift tool. If a lift tool is not available, see Appendix B, “DE6600 component weights,” on page 101 for additional information.
- b. Before you move or relocate a rack that contains storage enclosures, see “Relocating a storage enclosure” on page 50 for additional information.

Note: For more information about how to use a lift tool, see the documentation that comes with the lift tool.

3. Remove the storage enclosure from its shipping container and check the contents (see “Unpacking the shipping box” on page 29). If any items are missing, contact your IBM reseller before you proceed with the installation.

4. Continue with “Preparing the site.”

Preparing the site

This section lists the floor space requirements and weight information for the GPFS Storage Server and its components. It also informs you about the other devices and switches you must install.

For information about interface cables and connections, see Chapter 4, “Cabling the GPFS Storage Server,” on page 43.

Floor space: The floor area at the installation site must provide the following conditions:

- Enough stability to support the weight of the fully-configured GPFS Storage Server and its components
- Sufficient space to install the GPFS Storage Server and its components

Weight: The weight of the GPFS Storage Server and its components depends on the number of components that are installed. A fully-configured GSS Model 24 with four storage enclosures and 238 hard disk drives weighs up to (?) kg ((?) lb).(?) A fully-configured GSS Model 26 with six storage enclosures and 354 hard disk drives weighs up to (?) kg ((?) lb).(?) For more information, see Appendix B, “DE6600 component weights,” on page 101.

Other: Before you prepare the rack:

- Install uninterruptible power supply (UPS) devices.
- Install host bus adapters (HBAs), switches, or other devices, if applicable.
- Route interface cables from the hosts or switches to the installation area.
- Route main power cords to the installation area.

Preparing the rack

Important: Before you install the GPFS Storage Server and its components in a rack, keep in mind the following considerations:

- When storage enclosures are to be plant- or field-integrated into IBM racks, the racks must be configured with PDU power cords that are rated for 240 V electrical service.
- IBM does not support the ruggedized rack feature for the 2101-200 rack when it is used with the GSS. The GSS does not fit in the 2101-200 rack if the ruggedized rack feature is installed.
- Do not install a GSS storage enclosure above the 32U position in any rack. Installing a storage enclosure above the 32U position requires a ladder and is not supported.
- Do not extend more than one device out of the rack at the same time.
- To ensure proper airflow, do not block the air vents; 15 cm (6 in.) of air space is sufficient.
- To ensure rack stability, populate the rack starting at the bottom.
- If you install multiple components in the rack, do not overload the power outlets.
- Always connect the GSS to a properly-grounded outlet.

Complete the following steps to prepare the rack before you install the GSS:

1. Move, unpack, and level the rack at the installation site (if necessary).
2. Remove the external rack panels.
3. If necessary, stop all I/O activity to the devices in the rack.
4. If necessary, turn off all drive enclosure and rack power. Disconnect existing power, network, and other external cables.
5. Install any additional interface cables and power cables.

Continue with “Installing the support rails” on page 31.

Unpacking the shipping box

The disk drives that come with a storage enclosure are packaged in a smaller box inside the shipping box. To unpack the shipping box, complete the following steps.

Important: Do not remove the storage enclosure from the shipping box until the support rails are installed in the rack cabinet. You must install the support rails in the rack cabinet before you install the storage enclosure.

1. Remove the following items from the shipping box. Do not remove the storage enclosure from the shipping box at this time.
 - Box containing the disk drives.
 - Box containing the mounting hardware kit.
 - Box containing storage enclosure handles.
 - Box containing the power cords and documentation.
2. Check the items in the preceding list to make sure that you received all the necessary parts. See the “Inventory checklist” for the parts that are included with the storage enclosure.

Inventory checklist

Figure 22 on page 30 and the inventory list that follows it show the items that you need to install the DE6600 storage enclosures in a rack. If any items are missing or damaged, contact your place of purchase.

Note: The illustrations in this document might differ slightly from your hardware. Depending on your order, your shipping box might contain additional materials that are not shown in Figure 22 on page 30.

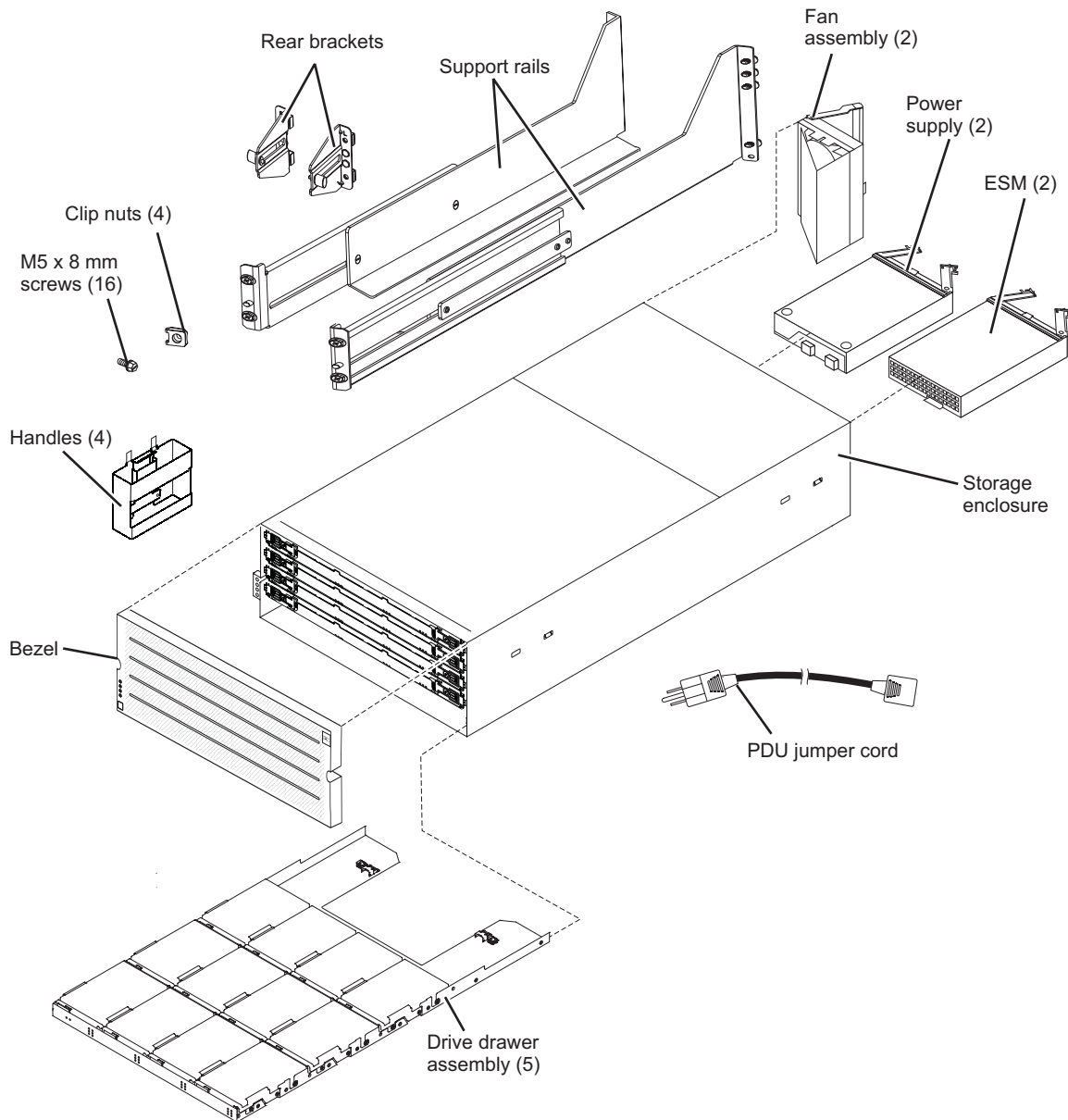


Figure 22. DE6600 storage enclosure components

After you unpack your shipping box, make sure that you have the following items:

- Storage enclosures (4 or 6, depending on the GSS model), each containing:
 - Drive drawer assemblies (5).
 - Fan assemblies (2).
 - Power supplies (2).
 - ESMs (2).
- Handles (4), packaged in a smaller box inside the shipping box.
- Disk drives, packaged in a smaller box inside the shipping box:
 - Solid-state drives (6).
 - Spinning drives (58 x number of enclosures).
- Bezel (1).

- Rack-mounting hardware kit (1), packaged in a smaller box inside the shipping box, including the following parts:
 - Rails (2), right and left assembly.
 - Rear brackets (2).
 - M5 black hex-head slotted screws (16).

Note: The screws are either pre-installed in the support rails or packaged in a plastic bag.

- Washers (8).
- Clip nuts (4).

Important: The GSS does not come with region-specific ac power cords. You must obtain the IBM-approved power cords for your region.

Tools and equipment required

Gather the tools and equipment you need for installation.

Before you install GPFS Storage Server and its components, the installation area must have an internet connection, and you must have the following tools:

- A cart to hold the GSS and its components
- A portable mechanized lift
- Rack-mounting hardware that ships with the storage enclosures
- The rack power jumper cords that are shipped with the storage enclosures
- A No. 2 Phillips screwdriver or an M5 hex driver
- A medium flat-blade screwdriver
- Anti-static protection (such as a grounding wrist strap)
- Labels for the cable connectors.

Installing the support rails

Note: Duplicate copies of the rack-mounting templates are provided in Appendix A, “Rack mounting template,” on page 97. If you want to tear out the templates from this document for easier use, use the template in Appendix A, “Rack mounting template,” on page 97 instead of the templates in this section.

Use the following templates to identify the locations for inserting M5 screws when you mount the support rails and in a rack. The locations for the M5 screws are highlighted in the templates.

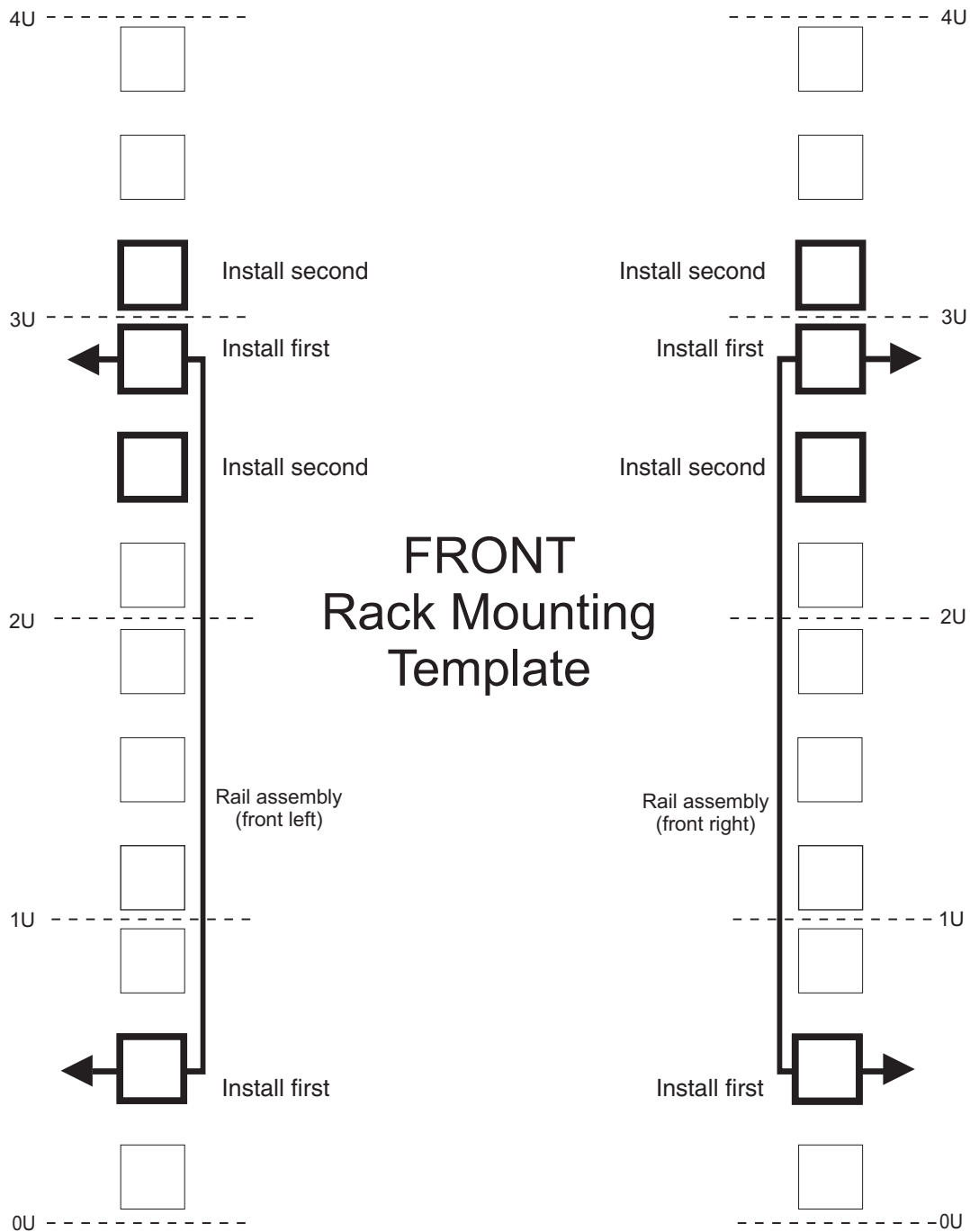


Figure 23. 4U front rack-mounting template

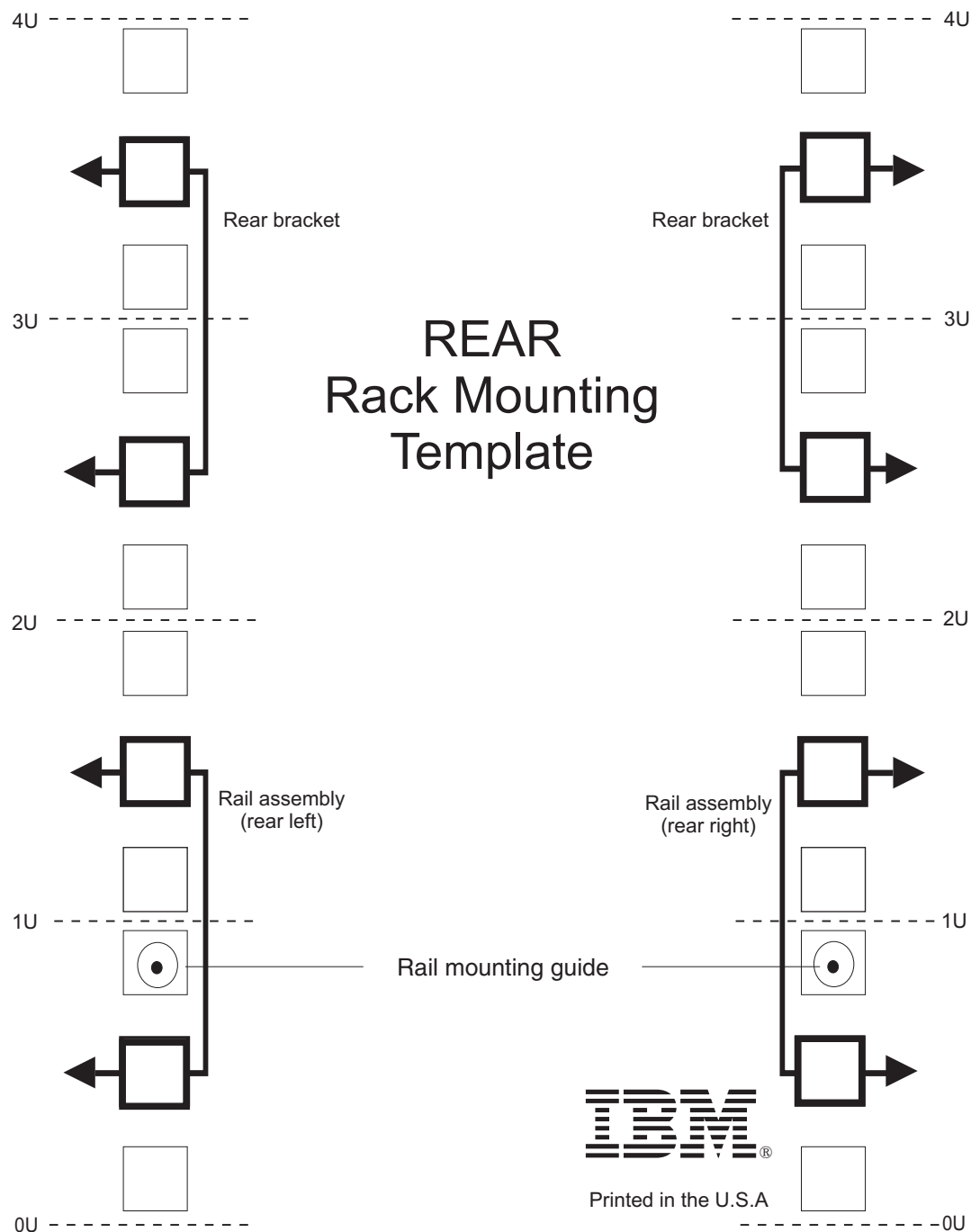


Figure 24. 4U rear rack-mounting template

GSS storage enclosures are 2U or 4U high. Align the template with the rack at a U boundary. U boundaries are shown as horizontal dashed lines in the rack-mounting templates.

Note: The mounting holes that are shown in the following templates are round. The holes in the rack might be round, square, or threaded.

Before you install a storage enclosure in a rack, you must install the rails and rack-mounting hardware that come with the storage enclosure. GSS storage enclosures require an Electronic Industries Association (EIA) 310-D Type A 19-inch rack. The distance between EIA rails, from the front to the rear of the rack, is

76 cm (30 in.) minimum and 81.28 cm (32 in.) maximum. This rack conforms to the EIA standard. Where you place the support rails in the rack depends on where you intend to place the storage enclosure.

Use the front and rear rack-mounting templates to align the support rails and rear brackets with the correct rack holes. If the support rails will be installed above an existing storage subsystem or storage enclosure, position the storage enclosure support rails directly above it. If the support rails will be installed below an existing storage enclosure, allow 178 mm (7 in.) of vertical clearance for the GSS storage enclosure.

Note: For proper weight distribution, install the support rails as low in the rack as possible. The rack must have a minimum depth of 100 cm (40 in.).

To install the left and right support rails in the rack, complete the following steps:

1. Make sure that the rack has already been installed.
2. Make sure that a stabilizer has been attached correctly to the bottom front of the rack to prevent the rack from tipping forward while the storage enclosure is being installed.

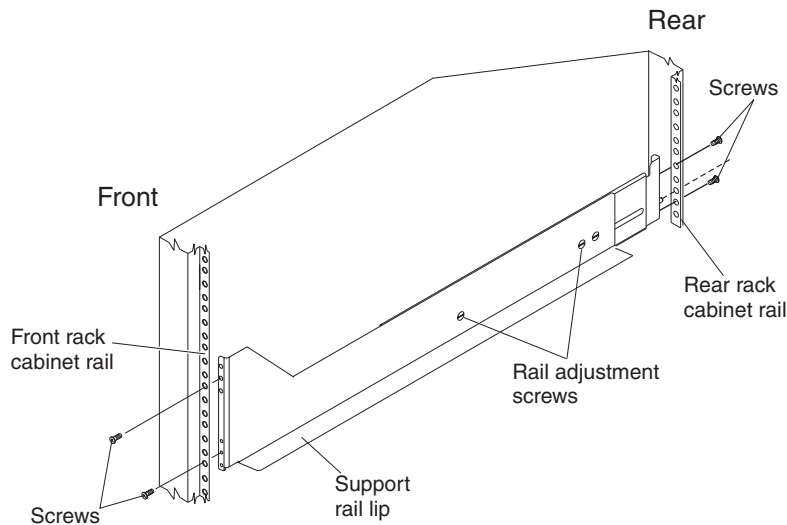
See the rack documentation for more information.

3. Locate the two support rails, eight M5 screws, and eight washers that come with the storage enclosure.

Note: The screws and washers might already be attached to the support rails. If they are, remove them from the support rails.

4. Starting with the left support rail, loosen the two rail-adjustment screws with a medium flat-blade screwdriver. The rail-adjustment screws are used to lock the support rails at a certain length.

Note: The support rails are not marked as left or right. However, each rail can be mounted correctly on only one side of the rack. Install each rail with the alignment pin at the rear of the rack.



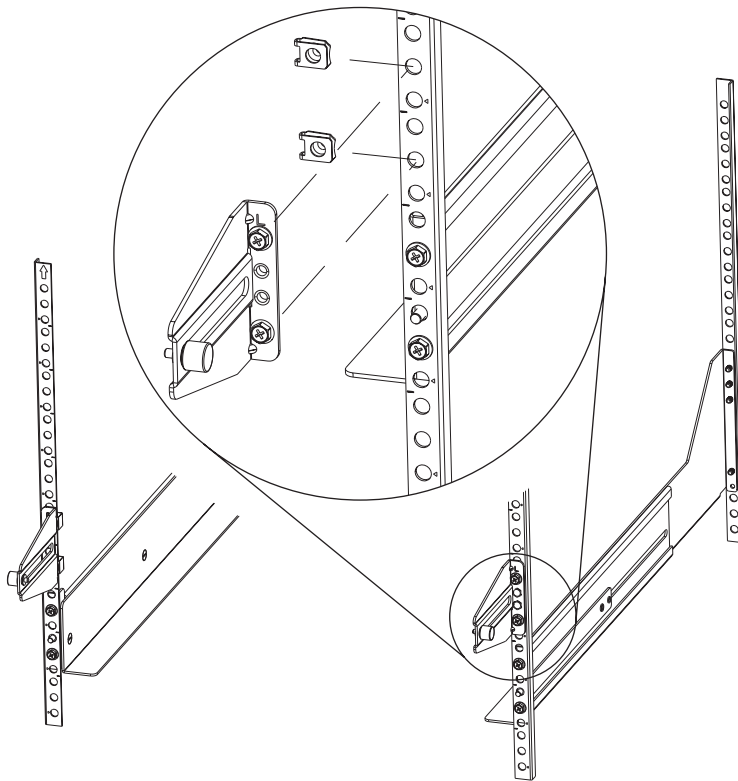
5. Hold the front of the left support rail against the inside of the front rack-support flange, and extend the rear of the support rail until it makes contact with the rear rack-support flange. The alignment pins at the rear of the support rail slide into the mounting holes at the rear of the rack. The wider end of the support rail must be positioned at the front of the rack.
6. From the front of the rack, with the support-rail flanges positioned inside the rack support-rail assemblies, insert two M5 screws with washers through the front of the rack and screw them into the support-rail front flange. Be sure to use a washer when you install an M5 screw through a square hole on a rack-mounting flange.

Attention: Make sure that the screws are tight enough to support the weight of the storage enclosure, but do not completely tighten the screws yet.

7. Make sure that the holes in the support rail above and below the top mounting screw are visible through the holes of the rack flange, and tighten the two M5 screws to secure the front of the support rail to the rack flange.
8. From the rear of the rack, insert two M5 screws with washers through the rear of the rack, and screw them into the support-rail rear flange.
9. Tighten the two rail-adjustment screws with a medium flat-blade screwdriver.
10. Repeat steps 4 on page 34 through 9 for the right support rail.

Note: Because the mounting holes on the rack are not always the same size as the mounting screws, the lip of each of the support rails might not line up evenly. Make minor adjustments to ensure that the lip of the left and right support rails are lined up evenly on the racks. Failure to do so will cause the storage enclosure to fit unevenly in the rack.

11. Locate the two rear brackets, four M5 screws, four washers, and four clip nuts that come with the storage enclosure.
12. Install the rear brackets at the rear of the rack as shown in the following illustration, using the M5 screws, washers, and clip nuts to secure the brackets to the rack-mounting holes. Do not tighten the screws until the storage enclosure is installed in the rack (see step 8 on page 38).



13. Continue with “Installing the storage enclosure in a rack” on page 36.

Installing and removing the handles

Install the handles on the storage enclosure before you move the storage enclosure onto the lift tool. After you install the storage enclosure in the rack and remove the handles, store the handles for future use.

Installing the handles

Complete the following steps to install the handles on the storage enclosure:

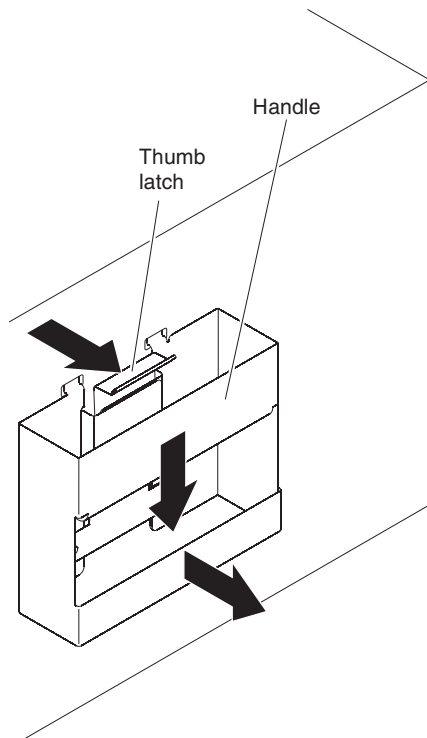
1. Locate the box of handles.

2. Insert the notch at the bottom of one of the handles into one of the openings in the storage enclosure, and push the handle in and up until the latch at the top of the handle secures the handle to the storage enclosure.
3. Repeat step 2 for each of the three remaining handles.

Removing the handles

Before you install the storage enclosure completely into a rack, you must remove the handles. Complete the following steps to remove the handles from the storage enclosure:

1. Release the latch on one of the handles with your thumb and pull the handle down and away from the storage enclosure.
2. Repeat step 1 for each of the three remaining handles.



3. Store the handles for future use.

Installing the storage enclosure in a rack

To install the storage enclosure, complete the following steps:

1. Prepare the storage enclosure for installation:
 - a. Position the lift tool so that it is facing one side of the shipping box.

Note: For information about how to use a lift tool, see the documentation that comes with the lift tool.
 - b. Remove the foam shipping material from the sides and ends of the storage enclosure.
 - c. If necessary, cut away the sides of the shipping box so that the lift tool has access to the storage enclosure.
 - d. Open the plastic bag and tuck it under the storage enclosure. The plastic bag reduces friction and makes it easier to slide the storage enclosure out of the shipping box, onto the lift tool, and then out of the lift tool and into the rack.
 - e. Install the four handles onto the sides of the storage enclosure. See "Installing the handles" on page 35 for detailed instructions.



Attention:

- a. Because of the size and weight of the storage enclosure as shipped, a lift tool and two trained service technicians are required to push the storage enclosure out of its custom-designed package and onto the lift tool. If a lift tool is not available, see Appendix B, “DE6600 component weights,” on page 101 for additional information.
- b. Before you move or relocate a rack that contains storage enclosures, see “Relocating a storage enclosure” on page 50 for additional information.
2. Slide the storage enclosure out of the side of the shipping box and onto the lift tool. Align it in front of the rack.
3. Rest the rear edge of the storage enclosure on the support rails.
4. Remove the two rear handles (one on each side) from the storage enclosure. Do not remove the front handles.
5. Slide the storage enclosure halfway into the rack and remove the two handles (one on each side) from the front of the storage enclosure.

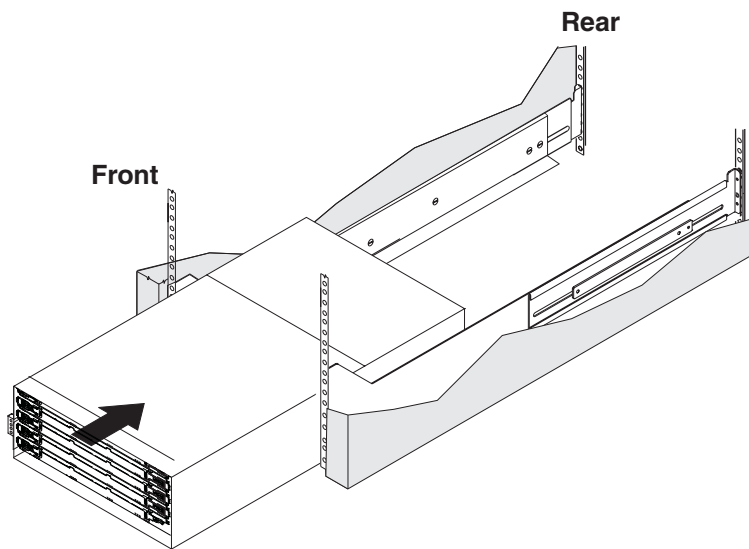


Figure 25. Sliding the storage enclosure halfway into a rack

6. Install and tighten two M5 screws on each side of the rack, above and below the top M5 screws, in the front of the storage enclosure to secure the storage enclosure.

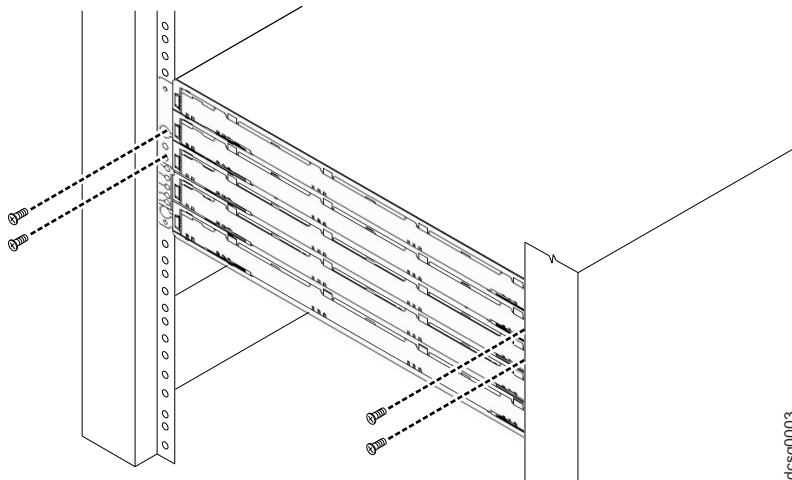


Figure 26. Securing the storage enclosure in a rack

7. Turn the rear-bracket thumbscrews to attach the rear brackets to the sides of the storage enclosure. The screw holes are approximately 51 mm (2 in.) from the rack flange.

Note: To align the thumbscrews with the holes in the unit, you might have to loosen the screws that attach the rear brackets to the rack.

8. Tighten all of the M5 screws to secure the rear bracket to the rack.

Continue with “Installing disk drives.”

Installing disk drives

Attention:

1. **Potential damage to disk drives:** Repeatedly turning the power off and on without waiting for the disk drives to spin down can damage them. After you turn off the power, always wait at least 90 seconds before you turn on the power.
2. The installation order in each drive drawer is from left to right in rows. To ensure sufficient airflow throughout the drive drawers, bays 1, 4, 7, and 10 (the front-row bays) in each drive drawer must be populated. Therefore, the storage enclosure must be configured with a minimum of 20 drives. Bay numbers are indicated on an overlay on the front of each drive drawer. Make sure that the four drives in each row are next to each other. The long edge of each drive must touch the drive next to it.

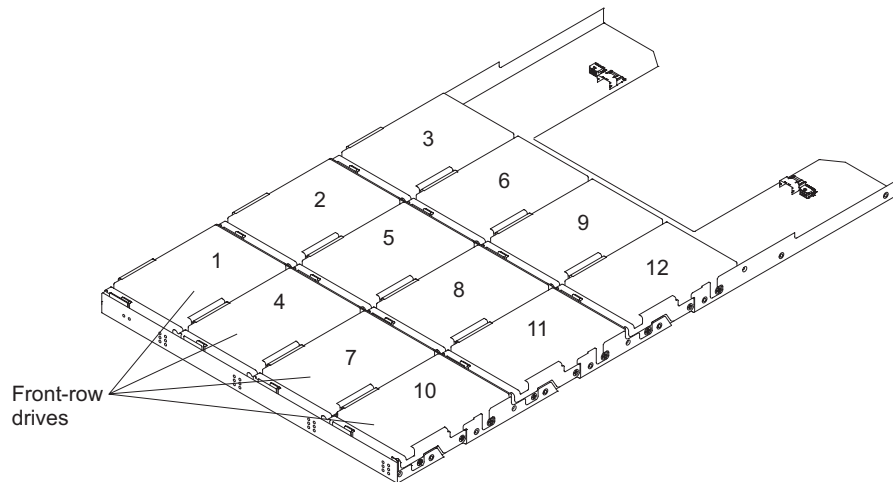


Figure 27. A drive drawer

The drive drawers are preinstalled in the storage enclosure, but the disk drives are shipped separately from the drive drawers. Be sure to install the storage enclosure in the rack before you install disk drives.

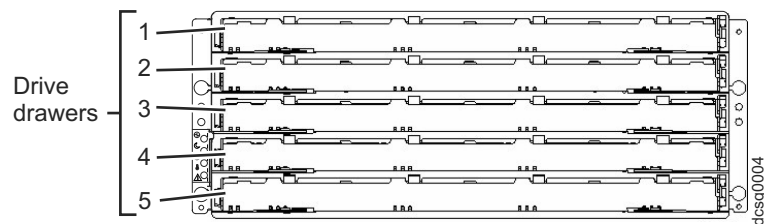


Figure 28. The drive drawers

To install disk drives in the drive drawers, complete the following steps:

1. Open the two release levers on the drive drawer, as shown in the following illustration. Starting with the top drive drawer in the storage enclosure, pull the release lever on each side of the drive drawer out and cam away from the storage enclosure to release the drive drawer.

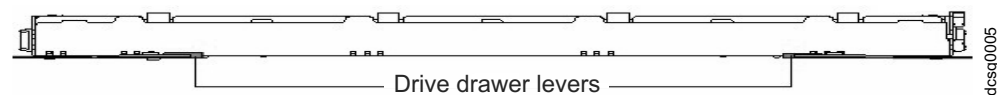


Figure 29. Opening the release levers on a drive drawer

2. With the release levers fully open, slide the drive drawer out until it is fully extended, but do not remove it from the storage enclosure.
3. Raise the handle on a disk drive to the vertical position.

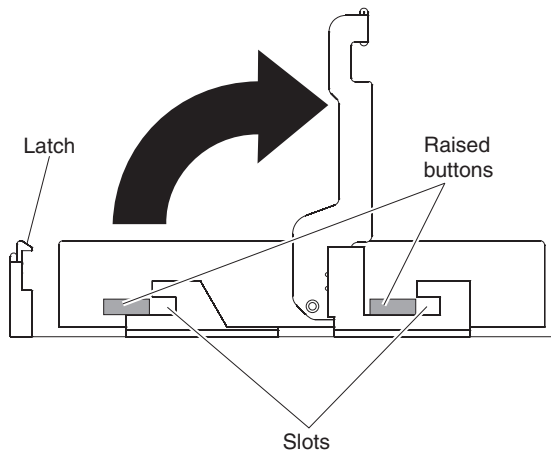


Figure 30. Raising the handle on a disk drive

4. Align the raised buttons on the sides of the disk drive with the matching slots in the bay on the drive drawer. Lower the disk drive onto the drive drawer, and lower the handle on the disk drive until the handle snaps into place under the latch on the disk drive.

Note:

- a. If the disk drive does not correctly fit into the connector on the drive drawer, push on the rear of the disk drive as you lower it onto the drive drawer.
 - b. If the storage enclosure is turned on, you must wait at least 90 seconds after you install each disk drive to allow the storage enclosure enough time to recognize the new disk drive. Otherwise, the storage enclosure might not recognize the new disk drive, might recognize the disk drive as failed, or might recognize the disk drive as incompatible. If this happens, raise the handle on the disk drive, wait 90 seconds, and lower the handle again.
5. Install disk drives in rows from left to right until the front row of the drive drawer is populated, at a minimum.
 6. Push the drive drawer into the storage enclosure until it clicks, and close the release lever on each side of the drive drawer.

Attention: Be sure to push both release levers back against the drive drawer completely so that the drive drawer is closed. If the drive drawer is not completely closed, excess airflow through the storage enclosure might cause damage to the disk drives, and you will not be able to open another drive drawer. If you try to open another drive drawer, both drive drawers might be damaged.

7. Repeat steps 1 on page 39 through 6 for each drive drawer in the storage enclosure.
8. Position the bezel in front of the storage enclosure as shown in the following illustration.

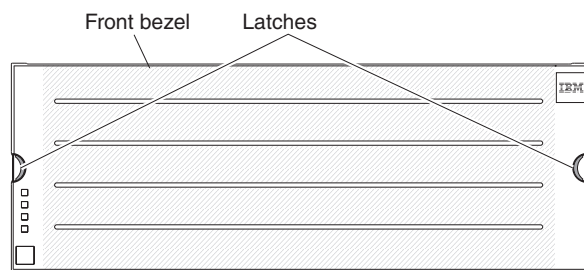


Figure 31. Installing the bezel on the storage enclosure

9. Align the tabs on the top and bottom of the bezel with the slots on the front of the storage enclosure, and align the pins on the side of the bezel with the holes in the storage enclosure. Push the bezel onto the front of the storage enclosure until the latches on both sides of the bezel lock it in place.

Continue with Chapter 4, “Cabling the GPFS Storage Server,” on page 43.

Chapter 4. Cabling the GPFS Storage Server

The section contains information and instructions about cabling the GPFS Storage Server.

After you install the GPFS Storage Server in its permanent location, you must cable it to storage enclosures and other external devices, depending on your hardware configuration.

Cabling the storage enclosure

The GSS storage enclosures are dual ESM units.

ESM connectors

Figure 32 shows the connectors on an environmental service module (ESM).

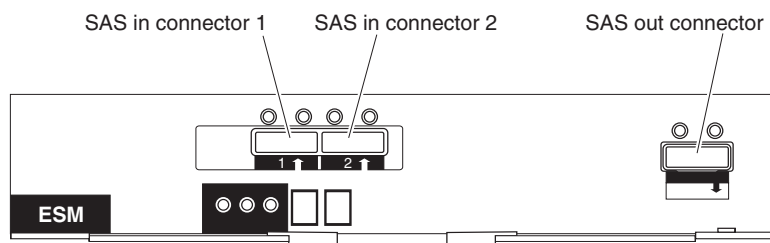


Figure 32. ESM connectors

Each ESM has two SAS In connectors and one SAS Out connector. The SAS Out connector is not used.

Cabling schema

This section includes the cabling schema for the GPFS Storage Server.

GSS Model 24 four-enclosure configuration

Figure 33 on page 44 shows the port mapping of a GSS Model 24 four-enclosure configuration.

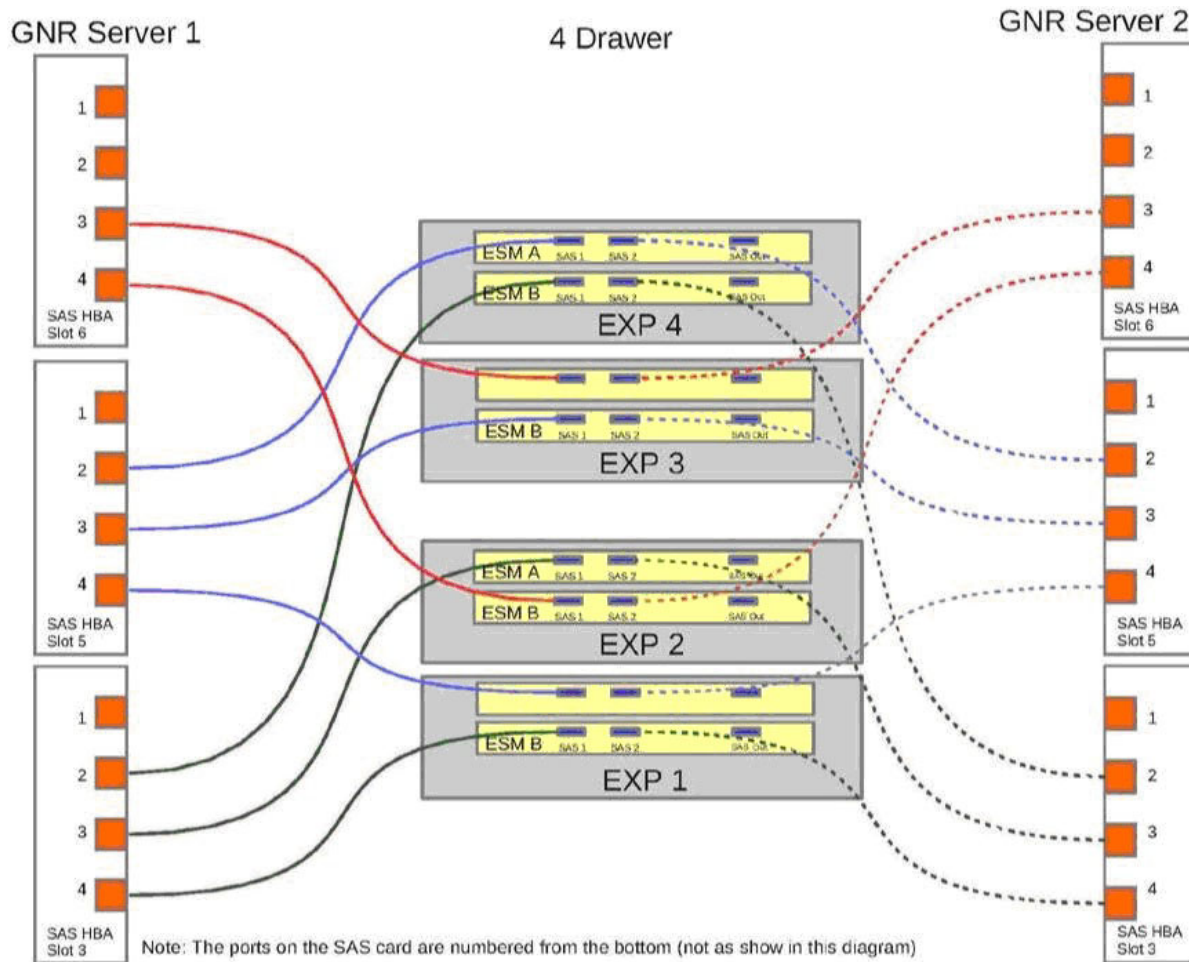


Figure 33. GSS Model 24 four-enclosure configuration

GSS Model 24 four-enclosure port mapping

Figure 34 on page 45 shows the port mapping of a GSS Model 24 four-enclosure building block.

Server	PCI Slot	SAS Port		EXP	ESM	Port
1	3	2	----->	4	B	1
1	3	3	----->	2	A	1
1	3	4	----->	1	B	1
1	5	2	----->	4	A	1
1	5	3	----->	3	B	1
1	5	4	----->	1	A	1
1	6	3	----->	3	A	1
1	6	4	----->	2	B	1
2	3	2	----->	4	B	2
2	3	3	----->	2	A	2
2	3	4	----->	1	B	2
2	5	2	----->	4	A	2
2	5	3	----->	3	B	2
2	5	4	----->	1	A	2
2	6	3	----->	3	A	2
2	6	4	----->	2	B	2

Figure 34. GSS Model 24 port mapping

GSS Model 26 six-enclosure configuration

Figure 35 on page 46 shows the port mapping of a GSS Model 26 six-enclosure configuration.

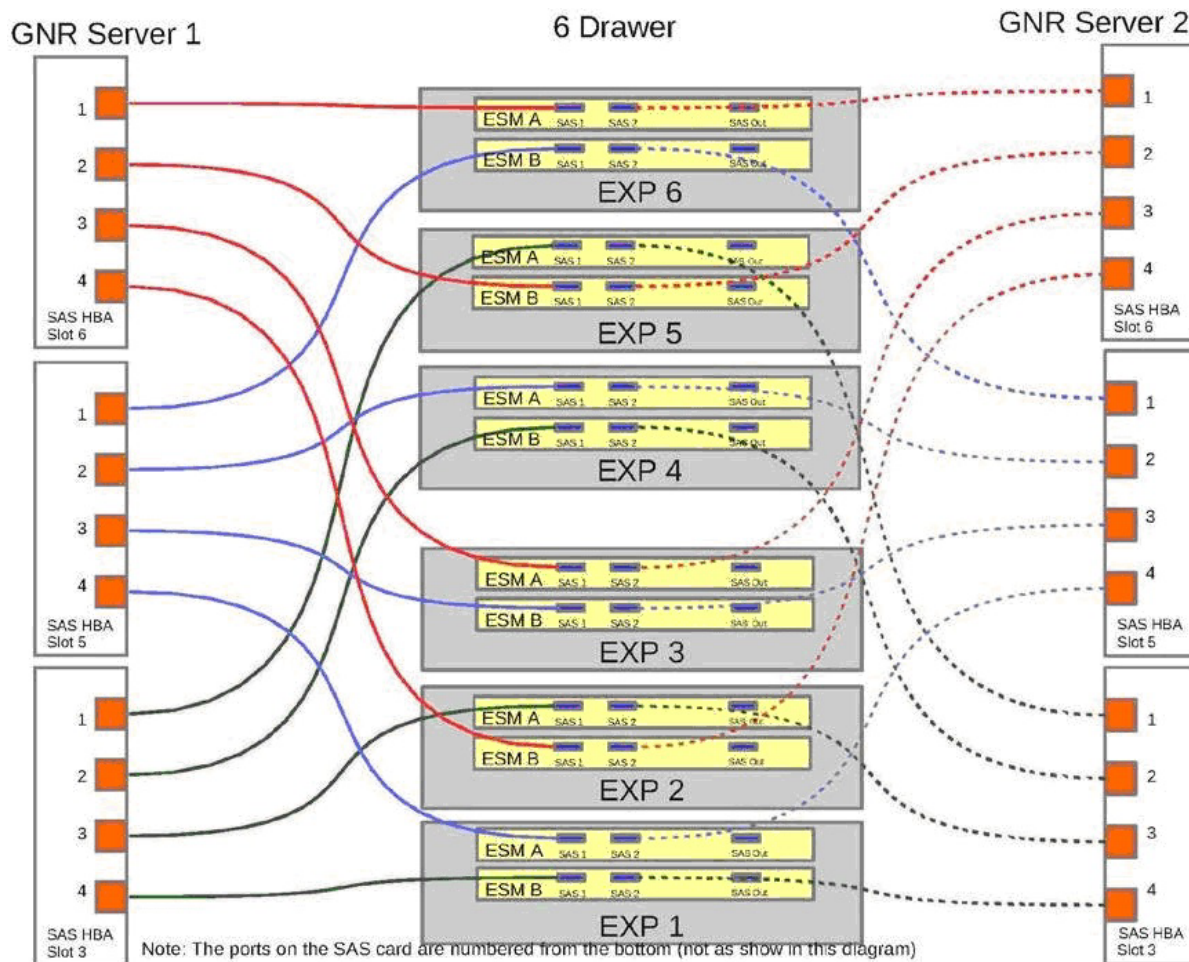


Figure 35. GSS Model 26 six-enclosure configuration

GSS six-enclosure port mapping

Figure 36 on page 47 shows the port mapping of a GSS Model 26 six-enclosure building block.

Server	PCI Slot	SAS Port		EXP	ESM	Port
1	3	1	----->	5	A	1
1	3	2	----->	4	B	1
1	3	3	----->	2	A	1
1	3	4	----->	1	B	1
1	5	1	----->	6	B	1
1	5	2	----->	4	A	1
1	5	3	----->	3	B	1
1	5	4	----->	1	A	1
1	6	1	----->	6	A	1
1	6	2	----->	5	B	1
1	6	3	----->	3	A	1
1	6	4	----->	2	B	1
2	3	1	----->	5	A	2
2	3	2	----->	4	B	2
2	3	3	----->	2	A	2
2	3	4	----->	1	B	2
2	5	1	----->	6	B	2
2	5	2	----->	4	A	2
2	5	3	----->	3	B	2
2	5	4	----->	1	A	2
2	6	1	----->	6	A	2
2	6	2	----->	5	B	2
2	6	3	----->	3	A	2
2	6	4	----->	2	B	2

Figure 36. GSS Model 26 six-enclosure port mapping

Cabling the power supply

The storage enclosures require 200 V to 240 V ac power. Make sure they are connected only to the correct ac supply voltage. Make sure the AC source and the rack power distribution unit current rating are sufficient to support the operating and surge current requirements.

Complete the following steps to connect the power supply cable:

1. Using the strap that is provided with the power supply, tie the power-supply cord to the strap to provide strain relief and to prevent the power cord from being disconnected accidentally.
2. Connect the power cable to the power supply.
3. Continue with “Powering on the GPFS Storage Server” on page 52 for the initial startup of the GSS.

Server network adapter placements

This section shows the server adapter placement options.



Config 1

2 x IB FDR
3 x LSI SAS

Adapter Legend

Infiniband
40Gb Ethernet
10Gb Ethernet
SAS



Config 2

3 x 10Gb Ethernet
3 x LSI SAS



Config 3

2 x 40Gb Ethernet
3 x LSI SAS



Config 4

2 x IB FDR
1 x 10Gb Ethernet
3 x LSI SAS

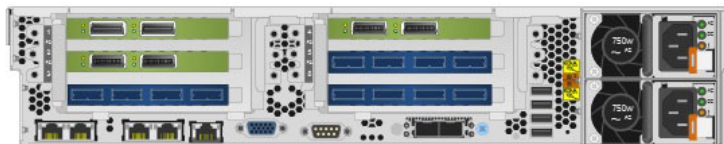


Config 5 [NEW]

1 x IB FDR
2 x 10Gb Ethernet
3 x LSI SAS

Adapter Legend

Infiniband
40Gb Ethernet
10Gb Ethernet
SAS



Config 6 [NEW]

3 x IB FDR
3 x LSI SAS



Config 7 [NEW]

3 x 40Gb Ethernet
3 x LSI SAS

Enclosure ID settings

The enclosure ID is a two-digit identifier on the back of each ESM. In a dual-ESM configuration, both enclosure IDs are identical under normal operating conditions.

Setup of the GSS component database will configure these displays to be the U position in the rack.

Relocating a storage enclosure

Before you move a storage enclosure with populated drive drawers, by itself or as part of the rack that it is mounted in, you must obtain a rack relocation kit. Follow the instructions that come with the relocation kit to avoid potential damage to the storage enclosure:

- Remove the drives from the storage enclosure and place them in the boxes that come with the relocating kit.
- Label the drives by using the labels that come with the relocating kit.
- You must use a lift tool if the storage enclosure is to be removed from the rack.

Chapter 5. Operating the GPFS Storage Server

This chapter describes operating procedures for the GPFS Storage Server.

To ensure optimal operation of the GPFS Storage Server, see “Best practices guidelines.”

Best practices guidelines

To ensure optimal operation of the GSS, always follow these best practices guidelines:

- Make sure the GSS is in an optimal state before you shut it down. Never turn off the power if any service action required LED is lit. Resolve any error conditions before you shut down the GSS.
- To maintain power redundancy, connect the right and left power supplies of the GSS to two independent external power circuits through the distribution units that are inside a rack or directly to external receptacles. The GSS and its enclosures can then have power in the event that only one power circuit is available. Also, during an unattended restoration of power, the storage devices in the configuration can power on simultaneously.

Note: Do not overload the circuits that power the GSS. Use additional pairs of power distribution units (PDUs) if necessary. See “Airflow and heat dissipation” on page 18 for information about GSS power requirements. Contact your IBM service representative for additional information.

- During any maintenance or attended power-up procedure, carefully follow the power-up sequence listed in “Restoring power after an unexpected shutdown” on page 66.
- A system in a normal state should recover automatically from an unexpected shutdown and an unattended restoration of power to system components. After power is restored, call IBM support if the system is not online.

Performing the health check process

1. Use the `/usr/lpp/mmfs/bin/gnrhealthcheck` sample script to check the general health of the system. In particular:

```
gnrhealthcheck --topology --enclosure
```

can be run to check that the GPFS Storage Server has been cabled correctly, disks are in the expected locations, and whether any of the storage enclosures are reporting errors.

2. Monitor the GPFS Storage Server using the GSS GUI for any obvious system errors or problem conditions.
3. Use the `mmfsfirmware` command to display the firmware levels for the ESMs and drives. The command syntax is:

```
mmfsfirmware --type {storage-enclosure} | {drive} ]  
[ --serial-number SerialNumber ]  
[ -N {Node[,Node...]} | NodeFile | NodeClass ] ]
```

The `gpfs.gss.firmware` RPM contains the latest firmware. See Chapter 2, “Installation prerequisites,” on page 23 for information about where to find the latest firmware and software.

4. If hardware or software problems are detected and IBM service needs to be engaged, use the `gpfs.snap` command to collect data. This will collect GPFS data and storage enclosure data.

Set a regular schedule of periodic health check evaluations to keep the firmware levels current and to preserve optimal data access and performance.

Hardware inspection

In addition to the health check process, regular hardware inspection and maintenance helps to support the optimal performance of the storage configuration. Periodically inspect the components of the storage configuration.

For best results, follow these guidelines:

- Develop a change management plan. The plan should include schedules for updating subsystem firmware and server host software.

Note: Some updates might require storage subsystem downtime.

- Use only IBM-approved cables. If any of the cables are not IBM-approved, note this in the configuration document.
- Create and maintain a cabling diagram of the current configuration. Keep this diagram updated as you make configuration changes, and keep the cabling diagram available for review.
- Create and maintain a list of other components that are being used within the cabling diagram (such as the host system and other attached devices).
- Make sure that all controllers and ESMs are correctly seated.
- Make sure that all drives are correctly seated.
- Make sure that cables are managed correctly.
- Ensure proper air flow and temperature for all components in the storage configuration.

You can find details about many of these inspection and maintenance responsibilities in other sections of this document.

In addition to these inspection and maintenance responsibilities, conduct training for staff personnel who support storage configurations. Although it is not a part of the health check process, training reduces the potential for configuration problems and contributes to the correct operation of the system.

Powering on the GPFS Storage Server

This section contains instructions for turning on the GPFS Storage Server under normal situations. “Turning off the GPFS Storage Server” on page 64 contains instructions for turning off the GSS under normal and emergency situations. When you turn on and turn off the GSS, be sure to follow the startup sequence that is described in this section. If you are turning on the GSS after an emergency shutdown or power outage, see “Restoring power after an unexpected shutdown” on page 66.

Follow this procedure keeping in mind these two scenarios:

- The entire storage subsystem has been shut down (the main circuit breakers for the rack are off).
- Some storage enclosures are being powered on while others remain online (the main circuit breakers for the rack are on). You might encounter this if you are adding an enclosure to increase storage capacity.

Attention:

- Repeatedly turning the power off and on without waiting for the drives to spin down can damage the drives. Always wait at least 90 seconds after you turn off the power before you turn it on again.
 - If you are connecting a power cord to a storage enclosure, turn off the power switches first. If the main circuit breaker is off, make sure that both power switches are off on each storage enclosure in the rack before you turn on the main circuit breakers.
 - Turn on the power to the supporting devices (for example, Ethernet switches and management stations) before you power on the storage enclosures.
1. Check whether the main circuit breakers are turned on. If they are, turn off *both* power switches on each enclosure that you intend to connect to power. If they are not, turn off *both* power switches on *all* storage enclosures.
 2. Make sure that all power cords are connected.

Note: If the power cords are not connected, turn off both power switches on all modules in the configuration before you connect power cords or turn on the main circuit breakers.

3. If the main circuit breakers are turned off, turn them on.

Attention: You must turn on power to each attached storage enclosure before you turn on power to the GPFS Storage Server so that the GSS ESMs recognize all drives in the configuration during the startup process.

Depending on the number of storage enclosures in the configuration, the GPFS Storage Server might take up to 10 minutes to fully power on. While each storage enclosure powers on, the green and yellow LEDs on the front and rear of the storage enclosure turn on and off intermittently.

4. Check the LEDs on the front and rear of the storage enclosures. Make sure that no yellow LEDs are lit on any of the storage enclosures.
5. Determine the status of all the components in the GSS configuration by completing the following steps:
 - a. Check all LEDs on each component in the storage enclosures. Make sure that all the LEDs show normal status. For more information about LED status for storage enclosures, see “Checking the LEDs” on page 56.
 - b. Check all LEDs on each component in the GPFS Storage Server. Make sure that all of the LEDs show normal status. For information about LED status, see “Checking the LEDs” on page 56 or “Solving problems” on page 91.
 - c. Use the GSS GUI to display the status of the GPFS Storage Server.
6. If the LEDs indicate normal operation and the GSS GUI status is Normal on all of the configuration components, power-on of the GPFS Storage Server is complete.
7. If the LEDs do not indicate normal operation or the GSS GUI status is not Normal on all of the configuration components, diagnose and correct the problem by completing the following steps:
 - a.

For troubleshooting procedures, see “Solving problems” on page 91.

If the problem persists, contact your IBM technical support representative.

Installing the GSS GUI

This section describes how to install the GSS graphical user interface (GUI) on the management node.

To enable continuous monitoring of the status of the GPFS Storage Server, install the GSS GUI on the management node. For more information about the importance of this information, see “Monitoring status” on page 56.

The GSS GUI, a web-based interface for administering GSS clusters, provides management and monitoring capabilities.

Prerequisites

Download the following required RPMs from the Fix Central website (<http://www.ibm.com/support/fixcentral>):

- postgresql92-9.2.8-1PGDG.rhel6.x86_64.rpm
- postgresql92-contrib-9.2.8-1PGDG.rhel6.x86_64.rpm
- postgresql92-libs-9.2.8-1PGDG.rhel6.x86_64.rpm
- postgresql92-server-9.2.8-1PGDG.rhel6.x86_64.rpm
- java-1.6.0-ibm-1.6.0.15.1-1jpp.x86_64.rpm
- gpfs.gss.gui-4.1.0-1.x86_64.rpm
- gpfs.gss.pmcollector-4.1.0-1.el6.x86_64.rpm

Use the following commands to install the GSS GUI and performance monitor (PM) prerequisites:

```
yum install libxslt.x86_64
yum install uuid
yum install compat-libstdc++-33.x86_64
yum install jpackage-utils
yum install boost-regex
```

These packages might differ depending on which Red Hat Enterprise Linux (RHEL) packages are already installed.

If your system has OpenJDK installed, you need to remove it (or configure IBM JDK as the default with alternatives):

```
rpm -qa | grep openjdk
java-1.6.0-openjdk-1.6.0.0-1.50.1.11.5.el6_3.x86_64
java-1.7.0-openjdk-1.7.0.9-2.3.4.1.el6_3.x86_64

rpm -e java-1.6.0-openjdk-1.6.0.0-1.50.1.11.5.el6_3.x86_64
rpm -e java-1.7.0-openjdk-1.7.0.9-2.3.4.1.el6_3.x86_64
```

Installing the GUI

Use the following commands to install the GUI and the performance monitor:

```
rpm -ihv postgresql92-9.2.8-1PGDG.rhel6.x86_64.rpm
rpm -ihv postgresql92-contrib-9.2.8-1PGDG.rhel6.x86_64.rpm
rpm -ihv postgresql92-libs-9.2.8-1PGDG.rhel6.x86_64.rpm
rpm -ihv postgresql92-server-9.2.8-1PGDG.rhel6.x86_64.rpm
rpm -ihv java-1.6.0-ibm-1.6.0.15.1-1jpp.x86_64.rpm
rpm -ihv gpfs.gss.gui-4.1.0-1.x86_64.rpm
rpm -ihv gpfs.gss.pmcollector-4.1.0-1.el6.x86_64.rpm
```

Installing, configuring, and initializing the performance monitor sensors

In the previous step, the **pmcollector** component of the performance monitor was installed on the management node. Next, the **pmsensors** component is installed on all GPFS nodes across the GSS installation.

1. On the management node, go to the **/opt/IBM/zimon/tmp** directory.
2. To install sensors on all GPFS nodes (including the current node), run:

```
bash ./installSensors.sh
```

On each node:

- The script will install the **pmsensors** component and then start it.

- The log output is written to syslog (**/var/log/messages**).

Initializing the performance monitor

To start the PM collector, run this command:

```
service pmcollector start
```

The log output is written to syslog (**/var/log/messages**).

Initializing the GUI

Use the following commands to initialize the PostgreSQL database, start the GUI, and add the cluster to the GUI:

```
service postgresql-9.2 initdb
service gssgui start
/opt/IBM/sofs/cli/cli initgui --xcat xcat_server_IP_address
```

Shutting down the performance monitor

To shut down the performance monitor components:

1. On the management node, run these commands:

```
service pmcollector stop
service pmsensors stop
```
2. On each node that is running PM sensors, run this command:

```
service pmsensors stop
```

Logging in to the GUI

To access the GUI, open your web browser and enter your server URL, for example:

`https://server_address`

You should see the login page:



Figure 37. The GSS GUI login page

To log in, use the following default credentials. Type admin in the User Name field and admin001 in the Password field on the login page. Click on Log in ->. After you log in successfully, click on admin in the upper right corner of the Overview page and choose Modify password in the drop-down menu in order to replace the default password with your own password.

Related tasks

To force discovery of cluster components manually:

```
# /opt/IBM/sofs/cli/lsccluster
Cluster id      Name          Primary server  Secondary server  Profile Mode
8393575977173099624 GSS.cluster.com gss01.cluster.com gss02.cluster.com unknown normal
EFSSG1000I The command completed successfully.
#
# /opt/IBM/sofs/bin/cli runtask RECOVERY_GROUP -c 8393575977173099624
```

To clean up the database after an incompatible update:

```
su -l postgres -c 'psql -d postgres -c "drop schema fscc cascade"'
```

Monitoring status

You can monitor the status of the GPFS Storage Server using the GSS GUI.

Use the GSS GUI to monitor the status of the GPFS Storage Server. Run the GUI constantly and check it frequently.

The GSS GUI provides the best way to diagnose and repair GPFS Storage Server failures. The GUI can help you:

- Determine the nature of the failure
- Locate the failed component
- Determine the recovery procedures to repair the failure

Amber LEDs ("needs attention") do not necessarily indicate which component has failed or must be replaced or which type of recovery procedure you must perform. In some cases, such as when a drive exceeds its Predictive Failure Analysis (PFA) threshold, the amber LED is not lit. The GSS GUI can detect the failure.

For example, the recovery procedure for a PFA flag (impending drive failure) on a drive varies depending on the drive status (hot spare, unassigned, RAID level, or current logical drive status, for example). A PFA flag on a drive can indicate a minimal risk of data loss if the drive is unassigned. The GSS GUI can identify the risk level and provide the necessary recovery procedures.

Note: For PFA flags, the system-error LED and drive status LEDs are not lit, so checking the LEDs will not notify you of the failure, even if the risk of data loss is high.

Attention: Not following the software recovery procedures can result in data loss. In addition, always replace a failing component as soon as possible to minimize additional failures that might occur and cause loss of data access.

Checking the LEDs

The LEDs on the storage enclosures indicate the status of the enclosures.

Green LEDs indicate a normal operating status; yellow LEDs indicate a possible failure; a blue LED on a component indicates that it is safe to remove the component.

Check all of the LEDs on the front and rear of the storage enclosures when you turn on power. During power on, the LEDs flash intermittently. In addition to checking for faults, you can use the LEDs on the front of the storage enclosures to determine whether the drives are responding to I/O transmissions from the host.

Front LEDs

This section describes the primary LEDs and controls on the front of a storage enclosure.

Figure 38 shows the front LEDs and controls for a DE6600 storage enclosure.

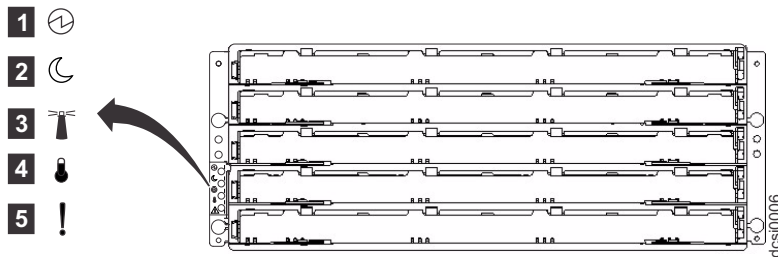


Figure 38. Front LEDs and controls

1 Power-on LED (green)

LED is lit, it indicates that the power supply is turned on and is supplying 5-volt and 12-volt dc power.

2 Standby power LED (green)

Future use only.

3 System locator LED (blue)

This blue LED can be lit by the GSS GUI to aid in visually locating the storage enclosure.

4 Overtemperature LED (amber)

When this amber LED is lit, it indicates that the storage enclosure is in an over-temperature condition.

5 System error LED (amber)

When this amber LED is lit, it indicates that the unit has a fault in a power supply or a drive, for example.

ESM LEDs

This section describes the ESM LEDs.

Figure 39 on page 58 shows the LEDs on the ESM.

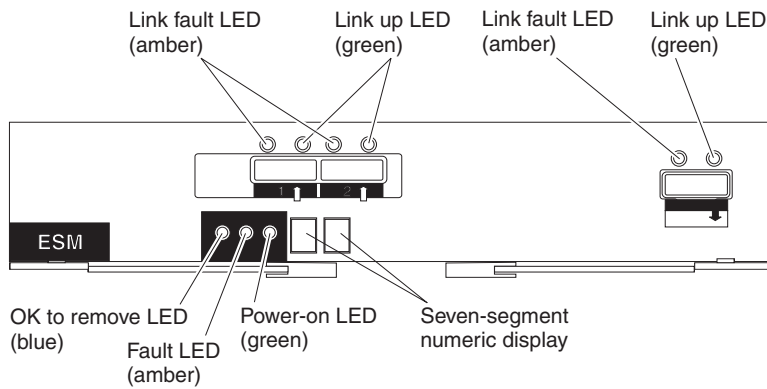


Figure 39. ESM LEDs

Link fault LED (amber)

When this amber LED is lit, it indicates that the link through the SAS cable is not successful.

Link up LED (green)

When this green LED is lit, it indicates that the link through the SAS cable is successful.

OK to remove LED (blue)

This LED is not supported on a GPFS Storage Server.

Fault LED (amber)

When this amber LED is lit, it indicates that the ESM has failed.

Power-on LED (green)

When this green LED is lit, it indicates that the ESM is receiving power.

Fan assembly LEDs

This section describes a storage enclosure's fan assembly LEDs.

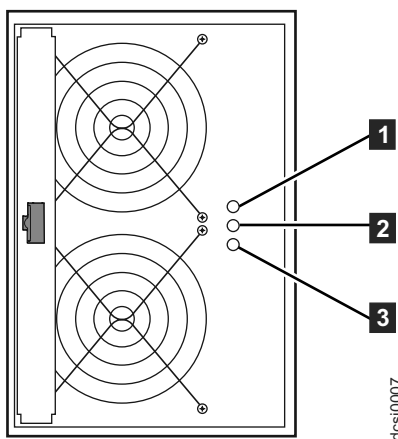


Figure 40. Fan assembly LEDs

Table 21. Fan assembly LEDs

Number	LED	Normal Status	Problem Status
1	Power 	On (Green)	Off: No power to fan assembly

Table 21. Fan assembly LEDs (continued)

Number	LED	Normal Status	Problem Status
2	Service Action Required (Fault) !	Off	On (Amber): A fault exists within the fan assembly
3	Service Action Allowed 	Off	On (Blue): The fan assembly can be removed. This LED is not supported on a GPFS Storage Server.

AC power-supply LEDs

This section describes the primary LEDs on a storage enclosure's ac power supplies.

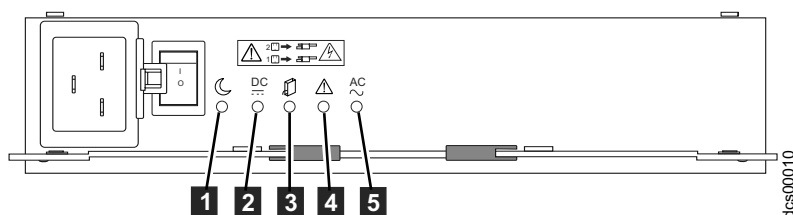


Figure 41. AC power-supply LEDs

1 Standby power LED (green)

Future use only.

2 DC power LED (green)

When this green LED is lit, it indicates that the storage enclosure is turned on and is supplying 5-volt, 12-volt, and 48-volt dc power.

3 Service Action Allowed LED (blue)

When this blue LED is lit, it indicates that it is safe to remove the power supply. This LED is not supported on a GPFS Storage Server.

4 Fault LED (amber)

When this amber LED is lit, it indicates that a power supply or fan has failed or that a redundant power supply is not turned on.

5 AC power LED (green)

When this green LED is lit, it indicates that the storage enclosure is receiving ac power.

Drive drawer LEDs

This section describes the LEDs on a storage enclosure's drive drawers.

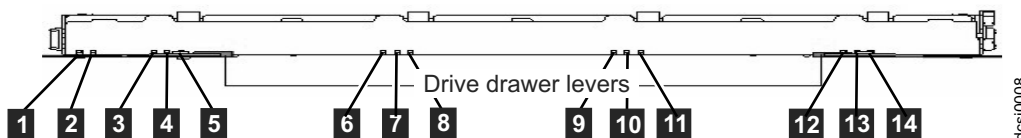


Figure 42. Drive drawer LEDs

Table 22. Drive drawer LEDs

Number	LED	Normal Status	Problem Status
1	Service Action Allowed 	Off	On (Blue): The drive drawer can be removed The drawer Service Action Allowed LED is also lit when a Service Action Allowed LED on one of the drives in the drawer is lit.
2	Service Action Required (Fault) 	Off	On (Amber): A fault exists within the drive drawer
3 - 14	Drive Activity (for drives 1 to 12 in the drawer)  Note: The associated disk drive is indicated by a number (1 to 12) that is displayed inside the Drive Activity icon.	On (Green): Power is on, drive is operating normally Flashing (Green): Indicates drive I/O activity	Off: No power to the drive or a drive is not installed

Disk drive LEDs

Description of the service LEDs on the disk drives.

This section describes the service LEDs on the disk drives. The drive power / drive activity LEDs are located on the front of the drive drawer. See “Drive drawer LEDs” on page 59 for more information.

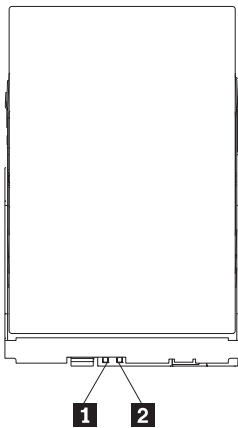


Figure 43. Disk drive LEDs

Table 23. Disk drive LEDs

Number	LED	Normal Status	Problem Status
1	Service Action Allowed 	Off	On (Blue): The disk drive can be removed

Table 23. Disk drive LEDs (continued)

Number	LED	Normal Status	Problem Status
2	Service Action Required (Fault) 	Off	On (Amber): A fault exists within the disk drive

Table 24. Drive state indicated by the LEDs

Drive State	Drive Power LED (Green)	Drive Service Action Required LED (Amber)	Drive Service Action Allowed LED (Blue)
Power is not applied	Off	Off	Off
Normal operation: The power is turned on but there is no drive I/O activity	On	Off	Off
Normal operation: Drive I/O activity is occurring	flashing	Off	Off
Service Action Required: A fault condition exists and the drive is offline	On	On	On

Seven-segment numeric display LEDs

The seven-segment numeric display LEDs provide information about enclosure identification and diagnostics. The following illustration shows the numeric display LEDs and the heartbeat and diagnostic LEDs.

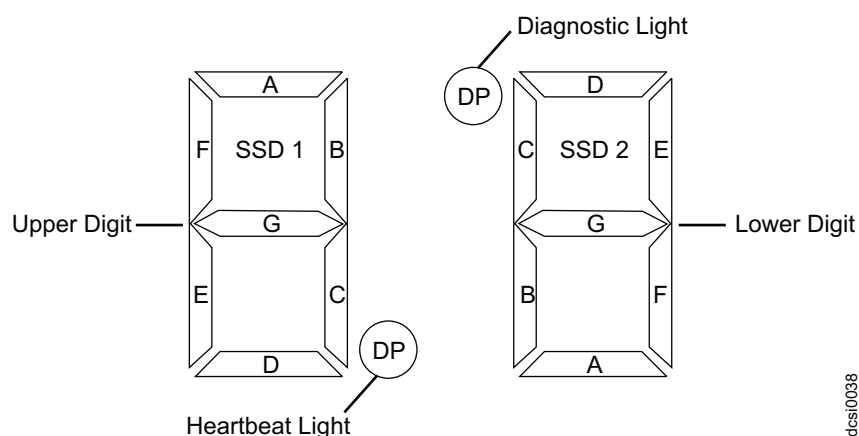


Figure 44. Numeric display LEDs

When you turn on the power to the storage enclosure, the numeric display LEDs cycle through various codes as the ESM firmware starts to boot. If the diagnostic LED is lit and the heartbeat LED is off, it indicates that diagnostic information is displayed on the numeric display. When the ESM completes the boot process and is operating normally, the diagnostic LED turns off, the heartbeat LED flashes, and the numeric display changes to show the enclosure identification (enclosure ID) for that individual enclosure.

If an error occurs during the boot process and the needs attention LED is lit, the numeric display shows diagnostic information as a sequence of two-digit diagnostic codes. The number of times each two-digit

code is displayed during a sequence is fixed and under hardware control. Each sequence minimally consists of a two-digit category code, followed by a two-digit detail code that is specific to the category. Longer sequences can be displayed if more than one event is to be reported. This nominally consists of a series of category-detail sequences with a delimiter between category-detail sequences. The entire display goes blank at the end of the sequence (all segments off, the diagnostic light off), and then the sequence repeats.

For more information about the diagnostic codes and their possible causes, see "Seven-segment display sequence codes and their causes."

Seven-segment display sequence codes and their causes

If an error occurs during the ESM boot process and the Needs Attention LED is on, the numeric display shows diagnostic information as a sequence of two-digit diagnostic codes.

The following figure shows the seven-segment alphanumeric characters.

Numbers	0	1	2	3	4	5	6	7	8	9
7-Segment Font										

Letters	A	b	C	d	E	F	H	L	n	O	o	P	r	S	U	u
7-Segment Font																

Similar Letters and Numbers			
Upper-Case Letter "O"			Number "0"
Upper-Case Letter "S"			Number "5"
Lower-Case Letter "b"			Number "6"

Figure 45. Seven-segment alphanumeric characters

The following table lists the sequence category codes and their associated detail codes.

Startup errors and operational states are displayed in sequences. The numeric display helps to identify a component failure. Table 25 lists the different sequences and the corresponding errors.

Table 25. Seven-segment display sequence code definitions

Category	Category code	Detail codes
Startup Error	SE+	- SE+ Power-on default - dF+ Power-on diagnostic fault - Sx Power-on validation error
Operational State	OS+	- OL+ Offline (See note 1.) - CF+ Component failure (See note 2)
Component Failure	CF+	Hx+ Host card (x = location)

Table 25. Seven-segment display sequence code definitions (continued)

Category	Category code	Detail codes
Category Delimiter	dash+	Separator between category-detail code pairs (See notes 3 and 4)
End-Of-Sequence Delimiter	blank-	End-of-sequence indicator (See notes 5 and 6)
Notes: 1. If an enclosure ID is being displayed, this sequence is programmed to display. The controller is then held in reset. 2. The enclosure ID is nominally displayed during normal operation. This operational state is displayed if an internal controller component failure occurs while the controller is online. An additional detail code identifies the failed component as defined for the Component Failure category. This sequence will continue to display even if the controller is later placed offline (held in reset) to service the failed component. 3. dash+ All segments are off except the middle segments and the diagnostic light is on. 4. Category-Detail separator is used when there is more than one category-detail pair in the sequence. For examples, see Table 26 5. blank- All segments are off and the diagnostic light is off. 6. End-of-sequence indicator is automatically inserted by hardware at the end of the sequence. Example: SE+ 88+ blank- (repeat)		

Table 26. Repeating sequences on the seven-segment display and corresponding errors

Repeating sequence	Startup and operational error
Operational failure:	
OS+ OH+ blank-	The processor temperature exceeds the warning level
Power-on diagnostic failure:	
SE+ dF+ blank-	Failure of a component that is not a field replaceable unit is detected
SE+ dF+ dash+ CF+ Hx+ blank	Failure of a host interface card is detected

The following tables list the ESM diagnostic codes.

Table 27. ESM numeric display diagnostic codes.

Value	Description
FF	ESM Boot Diagnostic is running
88	This ESM is being held in Reset by the other ESM
AA	ESM-A application is booting up
bb	ESM-B application is booting up
L0	Mismatched ESM types
L2	Persistent memory errors
L3	Persistent hardware errors
L9	Over Temperature
LL	Cannot read midplane EEPROMs
LP	Missing Drive Port Mapping table
Ln	ESM not valid for enclosure
H2	Invalid/Incomplete Configuration
LF	Lockdown with limited SYMbol support
LH	Controller firmware mismatch

Table 27. ESM numeric display diagnostic codes (continued).

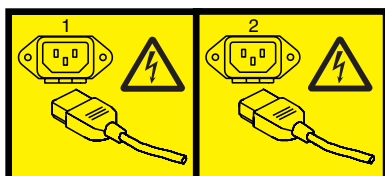
Value	Description
H3	Maximum Reboot Attempts Exceeded
H4	Cannot Communicate with Other ESM
H5	Midplane Harness Failure
H6	Firmware Failure
H9	Non-Catastrophic HW. ESM operational, but in a degraded mode
J0	Incompatible module

Turning off the GPFS Storage Server

The GPFS Storage Server is designed to run continuously. After you turn it on, do not turn it off. Turn off the power only in the following situations:

- Instructions in a hardware or software procedure require that you turn off the power.
- An IBM technical-support representative instructs you to turn off the power.
- A power outage or emergency situation occurs. See “Restoring power after an unexpected shutdown” on page 66.

Attention: Except in an emergency, never turn off the power if any yellow (needs attention) LEDs are lit. Correct the fault before you turn off the power. Use the GSS GUI and the yellow LEDs to check the overall status of the GSS. All LEDs must be green on the front of the storage enclosures. If they are not, use the GSS GUI to diagnose the problem so that the GSS will power on correctly later.



Attention: Turning off and turning on power without waiting for the disk drives to spin down can damage the drives and might cause data loss. Always wait at least 90 seconds after you turn off the power before you turn on the power again.

Turn off the power to each device according to the following shutdown sequence:

1. Turn off power to the host before the storage enclosure. If the host must stay powered on to support a network, see the operating-system documentation for information about disconnecting the storage enclosure logical drives from the host before the storage enclosure is powered off.
2. Turn off power to the storage enclosure before you turn off power to the expansion enclosures. Turn off both power-supply switches on the rear of the enclosures.
3. Turn off power to other supporting devices (such as management stations).

Note: You do not have to perform this step if you are servicing only the storage enclosure.

To turn off power to one or more components of the storage enclosure for a planned shutdown, complete the steps in the following procedure. To turn off power for an unplanned shutdown, see “Restoring power after an unexpected shutdown” on page 66.

Figure 17 on page 15 shows the locations of the power switches on the GSS.

Before you proceed, use the GSS GUI to determine the status of the storage enclosure components and special instructions. You might have to complete other procedures before you turn off the power.

1. Stop all I/O activity to each storage enclosure.
2. Determine the status of all storage enclosure components in the configuration:
 - a. Check all LEDs on each component in the storage enclosures. Make sure that all the LEDs indicate normal status.
 - b. Check all LEDs on each component in the storage enclosure. Make sure that all the LEDs indicate normal status.
3. Use one of the following procedures, depending on the status of the LEDs:
 - If the LEDs do not indicate normal operation or the status on all configuration components is not Optimal, diagnose and correct the fault:
 - a. If you need to replace a failed component, use the individual LEDs to locate the failed component.
 - b. If the problem has not been corrected, contact your IBM technical-support representative. Do not turn off power until all problems are corrected.
4. Check the LEDs on the drive drawer to ensure that all drive activity LEDs are off. If one or more LEDs are flashing, data is being written to or from the drives. Wait for all activity LEDs to stop flashing.
5. Turn off the ac power switches on the backs of the storage enclosures.

Note: Until the power switch on each power supply is turned off, power remains turned on for both ESMs.

6. Turn off both power switches on the back of each storage enclosure in the configuration.
7. After you perform the necessary maintenance procedures, turn on the power, using the procedure in “Powering on the GPFS Storage Server” on page 52.

Performing an emergency shutdown

Attention: Emergency situations might include fire, flood, extreme weather conditions, or other hazardous circumstances. If a power outage or emergency situation occurs, turn off all power switches on all computing equipment. This helps to safeguard your equipment from potential damage due to electrical surges when power is restored. If the storage subsystem loses power unexpectedly, it might be due to a hardware failure in the power system or in the midplane.

To shut down the system during an emergency, complete the following steps:

1. If you have time, stop all I/O activity to the GSS by shutting down the host or disconnecting the GSS logical drives through the host.
2. Check the LEDs. Note any yellow LEDs that are lit so that you can correct the problem when you turn on the power again.
3. Turn off all power-supply switches. Then, disconnect the power cables from the GSS.

Restoring power after an unexpected shutdown

To restore power to the GPFS Storage Server after an unplanned shutdown, complete the following steps.

DANGER

Never turn on any equipment when there is evidence of fire, water, or structural damage.

1. After the emergency situation is over or power is restored, check the GSS for damage.
2. If there is evidence of damage to any of the GSS components, cables, or equipment attached to the GSS, do not continue with this procedure. Contact your IBM technical-support representative for assistance. Depending on the current service agreements, you might have to return the equipment to the factory or local service center for repair.

Attention: To avoid potential data loss, make sure that the GSS power switches are turned off before you reset circuit breakers in the rack. Resetting circuit breakers after an emergency situation while the GSS is turned on can cause data loss, because the configuration components might not be powered on in the correct sequence. See “Powering on the GPFS Storage Server” on page 52 for details about the correct power-on sequence.
3. After you check the GSS for damage, make sure that the power switches are off; then, connect the GSS power cables, if required.
4. Check the system documentation of the hardware devices that you want to turn on and determine the correct startup sequence.
5. Turn on both of the power-supply switches on the storage enclosures and make sure that no ESM or power-supply fault LEDs are lit before you power on the storage enclosures.

In addition, consider the following information:

- The GSS supports simultaneous power-on of the system components. However, always check the system documentation of the hardware devices that you want to turn on and determine the correct startup sequence.
 - The GSS in Optimal state recovers automatically from an unexpected shutdown and unattended simultaneous restoration of power to system components. After power is restored, contact your IBM technical-support representative if the GSS logical drives and arrays do not come online.
6. Turn on both of the power-supply switches on the storage enclosures.

Recovering from an overheated power supply

A storage enclosure contains two power supplies. Each power supply contains a built-in temperature sensor to prevent the power supply from overheating. Under normal operating conditions, with an ambient air temperature range of 10°C to 40°C (50°F to 104°F), the fans in the power supplies maintain a suitable operating temperature inside the storage enclosure.

If the internal temperature reaches 65°C (149°F), the power supply shuts down automatically. If both power supplies shut down because of overheating, the storage enclosure has no power, and all LEDs are off.

The following factors can cause a power supply to overheat:

- An unusually high room temperature
- Fan failure in the power supply
- Defective circuitry in the power supply
- Blocked air vents
- Failures in other devices in the configuration or rack.

If a fan failure causes overheating, the system-error LED and overtemperature LEDs on the front bezel are lit. The fault LED on the power supply might also be lit. “Checking the LEDs” on page 56 shows the locations of the LEDs on a storage enclosure.

Attention: To prevent damage to the system components when the power supplies automatically shut down, immediately remove all rack panels to help reduce the rack air temperature.

To resume normal operation after a power-supply shutdown, complete the following steps:

1. Confirm whether you used the procedure in “Solving problems” on page 91 to ensure that the power supplies have shut down because of an overheating problem.
2. Stop I/O activity to the storage enclosure.
3. Take all or some of the following measures to alleviate the overheating problem:
 - Remove all panels from the rack immediately.
 - Use external fans to cool the area.
 - Shut down the power to the storage enclosures, using the procedure that is described in “Performing an emergency shutdown” on page 66.
4. Wait for the air in and around the storage enclosure to cool. After the temperature inside the power supplies drops to below 65°C (149°F), the storage enclosure is capable of power-on recovery without operator intervention.

If the power supplies do not restart automatically after the air has cooled, turn off both power switches on the storage enclosure (see Figure 17 on page 15).

5. Turn on both power switches on the rear of the storage enclosure. The storage enclosure can take up to 10 minutes to power on and up to 15 minutes for the battery self-test to be completed. During this time, the LEDs on the front and the back of the storage enclosure flash intermittently.
6. Check the LEDs on the front and back of the storage enclosure (a green LED indicates a normal status; a yellow LED indicates a hardware fault).
7. If any module (power supply or ESM) does not display a green status LED, or if the status for any module component is not Optimal, diagnose and correct the fault.
 - a. If you need to replace a failed component, locate and troubleshoot that component. See “Checking the LEDs” on page 56.
 - b. If the problem persists, contact your IBM technical-support representative.
8. Replace the bezel on the GSS, if applicable.

Chapter 6. Migrating the GPFS Storage Server

This section describes a procedure for migrating a GPFS Storage Server from GSS 1.0 or GSS 1.5 to GSS 2.0.

This section focuses on a single GSS building block. For installations with multiple building blocks, the procedure described in this section will need to be completed for each of the GSS building blocks. You can follow this procedure can be run on an active GSS system with workload running or during a planned maintenance window. If you do this during a planned outage, some of the following steps might not be required (**Phase 1, Step 1: Change the active server for the recovery group**, for example).

A GSS building block consists of a pair of nodes, which are referred to as *GSS server nodes*, each twin-tailed to four or six storage enclosures.

GSS 1.0 means the GSS server nodes have installed GPFS Version 3.5.0.11: **gpfs.base-3.5.0-11.x86_64.rpm** and **gpfs.gnr-3.5.0-11.x86_64.rpm**

GSS 1.5 means the GSS server nodes have installed GPFS Version 3.5.0.16: **gpfs.base-3.5.0-16.x86_64.rpm** and **gpfs.gnr-3.5.0-16.x86_64.rpm**

GSS 2.0 means the GSS server nodes have installed GPFS Version 4.1: **gpfs.base-4.1.0-1.x86_64.rpm** and **gpfs.gnr-4.1.0-1.x86_64.rpm**.

Sample names for the constructs discussed in this section follow:

- Each building block has two servers: node1 and node2
- Each building block has two recovery groups: rgL ("left") and rgR ("right")
- node1 is the primary serving node for rgL and the backup serving node for rgR
- node2 is the primary serving node for rgR and the backup serving node for rgL.

During normal running, node1 will be the "active recovery group server" for rgL and node2 will be the "active recovery group server" for rgR.

In preparation for the update, complete these tasks:

- Back up all of your GPFS data
- Review your xCAT installation image creation
- Download the update code for GPFS 4.1.0-1
- Create the stanza files used for creating the new vdisk constructs:
 - The declustered array NVRAM
 - The log tip vdisk
 - The log tip backup vdisk.

This procedure consists of four phases:

1. Upgrade the code.

In this phase, you will update the GPFS and GNR software on the server nodes. Other nodes in the same or external clusters would have their software levels managed according to the procedures in general use in your environment.

2. Migrate the recovery groups version.

In this phase, you will update the recovery groups to the latest version.

3. Create NVRAM pdisks and declustered arrays.

In this phase, you will create a new declustered array within each of the existing recovery groups. Each of these declustered arrays will consist of one NVRAM partition in the recovery group's primary server node and one NVRAM partition in the recovery group's backup server node.

4. Delete the old log tip and create the new log tip and log tip backup vdisks.

In this phase, you will move the GNR "fast cache" from SSD to NVRAM. It is assumed that NVRAM partitions have been created on all GSS building blocks in anticipation of this migration. If not, stop now and create these partitions.

Phase 1: Upgrade the code

Phase 1, Step 1: Change the active server for the recovery group

In this step, you will apply service to GPFS and GNR and create a new installation image with the later versions. To do this, you will need to shut down the GPFS instance. Before shutting down, you should move the service of the recovery group to the other (surviving) node.

You can do this using the **mmchrecoverygroup** command. For example:

```
/usr/lpp/mmfs/bin/mmchrecoverygroup rgL --active node2
```

Then, run the following command to ensure that the recovery group, rgL, is now served by the backup server node:

```
/usr/lpp/mmfs/bin/mmchrecoverygroup rgL -L
```

Focus on the final stanza of output from this command, looking for:

active recovery group server	servers
-----	-----
node2	node1,node2

This confirms that rgL is now served by node2.

To confirm that the active workload is now served by node1 and node2, invoke **dstat**, **iostat**, or another monitor on both nodes and verify that the workload is active.

Phase 1, Step 2: Shut down the GPFS instance on node1

Shut down the GPFS instance on node1 using the following command, which can be invoked from any node in the cluster containing node1:

```
/usr/lpp/mmfs/bin/mmshutdown -N node1
```

Confirm that the GPFS instance on node1 is now inactive:

```
/usr/lpp/mmfs/bin/mmgetstate -N node1
```

The output will look something like this:

Node number	Node name	GPFS state
-----	-----	-----
1	node1	down

Phase 1, Step 3: Update GPFS and GNR software levels

Update the RPMs on your Linux clusters:

```
rpm -Uvh gpfs.base-4.1.0-1.x86_64.rpm
```

Confirm that the updates have been installed:

```
rpm -qa|grep -i gpfs
```

Start up the GPFS instance:

```
/usr/lpp/mmfs/bin/mmstartup -N node1
```

Confirm that GPFS has started on node1:

```
/usr/lpp/mmfs/bin/mmgetstate -N node1
```

The output will look something like this:

Node number	Node name	GPFS state
1	node1	active

Confirm that this node can serve its recovery group:

```
/usr/lpp/mmfs/bin/mmchrecoverygroup rgL --active node1
```

Invoke the following command to ensure that the recovery group, rgL, is, indeed being served by its primary serving node:

```
/usr/lpp/mmfs/bin/mmIsrecoverygroup rgL -L
```

Focus on the final stanza of output from this command, looking for:

active recovery group server	servers
node1	node1,node2

This confirms that rgL is indeed now actively served by node1.

To confirm that the active workload is now served by node1 and node2, invoke **dstat**, **iostat**, or another monitor on both nodes and verify that the workload is active.

Next, invoke the appropriate xCAT commands to create a new server node install image, with the later versions of GPFS and GNR RPMs.

Update the software on the other server node, node2. Essentially, run the same set of commands for node2 that you ran for node1.

Move service of rgR from node2 to node1:

```
/usr/lpp/mmfs/bin/mmchrecoverygroup rgR --active node1
```

Confirm the move:

```
/usr/lpp/mmfs/bin/mmIsrecoverygroup rgR -L
```

The last stanza should show the active recovery group server is indeed node1:

active recovery group server	servers
node1	node1,node2

Shut down GPFS on node2:

```
/usr/lpp/mmfs/bin/mmshutdown -N node2
```

Confirm that the GPFS instance on node2 is now inactive:

```
/usr/lpp/mmfs/bin/mmgetstate -N node2
```

The output will look something like this:

Node number	Node name	GPFS state
1	node2	down

Here, you could do one of the following:

1. Update the GPFS and GNR software using your procedure for upgrading software levels
2. Shut down this node (node2). Using xCAT, bring the node up pointing to the new installation image that was created previously.

After the node is back, start up GPFS (unless you have set up your cluster configuration to start up GPFS automatically):

```
/usr/lpp/mmfs/bin/mmstartup -N node2
```

Confirm that GPFS has started on node1:

```
/usr/lpp/mmfs/bin/mmgetstate -N node2
```

The output will look something like this:

Node number	Node name	GPFS state
1	node2	active

Confirm that this node can serve its recovery group:

```
/usr/lpp/mmfs/bin/mmchrecoverygroup rgR --active node2
```

After invocation of this command, invoke the following command to ensure that the recovery group, rgL, is indeed served by its primary serving node:

```
/usr/lpp/mmfs/bin/mmIsrecoverygroup rgR -L
```

Focus on the final stanza of output from this command, looking for:

active recovery group server	servers
node2	node1,node2

This confirms that rgR is indeed now served by node2.

To confirm that the active workload is now served by node1 and node2, invoke **dstat**, **iostat**, or another monitor on both nodes and verify that the workload is active.

Phase 2: Migrate recovery groups' format version

After the steps in Phase 1 have been completed for all GSS server nodes in all GSS building blocks in the cluster, update the version of the recovery groups to the latest recovery group descriptor version: 4.1.0-1.

For every recovery group in all of the building blocks for which you have updated the GPFS and GNR software to Version 4.1.0-1, run the following command:

```
/usr/lpp/mmfs/bin/mmchrecoverygroup RecoveryGroupName --version LATEST
```

Confirm this using the following command:

```
/usr/lpp/mmfs/bin/mmIsrecoverygroup RecoveryGroupName -L
```

Check the second stanza and confirm that the string under format version looks like this:

recovery group	declustered arrays	vdisk	pdisk	format version
rgR	4	8	121	4.1.0.1

After all of the recovery groups have been migrated to the latest version, you are ready for the next set of steps.

Phase 3: Create NVRAM pdisks and NVRAM declustered arrays

The GSS 1.0 environment includes GNR logging (that is, fast cache) on SSD disks. In the GSS 2.0 environment, you will move the log tip vdisk ("fast cache") to the NVRAM, found on the system board of each of the server nodes. The first step is to create the new declustered array, NVR, in each recovery group in the cluster.

Phase 3, Step 1: Create the NVRAM declustered array stanza file

Create a file with stanzas like the following, one file per recovery group, for example, for rgL:

```
%da: daName=NVR spares=0 replaceThreshold=1 auLogSize=120m
nspdEnable=yes
%pdisk: pdiskName=rgL_nvram01 device=//node1/dev/sdb da=NVR
%pdisk: pdiskName=rgL_nvram02 device=//node2/dev/sdc da=NVR
```

Refer to the *GPFS Advanced Administration Guide* for information about creating the declustered array vdisk stanza file. If you call this file rgL_nvr_da.stanza.in, you create the NVRAM declustered array NVR within recovery group rgL:

```
/usr/lpp/mmfs/bin/mmaddpdisk rgL -F rgL_nvr_da.stanza.in
```

Confirm the existence of the above declustered array:

```
/usr/lpp/mmfs/bin/mmfsrecoverygroup rgL -L
```

Look for output that looks something like this:

declustered array	needs service	vdisks	pdisks	spares	replace threshold	free space	scrub duration	background task	progress	activity priority
SSD	no	1	3	0	1	558 GiB	14 days	scrub	4%	low
NVR	no	1	2	0	1	3648 MiB	14 days	scrub	20%	low
DA1	no	3	58	2	2	3072 MiB	14 days	scrub	82%	low
DA2	no	3	58	2	2	3072 MiB	14 days	scrub	84%	low

Phase 3, Step 2: Create the log tip and log tip backup stanza file

Create a file with stanzas like the following, with one file per recovery group. For example, for rgL:

```
# LogTip for recovery group rgL
%vdisk: vdiskName=logtip_rgL rg=rgL da=NVR size=48m blocksize=2m
raidCode=2WayReplication diskUsage=vdiskLogTip
# LogTipBackup for recovery group rgL

%vdisk: vdiskName=logtipbackup_rgL rg=rgL da=SSD size=48m
blocksize=2m raidCode=Unreplicated
diskUsage=vdiskLogTipBackup
```

Call this file rgL.logvdisk.stanza.in, for example. Before you can create the new log tip vdisk, you need to delete the existing one. This assumes that the declustered array created over the solid state disks, is called SSD, within the various recovery groups. Create one such stanza file (rgL.logvdisk.stanza.in) per recovery group, that is, two such stanza files per building block.

Phase 3, Step 3: Delete the existing log tip vdisk

The existence of the the persistent logging vdisk, loghome_*RecoveryGroupName*, enables us to delete the log tip vdisk, logtip_*RecoveryGroupName* on an active system. This process will *not* touch the loghome_rgL vdisk. The name of the log tip vdisk in your environment can be found using:

```
/usr/lpp/mmfs/bin/mmfsvdisk
```

Look for the vdisk (in the relevant recovery group) with logTip in the remarks column:

vdisk name	RAID code	recovery group	array	block size in KiB	remarks
-----	-----	-----	-----	-----	-----

da_DA1_rgL	8+3p	rgL	DA1	16384	
da_DA1_rgR	8+3p	rgR	DA1	16384	
da_DA2_rgL	8+3p	rgL	DA2	16384	
da_DA2_rgR	8+3p	rgR	DA2	16384	
loghome_rgL	4WayReplication	rgL	DA1	2048	log
loghome_rgR	4WayReplication	rgR	DA1	2048	log
logtip_rgL	2WayReplication	rgL	NVR	2048	logTip
logtip_rgR	2WayReplication	rgR	NVR	2048	logTip
logtipbackup_rgL	3WayReplication	rgL	SSD	2048	logTipBackup
logtipbackup_rgR	3WayReplication	rgR	SSD	2048	logTipBackup
md_DA1_rgL	4WayReplication	rgL	DA1	1024	
md_DA1_rgR	4WayReplication	rgR	DA1	1024	
md_DA2_rgL	4WayReplication	rgL	DA2	1024	
md_DA2_rgR	4WayReplication	rgR	DA2	1024	
reserved1_rgL	4WayReplication	rgL	DA2	2048	logRsvd
reserved1_rgR	4WayReplication	rgR	DA2	2048	logRsvd

Delete the current log tip vdisk, for each recovery group within the constituent building block:

```
/usr/lpp/mmfs/bin/mmdeivdisk logtip_rgL
```

Confirm that it has been deleted:

```
/usr/lpp/mmfs/bin/mm1svdisk | grep -w logtip_rgL
```

This command should return nothing, that is, logtip_rgL no longer exists.

Phase 3, Step 4: Create the new log tip and log tip backup vdisks

Using the stanza file created in Phase 3, Step 2, create the new log tip vdisk and log tip backup vdisk:

```
/usr/lpp/mmfs/bin/mmcrvdisk rgL -F rgL.logvdisk.stanza.in
```

Confirm this:

```
/usr/lpp/mmfs/bin/mm1svdisk | grep -i logtip | grep rgL
```

The output will look something like this:

```
logtip_rgL 2WayReplication rgL NVR 2048 logTip
logtipbackup_rgL 3WayReplication rgL SSD 2048 logTipBackup
```

Repeat this for every recovery group in every building block. After you have done this, the migration is completed.

References

For information about GPFS commands and their syntax, see the *GPFS Administration and Programming Reference*.

For information about creating vdisk stanza files, including sample stanza files, see the *GPFS Advanced Administration Guide*.

Chapter 7. Replacing components

Use this information to remove and replace components in the GPFS Storage Server.

For information about the terms of the warranty and getting service and assistance, see the IBM System x GPFS Storage Server website (<http://www.ibm.com/systems/x/hardware/highdensity/gpfsstorage/index.html>).

Installation guidelines

Before you remove or replace a component or install an optional device, read the following information.

- Before you begin, read “Safety” on page ix and “Handling static-sensitive devices” on page 27. This information will help you work safely.
- **Attention:** To avoid overheating the GSS and causing damage to its components, replace a failed component within 10 minutes of removal, unless otherwise indicated.
- Observe good housekeeping in the area where you are working. Place removed covers and other parts in a safe place.
- Back up all important data before you make changes to disk drives.
- Before you remove a failed part, make the following preparations:
 - Use the GPFS **mmchenclosure** command to determine whether it is safe to complete the repair action or whether GPFS needs to be shut down first.
 - Review the replacement procedure for the failed part in this document.
 - Locate screwdrivers or any other hand tools that you might need to replace the failed part.
 - Have the replacement part available and be ready to install it.

Service action allowed LED

The GPFS Storage Server only displays the blue service action allowed LED for disk drives. See “Replacing a failed disk drive” on page 81.

Do not remove a disk drive when its service action allowed LED is not lit, as a loss of data availability can result.

Removing and installing the bezel

You must remove the bezel to access the drive drawers and disk drives. Before you begin, be sure to wear an anti-static wrist strap. To remove the bezel from the front of a storage enclosure, complete the following steps:

1. At the front of the storage enclosure, remove the bezel by pressing inward on the latches, as shown in the following illustration.



Figure 46. Removing a bezel

2. Pull the bezel toward you to remove it from the enclosure.

To install the bezel, complete the following steps:

1. Place the bezel to the front of the storage enclosure.
2. Press the bezel inward until both latches lock the bezel in place.

Replacing a drive drawer

Use this procedure to replace a failed drive drawer. At a high level, the steps are:

1. Decide if this can be done in a maintenance window while GPFS is shut down. In some cases, there won't be enough fault tolerance to replace the drawer while GPFS is active and GPFS will have to be shut down. In this case, you only need to do step 3 and restart GPFS.

Using the **mmlsrecoverygroup** command to examine the two recovery groups for this building block will let you determine if there is sufficient fault tolerance.

If GPFS remains active, the process can take 24 hours or more to drain the data from the pdisks onto spare space. Having GPFS down allows for immediate drawer replacement.

2. Use the following sample script to prepare the drawer for disk replacement by draining all of the pdisks:

```
/usr/lpp/mmfs/samples/vdisk/chdrawer EnclosureSerialNumber DrawerNumber --release
```

If this gives warnings, but you have evaluated the state of the recovery groups and still want to proceed, use the the **--force-release** option as well:

```
/usr/lpp/mmfs/samples/vdisk/chdrawer EnclosureSerialNumber DrawerNumber --release --force-release
```

See the "Example scenario: Replacing a failed GSS storage enclosure drawer" topic in the *GPFS: Advanced Administration Guide* for more information.

3. Record the location of the drives and label them, as you will later need to replace them in the corresponding slots of the new drawer. Disconnect the drawer, repair it, and put it back in.
4. Complete the replacement sequence using the following command:

```
/usr/lpp/mmfs/samples/vdisk/chdrawer EnclosureSerialNumber DrawerNumber --replace
```

Attention:

- **Potential hardware damage:** Electrostatic discharge can damage sensitive components. To prevent electrostatic discharge damage to the GPFS Storage Server, use antistatic protection when you handle components.
 - **Potential loss of data access:** If the logical unit numbers (LUNs) have already been assigned and created, the locations of the disk drives in drive drawer is critical. Record the location of each disk drive before you remove the drives from the drawer.
 - **Potential loss of data access:** Replacing a drive drawer causes all of the disk drives in the replaced drawer to be unavailable to the GSS. If there is not enough fault tolerance for a drawer failure, you must schedule downtime to replace the drive drawer.
1. Read “Safety” on page ix, “Installation guidelines” on page 75, and “Best practices guidelines” on page 51.
 2. To prepare the drive drawer for removal, complete the following steps:
 - a. If possible, stop the I/O activity to the GSS. If it is not possible to stop the I/O activity, replace the drive drawer during a period of low I/O activity.
 - b. If power is not applied to the GSS, go to step 4.
 - c.
 3. Remove the bezel from the front of the storage enclosure. For instructions, see “Removing and installing the bezel” on page 75.
 4. To remove the cable chains from the back of the drive drawer, complete the following steps:
 - a. On the back of the storage enclosure, remove the right fan assembly. For instructions, see “Replacing a fan assembly” on page 84. The following illustration shows a storage enclosure with the fan assembly removed.

Attention: If you are performing this procedure with the power turned on, you must reinstall the fan assembly within five minutes. Otherwise, the equipment might overheat.

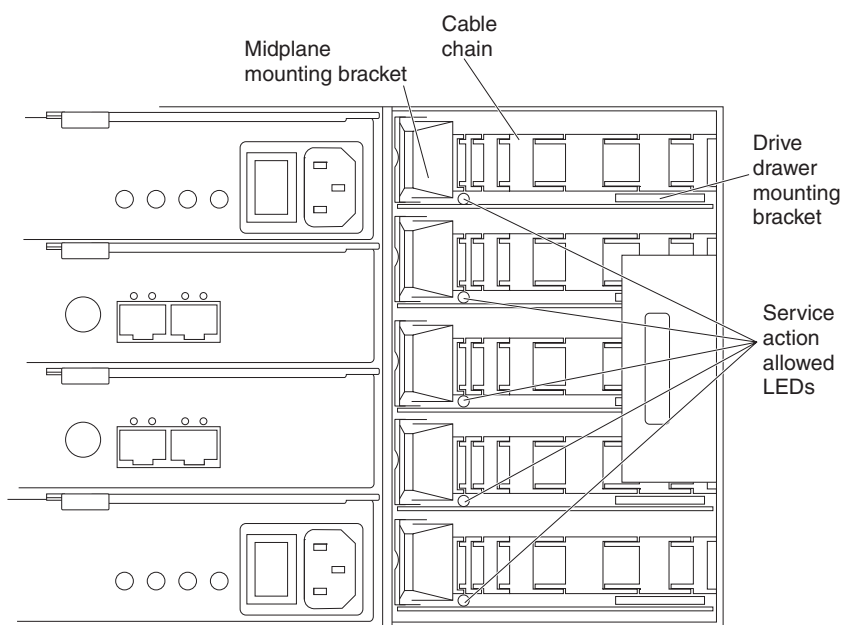


Figure 47. Back view of a storage enclosure with the right fan assembly removed

Note:

- 1) Each cable chain has a vertical mounting bracket that connects to the midplane and a horizontal mounting bracket that connects to the drive drawer.
- 2) The left and right cable chains are not interchangeable.

- b. If power is applied and you performed step 2c on page 77, locate the drive drawer for which the service action allowed LED is lit. If power is not applied, manually determine which cable chain you must disconnect. The top cable chain is attached to drive drawer 1. The bottom cable chain is attached to drive drawer 5.

Attention: Before you remove the cable chains, make sure that you have identified the correct drive drawer. Removing the wrong drive drawer cable chains might cause loss of data access.

- c. Disconnect the right cable chain mounting bracket from the midplane. Hold the orange handle and pull the mounting bracket completely out of the storage enclosure, as shown in the following illustration. If necessary, use a flashlight to see the orange handle.

Note: Remove the vertical side of the cable chain (the end that is connected to the midplane) before you remove the horizontal side of the cable chain (the end that is connected to the drive drawer).

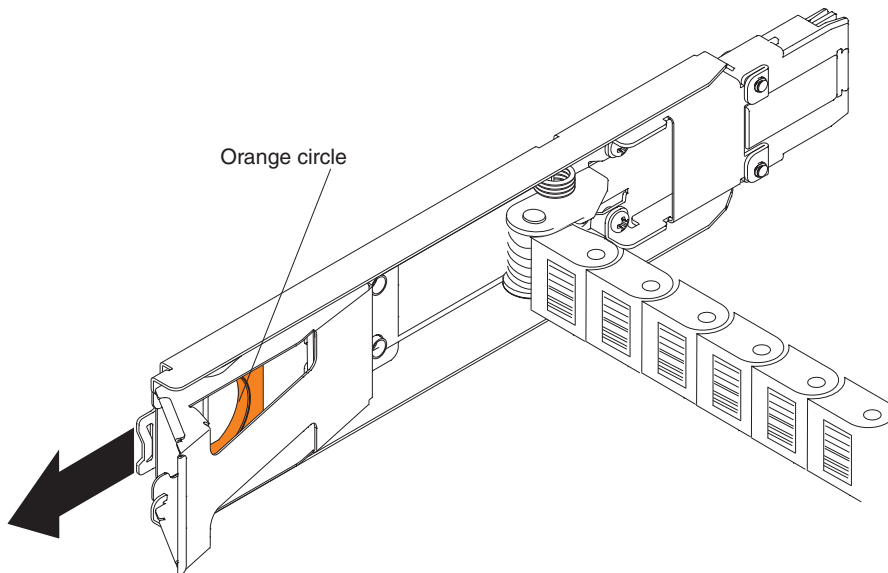


Figure 48. Vertical mounting bracket that connects to the midplane

- d. Disconnect the right cable chain mounting bracket from the drive drawer. Hold the orange handle and pull the mounting bracket completely out of the storage enclosure, as shown in the following illustration. Remove the right cable chain.

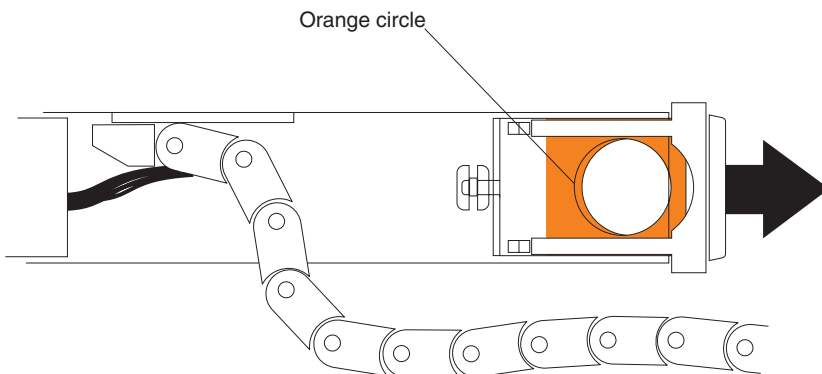


Figure 49. Horizontal mounting bracket that connects to the drive drawer

- e. Reinstall the right fan assembly. For instructions, see “Replacing a fan assembly” on page 84. Wait until the fan speed slows down and the green power LED is lit to ensure that the right fan assembly is operating correctly before you remove the left fan assembly.
 - f. Remove the left fan assembly. For instructions, see “Replacing a fan assembly” on page 84.
Attention: If you are performing this procedure with the power turned on, you must reinstall the fan assembly within 10 minutes. Otherwise, the equipment might overheat.
 - g. Disconnect the left cable chain mounting bracket from the midplane. Hold the orange handle and pull the mounting bracket completely out of the storage enclosure.
 - h. Disconnect the left cable chain mounting bracket from the drive drawer. Hold the orange handle and pull the mounting bracket completely out of the storage enclosure. Remove the left cable chain.
 - i. Reinstall the left fan assembly. For instructions, see “Replacing a fan assembly” on page 84.
Attention: If you are performing this procedure with the power turned on, you must reinstall the fan assemblies before you remove the drive drawer. Otherwise, the equipment might overheat.
5. To remove the drive drawer, complete the following steps:
 - a. At the front of the storage enclosure, pull the handles on the drive drawer until the drive drawer stops. Do not remove the drive drawer from the storage enclosure at this time.
 - b. Label each disk drive in the drive drawer before you remove it, so that the drive can be reinstalled in the same bay in the new drive drawer.
Attention: If the logical unit numbers (LUNs) have already been assigned and created, the location of each disk drive in the drive drawer is critical. You must record the location of each drive before you remove it in the next step.
 - c. Remove all of the disk drives from the drive drawer. For instructions, see “Replacing a failed disk drive” on page 81.
 - d. Slide the drive drawer release lever on each side of the drive drawer toward you, and remove the drive drawer from the enclosure.

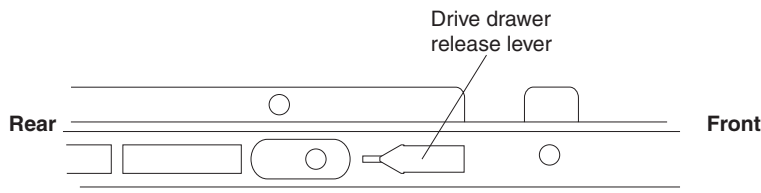


Figure 50. Drive drawer release lever on the side of the drive drawer

6. To install a new drive drawer, complete the following steps.
Attention: Damage might occur if the lock-out tumbler is in the middle of the drawer guide.
- a. At the front of the storage enclosure, install the new drive drawer into the slot, making sure that the lock-out tumbler is at the top of the drawer guide. The lock-out tumbler is a small alignment piece that is attached to the frame. The following illustration shows the location of the lock-out tumbler as shown from the front of the storage enclosure.

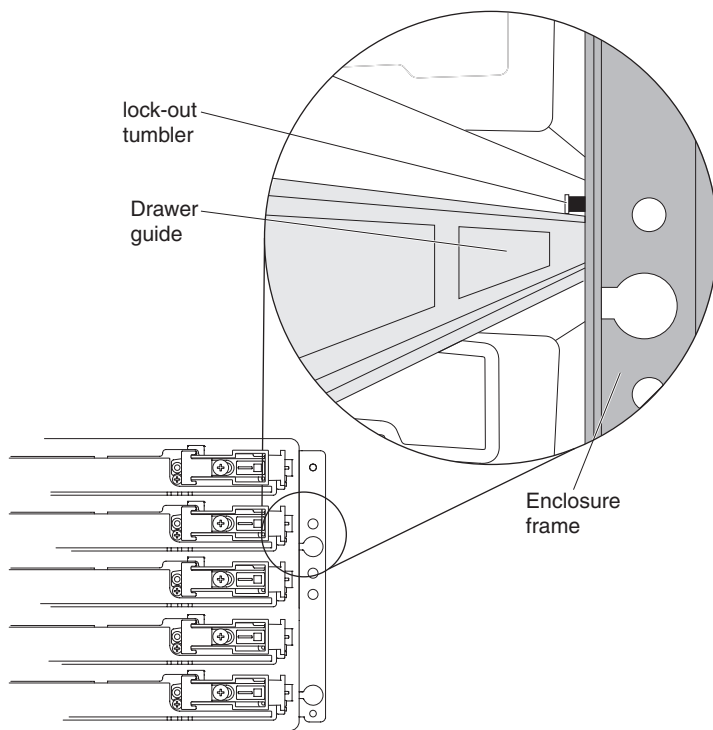


Figure 51. Lock-out tumbler above the drive drawer guide

- b. Push the drive drawer all the way in until the latch fully engages.
7. To install the cable chains on the rear of the drive drawer, complete the following steps:
 - a. Remove the left fan assembly. For instructions, see “Replacing a fan assembly” on page 84.
 - b. Connect the left cable chain mounting bracket to the drive drawer. Use a flashlight, if necessary, so that you can see the connector on the mounting bracket connect to the drive drawer connector.
 - c. Connect the left cable chain mounting bracket to the midplane.
 - d. Reinstall the left fan assembly. Wait until the fan speed slows down and the green power LED is lit to ensure that the left fan assembly is operating correctly before you remove the right fan assembly. For instructions, see “Replacing a fan assembly” on page 84.
 - e. Remove the right fan assembly. For instructions, see “Replacing a fan assembly” on page 84.
 - f. Connect the right cable chain mounting bracket to the drive drawer. Use a flashlight, if necessary, so that you can see the connector on the mounting bracket connect to the midplane connector.
 - g. Connect the right cable chain mounting bracket to the midplane.
 - h. Reinstall the right fan assembly.
8. To install the disk drives in the new drive drawer, complete the following steps:
 - a. Open the drive drawer by pulling the handles on the drive drawer toward you until the drive drawer stops.
 - b. **Attention:** You must install each drive in the same bay from which you removed it in the failed drive drawer.
Install the disk drives you that you removed from the failed drive drawer, one disk drive at a time. For instructions, see “Replacing a failed disk drive” on page 81. After you install a drive, wait at least 90 seconds before you install the next drive. If you do not wait until the drive is recognized, one or more drives will be marked as failed/bypassed or incompatible. If this occurs, remove the failed/bypassed drive, reinstall it, and wait at least 90 seconds.
 - c. Push the drive drawer all the way in until the latch engages fully.
9. Install the bezel on the front of the storage enclosure. For instructions, see “Removing and installing the bezel” on page 75.

10. Power on the storage enclosure.

Replacing a failed disk drive

The GPFS Storage Server has explicit commands for identifying failed disks and replacing disks. For more information, see the "Example scenario: Replacing failed disks in a GSS recovery group" topic in the *GPFS: Advanced Administration Guide*.

Attention: Disk drives must not be replaced by simply hot-swapping them.

Attention: Failed disks must be replaced one at a time.

Replacing each disk is a three-step process:

1. Use the **mmchcarrier** command with the **--release** flag to inform GPFS to locate the disk, suspend it, and allow it to be removed.
2. Locate and remove the failed disk and replace it with a new one.
3. Use the **mmchcarrier** command with the **--replace** flag to start using the new disk.

The physical steps to follow after the **mmchcarrier --release** command has been run for a DE6600 disk enclosure

1. The amber system error LED on the front of the storage enclosure should be lit.
2. The amber LED on the drawer should be lit.
3. The amber Service Action Required LED and the blue Drive Service Action allowed LED on the drive should be lit.
4. Remove the bezel from the front of the storage enclosure. See "Removing and installing the bezel" on page 75 for instructions on removing the bezel.
5. Complete the following steps to open the drive drawer:
 - a. Open the release levers on each side of the drawer and pull them out while you cam the levers away from the chassis to release the drawer.
 - b. Pull on the extended levers to pull the drive drawer out to its full extension without removing it from the storage enclosure.

Note: The fan assemblies spin up to increase airflow through the storage enclosure when a drive drawer is open. This is normal and does not indicate a fault. Fan speed will return to normal after the drive drawer is closed.

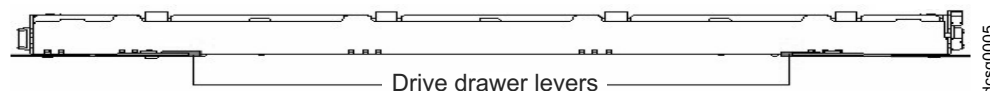
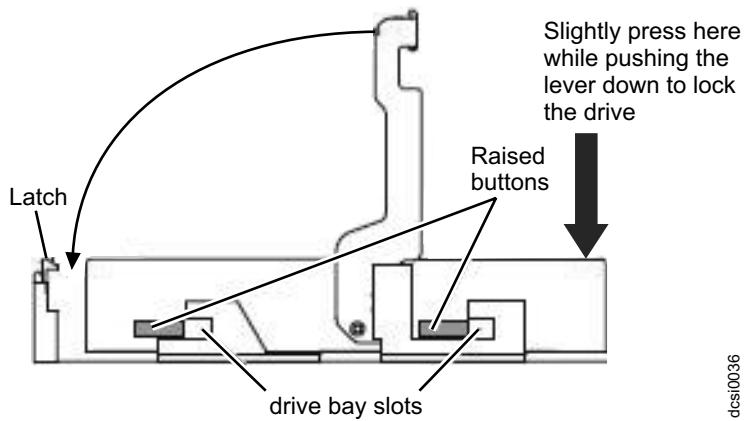


Figure 52. Opening the release levers on a drive drawer

Attention: To prevent damage to the drive drawer, gently press on the back of the drive while you pull the lever downward to push the drive into the connector in the drive drawer.



dcsl0036

Figure 53. Inserting a hard disk drive into the connector

Complete the following steps to install the disk drive.

Note: The disk drive comes installed in a drive enclosure. Do not attempt to detach the disk drive from the enclosure.

1. Raise the drive handle to the vertical position, as shown in Figure 54.

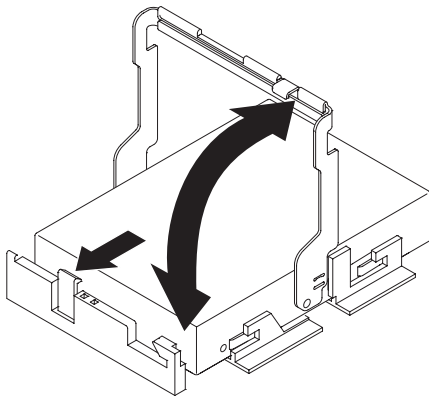


Figure 54. Raising the drive handle

2. Align the two raised buttons on each side over the matching gap in the drive channel on the drawer, as shown in Figure 55.

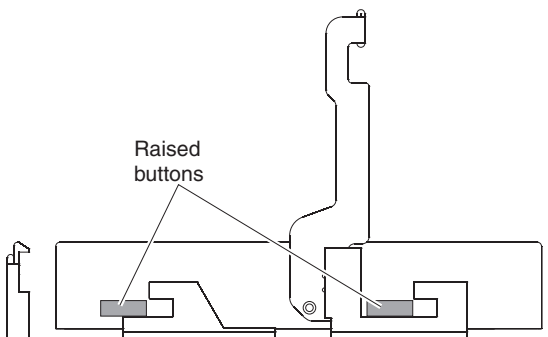


Figure 55. Aligning the drive

3. Lower the disk drive straight down; then, rotate the drive handle down until the drive snaps into place under the release latch, as shown in Figure 56.

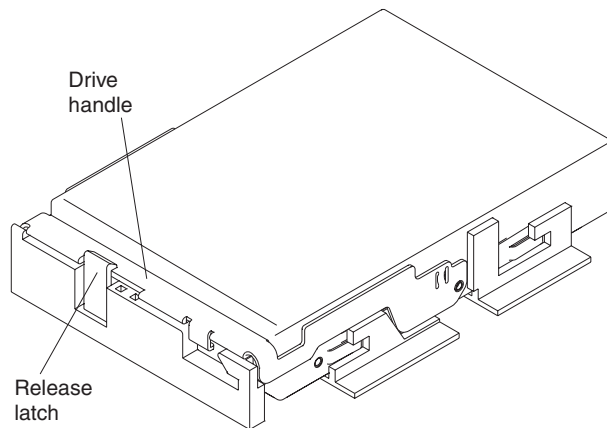


Figure 56. Locking the disk drive in the connector

4. Push the drive drawer all the way back into the storage enclosure, closing the levers on each side of the drive drawer.
5. Install the bezel on the front of the storage enclosure. See “Removing and installing the bezel” on page 75 for instructions on installing the bezel.

The physical steps to follow after the `mmchcarrier --release` command has been run for a DE5600 disk enclosure

Attention: Never remove a drive when its green activity LED is flashing. Remove a drive only when its amber status LED is lit (riot flashing), when the drive is inactive (activity LED is off), or when the GPFS Storage Server is turned off.

1. After you have identified the drive to be replaced, press the latch on the end of the enclosure handle to release it, then pull out the enclosure handle to the open position. Pull the drive approximately 12 mm (0.5 inches) out of the bay and wait 70 seconds to allow the drive to spin down.
2. Make sure there is proper identification (such as a label) on the drive. Then, slide the drive completely out of the bay. If the drive has failed, indicate that on the label. Place the drive horizontally on a dry, static-free, level surface.
3. Unpack the replacement drive. Save all packing material in case you need to return the drive. Press the latch on the end of the drive enclosure handle to release it, then pull out the enclosure handle to the open position. Slide the drive all the way into the empty bay until the drive stops. Push the enclosure handle into the closed (latched) position.

Replacing an environmental service module

Before you begin, read “Safety” on page ix.

Attention: To prevent damage from overheating, replace a failed environmental service module (ESM) assembly within five minutes of removal. If replacing it will take longer than five minutes, stop all I/O activity to the GPFS Storage Server and turn off the power until you complete the replacement.

Do *not* remove a failed ESM from a storage enclosure until you have completed the following tasks:

- Review the replacement procedure for the failed ESM in this document.
- Locate screwdrivers or any other tools that you might need to replace the failed ESM.
- Receive the replacement ESM.

To replace an ESM, complete the following steps:

1. Disconnect the SAS cables from the ESM.
2. Open the two release levers. The ESM moves out of the bay approximately 0.6 cm (0.25 inch).

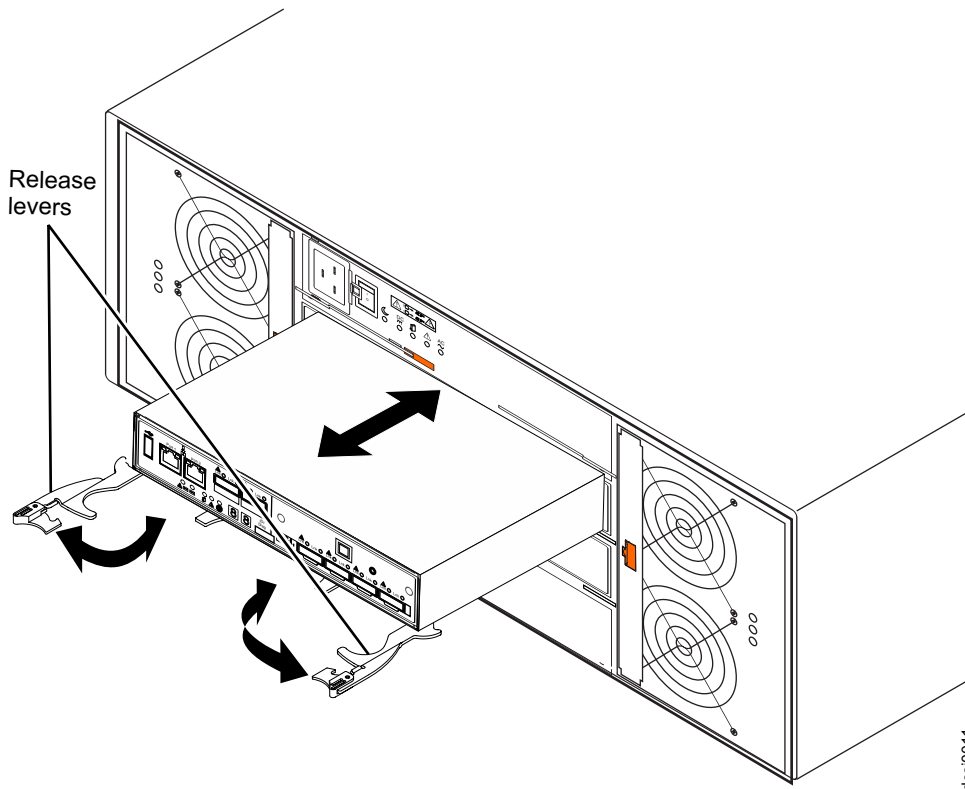


Figure 57. Removing an ESM

3. Slide the ESM out of the bay and set it aside.
4. Make sure that the release levers on the ESM are in the open position.
5. Slide the ESM into the bay until it stops.
6. Close the release levers.
7. Connect the SAS cables to the ESM.
8. Turn on the power.
9. Go to the Fix Central website (<http://www.ibm.com/support/fixcentral>) to check for ESM firmware updates.

Replacing a fan assembly

Before you begin, be sure to wear an anti-static wrist strap.

To preserve the optimal airflow, do not remove a failed fan assembly from the GPFS Storage Server until you are ready to replace it with a new fan assembly. To replace a fan assembly, complete the following steps.

Attention: To prevent damage from overheating, replace a failed fan assembly within five minutes of removal. If replacing it will take longer than five minutes, stop all I/O activity to the GPFS Storage Server and turn off the power until you complete the replacement.

Note: If one of the fan assemblies has failed, the remaining fan assembly will operate at maximum speed.

1. To remove the fan assembly, complete the following steps:
 - a. On the back of the storage enclosure, press on the locking tab that holds the fan-assembly handle in place, and pull the fan-assembly handle toward you, as shown in the following illustration.

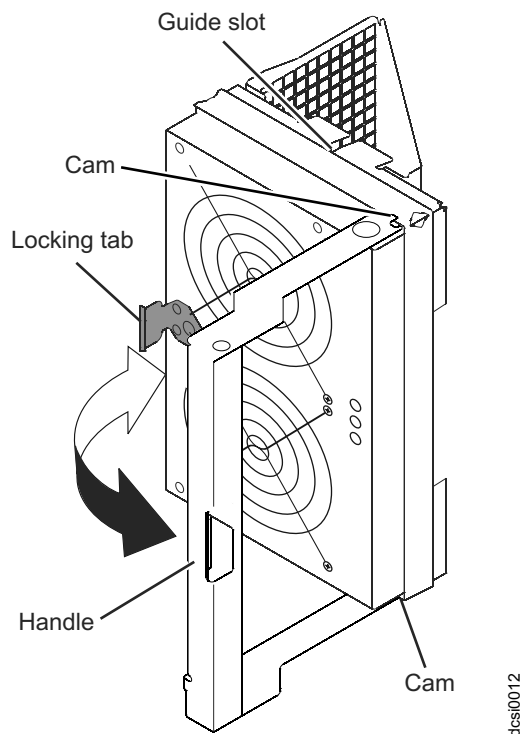


Figure 58. Removing a fan assembly

- b. Using the handle, pull the fan assembly out of the storage enclosure.
2. To install a new fan assembly, complete the following steps.

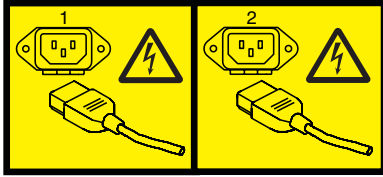
Attention: If you are performing this procedure with the power turned on, you must reinstall the fan assembly within 5 minutes. Otherwise, the equipment might overheat.

 - a. Orient the fan assembly to the fan-assembly bay and push the fan assembly all the way into the bay.

Note: Although the two fan assemblies (left and right) are identical, they are seated in the storage enclosure in opposite orientations. If the fan assembly cannot be fully inserted into the fan-assembly bay, rotate it 180° and reinsert it.

- b. Make sure that the cams on the fan-assembly handle engage the corresponding slots in the storage enclosure; then, rotate the fan-assembly handle to the closed position.
 - c. Press the fan-assembly handle in until it latches in place.

Replacing an ac power supply



or



The power supplies are customer replaceable units (CRUs) and do not require preventive maintenance. Use only the supported power supplies in the storage enclosure.

Each power supply has a built-in sensor that detects the following conditions:

- Over-voltage
- Over-current
- Overheated power supply

If any of these conditions occurs, one or both power supplies will shut down. If the power remains off (does not automatically restart), make sure that the environment is optimal (no overheating has occurred, all electrical receptacles are working, and so on).

If both power supplies fail or if the power supplies cannot maintain an internal temperature below 65°C (149°F), the power supplies will automatically shut down (an overtemperature condition). If this occurs, you must cool the storage enclosure and restart it.

Attention: Do not remove a failed power supply until you have the replacement power supply. When you do remove the failed power supply, be sure to install the second power supply within five minutes to prevent any overheating due to the interruption to the airflow that cools the GSS.

Do not run the GSS without adequate ventilation and cooling, because it might cause damage to the internal components and circuitry.

Before you begin:

- Read the "Safety" section of this document.
- Be sure to wear an anti-static wrist strap.



DANGER

When working on or around the system, observe the following precautions:

Electrical voltage and current from power, telephone, and communication cables are hazardous. To avoid a shock hazard:

- Connect power to this unit only with the provided power cord. Do not use the provided power cord for any other product.
- Do not open or service any power supply assembly.
- Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.
- The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords.
- Connect all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.
- Connect any equipment that will be attached to this product to properly wired outlets.
- When possible, use one hand only to connect or disconnect signal cables.
- Never turn on any equipment when there is evidence of fire, water, or structural damage.
- Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.
- Connect and disconnect cables as described in the following procedures when installing, moving, or opening covers on this product or attached devices.

To disconnect:

1. Turn off everything (unless instructed otherwise).
2. Remove the power cords from the outlets.
3. Remove the signal cables from the connectors.
4. Remove all cables from the devices.

To connect:

1. Turn off everything (unless instructed otherwise).
2. Attach all cables to the devices.
3. Attach the signal cables to the connectors.
4. Attach the power cords to the outlets.
5. Turn on the devices.

To replace a power supply, complete the following steps.

CAUTION:

To prevent damage to the storage subsystem components from overheating, replace a failed power supply within 5 minutes of removal. If replacing it will take longer than 5 minutes, stop all I/O activity to the storage subsystem and turn off the power until you complete the replacement. Do not remove the failed power supply from the storage enclosure until you:

- Review the replacement procedure in this section.
- Have the replacement power supply and are ready to install it in the enclosure.



1. Unpack the new power supply. Save all packing material in case you have to return the failed power supply.
2. Turn off the power switch on the new unit.
3. Check the fault LED to locate the failed power supply. If a fault is detected, the yellow fault LED is lit.
4. Turn off the power switch and disconnect the power cord from the failed power supply.
5. Remove the power supply from the bay.

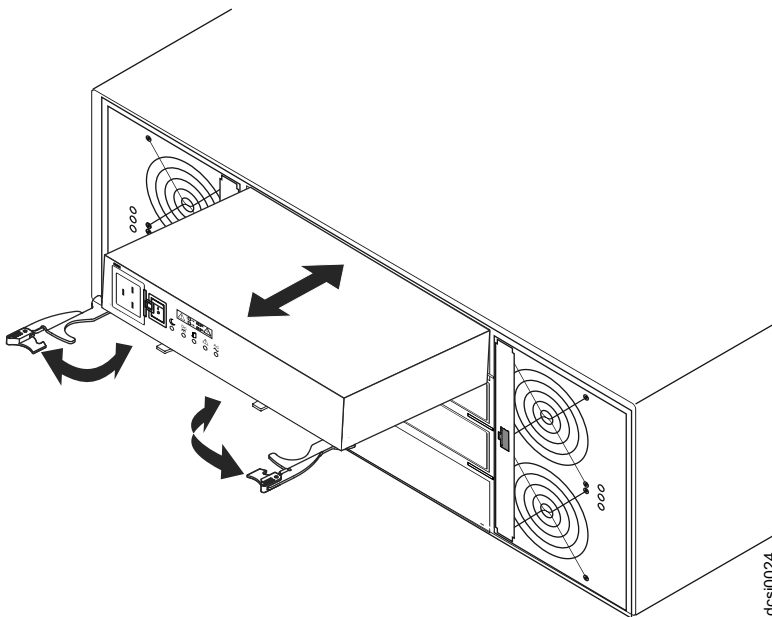


Figure 59. Replacing a power supply

- a. Open the two release levers as shown in the illustration. The power supply moves out of the bay approximately 0.6 cm (0.25 inch).
 - b. Slide the power supply out of the bay and set it aside.
6. Place the replacement power supply on a level surface.

7. Make sure the release levers on the power supply are in the open position.
 8. Slide the power supply into the bay until it stops.
 9. Push the release levers to the closed position.
 10. Connect the power cord and turn on the power.
 11. Check the power and fault LEDs on the new power supply.
 12. According to the status of the power and fault LEDs, use one of the following procedures:
 - **The fault LED is lit and the ac and dc power LEDs are off:**
 - The new power supply might be installed incorrectly.
 - The power-supply switch might not be turned on.
 - A power cord plug might not be fully inserted into the power receptacle or the power-supply ac connector.
 - There might not be any power to the receptacle that the power supply is connected to.
 - The power cord might be faulty.
 - Go to step 13.
 - **The fault and ac power LEDs are lit but the dc power LED is off:** The power supply is faulty. Turn off the power switch and contact your IBM technical-support representative for a replacement power supply.
 13. Perform the following tasks as necessary to solve the problem:
 - Make sure the power switch is in the on position.
 - Make sure there is power at the ac outlet and no circuit breaker is tripped.
 - Make sure the power cord is working and the plugs are fully seated in the power receptacle and the power-supply ac connector.
 - Reinstall the power supply.
- If these tasks do not solve the problem, contact your IBM technical-support representative.

Chapter 8. Hardware maintenance

This section contains information to help you solve some of the simpler problems that you might have with your GPFS Storage Server. It contains the problem indicators and error messages along with suggested actions to take to resolve the problem.

Take these steps to try to solve the problem yourself:

- Check all cables to make sure they are connected.
- Check the power switches to make sure the system is turned on.
- Use the troubleshooting information in your system documentation and use the diagnostic tools that come with your system.
- Use an IBM discussion forum on the IBM website to ask questions.

You can solve many problems without outside assistance by following the troubleshooting procedures that IBM provides in the documents that are provided with your system and software. The information that comes with your system also describes the diagnostic tests that you can perform. Most subsystems, operating systems, and programs come with information that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the information for the operating system or program.

Solving problems

This section contains information to help you solve some of the problems you might have with your GPFS Storage Server.

Use the GSS GUI to diagnose storage enclosure problems and component failures and find solutions to problems that have definite symptoms. Run the GSS GUI continually and check the configuration status frequently.

You can use Table 28 on page 92, which contains the problems, symptoms and error messages, along with suggested actions as a guide for troubleshooting problems. Do not depend solely on this table for a FRU replacement decision.

Troubleshooting problems in the GPFS Storage Server

This section lists some potential problems that could occur with the GSS, the affected component, and possible causes and solutions.

Table 28 on page 92 contains the problems, symptoms and error messages, along with suggested actions to take to resolve problems.

Table 28. Troubleshooting

Problem indicator	Component	Possible cause	Possible solutions
Amber LED is lit	Drive (Drive fault LED)	Drive failure	Determine whether the drive has actually failed. Use mm lspdisk to check the state of the drive. If it is marked for replacement, replace the failed drive. See “Replacing a failed disk drive” on page 81. If it is not marked for replacement, turn off the identifyin LED using mmchpdisk RecoveryGroupName --pdisk --identify off .
	Front bezel (System error LED)	General machine fault	A fault LED is lit somewhere on the storage enclosure (check for amber LEDs on components).
	ESM	Board failure	Replace the failed ESM. See “Replacing an environmental service module” on page 83 for more information.
Amber LED is lit and green LED is off	Power supply (Amber fault LED is lit and both power LEDs are not lit)	Board failure	Replace the failed power supply or turn on all power-supply switches. If this is a dc power supply, check the disconnect device to make sure that it is working and is in the on position.
Amber and green LEDs are lit	Power supply (Amber fault LED is lit and both power LEDs are not lit, AC power or DC IN LED is lit and DC power or DC out LED is not lit)	Power supply failure	Replace the failed power supply. See “Replacing an ac power supply” on page 86 for more information.
	Fan assembly	Fan failure	Replace the fan assembly.
All amber and green LEDs are slowly flashing	All drives (activity and fault LEDs are not lit)	Check for and solve one of the following situations: • The storage enclosures are not correctly connected to the GSS. • The GSS does not have the correct firmware version.	
All green LEDs are off	All components	Subsystem power is off	Make sure that all storage subsystem power cables are connected and that the power-supply switches are on. If applicable, make sure that the main circuit breakers for the rack are turned on.
		Power failure	Check the main circuit breaker and ac receptacle (ac models). Check the -48 V dc power source and disconnect device (dc models).
		Power-supply failure	Replace the power supply.
		Operating environment is too hot	Cool down the environment.
		Midplane failure	Contact your IBM technical support representative.
Amber LED is flashing	Drives (fault LED is lit)	Drive identification is in process	Use mmchpdisk RecoveryGroupName --pdisk --identify off to turn off the LED.

Table 28. Troubleshooting (continued)

Problem indicator	Component	Possible cause	Possible solutions
One or more green LEDs are off	Power supplies	Power cable is disconnected or switches are turned off	Make sure that the power cables are connected (ac or dc) and that the disconnect device (dc only) and the power-supply switches are turned on.
	Several components	Hardware failure	Replace the affected components. Contact your IBM technical-support representative.
		The GPFS Storage Server was not powered on, or all SAS cable connections between the storage enclosures and the GPFS Storage Server failed.	Perform one of the following actions: • Power-on the storage enclosure. • Make sure the SAS cable connections between the storage enclosures and the GPFS Storage Server are made.
	Front panel	Power supply problem	Make sure that the power cables are connected and that the power supplies are turned on.
		Hardware failure	If any other LEDs are lit, replace the midplane. Contact your IBM technical-support representative.
	All drives	Midplane failure	Replace the GPFS Storage Server. Contact your IBM technical-support representative.
		The disk drawer cable chains are not installed correctly	This condition might occur after the disk drawer is replaced and the disk drawer cable chains are not fully inserted in the disk drawer or the midplane sockets. Use the instructions in “Replacing a drive drawer” on page 76 to reseal the left and right disk drawer cable chains.
		Drives are not fully inserted in the drive drawers	Verify that the drives are seated correctly in the drive drawers. Remove and reinsert the drives if required.
		No activity to the drives	No action is required.
		Damaged or loose SAS cables	Check the SAS cables and connections.
Green LED is flashing slowly (once every two seconds)	Drives	The GPFS Storage Server was not powered on, or all SAS connections between the storage enclosures and the GPFS Storage Server have failed.	Perform one of the following actions: • Power-on the storage enclosure. • Make sure the SAS connections between the storage enclosures and the GPFS Storage Server are made. • Make sure all of the storage enclosures in the same channel pair have the same enclosure speed setting.

Table 28. Troubleshooting (continued)

Problem indicator	Component	Possible cause	Possible solutions
Intermittent or sporadic power loss to the storage enclosures	Some or all components	Defective power source or incorrectly connected power cable	Check the ac or dc power source. Reseat all installed power cables and power supplies. If applicable, check the power components (power supplies or uninterruptible power supply). Replace defective power cables.
		Power supply failure	Check the fault LED on the power supply. If the LED is lit, replace the failed component.
		Faulty disconnect device	Check and install a new 30A rated disconnect device.
		Midplane failure	Replace the GPFS Storage Server. Contact your IBM technical-support representative.
Unable to access drives	Drives	Drive failure	Replace the failed drive or drives.
		SAS cable	1. Make sure that the SAS cables are undamaged and correctly connected. 2. Replace the SAS cables.
		ESM failure	Contact your IBM technical support representative.
Random errors	Enclosure	Midplane failure	Replace the enclosure. Contact your IBM technical-support representative.
Blue LED is lit with associated Amber LED lit	Disk drive	Failed component	Identify the failure and replace the failed component.
Link fault amber LED lit	ESM	SAS communication failure	1. Reconnect the SAS cable 2. Replace the SAS cable 3. If the LED is still lit, replace the ESM. Also, consider replacing the device at the other end of the SAS cable.

Parts lists

For a complete list of field replaceable units (FRUs) and FRU part numbers for the GSS components, see the *Service Component Guide Supporting IBM Intelligent Cluster and iDataPlex, 14A Release v1.0* (http://public.dhe.ibm.com/systems/support/system_x_pdf/14a_comp_guide_v1.0.pdf).

Determining basic information of drive FRUs

You can determine the drive capacity and the drive FRU part number of a replacement drive FRU.

Update for GSS:

IBM might ship drive FRUs of higher capacity than that of the drive FRUs they replace. These new drives are programmed in manufacturing to give the same capacity as the drive FRUs being replaced.

The new drive FRUs have different model IDs than the ones printed on the drive manufacturer label. You can determine the model ID and other information of these drives by using base operating system commands.

You can also use the IBM hologram label to determine the drive capacity and the drive FRU part number. A sample IBM hologram label is shown in the following figure.



Figure 60. An IBM hologram label example

Appendix A. Rack mounting template

This section provides duplicate copies of the rack mounting templates.

If you want to tear out the templates from this document for easier use, use these copies rather than those provided in “Installing the support rails” on page 31.

Use the following templates (Figure 61 on page 98 and Figure 62 on page 99) to identify the proper locations for inserting M5 screws when mounting the support rails and storage enclosure to a rack. The locations for the M5 screws are highlighted in the templates.

The storage enclosures are 2U or 4U high. Align the template with the rack at a U boundary. U boundaries are shown as horizontal dashed lines in the rack mounting templates.

Note: The mounting holes that are shown in the following templates are square. The holes in your rack might be round or square.

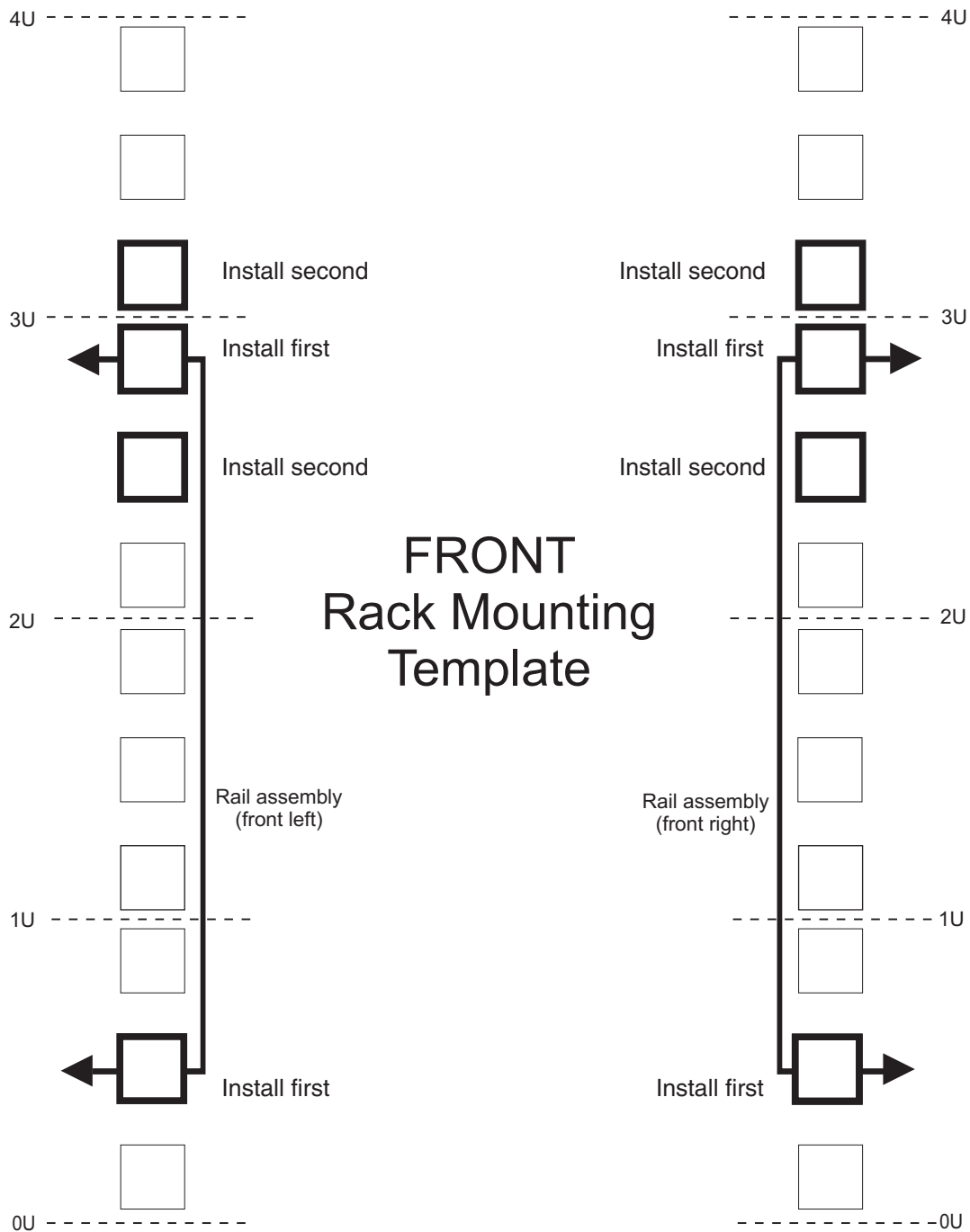


Figure 61. 4U front rack mounting template

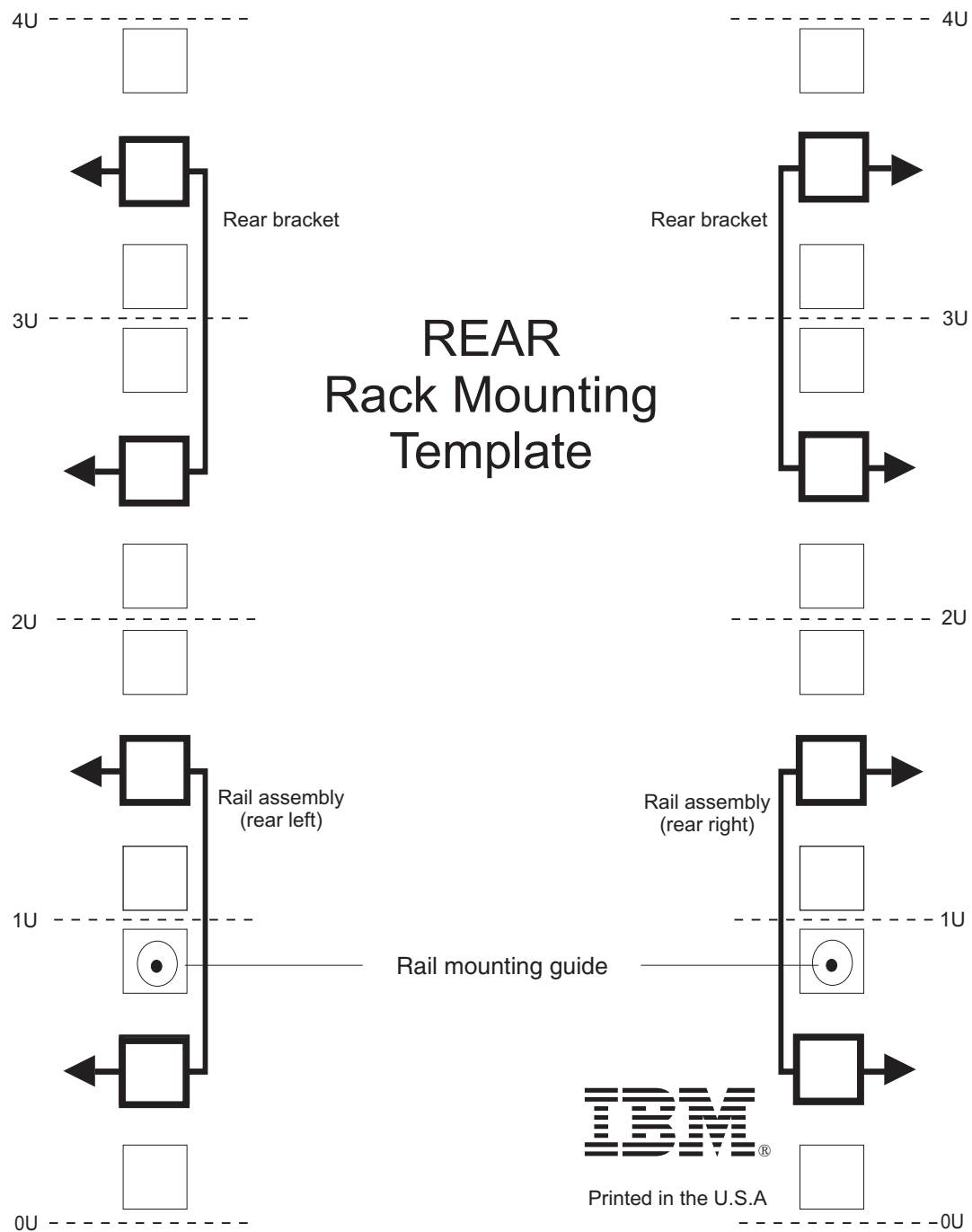


Figure 62. 4U rear rack mounting template

Appendix B. DE6600 component weights

This section includes a list of the component weights of the DE6600 storage enclosure.

Because of the size and weight of a storage enclosure, a lift tool and two trained service technicians are required to install the enclosure in a rack or remove the enclosure from a rack. If a lift tool is not available, you must reduce the weight of the storage enclosure before you lift it, as follows:

- Remove two power supplies and make sure that the hard disk drive drawers are empty; then, three trained service technicians can lift the storage enclosure.
- Make sure the hard disk drive drawers are empty. Remove two power supplies, two fan assemblies, two environmental service modules, and a minimum of three of the five unpopulated hard disk drive drawers; then, two trained service technicians can lift the storage enclosures.

The total weight of the storage enclosure depends on the number of components installed. Table 29 lists the unit weights for the storage enclosures and enclosure components.

Note: Two trained service technicians can lift up to 70 lb, and three trained service technicians can lift up to 121.2 lb.

Table 29. DE6600 component weights

Unit or component	Weight
DE6600 storage system	
Drive-ready weight: 5 drive drawers, 2 power supplies, 2 fan assemblies, no disk drives	126.8 lb (57.5 kg)
Maximum system weight: 5 drive drawers, 2 power supplies, 2 fan assemblies, 354 disk drives	225 lb (102.1 kg)
Enclosure components	
Chassis with midplane only	43 lb (19.5 kg)
Rails (left and right)	8.2 lb (3.7 kg)
2.5" disk drive	.68 lb (.31 kg)
3.5" disk drive	1.6 lb (0.7 kg)
Gbps SAS6 host interface card	.15 lb (.07 kg)
ESM	3.4 lb (1.5 kg)
Fan assembly	2.4 lb (1.1 kg)
Power supply	5.5 lb (2.5 kg)
Drive drawer assembly including right and left cable chains	11.5 lb (5.2 kg)

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Important notes

Processor speed indicates the internal clock speed of the microprocessor; other factors also affect application performance.

CD or DVD drive speed is the variable read rate. Actual speeds vary and are often less than the possible maximum.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for 1024 bytes, MB stands for 1,048,576 bytes, and GB stands for 1,073,741,824 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1,000,000 bytes, and GB stands for 1,000,000,000 bytes. Total user-accessible capacity can vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard disk drive bays with the largest currently supported drives that are available from IBM.

Maximum memory might require replacement of the standard memory with an optional memory module.

Each solid-state memory cell has an intrinsic, finite number of write cycles that the cell can incur. Therefore, a solid-state device has a maximum number of write cycles that it can be subjected to, expressed as “total bytes written” (TBW). A device that has exceeded this limit might fail to respond to system-generated commands or might be incapable of being written to. IBM is not responsible for replacement of a device that has exceeded its maximum guaranteed number of program/erase cycles, as documented in the Official Published Specifications for the device.

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A fire suppression system is the responsibility of the customer. The customer's own insurance underwriter, local fire marshal, local building inspector, or all should be consulted in selecting a fire suppression system that provides the correct level of coverage and protection. IBM designs and manufactures equipment to internal and external standards that require certain environments for reliable operation. Because IBM does not test any equipment for compatibility with fire suppression systems, IBM does not make compatibility claims of any kind, nor does IBM provide recommendations about fire suppression systems.

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Attention: Airborne particulates (including metal flakes or particles) and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might pose a risk to the device that is described in this document.

Risks that are posed by the presence of excessive particulate levels or concentrations of harmful gases include damage that might cause the device to malfunction or cease functioning altogether. This specification sets forth limits for particulates and gases that are intended to avoid such damage. The limits must not be viewed or used as definitive limits, because numerous other factors, such as temperature or moisture content of the air, can influence the impact of particulates or environmental corrosives and gaseous contaminant transfer. In the absence of specific limits that are set forth in this document, you must implement practices that maintain particulate and gas levels that are consistent with the protection of human health and safety. If IBM determines that the levels of particulates or gases in your environment have caused damage to the device, IBM may condition provision of repair or replacement of devices or parts on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

Table 30. Limits for particulates and gases

Contaminant	Limits
Particulate	• The room air must be continuously filtered with 40% atmospheric dust spot efficiency (MERV 9) according to ASHRAE Standard 52.2¹. • Air that enters a data center must be filtered to 99.97% efficiency or greater, using high-efficiency particulate air (HEPA) filters that meet MIL-STD-282. • The deliquescent relative humidity of the particulate contamination must be more than 60%². • The room must be free of conductive contamination such as zinc whiskers.
Gaseous	• Copper: Class G1 as per ANSI/ISA 71.04-1985³ • Silver: Corrosion rate of less than 300 Å in 30 days

¹ ASHRAE 52.2-2008 - *Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

² The deliquescent relative humidity of particulate contamination is the relative humidity at which the dust absorbs enough water to become wet and promote ionic conduction.

³ ANSI/ISA-71.04-1985. *Environmental conditions for process measurement and control systems: Airborne contaminants*. Instrument Society of America, Research Triangle Park, North Carolina, U.S.A.

Electronic emission notices

When you attach a monitor to the equipment, you must use the designated monitor cable and any interference suppression devices that are supplied with the monitor.

Federal Communications Commission (FCC) statement

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 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 his own expense.

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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 might cause undesired operation.

Industry Canada Class A emission compliance statement

This Class A digital apparatus complies with Canadian ICES-003.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Australia and New Zealand Class A statement

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This product is in conformity with the protection requirements of EU Council Directive 2004/108/EC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a nonrecommended modification of the product, including the fitting of non-IBM option cards.

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International Business Machines Corp.
New Orchard Road
Armonk, New York 10504
914-499-1900

European Community contact:

IBM Deutschland GmbH
Technical Regulations, Department M372
IBM-Allee 1, 71139 Ehningen, Germany
Telephone: +49 7032 15 2941
Email: lugi@de.ibm.com

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種情況下，使用者會被要
求採取某些適當的對策。

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Printed in USA

GA35-0001-00

