

Power Systems

*Site and hardware planning*



**Note**

Before using this information and the product it supports, read the information in [“Safety notices” on page v](#), [“Notices” on page 141](#), the *IBM Systems Safety Notices* manual, G229-9054, and the *IBM Environmental Notices and User Guide*, Z125-5823.

This edition applies to IBM® Power® servers that contain the Power11 processor and to all associated models.

© **Copyright International Business Machines Corporation 2025.**

US Government Users Restricted Rights – Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

---

# Contents

|                                                                                    |            |
|------------------------------------------------------------------------------------|------------|
| <b>Safety notices.....</b>                                                         | <b>v</b>   |
| <b>Site and hardware physical planning overview.....</b>                           | <b>1</b>   |
| <b>Planning activities.....</b>                                                    | <b>3</b>   |
| Planning task checklist.....                                                       | 3          |
| General considerations.....                                                        | 3          |
| Site preparation and physical planning guidelines.....                             | 4          |
| <b>Site and hardware planning.....</b>                                             | <b>7</b>   |
| Hardware specification sheets.....                                                 | 7          |
| Server specifications.....                                                         | 7          |
| Expansion unit and migration tower specifications.....                             | 14         |
| Rack specifications.....                                                           | 22         |
| Hardware Management Console specifications.....                                    | 64         |
| Rack switch specifications.....                                                    | 69         |
| Rack installation specifications for racks that are not purchased from IBM.....    | 72         |
| Planning for power.....                                                            | 78         |
| Determining your power requirements.....                                           | 78         |
| Plugs and receptacles.....                                                         | 80         |
| Modification of IBM-provided power cords.....                                      | 99         |
| Uninterruptible power supply.....                                                  | 100        |
| Power distribution unit and power cord options for 7014, 7953, and 7965 racks..... | 102        |
| Calculating the power load for 7188 or 9188 power distribution units.....          | 115        |
| Planning for cables.....                                                           | 117        |
| Cable management.....                                                              | 117        |
| Planning for serial-attached SCSI cables.....                                      | 121        |
| <b>Notices.....</b>                                                                | <b>141</b> |
| Accessibility features for IBM Power servers.....                                  | 142        |
| Privacy policy considerations .....                                                | 143        |
| Trademarks.....                                                                    | 143        |
| Electronic emission notices.....                                                   | 143        |
| Class A Notices.....                                                               | 144        |
| Class B Notices.....                                                               | 147        |
| Terms and conditions.....                                                          | 150        |





# Safety notices

---

Safety notices may be printed throughout this guide:

- **DANGER** notices call attention to a situation that is potentially lethal or extremely hazardous to people.
- **CAUTION** notices call attention to a situation that is potentially hazardous to people because of some existing condition.
- **Attention** notices call attention to the possibility of damage to a program, device, system, or data.

## World Trade safety information

Several countries require the safety information contained in product publications to be presented in their national languages. If this requirement applies to your country, safety information documentation is included in the publications package (such as in printed documentation, on DVD, or as part of the product) shipped with the product. The documentation contains the safety information in your national language with references to the U.S. English source. Before using a U.S. English publication to install, operate, or service this product, you must first become familiar with the related safety information documentation. You should also refer to the safety information documentation any time you do not clearly understand any safety information in the U.S. English publications.

Replacement or additional copies of safety information documentation can be obtained by calling the IBM Hotline at 1-800-300-8751.

## German safety information

Das Produkt ist nicht für den Einsatz an Bildschirmarbeitsplätzen im Sinne § 2 der Bildschirmarbeitsverordnung geeignet.

## Laser safety information

IBM servers can use I/O cards or features that are fiber-optic based and that utilize lasers or LEDs.

### Laser compliance

IBM servers may be installed inside or outside of an IT equipment rack.



**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: If IBM supplied the power cord(s), connect power to this unit only with the IBM provided power cord. Do not use the IBM 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. For AC power, disconnect all power cords from their AC power source. For racks with a DC power distribution panel (PDP), disconnect the customer's DC power source to the PDP.
- When connecting power to the product ensure all power cables are properly connected. For racks with AC power, 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. For racks with a DC power distribution panel (PDP), connect the customer's DC power source to the PDP. Ensure that the proper polarity is used when attaching the DC power and DC power return wiring.
- 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.
- Do not attempt to switch on power to the machine until all possible unsafe conditions are corrected.
- When performing a machine inspection: Assume that an electrical safety hazard is present. Perform all continuity, grounding, and power checks specified during the subsystem installation procedures to ensure that the machine meets safety requirements. Do not attempt to switch power to the machine until all possible unsafe conditions are corrected. Before you open the device covers, unless instructed otherwise in the installation and configuration procedures: Disconnect the attached AC power cords, turn off the applicable circuit breakers located in the rack power distribution panel (PDP), and disconnect any telecommunications systems, networks, and modems.
- 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) For AC power, remove the power cords from the outlets. 3) For racks with a DC power distribution panel (PDP), turn off the circuit breakers located in the PDP and remove the power from the Customer's DC power source. 4) Remove the signal cables from the connectors. 5) 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) For AC power, attach the power cords to the outlets. 5) For racks with a DC power distribution panel (PDP), restore the power from the Customer's DC power source and turn on the circuit breakers located in the PDP. 6) Turn on the devices.



- Sharp edges, corners and joints may be present in and around the system. Use care when handling equipment to avoid cuts, scrapes and pinching. (D005)

**(R001 part 1 of 2):**



**DANGER:** Observe the following precautions when working on or around your IT rack system:

- Heavy equipment—personal injury or equipment damage might result if mishandled.
- Always lower the leveling pads on the rack cabinet.
- Always install stabilizer brackets on the rack cabinet if provided, unless the earthquake option is to be installed.
- To avoid hazardous conditions due to uneven mechanical loading, always install the heaviest devices in the bottom of the rack cabinet. Always install servers and optional devices starting from the bottom of the rack cabinet.
- Rack-mounted devices are not to be used as shelves or work spaces. Do not place objects on top of rack-mounted devices. In addition, do not lean on rack mounted devices and do not use them to stabilize your body position (for example, when working from a ladder).



- Stability hazard:
  - The rack may tip over causing serious personal injury.
  - Before extending the rack to the installation position, read the installation instructions.
  - Do not put any load on the slide-rail mounted equipment mounted in the installation position.
  - Do not leave the slide-rail mounted equipment in the installation position.
- Each rack cabinet might have more than one power cord.
  - For AC powered racks, be sure to disconnect all power cords in the rack cabinet when directed to disconnect power during servicing.

- For racks with a DC power distribution panel (PDP), turn off the circuit breaker that controls the power to the system unit(s), or disconnect the customer's DC power source, when directed to disconnect power during servicing.
- Connect all devices installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device installed in one rack cabinet into a power device installed in a different rack cabinet.
- An electrical outlet that is not correctly wired could place hazardous voltage on the metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (R001 part 1 of 2)

**(R001 part 2 of 2):**



**CAUTION:**

- Do not install a unit in a rack where the internal rack ambient temperatures will exceed the manufacturer's recommended ambient temperature for all your rack-mounted devices.
- Do not install a unit in a rack where the air flow is compromised. Ensure that air flow is not blocked or reduced on any side, front, or back of a unit used for air flow through the unit.
- Consideration should be given to the connection of the equipment to the supply circuit so that overloading of the circuits does not compromise the supply wiring or overcurrent protection. To provide the correct power connection to a rack, refer to the rating labels located on the equipment in the rack to determine the total power requirement of the supply circuit.
- *(For sliding drawers.)* Do not pull out or install any drawer or feature if the rack stabilizer brackets are not attached to the rack or if the rack is not bolted to the floor. Do not pull out more than one drawer at a time. The rack might become unstable if you pull out more than one drawer at a time.



- *(For fixed drawers.)* This drawer is a fixed drawer and must not be moved for servicing unless specified by the manufacturer. Attempting to move the drawer partially or completely out of the rack might cause the rack to become unstable or cause the drawer to fall out of the rack. (R001 part 2 of 2)



**CAUTION:** Removing components from the upper positions in the rack cabinet improves rack stability during relocation. Follow these general guidelines whenever you relocate a populated rack cabinet within a room or building.

- Reduce the weight of the rack cabinet by removing equipment starting at the top of the rack cabinet. When possible, restore the rack cabinet to the configuration of the rack cabinet as you received it. If this configuration is not known, you must observe the following precautions:
  - Remove all devices in the 32U position (compliance ID RACK-001 or 22U (compliance ID RR001) and above.
  - Ensure that the heaviest devices are installed in the bottom of the rack cabinet.

- Ensure that there are little-to-no empty U-levels between devices installed in the rack cabinet below the 32U (compliance ID RACK-001 or 22U (compliance ID RR001) level, unless the received configuration specifically allowed it.
- If the rack cabinet you are relocating is part of a suite of rack cabinets, detach the rack cabinet from the suite.
- If the rack cabinet you are relocating was supplied with removable outriggers they must be reinstalled before the cabinet is relocated.
- Inspect the route that you plan to take to eliminate potential hazards.
- Verify that the route that you choose can support the weight of the loaded rack cabinet. Refer to the documentation that comes with your rack cabinet for the weight of a loaded rack cabinet.
- Verify that all door openings are at least 760 x 2083 mm (30 x 82 in.).
- Ensure that all devices, shelves, drawers, doors, and cables are secure.
- Ensure that the four leveling pads are raised to their highest position.
- Ensure that there is no stabilizer bracket installed on the rack cabinet during movement.
- Do not use a ramp inclined at more than 10 degrees.
- When the rack cabinet is in the new location, complete the following steps:
  - Lower the four leveling pads.
  - Install stabilizer brackets on the rack cabinet or in an earthquake environment bolt the rack to the floor.
  - If you removed any devices from the rack cabinet, repopulate the rack cabinet from the lowest position to the highest position.
- If a long-distance relocation is required, restore the rack cabinet to the configuration of the rack cabinet as you received it. Pack the rack cabinet in the original packaging material, or equivalent. Also lower the leveling pads to raise the casters off of the pallet and bolt the rack cabinet to the pallet.

(R002)

(L001)



**DANGER:** Hazardous voltage, current, or energy levels are present inside any component that has this label attached. Do not open any cover or barrier that contains this label. (L001)

(L002)



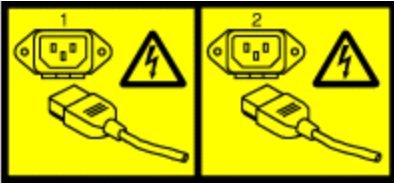
**DANGER:** Rack-mounted devices are not to be used as shelves or work spaces. Do not place objects on top of rack-mounted devices. In addition, do not lean on rack-mounted devices and do not use them to stabilize your body position (for example, when working from a ladder). Stability hazard:

- The rack may tip over causing serious personal injury.

- Before extending the rack to the installation position, read the installation instructions.
- Do not put any load on the slide-rail mounted equipment mounted in the installation position.
- Do not leave the slide-rail mounted equipment in the installation position.

(L002)

**(L003)**



or



or

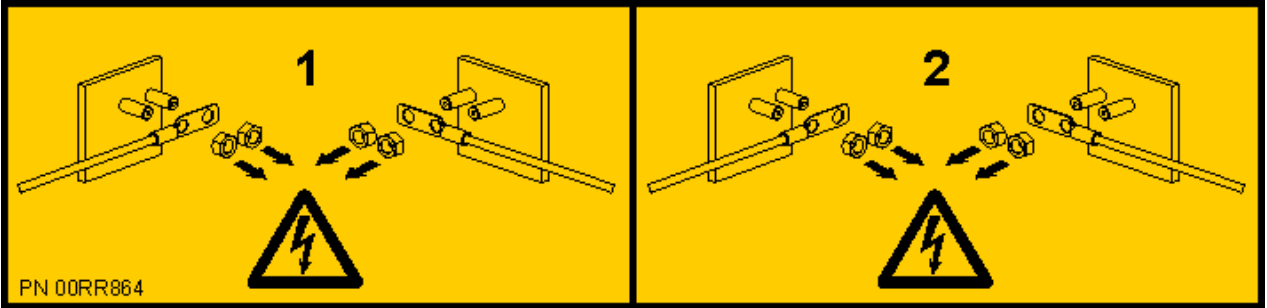


or



or





**DANGER:** Multiple power cords. The product might be equipped with multiple AC power cords or multiple DC power cables. To remove all hazardous voltages, disconnect all power cords and power cables. (L003)

(L007)



**CAUTION:** A hot surface nearby. (L007)

(L008)



**CAUTION:** Hazardous moving parts nearby. (L008)

(L018)



or



**CAUTION:** High levels of acoustical noise are (or could be under certain circumstances) present. Use approved hearing protection and/ or provide mitigation or limit exposure. (L018)

(L031)

**CAUTION:**

Enclosure Integrity.

- Access covers are intended only for occasional removal.
- Follow documented procedures when opening during live or temporary service.
- When service is complete, promptly reinstall all covers, lids, and/or doors for correct operation. (L031)

All lasers are certified in the U.S. to conform to the requirements of DHHS 21 CFR Subchapter J for class 1 laser products. Outside the U.S., they are certified to be in compliance with IEC 60825 as a class 1 laser product. Consult the label on each part for laser certification numbers and approval information.



**CAUTION:** This product might contain one or more of the following devices: CD-ROM drive, DVD-ROM drive, DVD-RAM drive, or laser module, which are Class 1 laser products. Note the following information:

- 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 the controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.

(C026)



**CAUTION:** Data processing environments can contain equipment transmitting on system links with laser modules that operate at greater than Class 1 power levels. For this reason, never look into the end of an optical fiber cable or open receptacle. Although shining light into one end and looking into the other end of a disconnected optical fiber to verify the continuity of optic fibers may not injure the eye, this procedure is potentially dangerous. Therefore, verifying the continuity of optical fibers by shining light into one end and looking at the other end is not recommended. To verify continuity of a fiber optic cable, use an optical light source and power meter. (C027)



**CAUTION:** This product contains a Class 1M laser. Do not view directly with optical instruments. (C028)



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

- Laser radiation when open.
- Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam. (C030)

(C030)



**CAUTION:** The battery contains lithium. To avoid possible explosion, do not burn or charge the battery.

*Do Not:*

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



Exchange 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 the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (C003)



**CAUTION:** Regarding IBM provided VENDOR LIFT TOOL:

- Operation of LIFT TOOL by authorized personnel only.
- LIFT TOOL intended for use to assist, lift, install, remove units (load) up into rack elevations. It is not to be used loaded transporting over major ramps nor as a replacement for such designated tools like pallet jacks, walkies, fork trucks and such related relocation practices. When this is not practicable, specially trained persons or services must be used (for instance, riggers or movers).
- Read and completely understand the contents of LIFT TOOL operator's manual before using. Failure to read, understand, obey safety rules, and follow instructions may result in property damage and/or personal injury. If there are questions, contact the vendor's service and support. Local paper manual must remain with machine in provided storage sleeve area. Latest revision manual available on vendor's web site.
- Test verify stabilizer brake function before each use. Do not over-force moving or rolling the LIFT TOOL with stabilizer brake engaged.
- Do not raise, lower or slide platform load shelf unless stabilizer (brake pedal jack) is fully engaged. Keep stabilizer brake engaged when not in use or motion.
- Do not move LIFT TOOL while platform is raised, except for minor positioning.
- Do not exceed rated load capacity. See LOAD CAPACITY CHART regarding maximum loads at center versus edge of extended platform.
- Only raise load if properly centered on platform. Do not place more than 200 lb (91 kg) on edge of sliding platform shelf also considering the load's center of mass/gravity (CoG).
- Do not corner load the platforms, tilt riser, angled unit install wedge or other such accessory options. Secure such platforms -- riser tilt, wedge, etc options to main lift shelf or forks in all four (4x or all other provisioned mounting) locations with provided hardware only, prior to use. Load objects are designed to slide on/off smooth platforms without appreciable force, so take care not to push or lean. Keep riser tilt [adjustable angling platform] option flat at all times except for final minor angle adjustment when needed.
- Do not stand under overhanging load.
- Do not use on uneven surface, incline or decline (major ramps).
- Do not stack loads.
- Do not operate while under the influence of drugs or alcohol.
- Do not support ladder against LIFT TOOL (unless the specific allowance is provided for one following qualified procedures for working at elevations with this TOOL).
- Tipping hazard. Do not push or lean against load with raised platform.
- Do not use as a personnel lifting platform or step. No riders.
- Do not stand on any part of lift. Not a step.
- Do not climb on mast.
- Do not operate a damaged or malfunctioning LIFT TOOL machine.
- Crush and pinch point hazard below platform. Only lower load in areas clear of personnel and obstructions. Keep hands and feet clear during operation.
- No Forks. Never lift or move bare LIFT TOOL MACHINE with pallet truck, jack or fork lift.
- Mast extends higher than platform. Be aware of ceiling height, cable trays, sprinklers, lights, and other overhead objects.
- Do not leave LIFT TOOL machine unattended with an elevated load.
- Watch and keep hands, fingers, and clothing clear when equipment is in motion.



- Turn Winch with hand power only. If winch handle cannot be cranked easily with one hand, it is probably over-loaded. Do not continue to turn winch past top or bottom of platform travel. Excessive unwinding will detach handle and damage cable. Always hold handle when lowering, unwinding. Always assure self that winch is holding load before releasing winch handle.
- A winch accident could cause serious injury. Not for moving humans. Make certain clicking sound is heard as the equipment is being raised. Be sure winch is locked in position before releasing handle. Read instruction page before operating this winch. Never allow winch to unwind freely. Freewheeling will cause uneven cable wrapping around winch drum, damage cable, and may cause serious injury.
- This TOOL must be maintained correctly for IBM Service personnel to use it. IBM shall inspect condition and verify maintenance history before operation. Personnel reserve the right not to use TOOL if inadequate. (C048)



**CAUTION:** This equipment is not suitable for use in locations where children are likely to be present. (C052)

## **Power and cabling information for NEBS (Network Equipment-Building System) GR-1089-CORE**

The following comments apply to the IBM servers that have been designated as conforming to NEBS (Network Equipment-Building System) GR-1089-CORE:

The equipment is suitable for installation in the following:

- Network telecommunications facilities
- Locations where the NEC (National Electrical Code) applies

The intra-building ports of this equipment are suitable for connection to intra-building or unexposed wiring or cabling only. The intra-building ports of this equipment *must not* be metallically connected to the interfaces that connect to the OSP (outside plant) or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE) and require isolation from the exposed OSP cabling. The addition of primary protectors is not sufficient protection to connect these interfaces metallically to OSP wiring.

**Note:** All Ethernet cables must be shielded and grounded at both ends.

The AC-powered system does not require the use of an external surge protection device (SPD).

The DC-powered system employs an isolated DC return (DC-I) design. The DC battery return terminal *shall not* be connected to the chassis or frame ground.

The DC-powered system is intended to be installed in a common bonding network (CBN) as described in GR-1089-CORE.



---

# Site and hardware physical planning overview

Successful installation requires effective planning of your physical and operational environment. You are the most valuable resource in site planning because you know where and how your system, and the devices that are attached to it, are used.

Site preparation for the complete system is the responsibility of the customer. The primary task of your site planner is to ensure that each system is installed so that it can operate and be serviced efficiently.

This topic collection provides the basic information that you need to plan for your system installation. It provides an overview of each planning task and valuable reference information useful throughout the performance of these tasks. Depending on the complexity of the system that you ordered and your existing computing resource, you might not need to complete all the steps noted here.

First, with the help of your systems engineer, sales representative, or with the help of those coordinating your installation, list the hardware for which you need to plan. Use the summary of your order to help you when you make your list. This list is now your “To Do” list. You can use the [Planning task checklist](#) to assist you.

While you are responsible for planning, vendors, contractors, and your sales representative are also available to help with any aspect of the planning. For some system units, a customer service representative installs your system unit and verifies correct operation. Some system units are considered customer-installed. If you are not sure, check with your sales representative.

The physical planning section of this topic collection provides the physical characteristics of many system units, and associated products. For information on products not included in this topic collection, contact your sales representative or your IBM reseller.

Before you proceed with planning, ensure that the hardware and software you chose meets your needs. Your sales representative is available to answer questions.

While this information is for hardware planning, the system memory and disk storage needed are a function of the software to be used, therefore some things to consider are listed below. Information on software products is generally in or with the software licensed program itself.

In assessing the adequacy of hardware and software, consider the following guidelines:

- Available disk space and system memory for accommodating software, online documentation, and data (including future growth needs resulting from extra users, more data, and new applications).
- Compatibility of all devices.
- Compatibility of software packages with each other and with the hardware configuration.
- Adequate redundancy or backup capabilities in hardware and software.
- Software portability to the new system, if necessary.
- Prerequisites and corequisites of chosen software are satisfied.
- Data to be transferred to the new system.



---

## Planning activities

You can use this information to help you plan the physical installation for your server.

Proper planning for your system facilitates a smooth installation and fast system start-up. Sales and installation planning representatives are also available to help you with installation planning.

As part of your planning activity, you make decisions about where to locate your server and who operates the system.

### Planning task checklist

---

Use this checklist to document your planning progress.

Working with your sales representative, establish completion dates for each of the tasks. You might want to review your planning schedule periodically with your sales representative.

| Table 1. Planning task checklist                             |                    |             |                 |
|--------------------------------------------------------------|--------------------|-------------|-----------------|
| Planning step                                                | Person responsible | Target date | Completion date |
| Plan your office or computer room layout (physical planning) |                    |             |                 |
| Prepare for power cords and electrical needs                 |                    |             |                 |
| Prepare for cables and cabling                               |                    |             |                 |
| Create or modify communications networks                     |                    |             |                 |
| Perform building alterations, as needed                      |                    |             |                 |
| Prepare maintenance, recovery, and security plans            |                    |             |                 |
| Develop an education plan                                    |                    |             |                 |
| Order supplies                                               |                    |             |                 |
| Prepare for system delivery                                  |                    |             |                 |

### General considerations

---

Planning your system requires attention to the numerous details.

When you are determining the placement of your system, look the following considerations:

- Adequate space for the devices.
- Working environment of personnel who are using the devices (their comfort, ability to access the devices, supplies, and reference materials).
- Adequate space for maintaining and servicing the devices.
- Physical security requirements necessary for the devices.
- Weight of the devices.
- Heat output of the devices.
- Operating temperature requirements of the devices.
- Humidity requirements of the devices.

- Air flow requirements of the devices.
- Air quality of the location where the devices are used. For example, excess dust can damage your system.

**Note:** The system and devices are designed to operate in normal office environments. Dirty or other poor environments might damage the system or the devices. You are responsible for providing the proper operating environment.

- Altitude limitations of the devices.
- Noise emission levels of the devices.
- Any vibration of equipment near where the devices are placed.
- Paths of power cords.

The following pages contain the information that you need to evaluate these considerations.

## Site preparation and physical planning guidelines

---

These guidelines help you prepare your site for the delivery and installation of your server.

The [Site preparation and physical planning](#) topic covers the following information:

### **Site selection, building and space considerations**

- Site selection
- Access
- Static electricity and floor resistance
- Space requirements
- Floor construction and floor loading
- Raised floors
- Conductive contamination
- Computer room layout

### **Site environment, safety, and security**

- Vibration and shock
- Lighting
- Acoustics
- Electromagnetic compatibility
- Computer room location
- Material and data storage protection
- Emergency planning for continuous operations

### **Electrical power and grounding**

- General power information
- Power quality
- Voltage and frequency limits
- Power load
- Power source
- Dual power installations

### **Air conditioning**

- Air conditioning determination
- General guidelines for data centers
- Temperature and humidity design criteria

- Temperature and humidity recording instruments
- Relocation and temporary storage
- Acclimation
- System air distribution

#### **Planning for the installation of rear door heat exchangers**

- Planning for the installation of rear door heat exchangers
- Heat exchanger specifications
- Water specifications for the secondary cooling loop
- Water delivery specifications for secondary loops
- Layout and mechanical installation
- Suggested sources for secondary loop components

#### **Communications**

- Planning for communications





# Site and hardware planning

Learn about the specifications that site planners can use to assess the physical site and operational requirements necessary to prepare your site for a new server. This information includes specifications for servers and expansion units, plugs and receptacles, and cables, and information about power-distribution units and uninterruptible power supplies.

## Hardware specification sheets

Hardware specification sheets provide detailed information for your hardware, including dimensions, electrical, power, temperature, environment, and service clearances.

**Note:**

These products were designed, tested, manufactured, and certified for safe operation. It complies with IEC 60950-1 and/or IEC 62368-1 and where required, to relevant national differences/deviations (ND) to these IEC base standards. This includes, but is not limited to: EN (European Norms including all Amendments under the Low Voltage Directive), UL/CSA (North America bi-national harmonized and marked per accredited NRTL agency listings), and other such derivative certifications according to corporate determinations and latest regional publication compliance standardized requirements.

Regulatory Model ID (RMID) or Machine Type - Models (MT-Ms) may also be used to supplement identification (ID) for worldwide (WW) co-compliance filings or registrations with regulatory bodies.

## Server specifications

Server specifications provide detailed information for your server, including dimensions, electrical, power, temperature, environment, and service clearances.

Select the appropriate models to view the specifications for your server.

### Model 9080-HEU server specifications

Server specifications provide detailed information for your server, including dimensions, electrical, power, temperature, environment, and service clearances.

Use the following specifications to plan for your server.

**Note:** Due to special safety and servicing considerations, IBM does not support installation of 9080-HEU server nodes higher than the EIA 29 position (location of the rail that supports the rack-mounted server) in any IBM or non-IBM rack. These special considerations include, but are not limited to, requirements for multiple service personnel during installation, additional required equipment such as an IBM approved lift tool and OSHA approved, nonconductive ladders, and specialized instructions.

| Table 2. Dimensions for the 9080-HEU node (feature code EMN1)                                             |                       |                      |           |                     |
|-----------------------------------------------------------------------------------------------------------|-----------------------|----------------------|-----------|---------------------|
| Width                                                                                                     | Depth                 | Height               | EIA units | Weight <sup>1</sup> |
| 445 mm (17.51 in.)                                                                                        | 866.95 mm (34.13 in.) | 217.25 mm (8.55 in.) | 5         | 81.6 kg (180 lb)    |
| <b>Note:</b> <sup>1</sup> Rack hardware (slides or rails, cable bracket, and screws) adds 6.8 kg (15 lb). |                       |                      |           |                     |

| Table 3. Dimensions for the 9080-HEU system control unit |                     |                  |           |                     |
|----------------------------------------------------------|---------------------|------------------|-----------|---------------------|
| Width                                                    | Depth               | Height           | EIA units | Weight <sup>1</sup> |
| 445.6 mm (17.54 in.)                                     | 779.7 mm (30.7 in.) | 86 mm (3.39 in.) | 2         | 22.7 kg (50 lb)     |

| Table 3. Dimensions for the 9080-HEU system control unit (continued)                                      |       |        |           |                     |
|-----------------------------------------------------------------------------------------------------------|-------|--------|-----------|---------------------|
| Width                                                                                                     | Depth | Height | EIA units | Weight <sup>1</sup> |
| <b>Note:</b> <sup>1</sup> Rack hardware (slides or rails, cable bracket, and screws) adds 4.5 kg (10 lb). |       |        |           |                     |

| Table 4. Packaging dimensions for the 9080-HEU |                    |                    |                 |
|------------------------------------------------|--------------------|--------------------|-----------------|
| Width                                          | Depth              | Height             | Weight          |
| 558.8 mm (22 in.)                              | 667 mm (26.25 in.) | 117.6 mm (4.6 in.) | 17.4 kg (38 lb) |

| Table 5. Electrical characteristics per system node for the 9080-HEU <sup>1, 5</sup> |                                                                       |
|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Electrical characteristics                                                           | Properties                                                            |
| AC rated voltage and frequency <sup>2, 6</sup>                                       | 200 - 208 V ac or 220 - 240 V ac at 50 Hz or 60 Hz plus or minus 3 Hz |
| Thermal output (maximum) <sup>3</sup>                                                | 16548 BTU/hr                                                          |
| Maximum power consumption <sup>3</sup>                                               | 4850 W                                                                |
| Maximum kVA <sup>4</sup>                                                             | 5 kVA                                                                 |
| Phase                                                                                | Single                                                                |

**Notes:**

1. Redundancy is supported. There are a total of four power supply units per system node drawer. Each power supply unit has an IEC 320-C20 inlet. A minimum of two power supply units are required for operation. There is no specific power supply unit plugging sequence for the PDUs. Any two power supply units can be plugged into the A-side electrical distribution. The remaining two power supply units can be plugged into the B-side electrical distribution.
2. The power supplies automatically accept any voltage with the published, rated-voltage range. If multiple power supplies are installed and operating, the power supplies draw approximately equal current from the utility (electricity supply) and provide approximately equal current to the load.
3. Power draw and heat load vary greatly by configuration. When you plan for an electrical system, it is important to use the maximum values. However, when you plan for heat load, you can use the IBM Systems Energy Estimator to obtain a heat output estimate based on a specific configuration. See [The IBM Systems Energy Estimator website](#) to determine whether the machine type and model is supported.
4. To calculate the amperage, multiply the kVA by 1000 and divide that number by the operating voltage. The system control unit (SCU) power consumption is included in the W, kVA, and BTU/hr values. Since the SCU derives its power from the primary system node and has a very low power consumption when compared to the overall load, it is not separated out.
5. Horizontally mounted power distribution units (PDUs) must be used. Vertically mounted PDUs occupy and limit access to the cable routing space on the side of the rack and cannot be used.
6. The current will not exceed 10 A (rated 9.7 A) per power supply cord where the nominal voltage is 220 V ac. For 200 – 208 V ac, the current will not exceed 12 A (rated 10.6 A) per power supply cord that is allowed in those regions.

| Table 6. Environment requirements    |             |                            |
|--------------------------------------|-------------|----------------------------|
| Environment requirements             |             |                            |
| Environment (operating) <sup>1</sup> |             |                            |
| Properties                           | Recommended | Allowable <sup>2,3,4</sup> |
| ASHRAE class                         |             | A3 (Fourth edition)        |

| Table 6. Environment requirements (continued)     |                                                 |                                                     |
|---------------------------------------------------|-------------------------------------------------|-----------------------------------------------------|
| Environment requirements                          |                                                 |                                                     |
| Airflow direction                                 | Front-to-back                                   |                                                     |
| Temperature                                       | 18.0°C – 27.0°C (64.4°F – 80.6°F)               | 5.0°C – 40.0°C (41.0°F – 104.0°F)                   |
| Low-end moisture                                  | -9.0°C (15.8°F) dew point                       | -12.0°C (10.4°F) dew point and 8% relative humidity |
| High-end moisture                                 | 60% relative humidity and 15°C (59°F) dew point | 85% relative humidity and 24.0°C (75.2°F) dew point |
| Maximum altitude                                  |                                                 | 3050 m (10,000 ft)                                  |
| Allowable environment (nonoperating) <sup>5</sup> |                                                 |                                                     |
| Temperature                                       | 5°C - 45°C (41°F - 113°F)                       |                                                     |
| Relative humidity                                 | 8% to 85%                                       |                                                     |
| Maximum dew point                                 | 27.0°C (80.6°F)                                 |                                                     |
| Environment (shipping)                            |                                                 |                                                     |
| Temperature                                       | -40.0°C to 60.0°C (-40°F to 140°F)              |                                                     |
| Relative humidity                                 | 5% - 100% (no condensation)                     |                                                     |
| Maximum wet bulb temperature                      | 29.0°C (84.2°F)                                 |                                                     |
| Environment (storage)                             |                                                 |                                                     |
| Temperature                                       | 1°C - 60°C (33.8°F - 140°F)                     |                                                     |
| Relative humidity                                 | 5% - 80% (no condensation)                      |                                                     |
| Maximum wet bulb temperature                      | 29.0°C (84.2°F)                                 |                                                     |

Table 6. Environment requirements (continued)

| Environment requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|
| <b>Notes:</b> <ol style="list-style-type: none"> <li>1. IBM provides the recommended operating environment as the long-term operating environment that can result in the greatest reliability, energy efficiency, and reliability. The allowable operating environment represents where the equipment is tested to verify functionality. Due to the stresses that operating in the allowable envelope can place on the equipment, these envelopes must be used for short-term operation, not continuous operation.</li> <li>2. Must derate the maximum allowable temperature 1°C (1.8°F) per 175 m (574 ft) above 900 m (2953 ft) up to a maximum allowable elevation of 3050 m (10000 ft).</li> <li>3. The minimum humidity level is the larger absolute humidity of the -12°C (10.4°F) dew point and the 8% relative humidity. These levels intersect at approximately 25°C (77°F). Below this intersection, the dew point (-12°C) represents the minimum moisture level, while above it, the relative humidity (8%) is the minimum. For the upper moisture limit, the limit is the minimum absolute humidity of the dew point and relative humidity that is stated.</li> <li>4. The following minimum requirements apply to data centers that are operated at low relative humidity: <ul style="list-style-type: none"> <li>• Data centers that do not have ESD floors and where people are allowed to wear non-ESD shoes might want to consider increasing humidity given that the risk of generating 8 kV increases slightly at 8% relative humidity, when compared to 25% relative humidity.</li> <li>• All mobile furnishings and equipment must be made of conductive or static dissipative materials and be bonded to ground.</li> <li>• During maintenance on any hardware, a properly functioning and grounded wrist strap must be used by any personnel who comes in contact with information technology (IT) equipment.</li> </ul> </li> <li>5. Equipment that is removed from the original shipping container and is installed, but is powered down. The allowable nonoperating environment is provided to define the environmental range that an unpowered system can experience short term without being damaged.</li> </ol> |  |  |  |  |  |  |

Table 7. Noise emissions for the 9080-HEU single node

| Declared noise emission values in accordance with ISO 9296 <sup>(1-8)</sup> |                                                   |      |                                                                                                                    |      |                                               |      |
|-----------------------------------------------------------------------------|---------------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------|------|-----------------------------------------------|------|
| Model 9080-HEU                                                              | Mean A-weighted sound power level, $L_{WA,m}$ (B) |      | Mean A-weighted emission sound pressure level, $L_{pA,m}$ (dB)<br><br>Bystander<br>Operator front<br>Operator rear |      | Statistical adder for verification, $K_v$ (B) |      |
|                                                                             |                                                   |      |                                                                                                                    |      |                                               |      |
|                                                                             | Operating                                         | Idle | Operating                                                                                                          | Idle | Operating                                     | Idle |

Table 7. Noise emissions for the 9080-HEU single node (continued)

| Declared noise emission values in accordance with ISO 9296 <sup>(1-8)</sup>                                                                                                                                                                                        |     |     |                |                |     |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|----------------|----------------|-----|-----|
| <ul style="list-style-type: none"> <li>• Single node</li> <li>• Typical configuration: 4x16 core processors and 16 TB memory</li> <li>• Typical workload</li> <li>• 25°C (77°F), 500 m (1640 ft) environment</li> </ul>                                            | 9.3 | 7.6 | 78<br>92<br>84 | 60<br>75<br>66 | 0.3 | 0.3 |
| <ul style="list-style-type: none"> <li>• Single node</li> <li>• Typical configuration: 4x16 core processors and 16 TB memory</li> <li>• Typical workload</li> <li>• 25°C (77°F), 500 m (1640 ft) environment</li> <li>• Front acoustic door<sup>9</sup></li> </ul> | 8.9 | 7.2 | 74<br>-<br>-   | 57<br>-<br>-   | 0.3 | 0.3 |
| <ul style="list-style-type: none"> <li>• Two nodes</li> <li>• Typical configuration: 4x16 core processors and 16 TB memory</li> <li>• Typical workload</li> <li>• 25°C (77°F), 500 m (1640 ft) environment</li> </ul>                                              | 9.6 | 7.9 | 82<br>94<br>85 | 64<br>77<br>69 | 0.3 | 0.3 |

| Table 7. Noise emissions for the 9080-HEU single node (continued)                                                                                                                                                                                                |     |     |                |                |     |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|----------------|----------------|-----|-----|
| Declared noise emission values in accordance with ISO 9296 <sup>(1-8)</sup>                                                                                                                                                                                      |     |     |                |                |     |     |
| <ul style="list-style-type: none"> <li>• Two nodes</li> <li>• Typical configuration: 4x16 core processors and 16 TB memory</li> <li>• Typical workload</li> <li>• 25°C (77°F), 500 m (1640 ft) environment</li> <li>• Front acoustic door<sup>9</sup></li> </ul> | 9.1 | 7.5 | 79<br>-<br>-   | 61<br>-<br>-   | 0.3 | 0.3 |
| <ul style="list-style-type: none"> <li>• Four nodes</li> <li>• Typical configuration: 4x16 core processors and 16 TB memory</li> <li>• Typical workload</li> <li>• 25°C (77°F), 500 m (1640 ft) environment</li> </ul>                                           | 9.9 | 8.2 | 86<br>97<br>87 | 69<br>79<br>71 | 0.3 | 0.3 |

Table 7. Noise emissions for the 9080-HEU single node (continued)

| Declared noise emission values in accordance with ISO 9296 <sup>(1-8)</sup>                                                                                                                                                                                       |     |     |    |    |     |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|----|----|-----|-----|
| <ul style="list-style-type: none"> <li>• Four nodes</li> <li>• Typical configuration: 4x16 core processors and 16 TB memory</li> <li>• Typical workload</li> <li>• 25°C (77°F), 500 m (1640 ft) environment</li> <li>• Front acoustic door<sup>9</sup></li> </ul> | 9.4 | 7.9 | 82 | 66 | 0.3 | 0.3 |
|                                                                                                                                                                                                                                                                   |     |     | -  | -  |     |     |
|                                                                                                                                                                                                                                                                   |     |     | -  | -  |     |     |

**Notes:**

1. Declared level  $L_{WA,m}$  is the mean A-weighted sound power level.
2. Declared level  $L_{pA,m}$  is the mean A-weighted sound pressure level that is computed as the arithmetic average of the measurements made at the 1-meter bystander positions, or it is measured as the maximum 0.5-meter operator position at the front or rear face with the doors opened.
3. The statistical adder for verification,  $K_v$ , is a quantity to be added to the declared mean A-weighted sound power level,  $L_{WA,m}$ , such that there is a 95% probability of acceptance, when using the verification procedures of ISO 9296, if no more than 6.5% of the batch of new equipment has A-weighted sound power levels greater than  $(L_{WA,m} + K_v)$ .
4. The quantity  $L_{WA,c}$  (formerly called  $L_{WA,d}$ ), can be computed from the sum of  $L_{WA,m}$  and  $K_v$ .
5. Measurements are made in conformance with ISO 7779 and declared in conformance with ISO 9296 except for the inclusion of some modeled results that are derived from ISO 7779 measurements and system performance assessments.
6. B and dB stand for bels and decibels. 1 B equals 10 dB.
7. Under certain environments, configurations, system settings, or workloads, there is an increase in fan speeds that results in higher noise levels.
8. Notice: Government regulations (such as those prescribed by OSHA or European Community Directives) might govern noise level exposure in the workplace and might apply to you and your server installation. The actual sound pressure levels in your installation depend upon various factors, including the number of racks in the installation; the size, materials, and configuration of the room where you designate the racks to be installed; the noise levels from other equipment; the room ambient temperature, and employees' location in relation to the equipment. Further, compliance with such government regulations also depends upon various extra factors, including the duration of employees' exposure and whether employees wear hearing protection. IBM recommends that you consult with qualified experts in this field to determine whether you are in compliance with the applicable regulations.
9. Acoustical doors for IBM Enterprise Slim Rack (Model 7965-S42).

| Table 8. Clearances                                                                                                                                                                                                                                                                                                                                                                                                                      |                               |                 |                               |                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-----------------|-------------------------------|-----------------|
| Clearances                                                                                                                                                                                                                                                                                                                                                                                                                               | Front                         | Rear            | Side                          | Top             |
| Operating <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                   | 813 mm (32 in.)               | 813 mm (32 in.) |                               |                 |
| Service position <sup>3</sup>                                                                                                                                                                                                                                                                                                                                                                                                            | 1219 mm (48 in.) <sup>2</sup> | 813 mm (32 in.) | 1219 mm (48 in.) <sup>2</sup> | 762 mm (30 in.) |
| <b>Notes:</b> <ol style="list-style-type: none"> <li>1. Operating clearances are needed for proper air flow and ventilation.</li> <li>2. A service clearance of 1219 mm (48 in.) is required in the front of the rack and between racks (when the server is extended in the service position) for servicing.</li> <li>3. The space that is needed to perform both concurrent or nonconcurrent maintenance or service actions.</li> </ol> |                               |                 |                               |                 |

**Electromagnetic compatibility compliance:** CISPR 22; CISPR 32; CISPR 24; FCC, CFR 47, Part 15 (US); VCCI (Japan); EMC Directive (EEA); ICES-003 (Canada); ACMA (Australia, New Zealand); CNS 13438 (Taiwan); Radio Waves Act (Korea); Commodity Inspection Law (China); QCVN 118 (Vietnam); MoCI (Saudi Arabia); SI 961 (Israel); EAC (EAEU)

**Safety compliance:** This product was designed, tested, manufactured, and certified for safe operation. It complies with IEC 60950-1, IEC 62368-1, and where required, to relevant national differences/deviations (ND) to these IEC base standards. This includes, but is not limited to: EN (European Norms including all Amendments under the Low Voltage Directive), UL/CSA (North America bi-national harmonized and marked per accredited NRTL agency listings), and other such derivative certifications according to corporate determinations and latest regional publication compliance standardized requirements.

Regulatory Model ID (RMID) or Machine Type - Models (MT-Ms) can also be used to supplement identification (ID) for worldwide (WW) co-compliance filings or registrations with regulatory bodies.

## Special Hardware Management Console considerations

When an HMC manages the server, the console must be provided within the same room and within 8 m (26 ft) of the server.

**Note:** As an alternative to the local HMC requirement, you can provide a supported device, such as a PC, with connectivity and authority to operate through a remotely attached HMC. This local device must be in the same room and within 8 m (26 ft) of your server. This local device must provide functional capabilities that are equivalent to the HMC that it replaces. The service representative needs this local device to service the system.

## Expansion unit and migration tower specifications

Expansion unit and migration tower specifications provide detailed information for your hardware, including dimensions, electrical, power, temperature, environment, and service clearances.

Select a model to view its specifications.

### EMX0 PCIe Gen3 I/O expansion drawer (feature code EMX0)

Hardware specifications provide detailed information for your expansion unit, including dimensions, electrical, power, temperature, environment, and service clearances.

| Table 9. Dimensions for rack-mounted expansion unit |                   |                               |                  |
|-----------------------------------------------------|-------------------|-------------------------------|------------------|
| Width                                               | Depth             | Height                        | Weight (maximum) |
| 482 mm (19 in.)                                     | 802 mm (31.6 in.) | 173 mm (6.8 in.), 4 EIA units | 54.4 kg (120 lb) |



| <i>Table 10. Electrical<sup>1,2,3</sup></i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| <b>Electrical characteristics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Properties</b>                                                            |
| AC rated voltage and frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 100 - 127 V ac or 200 - 240 V ac at 50 or 60 Hz plus or minus 3 Hz (FC EMXA) |
| DC rated voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 192 - 400 V dc (FC EMXB)                                                     |
| Thermal output (maximum)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1740 BTU/hr                                                                  |
| Maximum power consumption                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 510 W                                                                        |
| Maximum kVA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.520                                                                        |
| Phase                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Single                                                                       |
| <b>Notes:</b> <ol style="list-style-type: none"> <li>1. The power supplies for AC or DC voltage do not change. Only the power channel is different. The power channel uses internal cables to carry power from the rear of the system node to the power supplies that are in the front of the system node.</li> <li>2. All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296.</li> <li>3. AC and HVDC power supplies cannot be mixed in the same server or I/O drawer. IBM recommends that AC products and HVDC products with HVDC PDUs are installed in separate racks. However, AC and HVDC products can be supported in the same rack if all grounding (earthing) is done in accordance with the applicable electrical code or codes. IBM provides documentation for different AC and HVDC products about the disconnecting means for service. If a different disconnecting means is to be used for service of the equipment in a rack with AC-powered and DC-powered products, the disconnecting means must be made clear to service.</li> </ol> |                                                                              |

| <i>Table 11. Environment requirements</i>                                   |                                                                                     |                                     |                                |
|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------|--------------------------------|
| <b>Environment</b>                                                          | <b>Recommended operating</b>                                                        | <b>Allowable operating</b>          | <b>Nonoperating</b>            |
| ASHRAE class                                                                |                                                                                     | A3                                  |                                |
| Airflow direction                                                           |                                                                                     | Front-to-back                       |                                |
| Temperature <sup>1</sup>                                                    | 18°C - 27°C (64°F - 80°F)                                                           | 5°C - 40°C (41°F - 104°F)           | 1°C - 60°C (34°F - 140°F)      |
| Humidity range                                                              | 5.5°C (42°F) dew point (DP) to 60% relative humidity (RH) and 15°C (59°F) dew point | -12.0°C (10.4°F) DP and 8% - 80% RH | 5% - 80% RH                    |
| Maximum dew point                                                           |                                                                                     | 24°C (75°F)                         | 27°C (80°F)                    |
| Maximum operating altitude                                                  |                                                                                     | 3050 m (10000 ft)                   |                                |
| Shipping temperature                                                        |                                                                                     |                                     | -40°C to 60°C (-40°F to 140°F) |
| Shipping relative humidity                                                  |                                                                                     |                                     | 5% - 100%                      |
| 1. Derate maximum allowable dry-bulb temperature 1°C per 175 m above 950 m. |                                                                                     |                                     |                                |

| <i>Table 12. Service clearances for rack-mounted expansion unit</i> |                 |                 |
|---------------------------------------------------------------------|-----------------|-----------------|
| <b>Front</b>                                                        | <b>Back</b>     | <b>Sides</b>    |
| 914 mm (36 in.)                                                     | 914 mm (36 in.) | 914 mm (36 in.) |

| Table 12. Service clearances for rack-mounted expansion unit (continued) |      |       |
|--------------------------------------------------------------------------|------|-------|
| Front                                                                    | Back | Sides |
| Side and top clearances are optional during operation.                   |      |       |

**Safety compliance:** This hardware is designed and certified to meet the following safety standards: UL 60950; CAN/CSA C22.2 No. 60950-00; EN 60950; IEC 60950 including all National Differences.

## ESLS storage enclosures

Hardware specifications for ESLS storage enclosures provide detailed information for your storage enclosures, including dimensions, electrical, power, temperature, environment, and service clearances.

| Table 13. Dimensions for storage enclosures |                      |                   |                                |
|---------------------------------------------|----------------------|-------------------|--------------------------------|
| Width                                       | Depth                | Height            | Weight (maximum configuration) |
| 448.6 mm (17.7 in.)                         | 744.22 mm (29.3 in.) | 87.4 mm (3.4 in.) | 31.1 kg (68.6 lb) (ESLS)       |

| Table 14. Electrical           |                                                                    |
|--------------------------------|--------------------------------------------------------------------|
| Electrical characteristics     | Properties                                                         |
| AC rated voltage and frequency | 100 - 127 V ac or 200 - 240 V ac at 50 or 60 Hz plus or minus 3 Hz |
| Thermal output (maximum)       | 939 BTU/hr                                                         |
| Maximum power consumption      | 275 W                                                              |
| Maximum kVA                    | 0.28                                                               |
| Phase                          | Single                                                             |

| Table 15. Environment requirements                                          |                                                                                     |                                     |                                |
|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------|--------------------------------|
| Environment                                                                 | Recommended operating                                                               | Allowable operating                 | Nonoperating                   |
| ASHRAE class                                                                |                                                                                     | A3                                  |                                |
| Airflow direction                                                           |                                                                                     | Front-to-back                       |                                |
| Temperature <sup>1</sup>                                                    | 18°C - 27°C (64°F - 80°F)                                                           | 5°C - 40°C (41°F - 104°F)           | 1°C - 60°C (34°F - 140°F)      |
| Humidity range                                                              | 5.5°C (42°F) dew point (DP) to 60% relative humidity (RH) and 15°C (59°F) dew point | -12.0°C (10.4°F) DP and 8% - 80% RH | 5% - 80% RH                    |
| Maximum dew point                                                           |                                                                                     | 24°C (75°F)                         | 27°C (80°F)                    |
| Maximum operating altitude                                                  |                                                                                     | 3050 m (10000 ft)                   |                                |
| Shipping temperature                                                        |                                                                                     |                                     | -40°C to 60°C (-40°F to 140°F) |
| Shipping relative humidity                                                  |                                                                                     |                                     | 5% - 100%                      |
| 1. Derate maximum allowable dry-bulb temperature 1°C per 175 m above 950 m. |                                                                                     |                                     |                                |

| Table 16. Service clearances for rack-mounted expansion unit |                 |                 |
|--------------------------------------------------------------|-----------------|-----------------|
| Front                                                        | Back            | Sides           |
| 914 mm (36 in.)                                              | 914 mm (36 in.) | 914 mm (36 in.) |
| Side and top clearances are optional during operation.       |                 |                 |

**Safety compliance:** This hardware is designed and certified to meet the following safety standards: UL 60950; CAN/CSA C22.2 No. 60950-00; EN 60950; IEC 60950 including all National Differences.

## NED24 – NVMe Expansion Drawer 24

Hardware specifications for NED24 – NVMe Expansion Drawer 24 provide detailed information for your storage enclosures, including dimensions, electrical, power, temperature, environment, and service clearances.

**Note:** Preliminary information is subject to change.

| Table 17. Dimensions for storage enclosures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                     |                   |                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------------|---------------------------------------------|
| Width <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Depth <sup>2</sup>  | Height            | Weight (maximum configuration) <sup>3</sup> |
| 481.1 mm (18.9 in.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 596.7 mm (23.5 in.) | 86.5 mm (3.4 in.) | 24.9 kg (54.8 lb)                           |
| <b>Notes:</b> <ol style="list-style-type: none"> <li>1. The width is measured to the outside edges of the rack-mount bezels. The width of the chassis is 435 mm (17.1 in.) for the main chassis that fits in between the 482.6 mm (19 in.) rack mounting flanges.</li> <li>2. The depth is measured from the front mounting flange toward the back of the rack. The chassis protrudes forward 34 mm (1.3 in.) from the front mounting flange. The cable management arm with the maximum cable bundle adds 341.3 mm (13.4 in.) to the depth.</li> <li>3. The slide rails add 9.6 lb (4.4 kg).</li> </ol> |                     |                   |                                             |

| Table 18. Shipping dimensions |                     |                     |                                |
|-------------------------------|---------------------|---------------------|--------------------------------|
| Width                         | Length              | Height              | Weight (maximum configuration) |
| 590.5 mm (23.25 in.)          | 990.6 mm (39.0 in.) | 317.5 mm (12.5 in.) | 30.0 kg (66.0 lb)              |

| Table 19. Electrical <sup>1, 2, 3, 4</sup> |                                                  |
|--------------------------------------------|--------------------------------------------------|
| Electrical characteristics                 | Properties                                       |
| AC rated voltage and frequency             | 200 - 240 V ac at 50 or 60 Hz plus or minus 3 Hz |
| Thermal output (maximum)                   | 3412 BTU/hr                                      |
| Maximum power consumption                  | 1000 W                                           |
| Maximum kVA                                | 1.3                                              |
| Phase                                      | Single                                           |

| Table 19. Electrical <sup>1, 2, 3, 4</sup> (continued)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Electrical characteristics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Properties |
| <b>Notes:</b> <ol style="list-style-type: none"> <li>1. Redundancy is supported. There are two 1500 W rated output power supplies with C14 appliance inlet, but can operate on one power supply. There are no specific plugging rules or plugging sequence when you connect the power supplies to the rack PDUs. Both power supplies feed a common DC bus.</li> <li>2. The power supplies automatically accept any voltage with the published, rated-voltage range. If multiple power supplies are installed and operating, the power supplies draw approximately equal current from the utility (electrical supply) and provide approximately equal current to the load.</li> <li>3. To calculate the amperage, multiply the kVA by 1000 and divide that number by the operating voltage.</li> <li>4. System input rating label is 200 - 240 V ac, 9 A (x2), 50 or 60 Hz. The current rating is defined per power supply.</li> </ol> |            |

| Table 20. Environment requirements                                          |                                                                                     |                                     |                                |
|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------|--------------------------------|
| Environment                                                                 | Recommended operating                                                               | Allowable operating                 | Nonoperating                   |
| ASHRAE class                                                                |                                                                                     | A3                                  |                                |
| Airflow direction                                                           |                                                                                     | Front-to-back                       |                                |
| Temperature <sup>1</sup>                                                    | 18°C - 27°C (64°F - 80°F)                                                           | 5°C - 40°C (41°F - 104°F)           | 1°C - 60°C (34°F - 140°F)      |
| Humidity range                                                              | 5.5°C (42°F) dew point (DP) to 60% relative humidity (RH) and 15°C (59°F) dew point | -12.0°C (10.4°F) DP and 8% - 80% RH | 5% - 80% RH                    |
| Maximum dew point                                                           |                                                                                     | 24°C (75°F)                         | 27°C (80°F)                    |
| Maximum operating altitude                                                  |                                                                                     | 3050 m (10000 ft)                   |                                |
| Shipping temperature                                                        |                                                                                     |                                     | -40°C to 60°C (-40°F to 140°F) |
| Shipping relative humidity                                                  |                                                                                     |                                     | 5% - 100%                      |
| 1. Derate maximum allowable dry-bulb temperature 1°C per 175 m above 950 m. |                                                                                     |                                     |                                |

| Table 21. Service clearances for rack-mounted expansion unit |                 |                 |
|--------------------------------------------------------------|-----------------|-----------------|
| Front                                                        | Back            | Sides           |
| 914 mm (36 in.)                                              | 914 mm (36 in.) | 914 mm (36 in.) |
| Side and top clearances are optional during operation.       |                 |                 |

**Electromagnetic compatibility compliance:** CISPR 22; CISPR 32; CISPR 24; CISPR 35; FCC, CFR 47, Part 15 (US); VCCI (Japan); EMC Directive (EEA); ICES-003 (Canada); ACMA (Australia, New Zealand); CNS 15936 (Taiwan); Radio Waves Act (Korea); Commodity Inspection Law (China); QCVN 118 (Vietnam); MoCI (Saudi Arabia); SI 961 (Israel); EAC (EAEU); UKCA (United Kingdom); Cm (Morocco).

**Safety compliance:** This product was designed, tested, manufactured, and certified for safe operation. It complies with IEC 60950-1, IEC 62368-1, or both and where required, to relevant national differences and national deviations (ND) to these IEC base standards. This includes, but is not limited to: EN (European Norms including all Amendments under the Low Voltage Directive), UL/CSA (North America bi-national harmonized and marked per accredited NRTL agency listings), and other such

derivative certifications according to corporate determinations and latest regional publication compliance standardized requirements.

Regulatory Model ID (RMID) or Machine Type - Models (MT-Ms) can also be used to supplement identification (ID) for worldwide (WW) co-compliance filings or registrations with regulatory bodies.

## ENZ0 PCIe Gen4 I/O expansion drawer (feature code ENZ0)

Hardware specifications provide detailed information for your expansion unit, including dimensions, electrical, power, temperature, environment, and service clearances.

| Table 22. Dimensions for rack-mounted expansion unit |                   |                               |                  |
|------------------------------------------------------|-------------------|-------------------------------|------------------|
| Width                                                | Depth             | Height                        | Weight (maximum) |
| 482 mm (19 in.)                                      | 802 mm (31.6 in.) | 173 mm (6.8 in.), 4 EIA units | 46.3 kg (102 lb) |

| Table 23. Electrical <sup>1</sup> |                                                                    |
|-----------------------------------|--------------------------------------------------------------------|
| Electrical characteristics        | Properties                                                         |
| AC rated voltage and frequency    | 100 - 127 V ac or 200 - 240 V ac at 50 or 60 Hz plus or minus 3 Hz |
| Thermal output (maximum)          | 2081 BTU/hr                                                        |
| Maximum power consumption         | 610 W                                                              |
| Maximum kVA                       | 0.63                                                               |
| Phase                             | Single                                                             |

| Table 24. Environment requirements                                          |                                                                                     |                                     |                                |
|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------|--------------------------------|
| Environment                                                                 | Recommended operating                                                               | Allowable operating                 | Nonoperating                   |
| ASHRAE class                                                                |                                                                                     | A3                                  |                                |
| Airflow direction                                                           |                                                                                     | Front-to-back                       |                                |
| Temperature <sup>1</sup>                                                    | 18°C - 27°C (64°F - 80°F)                                                           | 5°C - 40°C (41°F - 104°F)           | 1°C - 60°C (34°F - 140°F)      |
| Humidity range                                                              | 5.5°C (42°F) dew point (DP) to 60% relative humidity (RH) and 15°C (59°F) dew point | -12.0°C (10.4°F) DP and 8% - 80% RH | 5% - 80% RH                    |
| Maximum dew point                                                           |                                                                                     | 24°C (75°F)                         | 27°C (80°F)                    |
| Maximum operating altitude                                                  |                                                                                     | 3050 m (10000 ft)                   |                                |
| Shipping temperature                                                        |                                                                                     |                                     | -40°C to 60°C (-40°F to 140°F) |
| Shipping relative humidity                                                  |                                                                                     |                                     | 5% - 100%                      |
| 1. Derate maximum allowable dry-bulb temperature 1°C per 175 m above 950 m. |                                                                                     |                                     |                                |

Table 25. Noise emissions

| Declared noise emission values in accordance with ISO 9296 <sup>(1-8)</sup>                                                                                                                            |                                                   |      |                                                                |                  |                                               |      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|------|----------------------------------------------------------------|------------------|-----------------------------------------------|------|
| FC ENZO                                                                                                                                                                                                | Mean A-weighted sound power level, $L_{WA,m}$ (B) |      | Mean A-weighted emission sound pressure level, $L_{pA,m}$ (dB) |                  | Statistical adder for verification, $K_v$ (B) |      |
|                                                                                                                                                                                                        |                                                   |      | Bystander<br>Operator front<br>Operator rear                   |                  |                                               |      |
|                                                                                                                                                                                                        | Operating                                         | Idle | Operating                                                      | Idle             | Operating                                     | Idle |
| <ul style="list-style-type: none"> <li>• Typical configuration</li> <li>• Typical workload</li> <li>• 23°C (73.4°F), 500 m (1640 ft) environment</li> </ul>                                            | 6.5                                               | 6.5  | 54<br>62<br>60                                                 | 54<br>62<br>60   | 0.3                                           | 0.3  |
| <ul style="list-style-type: none"> <li>• Typical configuration</li> <li>• Typical workload</li> <li>• 23°C (73.4°F), 500 m (1640 ft) environment</li> <li>• Front acoustic door<sup>9</sup></li> </ul> | 6.3                                               | 6.3  | 51<br>N/A<br>N/A                                               | 51<br>N/A<br>N/A | 0.3                                           | 0.3  |
| <ul style="list-style-type: none"> <li>• Typical configuration</li> <li>• Typical workload</li> <li>• 25°C (77°F), 500 m (1640 ft) environment</li> </ul>                                              | 7.0                                               | 7.0  | 59<br>68<br>66                                                 | 59<br>68<br>66   | 0.3                                           | 0.3  |

Table 25. Noise emissions (continued)

| Declared noise emission values in accordance with ISO 9296 <sup>(1-8)</sup>                                                                                                                              |     |     |                  |                  |     |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|------------------|------------------|-----|-----|
| <ul style="list-style-type: none"> <li>• Typical configuration</li> <li>• Typical workload</li> <li>• 25°C (77°F), 500 m (1640 ft) environment</li> <li>• Front acoustic door<sup>9</sup></li> </ul>     | 6.8 | 6.8 | 57<br>N/A<br>N/A | 57<br>N/A<br>N/A | 0.3 | 0.3 |
| <ul style="list-style-type: none"> <li>• High power PCIe adapter</li> <li>• Typical workload</li> <li>• 23°C (73.4°F), 500 m (1640 ft) environment</li> </ul>                                            | 8.9 | 8.9 | 78<br>88<br>84   | 78<br>88<br>84   | 0.3 | 0.3 |
| <ul style="list-style-type: none"> <li>• High power PCIe adapter</li> <li>• Typical workload</li> <li>• 23°C (73.4°F), 500 m (1640 ft) environment</li> <li>• Front acoustic door<sup>9</sup></li> </ul> | 8.5 | 8.5 | 74<br>N/A<br>N/A | 74<br>N/A<br>N/A | 0.3 | 0.3 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| <i>Table 25. Noise emissions (continued)</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |
| <b>Declared noise emission values in accordance with ISO 9296<sup>(1-8)</sup></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |
| <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. Declared level <math>L_{WA,m}</math> is the mean A-weighted sound power level.</li> <li>2. Declared level <math>L_{pA,m}</math> is the mean A-weighted emission sound pressure level that is measured either at the 0.5-meter operator positions with doors open or 1-meter bystander positions with doors closed.</li> <li>3. The statistical adder for verification, <math>K_v</math>, is a quantity to be added to the declared mean A-weighted sound power level, <math>L_{WA,m}</math>, such that there is a 95% probability of acceptance, when using the verification procedures of ISO 9296, if no more than 6.5% of the batch of new equipment has A-weighted sound power levels greater than <math>(L_{WA,m} + K_v)</math>.</li> <li>4. The quantity <math>L_{WA,c}</math> (formerly called <math>L_{WAd}</math>), can be computed from the sum of <math>L_{WA,m}</math> and <math>K_v</math>.</li> <li>5. Measurements are made in conformance with ISO 7779 and declared in conformance with ISO 9296.</li> <li>6. 10 decibels (dB) equals 1 bel (B).</li> <li>7. Under certain environments, configurations, system settings, or workloads, there is an increase in fan speeds that results in higher noise levels.</li> <li>8. Notice: Government regulations (such as those prescribed by OSHA or European Community Directives) might govern noise level exposure in the workplace and might apply to you and your server installation. The actual sound pressure levels in your installation depend upon various factors, including the number of racks in the installation; the size, materials, and configuration of the room where you designate the racks to be installed; the noise levels from other equipment; the room ambient temperature, and employees' location in relation to the equipment. Further, compliance with such government regulations also depends upon various extra factors, including the duration of employees' exposure and whether employees wear hearing protection. IBM recommends that you consult with qualified experts in this field to determine whether you are in compliance with the applicable regulations.</li> <li>9. IBM acoustic door feature code (FC) ECRC/ECRD.</li> </ol> |  |  |

| <i>Table 26. Service clearances for rack-mounted expansion unit</i> |                 |                 |
|---------------------------------------------------------------------|-----------------|-----------------|
| <b>Front</b>                                                        | <b>Back</b>     | <b>Sides</b>    |
| 914 mm (36 in.)                                                     | 914 mm (36 in.) | 914 mm (36 in.) |
| Side and top clearances are optional during operation.              |                 |                 |

**Safety compliance:** This hardware is designed and certified to meet the following safety standards: CSA/UL 62368-1; EN 62368-1; IEC 62368-1 including all National Differences.

## Rack specifications

Rack specifications provide detailed information for your rack, including dimensions, electrical, power, temperature, environment, and service clearances.

For non-IBM rack specifications, see [“Rack installation specifications for racks that are not purchased from IBM” on page 72.](#)

Select your rack model to view its specifications.

## Planning for the 7014-T00 and 7014-T42 racks

Rack specifications provide detailed information for your rack, including dimensions, electrical, power, temperature, environment, and service clearances.

Some products can have rack installation limitations. Refer to the specific server or product specifications for any restrictions.

The following provide specifications for the 7014-T00 and 7014-T42 racks.



## Model 7014-T00 rack

Hardware specifications provide detailed information for your rack, including dimensions, electrical, power, temperature, environment, and service clearances.

Table 27. Dimensions for rack

| Rack configuration                                                   | Width             | Depth              | Height             | Weight (empty)  | Weight (maximum configuration) and EIA unit capacity |
|----------------------------------------------------------------------|-------------------|--------------------|--------------------|-----------------|------------------------------------------------------|
| Rack Only with side covers                                           | 644 mm (25.4 in.) | 1016 mm (40.0 in.) | 1804 mm (71.0 in.) | 244 kg (535 lb) | 816 kg (1795 lb) <sup>1</sup><br>36 EIA units        |
| Rack with standard rear door only                                    | 644 mm (25.4 in.) | 1042 mm (41.0 in.) | 1804 mm (71.0 in.) | 254 kg (559 lb) | N/A                                                  |
| Rack with standard front and rear doors                              | 644 mm (25.4 in.) | 1100 mm (43.3 in.) | 1804 mm (71.0 in.) | 268 kg (590 lb) | N/A                                                  |
| Rack with FC 6101 OEM front door and standard rear door              | 644 mm (25.4 in.) | 1100 mm (43.3 in.) | 1804 mm (71.0 in.) | 268 kg (590 lb) | N/A                                                  |
| Rack with FC 6068 high perforation front door and standard rear door | 644 mm (25.4 in.) | 1100 mm (43.3 in.) | 1804 mm (71.0 in.) | 268 kg (590 lb) | N/A                                                  |
| Rack with FC 6248 acoustic front and rear doors                      | 644 mm (25.4 in.) | 1413 mm (55.6 in.) | 1804 mm (71.0 in.) | 268 kg (589 lb) | N/A                                                  |

<sup>1</sup> For more information about rack weight distribution and floor loading, see [7014-T00](#), [7014-T42](#), and [0553](#) rack weight distribution and floor loading.

Table 28. Dimensions for doors

| Door model                             | Width                  | Height                  | Depth                   | Weight                                             |
|----------------------------------------|------------------------|-------------------------|-------------------------|----------------------------------------------------|
| Standard front door                    | 639 mm (25.2 in.)      | 1740 mm (68.5 in.)      | 56 mm (2.3 in.)         | 14 kg (31 lb)                                      |
| Standard rear door                     | 639 mm (25.2 in.)      | 1740 mm (76.6 in.)      | 26 mm (1.0 in.)         | 11 kg (24 lb)<br>With acoustic foam: 14 kg (31 lb) |
| Standard side covers                   | 10 mm (0.4 in.) each   | 1740 mm (68.5 in.) each | 1042 mm (41.0 in.) each | 18 lbs 8.25 kg (18 lb) each                        |
| FC 6101 front door (OEM)               | 639 mm (25.2 in.)      | 1740 mm (68.5 in.)      | 56 mm (2.3 in.)         | 14 kg (31 lb)                                      |
| FC 6068 front door, high perforation   | 639 mm (25.2 in.)      | 1740 mm (68.5 in.)      | 56 mm (2.3 in.)         | 14 kg (31 lb)                                      |
| FC 6248 acoustic doors, front and rear | 639 mm (25.2 in.) each | 1740 mm (76.6 in.) each | 198 mm (7.8 in.) each   | 12.3 kg (27 lb) each                               |

Table 29. Electrical<sup>1</sup>

| Electrical characteristics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Properties                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| Power source loading maximum in kVA <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 8.4 (FC 6117 <sup>3</sup> )<br>8.4 (FC EPB8 <sup>3,4</sup> ) |
| <b>Notes:</b> <ol style="list-style-type: none"> <li>1. The total rack power can be derived from the sum of the power that is used by the drawers in the rack.</li> <li>2. For FC EPB8, each side can support a maximum of 600 amps (A) and 10 circuit breakers. The PDP can hold up to twenty (ten per power source) circuit breakers with ratings between 5 A and 90 A. Each power source supports up to 8.4 kVA.</li> <li>3. For more information about FC 6117 and FC EPB8, see <a href="#">“Model 7014-T00 rack with optional DC power distribution panel”</a> on page 24.</li> <li>4. Preliminary data is subject to change.</li> </ol> |                                                              |

See your individual server or hardware specifications for temperature and humidity requirements.

Rack noise levels depend on the number and type of drawers installed. See your server or hardware specifications for specific requirements.

**Note:** All rack installations require careful site and facilities planning that are designed to both address the cumulative drawer heat output and provide the airflow volume rates necessary to comply with drawer temperature requirements. All rack installations require careful site and facilities planning that are designed to address both the cumulative drawer heat output and provide the airflow volume rates necessary to comply with drawer temperature requirements. Rack airflow requirements depend on the number and type of drawers installed.

**Note:** Acoustic doors are available for IBM racks. Feature code 6248 is available for the 0551 and 7014-T00 racks. Feature code 6249 is available for 7014-T42 racks. The overall sound reduction is approximately 6 dB. The doors add approximately 381 mm (15 in.) to the depth of the racks.

### ***Model 7014-T00 rack with optional DC power distribution panel***

Hardware specifications provide detailed information for your rack, including dimensions, electrical, power, temperature, environment, and service clearances.

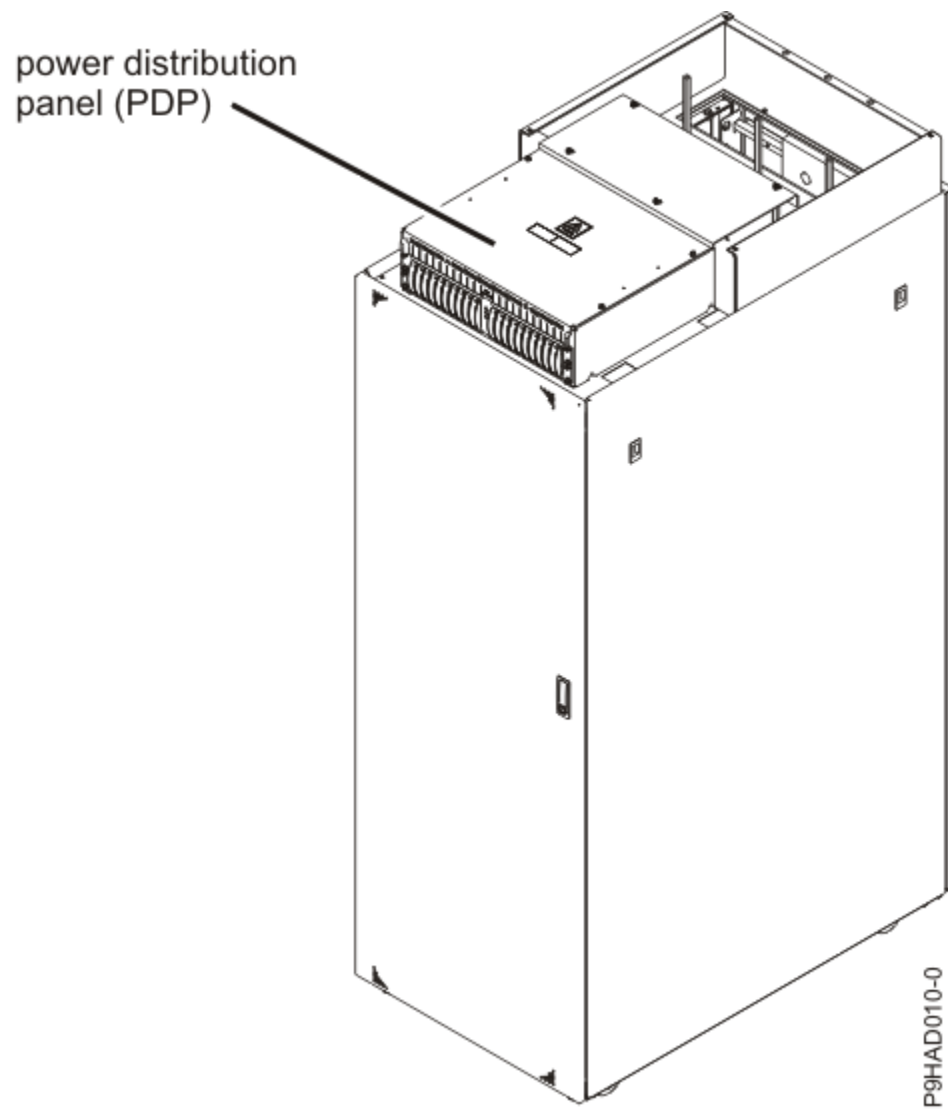
### **Feature code (FC) 6117 (-48 V dc power distribution panel (PDP))**

This feature provides a top-mounted, dual DC power distribution panel for a rack that can contain varying quantities of central processing unit (CPU) drawers, storage subsystems, or both. Up to two DC H80 systems or two DC M80 systems are supported, in addition to up to four DC storage subsystems. This feature is built without attached power cables. It comes with a series of power connectors that are built into its rear bulkhead. The appropriate DC power cables are included with supported drawer systems and plug into the power connectors at the rear of the 6117 PDP.

### **FC EPB8 (-48 V dc power distribution panel (PDP))**

This feature provides a top-mounted -48 V dc PDP for model 7014-T00 racks that can contain varying quantities of drawers, storage subsystems, and OEM equipment. This feature is preinstalled on the 7014-T00 rack. The PDP sits on top of the rack and does not take up any EIA space. The PDP supports redundant power with a split A and B side. Each side can support up to 10 circuit breakers that are rated 5 - 90 amperes with a maximum load of 600 amperes. FC EPB8 does not include circuit breakers or DC power cables. The circuit breakers and associated DC power cables are typically supplied with IBM products. For OEM products, you must provide the applicable circuit breakers and DC power cables.

**Note:** Front doors are optional on the 7014-T00 rack.



*Figure 1. FC EPB8 - power distribution panel*

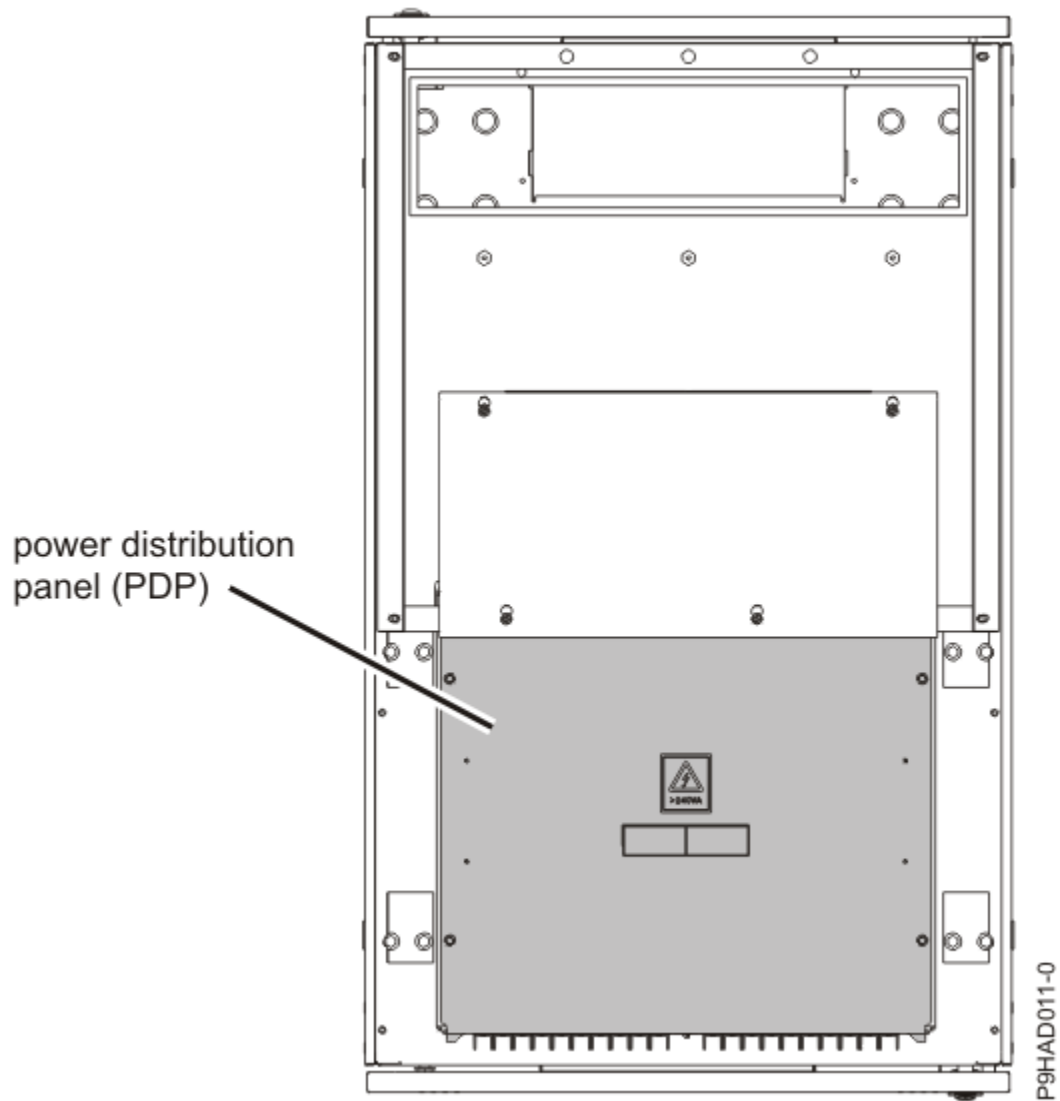


Figure 2. FC EPB8 - power distribution panel (top-down view)

| Table 30. Dimensions for 7014-T00 rack with FC 6117 or FC EPB8 installed            |                    |
|-------------------------------------------------------------------------------------|--------------------|
| Dimensions                                                                          | Properties         |
| Width (rack with side panels)                                                       | 644 mm (25.4 in.)  |
| Depth                                                                               | 1148 mm (45.2 in.) |
| Height with -48 v DC power only                                                     | 1926 mm (75.8 in.) |
| Height with -48 v DC power and overhead cable tray (normally included with FC EPB8) | 1941 mm (76.4 in.) |

| Table 31. Environment requirements for FC 6117 and FC EPB8 |                       |                                                  |              |
|------------------------------------------------------------|-----------------------|--------------------------------------------------|--------------|
| Environment                                                | Recommended operating | Allowable operating                              | Nonoperating |
| Temperature                                                |                       | -5°C to 55°C (23°F - 131°F)                      |              |
| Humidity range                                             |                       | 0% - 90% relative humidity (RH) (non-condensing) |              |

Table 31. Environment requirements for FC 6117 and FC EPB8 (continued)

| Environment                | Recommended operating | Allowable operating | Nonoperating                   |
|----------------------------|-----------------------|---------------------|--------------------------------|
| Shipping temperature       |                       |                     | -40°C to 70°C (-40°F to 158°F) |
| Shipping relative humidity |                       |                     | 0% - 93%                       |

### Model 7014-T42 and 7014-B42 rack

Hardware specifications provide detailed information for your rack, including dimensions, electrical, power, temperature, environment, and service clearances.

Table 32. Dimensions for rack

| Rack configuration                                                           | Width             | Height             | Depth              | Weight (empty)                                            | Weight (maximum configuration) and EIA unit capacity                 |
|------------------------------------------------------------------------------|-------------------|--------------------|--------------------|-----------------------------------------------------------|----------------------------------------------------------------------|
| Rack only with side covers                                                   | 644 mm (25.4 in.) | 1016 mm (40.0 in.) | 2015 mm (79.3 in.) | 261 kg (575 lb)                                           | 1597 kg (3521 lb) <sup>2</sup><br>(1336 kg + 261 kg)<br>42 EIA units |
| Rack with standard rear door only                                            | 644 mm (25.4 in.) | 1042 mm (41.0 in.) | 2015 mm (79.3 in.) | 273 kg (602 lb)                                           | N/A                                                                  |
| Rack with standard front and rear doors                                      | 644 mm (25.4 in.) | 1098 mm (43.3 in.) | 2015 mm (79.3 in.) | 289 kg (636 lb)                                           | N/A                                                                  |
| Rack with FC 6084 OEM front door and standard rear door                      | 644 mm (25.4 in.) | 1098 mm (43.3 in.) | 2015 mm (79.3 in.) | 289 kg (636 lb)                                           | N/A                                                                  |
| Rack with FC 6069 high perforation front door and standard rear door         | 644 mm (25.4 in.) | 1098 mm (43.3 in.) | 2015 mm (79.3 in.) | 289 kg (636 lb)                                           | N/A                                                                  |
| Rack with FC ERG7 770/780 high perforation front door and standard rear door | 644 mm (25.4 in.) | 1176 mm (46.3 in.) | 2015 mm (79.3 in.) | 290 kg (639 lb)                                           | N/A                                                                  |
| Rack with FC 6249 acoustic front and rear doors                              | 644 mm (25.4 in.) | 1413 mm (55.6 in.) | 2015 mm (79.3 in.) | 289 kg (635 lb)                                           | N/A                                                                  |
| Rack with FC 6250 high end appearance front door and standard rear door      | 644 mm (25.4 in.) | 1131 mm (44.5 in.) | 2015 mm (79.3 in.) |                                                           | N/A                                                                  |
| Rack with FC ERGB acoustic front door and standard rear door                 | 644 mm (25.4 in.) | 1240 mm (48.8 in.) | 2015 mm (79.3 in.) | 285 kg (627 lb)                                           | N/A                                                                  |
| Rack with FC 6858 heat exchanger rear door and standard front door           | 644 mm (25.4 in.) | 1222 mm (48.1 in.) | 2015 mm (79.3 in.) | Empty:<br>306 kg (675 lb)<br><br>Full:<br>312 kg (688 lb) | N/A                                                                  |

*Table 32. Dimensions for rack (continued)*

| Rack configuration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Width             | Height             | Depth              | Weight (empty)  | Weight (maximum configuration) and EIA unit capacity |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------------------|--------------------|-----------------|------------------------------------------------------|
| Rack with FC ERG0 rack extension and standard front and rear doors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 644 mm (25.4 in.) | 1303 mm (51.3 in.) | 2015 mm (79.3 in.) | 315 kg (694 lb) | N/A                                                  |
| <b>Notes:</b> <ol style="list-style-type: none"> <li>1. The top 6U of the rack can be temporarily detached at the client site to make it easier to move the rack through doors or elevators. The top 6U is then reattached to the rack frame to provide the full 42U rack capacity. The rack is approximately 28 cm (11 in.) shorter when the top is removed. The weight of the top cover is approximately 29 kg (63 lbs).</li> <li>2. For more information about rack weight distribution and floor loading, see <a href="#">7014-T00</a>, <a href="#">7014-T42</a>, and <a href="#">0553 rack weight distribution and floor loading</a>.</li> </ol> |                   |                    |                    |                 |                                                      |

*Table 33. Dimensions for doors*

| Door model                                  | Width                  | Height                  | Depth                 | Weight                                                |
|---------------------------------------------|------------------------|-------------------------|-----------------------|-------------------------------------------------------|
| Standard front door                         | 639 mm (25.2 in.)      | 1946 mm (76.6 in.)      | 56 mm (2.3 in.)       | 16 kg (34 lb)                                         |
| Standard rear door                          | 639 mm (25.2 in.)      | 1946 mm (76.6 in.)      | 26 mm (1.0 in.)       | 13 kg (27 lb)<br>With acoustic foam:<br>16 kg (34 lb) |
| Standard side covers (each)                 | 10 mm (.4 in.)         | 1740 mm (68.5 in.)      | 1042 mm (41.0 in.)    | 18 lbs 8.25 kg(18 lb)                                 |
| FC 6084 front door (OEM)                    | 639 mm (25.2 in.)      | 1946 mm (76.6 in.)      | 56 mm (2.3 in.)       | 16 kg (34 lb)                                         |
| FC 6069 front door, high perforation        | 639 mm (25.2 in.)      | 1946 mm (76.6 in.)      | 56 mm (2.3 in.)       | 16 kg (34 lb)                                         |
| FC ERG7 front door 770/780 high perforation | 639 mm (25.2 in.)      | 1946 mm (76.6 in.)      | 134 mm (5.3 in.)      | 17 kg (37 lb)                                         |
| FC 6249 acoustic doors, front and rear      | 639 mm (25.2 in.) each | 1946 mm (76.6 in.) each | 198 mm (7.8 in.) each | 13.6 kg (30 lb) each                                  |
| FC 6250 high end appearance front door      | 639 mm (25.2 in.) each | 1946 mm (76.6 in.) each | 90 mm (3.5 in.)       |                                                       |
| FC ERGB acoustic door, front only           | 639 mm (25.2 in.)      | 1946 mm (76.6 in.)      | 198 mm (7.8 in.)      | 13.6 kg (30 lb)                                       |
| FC 6238 high end appearance side covers     | 10 mm (.4 in.)         | 1740 mm (68.5 in.)      | 1042 mm (41.0 in.)    | 8.5 kg (18 lb)                                        |

| <i>Table 33. Dimensions for doors (continued)</i>          |                        |                         |                         |                                                   |
|------------------------------------------------------------|------------------------|-------------------------|-------------------------|---------------------------------------------------|
| Door model                                                 | Width                  | Height                  | Depth                   | Weight                                            |
| FC 6858 heat exchanger rear door                           | 639 mm (25.2 in.)      | 1946 mm (76.6 in.)      | 147 mm (5.8 in.)        | Empty: 29.9 kg (66 lb)<br>Full: 35.6 kg (78.5 lb) |
| FC ERG0 8-inch rack extension                              | 647 mm (25.4 in.)      | 1957 mm (77.1 in.)      | 203 mm (8.0 in.)        | 27 kg (58.0 lb)                                   |
| FC ERG8 ballast weight specify code                        | N/A                    | N/A                     | N/A                     | 52.1 kg (115 lb)                                  |
| FC EC07 and EC08 acoustic doors, black IBM, front and rear | 639 mm (25.2 in.) each | 1946 mm (76.6 in.) each | 114.3 mm (4.5 in.) each | 19 kg (42 lb)                                     |

| <i>Table 34. Electrical<sup>1</sup></i>                                                                             |                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Electrical characteristics                                                                                          | Properties                                                                                                                                                           |
| Power source loading maximum in kVA                                                                                 | For more information about rack power distribution units and power cord options, see <a href="#">Power distribution unit and power cord options for 7014 racks</a> . |
| <sup>1</sup> The total rack power can be derived from the sum of the power that is used by the drawers in the rack. |                                                                                                                                                                      |

See your individual server or hardware specifications for temperature and humidity requirements.

Rack noise levels depend on the number and type of drawers installed. See your server or hardware specifications for specific requirements.

**Note:** All rack installations require careful site and facilities planning that is designed to both address the cumulative drawer heat output and provide the airflow volume rates necessary to comply with drawer temperature requirements. All rack installations require careful site and facilities planning that is designed to address both the cumulative drawer heat output and provide the airflow volume rates necessary to comply with drawer temperature requirements. Rack airflow requirements depend on the number and type of drawers installed.

**Note:** Acoustic doors are available for IBM racks. Feature code 6248 is available for 7014-T00 racks. Feature code 6249 is available for 7014-T42 racks. The overall sound reduction is approximately 6 dB. The doors add approximately 381 mm (15 in.) to the depth of the racks.

## Service clearances

| <i>Table 35. Service clearances for 7014-T00 and 7014-T42 racks</i>                           |                 |                 |
|-----------------------------------------------------------------------------------------------|-----------------|-----------------|
| Front                                                                                         | Rear            | Sides           |
| 915 mm (36 in.)                                                                               | 915 mm (36 in.) | 915 mm (36 in.) |
| <b>Note:</b> Recommended minimum vertical service clearance from the floor is 2439 mm (8 ft). |                 |                 |

Figure 3 on page 30 provides the caster and leveler locations for 7014-T00 and 7014-T42 racks.

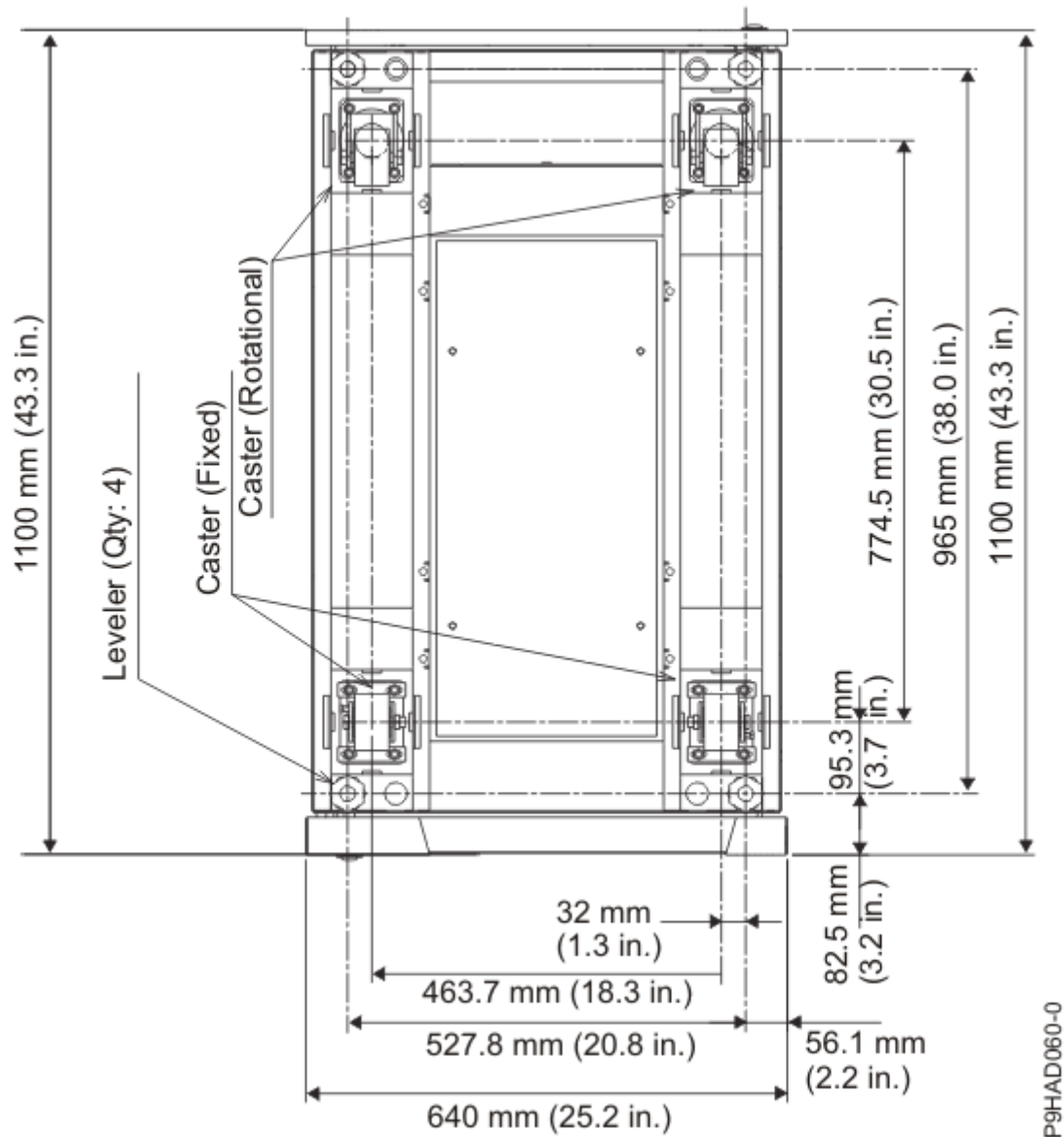


Figure 3. Caster and leveler locations

**Note:** Rack units are large and heavy and are not easily moved. As maintenance activities require access at both the front and the back, extra room is needed. The footprint illustration does not show the radius of the swinging doors on the I/O rack. A service clearance of 915 mm (36 in.) needs to be maintained on front, rear, and sides of the I/O rack.

### 7014-T00 and 7014-T42 service clearances and caster location

Use the service clearances and caster locations for 7014-T00 and 7014-T42 racks to plan the correct service clearances and caster locations for your rack.

### Service clearances

| Table 36. Service clearances for 7014-T00, 7014-T42, and 0553 racks                           |                 |                 |
|-----------------------------------------------------------------------------------------------|-----------------|-----------------|
| Front                                                                                         | Rear            | Sides           |
| 915 mm (36 in.)                                                                               | 915 mm (36 in.) | 915 mm (36 in.) |
| <b>Note:</b> Recommended minimum vertical service clearance from the floor is 2439 mm (8 ft). |                 |                 |



Figure 4 on page 31 provides the caster and leveler locations for 7014-T00 and 7014-T42 racks.

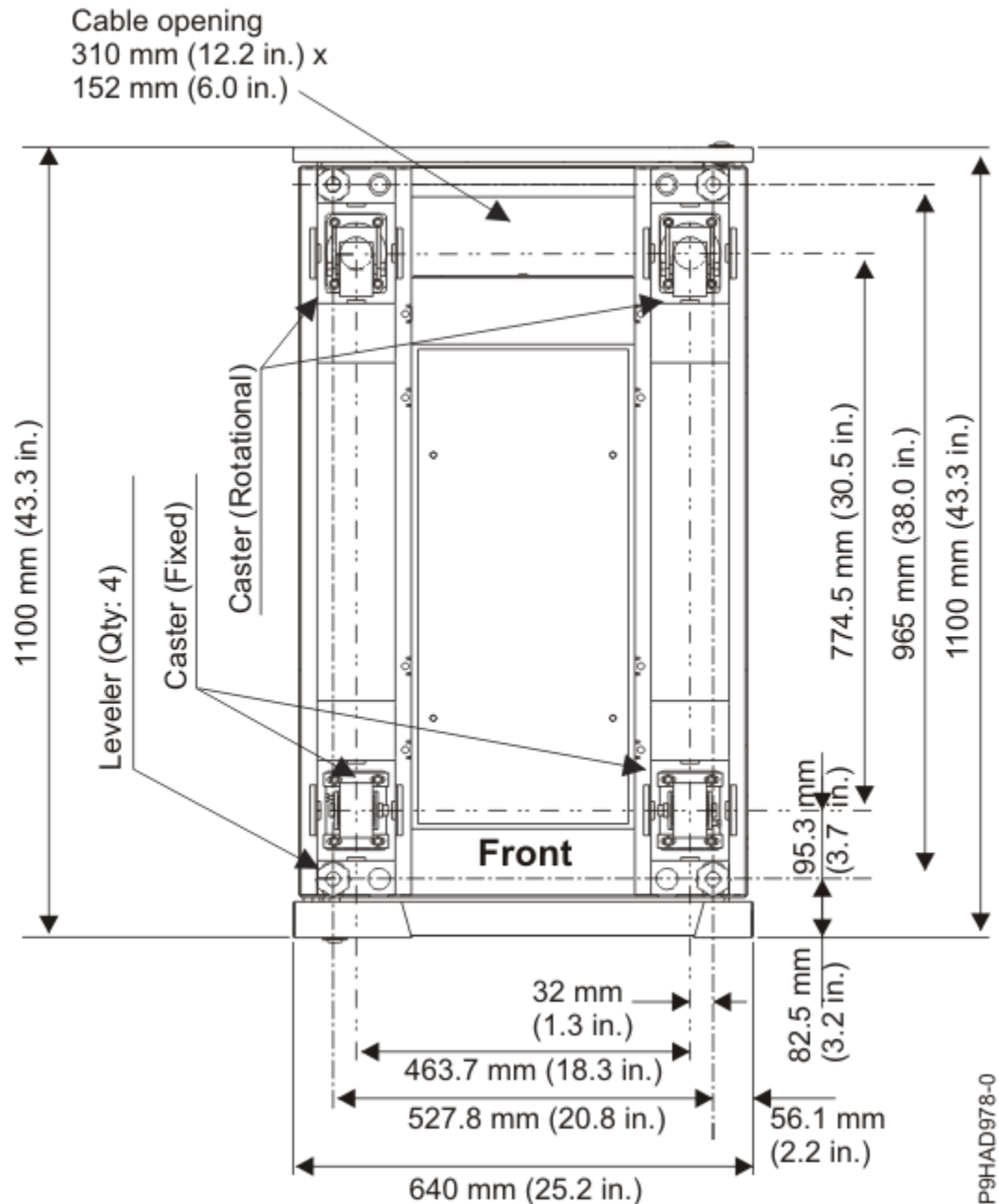


Figure 4. Caster and leveler locations

**Note:** Rack units are large and heavy and are not easily moved. As maintenance activities require access at both the front and the back, extra room is needed. The footprint illustration does not show the radius of the swinging doors on the I/O rack. A service clearance of 915 mm (36 in.) needs to be maintained on front, rear, and sides of the I/O rack.

### Feature code (FC) ERG0

FC ERG0 is an optional rear rack extender that can be used for 7014-T42 racks. The extender is installed on the rear of the 7014-T42 rack and provides 203 mm (8 in.) of extra space to hold cables on the side of the rack and to keep the center area clear for cooling and service access.

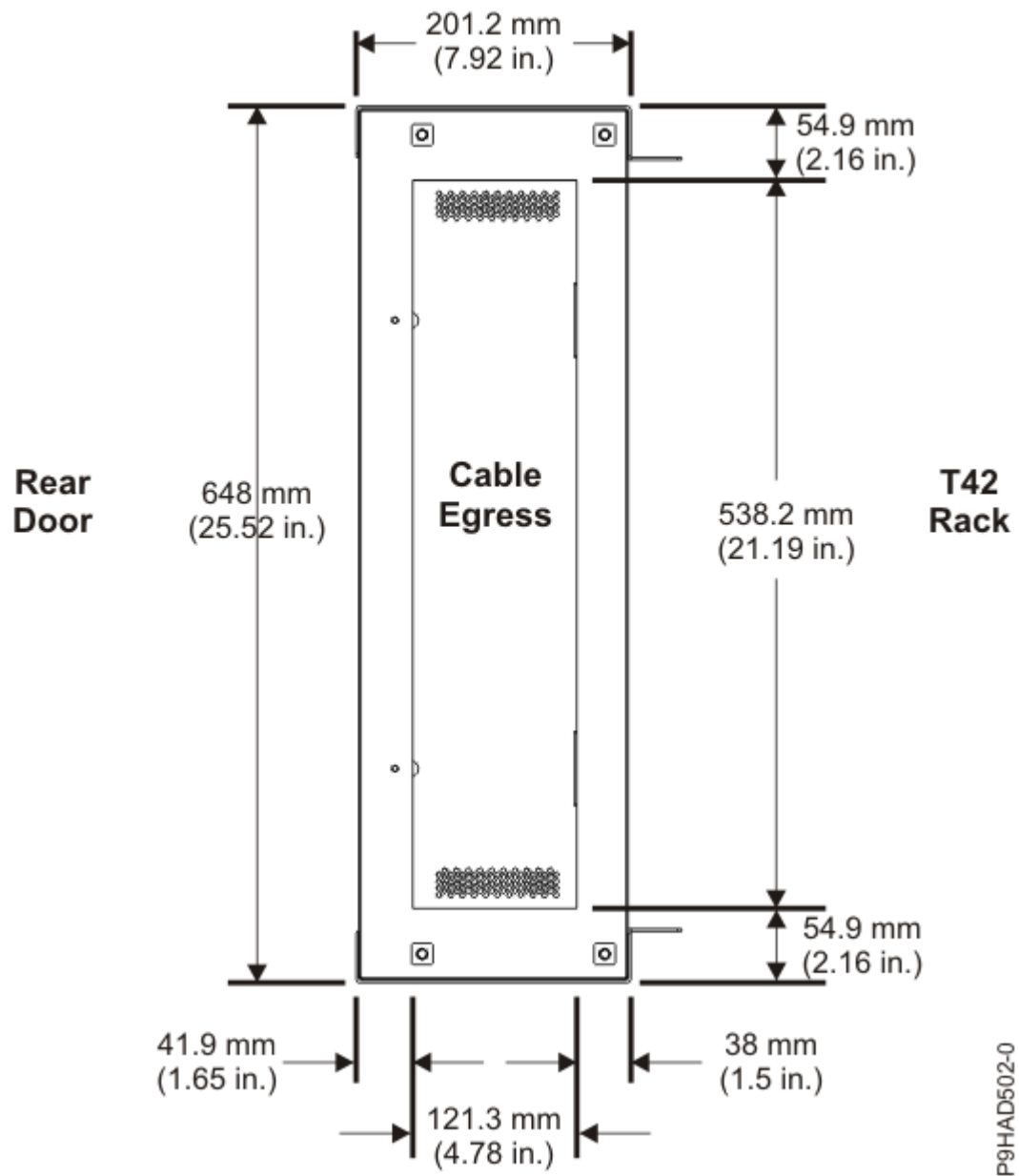


Figure 5. FC ERG0 rear rack extender (top-down view)

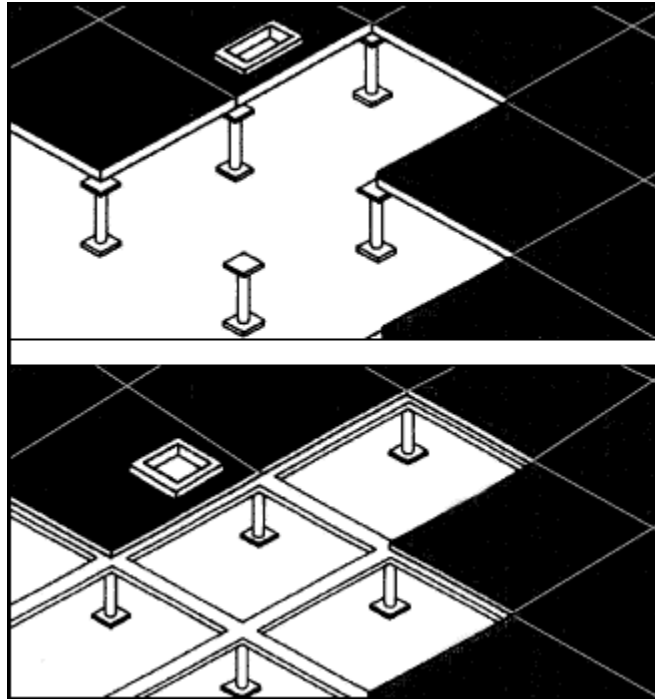
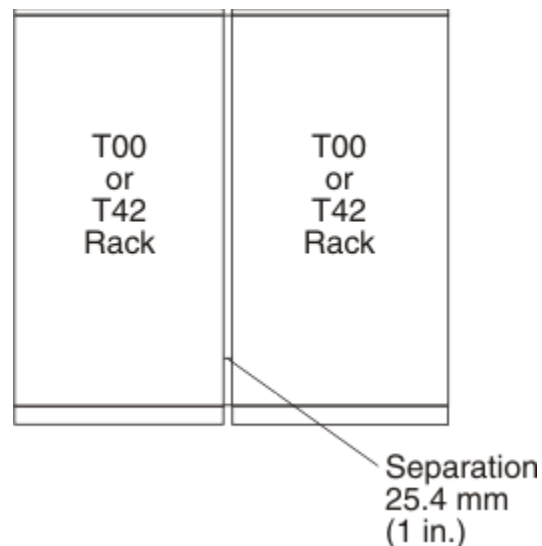


Figure 6. FC ERGO assembled view

### **7014-T00 and 7014-T00 multiple attachment racks**

Model 7014-T00 or 7014-T42 racks can be bolted together in a multiple-rack arrangement. This figure shows that arrangement.



A kit is available including the bolts, spacers, and decorative trim pieces to cover the 25.4 mm (1 in.) space. For service clearances, see the service clearances as shown in the table for the model 7014-T00 rack.

### **7014-T00 and 7014-T42 rack weight distribution and floor loading**

Racks can be heavy when populated with several drawers. Use the Weight distribution distances for racks when loaded and Floor loading for racks when loaded tables to ensure proper floor loading and weight distribution.

The 7014-T00 and 7014-T42 racks can be heavy when several drawers are present. The following table shows the necessary weight distribution distances for the 7014-T00 and 7014-T42 racks when loaded.

Table 37. Weight distribution distances for racks when loaded

| Rack                  | System weight <sup>1</sup> | Width <sup>2</sup> | Depth <sup>2</sup> | Weight distribution distance <sup>3</sup> |                    |
|-----------------------|----------------------------|--------------------|--------------------|-------------------------------------------|--------------------|
|                       |                            |                    |                    | Front and back                            | Left and right     |
| 7014-T00 <sup>4</sup> | 816 kg (1795 lb)           | 623 mm (24.5 in)   | 1021 mm (40.2 in)  | 515.6 mm (20.3 in), 477.5 mm (18.8 in)    | 467.4 mm (18.4 in) |
| 7014-T00 <sup>5</sup> | 816 kg (1795 lb)           | 623 mm (24.5 in)   | 1021 mm (40.2 in)  | 515.6 mm (20.3 in), 477.5 mm (18.8 in)    | 0                  |
| 7014-T00 <sup>6</sup> | 816 kg (1795 lb)           | 623 mm (24.5 in)   | 1021 mm (40.2 in)  | 515.6 mm (20.3 in), 477.5 mm (18.8 in)    | 559 mm (22 in)     |
| 7014-T42 <sup>4</sup> | 930 kg (2045 lb)           | 623 mm (24.5 in)   | 1021 mm (40.2 in)  | 515.6 mm (20.3 in), 477.5 mm (18.8 in)    | 467.4 mm (18.4 in) |
| 7014-T42 <sup>5</sup> | 930 kg (2045 lb)           | 623 mm (24.5 in)   | 1021 mm (40.2 in)  | 515.6 mm (20.3 in), 477.5 mm (18.8 in)    | 0                  |
| 7014-T42 <sup>6</sup> | 930 kg (2045 lb)           | 623 mm (24.5 in)   | 1021 mm (40.2 in)  | 515.6 mm (20.3 in), 477.5 mm (18.8 in)    | 686 mm (27 in)     |

**Notes:**

1. Maximum weight of fully populated rack, units are lb with kg in parentheses.
2. Dimensions without covers, units are mm with inches in parentheses.
3. The weight distribution distance in all four directions is the area around the rack perimeter (minus covers) necessary to distribute the weight beyond the perimeter of the rack. Weight distribution areas cannot overlap with adjacent computer equipment weight distribution areas. Units are inches with mm in parentheses.
4. Weight distribution distance is 1/2 the service clearance values that are shown in the figure plus cover thickness.
5. No left and right weight distribution distance.
6. Left and right weight distribution distance that is required for a 70 lb/ft<sup>2</sup> raised floor loading objective.

The following table shows the necessary floor loading for the 7014-T00 and 7014-T42 racks when loaded.

Table 38. Floor loading for racks when loaded

| Rack                  | Floor loading            |                              |                           |                               |
|-----------------------|--------------------------|------------------------------|---------------------------|-------------------------------|
|                       | Raised kg/m <sup>1</sup> | Non-raised kg/m <sup>1</sup> | Raised lb/ft <sup>1</sup> | Non-raised lb/ft <sup>1</sup> |
| 7014-T00 <sup>2</sup> | 366.7                    | 322.7                        | 75                        | 66                            |
| 7014-T00 <sup>3</sup> | 734.5                    | 690.6                        | 150.4                     | 141.4                         |
| 7014-T00 <sup>4</sup> | 341                      | 297                          | 70                        | 61                            |
| 7014-T42 <sup>2</sup> | 403                      | 359                          | 82.5                      | 73.5                          |
| 7014-T42 <sup>3</sup> | 825                      | 781                          | 169                       | 160                           |
| 7014-T42 <sup>4</sup> | 341.4                    | 297.5                        | 70                        | 61                            |

Table 38. Floor loading for racks when loaded (continued)

| Rack                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Floor loading            |                              |                           |                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------------|---------------------------|-------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Raised kg/m <sup>1</sup> | Non-raised kg/m <sup>1</sup> | Raised lb/ft <sup>1</sup> | Non-raised lb/ft <sup>1</sup> |
| <b>Notes:</b> <ol style="list-style-type: none"> <li>1. Dimensions without covers, units are mm with inches in parentheses.</li> <li>2. Weight distribution distance is one half of the service clearance values that is shown in the figure plus cover thickness.</li> <li>3. No left and right weight distribution distance.</li> <li>4. Left and right weight distribution distance that is required for a 70 lb/ft<sup>2</sup> raised floor loading objective.</li> </ol> |                          |                              |                           |                               |

## Planning for the 7953-94X and 7965-94Y rack

Rack specifications provide detailed information for your rack, including dimensions, electrical, power, temperature, environment, and service clearances.

The following provide specifications for the 7953-94X and 7965-94Y rack.

### Model 7953-94X and 7965-94Y rack

Hardware specifications provide detailed information for your rack, including dimensions, electrical, power, temperature, environment, and service clearances.

Table 39. Dimensions for rack

|                                                                                                                                                                                    | Width             | Depth                                | Height             | Weight (Empty)  | Weight (Maximum configuration) | EIA unit capacity |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------------------------------------|--------------------|-----------------|--------------------------------|-------------------|
| Rack only                                                                                                                                                                          | 600 mm (23.6 in.) | 1095 mm (43.1 in.)                   | 2002 mm (78.8 in.) | 130 kg (287 lb) | 1140 kg (2512 lb)              | 42 EIA units      |
| Rack with standard doors                                                                                                                                                           | 600 mm (23.6 in.) | 1145.5 mm (45. in.)                  | 2002 mm (78.8 in.) | 138 kg (304 lb) | N/A                            | N/A               |
| Rack with triplex doors                                                                                                                                                            | 600 mm (23.6 in.) | 1206.2 - 1228.8 mm (47.5 - 48.4 in.) | 2002 mm (78.8 in.) | 147 kg (324 lb) | N/A                            | N/A               |
| Rack with rear door heat exchanger indicator                                                                                                                                       | 600 mm (23.6 in.) | 1224 mm (48.2 in.)                   | 2002 mm (78.8 in.) | 169 kg (373 lb) | N/A                            | N/A               |
| <b>Note:</b> When the rack is delivered or is moved, outriggers are needed for stability. For more information about outriggers, see <a href="#">Side stabilizing outriggers</a> . |                   |                                      |                    |                 |                                |                   |

| Table 40. Dimensions for doors                                                                                                                                                                                                                                                                     |                     |                      |                                 |                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------|---------------------------------|-----------------|
| Door model                                                                                                                                                                                                                                                                                         | Width               | Height               | Depth                           | Weight          |
| Standard front door (FC EC01) and standard back door (FC EC02)                                                                                                                                                                                                                                     | 597 mm (23.5 in.)   | 1925 mm (75.8 in.)   | 22.5 mm (0.9 in.)               | 7.7 kg (17 lb)  |
| Triplex door (FC EU21) <sup>3</sup>                                                                                                                                                                                                                                                                | 597.1 mm (23.5 in.) | 1923.6 mm (75.7 in.) | 105.7 mm (4.2 in.) <sup>1</sup> | 16.8 kg (37 lb) |
|                                                                                                                                                                                                                                                                                                    |                     |                      | 128.3 mm (5.2 in.) <sup>2</sup> |                 |
| <sup>1</sup> Measured from the front flat surface of the door.                                                                                                                                                                                                                                     |                     |                      |                                 |                 |
| <sup>2</sup> Measured from the IBM logo on the front of the door.                                                                                                                                                                                                                                  |                     |                      |                                 |                 |
| <sup>3</sup> Multiple racks that are placed side-by-side must have a 6 mm (0.24 in.) minimum clearance between racks to allow the triplex front door to hinge properly. Feature code EC04 (Rack suite attachment kit) can be used to maintain the 6 mm (0.24 in.) minimum clearance between racks. |                     |                      |                                 |                 |

| <i>Table 41. Dimensions for side covers<sup>1</sup></i>                 |                    |                 |
|-------------------------------------------------------------------------|--------------------|-----------------|
| Depth                                                                   | Height             | Weight          |
| 885 mm (34.9 in.)                                                       | 1870 mm (73.6 in.) | 17.7 kg (39 lb) |
| <sup>1</sup> Side covers do not increase the overall width of the rack. |                    |                 |

| <i>Table 42. Temperature requirements</i>                                                                                   |                                |
|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| Operating                                                                                                                   | Nonoperating                   |
| 10°C - 38°C (50°F - 100.4°F) <sup>1</sup>                                                                                   | -40°C to 60°C (-40°F to 140°F) |
| <sup>1</sup> The maximum 38°C (100.4°F) temperature must be derated 1°C (1.8 °F) per 137 m (450 ft) above 1295 m (4250 ft). |                                |

| <i>Table 43. Environmental requirements</i> |                                                  |                                 |                                  |
|---------------------------------------------|--------------------------------------------------|---------------------------------|----------------------------------|
| Environment                                 | Operating                                        | Nonoperating                    | Maximum altitude                 |
| Noncondensing humidity                      | 20% - 80% (allowable)<br>40% - 55% (recommended) | 8% - 80% (including condensing) | 2134 m (7000 ft) above sea level |
| Wet bulb temperature                        | 21°C (69.8°F)                                    | 27°C (80.6°F)                   |                                  |

| <i>Table 44. Service clearances</i>                                                                                                                                                                 |                 |                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------|
| Front                                                                                                                                                                                               | Back            | Side <sup>1</sup> |
| 915 mm (36 in.)                                                                                                                                                                                     | 915 mm (36 in.) | 610 mm (24 in.)   |
| <sup>1</sup> Side service clearance is only required when outriggers are on the rack. Side service clearance is not required during normal operation of the rack when outriggers are not installed. |                 |                   |

## Rear door heat exchanger

Specifications for Power orderable feature code (FC): EC05 - Rear door heat exchanger indicator (Model 1164-95X).

| Table 45. Dimensions for rear door heat exchanger                          |                  |                    |                |                 |
|----------------------------------------------------------------------------|------------------|--------------------|----------------|-----------------|
| Width                                                                      | Depth            | Height             | Weight (empty) | Weight (filled) |
| 600 mm (23.6 in.)                                                          | 129 mm (5.0 in.) | 1950 mm (76.8 in.) | 39 kg (85 lb)  | 48 kg (105 lb)  |
| For more information, see <i>Model 1164-95X rear door heat exchanger</i> . |                  |                    |                |                 |

## Electrical

For electrical requirements, see [Power distribution unit and power cord options](#).

## Features

The 7953-94X and 7965-94Y rack has the following features available for use:

- Recirculation prevention plate that is installed at the bottom, front of the rack.
- Stabilizer bracket that is installed at the front of the rack.

## Caster locations

The following diagram provides the caster locations for the 7953-94X and 7965-94Y rack.

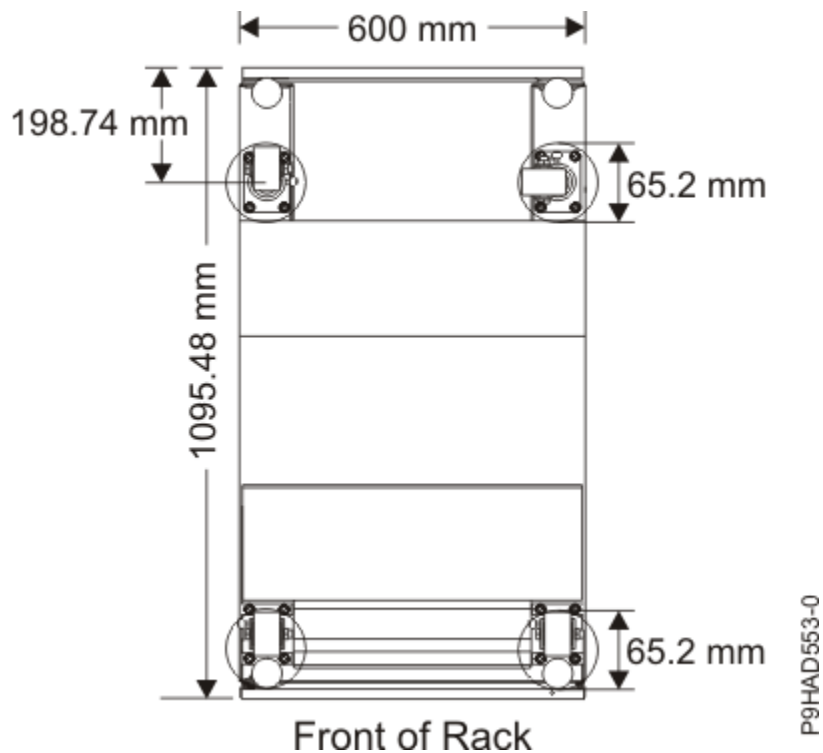


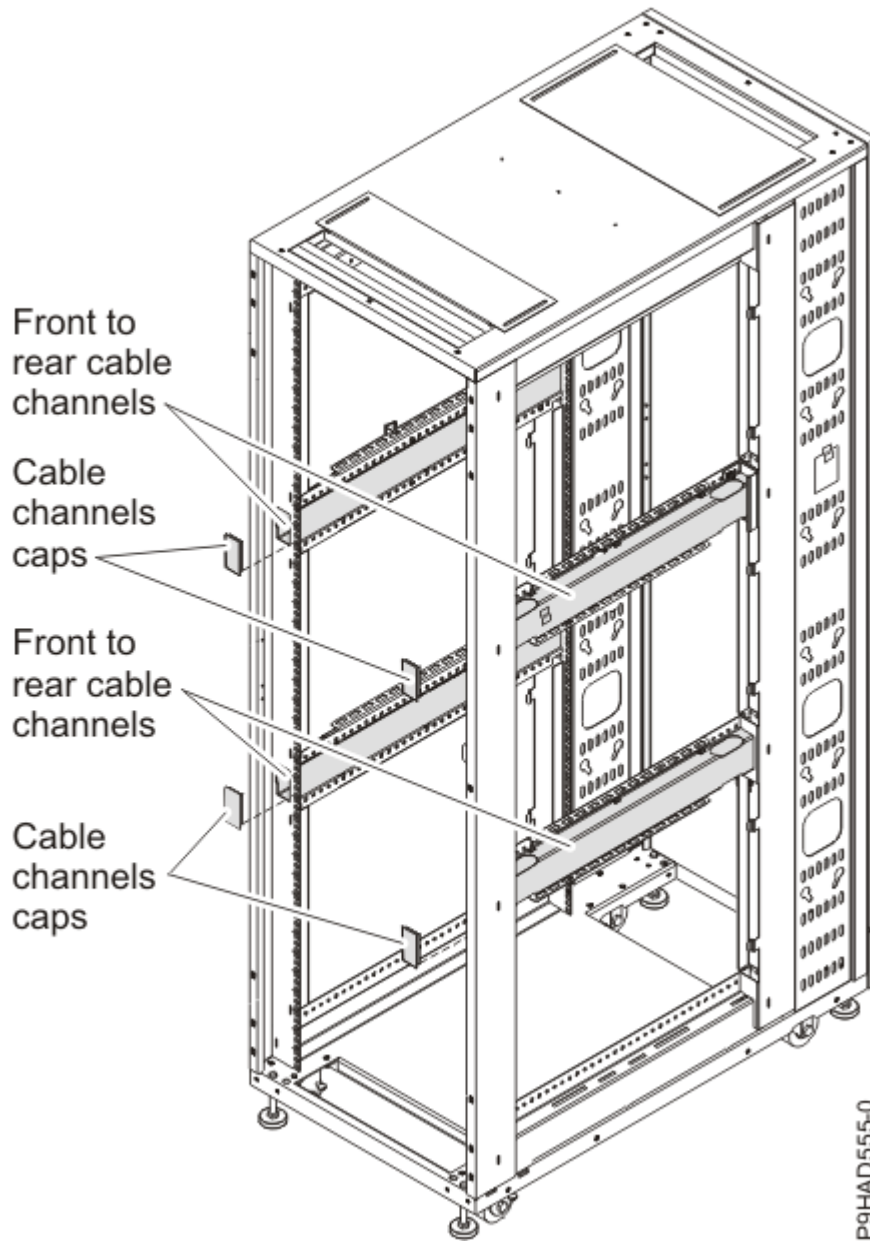
Figure 7. Caster locations

## ***Cabling the 7953-94X and 7965-94Y rack***

Learn about the different cable routing options available for the 7953-94X and 7965-94Y rack.

### **Cabling within the rack**

Side cable channels are available in the rack to route cables. Two cable channels are on each side of the rack as shown in [Figure 8 on page 38](#).



*Figure 8. Cabling within the rack*

### **Cabling under the floor**

A cable access bar on the bottom rear of the rack helps to route the cables, leaving the rack in place. This bar can be removed for installation and then reattached after the rack is installed and cabled.



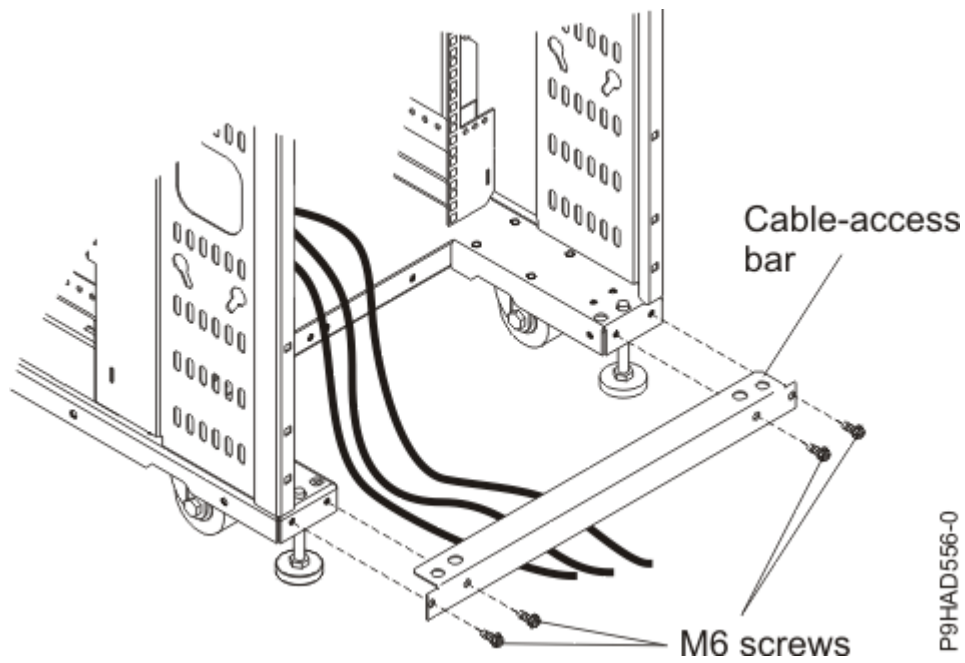


Figure 9. Cable access bar

### Cabling overhead

Front and rear rectangular cable access openings that are on the top of the rack cabinet allow cables to be routed up and out of the rack. Cable access covers are adjustable by loosening the side screws and sliding the covers forward or backward.

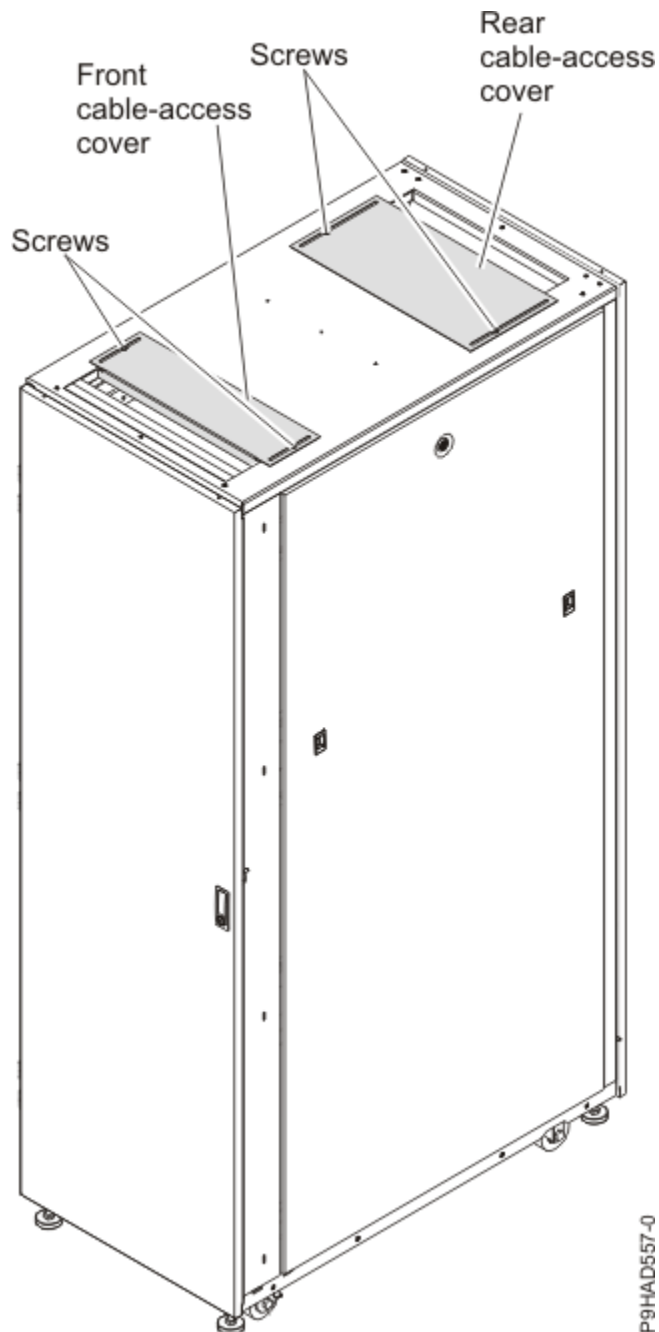


Figure 10. Cable access covers

### **Side stabilizing outriggers**

Learn about the side stabilizing outriggers available for the 7953-94X and 7965-94Y rack.

The outriggers are stabilizers with wheels that are installed on the sides of the rack cabinet. The outriggers can be removed only after the rack is in the final location and is not moved more than 2 m (6 ft) away in any direction.

To remove the outriggers, use a 6 mm hex wrench to remove the four bolts that attach each outrigger to the rack cabinet.

Keep each of the outriggers and bolts in a safe place for future use when you move the rack. Reinstall the outriggers to move the rack cabinet to another location that is greater than 2 m (6 ft) away from its current location.

Table 46. Dimensions for rack with outriggers

| Width             | Depth              | Height             | Weight          | EIA unit capacity |
|-------------------|--------------------|--------------------|-----------------|-------------------|
| 780 mm (30.7 in.) | 1095 mm (43.1 in.) | 2002 mm (78.8 in.) | 261 kg (575 lb) | 42 EIA units      |

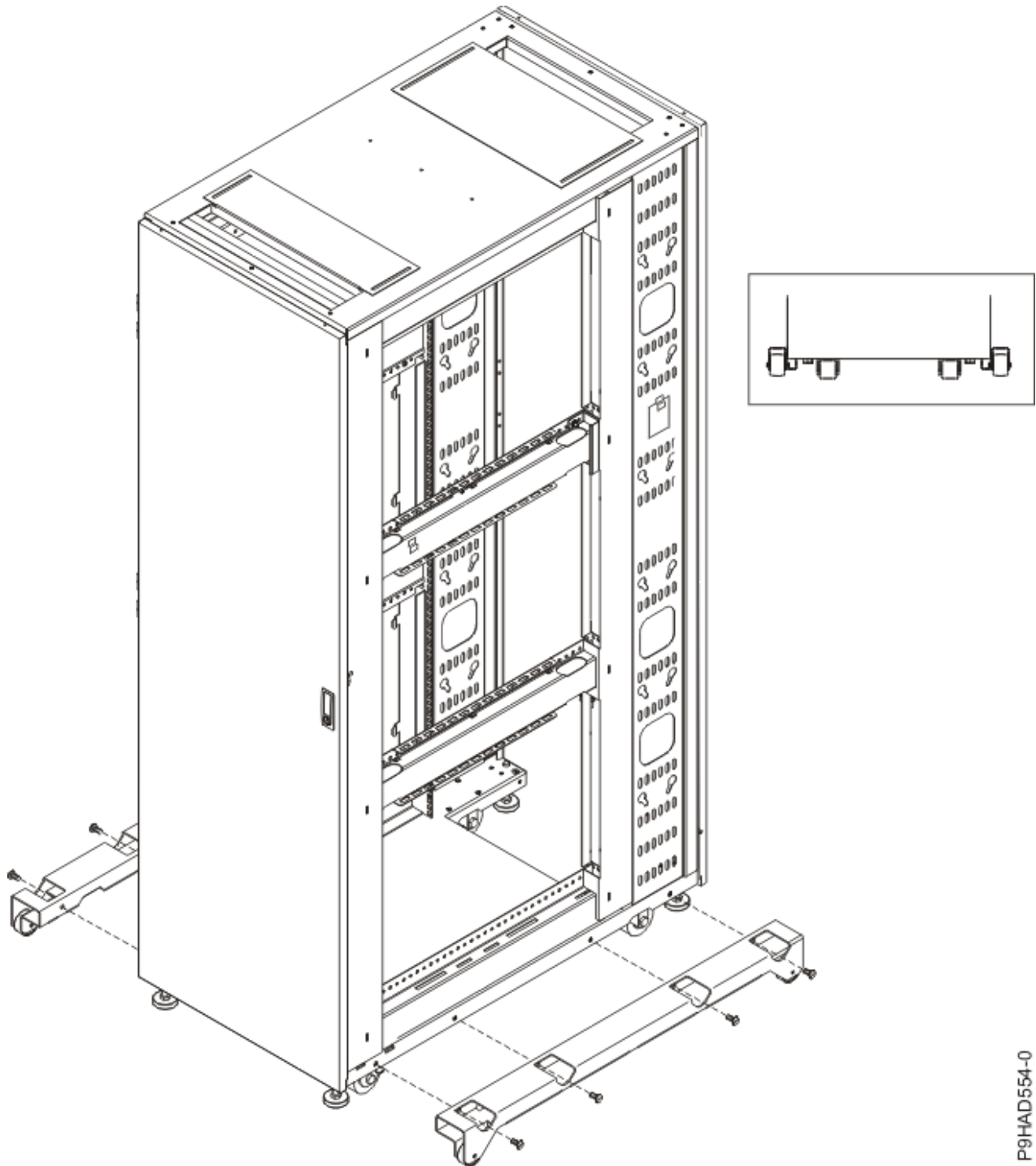


Figure 11. Outrigger locations

P9HAD554-0

## Multiple racks

Learn how to attach multiple 7953-94X and 7965-94Y racks together.

Multiple 7953-94X and 7965-94Y racks can be attached together by using attachment brackets that connect the units at the front of the rack. See [Figure 12 on page 42](#).

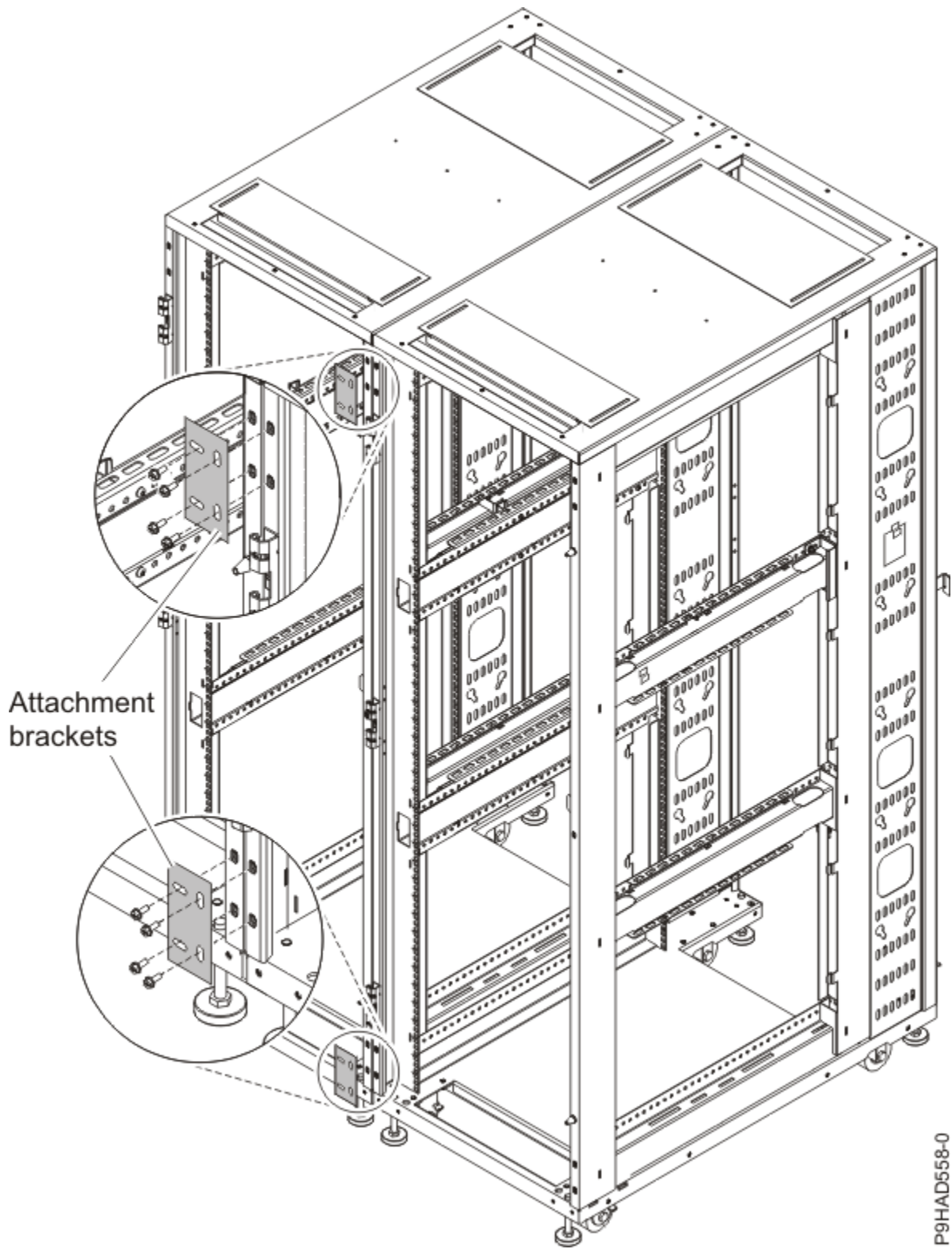


Figure 12. Attachment brackets

## Planning for the 7965-S42 rack

Rack specifications provide detailed information for your rack, including dimensions, electrical, power, temperature, environment, and service clearances.

### Model 7965-S42 rack specifications

Hardware specifications provide detailed information for your rack, including dimensions, electrical, power, temperature, environment, and service clearances.

Table 47. Dimensions for rack

|                                                             | Width             | Depth              | Height             | Weight (Empty)  | EIA unit capacity |
|-------------------------------------------------------------|-------------------|--------------------|--------------------|-----------------|-------------------|
| Rack only                                                   | 600 mm (23.6 in.) | 1070 mm (42.1 in.) | 2020 mm (79.5 in.) | 166 kg (365 lb) | 42 EIA units      |
| Rack with two standard doors                                | 600 mm (23.6 in.) | 1132 mm (44.6 in.) | 2020 mm (79.5 in.) | 177 kg (391 lb) | 42 EIA units      |
| Rack with rear door heat exchanger (dry) and standard doors | 600 mm (23.6 in.) | 1231 mm (48.5 in.) | 2020 mm (79.5 in.) | 210 kg (463 lb) | 42 EIA units      |
| Rack with high-end appearance front door and rear door      | 600 mm (23.6 in.) | 1201 mm (47.3 in.) | 2020 mm (79.5 in.) | 181 kg (398 lb) | 42 EIA units      |

Table 48. Weight capacity limits

| Characteristics   | Maximum weight    | EIA unit capacity           |
|-------------------|-------------------|-----------------------------|
| Dynamic (rolling) | 1134 kg (2500 lb) | 18 kg (40 lb) / EIA average |
| Static            | 1678 kg (3700 lb) | 32 kg (70 lb) / EIA average |
| Seismic certified | 1170 (2580 lb)    | 20 kg (45 lb) / EIA maximum |

Table 49. Dimensions for doors

| Door model                                                | Width             | Height             | Depth             | Weight                  |
|-----------------------------------------------------------|-------------------|--------------------|-------------------|-------------------------|
| Standard front door and standard back door                | 590 mm (23.2 in.) | 1942 mm (76.5 in.) | 31 mm (1.2 in.)   | 5.9 kg (13 lb)          |
| Rear door heat exchanger door                             | 600 mm (23.6 in.) | 1950 mm (76.8 in.) | 129 mm (5.0 in.)  | 39 kg (85 lb) - empty   |
|                                                           |                   |                    |                   | 48 kg (105 lb) - filled |
| High-end appearance front door, panels                    | 590 mm (23.2 in.) | 1942 mm (76.5 in.) | 81 mm (3.0 in.)   | 12.3 kg (27 lb)         |
| High-end appearance front door, chevrons                  | 590 mm (23.2 in.) | 1942 mm (76.5 in.) | 100 mm (3.9 in.)  | 9.1 kg (20 lb)          |
| FC ECRC and ECRD acoustic front and rear doors, black IBM | 590 mm (23.2 in.) | 1942 mm (76.5 in.) | 115.5 mm (4.6 in) | 17.7 kg (39 lb)         |

| <i>Table 49. Dimensions for doors (continued)</i>         |                   |                    |                 |                 |
|-----------------------------------------------------------|-------------------|--------------------|-----------------|-----------------|
| Door model                                                | Width             | Height             | Depth           | Weight          |
| FC ECRC and ECRD acoustic front and rear doors, black OEM | 590 mm (23.2 in.) | 1942 mm (76.5 in.) | 110 mm (4.3 in) | 17.7 kg (39 lb) |

| <i>Table 50. Dimensions for side covers</i>                                                                                             |                    |                    |                     |
|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|---------------------|
| Width <sup>1</sup>                                                                                                                      | Depth              | Height             | Weight <sup>2</sup> |
| 12 mm (0.5 in.)                                                                                                                         | 1070 mm (42.1 in.) | 1942 mm (76.5 in.) | 20 kg (44 lb)       |
| <sup>1</sup> Side covers increase the overall width of the rack by 12 mm (0.5 in.) per side, but are only used on the ends of the rows. |                    |                    |                     |
| <sup>2</sup> Weight is for each side cover.                                                                                             |                    |                    |                     |

| <i>Table 51. Environment requirements<sup>1</sup></i>                                                                                                                                                                                                                                                                      |                                                                                     |                                     |                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------|--------------------------------|
| Environment                                                                                                                                                                                                                                                                                                                | Recommended operating                                                               | Allowable operating                 | Nonoperating                   |
| ASHRAE class                                                                                                                                                                                                                                                                                                               |                                                                                     | A3                                  |                                |
| Airflow direction                                                                                                                                                                                                                                                                                                          |                                                                                     | Front-to-back                       |                                |
| Temperature <sup>2</sup>                                                                                                                                                                                                                                                                                                   | 18°C - 27°C (64°F - 80°F)                                                           | 5°C - 40°C (41°F - 104°F)           | 1°C - 60°C (34°F - 140°F)      |
| Humidity range                                                                                                                                                                                                                                                                                                             | 5.5°C (42°F) dew point (DP) to 60% relative humidity (RH) and 15°C (59°F) dew point | -12.0°C (10.4°F) DP and 8% - 80% RH | 8% - 80% RH                    |
| Maximum dew point                                                                                                                                                                                                                                                                                                          |                                                                                     | 24°C (75°F)                         | 27°C (80°F)                    |
| Maximum operating altitude                                                                                                                                                                                                                                                                                                 |                                                                                     | 3050 m (10000 ft)                   |                                |
| Shipping temperature                                                                                                                                                                                                                                                                                                       |                                                                                     |                                     | -40°C to 60°C (-40°F to 140°F) |
| Shipping relative humidity                                                                                                                                                                                                                                                                                                 |                                                                                     |                                     | 5% - 100%                      |
| <p>1. The final ASHRAE class is determined by the hardware that is installed in the rack. Individual specifications for each piece of hardware must be reviewed.</p> <p>2. Derate maximum allowable dry-bulb temperature 1°C per 175 m above 950 m. IBM recommends a temperature range of 18°C - 27°C (64°F - 80.6°F).</p> |                                                                                     |                                     |                                |

| <i>Table 52. Service clearances</i>                                                    |                 |
|----------------------------------------------------------------------------------------|-----------------|
| Front <sup>1</sup>                                                                     | Back            |
| 915 mm (36 in.)                                                                        | 915 mm (36 in.) |
| <sup>1</sup> Storage racks require larger service clearances in the front of the rack. |                 |

## Rear door heat exchanger

Specifications for Power orderable feature code (FC) EC05 (Rear door heat exchanger indicator (Model 1164-95X)).

| Table 53. Dimensions for rear door heat exchanger                                                              |                  |                    |                |                 |
|----------------------------------------------------------------------------------------------------------------|------------------|--------------------|----------------|-----------------|
| Width                                                                                                          | Depth            | Height             | Weight (empty) | Weight (filled) |
| 600 mm (23.6 in.)                                                                                              | 129 mm (5.0 in.) | 1950 mm (76.8 in.) | 39 kg (85 lb)  | 48 kg (105 lb)  |
| For more information, see <a href="#">“Model 1164-95X rear door heat exchanger specifications”</a> on page 52. |                  |                    |                |                 |

## Electrical

For electrical requirements, see [Power distribution unit and power cord options](#).

## Floor cutout

Racks with water hoses and power cords that exit from the bottom of the rack require a floor tile cutout of at least 30.48 cm (12 in.) long by 22.86 cm (9 in.) wide. Due to the hose bend radii, the hole must be positioned towards the side of the rack without the manifold (the left side of the rack when looking at the rear of the rack). The left edge of the hole must be at least 11.43 cm (4.5 in.) from the side and 3.81 cm (1.5 in.) from the back edge of the rack (not including doors). Hole placement on the tile depends on the location of the rack, tile size, and tile load limitations.

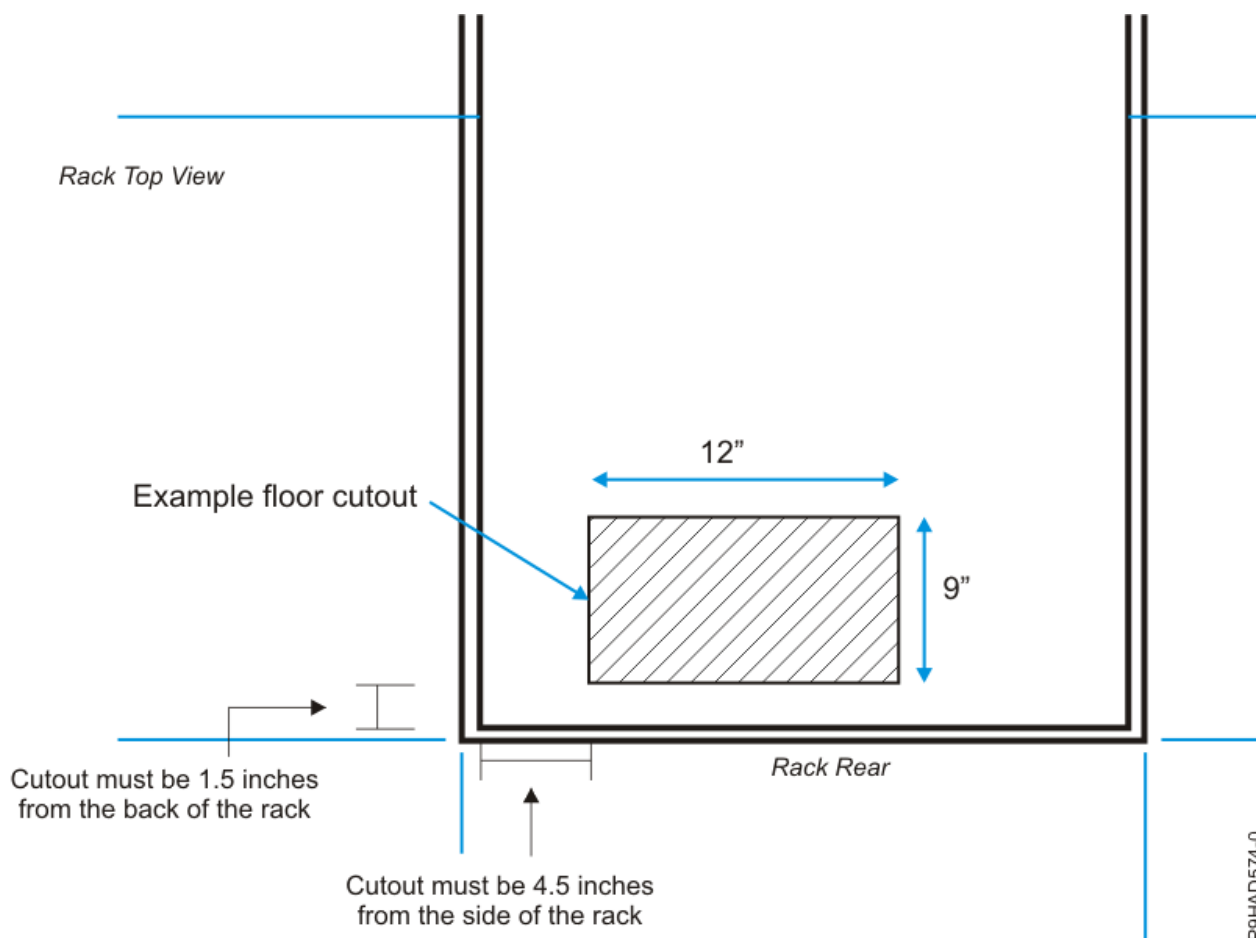


Figure 13. Floor cutout

## Caster and leveler locations

The following diagram provides the caster and leveler locations for the 7965-S42 rack.

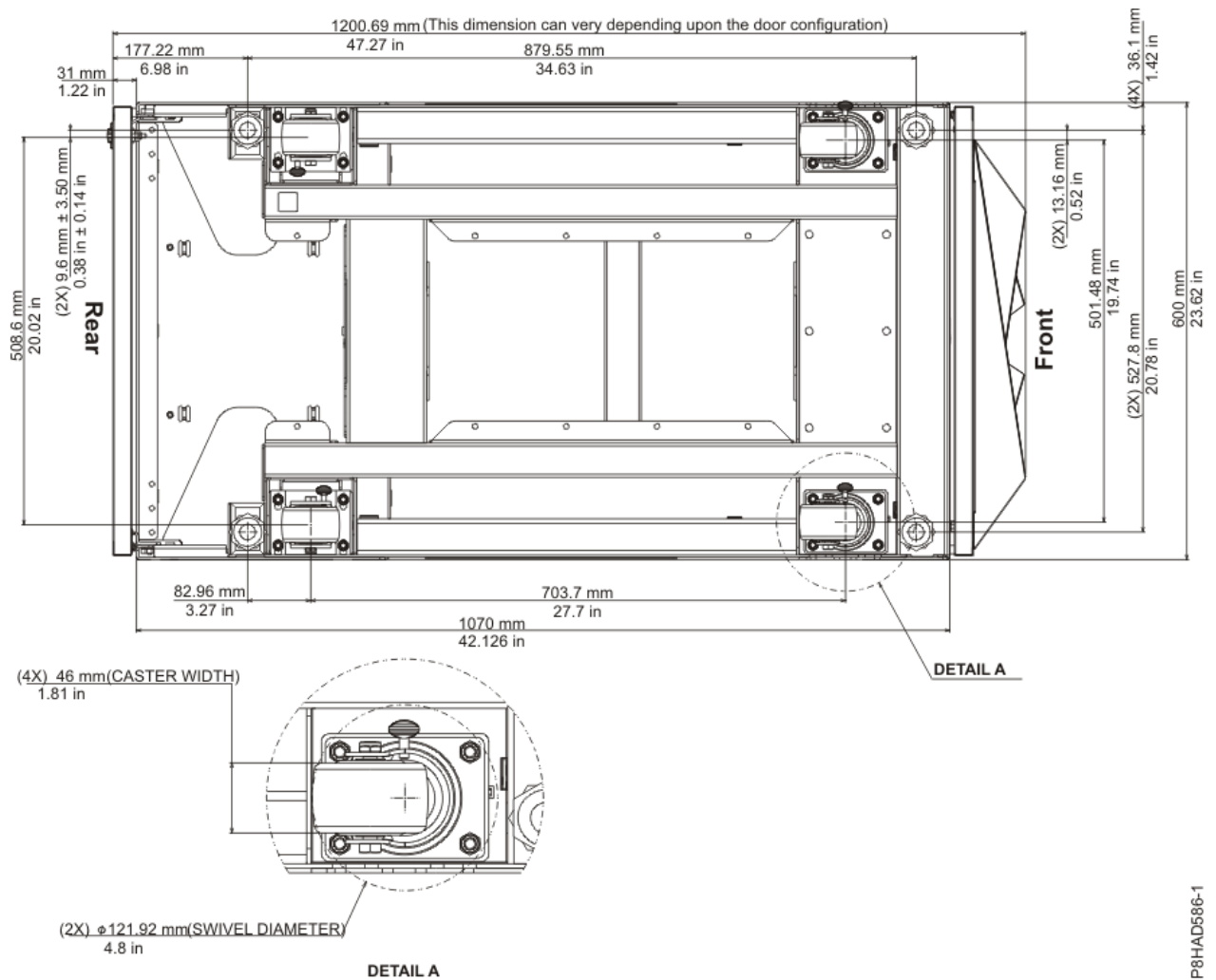


Figure 14. Caster and leveler locations

## Cabling the 7965-S42 rack

Learn about the different cable routing options available for the 7965-S42 rack.

### Cabling within the rack

Side cable channels are available in the rack to route cables. Three cable channels are on each side of the rack.

P8HAD586-1



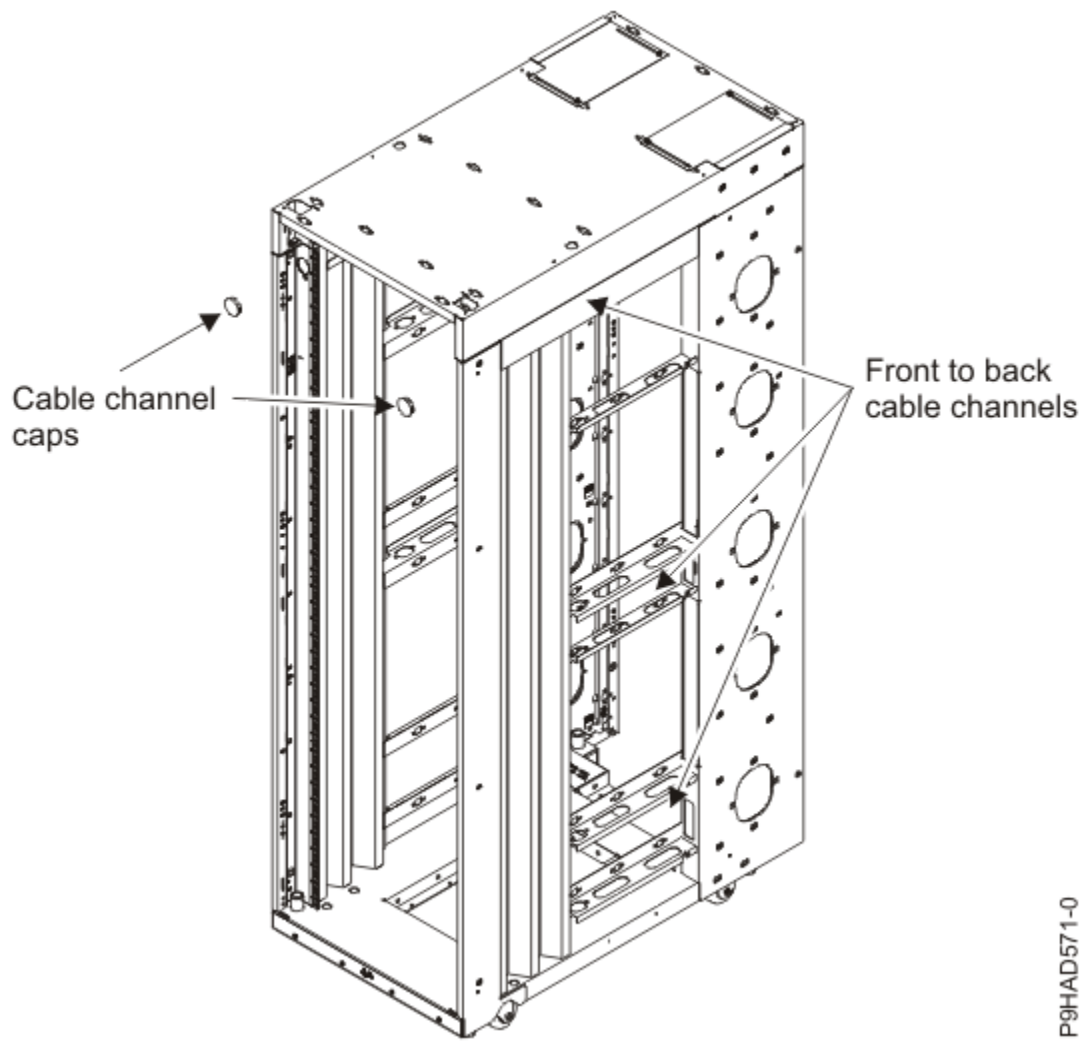


Figure 15. Cabling within the rack

### Cabling under the floor

Cables can be routed straight down through the side channels of the rack or routed towards the center of the opening.

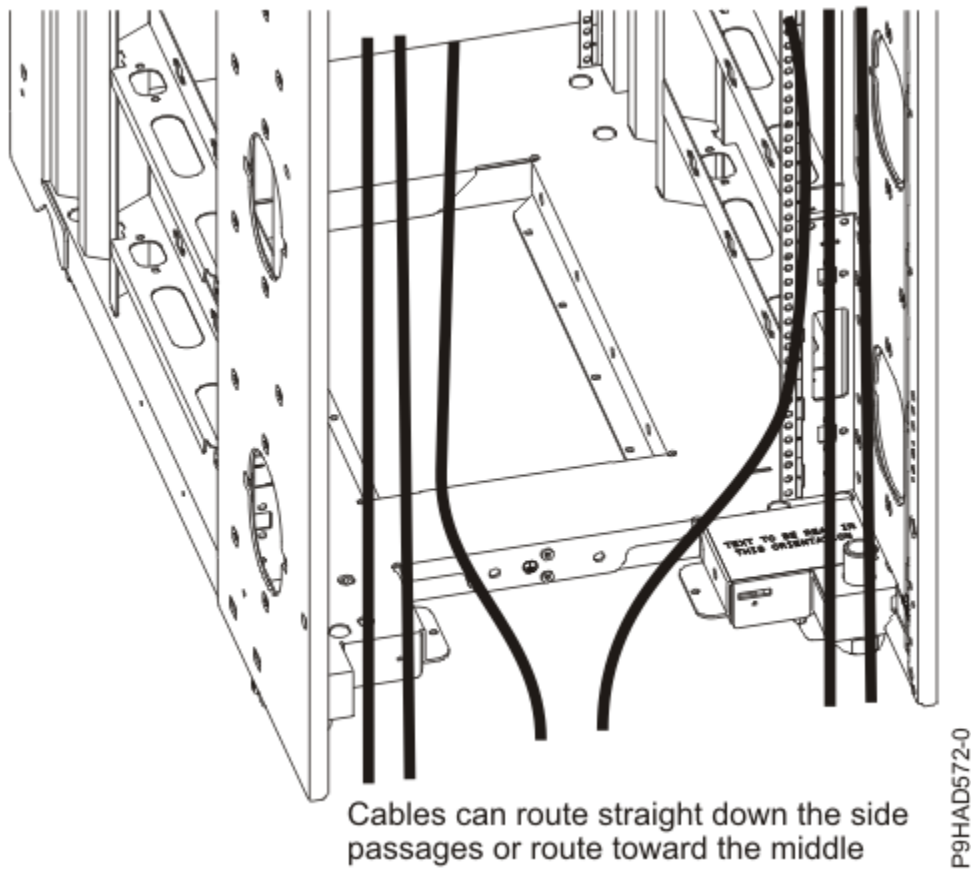
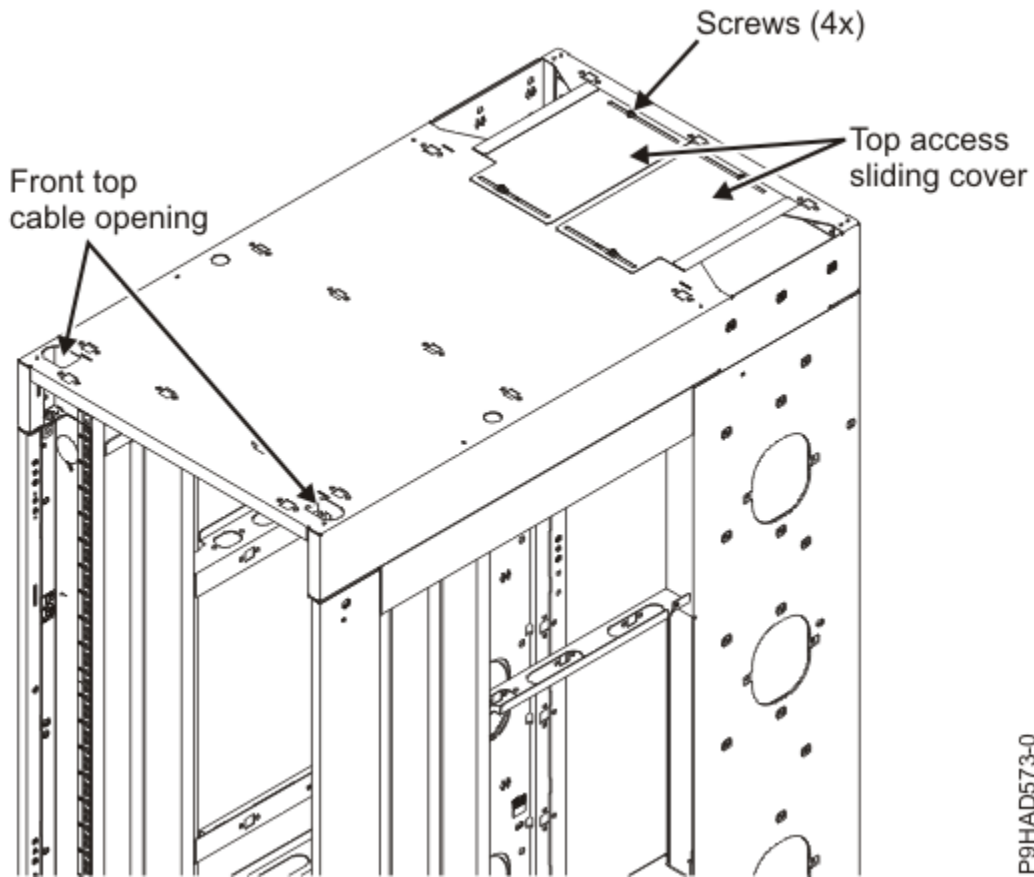


Figure 16. Cabling under the floor

### Cabling overhead

Front and rear cable access openings that are on the top of the rack cabinet allow cables to be routed up and out of the rack. Cable access covers on the rear are adjustable by loosening the side screws and sliding the covers forward or backward. Because of the smaller size of the cable openings in front, cables that pass through this area must be minimized.



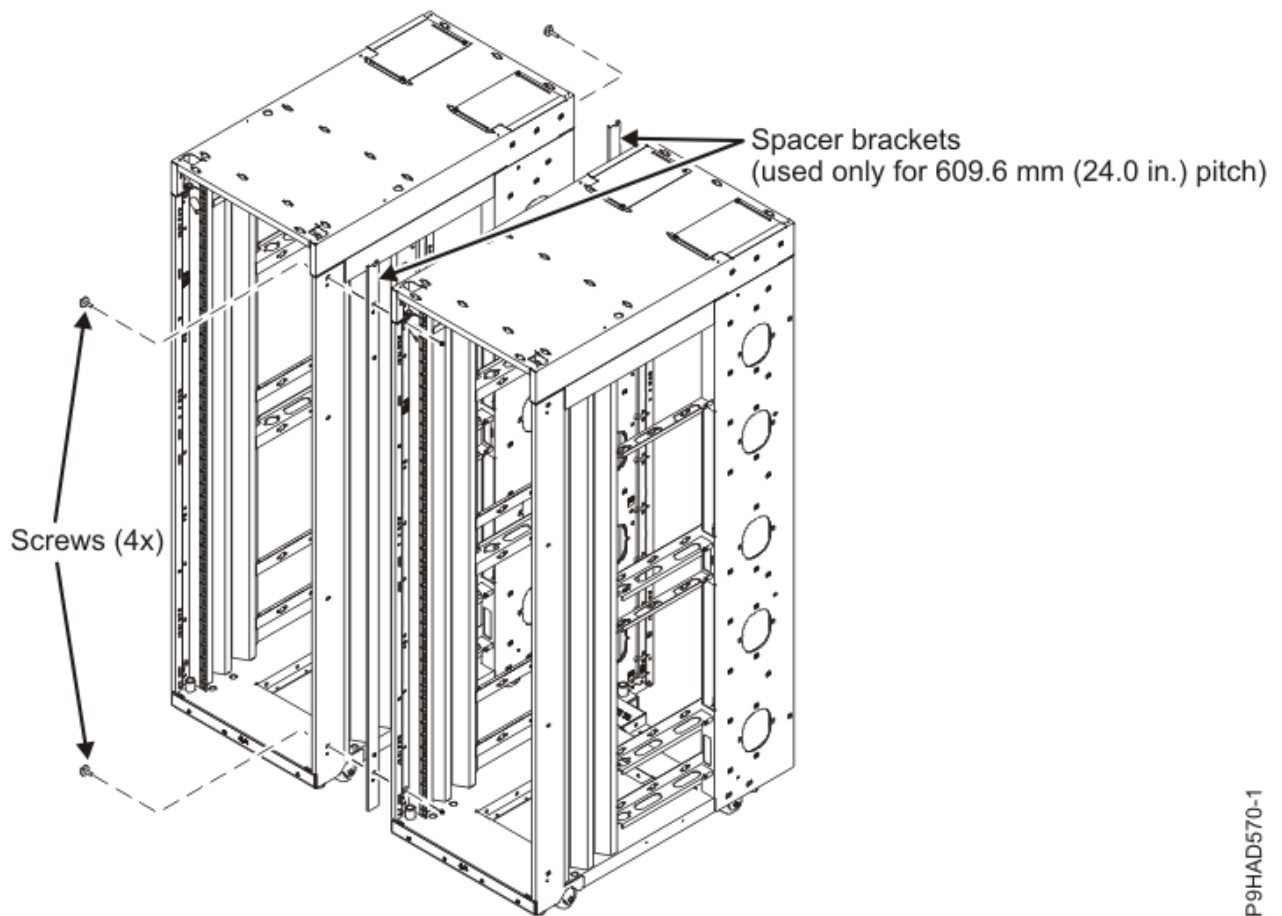
P9HAD573-0

Figure 17. Cabling overhead

### **Multiple racks**

Learn how to attach multiple 7965-S42 racks together.

Multiple 7965-S42 racks can be attached together. For racks that are on a 600 mm (23.6 in.) pitch, you can use screws to clamp the racks together. For racks that are on a 609 mm (24.0 in.) pitch, two spacer brackets must be added to set the proper spacing before you can use screws to clamp the racks together.



P9HAD570-1

Figure 18. Attaching multiple racks with spacer brackets

### Model 7965-S42 supported feature codes

Learn about the supported feature codes that are available for 7965-S42 racks.

#### Feature code (FC) ECRK

FC ECRK is an optional rear rack extender that can be used for 7965-S42 racks. This extender is installed on the rear of the 7965-S42 rack and provides 130 mm (5 in.) of extra space. This space is intended to hold cables on the side of the rack and to keep the center area clear for cooling and service access. Two extenders can be stacked to provide 260 mm (10 in.) of extra rear cabling space. The extender has hook-and-loop fasteners to secure cables.

| Table 54. Dimensions for FC ECRK rear rack extender |                   |                       |                  |
|-----------------------------------------------------|-------------------|-----------------------|------------------|
| Width                                               | Depth             | Height                | Weight           |
| 600 mm (23.62 in.)                                  | 130 mm (5.11 in.) | 1952.4 mm (76.87 in.) | 14.5 kg (32 lbs) |

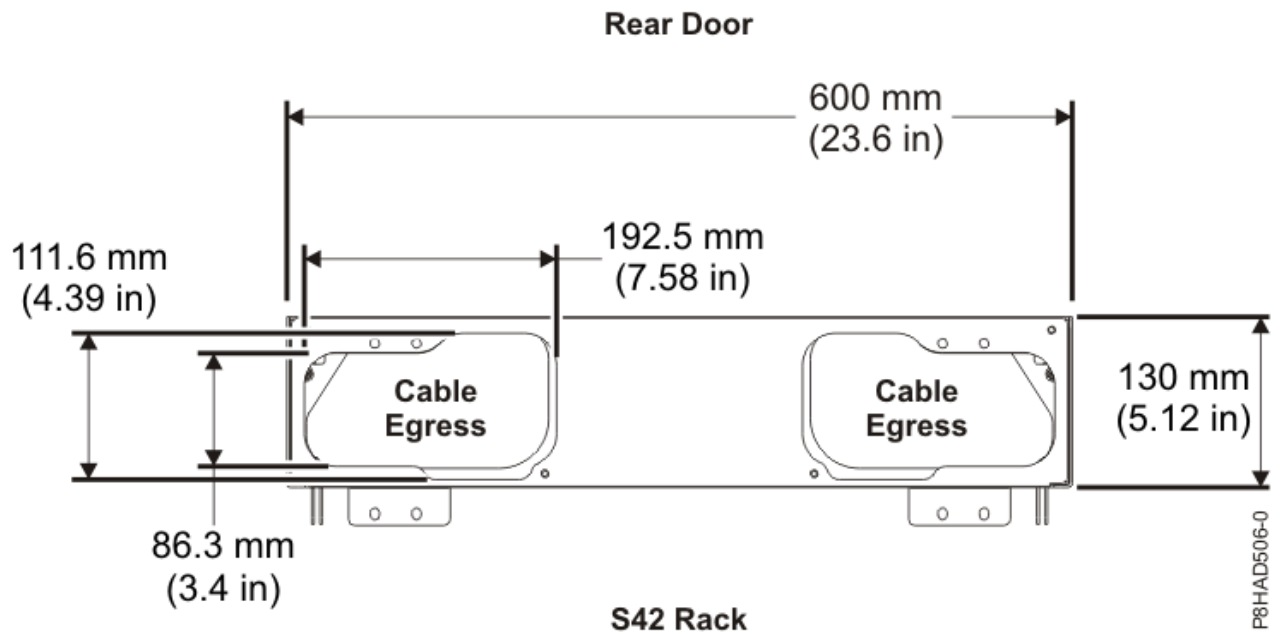


Figure 19. FC ECRK rear rack extender (top cable exit)

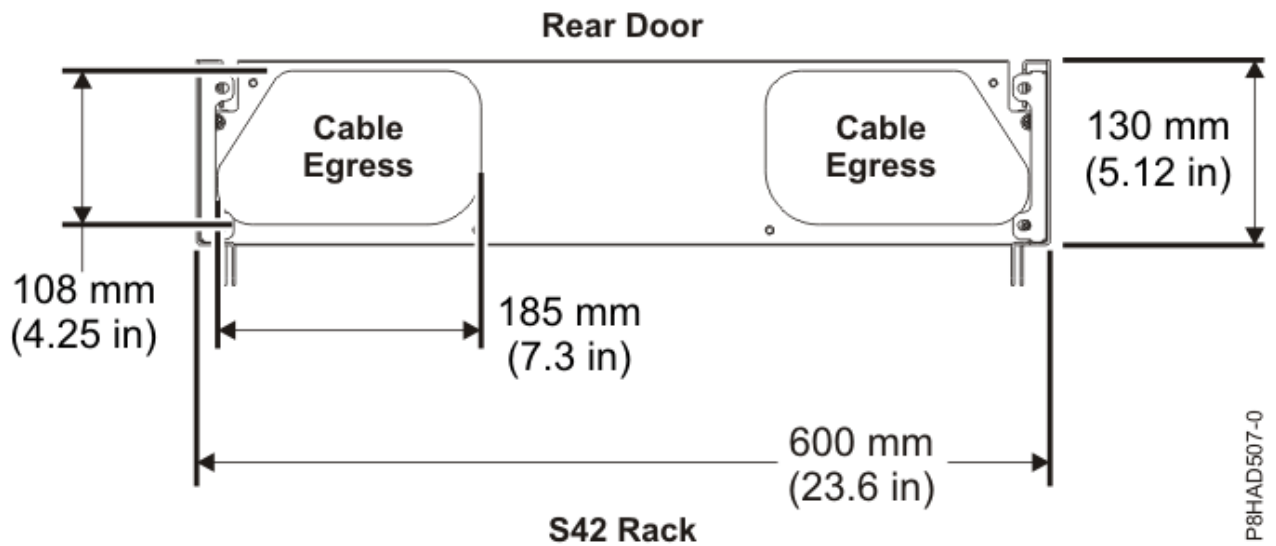


Figure 20. FC ECRK rear rack extender (bottom cable exit)

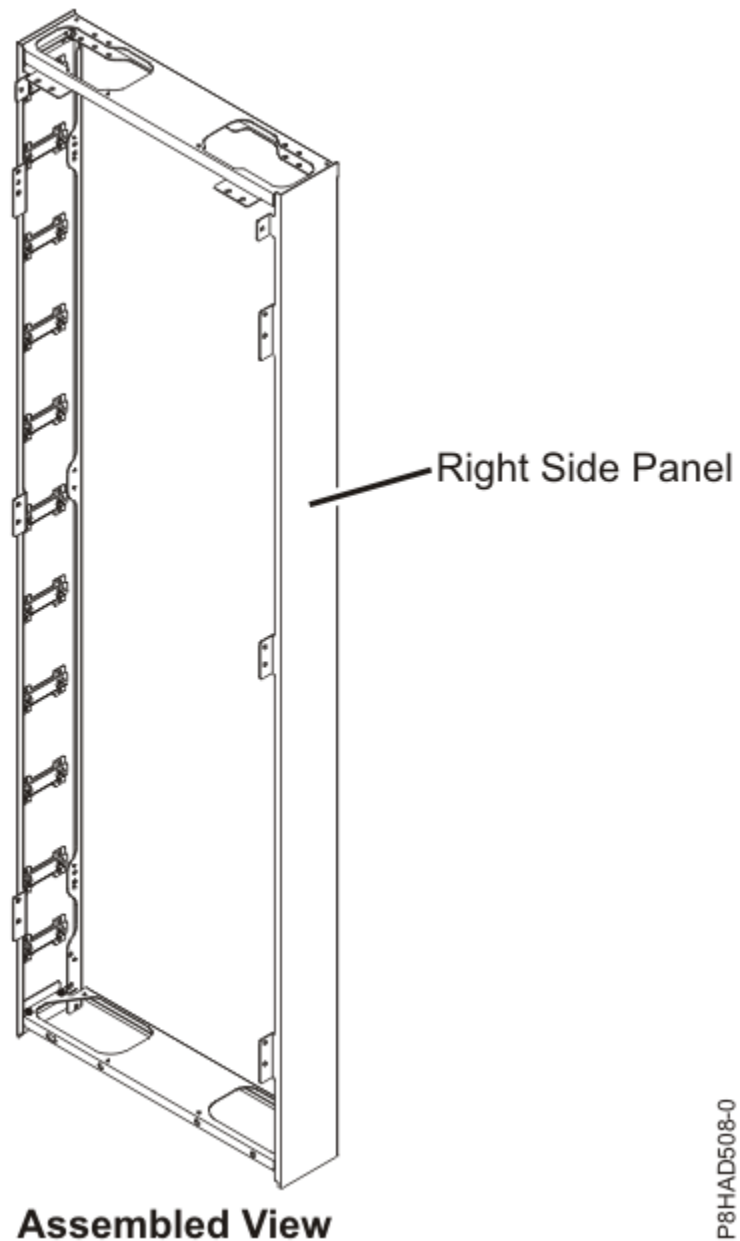


Figure 21. FC ECRK assembled view

### Model 1164-95X rear door heat exchanger specifications

Learn about the specifications of the 1164-95X rear door heat exchanger (feature code ECR2).

| Table 55. Dimensions for the 1164-95X rear door heat exchanger                                        |                  |                    |                              |                  |
|-------------------------------------------------------------------------------------------------------|------------------|--------------------|------------------------------|------------------|
| Width                                                                                                 | Depth            | Height             | Weight (empty)               | Weight (filled)  |
| 600 mm (23.6 in.)                                                                                     | 129 mm (5.0 in.) | 1950 mm (76.8 in.) | 39 kg (85.0 lb) <sup>1</sup> | 48 kg (105.0 lb) |
| 1. A minimum of three people are required to lift the rear door heat exchanger because of the weight. |                  |                    |                              |                  |

### Water specifications

- Pressure
  - Normal operation: <414 kPa (60 psi)

- Maximum: 689.66 kPa (100 psi)
- Volume
  - Approximately 9 liters (2.4 gallons)
- Temperature
  - Water temperature must be above the dew point in the data center
  - $18^{\circ}\text{C} \pm 1^{\circ}\text{C}$  ( $64.4^{\circ}\text{F} \pm 1.8^{\circ}\text{F}$ ) for ASHRAE Class 1 Environment
  - $22^{\circ}\text{C} \pm 1^{\circ}\text{C}$  ( $71.6^{\circ}\text{F} \pm 1.8^{\circ}\text{F}$ ) for ASHRAE Class 2 Environment
- Required water flow rate (as measured from the supply entrance to the heat exchanger)
  - Minimum: 22.7 liters (6 gallons) per minute
  - Maximum: 56.8 liters (15 gallons) per minute
  - **Note:** The actual flow rate differs per installation, which is based on achieving heat removal requirements.

## Water specifications for the secondary cooling loop

**Important:** The water that is being supplied to the heat exchanger must meet the requirements that are described in this section. Otherwise, system failures might occur over time as a result of any of the following problems:

- Leaks due to corrosion and pitting of the metal components of the heat exchanger or of the water-supply system.
- Buildup of scale deposits inside the heat exchanger, which can cause the following problems:
  - A reduction in the ability of the heat exchanger to cool the air that is exhausted from the rack.
  - Failure of mechanical hardware, such as a hose quick-connect coupling.
- Organic contamination, such as bacteria, fungi, or algae. This contamination can cause the same problems as described for scale deposits.

Contact a water quality and water distribution services expert for designing and implementing the infrastructure and water chemistry of the secondary loop.

## Water-supply requirements for secondary loops

Learn about the specific characteristics of the system that supplies the chilled conditioned water to the heat exchanger.

### Temperature:

The heat exchanger and its supply hose and return hoses are not insulated. Avoid any condition that might cause condensation. The temperature of the water inside the supply hose, return hose, and heat exchanger must be kept above the dew point of the location where the heat exchanger is being used.



**Attention:** Typical primary chilled water is too cold for use in this application because building chilled water can be as cold as  $4^{\circ}\text{C}$  -  $6^{\circ}\text{C}$  ( $39^{\circ}\text{F}$  -  $43^{\circ}\text{F}$ ).

### Important:

The system that supplies the cooling water must be able to measure the room dew point and automatically adjust the water temperature. Otherwise, the water temperature must be above the maximum dew point for that data center installation. For example, the following minimum water temperature must be maintained:

- $18^{\circ}\text{C}$  plus or minus  $1^{\circ}\text{C}$  ( $64.4^{\circ}\text{F}$  plus or minus  $1.8^{\circ}\text{F}$ ). This specification is applicable within an ASHRAE Class 1 Environmental Specification that requires a maximum dew point of  $17^{\circ}\text{C}$  ( $62.6^{\circ}\text{F}$ ).
- $22^{\circ}\text{C}$  plus or minus  $1^{\circ}\text{C}$  ( $71.6^{\circ}\text{F}$  plus or minus  $1.8^{\circ}\text{F}$ ). This specification is applicable within an ASHRAE Class 2 Environmental Specification that requires a maximum dew point of  $21^{\circ}\text{C}$  ( $69.8^{\circ}\text{F}$ ).

See the ASHRAE document *Thermal Guidelines for Data Processing Environments*.

**Pressure:**

The water pressure in the secondary loop must be less than 690 kPa (100 psi). Normal operating pressure at the heat exchanger must be 414 kPa (60 psi) or less.

**Flow rate:**

The flow rate of the water in the system must be in the range of 23 - 57 liters (6 - 15 gallons) per minute and high enough to meet heat removal requirements.

Pressure drop versus flow rate for heat exchangers (including quick-connect couplings) is defined as approximately 103 kPa (15 psi) at 57 liters (15 gallons) per minute. For more information, see the pressure vs flow curve in [Figure 27 on page 57](#).

**Water volume limits:**

The heat exchanger holds approximately 9 liters (2.4 gallons). The full length of the hose kits (4.26 m (14 ft) of 2.54 cm (1.0 in.) inner diameter hose) for supply and return hoses hold approximately 4.3 liters (1.1 gallons).

**Air exposure:**

The secondary cooling loop is a closed loop, with no continuous exposure to room air. After you fill the loop, remove all air from the loop. An air bleed valve is provided at the top of a heat exchanger manifold for purging all air from the system. You must obtain a [bleeding hose](#). The instructions for bleeding the air are located in the [installation instructions](#).

**Heat exchanger performance**

A heat removal of 100% indicates an amount of heat that is equivalent to the heat that is generated by the devices that is removed by the heat exchanger and the average air temperature that is leaving the heat exchanger is identical to that entering the rack (27°C (80.6°F) in this example). Heat removal in excess of 100% indicates that the heat exchanger not only removed all of the heat that was generated by the devices, but further cooled the air so that the average air temperature that is leaving the rack is lower than air temperature that is entering the rack.

To help maintain optimum performance of the rear door heat exchanger and provide proper cooling for all rack components, you must take the following precautions:

- Install filler panels over all unoccupied bays.
- Route signal cables at the rear of the rack so that they enter or exit the cabinet through the top and bottom air baffles.
- Bundle signal cables together in a rectangle so that the upper and lower air-baffle sliders are closed as far as possible. Do not bundle signal cables together in a circular formation.

[Figure 22 on page 55](#) - [Figure 27 on page 57](#) allows you to decide what is the required water flowrate per rear door heat exchanger, so the facility and CDU can be sized.

As example, pick one of [Figure 22 on page 55](#) - [Figure 26 on page 57](#), whichever more closely resembles the expected sustained heat load. Interpolate between graphs if necessary. Pick the curve that defines the water temperature that can be provided to the rear door heat exchanger. Determine the water flow rate that is required to achieve 5 - 10% more heat removal than is required for the installation. This additional capacity allows for less than perfect airflow that is blocking and possible air that bypasses the rear door heat exchanger. For instance, if you want the rear door heat exchanger to make the rack data center neutral, you can select a water flow rate that provides 105 - 110% heat removal in order to provide some margin to the cooling design. For rack powers other than what is listed in [Figure 22 on page 55](#) - [Figure 26 on page 57](#), for racks that are far from uniformly populated with heat generating devices, or for racks with significantly different airflow rates than what the curves show (plus or minus 30%), you must take guidance from IBM Power Systems Thermal Development, which is available through the IBM Sales team.



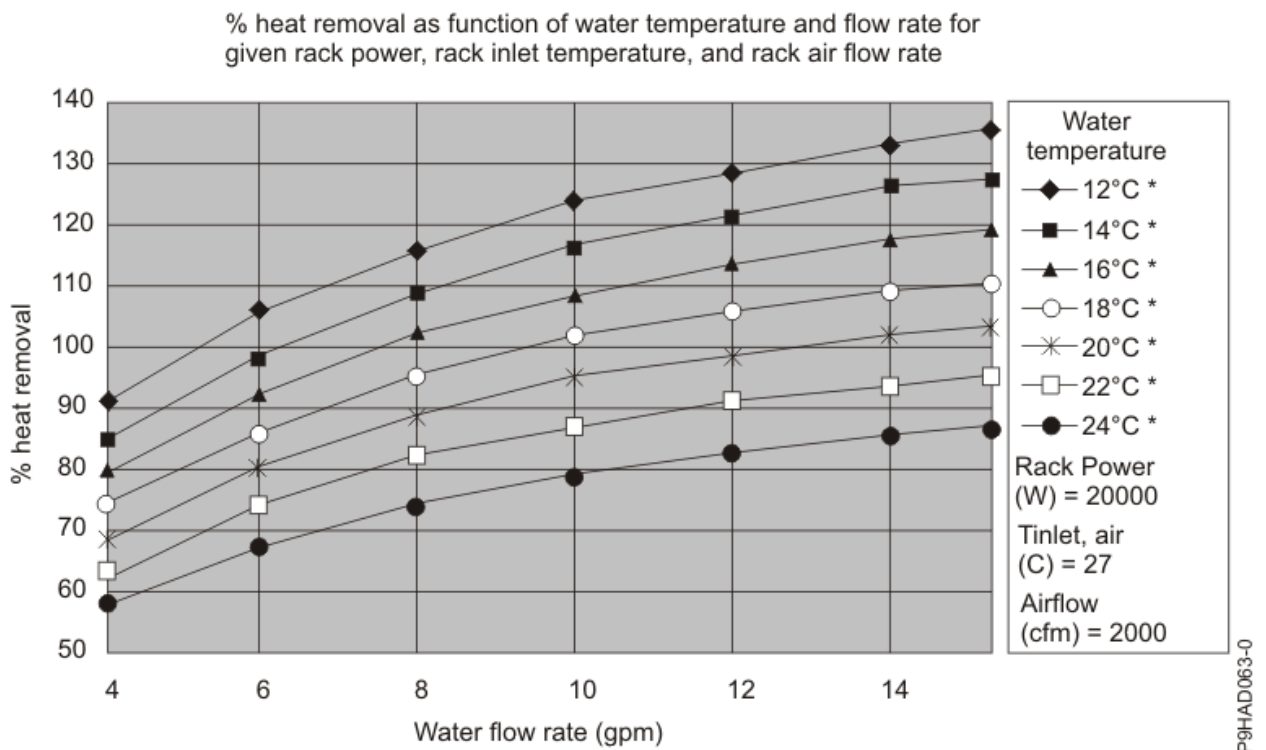


Figure 22. Typical performance of the heat exchanger, 20 kW heat load

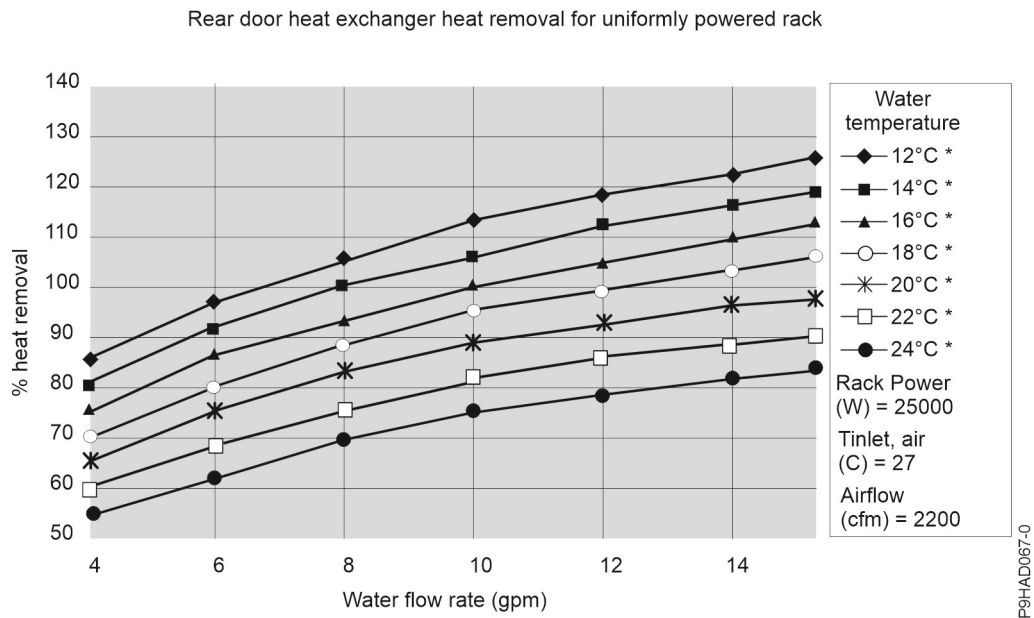


Figure 23. Typical performance of the heat exchanger, 25 kW heat load

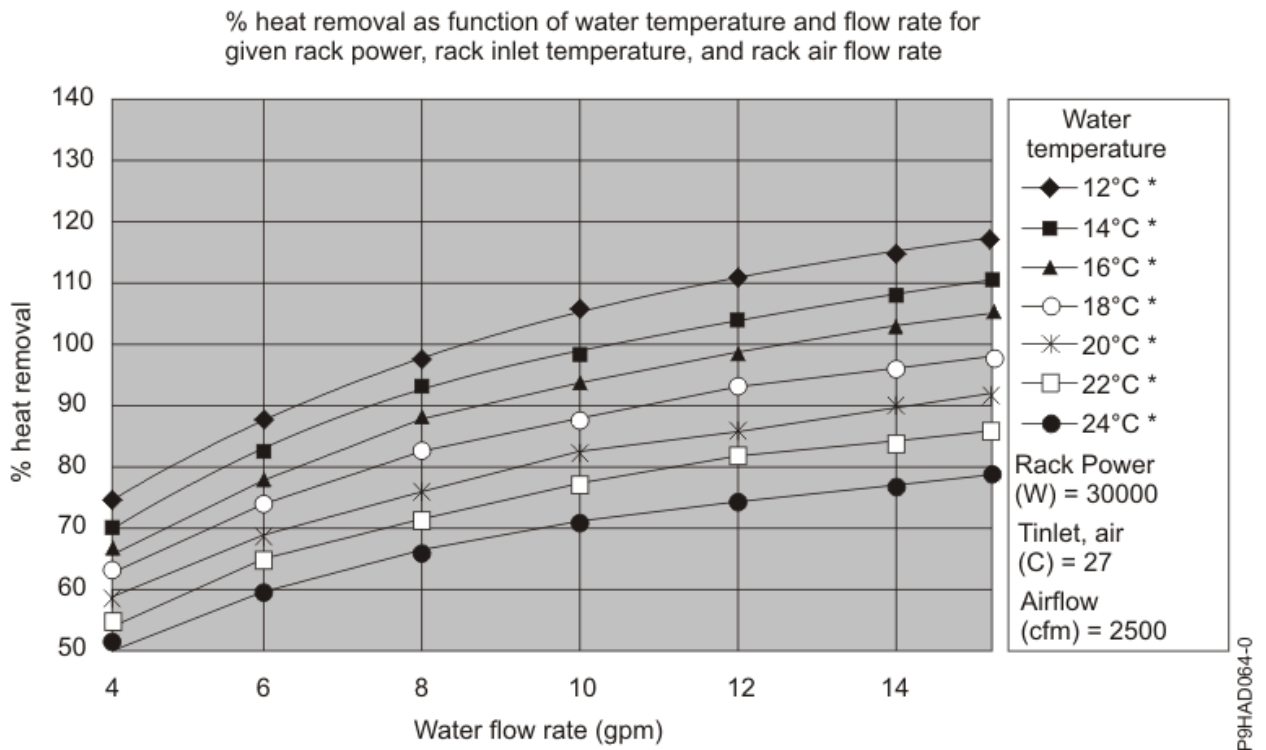


Figure 24. Typical performance of the heat exchanger, 30 kW heat load

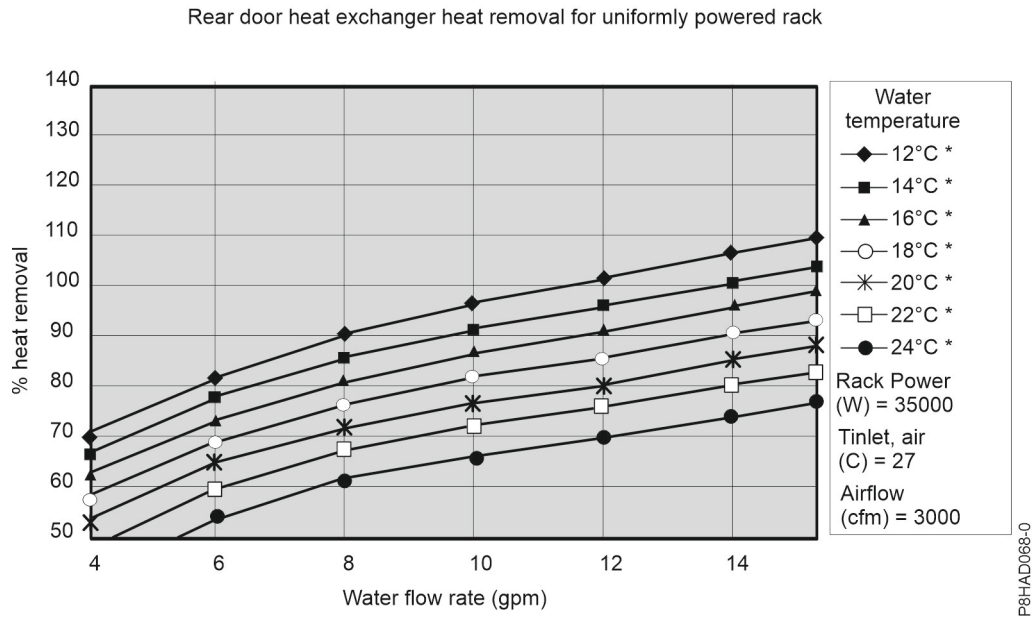


Figure 25. Typical performance of the heat exchanger, 35 kW heat load

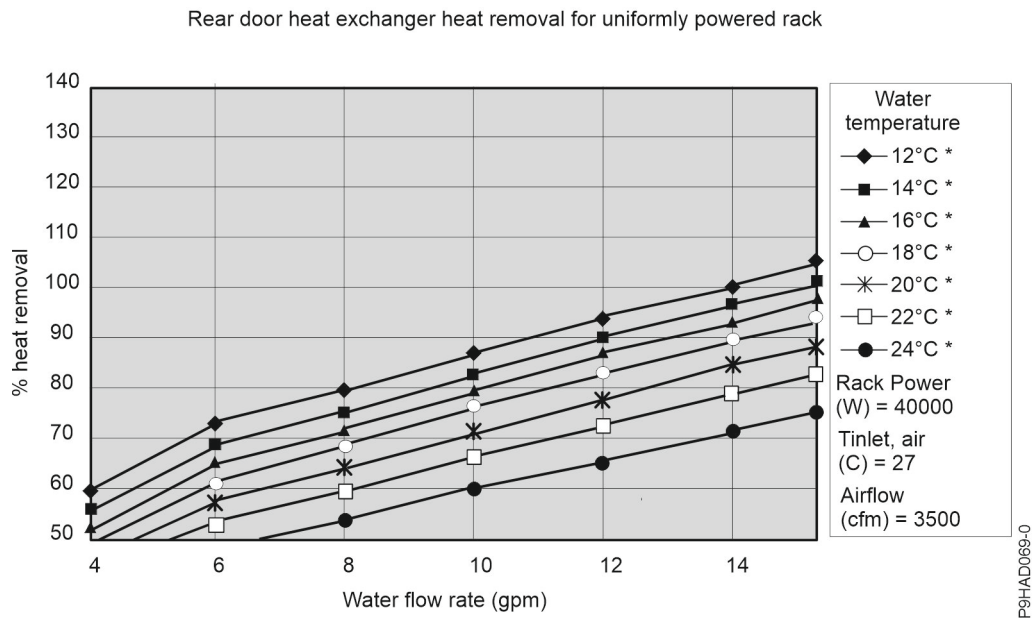


Figure 26. Typical performance of the heat exchanger, 40 kW heat load

After the required water flowrate per rear door heat exchanger is defined per the heat removal information above, the water-side pressure drop of the rear door heat exchanger can be determined from [Figure 27 on page 57](#).

Using the total water flowrate requirement for all of the rear door heat exchangers and the pressure drop for the entire water flow network, which the rear door heat exchanger is a part of, the facility and CDU can be defined to meet these flow and pressure drop requirements.

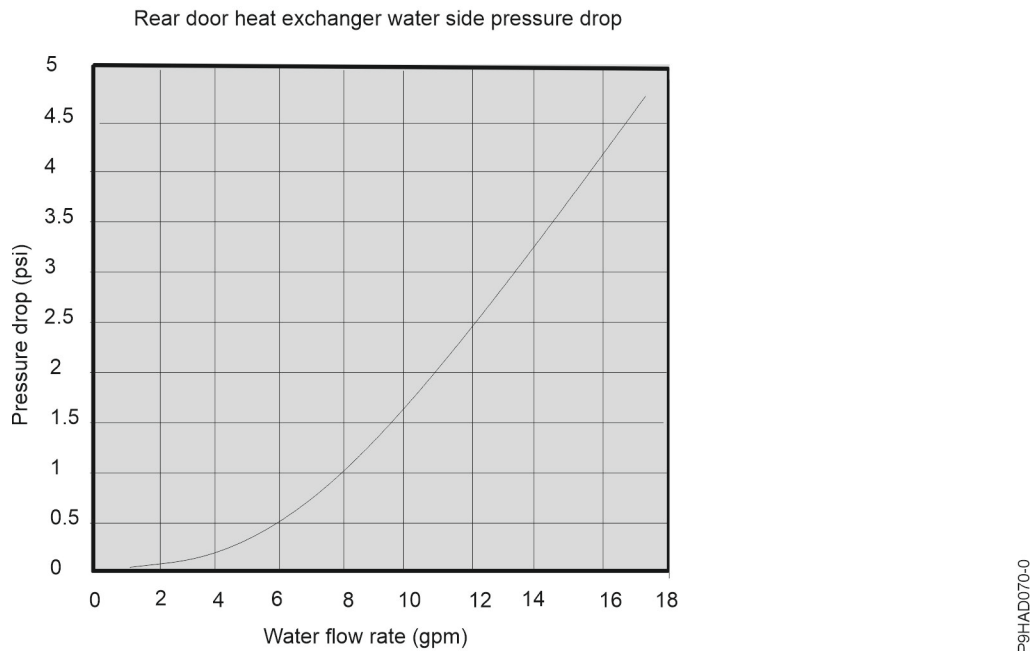


Figure 27. Pressure drop (standard units)

## Water delivery specifications for secondary loops

Learn about the various hardware components that make up the delivery system secondary loop that provides the chilled, conditioned water to the heat exchanger. The delivery system includes pipes, hoses,

and the required connection hardware to connect the hoses to the heat exchanger. Hose management can be used in raised-floor and non-raised-floor environments.

The heat exchanger can remove 100% or more of the heat load from an individual rack when it is running under optimum conditions.

The primary cooling loop is considered to be the building chilled-water supply or a modular chiller unit. The primary loop must not be used as a direct source of coolant for the heat exchanger because the fluid that is delivered to the rear door heat exchanger must be above the dew point. Procurement and installation of the components that are needed to create the secondary cooling loop system are required for this design and are your responsibility. The main purpose is to provide examples of typical methods of secondary loop setup and operating characteristics that are needed to provide an adequate and safe supply of water to the heat exchanger.

You must obtain a cooling distribution unit (CDU) and water that meets cleanliness, filtration, and chemical requirements that are listed in [Planning for water cooling](#). CDUs are available from suppliers such as [Motivair](#) and [Nortek](#). CDUs deliver water at a proper flow rate and temperature to the heat exchanger, while it maintains the temperature above the dew point to avoid condensation. CDUs are also essential to control the closed loop of the water that flows through the heat exchanger to maintain proper water cleanliness, filtration, and chemistry while it controls the wet materials in the loop.



**Attention:**

The overpressure safety device must meet the following requirements:

- Comply with *ISO 4126-1*.
- Be installed so that it is easily accessed for inspection, maintenance, and repair.
- Be connected as close as possible to the device that it is intended to protect.
- Be adjustable only with the use of a tool.
- Have a discharge opening that is directed so that discharged water or fluid does not create a hazard or be directed toward any person.
- Be of adequate discharge capacity to ensure that the maximum working pressure is not exceeded.
- Be installed without a shutoff valve between the overpressure safety device and the protected device.

Read the following guidelines before you design the installation:

- A method for monitoring and setting the total flow rate that is delivered to all of the heat exchangers is required. This can be a discrete flowmeter that is built into the flow loop or a flowmeter within the secondary loop of the coolant distribution unit (CDU).
- After you set the total flow rate for all of the heat exchangers by using a flowmeter, it is important to design the plumbing so that it provides the flow rate that you want for each heat exchanger and provides a way to verify the flow rate. Other methods, such as inline or external flowmeters, can provide a more accurate method for setting the flow rate through the individual shutoff valves.
- Design the flow loop to minimize the total pressure drop within the flow loop.

**Manifolds and piping:**

Manifolds that accept large-diameter feed pipes from a pump unit are the preferred method for splitting the flow of water to smaller-diameter pipes or hoses that are routed to individual heat exchangers. Manifolds must be constructed of materials that are compatible with the pump unit and related piping. The manifolds must provide enough connection points to allow a matching number of supply and return lines to be attached, and the manifolds must match the capacity rating of the pumps and the loop heat exchanger (between the secondary cooling loop and the building chilled-water source). Anchor or restrain all manifolds to provide the required support to avoid movement when quick-connect couplings are connected to the manifolds. Design the manifolds so that there is a minimal pressure drop that is based on the total flow rate through the manifold. The manifold size must be selected to allow an even flow rate through each parallel rear door heat exchanger.

To stop the flow of water in individual legs of multiple circuit loops, install shutoff valves for each supply and return line. This provides a way to service or replace an individual heat exchanger without affecting the operation of other heat exchangers in the loop.

To ensure that water specifications are being met and that the optimum heat removal is taking place, use temperature and flow metering (monitoring) in secondary loops.

Anchor or restrain all manifolds and pipes to provide the required support and to avoid movement when quick-connect couplings are being attached to the manifolds.

Figure 28 on page 59 shows an example of a CDU with a manifold that is plumbed with supply and return ports for each heat exchanger that the CDU flows water to. This example is of an implementation of multiple heat exchangers with a single CDU that allows 35.56 cm (14 in.) or shorter hoses to be connected to the CDU.

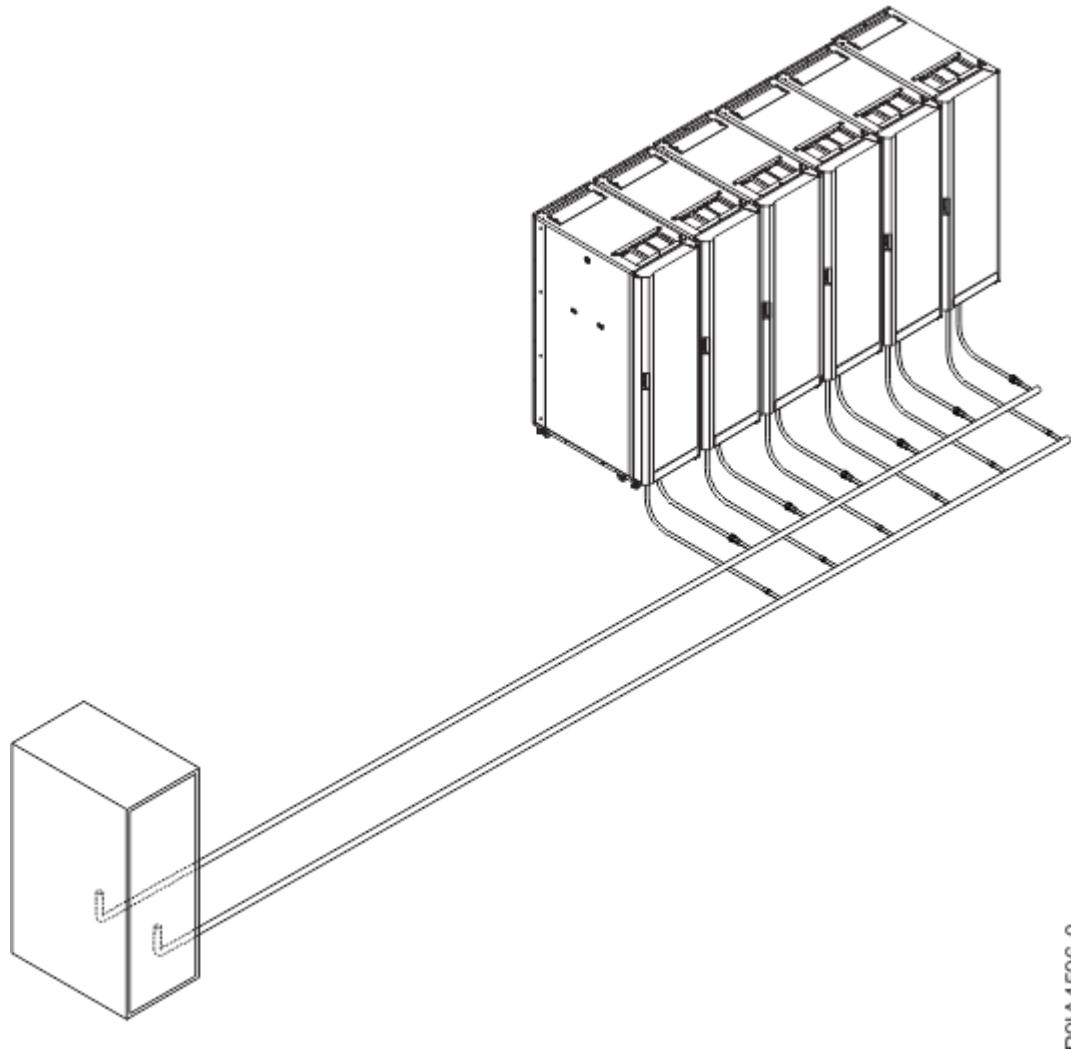


Figure 28. Typical extended manifold

#### **Flexible hoses and connections to manifolds and heat exchangers:**

Pipe and hose configurations can vary. You can determine the best configuration for your installation by analyzing the needs of your facilities, or a site preparation representative can provide this analysis.

Flexible hoses that supply and return water between your hard plumbing (manifolds and coolant distribution units) and the heat exchanger (allowing needed movement for opening and closing the rack rear door) are provided by IBM. Hoses can be cut to length, but first must be cleaned so that no particles are inside the hose before installation. Some slack must be kept in the hose for easier installation. For more information about recommended clamping tools and specifications, see the

Oetiker website. Figure 29 on page 60 shows what is in the hose kit that is supplied with the heat exchanger.

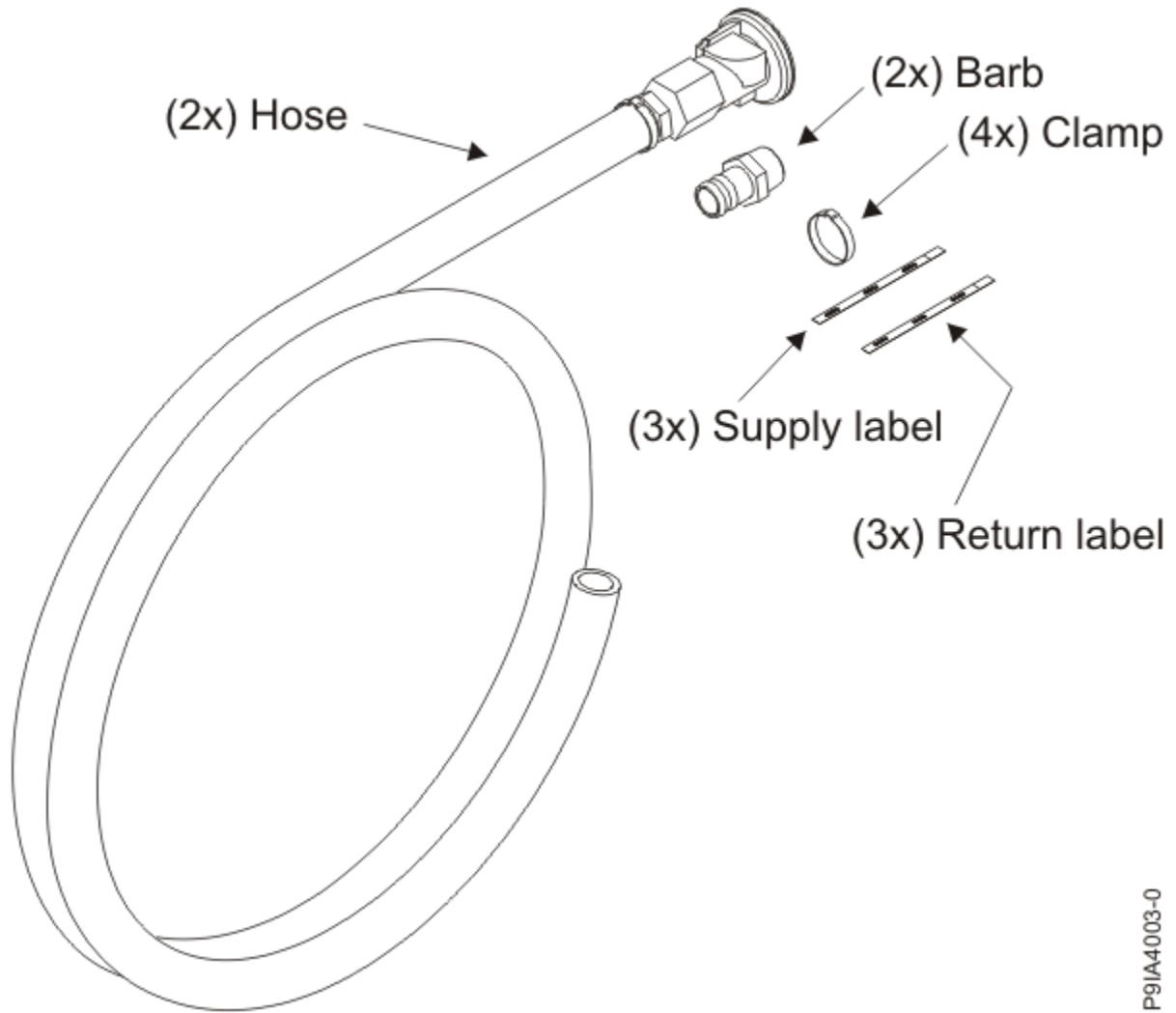


Figure 29. Hose kit

| Table 56. Hose kit dimensions |                                                                                            |
|-------------------------------|--------------------------------------------------------------------------------------------|
| Hose information              | Dimensions or type                                                                         |
| Hose length                   | 4.26 m (14 ft)                                                                             |
| Hose machine end              | Quick-connect                                                                              |
| Water supply end              | 25.4 mm (1 in.)<br>National Pipe Thread<br>Taper (NPT) male barb<br>and clamp <sup>1</sup> |
| Bend radius                   | 203.2 mm (8 in.)                                                                           |
| Hose inside diameter          | 25.4 mm (1 in.) plus or<br>minus 0.5 mm (0.02 in.)                                         |
| Hose outside diameter         | 34.54 mm (1.4 in.) plus<br>or minus 0.76 mm (0.03<br>in.)                                  |

Table 56. Hose kit dimensions (continued)

| Hose information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Dimensions or type |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| <p><b>Notes:</b></p> <p>The facility hose kit is supplied in a separate box from the rack and contains the following items:</p> <ul style="list-style-type: none"> <li>• Two 4.26 m (14 ft) hoses with preattached quick-connects for connection to manifold. At one end of the hose, there is a quick-connect that mates with the quick-connect at the end of the hose from the manifold. The other end is a bare cut end.</li> <li>• Two 25.4 mm (1 in.) NPT male barbs. One end of the fitting is a 25.4 mm (1 in.) barb to fit on the inside of the 25.4 mm (1 in.) inner diameter hose. The other end of the fitting is a 25.4 mm (1 in.) male NPT.</li> <li>• Four Oetiker hose clamps 16703242 (two hose clamps are required and two hose clamps are extra).</li> <li>• Three supply labels (only two supply labels are required). The supply labels need to be installed on the supply end of the hose after it is connected to the facility.</li> <li>• Three return labels (only two return labels are required). The return labels need to be installed on the return end of the hose after it is connected to the facility.</li> </ul> <p><sup>1</sup>You must provide a 25.4 mm (1 in.) NPT female fitting on the facility hoses.</p> |                    |

The customer provided interconnection to the rack (under-the-floor manifold, CDU, and so on) must have a 25.4 mm (1 in.) female NPT fitting for each manifold supply and return connection. The 25.4 mm (1 in.) NPT male barb fitting from the hose kit must be threaded onto the NPT female fitting on the customer CDU plumbing. A thread sealant must be used to create a leak-free connection. Teflon tape cannot be used, as Teflon tape particles might enter the water stream.

To make the connection from the hose to the barb fitting, the facility hoses must first be cut to length. If the CDU plumbing fitting requires a longer hose than the 4.26 m (14 ft) facility hose, the plumbing must be altered to bring the fitting close enough such that the 4.26 m (14 ft) facility hose is sufficient. The end of the hose must be cleaned so that no particles are inside the hose before installation. The clamp is inserted over the hose and then the barb is inserted into the hose. Position the clamp within 5 mm (1.97 in.) of the hex portion of the fitting (not over the barb) and tighten the clamp with an Oetiker clamp tool. For more information about the clamp tool, see [Forged steel Standard Jaw Pincers](#). The ears of the clamp must be tightened so that they make contact with each other. When the clamp is released, the ears relax and a small space is left between. This small space is normal. [Figure 30 on page 61](#) shows dimension **s** that must be fully closed during the clamping process.

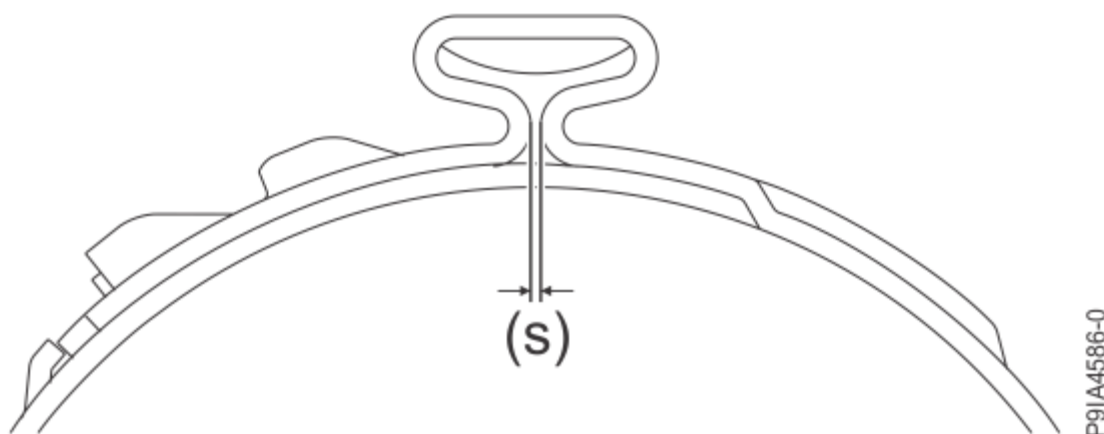


Figure 30. Clamp ear

The supply and return labels must be applied on both ends of the facility hose to indicate the function of each hose. The quick connects on the end of the facility hose can now be connected to the quick connects on the heat exchanger.



## Hose routing and floor tile cutout information

### Raised-floor Environment

If the hose is to be routed under the raised floor, a cutout must be made in the floor tile under the rack. The access hole for the supply and return hoses must be a minimum of 200 mm (8 in.) long by 100 mm (4 in.) wide. Each cutout must be lined with grommets so that the hose is not pulled across sharp edges of the cutout. Consult your floor tile manufacturer to determine whether there are more supports that are required for the cutout, or requirements for the position of the cutout in regard to the edge of the floor tile. The following figures show three different possibilities for floor tile cutout locations and the hose routing for each cutout location. Variations to this routing are allowed. These three figures show the general routing that allows for the door to open and close with minimal hose kinking and movement.

**Note:** These illustrations show the view of the rack from the top, looking down.

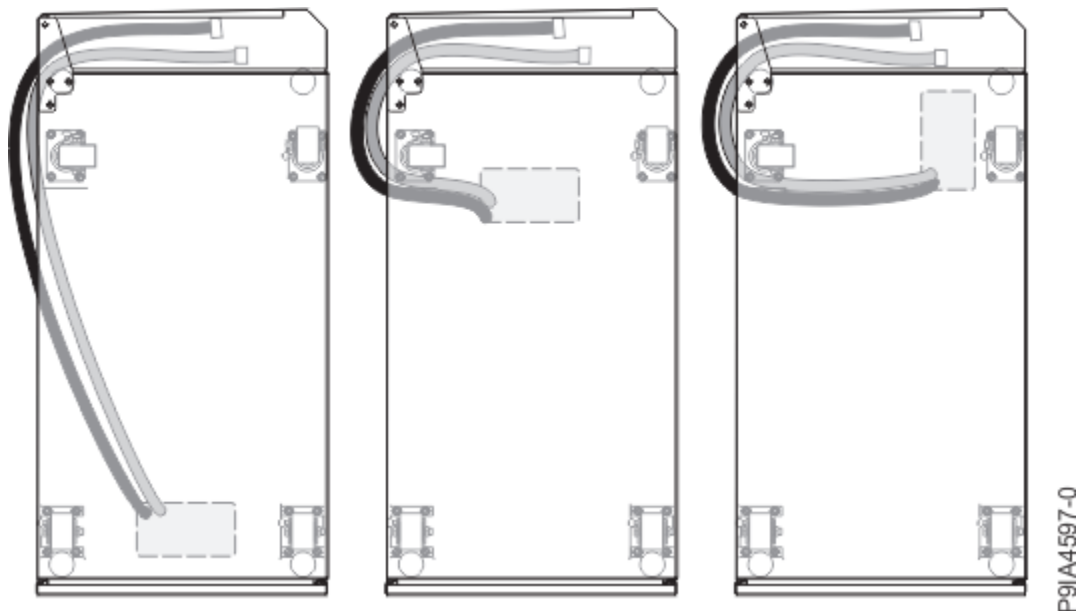


Figure 31. Routing and securing the hoses in a raised floor environment for individual racks

In the following illustration, the numbers represent the suggested placement of racks that share one hole in the floor. For example, if three racks share one hole in the floor, place the racks as shown by numbers 1, 2, and 3. If you want to add a fourth rack that uses the same hole in the floor, then place it next to rack number 1.

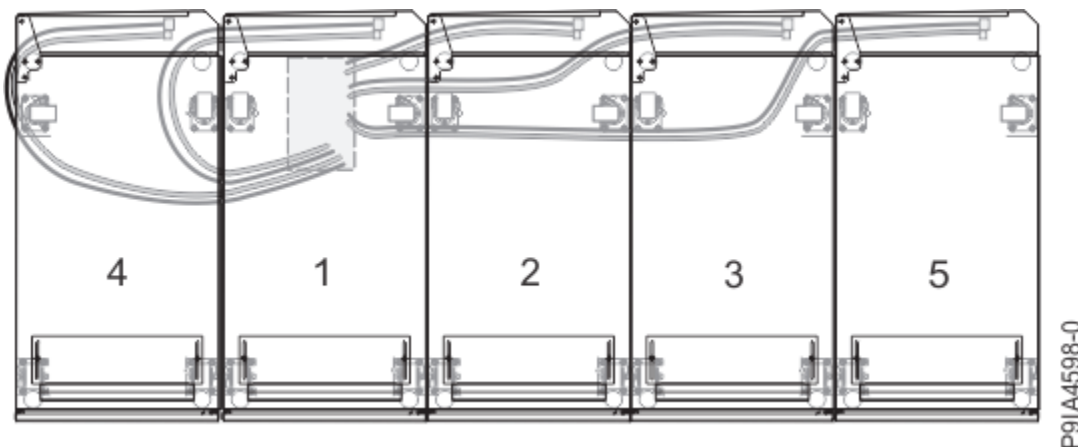


Figure 32. Option for hoses in adjacent racks to share a single hole in the floor

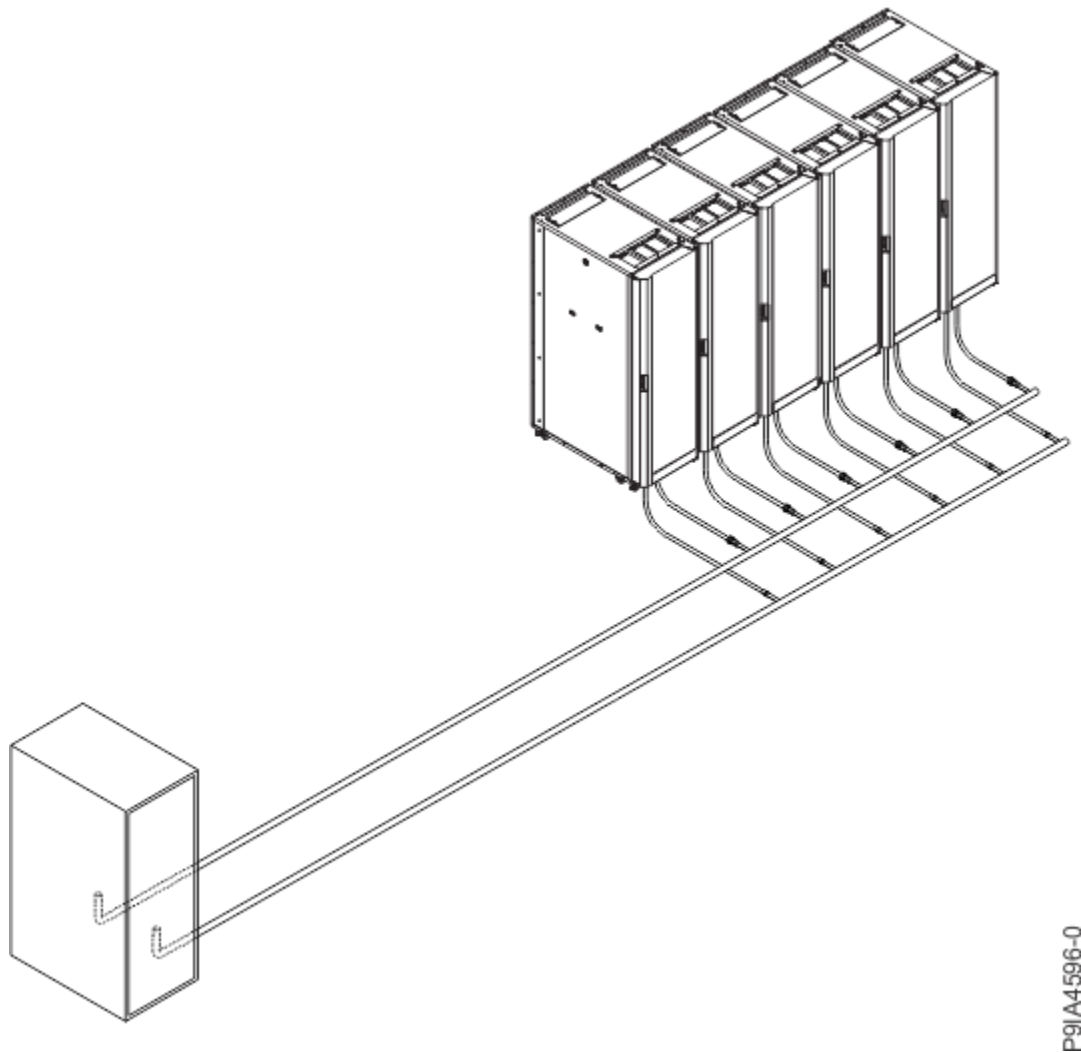


**Note:** If more than one rack uses the same hole in the floor tile, the floor tile cutout must be increased in size.

## Raised-floor and non-raised-floor Environments

If the coolant distribution unit (CDU) that is providing water to the heat exchangers is in a row of racks with the heat exchangers, all hoses can be routed on top of the floor, irrespective of whether it is a raised floor or a slab floor installation. The model type 7965 rack has sufficient clearance underneath the rack to enable the quick connects to be run underneath the rack. This configuration provides a clean hose routing solution with the hoses of minimum length.

**Note:** If this solution is used, you must determine the CDU position such that 4.26 m (14 ft) of hose is sufficient from the CDU to the heat exchanger. Each hose must be routed with a minimum bend radius of 200 mm (8 in.). A bend radius less than 200 mm (8 in.) causes the hose to kink, restricts flow to and from the heat exchanger, and voids the heat exchanger warranty.



P91A4596-0

*Figure 33. Routing and securing the hoses in a raised-floor and non-raised floor environment*

## Overhead hose routing Environment

The heat exchanger can be configured on the rack so that the quick connects are at the top of the rack instead of the bottom. This configuration must be used if the hoses are to be routed above the racks. In this configuration, the hose must be strain relieved and supported by a customer supported structure above the racks.

Each hose must be routed with a minimum bend radius of 200 mm (8 in.). A bend radius less than 200 mm (8 in.) causes the hose to kink, restricts flow to and from the heat exchanger, and voids the heat exchanger warranty.

The CDU must be placed so that 4.26 m (14 ft) of hose is sufficient from the CDU to the heat exchanger.

## Placement of 7965 racks with 1164-95X installed

When model type 7965 racks with the 1164-95X rear door heat exchanger are placed directly next to another model type 7965 with the 1164-95X rear door heat exchanger, the rear door heat exchanger can open approximately 130 degrees to allow for rear access.

If a 7965 rack with the 1164-95X rear door heat exchanger is placed next to a wall, building column, or any other obstruction, approximately 38.1 cm (15 in.) of space must be left between the hinge side of the rear door heat exchanger and the wall to ensure proper opening of the rear door heat exchanger for rear service.

If another rack type is placed next to a 7965 rack with the 1164-95X rear door heat exchanger, the other rack must be positioned so that it does not extend beyond the rear of the 7965 rack frame.

## Required tools

The following tools are required onsite to install the rear door heat exchanger:

- [Forged steel Standard Jaw Pincers](#)
- [Hose cutter](#)
- [bleeding hose](#)
- Nut drivers or sockets
- Screwdriver

**Important:** You must obtain these tools before you start the installation process.

## Hardware Management Console specifications

Hardware Management Console (HMC) specifications provide detailed information for your HMC, including dimensions, electrical, power, temperature, environment, and service clearances.

### 7063-CR1 Hardware Management Console specifications

Hardware specifications for model 7063-CR1 provide detailed information for your Hardware Management Console (HMC), including dimensions, electrical, power, temperature, environmental specifications, and noise emissions.

The HMC controls managed systems, including the management of logical partitions and the use of capacity on demand. Using service applications, the HMC communicates with managed systems to detect, consolidate, and send information to IBM for analysis. The HMC provides service technicians with diagnostic information for systems that can operate in a multiple-partitioned environment.

Use the following specifications to plan for your HMC.

| Table 57. Dimensions |                      |                   |                 |
|----------------------|----------------------|-------------------|-----------------|
| Width                | Depth                | Height            | Weight          |
| 437 mm (17.2 in.)    | 705.3 mm (27.76 in.) | 43.0 mm (1.7 in.) | 14.5 kg (32 lb) |

| Table 58. Electrical <sup>1</sup> |            |
|-----------------------------------|------------|
| Electrical characteristics        | Properties |
| Maximum measured power            | 300 W      |

| <i>Table 58. Electrical <sup>1</sup> (continued)</i>                                                                                                                           |                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>Electrical characteristics</b>                                                                                                                                              | <b>Properties</b>                |
| Maximum kVA                                                                                                                                                                    | 0.330                            |
| Maximum thermal output                                                                                                                                                         | 1024 BTU/hr                      |
| Input voltage                                                                                                                                                                  | 100 - 127 V ac or 200 - 240 V ac |
| Frequency                                                                                                                                                                      | 50 or 60 Hz                      |
| 1. Power consumption and heat output vary depending on the number and type of optional features that are installed and the power-management optional features that are in use. |                                  |

| <i>Table 59. Environment requirements</i>                                                                                                                                                                  |                                                                                     |                                         |                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------|----------------------------------|
| <b>Environment</b>                                                                                                                                                                                         | <b>Recommended operating requirements</b>                                           | <b>Allowable operating requirements</b> | <b>Nonoperating requirements</b> |
| ASHRAE class                                                                                                                                                                                               |                                                                                     | A2                                      |                                  |
| Airflow direction <sup>1</sup>                                                                                                                                                                             |                                                                                     | Front-to-back                           |                                  |
| Temperature <sup>2</sup>                                                                                                                                                                                   | 18°C - 27°C (64°F - 80°F)                                                           | 10°C - 35°C (50°F - 95°F)               | 5°C - 45°C (41°F - 113°F)        |
| Humidity range                                                                                                                                                                                             | 5.5°C (42°F) dew point (DP) to 60% relative humidity (RH) and 15°C (59°F) dew point | 20% - 80% RH                            | 8% - 80% RH                      |
| Maximum rate of change                                                                                                                                                                                     |                                                                                     | 5°C/20 hrs                              |                                  |
| Maximum dew point                                                                                                                                                                                          |                                                                                     | 21°C (70°F)                             | 27°C (80°F)                      |
| Maximum operating altitude                                                                                                                                                                                 |                                                                                     | 3050 m (10000 ft)                       |                                  |
| Shipping temperature                                                                                                                                                                                       |                                                                                     |                                         | -40°C to 60°C (-40°F to 140°F)   |
| Shipping relative humidity                                                                                                                                                                                 |                                                                                     |                                         | 5% - 100%                        |
| 1. Nominal cubic feet per minute (CFM) is approximately 2030. Maximum CFM is approximately 4025.<br>2. Derate maximum allowable dry-bulb temperature 1°C (1.8°F) per 175 m (574 ft) above 950 m (3117 ft). |                                                                                     |                                         |                                  |

| <i>Table 60. Noise emissions<sup>1, 2, 3</sup></i>              |                                                                   |                     |                                                                       |      |
|-----------------------------------------------------------------|-------------------------------------------------------------------|---------------------|-----------------------------------------------------------------------|------|
| <b>Product description</b>                                      | <b>Declared A-weighted sound power level, L<sub>Wad</sub> (B)</b> |                     | <b>Declared A-weighted sound pressure level, L<sub>pAm</sub> (dB)</b> |      |
|                                                                 | Operating                                                         | Idle                | Operating                                                             | Idle |
| Model 7063-CR1 (1-socket) FC EKB0                               | 7.8 <sup>5</sup>                                                  | 6.8                 | 62                                                                    | 50   |
| Model 7063-CR1 (1-socket) at maximum temperature and operation. | 8.7 <sup>4, 5</sup>                                               | 8.7 <sup>4, 5</sup> | 69                                                                    | 69   |

Table 60. Noise emissions<sup>1, 2, 3</sup> (continued)

| Product description                                                                                                      | Declared A-weighted sound power level, L <sub>Wad</sub> (B) |                     | Declared A-weighted sound pressure level, L <sub>pAm</sub> (dB) |    |
|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|---------------------|-----------------------------------------------------------------|----|
|                                                                                                                          |                                                             |                     |                                                                 |    |
| Model 7063-CR1 (1-socket) at maximum temperature with acoustical doors (front and rear), FC EC08 and FC EC07, installed. | 7.9 <sup>4, 5</sup>                                         | 7.9 <sup>4, 5</sup> | 63                                                              | 63 |

**Notes:**

1. Declared level L<sub>Wad</sub> is the upper-limit A-weighted sound power level. Declared level L<sub>pAm</sub> is the mean A-weighted emission sound pressure level that is measured at the 1-meter bystander positions.
2. All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296.
3. 10 dB (decibel) equals 1 B (bel).
4. Under certain environments, configurations, system settings, and workloads, fan speeds are increased that result in higher noise levels.
5. Notice: Government regulations (such as those prescribed by OSHA or European Community Directives) might govern noise level exposure in the workplace and might apply to you and your server installation. This IBM system is available with an optional acoustical door feature that can help reduce the noise that is emitted from this system. The actual sound pressure levels in your installation depend upon various factors, including the number of racks in the installation; the size, materials, and configuration of the room where you designate the racks to be installed; the noise levels from other equipment; the room ambient temperature, and employees' location in relation to the equipment. Further, compliance with such government regulations also depends upon various extra factors, including the duration of employees' exposure and whether employees wear hearing protection. IBM recommends that you consult with qualified experts in this field to determine whether you are in compliance with the applicable regulations.

**Electromagnetic compatibility compliance:** CISPR 22:2008; CISPR 32:2012, CNS 13438 (Taiwan); EN 55032:2012 (EU, Australia); EN 55024:2010 (EU); EN 61000-3-2:2014 (EU, Japan); EN 61000-3-3:2013 (EU); FCC, Title 47, Part 15 (USA); GB 9254-2008 (China); GB 17625.1-2012 (China); GB 17625.2-2007 (China); GOCT 30804.3.2-2013 (IEC 61000-3-2:2009) (EAEU); GOCT 30804.3.3-2013 (IEC 61000-3-3:2008) (EAEU); GOCT 30805.22-2013 (CISPR 22:2006) (EAEU); GOCT CISPR 24-2013 (EAEU); ICES-003, Issue 6, January 2016 (Canada); KN 32:2015 (Korea); KN 35:2015 (Korea); TCVN 7189:2009 (Vietnam); VCCI, April 2015 (Japan)

**Safety compliance:** UL 60950-1, 2nd Edition, 2014-10-14; CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10, IEC 60950-1:2005 (Second Edition); Am1:2009 + Am2:2013; EN 60950-1:2006 + A1:2010 + A11:2009 + A12:2011 + A2:2013

## 7063-CR2 Hardware Management Console specifications

Hardware specifications for model 7063-CR2 provide detailed information for your Hardware Management Console (HMC), including dimensions, electrical, power, temperature, environmental specifications, and noise emissions.

The HMC controls managed systems, including the management of logical partitions and the use of capacity on demand. Using service applications, the HMC communicates with managed systems to detect, consolidate, and send information to IBM for analysis. The HMC provides service technicians with diagnostic information for systems that can operate in a multiple-partitioned environment.

Default notification policies are displayed in the table below. Team leads and managers have the flexibility to adjust certain metric thresholds and the number of days between each escalation. Executives have the option to reduce the timeframe between escalations when systems are in extreme need.

Power systems are a limited resource and must be used efficiently by development and test teams. When the threshold of a utilization metric is not met, a notification is sent to the system owner. Renotifications are sent to the system owner every 24 hours until the issue is resolved. If the issue persists, a notification is sent to the team lead and first line manager. If the issue is not fixed after the second notification, additional notifications are sent to the 2nd line, 3rd line, and integration managers according to the timeframe set in the notification policy. If the issue is not resolved after 9 days, a final notification is sent to the chief architect and program manager before the system is reassigned.

| <i>Table 61. Dimensions</i> |                      |                    |                   |
|-----------------------------|----------------------|--------------------|-------------------|
| Width                       | Depth                | Height             | Weight            |
| 434.1 mm (16.9 in.)         | 726.76 mm (28.6 in.) | 43.71 mm (1.7 in.) | 17.6 kg (38.8 lb) |

| <i>Table 62. Electrical <sup>1</sup></i>                                                                                                                                       |                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Electrical characteristics                                                                                                                                                     | Properties                       |
| Maximum measured power                                                                                                                                                         | 432 W                            |
| Maximum kVA                                                                                                                                                                    | 0.475                            |
| Maximum thermal output                                                                                                                                                         | 1473 BTU/hr                      |
| Input voltage                                                                                                                                                                  | 100 - 127 V ac or 200 - 240 V ac |
| Frequency                                                                                                                                                                      | 50 or 60 Hz                      |
| 1. Power consumption and heat output vary depending on the number and type of optional features that are installed and the power-management optional features that are in use. |                                  |

| <i>Table 63. Environment requirements</i>                                                                                                      |                                                                                     |                                     |                                |
|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------|--------------------------------|
| Environment                                                                                                                                    | Recommended operating                                                               | Allowable operating                 | Nonoperating                   |
| ASHRAE class                                                                                                                                   |                                                                                     | A3                                  |                                |
| Airflow direction                                                                                                                              |                                                                                     | Front-to-back                       |                                |
| Temperature <sup>1</sup>                                                                                                                       | 18°C - 27°C (64°F - 80°F)                                                           | 5°C - 40°C (41°F - 104°F)           | 5°C - 45°C (41°F - 113°F)      |
| Humidity range                                                                                                                                 | 5.5°C (42°F) dew point (DP) to 60% relative humidity (RH) and 15°C (59°F) dew point | -12.0°C (10.4°F) DP and 8% - 80% RH | 5% - 80% RH                    |
| Maximum dew point                                                                                                                              |                                                                                     | 24°C (75°F)                         | 27°C (80°F)                    |
| Maximum operating altitude                                                                                                                     |                                                                                     | 3050 m (10000 ft)                   |                                |
| Shipping temperature <sup>2</sup>                                                                                                              |                                                                                     |                                     | -40°C to 60°C (-40°F to 140°F) |
| Shipping relative humidity                                                                                                                     |                                                                                     |                                     | 5% - 100%                      |
| 1. Derate maximum allowable dry-bulb temperature 1°C per 175 m above 950 m. IBM recommends a temperature range of 18°C - 27°C (64°F - 80.6°F). |                                                                                     |                                     |                                |

Table 64. Noise emissions

| Declared noise emission values in accordance with ISO 9296 <sup>(1-8)</sup> |            |      |                                             |      |                                             |      |
|-----------------------------------------------------------------------------|------------|------|---------------------------------------------|------|---------------------------------------------|------|
| 7063-CR2                                                                    | $L_{WA,m}$ |      | $L_{pA,m}$<br>(1-meter (3.28 ft) bystander) |      | $K_v$<br>Statistical adder for verification |      |
|                                                                             | Operating  | Idle | Operating                                   | Idle | Operating                                   | Idle |
| • 23°C (73.4°F), 500 m (1640 ft) environment                                | 5.5        | 5.5  | 42                                          | 42   | 0.3                                         | 0.3  |
| • Maximum Operating Condition Ambient 44°C (111.2°F) and above              | 8.5        | 8.5  | 73                                          | 73   | 0.3                                         | 0.3  |

**Notes:**

1. Declared level  $L_{WA,m}$  is the mean A-weighted sound power level.
2. Declared level  $L_{pA,m}$  is the mean A-weighted emission sound pressure level that is measured at the operator and 1-meter bystander.
3. The statistical adder for verification,  $K_v$ , is a quantity to be added to the declared mean A-weighted sound power level,  $L_{WA,m}$ , such that there is a 95% probability of acceptance, when using the verification procedures of ISO 9296, if no more than 6.5% of the batch of new equipment has A-weighted sound power levels greater than ( $L_{WA,m} + K_v$ ).
4. The quantity  $L_{WA,c}$  (formerly called  $L_{WA,d}$ ), can be computed from the sum of  $L_{WA,m}$  and  $K_v$ .
5. Measurements are made in conformance with ISO 7779 and declared in conformance with ISO 9296.
6. 10 decibels (dB) equals 1 bel (B).
7. Under certain environments, configurations, system settings, or workloads, there is an increase in fan speeds that results in higher noise levels.
8. Notice: Government regulations (such as those prescribed by OSHA or European Community Directives) might govern noise level exposure in the workplace and might apply to you and your server installation. The actual sound pressure levels in your installation depend upon various factors, including the number of racks in the installation; the size, materials, and configuration of the room where you designate the racks to be installed; the noise levels from other equipment; the room ambient temperature, and employees' location in relation to the equipment. Further, compliance with such government regulations also depends upon various extra factors, including the duration of employees' exposure and whether employees wear hearing protection. IBM recommends that you consult with qualified experts in this field to determine whether you are in compliance with the applicable regulations.

**Electromagnetic compatibility compliance:** CISPR 22:2008; CISPR 32:2012, CNS 13438 (Taiwan); EN 55032:2012 (EU, Australia); EN 55024:2010 (EU); EN 61000-3-2:2014 (EU, Japan); EN 61000-3-3:2013 (EU); FCC, Title 47, Part 15 (USA); GB 9254-2008 (China); GB 17625.1-2012 (China); GB 17625.2-2007 (China); ГOCT 30804.3.2-2013 (IEC 61000-3-2:2009) (EAEU); ГOCT 30804.3.3-2013 (IEC 61000-3-3:2008) (EAEU); ГOCT 30805.22-2013 (CISPR 22:2006) (EAEU); ГOCT CISPR 24-2013

(EAEU); ICES-003, Issue 6, January 2016 (Canada); KN 32:2015 (Korea); KN 35:2015 (Korea); TCVN 7189:2009 (Vietnam); VCCI, April 2015 (Japan)

**Safety compliance:** UL 60950-1, 2nd Edition, 2014-10-14; CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10, IEC 60950-1:2005 (Second Edition); Am1:2009 + Am2:2013; EN 60950-1:2006 + A1:2010 + A11:2009 + A12:2011 + A2:2013

## Rack switch specifications

Rack switch specifications provide detailed information for your IBM BNT RackSwitch, including dimensions, electrical, power, temperature, environment, and service clearances.

Select the appropriate models to view the specifications for your rack switch.

### G8052R RackSwitch specification sheet

Hardware specifications provide detailed information for your IBM BNT RackSwitch, including dimensions, electrical, power, temperature, environment, and service clearances.

| Table 65. Dimensions |                   |                   |                  |
|----------------------|-------------------|-------------------|------------------|
| Height               | Width             | Depth             | Weight (maximum) |
| 44 mm (1.73 in.)     | 439 mm (17.3 in.) | 445 mm (17.5 in.) | 8.3 kg (18.3 lb) |

| Table 66. Electrical       |               |
|----------------------------|---------------|
| Electrical characteristics | Properties    |
| Power requirements         | 200 W         |
| Voltage                    | 90 - 264 V ac |
| Frequency                  | 47 - 63 Hz    |
| Maximum thermal output     | 682.4 Btu/hr  |
| Phase                      | 1             |
| kVA                        | 0.204         |

| Table 67. Environmental and acoustical requirements |                           |                                 |
|-----------------------------------------------------|---------------------------|---------------------------------|
| Environment/Acoustical                              | Operating                 | Storage                         |
| Airflow direction                                   | Rear-to-front             |                                 |
| Temperature, ambient operating                      | 0°C - 40°C (32°F - 104°F) |                                 |
| Temperature, operating (fan failure)                | 0°C - 35°C (32°F - 95°F)  |                                 |
| Temperature, storage                                |                           | -40°C to +85°C (-40°F to 185°F) |
| Relative humidity range (non-condensing)            | 10% - 90% RH              | 10% - 90% RH                    |
| Maximum altitude                                    | 3050 m (10000 ft)         | 12190 m (40000 ft)              |
| Heat dissipation                                    | 444 Btu/hr                |                                 |
| Acoustic noise                                      | Less than 65 dB           |                                 |

## G8124ER RackSwitch specification sheet

Hardware specifications provide detailed information for your IBM BNT RackSwitch, including dimensions, electrical, power, temperature, environment, and service clearances.

| Table 68. Dimensions |                   |                   |                  |
|----------------------|-------------------|-------------------|------------------|
| Height               | Width             | Depth             | Weight (maximum) |
| 44 mm (1.73 in.)     | 439 mm (17.3 in.) | 381 mm (15.0 in.) | 6.4 kg (14.1 lb) |

| Table 69. Electrical       |                |
|----------------------------|----------------|
| Electrical characteristics | Properties     |
| Power requirements         | 275 W          |
| Voltage                    | 100 - 240 V ac |
| Frequency                  | 50 - 60 Hz     |
| Maximum thermal output     | 938.3 Btu/hr   |
| Phase                      | 1              |
| kVA                        | 0.281          |

| Table 70. Environmental and acoustical requirements |                           |                                 |
|-----------------------------------------------------|---------------------------|---------------------------------|
| Environment/Acoustical                              | Operating                 | Storage                         |
| Airflow direction                                   | Rear-to-front             |                                 |
| Temperature, ambient operating                      | 0°C - 40°C (32°F - 104°F) |                                 |
| Temperature (fan failure) operating                 | 0°C - 35°C (32°F - 95°F)  |                                 |
| Temperature, storage                                |                           | -40°C to +85°C (-40°F to 185°F) |
| Relative humidity range (non-condensing)            | 10% - 90% RH              | 10% - 95% RH                    |
| Maximum altitude                                    | 3050 m (10000 ft)         | 4573 m (15000 ft)               |
| Heat dissipation                                    | 1100 Btu/hr               |                                 |
| Acoustic noise                                      | Less than 65 dB           |                                 |

## G8264R RackSwitch specification sheet

Hardware specifications provide detailed information for your IBM BNT RackSwitch, including dimensions, electrical, power, temperature, environment, and service clearances.

| Table 71. Dimensions |                   |                   |                   |
|----------------------|-------------------|-------------------|-------------------|
| Height               | Width             | Depth             | Weight (maximum)  |
| 44 mm (1.73 in.)     | 439 mm (17.3 in.) | 513 mm (20.2 in.) | 10.5 kg (23.1 lb) |

| Table 72. Electrical       |                |
|----------------------------|----------------|
| Electrical characteristics | Properties     |
| Power requirements         | 375 W          |
| Voltage                    | 100 - 240 V ac |



| <i>Table 72. Electrical (continued)</i> |                   |
|-----------------------------------------|-------------------|
| <b>Electrical characteristics</b>       | <b>Properties</b> |
| Frequency                               | 50 - 60 Hz        |
| Maximum thermal output                  | 1280 Btu/hr       |
| Phase                                   | 1                 |
| kVA                                     | 0.383             |

| <i>Table 73. Environmental and acoustical requirements</i> |                           |                                 |
|------------------------------------------------------------|---------------------------|---------------------------------|
| <b>Environment/Acoustical</b>                              | <b>Operating</b>          | <b>Storage</b>                  |
| Airflow direction                                          | Rear-to-front             |                                 |
| Temperature, ambient operating                             | 0°C - 40°C (32°F - 104°F) |                                 |
| Temperature (fan failure) operating                        | 0°C - 35°C (32°F - 95°F)  |                                 |
| Temperature, storage                                       |                           | -40°C to +85°C (-40°F to 185°F) |
| Relative humidity range (non-condensing)                   | 10% - 90% RH              | 10% - 90% RH                    |
| Maximum altitude                                           | 1800 m (6000 ft)          | 12190 m (40000 ft)              |
| Heat dissipation                                           | 1127 Btu/hr               |                                 |
| Acoustic noise                                             | Less than 65 dB           |                                 |

## G8316R RackSwitch specification sheet

Hardware specifications provide detailed information for your IBM BNT RackSwitch, including dimensions, electrical, power, temperature, environment, and service clearances.

| <i>Table 74. Dimensions</i> |                   |                   |                         |
|-----------------------------|-------------------|-------------------|-------------------------|
| <b>Height</b>               | <b>Width</b>      | <b>Depth</b>      | <b>Weight (maximum)</b> |
| 43.7 mm (1.72 in.)          | 439 mm (17.3 in.) | 483 mm (19.0 in.) | 9.98 kg (22.0 lb)       |

| <i>Table 75. Electrical</i>       |                   |
|-----------------------------------|-------------------|
| <b>Electrical characteristics</b> | <b>Properties</b> |
| Power requirements                | 400 W             |
| Voltage                           | 100 - 240 V ac    |
| Frequency                         | 50 - 60 Hz        |
| Maximum thermal output            | 1365 Btu/hr       |
| Phase                             | 1                 |
| kVA                               | 0.408             |

| <i>Table 76. Environmental requirements</i> |                           |
|---------------------------------------------|---------------------------|
| <b>Environment</b>                          | <b>Operating</b>          |
| Airflow direction                           | Rear-to-front             |
| Temperature, ambient operating              | 0°C - 40°C (32°F - 104°F) |

| <i>Table 76. Environmental requirements (continued)</i> |                   |
|---------------------------------------------------------|-------------------|
| <b>Environment</b>                                      | <b>Operating</b>  |
| Relative humidity range (non-condensing)                | 10% - 90% RH      |
| Maximum altitude                                        | 3050 m (10000 ft) |
| Heat dissipation                                        | 1100 Btu/hr       |

## Rack installation specifications for racks that are not purchased from IBM

Learn about the requirements and specifications for installing IBM systems into racks that were not purchased from IBM.

Learn about the requirements and specifications for 19-inch racks. These requirements and specifications are provided as an aid to help you understand the requirements to install IBM systems into racks. It is your responsibility, working with your rack manufacturer, to ensure that the rack that is chosen meets the requirements and specifications that are listed here. Mechanical drawings of the rack, if available from the manufacturer, are recommended for comparison against the requirements and specifications.

IBM maintenance services and installation planning services do not cover verification of non-IBM racks for compliance to Power Systems rack specifications. IBM offers racks for IBM products that are tested and verified by IBM development labs to comply with applicable safety and regulatory requirements. These racks are also tested and verified to fit and function with IBM products. The customer is responsible for verifying with the rack manufacturer that any non-IBM racks comply with IBM specifications.

**Note:** IBM 7014-T00, 7014-T42, 7014-B42, 7953-94X, 7965-94Y, and 7965-S42 racks meet all the requirements and specifications.

### Rack specifications

The general rack specifications include the following specifications:

You must remove and replace the system backplane at a flat angle. The ventilation holes in the top cover can come into contact with the DIMMs in the system backplane if the insertion of the backplane is at an angle or is rushed. As a result of possible contact, DIMMs can be scratched and can leave residue on the top cover.

- The rack or cabinet must meet the EIA Standard EIA-310-D for 19-inch racks published August 24, 1992. The EIA-310-D standard specifies internal dimensions, for example, the width of the rack opening (width of the chassis), the width of the module mounting flanges, and the mounting hole spacing.
- The front rack opening must be a minimum of 450 mm (17.72 in.) wide, and the rail-mounting holes must be 465 mm plus or minus 1.6 mm (18.3 in. plus or minus 0.06 in.) apart on center (horizontal width between vertical columns of holes on the two front-mounting flanges and on the two rear-mounting flanges).

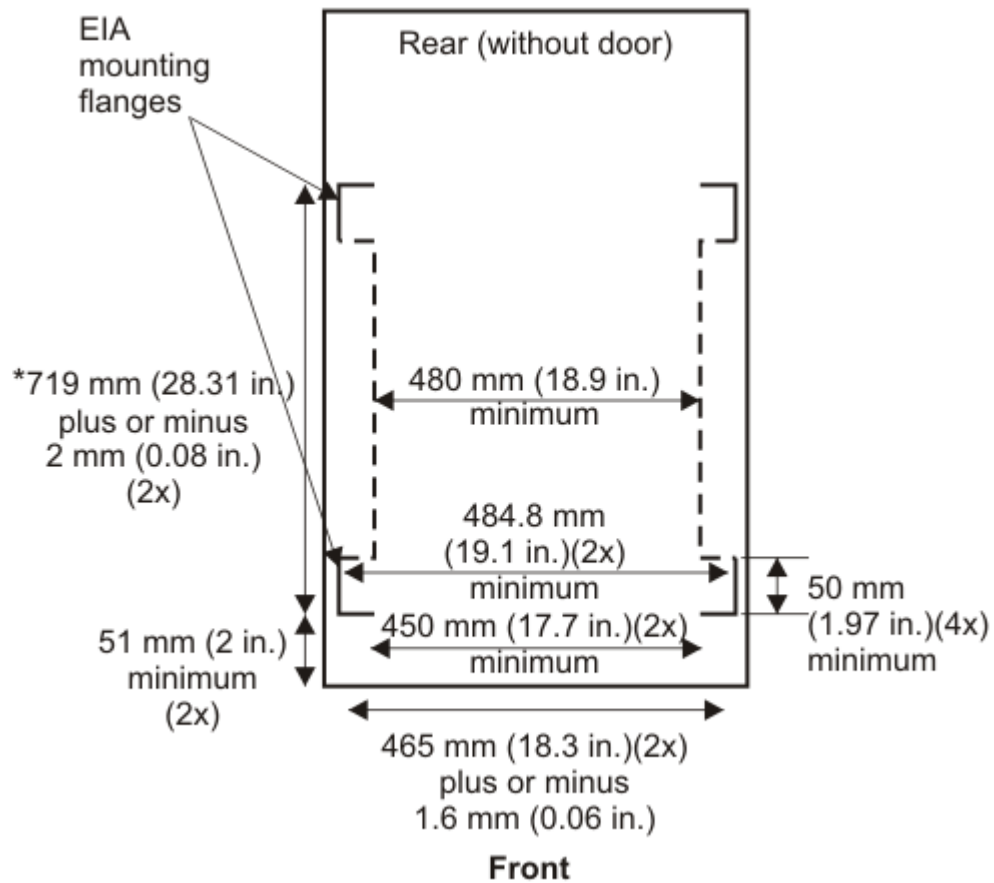
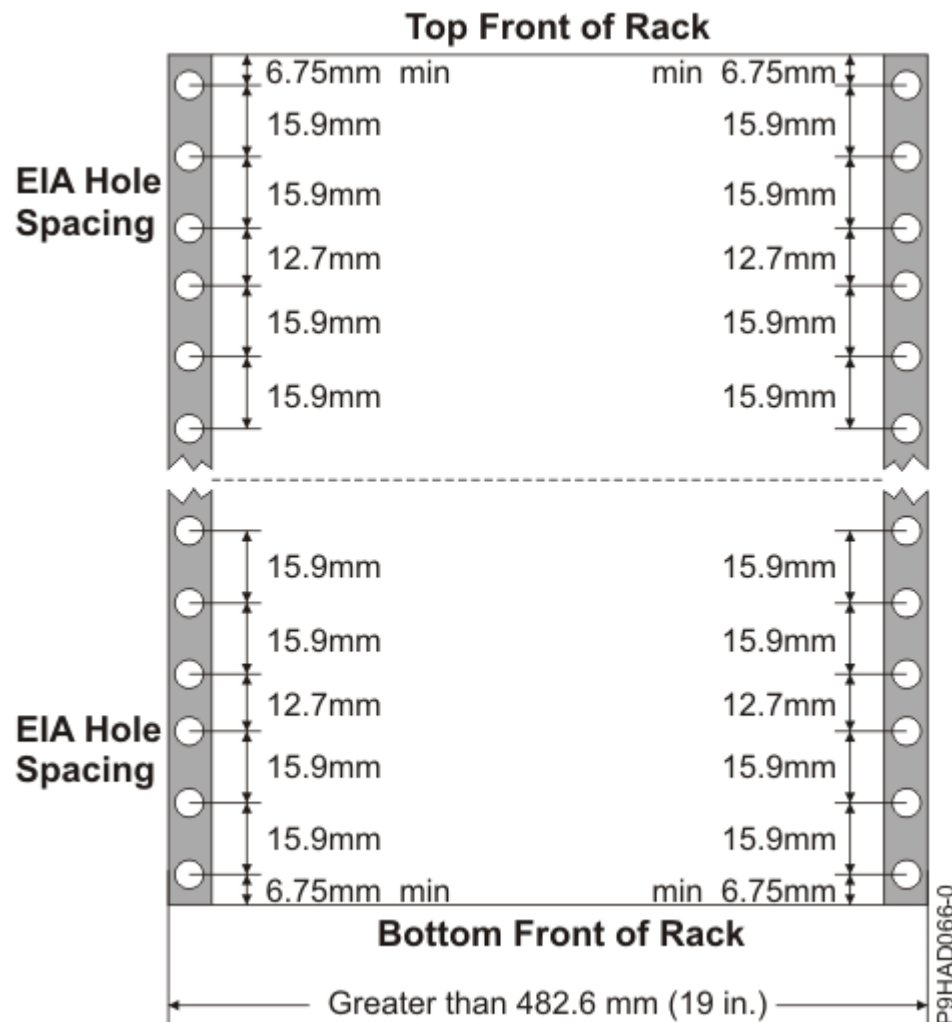


Figure 34. Rack specifications (top-down view)

- The vertical distance between mounting holes must consist of sets of three holes spaced (from bottom to top) 15.9 mm (0.625 in.), 15.9 mm (0.625 in.), and 12.7 mm (0.5 in.) on center (making each three-hole set of vertical hole spacing 44.45 mm (1.75 in.) apart on center).



- The following rack hole sizes are supported for racks where IBM hardware is mounted:

- 7.1 mm (0.28 in.) plus or minus 0.1 mm (round)
- 9.5 mm (0.37 in.) plus or minus 0.1 mm (square)

The rack or cabinet must be capable of supporting an average load of 20 kg (44 lb) of product weight per EIA unit.

For example, a four EIA drawer has a maximum drawer weight of 80 kg (176 lb).

- The system requires space at the rear of the rack for system brackets and cables.

For model 9080-HEU, you must have a minimum rear clearance of 240 mm (9.45 in.) or 356 mm (14.0 in.) depending on the width of the available rack space and the type of rack bracket that is used during installation.

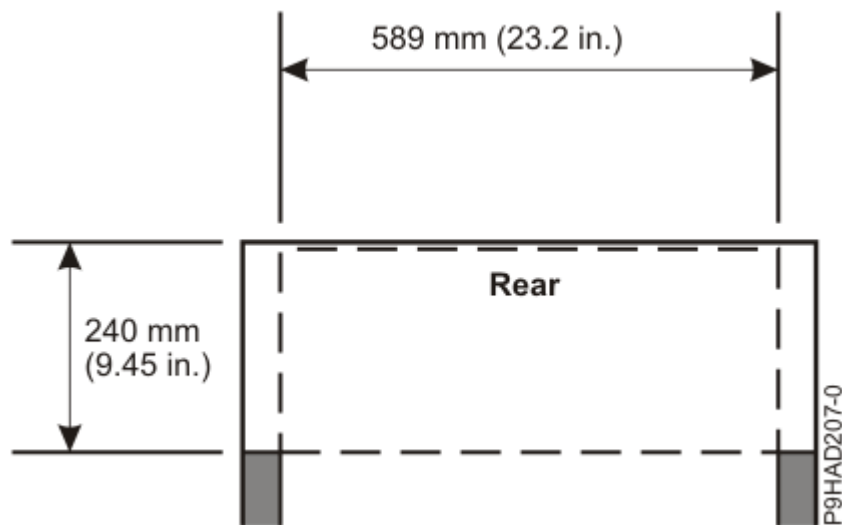


Figure 35. Model 9080-HEU rear rack clearance

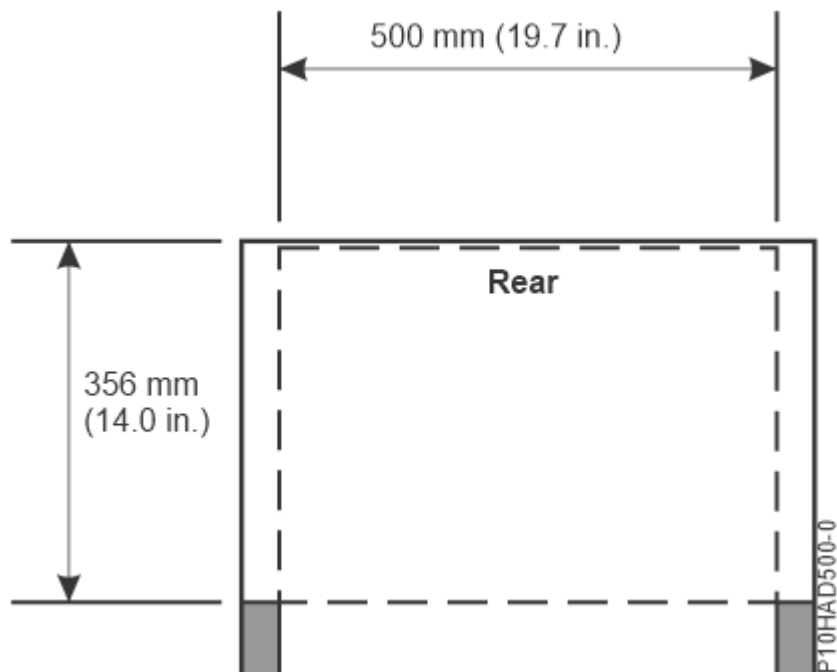


Figure 36. Model 9080-HEU rear rack clearance (narrow rack bracket installation)

The rack clearance dimensions between what is defined in the graphics might be acceptable if they meet the following requirements:

- Cable bend radius of the system SMP10 cables is a minimum of 32.5 mm (1.27 in.).
- Cables are supported by hook and loop ties or a similar method to the rack or other support.
- Cables are off to the side to allow for concurrent maintenance of components such as PCIe cards.
- Rear door does not pinch or apply force on the cables, which can affect the bend radius or routing.
- Only ac power drawers are supported in the rack or cabinet. It is strongly recommended to use a power distribution unit that meets the same specifications as IBM power distribution units to supply rack power (for example, feature code 7188). Rack or cabinet power distribution devices must meet the drawer voltage, amperage, and power requirements, as well as that of any additional products that are connected to the same power distribution device.

The rack or cabinet power receptacle (power distribution unit, uninterruptible power supply, or multi-outlet strip) must have a compatible plug type for your drawer or device.

- The rack or cabinet must be compatible with the drawer-mounting rails. The rail-mounting pins and screws must fit securely and snugly into the rack or cabinet rail-mounting holes. The mounting rails and mounting hardware that are provided with IBM products are designed and tested to safely support the product during operation and service activities, and to safely support the weight of your drawer or device. The rails must facilitate service access by allowing the drawer to be safely extended, if necessary, forward, backward, or both. Some rails, with IBM features for non-IBM racks, provide drawer-specific anti-tip brackets, rear lock-down brackets, and cable management guides that require clearance on the rear side of the rails.

**Note:** If the rack or cabinet has square holes on the mounting flanges, an adapter might be required.

- The rack or cabinet must have stabilization feet or brackets installed in the front of the rack, or have another means of preventing the rack/cabinet from tipping while the drawer or device is pulled into its extreme front service positions.

**Note:** Examples of some acceptable alternatives: The rack or cabinet might be securely bolted to the floor, ceiling or walls, or to adjacent racks or cabinets in a long and heavy row of racks or cabinets.

- If present, front and rear doors must be able to open far enough to provide unrestrained access for service or be easily removable. If doors must be removed for service, it is the responsibility of the customer to remove them before service.
- Front and rear doors must not violate the previously defined front and rear rack space that is required for the system.
- The rack or cabinet must provide adequate front-to-back ventilation.

**Note:** Rack doors must be fully perforated to provide proper front-to-back airflow for mounted Information Technology (IT) equipment. The total door area must result in a minimum of 45% opening area. Rear doors must not create back pressure that can interfere with the server fan operation.

## General safety requirements for IBM products installed in a non-IBM rack or cabinet

The general safety requirements for IBM products that are installed in non-IBM racks are:

- Any product or component that plugs into either an IBM power distribution unit or mains power (by using a power cord), or uses any voltage over 42 V ac or 60 V dc (considered to be hazardous voltage) must be Safety Certified by a Nationally Recognized Test Laboratory (NRTL) for the country in which it is installed.

Some of the items that require safety certification might include the rack or cabinet (if it contains electrical components integral to the rack or cabinet), fan trays, power distribution unit, uninterruptible power supplies, multi-outlet strips, or any other products that are installed in the rack or cabinet that connect to hazardous voltage.

Examples of OSHA-approved NRTLs for the US:

- UL
- ETL
- CSA (with CSA NRTL or CSA US mark)

Examples of approved NRTLs for Canada:

- UL (ULc mark)
- ETL (ETLc mark)
- CSA

The European Union requires a CE mark and a Manufacturer's Declaration of Conformity (DOC).

Certified products must have the NRTL logos or marks somewhere on the product or product label. However, proof of certification must be made available to IBM upon request. Proof consists of such items as copies of the NRTL license or certificate, a CB Certificate, a Letter of Authorization to apply the NRTL mark, the first few pages of the NRTL certification report, Listing in an NRTL publication, or a copy of the UL Yellow Card. Proof should contain the manufacturers name, product type, and model, standard

to which it was certified, the NRTL name or logo, the NRTL file number or license number, and a list of any Conditions of Acceptance or Deviations. A Manufacturer's Declaration is not proof of certification by an NRTL.

- The rack or cabinet must meet all electrical and mechanical safety legal requirements for the country in which it is installed. The rack or cabinet must be free of exposed hazards (such as voltages over 60 V dc or 42 V ac, energy over 240 VA, sharp edges, mechanical pinch points, or hot surfaces).
- There must be an accessible and unambiguous disconnect device for each product in the rack, including any power distribution unit.

A disconnect device might consist of either the plug on the power cord (if the power cord is no longer than 1.8 m (6 ft)), the appliance inlet receptacle (if the power cord is of a detachable type), or a power on/off switch, or an Emergency Power Off switch on the rack, provided all power is removed from the rack or product by the disconnect device.

If the rack or cabinet has electrical components (such as fan trays or lights), the rack must have an accessible and unambiguous disconnect device.

- The rack or cabinet, power distribution unit and multi-outlet strips, and products that are installed in the rack or cabinet must all be properly grounded to the customer facility ground.

There must be no more than 0.1 Ohms between the ground pin of the power distribution unit or rack plug and any touchable metal or conductive surface on the rack and on the products that are installed in the rack. Grounding method must comply with applicable country's electric code (such as NEC or CEC). Ground continuity can be verified by your IBM service personnel, after the installation is completed, and must be verified before the first service activity.

- The voltage rating of the power distribution unit and multi-outlet strips must be compatible with the products plugged into them.

The power distribution unit or multi-outlet strips current and power ratings are rated at 80% of the building supply circuit (as required by the National Electrical Code and the Canadian Electrical Code). The total load that is connected to the power distribution unit must be less than the rating of the power distribution unit. For example, a power distribution unit with a 30 A connection is rated for a total load of 24 A (30 A x 80 %). Therefore, the sum of all equipment that is connected to the power distribution unit in this example must be lower than the 24 A rating.

If an uninterruptible power supply is installed, it must meet all the electrical safety requirements as described for a power distribution unit (including certification by an NRTL).

- The rack or cabinet, power distribution unit, uninterruptible power supply, multi-outlet strips, and all products in the rack or cabinet must be installed according to the manufacturer's instructions, and in accordance with all national, state or province, and local codes and laws.

The rack or cabinet, power distribution unit, uninterruptible power supply, multi-outlet strips, and all products in the rack or cabinet must be used as intended by the manufacturer (per manufacturer's product documentation and marketing literature).

- All documentation for use and installation of the rack or cabinet, power distribution unit, uninterruptible power supply, and all products in the rack or cabinet, including safety information, must be available onsite.
- If there is more than one source of power in the rack cabinet, there must be clearly visible safety labels for Multiple Power Source (in the languages that are required for the country in which the product is installed).
- If the rack or cabinet or any products that are installed in the cabinet had safety or weight labels that are applied by the manufacturer, they must be intact and translated into the languages that are required for the country in which the product is installed.
- If the rack or cabinet has doors, the rack becomes a fire enclosure by definition and must meet the applicable flammability ratings (V-0 or better). Totally metal enclosures at least 1 mm (0.04 in.) thick are considered to comply.

Nonenclosure (decorative) materials must have a flammability rating of V-1 or better. If glass is used (such as in rack doors), it must be safety glass. If wood shelves are used in the rack/cabinet, they must be treated with a UL Listed flame-retardant coating.

- The rack or cabinet configuration must comply with all IBM requirements for "safe to service" (contact your IBM Installation Planning Representative for assistance in determining if the environment is safe).

There must be no unique maintenance procedures or tools that are required for service.

Elevated service installations, where the products to be serviced are installed between 1.5 m and 3.7 m (5 ft and 12 ft) above the floor, require the availability of an OSHA- and CSA-approved nonconductive step ladder or ladders. If a ladder or ladders are required for service, the customer must supply the OSHA- and CSA- approved nonconductive step ladder (unless other arrangements are made with the local IBM Service Branch Office). Some products can have rack installation limitations. Refer to the specific server or product specifications for any restrictions. Products that are installed over 2.9 m (9 ft) above the floor require a Special Bid to be completed before they can be serviced by IBM service personnel.

For products not intended for rack-mounting to be serviced by IBM, the products and parts that are replaced as part of that service must not weigh over 11.4 kg (25 lb). Contact your Installation Planning Representative if in doubt.

There must not be any special education or training that is required for safe servicing of any of the products that are installed in the racks. Contact your Installation Planning Representative if you are in doubt.

## Planning for power

---

Planning the power for your system requires knowledge of your server's power requirements, the power requirements of compatible hardware, and the uninterruptible power supply needs for your server. Use this information to build a complete power plan.

Before you begin your planning tasks, be sure you that complete the items in the following checklist:

- Know your server power requirements.
- Know your compatible hardware requirements.
- Know your uninterruptible power supply needs.

### Review power considerations

Complete the following checklist:

- Consult a qualified electrician about power needs.
- Determine an uninterruptible power supply vendor.
- Complete your server information form or forms.

## Determining your power requirements

Use these guidelines to ensure that your server has the proper power to operate.

Your server can have power requirements different from a PC (such as different voltage and different plugs). IBM Your seller supplies power cords with an attached plug that corresponds to the power outlet most commonly used in the country or region to which the product is being shipped. You are responsible for supplying the proper power outlets.

- Plan for system electrical service. For information on power requirements for a specific model, refer to the electrical section in the server specifications for that particular server. For information on power requirements for expansion units or peripherals, select the appropriate device from the list of compatible hardware specifications. For equipment not listed, check your equipment documentation (owner's manuals) for specifications.
- Determine your server's plug and receptacle types by model so that you can install the proper outlets.



**Tip:** Print a copy of your plug and receptacle table and give it to your electrician. The table contains information that is needed for installing outlets.

- Write down power information in your Server Information Form 3A. Include the following information:
  - Plug type
  - Input voltage
  - Power cord length (optional)
- Plan for power outages. Consider purchasing an uninterruptible power supply to protect your system against power fluctuations and outages. If your company owns an uninterruptible power supply, involve your uninterruptible power supply vendor with any type of uninterruptible power supply modification.
- Plan an emergency power-off switch. As a safety precaution, you must provide some method for disconnecting power to all equipment in your server area. Put emergency power-off switches in locations readily accessible to your systems operator and at designated exits from the room.
- Ground your system. Electrical grounding is important both for safety and correct operation. Your electrician must follow your national and local electrical codes when installing the electrical wiring, outlets, and power panels. These codes take precedence over any other recommendations.
- Contact an electrician. Contact a qualified electrician to take care of your server power requirements and install needed power outlets. Give the electrician a copy of your power information. You can print the recommended power distribution wiring diagram as a reference for your electrician.

## Server Information Form 3A

Use this form to record the type and quantity of power cords that you need for your server.

[illegible]

## Licensed programs

[illegible]

## Workstation Information Form 3B

Use this form to record the type and quantity of cables you need for your server.

| Part number | Device type | Device description | Device location | Cable length | Plug type/<br>input voltage | Telephone contact |
|-------------|-------------|--------------------|-----------------|--------------|-----------------------------|-------------------|
|             |             |                    |                 |              |                             |                   |
|             |             |                    |                 |              |                             |                   |
|             |             |                    |                 |              |                             |                   |
|             |             |                    |                 |              |                             |                   |
|             |             |                    |                 |              |                             |                   |

| Part number | Device type | Device description | Device location | Cable length | Plug type/<br>input voltage | Telephone contact |
|-------------|-------------|--------------------|-----------------|--------------|-----------------------------|-------------------|
|             |             |                    |                 |              |                             |                   |
|             |             |                    |                 |              |                             |                   |
|             |             |                    |                 |              |                             |                   |
|             |             |                    |                 |              |                             |                   |
|             |             |                    |                 |              |                             |                   |
|             |             |                    |                 |              |                             |                   |
|             |             |                    |                 |              |                             |                   |
|             |             |                    |                 |              |                             |                   |
|             |             |                    |                 |              |                             |                   |
|             |             |                    |                 |              |                             |                   |

## Licensed programs

|                                         |
|-----------------------------------------|
| <i>Table 78. Licensed programs list</i> |
|                                         |
|                                         |
|                                         |
|                                         |
|                                         |
|                                         |
|                                         |
|                                         |
|                                         |

## Plugs and receptacles

Select supported power cords to see plugs and receptacles available by country. Or, if you use a power distribution unit (PDU), select supported PDU power cords.

### Supported power cords

Find out which power cords are supported for your system.

Use the following tables to determine the appropriate power cord to use with your system in your country.

[Table 79 on page 80](#) lists power cords to use from the server to the power mains. These power cords are not used with IBM supplied PDUs.

[Table 80 on page 85](#) lists power cords that connect IBM servers to a PDU.


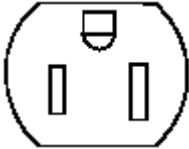
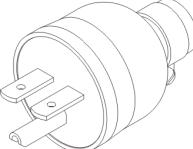
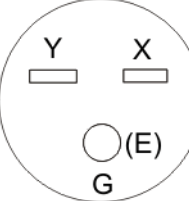
| <i>Table 79. Supported power cords for Power10 systems</i> |                       |                                        |                                                                                                     |                                                                                                            |                 |
|------------------------------------------------------------|-----------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------|
| Feature codes (FC)                                         | Description           | Voltage, cord set amperage, and length | IBM shipped plug                                                                                    | Matched female wall receptacle (on wall)                                                                   | IBM part number |
| <b>6460 EKL2</b>                                           | Type 4 NEMA 5-15 plug | 120 - 127 V ac, 10 A, 4.3 m (14 ft)    | Plug type 4<br> | Receptacle type 4<br> | 39M5513         |
| <b>6469 EKL3</b>                                           | Type 5 NEMA 6-15 plug | 200 - 240 V ac, 10 A, 4.3 m (14 ft)    | Plug type 5<br> | Receptacle type 5<br> | 39M5096         |

Table 79. Supported power cords for Power10 systems (continued)


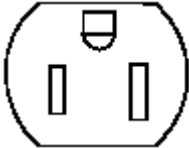
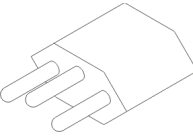
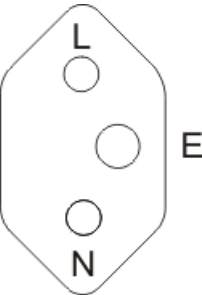
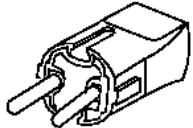



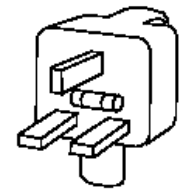
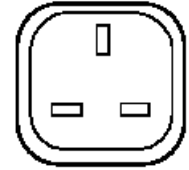
| Feature codes (FC)         | Description              | Voltage, cord set amperage, and length | IBM shipped plug                                                                                     | Matched female wall receptacle (on wall)                                                                    | IBM part number |
|----------------------------|--------------------------|----------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-----------------|
| <b>6470</b>                | Type 4 NEMA 5-15 plug    | 100 - 127 V ac, 12 A, 1.8 m (6 ft)     | Plug type 4<br>    | Receptacle type 4<br>    | 41V1960         |
| <b>6471</b>                | Type 70 INMETRO NBR 6147 | 100 - 127 V ac, 10 A, 2.7 m (9 ft)     | Plug type 73<br>   | Receptacle type 73<br>   | 39M5240         |
| <b>6472</b><br><b>EKL4</b> | Type 18 CEE (7) VII      | 200 - 240 V ac, 10 A, 2.7 m (9 ft)     | Plug type 18<br>  | Receptacle type 18<br>  | 39M5123         |
| <b>6473</b><br><b>EKL5</b> | Type 19 DK2-5a/S         | 200 - 240 V ac, 10 A, 2.7 m (9 ft)     | Plug type 19<br> | Receptacle type 19<br> | 39M5130         |
| <b>6474</b><br><b>EKL6</b> | Type 23 BS1363/A         | 200 - 240 V ac, 10 A, 2.7 m (9 ft)     | Plug type 23<br> | Receptacle type 23<br> | 39M5151         |

Table 79. Supported power cords for Power10 systems (continued)





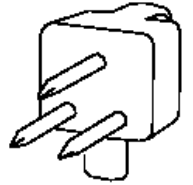
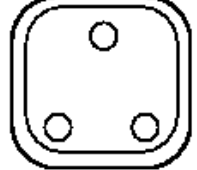


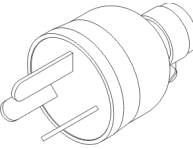
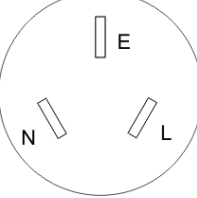
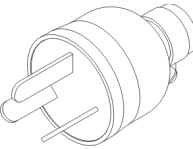
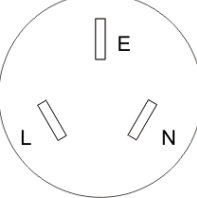
| Feature codes (FC)         | Description                                    | Voltage, cord set amperage, and length | IBM shipped plug                                                                                     | Matched female wall receptacle (on wall)                                                                    | IBM part number |
|----------------------------|------------------------------------------------|----------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-----------------|
| <b>6475</b><br><b>EKL7</b> | Type 79 SI 32 or Type 32                       | 200 - 240 V ac, 10 A, 2.7 m (9 ft)     | Plug type 32<br>   | Receptacle type 32<br>   | 39M5172         |
| <b>6476</b><br><b>EKL8</b> | Type 24 1011-S24507                            | 200 - 240 V ac, 10 A, 2.7 m (9 ft)     | Plug type 24<br>   | Receptacle type 24<br>   | 39M5158         |
| <b>6477</b><br><b>EKL9</b> | Type 23 BS1363/A or Type 22 SANS 1661/SABS 164 | 200 - 240 V ac, 10 A, 2.7 m (9 ft)     | Plug type 22<br>  | Receptacle type 22<br>  | 39M5144         |
| <b>6478</b><br><b>EKLA</b> | Type 25 CEI 23-16                              | 200 - 240 V ac, 10 A, 2.7 m (9 ft)     | Plug type 25<br> | Receptacle type 25<br> | 39M5165         |
| <b>6488</b><br><b>EKLB</b> | Type 2 IRAM 2073                               | 200 - 240 V ac, 10 A, 2.7 m (9 ft)     | Plug type 2<br>  | Receptacle type 2<br>  | 39M5068         |
| <b>6493</b><br><b>EKLC</b> | Type 62 GB 2099.1, 1002                        | 200 - 240 V ac, 10 A, 2.7 m (9 ft)     | Plug type 62<br> | Receptacle type 62<br> | 39M5206         |

Table 79. Supported power cords for Power10 systems (continued)







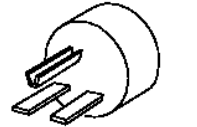
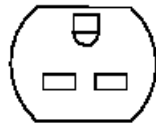

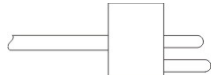


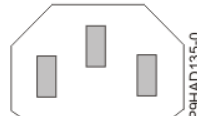

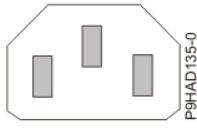

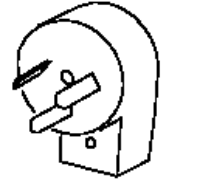

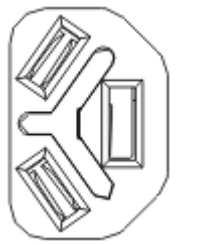
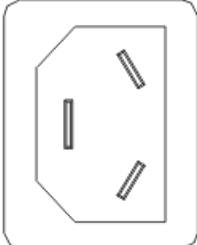
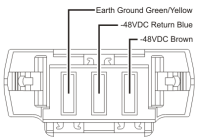

| Feature codes (FC)                | Description                | Voltage, cord set amperage, and length | IBM shipped plug                                                                                     | Matched female wall receptacle (on wall)                                                                    | IBM part number               |
|-----------------------------------|----------------------------|----------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------|
| <b>6494 EKLD</b>                  | Type 69 IS 6538            | 200 - 240 V ac, 16 A, 2.7 m (9 ft)     | Plug type 69<br>    | Receptacle type 69<br>   | 39M5226                       |
| <b>6496 EKLE</b>                  | Type 66 KSC 8305, K60884-1 | 200 - 240 V ac, 15 A, 2.7 m (9 ft)     | Plug type 66<br>    | Receptacle type 66<br>   | 39M5219                       |
| <b>6651 EKLF</b>                  | Type 75 CNS 10917-3        | 100 - 127 V ac, 12 A, 2.7 m (9 ft)     | Plug type 75<br>   | Receptacle type 75<br>   | 39M5463                       |
| <b>6659 EKLG</b>                  | Type 76 CNS 10917-3        | 200 - 240 V ac, 12 A, 2.7 m (9 ft)     | Plug type 76<br> | Receptacle type 76<br> | 39M5254                       |
| <b>6660 EKLIH</b>                 | Type 59 JIS C8303 C8306    | 100 - 127 V ac, 12 A, 4.3 m (14 ft)    | Plug type 59<br>  | Receptacle type 59<br> | 39M5200                       |
| <b>6669 EKLIK</b>                 | Type 57 JIS C8303 C8306    | 200 - 240 V ac, 12 A, 4.3 m (14 ft)    | Plug type 57<br>  | Receptacle type 57<br> | 39M5187                       |
| <b>6671 EKLL END1<sup>5</sup></b> | Type 26                    | 200 - 240 V ac, 10 A, 2.7 m (9 ft)     | Plug type 26<br> | Receptacle type 26<br> | 39M5509<br>39M5509<br>01KV681 |

Table 79. Supported power cords for Power10 systems (continued)

| Feature codes (FC)                                                                 | Description                    | Voltage, cord set amperage, and length | IBM shipped plug                                                                                                            | Matched female wall receptacle (on wall)                                                                                            | IBM part number                          |
|------------------------------------------------------------------------------------|--------------------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| <b>6672</b><br><b>EKLM</b><br><b>EKLP</b> <sup>5</sup><br><b>END0</b> <sup>5</sup> | Type 26                        | 200 -240 V ac,<br>10 A, 2 m (6.5 ft)   | Plug type 26<br>                          | Receptacle type 26<br>                           | 39M5508<br>39M5508<br>01KV680<br>01KV680 |
| <b>6680</b>                                                                        | Type 6 AS/NZS 3112:2000        | 200 - 240 V ac,<br>10 A, 2.7 m (9 ft)  | Plug type 6<br>                           | Receptacle type 6<br>                            | 39M5102                                  |
| <b>EPAD</b> <sup>1</sup>                                                           | Type Rong Feng RF-203P         | 192 - 400 V dc,<br>10 A, 2.5 m (8 ft)  | HVDC plug<br>                            | HVDC receptacle<br>                             | 00RR617                                  |
| <b>EB3H</b>                                                                        | DC power cable <sup>2, 3</sup> | -48 V dc, 25 A, 3 m (10 ft)            | Multi-Beam XLX 3 position connector<br> | Two-hole, standard barrel lug <sup>4</sup><br> | 00RR437                                  |

**Notes:**

1. FC EPAC can be used to allow IBM Manufacturing to select a length of cord (1.0 m (3.3 ft), 1.5 m (4.9 ft), or 2.5 m (8 ft)) during rack integration.
2. FC EB3H includes a 750 watt power supply and circuit breaker for FC EPB8 (power distribution panel).
3. Wire size is 10 AWG (American Wire Gauge).
4. FC EB3H attaches to FC EPB8.
5. India only.

Table 80. Supported server to PDU power cords on Power10 systems

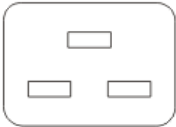
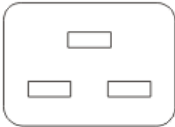


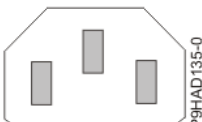
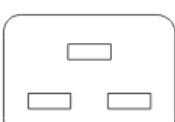

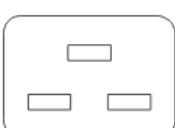
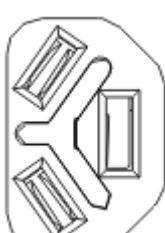
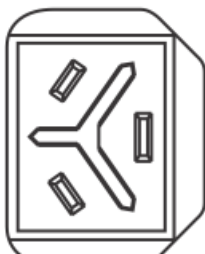
| Feature codes (FC)                                                     | Description                     | Voltage, amperage, and length                                                                            | Power cord (left end)                                                                                                          | Power cord (right end)                                                                                                     | IBM part number                                     |
|------------------------------------------------------------------------|---------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| 4558<br>END8 <sup>2</sup>                                              | IEC 320 C19/C20                 | 200 - 240 V ac,<br>16 A, 2.5 m (8 ft)<br>2 m (6.5 ft)                                                    | Plug Type 56 IEC 320 C20<br>                 | Plug Type 61 IEC 320 C19<br>            | 39M5389<br>01KV684                                  |
| 6458<br>6577 <sup>1</sup><br>END2 <sup>2</sup><br>END3 <sup>2, 3</sup> | Type 26 IEC320 C13/C14          | 200 - 240 V ac,<br>10 A, 4.3 m (14 ft)                                                                   | Connector Type 26 IEC 320 C13<br> P9HAD135-0 | Plug Type 26 IEC 320 C14<br> P9HAD137-0 | 39M5510<br>39M5510<br>01KV682<br>01KV679            |
| 6665<br>EKLJ<br>ELC5<br>END5 <sup>2</sup><br>END7 <sup>2, 4</sup>      | IEC 320 C13/C20                 | 200 - 240 V ac,<br>10 A, 2.8 m (9 ft)<br>2.8 m (9 ft)<br>4.3 m (14 ft)<br>2.8 m (9 ft)<br>1.0 m (3.3 ft) | Connector Type 26 IEC 320 C13<br> P9HAD135-0 | Plug Type 56 IEC 320 C20<br>            | 39M5392<br>39M5392<br>02EA542<br>01PP688<br>01PP687 |
| ELC6                                                                   | Rong Feng/IEC 320 C20           | 200 – 240 V ac,<br>10 A, 2 m (6.5 ft)                                                                    | RF-203P-M<br>                               | Plug Type 56 IEC 320 C20<br>          | 01KU018                                             |
| EPAH                                                                   | Rong Feng/Rong Feng right angle | 200 – 240 V ac,<br>10 A, 0.26 m (0.9 ft)                                                                 | RF-203P-M<br>                               | RF-203-M<br>                          | 02EA732                                             |

Table 80. Supported server to PDU power cords on Power10 systems (continued)


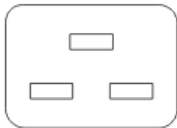
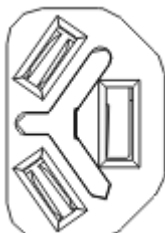


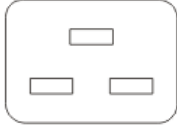

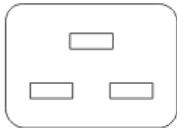
| Feature codes (FC) | Description                    | Voltage, amperage, and length         | Power cord (left end)                                                                            | Power cord (right end)                                                                                            | IBM part number |
|--------------------|--------------------------------|---------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------|
| EPAJ               | Rong Feng/IEC 320 C20          | 200 – 240 V ac, 10 A, 2 m (6.5 ft)    | RF-203P-M<br>   | Plug Type 56 IEC 320 C20<br>   | 01KU018         |
| EPAK               | Rong Feng/Rong Feng left angle | 200 – 240 V ac, 10 A, 0.26 m (0.9 ft) | RF-203P-M<br>   | RF-203-M<br>                   | 02EA733         |
| EPAL               | Rong Feng/IEC 320 C20          | 200 – 240 V ac, 10 A, 2.8 m (9 ft)    | RF-203P-M<br> | Plug Type 56 IEC 320 C20<br> | 01KU019         |
| EPAM               | Rong Feng/IEC 320 C20          | 200 – 240 V ac, 10 A, 4.3 m (14 ft)   | RF-203P-M<br> | Plug Type 56 IEC 320 C20<br> | 01KU020         |



Table 80. Supported server to PDU power cords on Power10 systems (continued)

| Feature codes (FC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Description | Voltage, amperage, and length | Power cord (left end) | Power cord (right end) | IBM part number |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------|-----------------------|------------------------|-----------------|
| <b>Notes:</b> <ol style="list-style-type: none"> <li>1. Feature code is specified as manufacturing select length when a rack is configured in the factory. The default length is 4.3 m (14 ft). Additional lengths are 1 m (3.3 ft) PN 39M5506, 2 m (6.5 ft) PN 39M5508, and 2.8 m (9 ft) PN 39M5509. FC EQ77 is quantity 150 of FC 6577. FC ENDQ is quantity 150 of FC END3.</li> <li>2. India only.</li> <li>3. Feature code is specified as manufacturing select length when a rack is configured in the factory. The default length is 1 m (3.3 ft). Additional lengths are 2 m (6.5 ft) PN 01KV680, 2.8 m (9 ft) PN 01KV681, and 4.3 m (14 ft) PN 01KV682.</li> <li>4. Feature code is specified as manufacturing select length when a rack is configured in the factory. The default length is 1 m (3.3 ft). Additional lengths are 2 m (6.5 ft) PN 01PP688, 2.8 m (9 ft) PN 01PP689, and 4.3 m (14 ft) PN 001PP690.</li> <li>5. Feature code is specified as manufacturing select length when a rack is configured in the factory. The default length is 2 m (6.5 ft). Additional lengths are 2.8 m (9 ft) PN 01KU019, 4.3 m (14 ft) PN 01KU020.</li> </ol> |             |                               |                       |                        |                 |

Table 81. Supported power cords by countries

| FC          | Supported countries                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>6460</b> | American Samoa, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Canada, Cayman Islands, Columbia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guam, Guatemala, Haiti, Honduras, Jamaica, Marshall Islands, Mexico, Micronesia (Federal States of), Montserrat, Netherlands Antilles, Nicaragua, Northern Mariana Islands, Palau, Panama, Peru, Philippines, Puerto Rico, San Marino, Saudi Arabia, Thailand, Turks and Caicos Islands, United States, Venezuela        |
| <b>6470</b> | American Samoa, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Canada, Cayman Islands, Columbia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guam, Guatemala, Haiti, Honduras, Jamaica, Japan, Marshall Islands, Mexico, Micronesia (Federal States of), Montserrat, Netherlands Antilles, Nicaragua, Northern Mariana Islands, Palau, Panama, Peru, Philippines, Puerto Rico, San Marino, Saudi Arabia, Thailand, Turks and Caicos Islands, United States, Venezuela |
| <b>6471</b> | Brazil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

Table 81. Supported power cords by countries (continued)

| FC          | Supported countries                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>6472</b> | Afghanistan, Albania, Algeria, American Samoa, Andorra, Angola, Antarctica, Armenia, Austria, Azerbaijan, Belarus, Belgium, Benin, Bhutan, Bosnia and Herzegovina, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Christmas Islands, Cocos (Keeling) Islands, Comoros, Congo (Democratic Republic of), Congo (Republic of), Cote D'Ivoire (Ivory Coast), Croatia (Republic of), Czech Republic, Djibouti, Egypt, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Faroe Islands, Finland, France, French Guyana, French Polynesia, Gabon, Georgia, Germany, Gibraltar, Greece, Greenland, Guadeloupe, Guinea, Guinea Bissau, Holy See (Vatican City State), Hungary, Iceland, Indonesia, Iran (Islamic Republic of), Kazakhstan, Kyrgyzstan, Laos (Peoples Democratic Republic of), Latvia, Lebanon, Lithuania, Luxembourg, Macedonia (former Yugoslav Republic of), Madagascar, Mali, Martinique, Mauritania, Mauritius, Mayotte, Moldova (Republic of), Monaco, Mongolia, Morocco, Mozambique, Netherlands, New Caledonia, Niger, Norfolk Island, Norway, Poland, Portugal, Reunion, Romania, Russian Federation, Rwanda, Saint Pierre and Miquelon, Sao Tome and Principe, Saudi Arabia, Senegal, Serbia and Montenegro, Slovakia, Slovenia (Republic of), Solomon Islands, Somalia, Spain, Suriname, Svalbard and Jan Mayen, Sweden, Syrian Arab Republic, Tajikistan, Timor-Leste, Togo, Tunisia, Turkey, Turkmenistan, Tuvalu, Ukraine, Uzbekistan, Vanuatu, Vietnam, Wallis and Futuna, Western Sahara |
| <b>6473</b> | Denmark, Falkland Islands (Malvinas), Faroe Islands                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>6474</b> | Bahrain, Bangladesh, Bhutan, Botswana, British Indian Ocean Territory, Brunei Darussalam, Cyprus, Dominica, Falkland Islands (Malvinas), Gambia, Ghana, Gibraltar, Grenada, Guyana, Hong Kong S.A.R. of the PRC, Iraq, Ireland, Jordan, Kenya, Kuwait, Lesotho, Liberia, Macao S.A.R. of the PRC, Malawi, Malaysia, Maldives, Malta, Myanmar, Namibia, Nepal, Nigeria, Oman, Pakistan, Pitcairn, Qatar, Saint Helena, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Seychelles, Sierra Leone, Singapore, South Africa, Sudan, Swaziland, Tanzania (United Republic of), Timor-Leste, Trinidad and Tobago, Uganda, United Arab Emirates, United Kingdom, Yemen, Zambia, Zimbabwe                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>6475</b> | Israel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>6476</b> | Liechtenstein, Switzerland                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>6477</b> | Bahrain, Bangladesh, Bhutan, Botswana, British Indian Ocean Territory, Brunei Darussalam, Cyprus, Dominica, Falkland Islands (Malvinas), Gambia, Ghana, Gibraltar, Grenada, Guyana, Hong Kong S.A.R. of the PRC, Iraq, Ireland, Jordan, Kenya, Kuwait, Lesotho, Liberia, Macao S.A.R. of the PRC, Malawi, Malaysia, Maldives, Malta, Myanmar, Namibia, Nepal, Nigeria, Oman, Pakistan, Pitcairn, Qatar, Saint Helena, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Seychelles, Sierra Leone, Singapore, South Africa, Sudan, Swaziland, Tanzania (United Republic of), Timor-Leste, Trinidad and Tobago, Uganda, United Arab Emirates, United Kingdom, Yemen, Zambia, Zimbabwe                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>6478</b> | Chile, Holy See (Vatican City State), Italy, Libyan Arab Jamahiriya                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>6479</b> | Australia, New Zealand                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>6488</b> | Argentina, Paraguay, Uruguay                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

Table 81. Supported power cords by countries (continued)

| FC   | Supported countries                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6489 | Afghanistan, Albania, Algeria, Andorra, Angola, Antarctica, Antigua and Barbuda, Argentina, Armenia, Azerbaijan, Bahrain, Bangladesh, Belarus, Belgium, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Bouvet Island, Brazil, British Indian Ocean Territory, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Chile, China, Christmas Island, Cocos (Keeling) Islands, Comoros, Congo, Congo (The Democratic Republic of the), Cook Islands, Cote D'Ivoire (Ivory Coast), Croatia (Republic of), Cuba, Cyprus, Djibouti, Dominica, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Falkland Islands (Malvinas), Faroe Islands, Fiji, France, French Guyana, French Southern Territories, Gabon, Gambia, Georgia, Germany, Ghana, Gibraltar, Greece, Greenland, Grenada, Guadeloupe, Guinea, Guinea-Bissau, Guyana, Heard Island and McDonald Islands, Holy See (Vatican City State), Hong Kong, Hungary, Iceland, India, Indonesia, Iran (Islamic Republic of), Iraq, Ireland, Italy, Jordan, Kazakhstan, Kenya, Kiribati, Kuwait, Kyrgyzstan, Laos (Peoples Democratic Republic of), Lebanon, Lesotho, Libyan Arab Jamahiriya, Luxembourg, Macao, Macedonia (The former Yugoslav Republic of), Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Mauritania, Mauritius, Mayotte, Moldova (Republic of), Monaco, Mongolia, Montserrat, Morocco, Mozambique, Myanmar, Namibia, Nauru, Nepal, Netherlands, Netherlands Antilles, New Caledonia, Niger, Nigeria, Niue, Norfolk Island, Northern Mariana Islands, Norway, Oman, Pakistan, Palestinian Territory, Papua New Guinea, Paraguay, Pitcairn, Poland, Portugal, Qatar, Reunion, Romania, Rwanda, Saint Helena, Saint Kitts and Nevis, Saint Lucia, Saint Pierre and Miquelon, Saint Vincent and the Grenadines, Samoa, Saudi Arabia, Senegal, Serbia and Montenegro, Seychelles, Sierra Leone, Singapore, Slovakia, Slovenia (Republic of), Solomon Islands, Somalia, South Africa, South Georgia and the South Sandwich Islands, Spain, Sri Lanka, Sudan, Suriname, Svalbard and Jan Mayen, Swaziland, Syrian Arab Republic, Tajikistan, Tanzania (United Republic of), Thailand, Timor-Leste, Togo, Tokelau, Tonga, Tunisia, Turkey, Turkmenistan, Tuvalu, Uganda, Ukraine, United Arab Emirates, United Kingdom, Uruguay, Uzbekistan, Vanuatu, Vietnam, Virgin Islands (British), Wallis and Futuna, Western Sahara, Yemen, Zambia, Zimbabwe |

Table 81. Supported power cords by countries (continued)

| FC          | Supported countries                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>6491</b> | Afghanistan, Albania, Algeria, Andorra, Angola, Antarctica, Antigua and Barbuda, Argentina, Armenia, Azerbaijan, Bahrain, Bangladesh, Belarus, Belgium, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Bouvet Island, Brazil, British Indian Ocean Territory, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Chile, China, Christmas Island, Cocos (Keeling) Islands, Comoros, Congo, Congo (The Democratic Republic of the), Cook Islands, Cote D'Ivoire (Ivory Coast), Croatia (Republic of), Cuba, Cyprus, Djibouti, Dominica, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Falkland Islands (Malvinas), Faroe Islands, Fiji, France, French Guyana, French Southern Territories, Gabon, Gambia, Georgia, Germany, Ghana, Gibraltar, Greece, Greenland, Grenada, Guadeloupe, Guinea, Guinea-Bissau, Guyana, Heard Island and McDonald Islands, Holy See (Vatican City State), Hong Kong, Hungary, Iceland, India, Indonesia, Iran (Islamic Republic of), Iraq, Ireland, Italy, Jordan, Kazakhstan, Kenya, Kiribati, Kuwait, Kyrgyzstan, Laos (Peoples Democratic Republic of), Lebanon, Lesotho, Libyan Arab Jamahiriya, Luxembourg, Macao, Macedonia (The former Yugoslav Republic of), Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Mauritania, Mauritius, Mayotte, Moldova (Republic of), Monaco, Mongolia, Montserrat, Morocco, Mozambique, Myanmar, Namibia, Nauru, Nepal, Netherlands, Netherlands Antilles, New Caledonia, Niger, Nigeria, Niue, Norfolk Island, Northern Mariana Islands, Norway, Oman, Pakistan, Palestinian Territory, Papua New Guinea, Paraguay, Pitcairn, Poland, Portugal, Qatar, Reunion, Romania, Rwanda, Saint Helena, Saint Kitts and Nevis, Saint Lucia, Saint Pierre and Miquelon, Saint Vincent and the Grenadines, Samoa, Saudi Arabia, Senegal, Serbia and Montenegro, Seychelles, Sierra Leone, Singapore, Slovakia, Slovenia (Republic of), Solomon Islands, Somalia, South Africa, South Georgia and the South Sandwich Islands, Spain, Sri Lanka, Sudan, Suriname, Svalbard and Jan Mayen, Swaziland, Syrian Arab Republic, Tajikistan, Tanzania (United Republic of), Thailand, Timor-Leste, Togo, Tokelau, Tonga, Tunisia, Turkey, Turkmenistan, Tuvalu, Uganda, Ukraine, United Arab Emirates, United Kingdom, Uruguay, Uzbekistan, Vanuatu, Vietnam, Virgin Islands (British), Wallis and Futuna, Western Sahara, Yemen, Zambia, Zimbabwe |
| <b>6492</b> | Algeria, American Samoa, Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belarus, Belize, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Colombia, Congo, Congo (The Democratic Republic of the), Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, French Polynesia, Guam, Guatemala, Haiti, Honduras, Jamaica, Japan, Kazakhstan, Liberia, Mali, Marshall Islands, Martinique, Mexico, Micronesia (Federal States of), Moldova (Republic of), Netherlands Antilles, Nicaragua, Northern Mariana Islands, Palau, Panama, Peru, Philippines, Puerto Rico, San Marino, Sao Tome and Principe, Saudi Arabia, Senegal, Somalia, Taiwan, Trinidad and Tobago, Turks and Caicos Islands, United States, United States Minor Outlying Islands, Venezuela, Vietnam, Virgin Islands (United States)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>6493</b> | China                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>6494</b> | India                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>6495</b> | Brazil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>6496</b> | Korea                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>6497</b> | United States, Mexico                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>6498</b> | Japan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>6651</b> | Taiwan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>6653</b> | Internationally available                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

*Table 81. Supported power cords by countries (continued)*

| <b>FC</b>   | <b>Supported countries</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>6654</b> | Algeria, American Samoa, Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belarus, Belize, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Colombia, Congo, Congo (The Democratic Republic of the), Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, French Polynesia, Guam, Guatemala, Haiti, Honduras, Jamaica, Japan, Kazakhstan, Liberia, Mali, Marshall Islands, Martinique, Mexico, Micronesia (Federal States of), Moldova (Republic of), Netherlands Antilles, Nicaragua, Northern Mariana Islands, Palau, Panama, Peru, Philippines, Puerto Rico, San Marino, Sao Tome and Principe, Saudi Arabia, Senegal, Somalia, Taiwan, Trinidad and Tobago, Turks and Caicos Islands, United States, United States Minor Outlying Islands, Venezuela, Vietnam, Virgin Islands (United States) |
| <b>6655</b> | United States, Canada                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>6656</b> | Internationally available                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>6657</b> | Australia, New Zealand                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>6658</b> | Korea                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>6659</b> | Taiwan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>6660</b> | Japan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>6662</b> | Taiwan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

Table 81. Supported power cords by countries (continued)

| FC          | Supported countries                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>6665</b> | Afghanistan, Albania, Algeria, American Samoa, Andorra, Angola, Anguilla, Antarctica, Antigua and Barbuda, Argentina, Armenia, Aruba, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bermuda, Bhutan, Bolivia, Bosnia and Herzegovina, Bulgaria, Bouvet Island, Brazil, British Indian Ocean Territory, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Cape Verde, Cayman Islands, Central African Republic, Chad, Chile, China, Christmas Island, Cocos (Keeling) Islands, Colombia, Comoros, Congo, Congo (The Democratic Republic of the), Cook Islands, Costa Rica, Cote D'Ivoire (Ivory Coast), Croatia (Republic of), Cuba, Cyprus, Czech Republic, Denmark, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Falkland Islands (Malvinas), Faroe Islands, Fiji, Finland, France, French Guyana, French Polynesia, French Southern Territories, Gabon, Gambia, Georgia, Germany, Ghana, Gibraltar, Greece, Greenland, Grenada, Guadeloupe, Guam, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Heard Island and McDonald Islands, Holy See (Vatican City State), Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran (Islamic Republic of), Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kiribati, Korea (Democratic Peoples Republic of), Korea (Republic of), Kuwait, Kyrgyzstan, Laos (Peoples Democratic Republic of), Latvia, Lebanon, Lesotho, Liberia, Libyan Arab Jamahiriya, Liechtenstein, Lithuania, Luxembourg, Macao, Macedonia (The former Yugoslav Republic of), Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Marshall Islands, Martinique, Mauritania, Mauritius, Mayotte, Mexico, Micronesia (Federated States of), Moldova (Republic of), Monaco, Mongolia, Montserrat, Morocco, Mozambique, Myanmar, Namibia, Nauru, Nepal, Netherlands, Netherlands Antilles, New Caledonia, New Zealand, Niger, Nigeria, Niue, Norfolk Island, Northern Mariana Islands, Norway, Oman, Pakistan, Palau, Palestinian Territory, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Pitcairn, Poland, Portugal, Puerto Rico, Qatar, Reunion, Romania, Russian Federation, Rwanda, Saint Helena, Saint Kitts and Nevis, Saint Lucia, Saint Pierre and Miquelon, Saint Vincent and the Grenadines, Samoa, San Marino, Sao Tome and Principe, Saudi Arabia, Senegal, Serbia and Montenegro, Seychelles, Sierra Leone, Singapore, Slovakia, Slovenia (Republic of), Solomon Islands, Somalia, South Africa, South Georgia and the South Sandwich Islands, Spain, Sri Lanka, Sudan, Suriname, Svalbard and Jan Mayen, Swaziland, Sweden, Switzerland, Syrian Arab Republic, Taiwan, Tajikistan, Tanzania (United Republic of), Thailand, Timor-Leste, Togo, Tokelau, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Turks and Caicos Islands, Tuvalu, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, United States Minor Outlying Islands, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Virgin Islands (British), Virgin Islands (United States), Wallis and Futuna, Western Sahara, Yemen, Zambia, Zimbabwe |
| <b>6669</b> | Japan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>6670</b> | Japan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>6680</b> | Australia, Cook Islands, Fiji, Kiribati, Nauru, New Zealand, Niue, Papua New Guinea, Tokelau, Tonga                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## Supported PDU power cords

Find out which power distribution unit (PDU) power cords are supported for your system.

Use the following table to determine the appropriate PDU power cord to use with your system in your country.

Table 82. Supported PDU power cords for PDU feature codes (FCs) EPTG, EPTJ, EPTM, EPTN, ECJG, ECJJ, ECJM, and ECJN with Souriau inlet


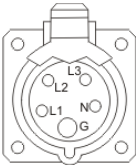

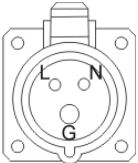

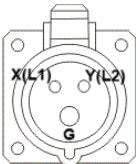

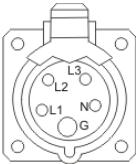
| Feature code (FC) | Description <ul style="list-style-type: none"> <li>• Amperage</li> <li>• Phase</li> <li>• Length</li> <li>• Wall plug</li> </ul>                                                           | IBM shipped plug                                                                                        | Typical mains voltage range <sup>4</sup> | Matched female connector (on cord) | Matched female wall receptacle (on wall)                                                                        | IBM part number | General countries                                       |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------|------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------------------------------|
| <b>6489</b>       | Power cord, PDU to wall <ul style="list-style-type: none"> <li>• 32 A</li> <li>• 3-phase wye</li> <li>• 4.3 m (14 ft)</li> <li>• IEC 309, 3P+N+G</li> </ul>                                | Plug type 532P6W<br>   | 220 - 240 V ac or 380 - 415 V ac         | Connector type 532C6W              | Receptacle type 532R6W<br>   | 39M5413         | Europe, Middle East, Africa (EMEA)                      |
| <b>6491</b>       | Power cord, PDU to wall <ul style="list-style-type: none"> <li>• 63 A</li> <li>• Single phase<sup>2</sup></li> <li>• 4.3 m (14 ft)</li> <li>• IEC 309, P+N+G</li> </ul>                    | Plug type 363P6W<br>   | 220 - 240 V ac                           | Connector type 363C6W              | Receptacle type 363P6W<br>  | 39M5415         | Europe, Middle East, Africa (EMEA)                      |
| <b>6492</b>       | Power cord, PDU to wall <ul style="list-style-type: none"> <li>• 60 A plug (48 A derated)</li> <li>• Single phase<sup>1</sup></li> <li>• 4.3 m (14 ft)</li> <li>• IEC 309, 2P+G</li> </ul> | Plug type 360P6W<br> | 200 - 240 V ac                           | Connector type 360C6W              | Receptacle type 360P6W<br> | 39M5417         | United States, Canada, Latin America, Japan, and Taiwan |
| <b>6653</b>       | Power cord, PDU to wall <ul style="list-style-type: none"> <li>• 16 A</li> <li>• 3-phase wye</li> <li>• 4.3 m (14 ft)</li> <li>• IEC 309, 3P+N+G</li> </ul>                                | Plug type 516P6W<br> | 220 - 240 V ac or 380 - 415 V ac         | Connector type 516C6W              | Receptacle type 516R6W<br> | 39M5412         | Switzerland                                             |

Table 82. Supported PDU power cords for PDU feature codes (FCs) EPTG, EPTJ, EPTM, EPTN, ECJG, ECJJ, ECJM, and ECJN with Souriau inlet (continued)

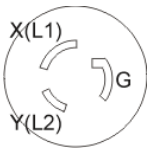




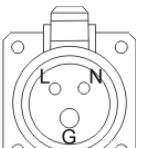

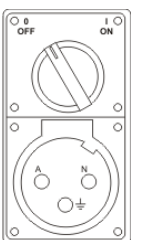
| Feature code (FC) | Description <ul style="list-style-type: none"> <li>• Amperage</li> <li>• Phase</li> <li>• Length</li> <li>• Wall plug</li> </ul>                                                                    | IBM shipped plug                                                                                           | Typical mains voltage range <sup>4</sup> | Matched female connector (on cord) | Matched female wall receptacle (on wall)                                                                           | IBM part number | General countries                                       |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|------------------------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------------------------------|
| <b>6654</b>       | Power cord, PDU to wall <ul style="list-style-type: none"> <li>• 30 A plug (24 A derated)</li> <li>• Single phase<sup>1, 3</sup></li> <li>• 4.3 m (14 ft)</li> <li>• NEMA L6-30</li> </ul>          | Plug type NEMA L6-30P<br> | 200 - 240 V ac                           |                                    | Receptacle type NEMA L6-30R<br> | 39M5416         | United States, Canada, Latin America, Japan, and Taiwan |
| <b>6655</b>       | Power cord, PDU to wall <ul style="list-style-type: none"> <li>• 30 A plug (24 A derated)</li> <li>• Single phase<sup>1</sup></li> <li>• 4.3 m (14 ft)</li> <li>• RS 3750DP (Watertight)</li> </ul> |                           | 200 - 240 V ac                           |                                    |                                 | 39M5418         | United States, Canada, Latin America, Japan, and Taiwan |
| <b>6656</b>       | Power cord, PDU to wall <ul style="list-style-type: none"> <li>• 32 A</li> <li>• Single phase<sup>2</sup></li> <li>• 4.3 m (14 ft)</li> <li>• IEC 309, P+N+G</li> </ul>                             | Plug type 60309<br>     | 220 - 240 V ac                           | Connector type 60309               | Receptacle type 60309<br>     | 39M5414         | Europe, Middle East, Africa (EMEA)                      |
| <b>6657</b>       | Power cord, PDU to wall <ul style="list-style-type: none"> <li>• 32 A</li> <li>• Single phase<sup>2</sup></li> <li>• 4.3 m (14 ft)</li> <li>• PDL</li> </ul>                                        | Plug type 56P332<br>    | 220 - 240 V ac                           | Connector type 56P332              | Receptacle type 56CV332<br>   | 39M5419         | Australia and New Zealand                               |



Table 82. Supported PDU power cords for PDU feature codes (FCs) EPTG, EPTJ, EPTM, EPTN, ECJG, ECJJ, ECJM, and ECJN with Souriau inlet (continued)


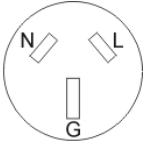
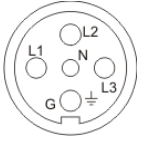
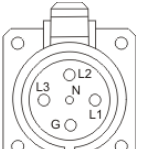

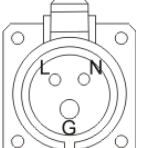


| Feature code (FC) | Description <ul style="list-style-type: none"> <li>• Amperage</li> <li>• Phase</li> <li>• Length</li> <li>• Wall plug</li> </ul>                                                                  | IBM shipped plug                                                                                        | Typical mains voltage range <sup>4</sup> | Matched female connector (on cord) | Matched female wall receptacle (on wall)                                                                        | IBM part number | General countries                        |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------|------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------|------------------------------------------|
| <b>6658</b>       | Power cord, PDU to wall <ul style="list-style-type: none"> <li>• 30 A plug (24 A derated)</li> <li>• Single phase<sup>2</sup></li> <li>• 4.3 m (14 ft)</li> <li>• Korean plug SJ-P3302</li> </ul> | Plug type KP 32A<br>   | 220 - 240 V ac                           | Connector type KP                  | Receptacle type KP<br>       | 39M5420         | South Korea                              |
| <b>6667</b>       | Power cord, PDU to wall <ul style="list-style-type: none"> <li>• 32 A</li> <li>• 3-phase wye</li> <li>• 4.3 m (14 ft)</li> <li>• PDL 56P532</li> </ul>                                            | Plug type 56P532<br>  | 220 - 240 V ac or 380 - 415 V ac         | Connector type 56P532              | Receptacle type 56P532<br>  | 69Y1619         | Australia and New Zealand                |
| <b>ELC1</b>       | Power cord, PDU to wall <ul style="list-style-type: none"> <li>• 30 A plug (24 A derated)</li> <li>• Single phase<sup>2</sup></li> <li>• 4.3 m (14 ft)</li> <li>• IEC 309 30A P+N+G</li> </ul>    | Plug type 330P6W<br> | 220 - 240 V ac                           | Connector type 330C6W              | Receptacle type 330R6W<br> | 03JJ281         | United States, Canada, Mexico, and Japan |
| <b>ELC2</b>       | Power cord, PDU to wall <ul style="list-style-type: none"> <li>• 30 A plug (24 A derated)</li> <li>• 3-phase wye</li> <li>• 4.3 m (14 ft)</li> <li>• IEC 309 30A 3P+N+G</li> </ul>                | Plug type 530P6W<br> | 220 - 240 V ac or 380 - 415 V ac         | Connector type 530C6W              | Receptacle type 532P6W<br> | 03FM499         | United States, Canada, Mexico, and Japan |

Table 82. Supported PDU power cords for PDU feature codes (FCs) EPTG, EPTJ, EPTM, EPTN, ECJG, ECJJ, ECJM, and ECJN with Souriau inlet (continued)

| Feature code (FC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Description <ul style="list-style-type: none"> <li>• Amperage</li> <li>• Phase</li> <li>• Length</li> <li>• Wall plug</li> </ul> | IBM shipped plug | Typical mains voltage range <sup>4</sup> | Matched female connector (on cord) | Matched female wall receptacle (on wall) | IBM part number | General countries |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|------------------|------------------------------------------|------------------------------------|------------------------------------------|-----------------|-------------------|
| <b>Note:</b> <ol style="list-style-type: none"> <li>1. The single phase wiring is line-to-line.</li> <li>2. The single phase wiring is line-to-neutral.</li> <li>3. FC 6654 supports only line-line-ground (L-L-G) wiring. It does not support line-neutral-ground (L-N-G) wiring. Options for L-N-G wiring in North American and Japan electrical distributions are FC 6655, FC ELC1, or FC ELC2.</li> <li>4. The typical mains voltage range is the expected range from the utility or a UPS. The normal operating voltage must be within the expected range. The tolerance around the range is -10% and +6% based on product safety testing. Receptacle quantity and voltage verification must be done before you connect PDUs by using the <i>Receptacle Quantity and Voltage Verification</i> procedure.</li> </ol> |                                                                                                                                  |                  |                                          |                                    |                                          |                 |                   |

Table 83. Supported PDU power cords for PDU feature codes ECJK, ECJL, ECJP, and ECJQ with Amphenol inlet

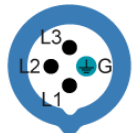
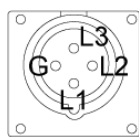



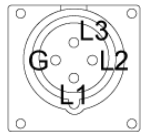
| Feature code (FC) | Description <ul style="list-style-type: none"> <li>• Amperage</li> <li>• Phase</li> <li>• Length</li> <li>• Wall plug</li> </ul>                               | IBM shipped plug                                                                                         | Typical mains voltage range <sup>1</sup> | Matched female connector (on cord) | Matched female wall receptacle (on wall)                                                                       | IBM part number | General countries                                |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|------------------------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------|--------------------------------------------------|
| <b>ECJ5</b>       | <ul style="list-style-type: none"> <li>• 30 A plug (24 A derated)</li> <li>• 3 phase delta</li> <li>• 4.3 m (14 ft)</li> <li>• IEC 309, 3P+G</li> </ul>        | Plug type 430P9W<br>  | 200 - 240 V ac                           | Connector type 430C9W              | Receptacle type 430R9W<br> | 02WN660         | United States, Canada, Latin America, and Japan, |
| <b>ECJ6</b>       | <ul style="list-style-type: none"> <li>• 50 A plug (40 A derated)</li> <li>• Three phase delta</li> <li>• 4.3 m (14 ft)</li> <li>• California style</li> </ul> | Plug type CS8365C<br> | 200 - 240 V ac                           | Connector type CS8364C             | Receptacle type CS8369<br> | 02WN662         | United States, Canada                            |

Table 83. Supported PDU power cords for PDU feature codes ECJK, ECJL, ECJP, and ECJQ with Amphenol inlet (continued)

| Feature code (FC) | Description <ul style="list-style-type: none"> <li>• Amperage</li> <li>• Phase</li> <li>• Length</li> <li>• Wall plug</li> </ul>                            | IBM shipped plug                                                                                      | Typical mains voltage range <sup>1</sup> | Matched female connector (on cord) | Matched female wall receptacle (on wall)                                                                     | IBM part number | General countries                               |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------|-----------------|-------------------------------------------------|
| ECJ7              | <ul style="list-style-type: none"> <li>• 60 A plug (48 A derated)</li> <li>• Three phase delta</li> <li>• 4.3 m (14 ft)</li> <li>• IEC 309, 3P+G</li> </ul> | Plug type 460P9W<br> | 200 - 240 V ac                           | Connector type 460C9W              | Receptacle type 460R9W<br> | 02WN658         | United States, Canada, Latin America, and Japan |

## Receptacle quantity

The quantity of ordered PDUs and PDU power cords must be reviewed carefully to confirm the number of receptacles (outlets, female connectors) match the number of attachment plugs that are on the PDU power cords. In addition, the compatibility of the receptacles and attachment plugs with the electrical distribution and wiring must be reviewed.

IBM recommends that an individual branch circuit is installed per receptacle. An individual branch circuit serves a single piece of equipment.

## Voltage verification

To verify 3-phase delta connection (3-phase, 3-wire delta system with ground), complete the following steps:

1. Turn on an individual branch circuit breaker.
2. Measure the 3-phase line-to-line voltages and line-to-ground (earth) voltages on the corresponding receptacle that is based on the feature code (FC) of the attachment plug. For more information, see [Table 84 on page 98](#) and [Table 85 on page 98](#).
3. Turn off an individual branch circuit breaker.
4. Repeat steps “1” on [page 97](#) - “3” on [page 97](#) for all remaining individual branch circuit breakers.
5. If any of the voltages are outside of the expected nominal voltage range and voltage tolerance, have a licensed electrician or installation electrician review and correct the wiring.

To verify 3-phase wye connection (3-phase, 4-wire wye system with ground), complete the following steps:

1. Turn on an individual branch circuit breaker.
2. Measure the 3-phase line-to-line voltages, line-to-neutral voltages, and line-to-ground (earth) voltages on the corresponding receptacle based on the feature code (FC) of the attachment plug. For more information, see [Table 86 on page 98](#).
3. Turn off an individual branch circuit breaker.
4. Repeat steps “1” on [page 97](#) - “3” on [page 97](#) for all remaining individual branch circuit breakers.
5. If any of the voltages are outside of the expected nominal voltage range and voltage tolerance, have a licensed electrician or installation electrician review and correct the wiring.

To verify Single-phase (line-to-line with ground), complete the following steps:

1. Turn on an individual branch circuit breaker.
2. Measure the single-phase line-to-line voltage or line-to-neutral voltage as well as the line-to-ground (earth) voltage and where applicable, the neutral-to-ground (earth) voltage on the corresponding receptacle based on the feature code (FC) of the attachment plug. For more information, see [Table 87 on page 99](#), [Table 88 on page 99](#), and [Table 89 on page 99](#).
3. Turn off an individual branch circuit breaker.
4. Repeat steps “1” on page 98 - “3” on page 98 for all remaining individual branch circuit breakers.
5. If any of the voltages are outside of the expected nominal voltage range and voltage tolerance, have a licensed electrician or installation electrician review and correct the wiring.

## Voltage measurements

The expected nominal voltage range in the following tables is from IBM PDU rated values. The measured voltage can be outside of the nominal voltage range that is based on allowable utility voltage regulation. For example, ANSI C84.1 provides the voltage tolerance above and below the nominal voltage range.

Voltage measurements must be performed by a Qualified Electrical Worker (QEW) as defined by NFPA 70E (Standard for Electrical Safety in the Workplace) or equivalent.

| Table 84. FC ECJ5 <sup>1</sup> , ECJ7 <sup>1</sup> |                                |
|----------------------------------------------------|--------------------------------|
| Measurement                                        | Expected Nominal Voltage Range |
| L1-L2                                              | 200 - 240 V                    |
| L2-L3                                              | 200 - 240 V                    |
| L3-L1                                              | 200 - 240 V                    |
| L1-G                                               | 100 - 127 V                    |
| L2-G                                               | 100 - 127 V                    |
| L3-G                                               | 100 - 127 V                    |

| Table 85. FC ECJ6 |                                |
|-------------------|--------------------------------|
| Measurement       | Expected Nominal Voltage Range |
| X-Y               | 200 - 240 V                    |
| Y-Z               | 200 - 240 V                    |
| Z-X               | 200 - 240 V                    |
| X-G               | 100 - 127 V                    |
| Y-G               | 100 - 127 V                    |
| Z-G               | 100 - 127 V                    |

| Table 86. FC 6489 <sup>2</sup> , 6653 <sup>2</sup> , 6667, ELC2 <sup>2</sup> |                                |
|------------------------------------------------------------------------------|--------------------------------|
| Measurement                                                                  | Expected Nominal Voltage Range |
| L1-L2                                                                        | 380 - 415 V                    |
| L2-L3                                                                        | 380 - 415 V                    |
| L3-L1                                                                        | 380 - 415 V                    |
| L1-N                                                                         | 220 - 240 V                    |
| L2-N                                                                         | 220 - 240 V                    |

Table 86. FC 6489<sup>2</sup>, 6653<sup>2</sup>, 6667, ELC2<sup>2</sup> (continued)

| Measurement | Expected Nominal Voltage Range |
|-------------|--------------------------------|
| L3-N        | 220 - 240 V                    |
| L1-G        | 220 - 240 V                    |
| L2-G        | 220 - 240 V                    |
| L3-G        | 220 - 240 V                    |

Table 87. FC 6491<sup>1</sup>, 6656<sup>1</sup>, 6658, ELC1<sup>1</sup>

| Measurement | Expected Nominal Voltage Range |
|-------------|--------------------------------|
| L1-N        | 220 - 240 V                    |
| L1-G        | 220 - 240 V                    |
| N-G         | less than 5 V                  |

Table 88. FC 6657

| Measurement | Expected Nominal Voltage Range |
|-------------|--------------------------------|
| A-N         | 220 - 240 V                    |
| A-G         | 220 - 240 V                    |
| N-G         | less than 5 V                  |

Table 89. FC 6492<sup>1</sup>, 6654, 6655

| Measurement | Expected Nominal Voltage Range |
|-------------|--------------------------------|
| X(L1)-Y(L2) | 200 - 240 V                    |
| X(L1)-G     | 100 - 127 V                    |
| Y(L2)-G     | 100 - 127 V                    |

#### Notes:

1. The housing of the receptacle is blue.
2. The housing of the receptacle is red.

## Modification of IBM-provided power cords

Modification of IBM-provided power cords must only be done in rare circumstances because the power cords that are provided with IBM systems meet stringent design and manufacturing specifications.

IBM encourages the use of an IBM released power cord because of the specifications that must be met for both the design and manufacture of our IBM power cords. The specifications, the components that are used in the design, and the manufacturing process is an external safety agency approved process that is audited by safety agencies on a periodic and ongoing basis to ensure quality and compliance with design requirements.

When a server leaves the manufacturing site, it is safety agency listed, therefore, IBM does not recommend modifying IBM-provided power cords. In the rare circumstance where modification of an IBM provided power cord is deemed essential, you must:

- Discuss the modification with their insurance provider to assess the effect, if any, on insurance coverage.

- Consult with a professional electrician regarding compliance with local codes.

The following excerpts from the Services Reference Manual (SRM) explains IBM policy on power cord alteration and the liabilities involved.

### **SRM excerpts**

A cable group that is associated with a purchased IBM machine, and bearing an IBM label, is the property of the IBM machine owner. All other IBM furnished cable groups (except those for which specific purchase invoices have been paid) are the property of IBM.

Customers assume all risks that are associated with turning a machine over to others for the performance of technical work such as, but not limited to, the installation or removal of features, alterations or attachments.

IBM will advise the customer of any limitation, resulting from the alteration, affecting IBM's ability to provide Warranty Service or Maintenance after review by the appropriate Service Delivery and Field Marketing Practices personnel.

### **Definition of an alteration**

An alteration is any change to an IBM machine that deviates from IBM physical, mechanical, electrical, or electronic design (including microcode) whether extra devices or parts are used. An alteration is also an interconnection at some place other than an IBM defined interface. See the Multiple Supplier Systems Bulletin for more detail.

For an altered machine, service is confined to the unaltered portions of the IBM machine.

After inspection, IBM will continue to make Warranty Service or Maintenance available, as appropriate, for the unaltered portion of an IBM machine.

IBM will not maintain the altered portion of an IBM machine under either an IBM Agreement or on an Hourly Service basis.

If you have more questions about power cord modification, contact an IBM service representative.

## **Uninterruptible power supply**

Uninterruptible power supplies are available to meet the power protection needs of IBM servers.

For more information about power warning and system shutdown events, or on making changes to the default configuration options such as system shutdown time when a power failure is detected, see:

- AIX®: [rc.powerfail Command](#)
- IBM i: [Uninterruptible power supply delay time system value](#)

### **Feature code ECCF (part number 00FV631) - System Port Converter Cable for UPS**

The ECCF is a converter cable that allows for communications from a UPS relay interface card to a service processor USB port. The server has two service processor USB 2.0 ports on the native I/O daughter card that are labeled 1 and 2. Either of these ports (1 or 2) can be used for the ECCF. Only one ECCF is allowed per server. The connectors on the ECCF include a male USB and a female 9-pin D-shell connector. The cable length is 1650 mm (65 inches).

The cable can be connected to either USB port 1 or USB port 2 at any time. It is not necessary to IPL the server for the server to recognize the cable. The cable contains active electronics that tell the service processor that a UPS is attached. The UPS can provide status information (such as UPS on, UPS utility fail, UPS battery low, and UPS bypass) over the cable to the physical hypervisor for broadcast to all partitions.

#### **Notes:**

1. The two service processor USB 2.0 ports that are labeled 1 and 2 correspond to location codes Un-P1-C1-T3 and Un-P1-C1-T4. For more information about location codes, see [Part locations and location codes](#).

2. Feature code (FC) ECCF is available for select systems.
3. The pin layout for the 9-pin D-shell connector is as follows:
  - **5** - Signal ground
  - **6** - UPS bypass
  - **7** - UPS battery low
  - **8** - UPS on
  - **9** - UPS utility fail
4. The UPS interface requires normally open (NO) contacts for the signal lines. The active signal level is 0 volts. The inactive signal level is an open circuit.

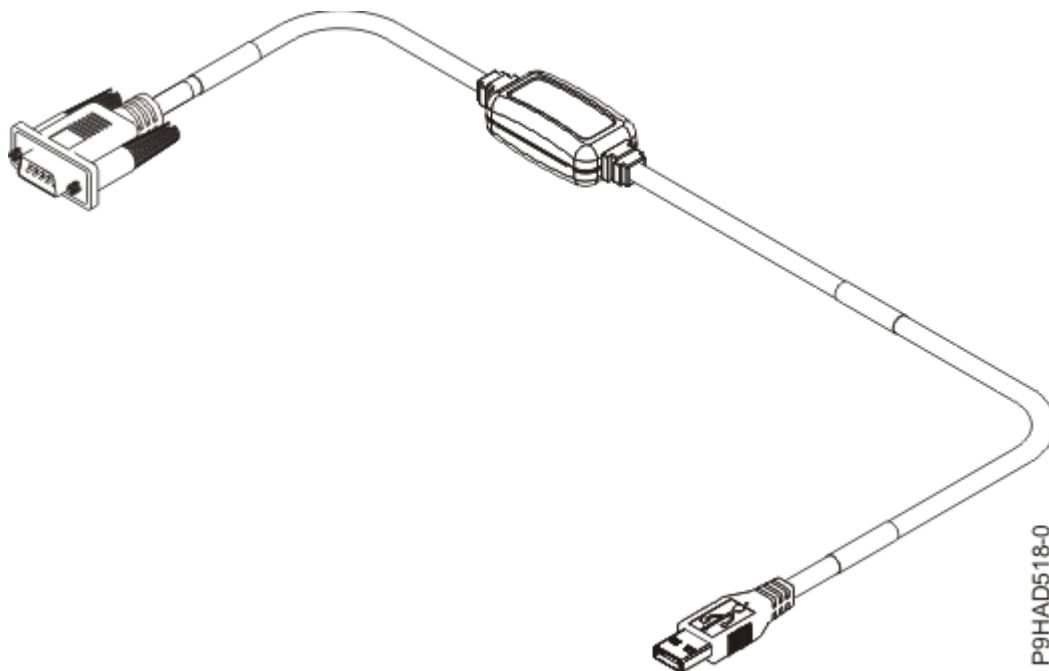


Figure 37. Feature code ECCF

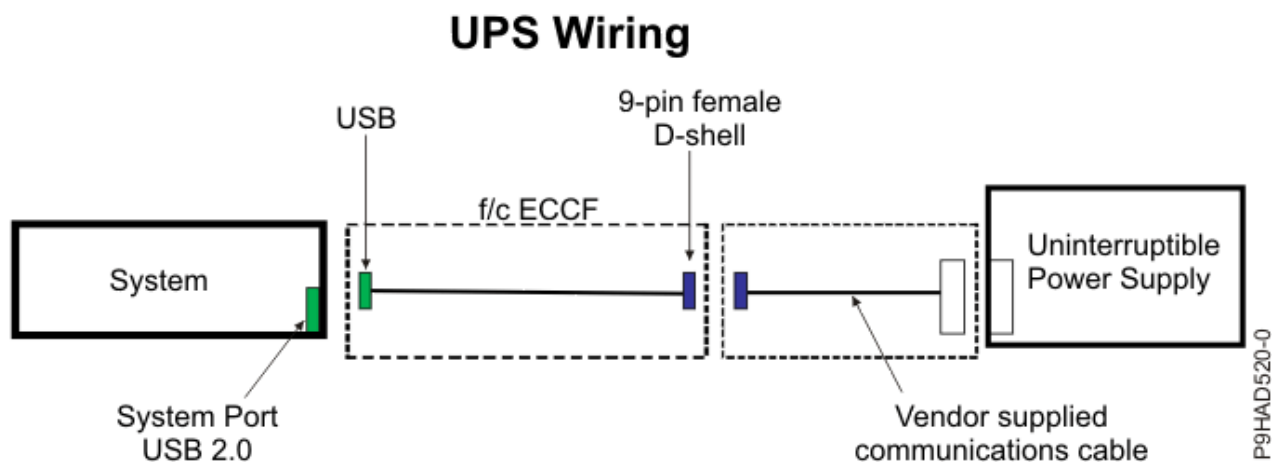


Figure 38. UPS wiring

## Power distribution unit and power cord options for 7014, 7953, and 7965 racks

Power distribution units (PDUs) can be used with 7014, 7953, and 7965 racks. The various configurations and specifications are provided.

### Power distribution unit

The following figure shows the four vertical PDU locations in 7014-T00, 7014-T42, 7014-B42, and 7965-S42 racks. The 7953-94X and 7965-94Y racks have six vertical PDU locations. Three locations are on the left side of the rack and three locations are on the right side of the rack.

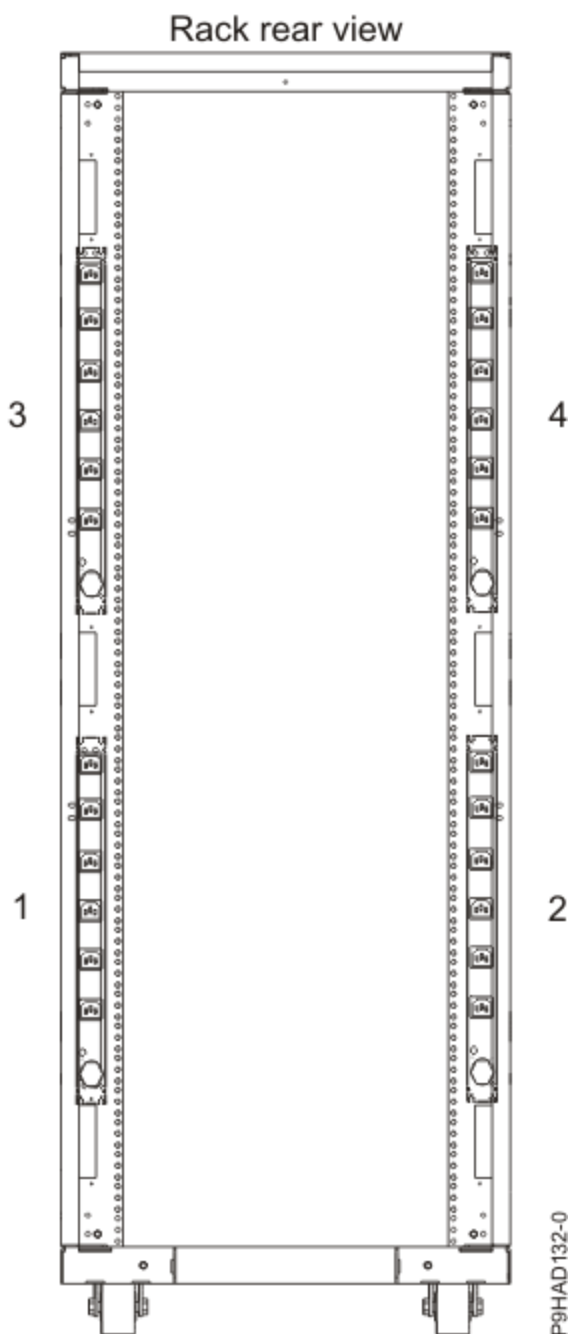


Figure 39. Power distribution unit vertical locations

Power distribution units (PDUs) are required for all IBM racks except for the 7014-B42 rack. If a PDU is not defaulted or ordered, a power cord is provided with each individual rack-mounted drawer



for connection to a country-specific utility mains receptacle or uninterruptible power supply. See the individual rack-mounted drawer specifications for the appropriate power cords.

## 7188 or 9188 universal PDU

| Table 90. 7188 or 9188 universal PDU features |                                                        |
|-----------------------------------------------|--------------------------------------------------------|
| PDU Number                                    | Supported power cords (PDU to wall)                    |
| 7188 or 9188 universal PDU                    | <a href="#">“Supported PDU power cords” on page 92</a> |

The amperage rating of the PDU is either 16 A, 24 A, 48 A, or 63 A, single phase or three-phase, depending on the power cord.

**Note:** All power cords are 4.3 m (14 ft). For installation in Chicago, only 2.8 m (6 ft) of the 4.3 m (14 ft) power cord can extend beyond the perimeter of the rack frame. If more than 2.8 m (6 ft) can exit the rack, retain any additional cordage within the rack frame with hook-and-loop fastener ties in the cable management space until 2.8 (6 ft) or less exits the rack.

The PDU has twelve customer-usable IEC 320-C13 outlets that are rated at 200 - 240 V ac. Six groups of two outlets that are fed by six circuit breakers. Each outlet is rated up to 10 A (220 - 240 V ac) or 12 A (200 - 208 V ac), but each group of two outlets is fed from one 20 A circuit breaker derated to 16 A.

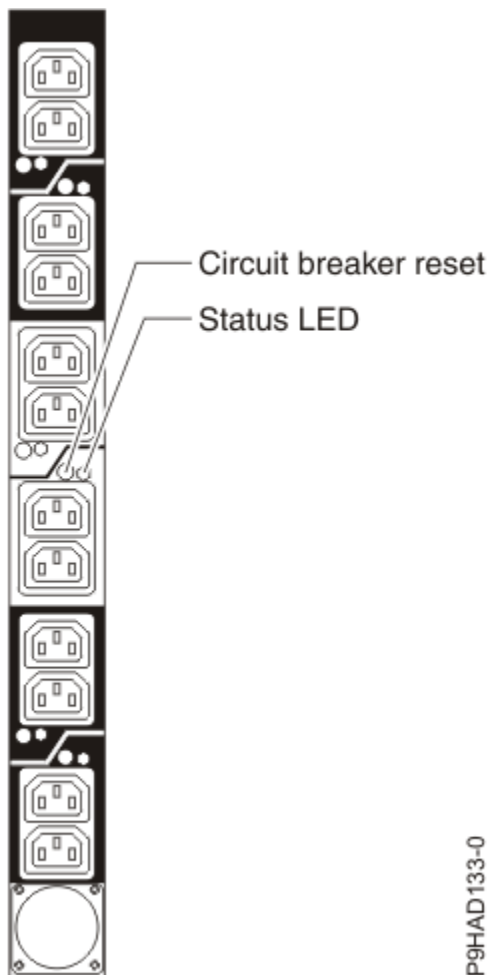


Figure 40. PDU outlet graphic

## Power distribution unit plus specifications

The power distribution unit plus (PDU+) has power-monitoring capabilities. The PDU+ is an intelligent AC power distribution unit (PDU+) that monitors the amount of power that is being used by the devices that are plugged into it. The PDU+ provides twelve C13 power outlets and receives power through a Souriau UTG connector. It can be used in many locations worldwide and for many applications by varying the PDU-to-wall power cord, which must be ordered separately. Each PDU+ requires one PDU-to-wall power cord. When the PDU+ is connected to a dedicated power source, it conforms to UL60950, CSA C22.2-60950, EN-60950, and IEC-60950 standards.

### 7109 or 5889 PDU+

| <i>Table 91. 7109 or 5889 PDU+ features</i> |                                                        |
|---------------------------------------------|--------------------------------------------------------|
| PDU Number                                  | Supported power cords (PDU to wall)                    |
| 7109 or 5889 PDU+                           | <a href="#">“Supported PDU power cords” on page 92</a> |

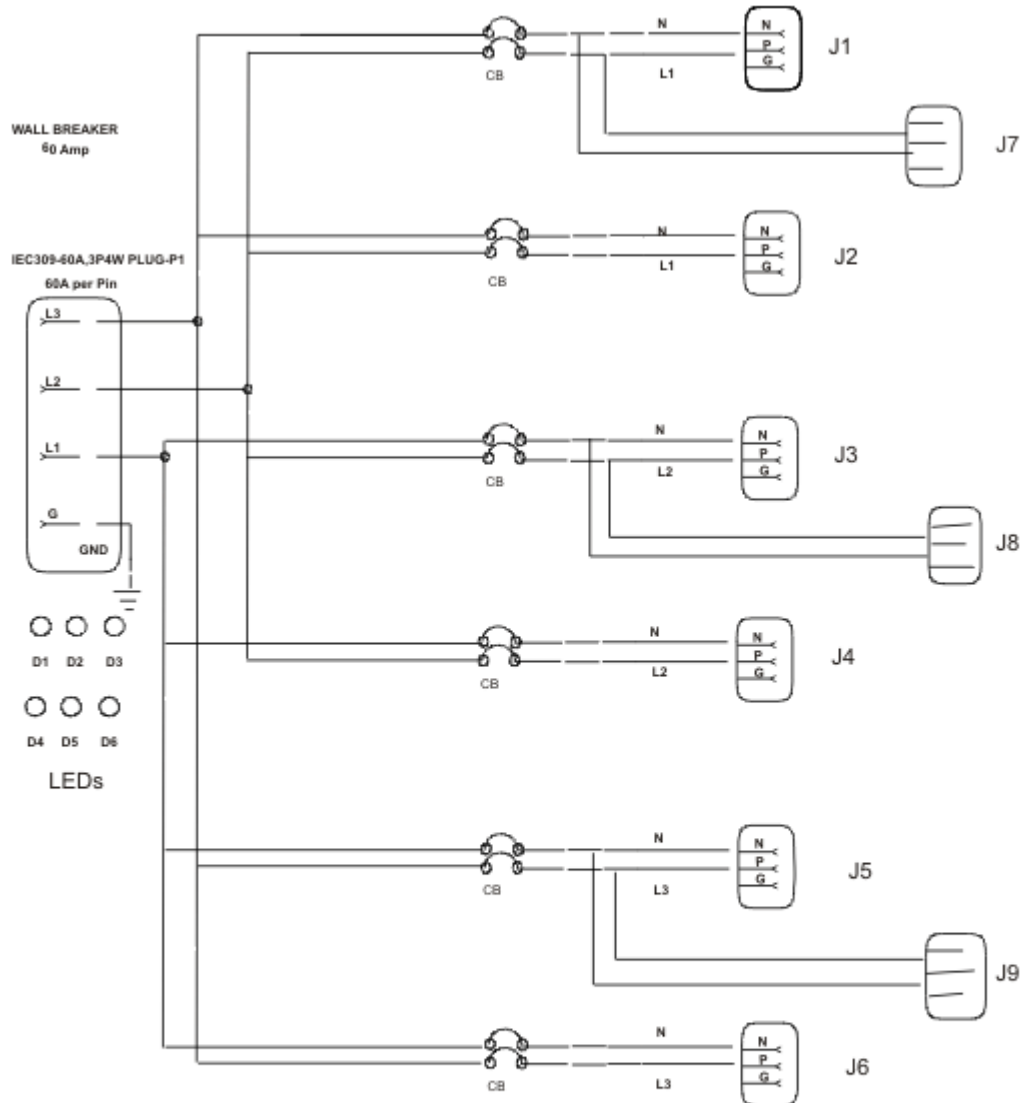
| <i>Table 92. 7109 PDU+ specifications</i>                             |                                                                      |
|-----------------------------------------------------------------------|----------------------------------------------------------------------|
| Characteristics                                                       | Properties                                                           |
| PDU number                                                            | 7109                                                                 |
| Height                                                                | 43.9 mm (1.73 in.)                                                   |
| Width                                                                 | 447 mm (17.6 in.)                                                    |
| Depth                                                                 | 350 mm (13.78 in.)                                                   |
| Additional clearance                                                  | 25 mm (0.98 in.) for circuit breakers                                |
|                                                                       | 3 mm (0.12 in.) for outlets                                          |
| Weight (not including power cord)                                     | 6.3 kg (13.8 lb)                                                     |
| Weight of power cord (approximate)                                    | 5.4 kg (11.8 lb)                                                     |
| Operating temperature at 0 - 914 m (0 - 3000 ft) (room ambient)       | 10°C - 32°C (50°F - 90°F)                                            |
| Operating temperature at 914 - 2133 m (3000 - 7000 ft) (room ambient) | 10°C - 35°C (50°F - 95°F)                                            |
| Operating humidity                                                    | 8% - 80% (noncondensing)                                             |
| Localized air temperature in PDU                                      | 60°C (140°F) maximum                                                 |
| Rated frequency (all feature codes)                                   | 50 - 60 Hz                                                           |
| Circuit breakers                                                      | Six double-pole branch rated circuit breakers that are rated at 20 A |
| Power outlet                                                          | 12 IEC 320-C13 outlets that are rated at 10 A (VDE) or 15 A (UL/CSA) |

### 7196 PDU+

| <i>Table 93. 7196 PDU+ features</i> |                                                  |
|-------------------------------------|--------------------------------------------------|
| PDU Number                          | Supported power cords (PDU to wall)              |
| 7196 PDU+                           | Fixed power cord with IEC 60309, 3P+E, 60 A plug |

| <i>Table 94. 7196 PDU+ specifications</i>                             |                                                                       |
|-----------------------------------------------------------------------|-----------------------------------------------------------------------|
| <b>Characteristics</b>                                                | <b>Properties</b>                                                     |
| PDU number                                                            | 7196                                                                  |
| Height                                                                | 43.9 mm (1.73 in.)                                                    |
| Width                                                                 | 447 mm (17.6 in.)                                                     |
| Depth                                                                 | 350 mm (13.78 in.)                                                    |
| Additional clearance                                                  | 25 mm (0.98 in.) for circuit breakers                                 |
|                                                                       | 3 mm (0.12 in.) for outlets                                           |
| Weight (not including power cord)                                     | 6.3 kg (13.8 lb)                                                      |
| Weight of power cord (approximate)                                    | 5.4 kg (11.8 lb)                                                      |
| Operating temperature at 0 - 914 m (0 - 3000 ft) (room ambient)       | 10 - 32°C (50 - 90°F)                                                 |
| Operating temperature at 914 - 2133 m (3000 - 7000 ft) (room ambient) | 10 - 35°C (50 - 95°F)                                                 |
| Operating humidity                                                    | 8 - 80% (noncondensing)                                               |
| Localized air temperature in PDU                                      | 60 °C (140 °F) maximum                                                |
| Rated frequency (all feature codes)                                   | 50 - 60 Hz                                                            |
| Circuit breakers                                                      | Six double-pole branch rated circuit breakers that are rated at 20 A  |
| Power outlet                                                          | Six IEC 320-C19 outlets that are rated at 16 A (VDE) or 20 A (UL/CSA) |

200-208Vac 3 Phase Delta, 48A, (39M2819).



#### NOTES:

1. GND WIRE AT J (14 AWG).
2. P1 TO BREAKER, (6 AWG).
3. BREAKER TO RY or J, (14 AWG).
4. P1 TO GROUND, G (6 AWG).

Figure 41. Wiring diagram for the 7196 PDU+

P9HAD006-0

## HVDC PDU

| Table 95. HVDC PDU features |                                     |
|-----------------------------|-------------------------------------|
| PDU Number                  | Supported power cords (PDU to wall) |
| EPAA                        | Not applicable - fixed power cord   |

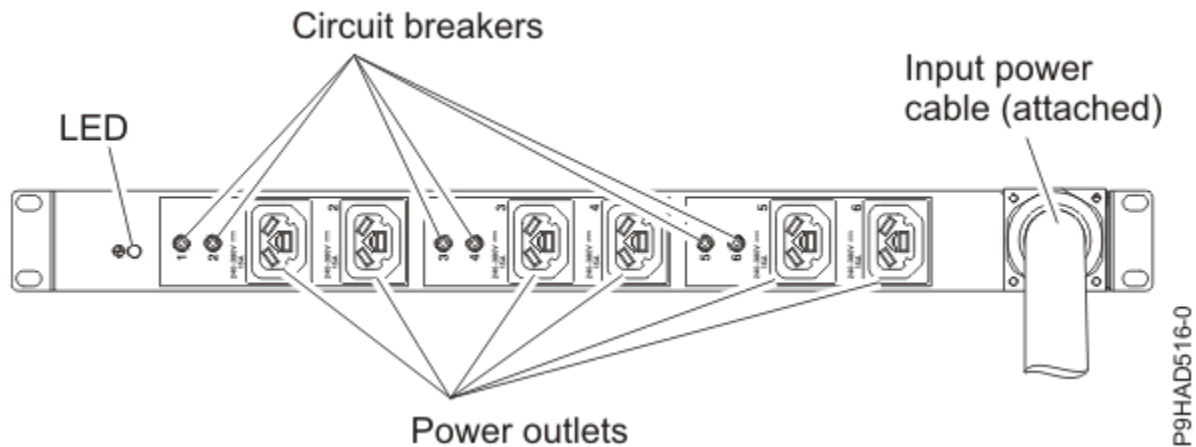


Figure 42. HVDC PDU

The rating of the HVDC PDU is 240 - 380 V dc, 90 A. The HVDC PDU has a permanently attached 4.3 m (14 ft) power cord and is unterminated (no plug). The minimum cross-sectional area of the two conductors and grounding conductor is 16 AWG (1.3 mm).

This PDU has six customer-usuable Rong Feng RF-203P outlets that are rated at 240 - 380 V dc. Each outlet is rated up to 10 A and is fed from one 20 A circuit breaker derated to 16 A. The HVDC PDU does not have the nationally recognized test laboratory certification that is required for use in North America.

This PDU can be either vertically mounted in the rack side pockets or horizontally mounted by using feature code (FC) EBA5 (mounting kit). If horizontally mounted, the PDU uses 1U of rack space.

## Intelligent Switched PDU

Table 96. Intelligent Switched PDU features

| Feature code (FC) | Description <ul style="list-style-type: none"> <li>Voltage</li> <li>Amperage</li> <li>Phase</li> </ul>                                                                 | Provided power receptacles                  | Supported power cords (PDU to wall)                            |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|----------------------------------------------------------------|
| EPTG (Base)       | <ul style="list-style-type: none"> <li>200 - 240 V ac</li> <li>Single phase or three phase<sup>1</sup></li> <li>16 A, 24 A, 32 A, 48 A, or 63 A<sup>1</sup></li> </ul> | 9 IEC 320-C19 and 3 IEC 320-C13 receptacles | <a href="#">“Supported PDU power cords” on page 92</a>         |
| EPTJ (Additional) |                                                                                                                                                                        |                                             |                                                                |
| EPTK (Base)       | <ul style="list-style-type: none"> <li>208 V ac</li> <li>60 A</li> <li>Three-phase</li> </ul>                                                                          | 9 IEC 320-C19 and 3 IEC 320-C13 receptacles | Not applicable - fixed IEC 60309, 60 A, plug (3P+G) power cord |
| EPTL (Additional) |                                                                                                                                                                        |                                             |                                                                |
| EPTM (Base)       | <ul style="list-style-type: none"> <li>200 - 240 V ac</li> <li>Single phase or three phase<sup>1</sup></li> <li>16 A, 24 A, 32 A, 48 A, or 63 A<sup>1</sup></li> </ul> | Twelve IEC 320-C13 receptacles              | <a href="#">“Supported PDU power cords” on page 92</a>         |
| EPTN (Additional) |                                                                                                                                                                        |                                             |                                                                |

Table 96. Intelligent Switched PDU features (continued)

| Feature code (FC) | Description <ul style="list-style-type: none"><li>• Voltage</li><li>• Amperage</li><li>• Phase</li></ul> | Provided power receptacles     | Supported power cords (PDU to wall)                            |
|-------------------|----------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------|
| EPTP (Base)       | <ul style="list-style-type: none"><li>• 208 V ac</li><li>• 60 A</li><li>• Three-phase</li></ul>          | Twelve IEC 320-C13 receptacles | Not applicable - fixed IEC 60309, 60 A, plug (3P+G) power cord |
| EPTQ (Additional) |                                                                                                          |                                |                                                                |

<sup>1</sup>Amperage and phase depend on the power cord that is used. Three phase is wye wired. The voltage is 380 - 415 V ac at the PDU input and 220 - 240 V ac at the PDU output.

Table 97. Intelligent Switched PDU specifications

| Characteristics                                                       | Properties                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Height                                                                | 43.9 mm (1.73 in.)                                                                                                                                                                                                                                                                                                      |
| Width                                                                 | 447 mm (17.6 in.)                                                                                                                                                                                                                                                                                                       |
| Depth                                                                 | 350 mm (13.78 in.)                                                                                                                                                                                                                                                                                                      |
| Additional clearance                                                  | 25 mm (0.98 in.) for circuit breakers                                                                                                                                                                                                                                                                                   |
|                                                                       | 3 mm (0.12 in.) for outlets                                                                                                                                                                                                                                                                                             |
| Weight (not including power cord)                                     | 6.3 kg (13.8 lb)                                                                                                                                                                                                                                                                                                        |
| Weight of power cord (approximate)                                    | 5.4 kg (11.8 lb)                                                                                                                                                                                                                                                                                                        |
| Operating temperature at 0 - 914 m (0 - 3000 ft) (room ambient)       | 10°C - 60°C (50°F - 140°F)                                                                                                                                                                                                                                                                                              |
| Operating temperature at 914 - 2133 m (3000 - 7000 ft) (room ambient) | 10°C - 60°C (50°F - 140°F)                                                                                                                                                                                                                                                                                              |
| Operating humidity                                                    | 8 - 80% (noncondensing)                                                                                                                                                                                                                                                                                                 |
| Localized air temperature in PDU                                      | 60 °C (140 °F) maximum                                                                                                                                                                                                                                                                                                  |
| Rated frequency (all feature codes)                                   | 50 - 60 Hz                                                                                                                                                                                                                                                                                                              |
| Circuit breakers                                                      | <p>Six double-pole branch rated circuit breakers that are rated at 20 amps for 1U C19 PDU models.</p> <p>Six double-pole branch rated circuit breakers that are rated at 20 amps for 1U C13 PDU models.</p> <p>All circuit breakers are derated to 16 A per information technology product safety design standards.</p> |

The intelligent switched AC power distribution unit (PDU) provides the capability to monitor the amount of electrical power that is being used by devices that are plugged into the PDU. The PDU can also cycle power to individual receptacles by using the switched function.

## Intelligent Switched PDU+

| Feature code (FC)                                                                                                                                                                                                                                                                                                                                                                | Description <ul style="list-style-type: none"><li>• Voltage</li><li>• Amperage</li><li>• Phase</li></ul>                                                                 | Provided power receptacles                  | Supported power cords (PDU to wall)                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------|
| ECJG (Base)                                                                                                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"><li>• 200 - 240 V ac</li><li>• Single phase or three phase<sup>1</sup></li><li>• 16 A, 24 A, 32 A, 48 A, or 63 A<sup>1</sup></li></ul> | 9 IEC 320-C19 and 3 IEC 320-C13 receptacles | <a href="#">“Supported PDU power cords” on page 92</a> |
| ECJJ (Additional)                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                          |                                             |                                                        |
| ECJK (Base)                                                                                                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"><li>• 200 - 240 V ac</li><li>• 24 A, 40 A, 48 A</li><li>• Three-phase<sup>2</sup></li></ul>                                            | 9 IEC 320-C19 and 3 IEC 320-C13 receptacles | <a href="#">“Supported PDU power cords” on page 92</a> |
| ECJL (Additional)                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                          |                                             |                                                        |
| ECJM (Base)                                                                                                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"><li>• 200 - 240 V ac</li><li>• Single phase or three phase<sup>1</sup></li><li>• 16 A, 24 A, 32 A, 48 A, or 63 A<sup>1</sup></li></ul> | Twelve IEC 320-C13 receptacles              | <a href="#">“Supported PDU power cords” on page 92</a> |
| ECJN (Additional)                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                          |                                             |                                                        |
| ECJP (Base)                                                                                                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"><li>• 200 - 240 V ac</li><li>• 24 A, 40 A, 48 A</li><li>• Three-phase<sup>2</sup></li></ul>                                            | Twelve IEC 320-C13 receptacles              | <a href="#">“Supported PDU power cords” on page 92</a> |
| ECJQ (Additional)                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                          |                                             |                                                        |
| <b>Notes:</b> <ul style="list-style-type: none"><li>1. Amperage and phase depend on the power cord that is used. Three phase is wye wired. The voltage is 380 - 415 V ac at the PDU input and 220 - 240 V ac at the PDU output. The single phase wiring is line-to-line and the expected voltage input range is 200 - 240 V ac.</li><li>2. Three phase is delta wired.</li></ul> |                                                                                                                                                                          |                                             |                                                        |

| Table 99. Intelligent Switched PDU+ specifications              |                                       |
|-----------------------------------------------------------------|---------------------------------------|
| Characteristics                                                 | Properties                            |
| Height                                                          | 42.5 mm (1.67 in.)                    |
| Width                                                           | 447.5 mm (17.6 in.)                   |
| Depth                                                           | 351 mm (13.82 in.)                    |
| Additional clearance                                            | 25 mm (0.98 in.) for circuit breakers |
|                                                                 | 3 mm (0.12 in.) for outlets           |
| Weight                                                          | C19 PDU models: 5.25 kg (11.6 lb)     |
|                                                                 | C13 PDU models: 4.3 kg (9.5 lb)       |
| Operating temperature at 0 - 914 m (0 - 3000 ft) (room ambient) | 10°C - 60°C (50°F - 140°F)            |

| Table 99. Intelligent Switched PDU+ specifications (continued)        |                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Characteristics                                                       | Properties                                                                                                                                                                                                                                                                                                              |
| Operating temperature at 914 - 2133 m (3000 - 7000 ft) (room ambient) | 10°C - 60°C (50°F - 140°F)                                                                                                                                                                                                                                                                                              |
| Operating humidity                                                    | 8 - 80% (noncondensing)                                                                                                                                                                                                                                                                                                 |
| Localized air temperature in PDU                                      | 60 °C (140 °F) maximum                                                                                                                                                                                                                                                                                                  |
| Rated frequency (all feature codes)                                   | 50 - 60 Hz                                                                                                                                                                                                                                                                                                              |
| Circuit breakers                                                      | <p>Six double-pole branch rated circuit breakers that are rated at 20 amps for 1U C19 PDU models.</p> <p>Six double-pole branch rated circuit breakers that are rated at 20 amps for 1U C13 PDU models.</p> <p>All circuit breakers are derated to 16 A per information technology product safety design standards.</p> |

The intelligent switched AC power distribution unit (PDU+) provides the capability to monitor the amount of electrical power that is being used by devices that are plugged into the PDU. The PDU can also cycle power to individual receptacles by using the switched function.

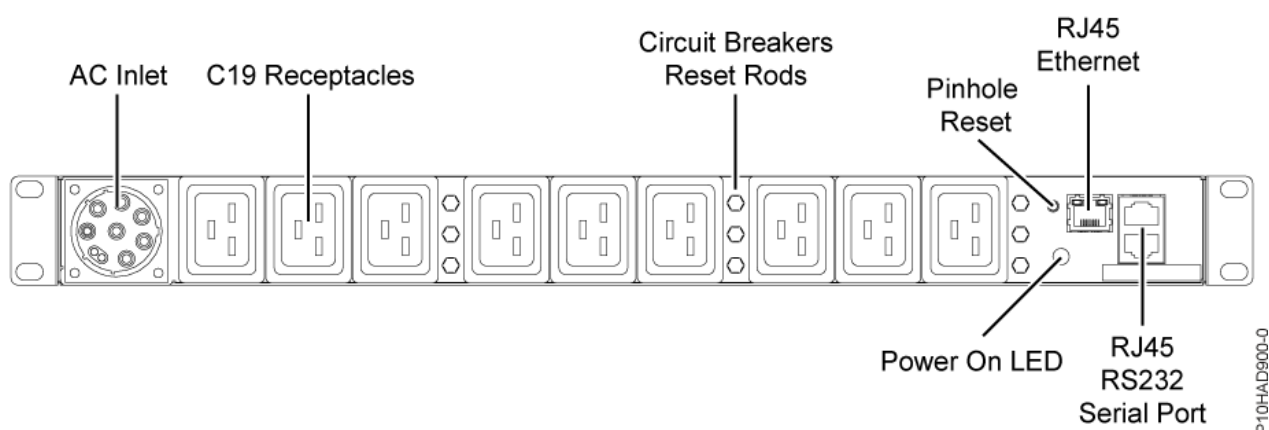


Figure 43. FC ECJJ (front view)

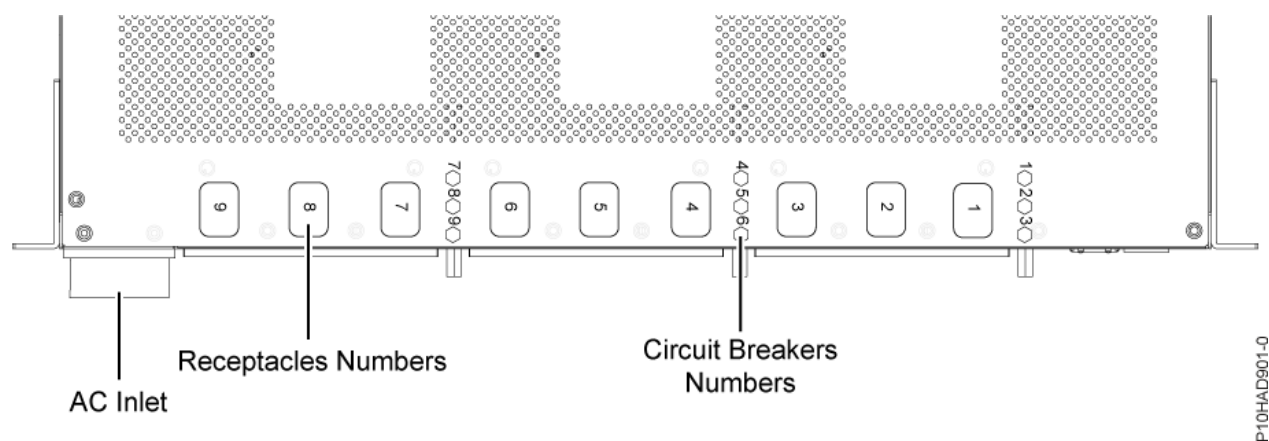


Figure 44. FC ECJJ (side view)



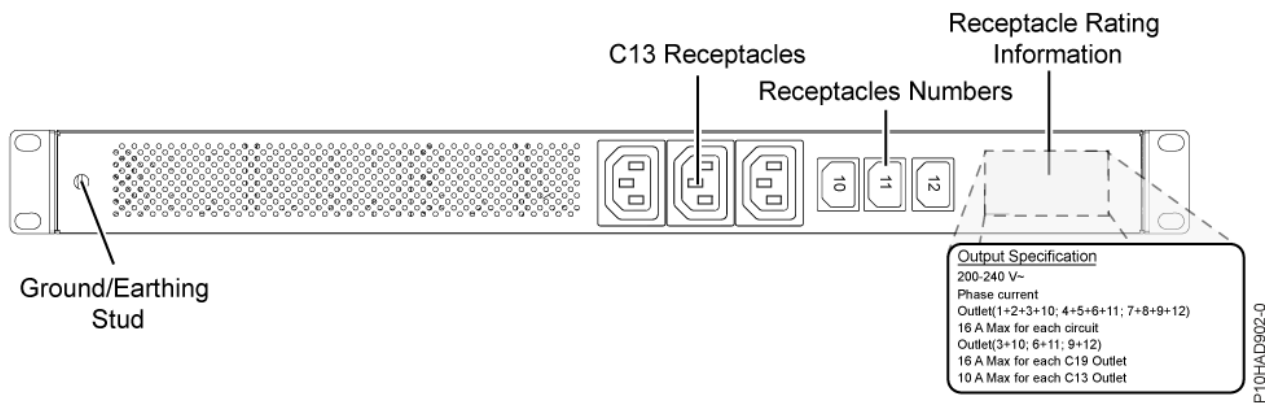


Figure 45. FC ECJJ (rear view)

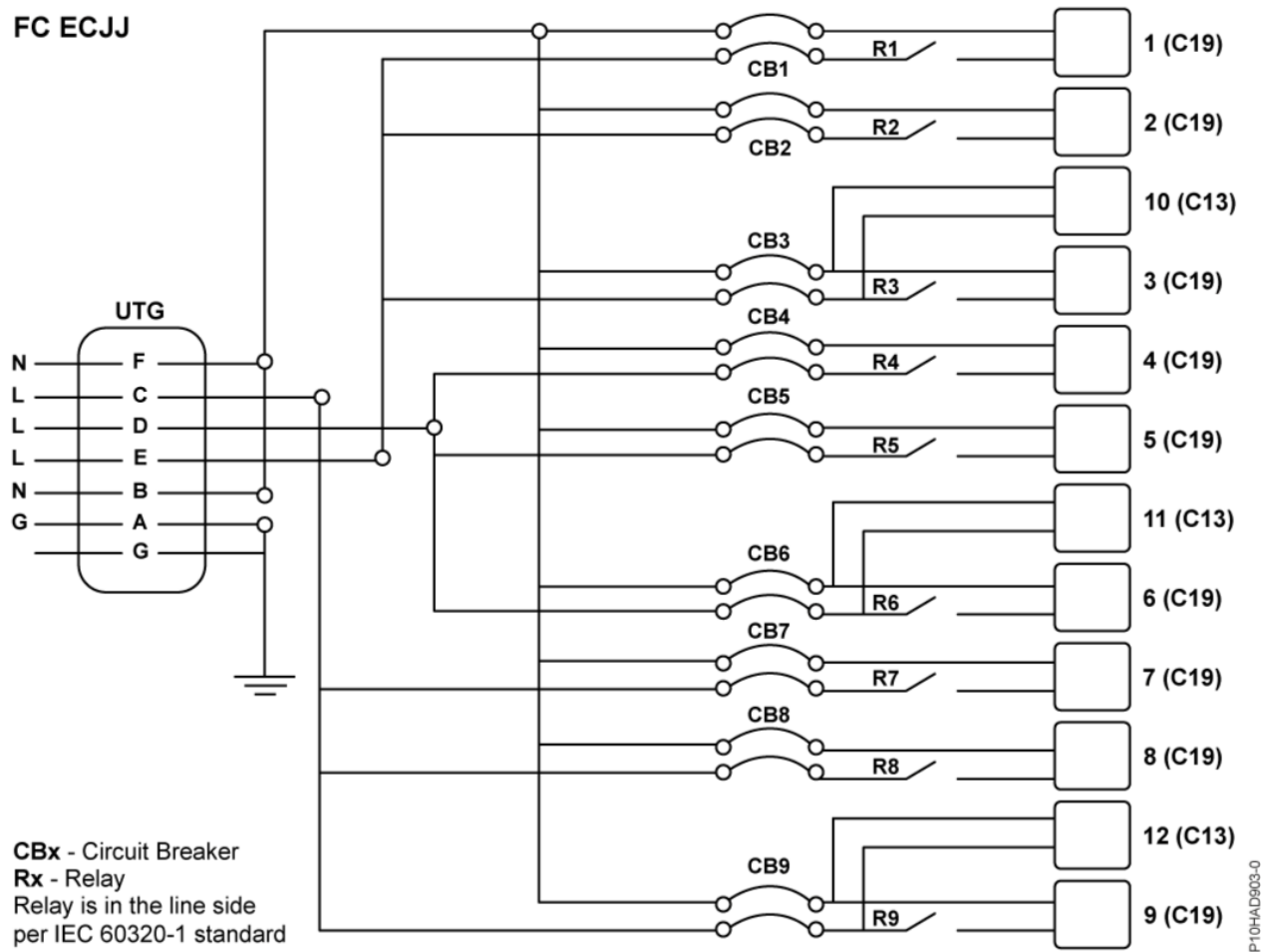


Figure 46. Wiring diagram for FC ECJJ

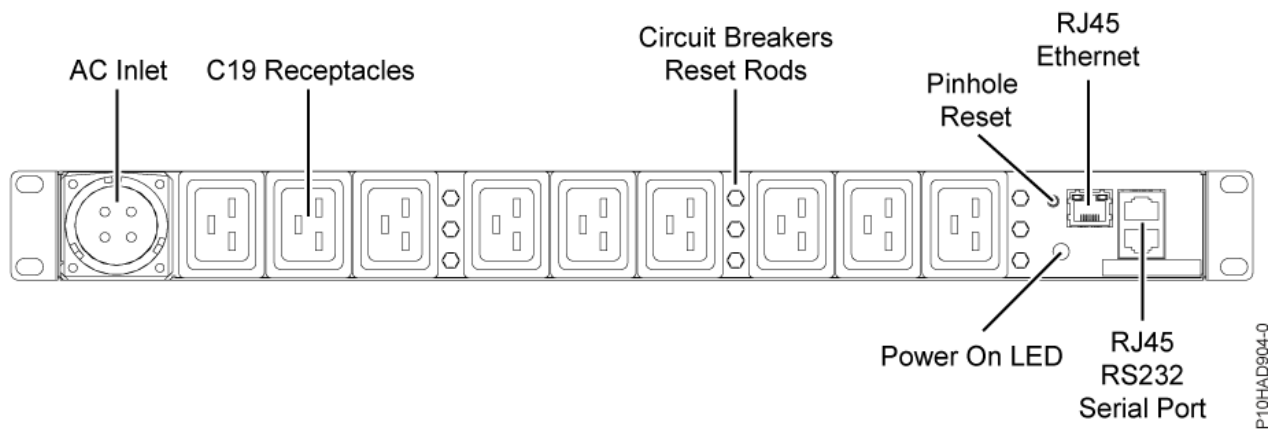


Figure 47. FC ECJL (front view)

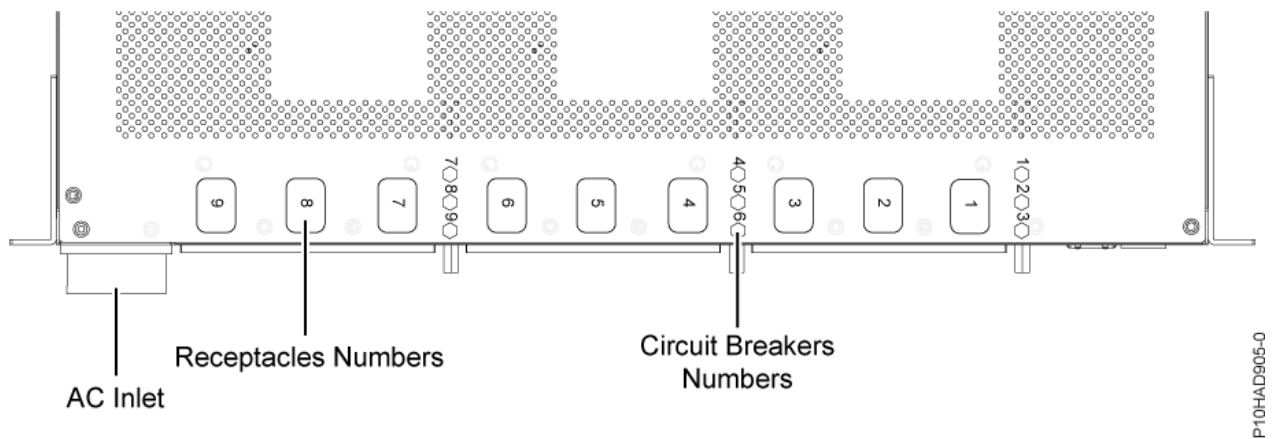


Figure 48. FC ECJL (side view)

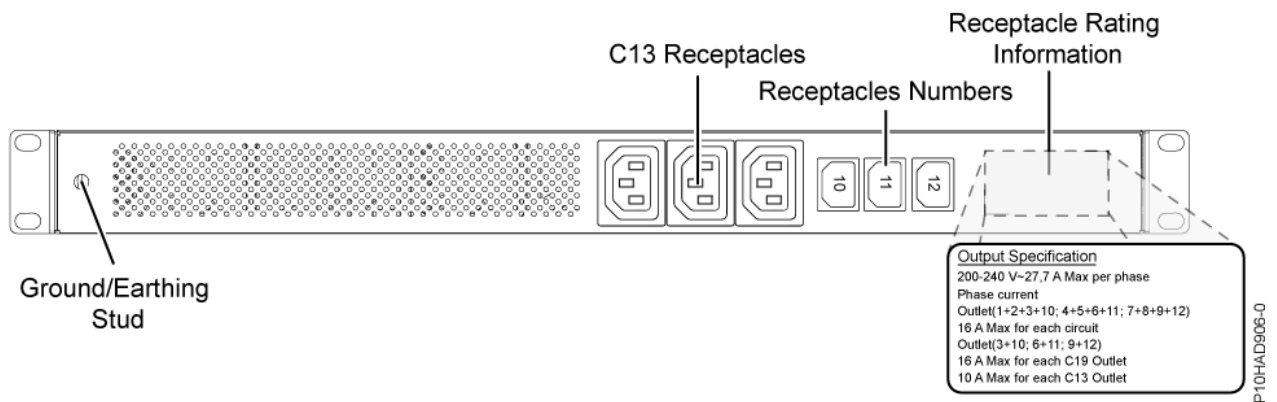


Figure 49. FC ECJL (rear view)

## FC ECJL

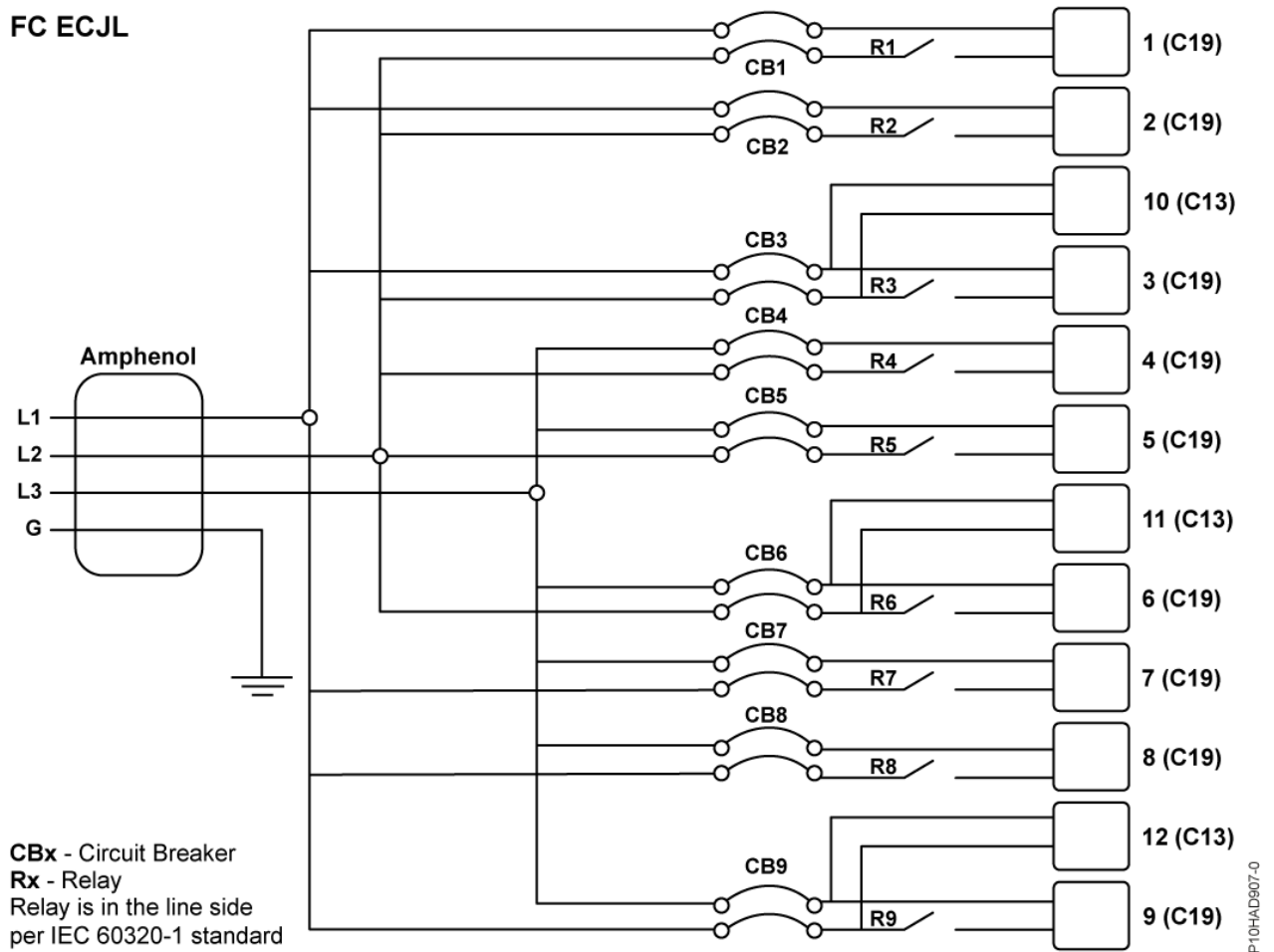


Figure 50. Wiring diagram for FC ECJL

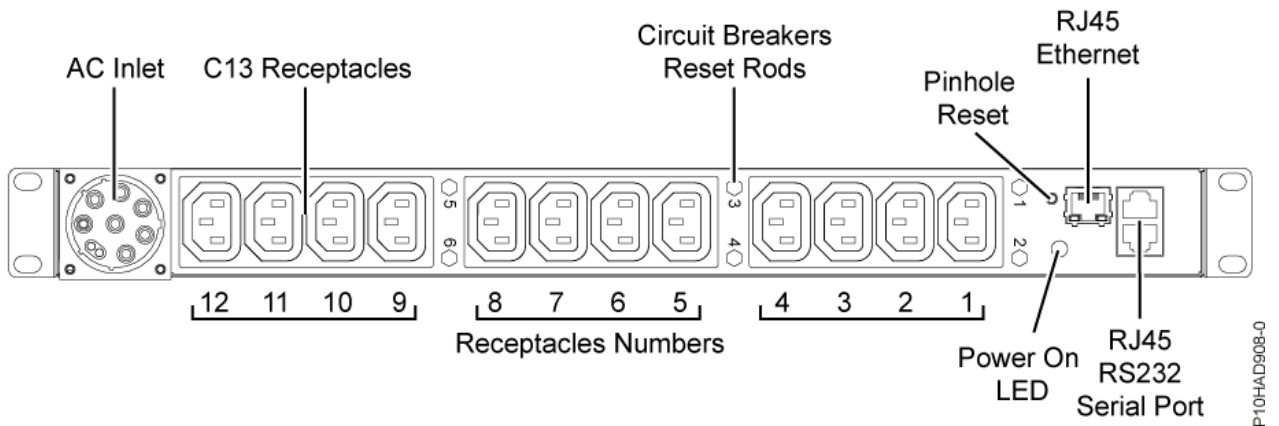


Figure 51. FC ECJN (front view)

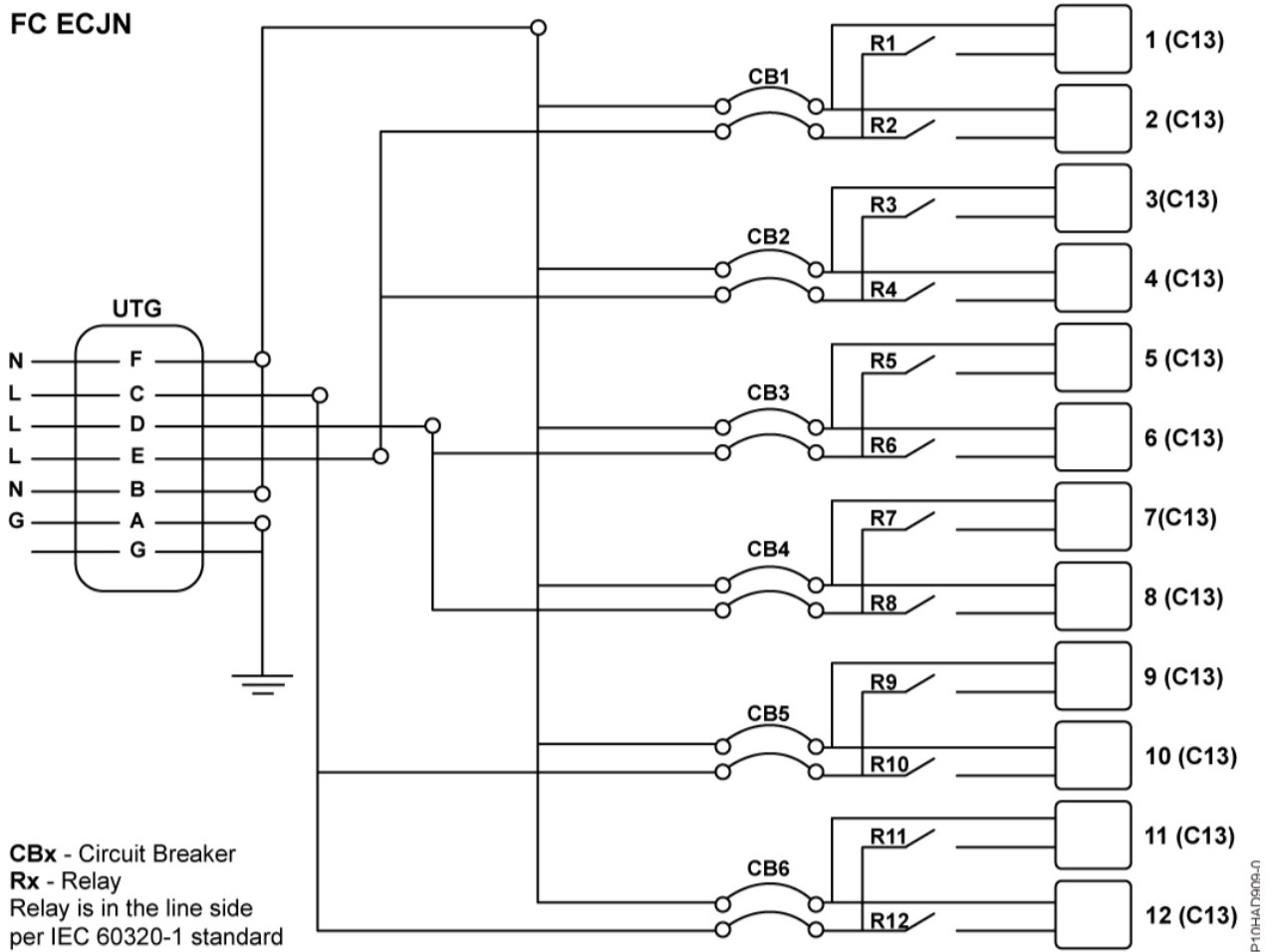


Figure 52. Wiring diagram for FC ECJN

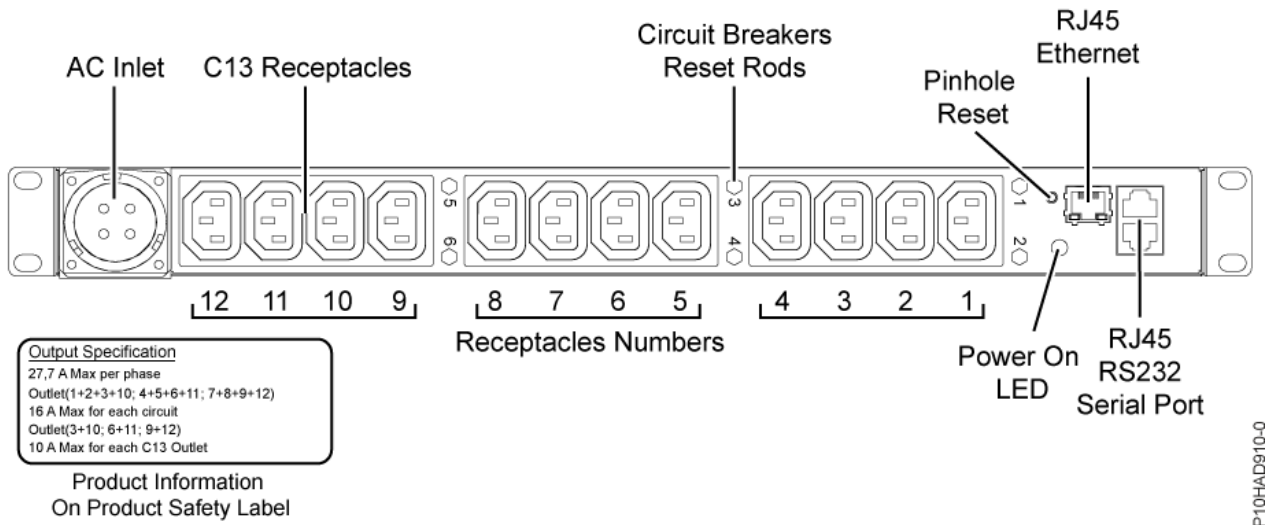


Figure 53. FC ECJQ (front view)

## FC ECJQ

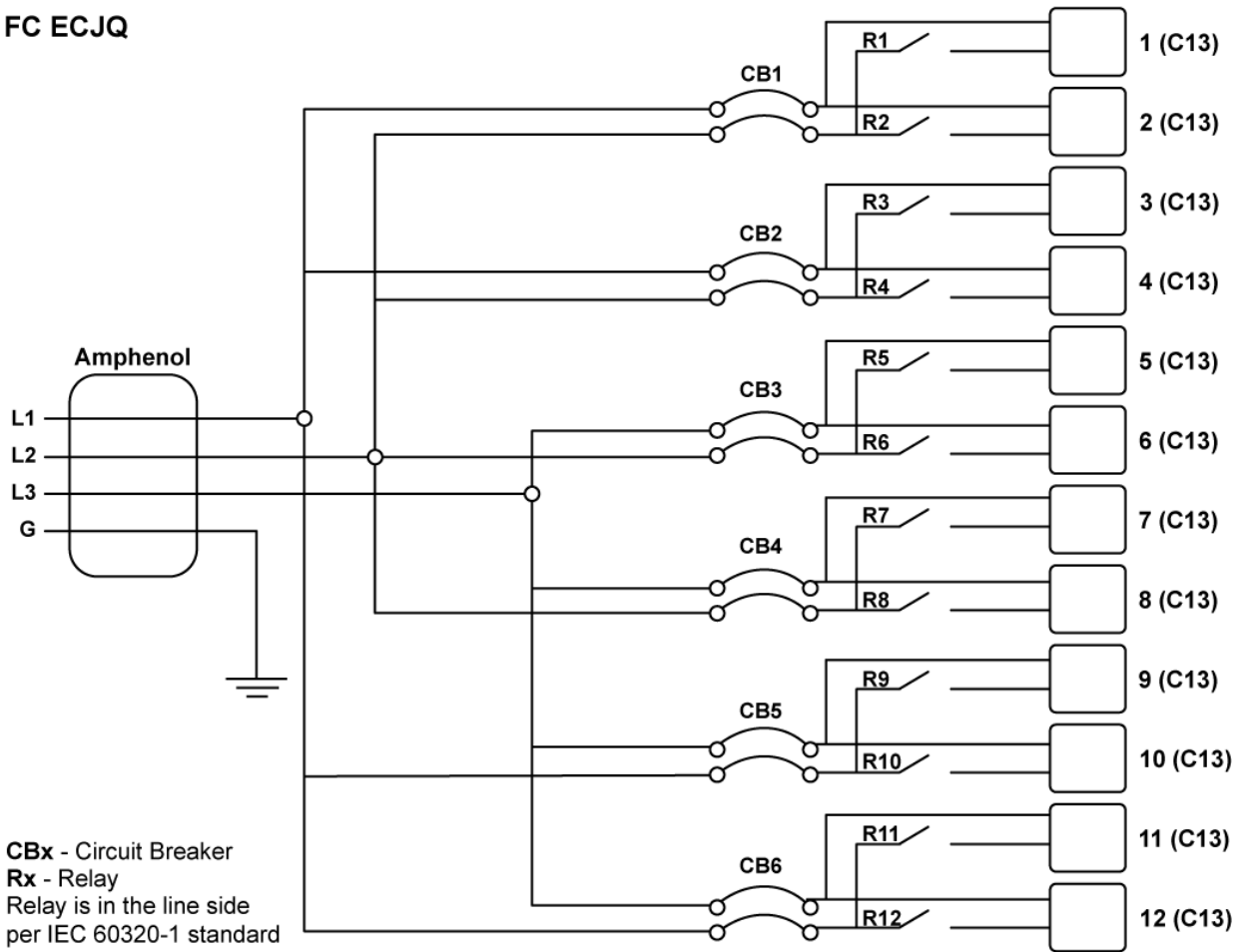


Figure 54. Wiring diagram for FC ECJQ

## Calculating the power load for 7188 or 9188 power distribution units

Learn how to calculate the power load for power distribution units.

### Rack-mounted 7188 or 9188 power distribution unit

Learn about the power loading requirements and proper loading sequence for the 7188 or 9188 power distribution unit.

The IBM 7188 or 9188 rack-mounted power distribution unit (PDU) contains 12 IEC 320-C13 outlets that are connected to six 20 amps (A) circuit breakers (two outlets per circuit breaker). The PDU employs an inlet current that allows various power cord options that are listed in the following chart. Based on the power cord that is used, the PDU can supply from 24 amps to 63 amps.

Table 100. Power cord options

| Feature code | Power cord description                                                                                   | Amps                |
|--------------|----------------------------------------------------------------------------------------------------------|---------------------|
| 6489         | Power cord, PDU to wall, 4.3 m (14 ft), 230 V ac, 3-phase wye, Souriau UTG, IEC 60309, 3P+N+E plug       | 96 A (32 A x 3)     |
| 6491         | Power cord, PDU to wall, 4.3 m (14 ft), 200 - 240 V ac, single phase, Souriau UTG, IEC 60309, P+N+E plug | 63 A                |
| 6492         | Power cord, PDU to wall, 4.3 m (14 ft), 200 - 240 V ac, single phase, Souriau UTG, IEC 60309, 2P+E plug  | 60 A (48 A derated) |

| <i>Table 100. Power cord options (continued)</i> |                                                                                                          |                     |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------|---------------------|
| <b>Feature code</b>                              | <b>Power cord description</b>                                                                            | <b>Amps</b>         |
| 6653                                             | Power cord, PDU to wall, 4.3 m (14 ft), 230 V ac, 3-phase wye, Souriau UTG, IEC 60309, 3P+N+E plug       | 48 A (16 A x 3)     |
| 6654                                             | Power cord, PDU to wall, 4.3 m (14 ft), 200 - 240 V ac, single phase, Souriau UTG, plug type 12 plug     | 30 A (24 A derated) |
| 6655                                             | Power cord, PDU to wall, 4.3 m (14 ft), 200 - 240 V ac, single phase, Souriau UTG, plug type 40 plug     | 30 A (24 A derated) |
| 6656                                             | Power cord, PDU to wall, 4.3 m (14 ft), 200 - 240 V ac, single phase, Souriau UTG, IEC 60309, P+N+E plug | 32 A                |
| 6657                                             | Power cord, PDU to wall, 4.3 m (14 ft), 200 - 240 V ac, single phase, Souriau UTG, plug type PDL plug    | 32 A                |
| 6658                                             | Power cord, PDU to wall, 4.3 m (14 ft), 200 - 240 V ac, single phase, Souriau UTG, plug type KP plug     | 30 A (24 A derated) |
| 6667                                             | Power cord, PDU to wall, 4.3 m (14 ft), 230 - 240 V ac, 3-phase wye, PDL 56P532                          | 96 A (32 A x 3)     |

## Loading requirements

The power loading of the 7188 or 9188 PDU must follow these rules:

1. Total power load that is connected to the PDU must be limited to below the amperage that is listed in the table.
2. Total power load that is connected to any one circuit breaker must be limited to 16 A (derating of circuit breaker).
3. Total power load that is connected to any one IEC320-C13 outlet must be limited to 10 A.

**Note:** The load on the PDU when a dual line configuration is used is only half of the total load of the system. When you are calculating the power load on the PDU, you must include the total power load of each drawer even if the load is distributed over two PDUs.

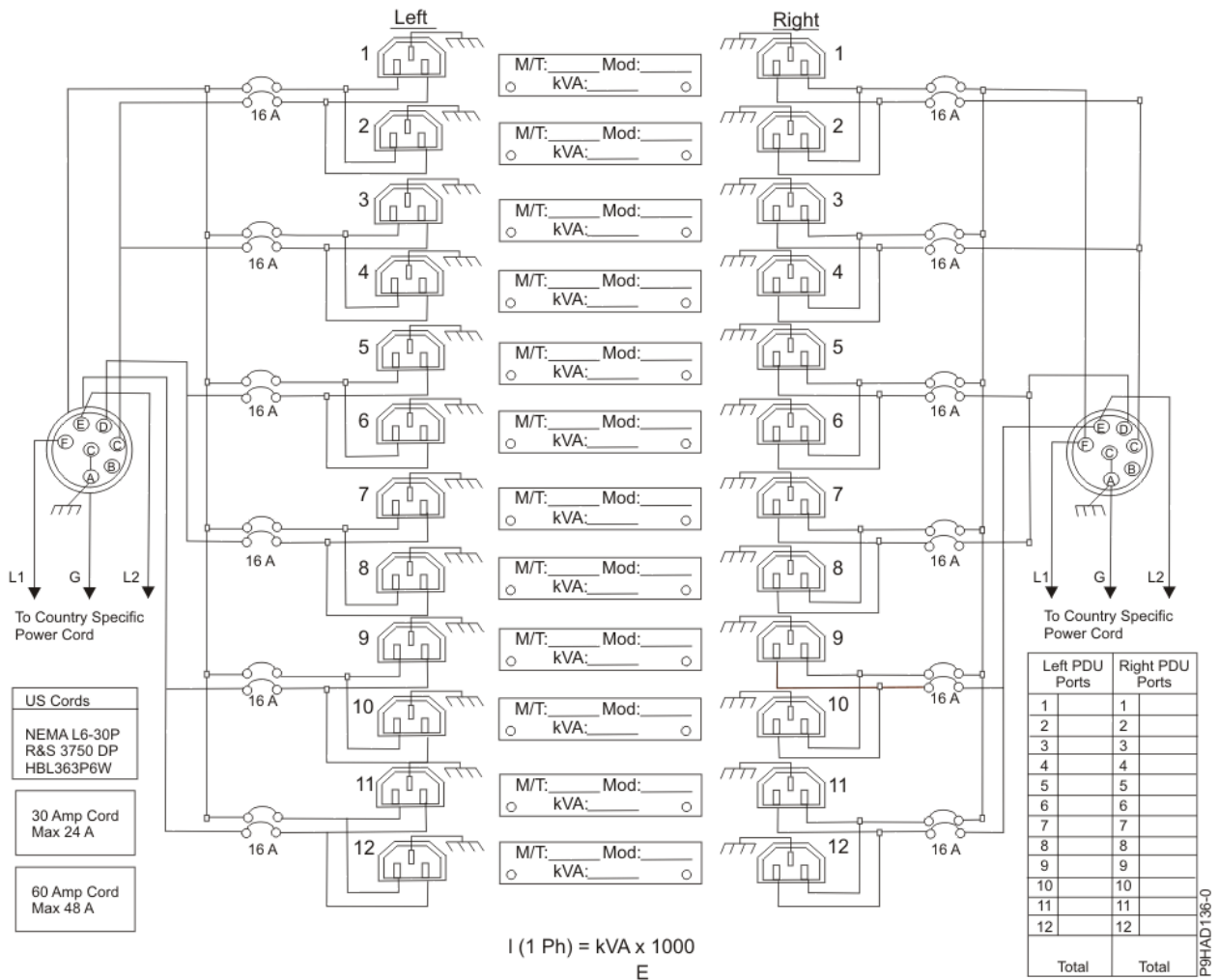
## Loading sequence

Follow these loading sequence steps:

1. Collect power requirements for all units that are connected to the 7188 or 9188 PDU. See your server specifications for specific power requirements.
2. Sort list by total power that is required from highest power draw to lowest power draw.
3. Connect highest power drawer to outlet 1 on circuit breaker 1.
4. Connect next highest power drawer to outlet 3 on circuit breaker 2.
5. Connect next highest power drawer to outlet 5 on circuit breaker 3.
6. Connect next highest power drawer to outlet 7 on circuit breaker 4.
7. Connect next highest power drawer to outlet 9 on circuit breaker 5.
8. Connect next highest power drawer to outlet 11 on circuit breaker 6.
9. Connect next highest power drawer to outlet 12 on circuit breaker 6.
10. Connect next highest power drawer to outlet 10 on circuit breaker 5.
11. Connect next highest power drawer to outlet 8 on circuit breaker 4.
12. Connect next highest power drawer to outlet 6 on circuit breaker 3.

13. Connect next highest power drawer to outlet 4 on circuit breaker 2.
14. Connect next highest power drawer to outlet 2 on circuit breaker 1.

Following these rules allows the load to be distributed more evenly across the six PDU circuit breakers. Ensure that your total power load is below the maximum that is listed in the table and that each circuit breaker is not loaded above 16 A.



## Planning for cables

Learn how to develop plans for cabling your server and devices.

## Cable management

These guidelines ensure that your system and its cables have optimal clearance for maintenance and other operations. The guidelines also provide guidance in correctly cabling your system and using the appropriate cables.

The following guidelines provide cabling information for installing, migrating, relocating, or upgrading your system:

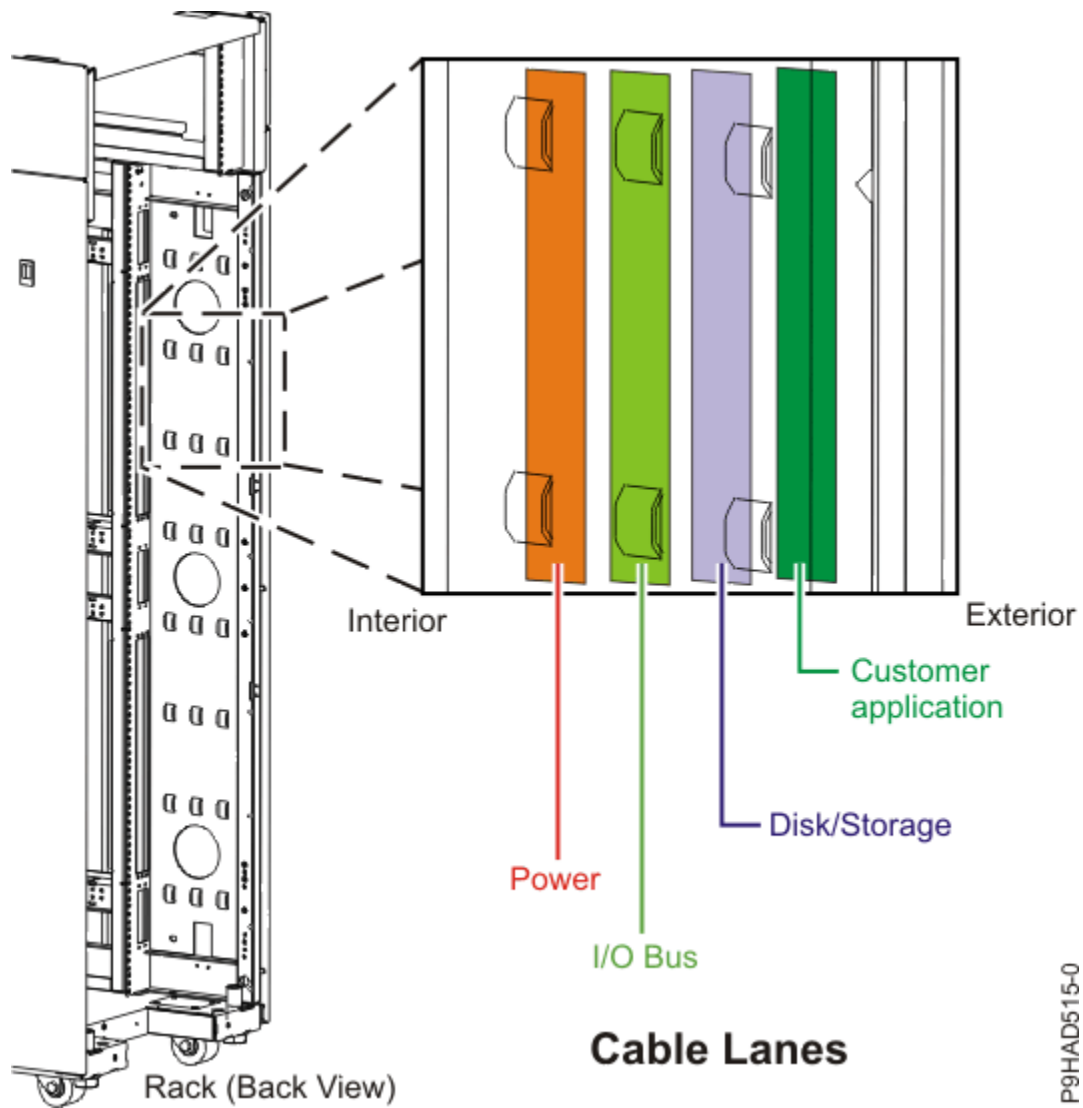
- Position drawers in racks to allow enough space, where possible, for cable routing on the bottom and top of the rack, and between drawers.
- Shorter drawers must not be placed between longer drawers in the rack (for example, placing a 19-inch drawer between two 24-inch drawers).

- When a specific cable plugging sequence is required, for example, for concurrent maintenance (symmetric multiprocessing cables), label the cables and note the sequence order.
- To facilitate cable routing, install cables in the following order:
  1. Power cables
  2. Communications (serial attached SCSI, InfiniBand, remote input/output, and peripheral component interconnect express) cables

**Note:** Install and route the communications cables, starting with the smallest diameter first and then progressing to the largest diameter. This applies to installing them into the cable management arm and retaining them to the rack, brackets, and other features that might be provided for cable management.
- Install and route the communications cables, starting with smallest diameter first and then progressing to the largest diameter.
- Use the innermost cable-management bridge lances for power cables.
- Use the middle cable-management bridge lances for communications cables.
- The outermost row of cable-management bridge lances is available for use when routing cables.
- Use the cable raceways on the sides of the rack to manage excess power cables.
- Four cable-management bridge lances are on the top of the rack. Use these bridge lances to route the cables from one side of the rack to the other, by routing to the top of the rack, where possible. This routing helps to avoid having a cable bundle that blocks the cable exit opening at the bottom of the rack.
- Use the cable management brackets that are provided with the system to maintain concurrent maintenance routing.
- Maintain a minimum bend diameter of 101.6 mm (4 in.) for communications (SAS, IB, and PCIe) cables.
- Maintain a minimum bend diameter of 50.8 mm (2 in.) for power cables.
- Use the shortest-length cable available for each point-to-point connection.
- If cables must be routed across the rear of a drawer, leave enough slack to reduce the tension on the cables for maintenance of the drawer.
- When routing cables, leave enough slack around the power connection on the power distribution unit (PDU) so that the wall-to-PDU power cord can be attached to the PDU.
- Use hook-and-loop fasteners where necessary.

**Note:**





P9HAD515-0

Figure 55. Cable management bridge lances

# Cable bend radius

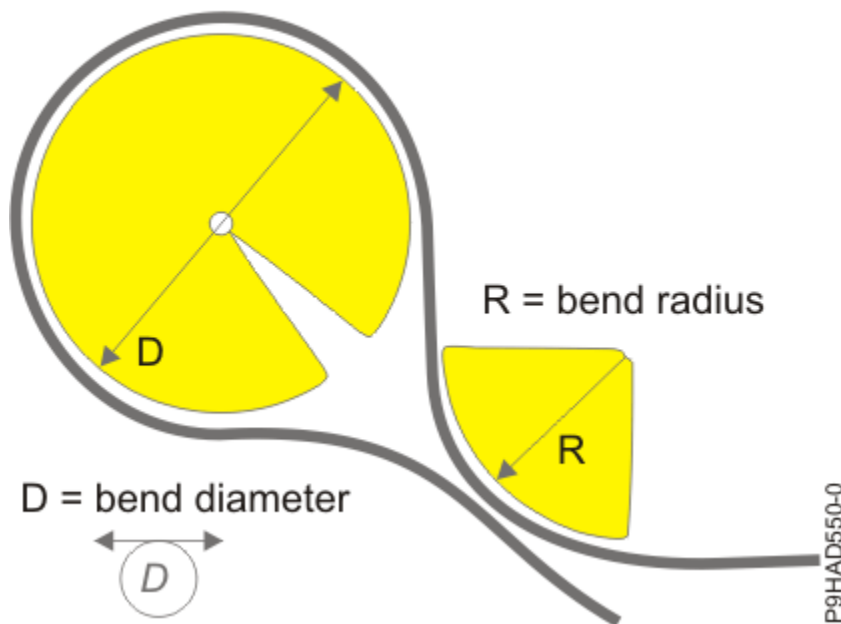


Figure 56. Cable bend radius

## Power cord routing and retention

Proper power cord routing and retention ensures that your system remains connected to a power supply.

The primary purpose of power cord retention is to prevent unexpected power loss to your system that can potentially cause system operations to stop functioning.

Different types of power cord retention are available. Some of the most commonly used types of retention include:

- Cable management arms
- Rings
- Clamps
- Plastic straps
- Hook-and-loop fasteners

Power cord retainers are typically found at the rear of the unit and on the chassis or pedestal near the alternating current (AC) power cord input.

Systems that are rack-mounted and are on rails must use the provided cable management arm.

Systems that are rack-mounted, but are not on rails must use the provided rings, clamps, or straps.

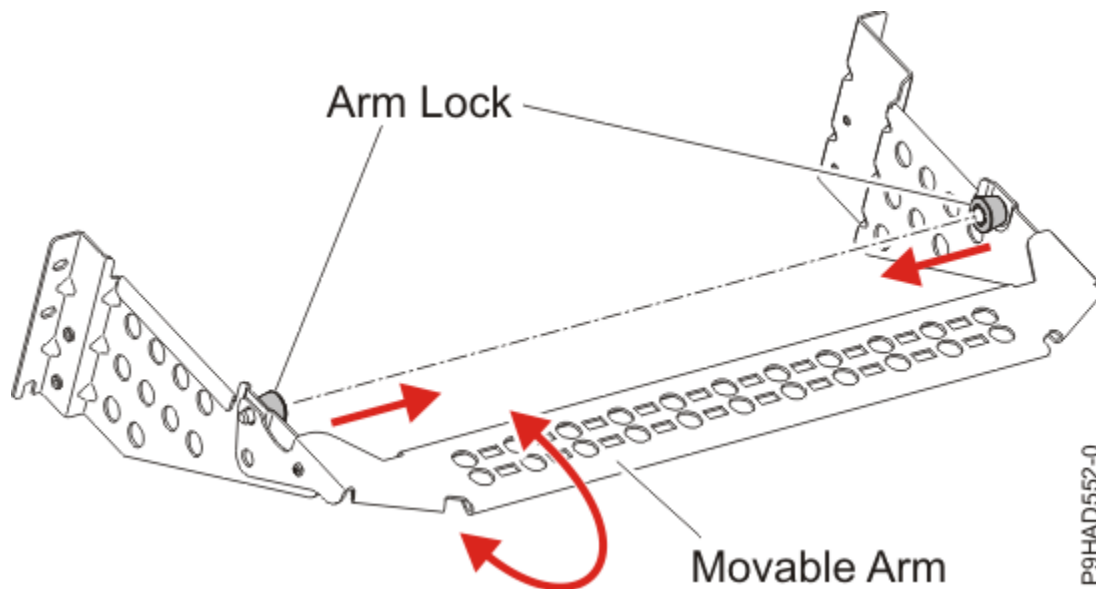


Figure 57. Cable management bracket

## Planning for serial-attached SCSI cables

Serial-attached SCSI (SAS) cables provide serial communication for transfer of data for directly attached devices, such as hard disk drives, solid-state drives, and CD-ROM drives.

### SAS cable overview

Serial-attached SCSI (SAS) is an evolution of the parallel SCSI device interface into a serial point-to-point interface. SAS physical links are a set of four wires that are used as two differential signal pairs. One differential signal transmits in one direction while the other differential signal transmits in the opposite direction. Data might be transmitted in both directions simultaneously. SAS physical links are contained in ports. A port contains one or more SAS physical links. A port is a wide port if there are more than one SAS physical link in the port. Wide ports are designed to enhance performance and provide redundancy in case an individual SAS physical link fail.

There are two types of SAS connectors, mini SAS and mini SAS high density (HD). High-density cables are typically needed to support 6 Gb/s SAS.

Each SAS cable contains four SAS physical links that are typically organized into either a single 4x SAS port or two 2x SAS ports. Each end of the cable uses a mini SAS or mini SAS HD 4x connector. Review the following design and installation criteria before you install SAS cables:

- Only specific cabling configurations are supported. Many configurations can be constructed that are not supported and will either not function correctly or generates errors. See [“SAS cabling configurations” on page 126](#) for figures of the supported cabling configurations.
- Each mini-SAS 4x connector is keyed to help prevent cabling an unsupported configuration.
- HD SAS cables have a key that prevents the cable retention from latching if the cable is oriented incorrectly. HD SAS cables slide in easily and latch correctly if they are inserted with the blue release tab on the right side of the card connector.
- Each cable end has a label that graphically describes the correct component port to which it is connected, such as:
  - SAS adapter
  - Expansion drawer
  - System external SAS port
  - Internal SAS disk slots connection.

- Cable routing is important. For example, YO and X cables must be routed along the right side of the rack frame (as viewed from the rear) when you connect to a disk expansion drawer. Additionally, X cables must be attached to the same numbered port on both SAS adapters to which it connects.
- When a choice of cable lengths is available, select the shortest cable that provides the needed connectivity.
- Always use care when you insert or remove a cable. The cable should slide easily into the connector. Forcing a cable into a connector can cause damage to the cable or connector. When you remove a cable, pull straight back on the blue release tab. Do not pull the blue release tab off to the side, otherwise breakage might occur. After the cable latch is released, pull on the black cable to remove it from the connector.
- New SAS cables with mini-SAS HD narrow connectors are required for any PCIe3 SAS adapter connection. These cables are also compatible with earlier PCIe2 SAS adapters.
- Not all cabling configurations are supported when you use solid-state drives (SSD). See *Installing and configuring Solid State Drives* for more information.

## Supported SAS cable information

The following table contains a list of the supported serial-attached SCSI (SAS) cable types and their designed usage.

| Table 101. Functions for supported SAS cables |                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cable type                                    | Function                                                                                                                                                                                                                                                                                                                                                       |
| AA cable                                      | This cable is used to connect the top one or two ports between two PCIe3 caching SAS RAID adapters.                                                                                                                                                                                                                                                            |
| AE cable                                      | These cables are used to connect a SAS adapter to a media expansion drawer.                                                                                                                                                                                                                                                                                    |
| YO cable                                      | This cable is used to connect a SAS adapter to a disk expansion drawer. The cable must be routed along the right side of the rack frame (as viewed from the rear) when you connect to a disk expansion drawer.                                                                                                                                                 |
| X cable                                       | This cable is used to connect two SAS adapters to a disk expansion drawer in a RAID configuration. The cable must be routed along the right side of the rack frame (as viewed from the rear) when you connect to a disk expansion drawer.                                                                                                                      |
| AE1 cable                                     | This 4 m (13.1 ft) SAS cable connects a PCIe3 SAS adapter to a SAS tape drive or DVD I/O enclosure. The AE cable has two connectors, one mini-SAS HD narrow connector and one mini-SAS connector. The mini-SAS HD Narrow connector attaches to a PCIe3 SAS adapter. The mini-SAS connector attaches to a SAS tape drive or DVD enclosure.                      |
| YE1 cable                                     | This 3 m (9.8 ft) SAS cable connects a PCIe3 SAS adapter to one or two SAS tape drives in an I/O enclosure. The YE1 cable has three connectors, one mini-SAS HD (High Density) narrow connector and two mini-SAS connectors. The Mini-SAS HD Narrow connector attaches to a PCIe3 SAS adapter. Each mini-SAS connector attaches to a different SAS tape drive. |
| AS cable                                      | This 3 m (9.8 ft) SAS cable is used to attach a DCS3700 to PCIe3 LP RAID SAS adapter.                                                                                                                                                                                                                                                                          |

The following table contains specific information about each supported SAS cable for PCIe SAS adapters.

| <i>Table 102. Supported SAS cables for PCIe SAS adapters</i> |               |                        |                     |
|--------------------------------------------------------------|---------------|------------------------|---------------------|
| <b>Name</b>                                                  | <b>Length</b> | <b>IBM part number</b> | <b>Feature code</b> |
| SAS 4x AE cable                                              | 3 m (9.8 ft)  | 44V4163                | 3684                |
|                                                              | 6 m (19.6 ft) | 44V4164                | 3685                |

The following table contains specific information about each supported SAS cable feature with narrow HD connectors for PCIe3 SAS adapters.

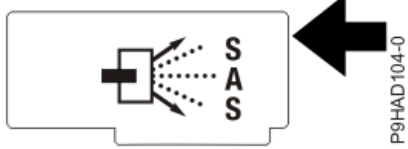

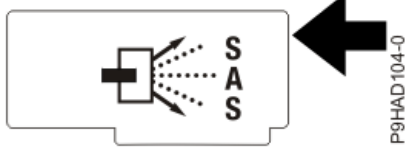
| <i>Table 103. Supported SAS cables for PCIe3 SAS adapters</i>             |                                  |                        |                     |
|---------------------------------------------------------------------------|----------------------------------|------------------------|---------------------|
| <b>Name</b>                                                               | <b>Length</b>                    | <b>IBM part number</b> | <b>Feature code</b> |
| HD SAS AA12 narrow connector cable, SAS adapter to SAS adapter            | 0.6 m (1.9 ft)                   | 01AF505                | ECE0                |
|                                                                           | 1.5 m (4.9 ft)                   | 01AF506                | ECE2                |
|                                                                           | 3 m (9.8 ft)                     | 01AF507                | ECE3 <sup>1</sup>   |
|                                                                           | 4.5 m (14.8 ft) AOC <sup>2</sup> | 78P4917                | ECE4                |
| HD SAS X12 narrow connector cable, SAS adapter to storage enclosure       | 3 m (9.8 ft)                     | 01AF504                | ECDJ                |
|                                                                           | 4.5 m (14.8 ft) AOC <sup>2</sup> | 78P4918                | ECDK                |
|                                                                           | 10 m (32.8 ft) AOC <sup>2</sup>  | 78P4919                | ECDL                |
| HD SAS YO12 narrow connector cable, two SAS adapters to storage enclosure | 1.5 m (4.9 ft)                   | 01AF502                | ECDT                |
|                                                                           | 3 m (9.8 ft)                     | 01AF503                | ECDU                |
|                                                                           | 4.5 m (14.8 ft) AOC <sup>2</sup> | 78P4920                | ECDV                |
|                                                                           | 10 m (32.8 ft) AOC <sup>2</sup>  | 78P4921                | ECDW                |
| HD SAS AA narrow connector cable, SAS adapter to SAS adapter              | 0.6 m (1.9 ft)                   | 00E6287                | ECC0                |
|                                                                           | 1.5 m (4.9 ft)                   | 00E6288                | ECC2                |
|                                                                           | 3 m (9.8 ft)                     | 00E6289                | ECC3                |
|                                                                           | 6 m (19.6 ft)                    | 00E6290                | ECC4                |
| HD SAS X narrow connector cable                                           | 3 m (9.8 ft)                     | 00E6297                | ECBJ                |
|                                                                           | 6 m (19.6 ft)                    | 00E6298                | ECBK                |
|                                                                           | 10 m (32.8 ft)                   | 00E6299                | ECBL                |
|                                                                           | 15 m (49.2 ft)                   | 00E6300                | ECBM                |

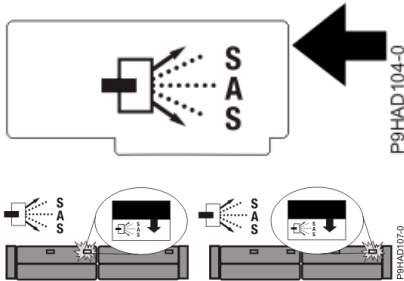
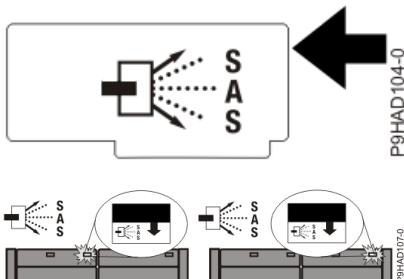
*Table 103. Supported SAS cables for PCIe3 SAS adapters (continued)*

| Name                                                                                                                     | Length         | IBM part number | Feature code |
|--------------------------------------------------------------------------------------------------------------------------|----------------|-----------------|--------------|
| HD SAS YO narrow connector cable                                                                                         | 1.5 m (4.9 ft) | 00E6292         | ECBT         |
|                                                                                                                          | 3 m (9.8 ft)   | 00E6293         | ECBU         |
|                                                                                                                          | 6 m (19.6 ft)  | 00E6294         | ECBV         |
|                                                                                                                          | 10 m (32.8 ft) | 00E6295         | ECBW         |
|                                                                                                                          | 15 m (49.2 ft) | 00E6296         | ECBX         |
| HD SAS AE1 narrow connector cable                                                                                        | 4 m (13.1 ft)  | 46C2900         | ECBY/5507    |
| HD SAS YE1 narrow connector cable                                                                                        | 3 m (9.8 ft)   | 46C2902         | ECBZ/5509    |
| HD SAS AS narrow connector cable                                                                                         | 3 m (9.8 ft)   | 00FW799         | ECC5         |
| 1. Can be used to attach just a bunch of disks (JBOD) storage enclosures to adapters.<br>2. Active optical cables (AOC). |                |                 |              |

The following table contains cable label information. The graphic labels are designed to match the correct component port to which the cable end is to be attached.

*Table 104. SAS cable labeling*

| Name            | Connects                                                                                                              | Label                                                                                                                                                                          |
|-----------------|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SAS 4x AE cable | SAS adapter to a media expansion drawer or two SAS adapters to a disk expansion drawer in a unique JBOD configuration | <br> |
| SAS AA cable    | SAS adapter to a SAS adapter                                                                                          |                                                                                           |

| Table 104. SAS cable labeling (continued) |                                                                     |                                                                                     |
|-------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Name                                      | Connects                                                            | Label                                                                               |
| SAS YO cable                              | SAS adapter to a disk expansion drawer                              |  |
| SAS X cable                               | Two SAS adapters to a disk expansion drawer in a RAID configuration |  |

### Cable section lengths

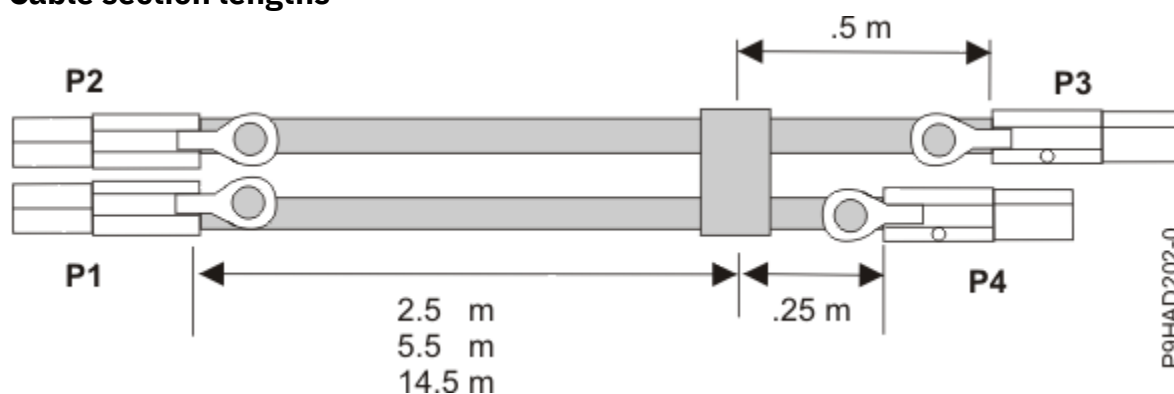


Figure 58. SAS external X cable assembly cable lengths

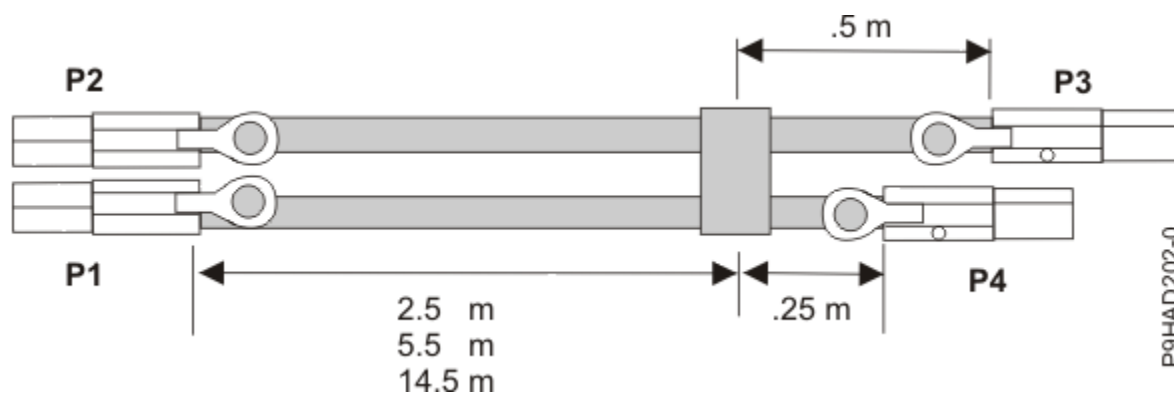


Figure 59. SAS external YO-cable assembly cable lengths

## SAS cabling configurations

The following sections provide the typical supported SAS cabling configurations. Many configurations can be constructed that are not supported and will either not function correctly or generates errors. To avoid problems, restrict cabling to only the general types of configurations that are shown in the following sections.

- [“SAS adapter to media expansion drawer” on page 126](#)
- [“SAS adapter to expansion drawer combinations” on page 127](#)
- [“System external SAS port to disk expansion drawer” on page 127](#)
- [“Two RAID SAS adapters with HD connectors to disk expansion drawer in a multi-initiator high availability \(HA\) mode \(dual storage adapter configuration\)” on page 128](#)

### SAS adapter to media expansion drawer

Figure 60 on page 126 illustrates connecting a SAS adapter to a media expansion drawer. It is also possible to connect a second media expansion drawer to the second port of the SAS adapter.

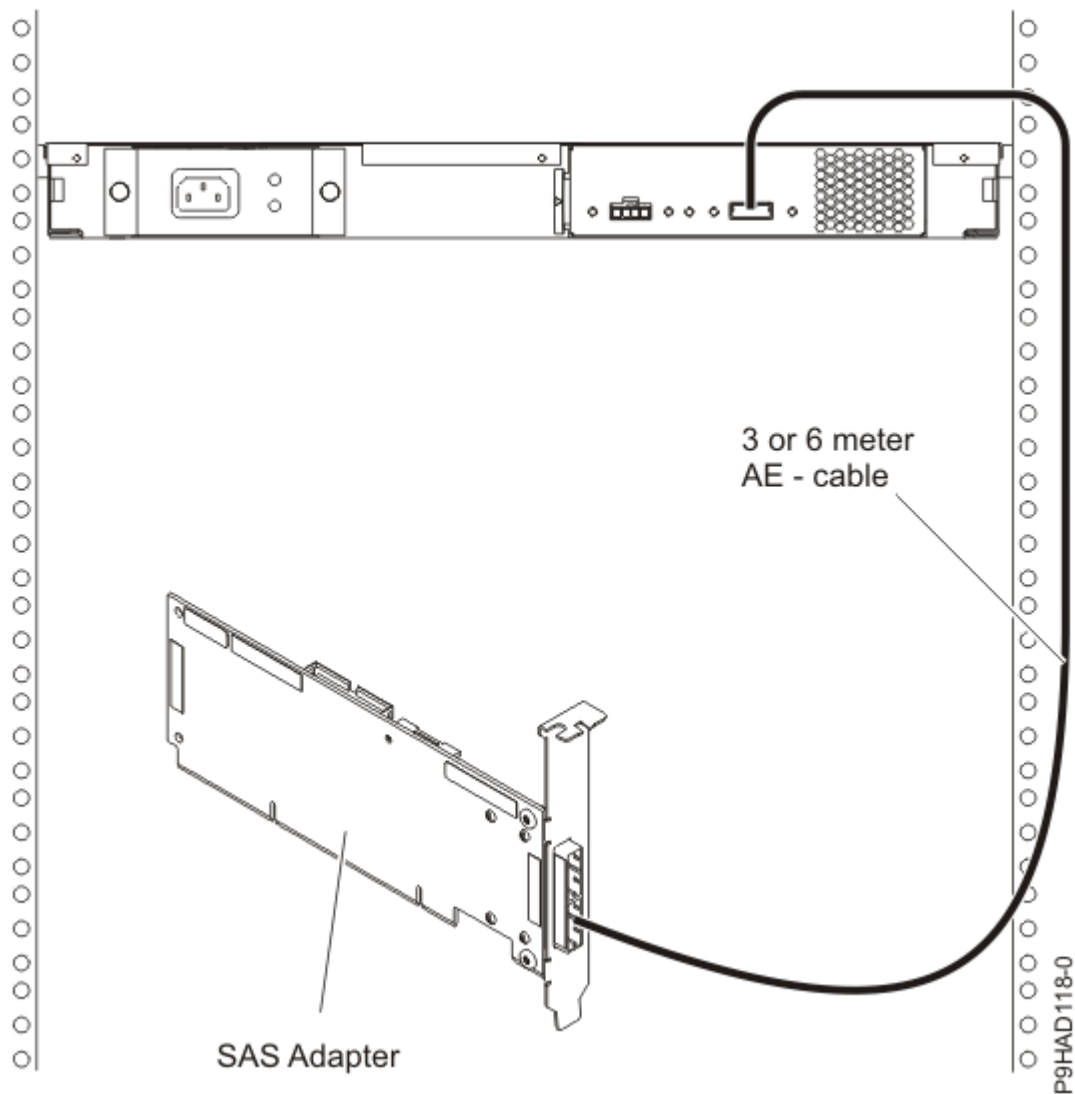


Figure 60. SAS adapter to a media expansion drawer



## SAS adapter to expansion drawer combinations

Figure 61 on page 127 illustrates connecting a PCIe SAS adapter to both a disk expansion drawer and a media expansion drawer on separate adapter ports.

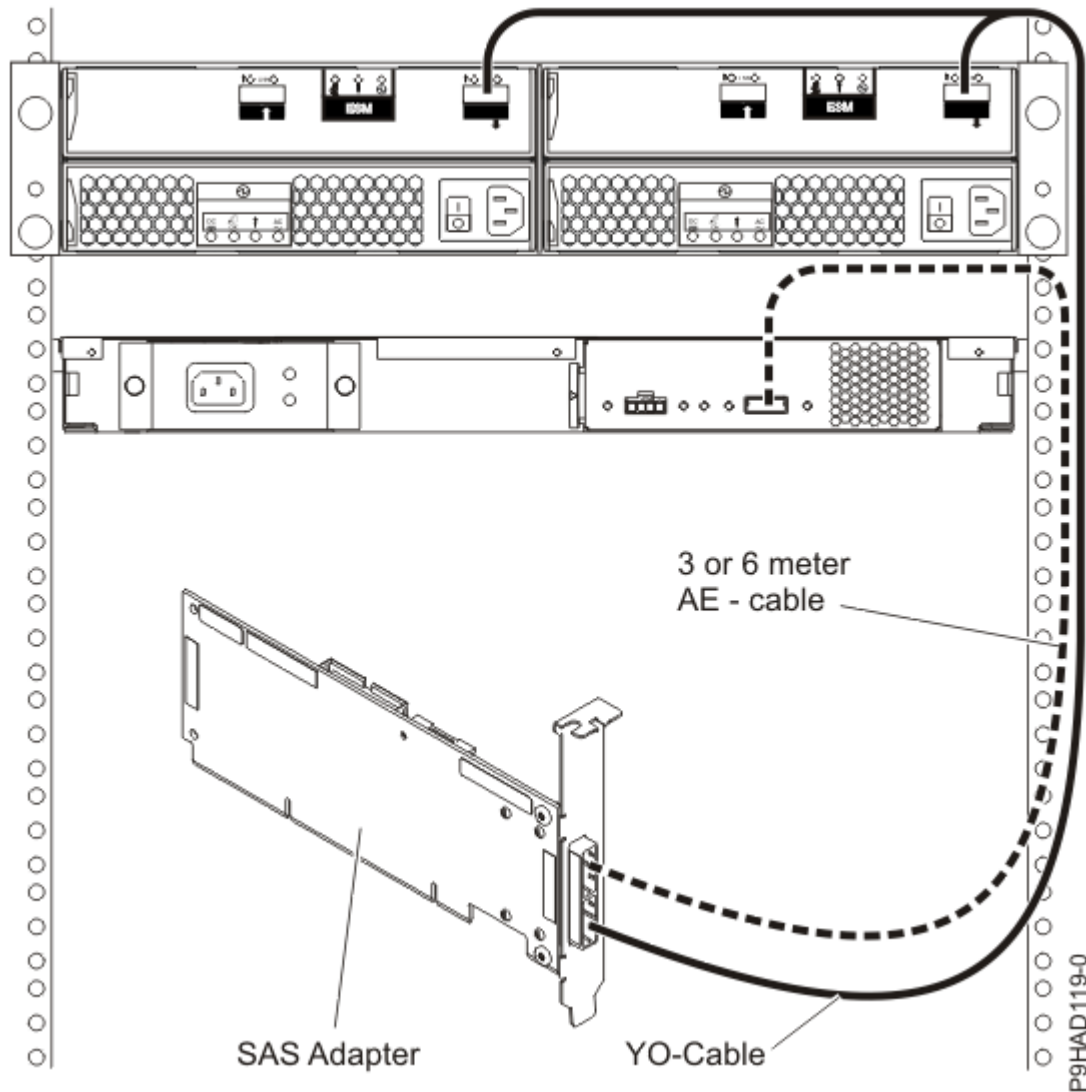


Figure 61. SAS adapter to both a disk expansion drawer and a media expansion drawer

**Note:** The YO cable must be routed along the right side of the rack frame.

## System external SAS port to disk expansion drawer

Figure 62 on page 128 illustrates connecting a system external SAS port to a disk expansion drawer. Disk expansion drawers cannot be cascaded.

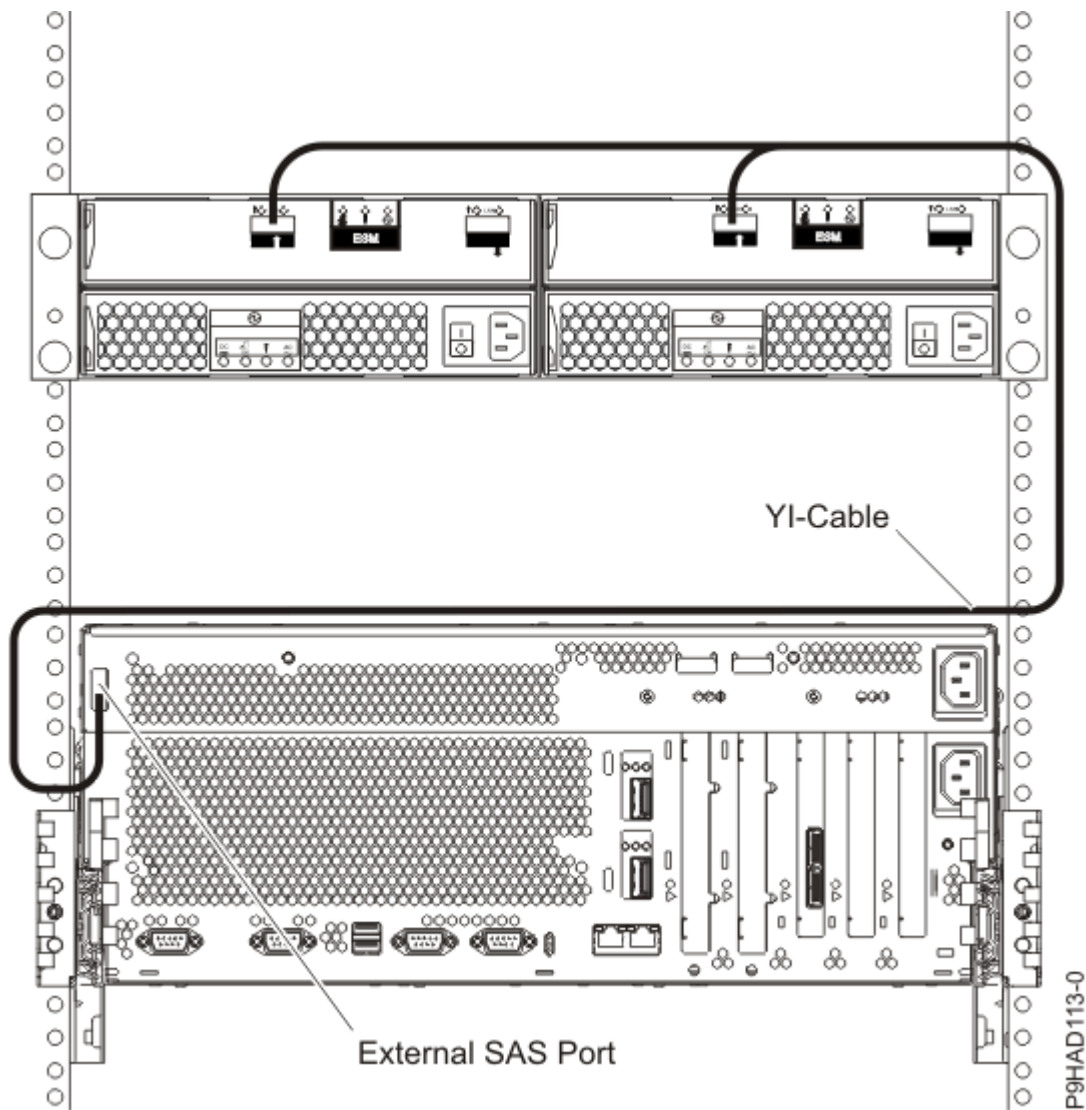
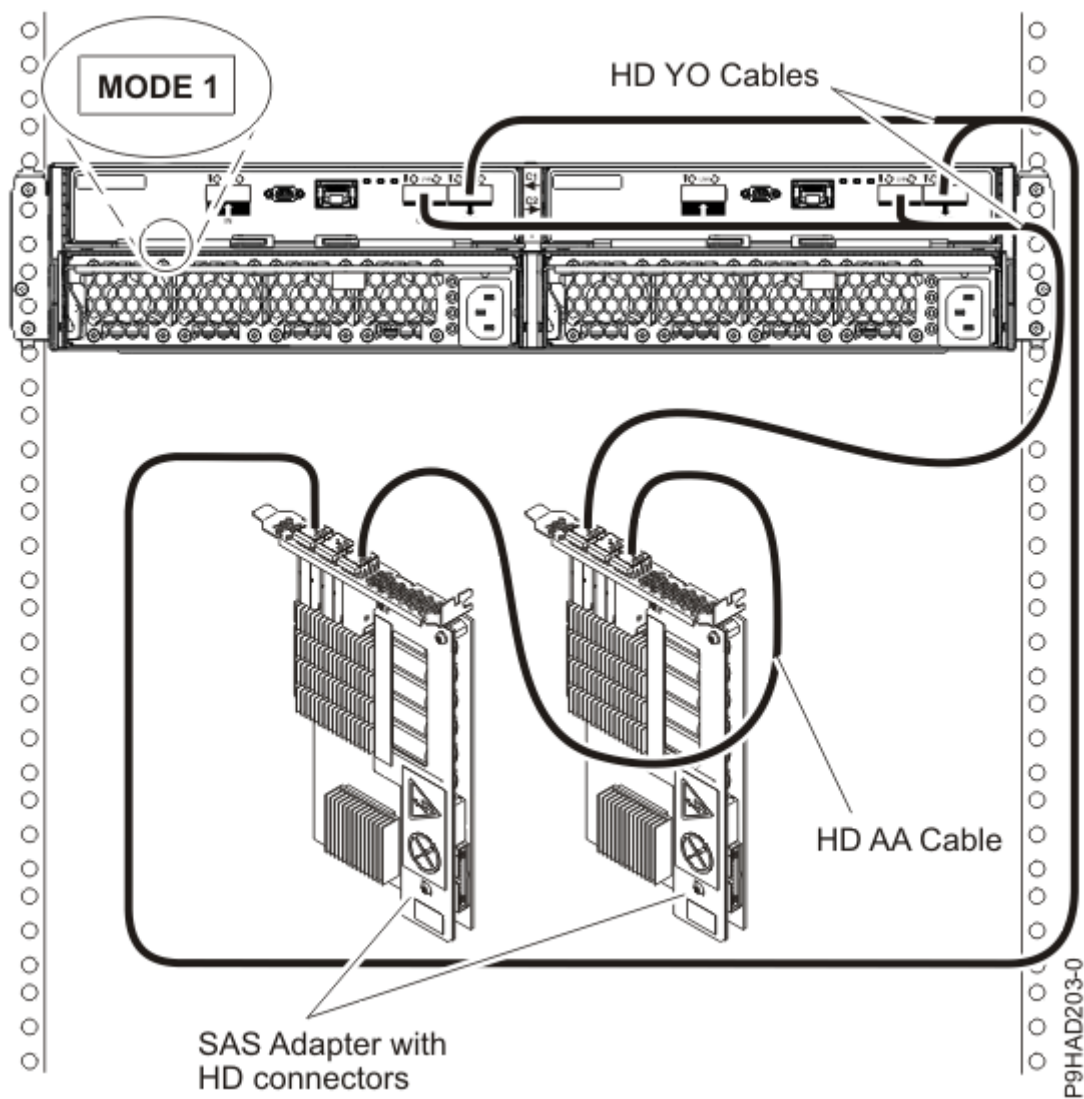


Figure 62. System external SAS adapter port to a disk expansion drawer

### Two RAID SAS adapters with HD connectors to disk expansion drawer in a multi-initiator high availability (HA) mode (dual storage adapter configuration)

Figure 63 on page 129, Figure 64 on page 130, and Figure 65 on page 131 illustrate connecting two SAS RAID adapters with HD connectors to one, two, or three disk expansion drawers in a multi-initiator HA mode.

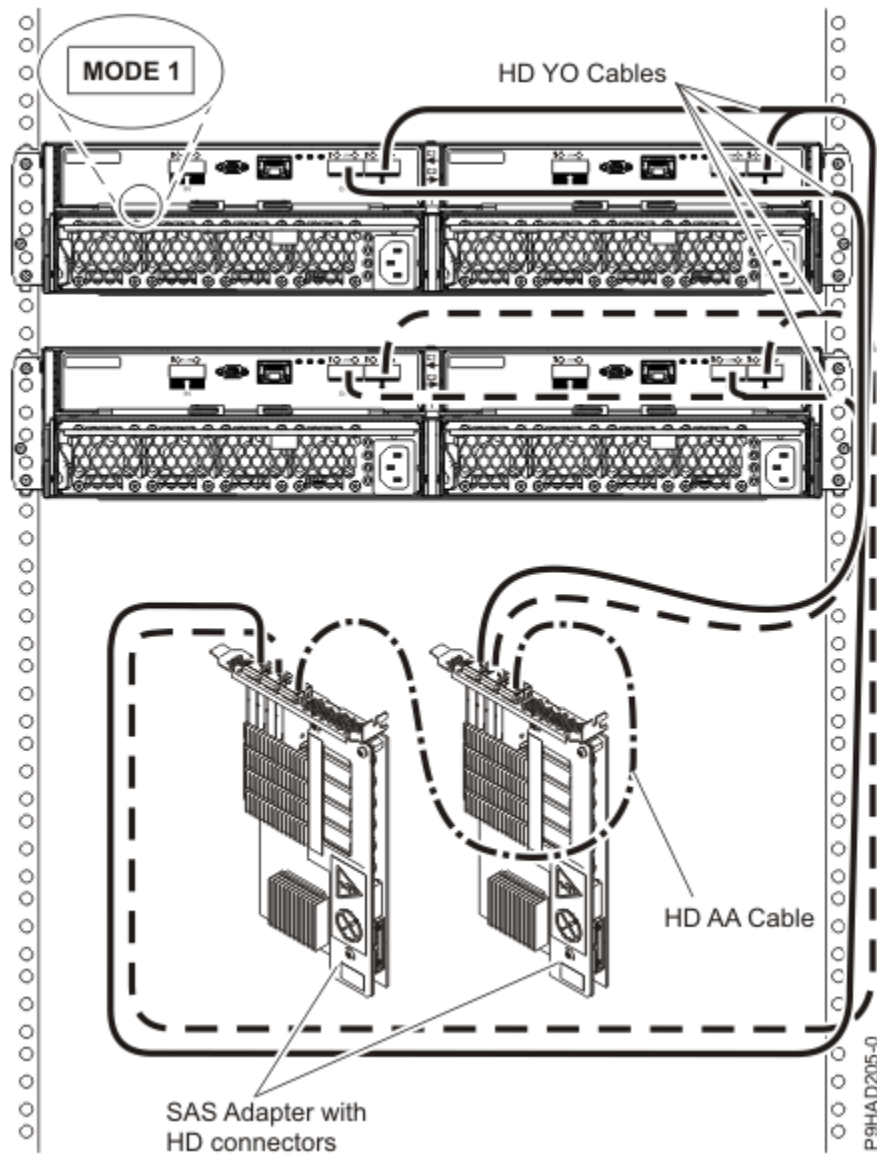
Figure 66 on page 132 illustrates connecting two pair of SAS RAID adapters with HD connectors to one disk expansion drawer in a multi-initiator HA mode.



**Notes:**

- HD AA cable is required.

*Figure 63. Two RAID SAS adapters with HD connectors to a disk expansion drawer in a multi-initiator HA mode*



**Notes:**

- HD AA cable is required.

*Figure 64. Two RAID SAS adapters with HD connectors to two disk expansion drawer in a multi-initiator HA mode*

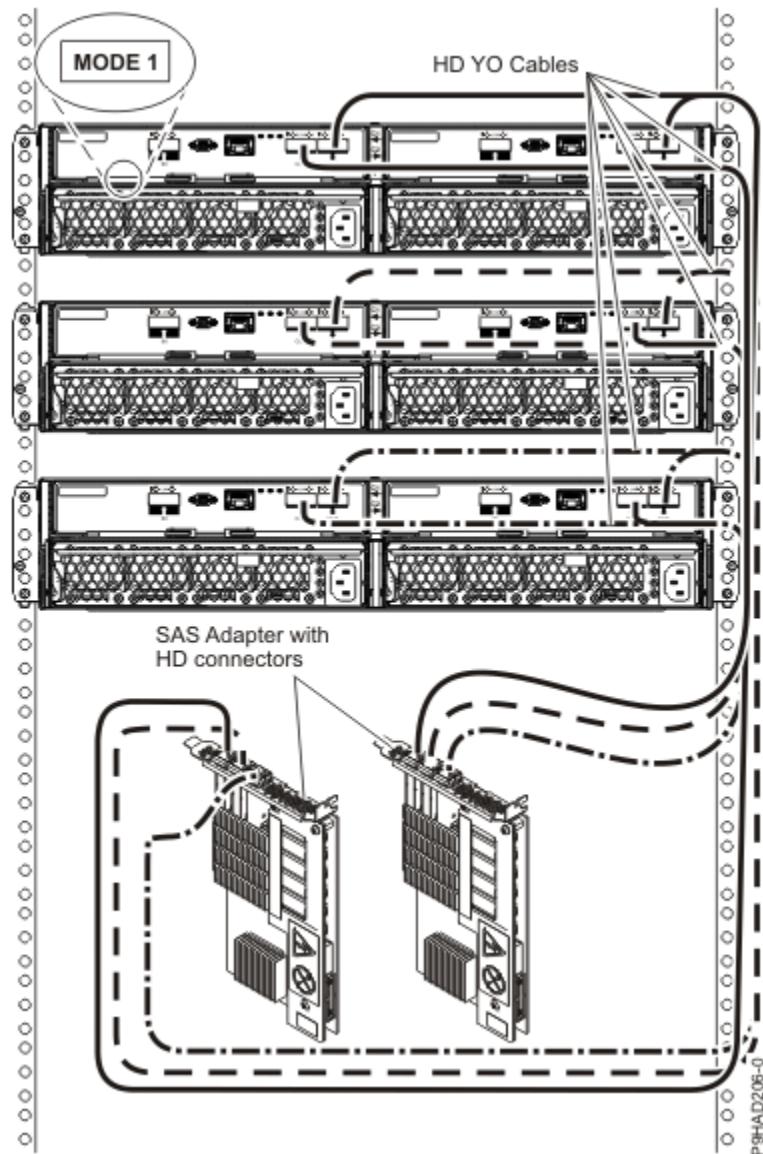
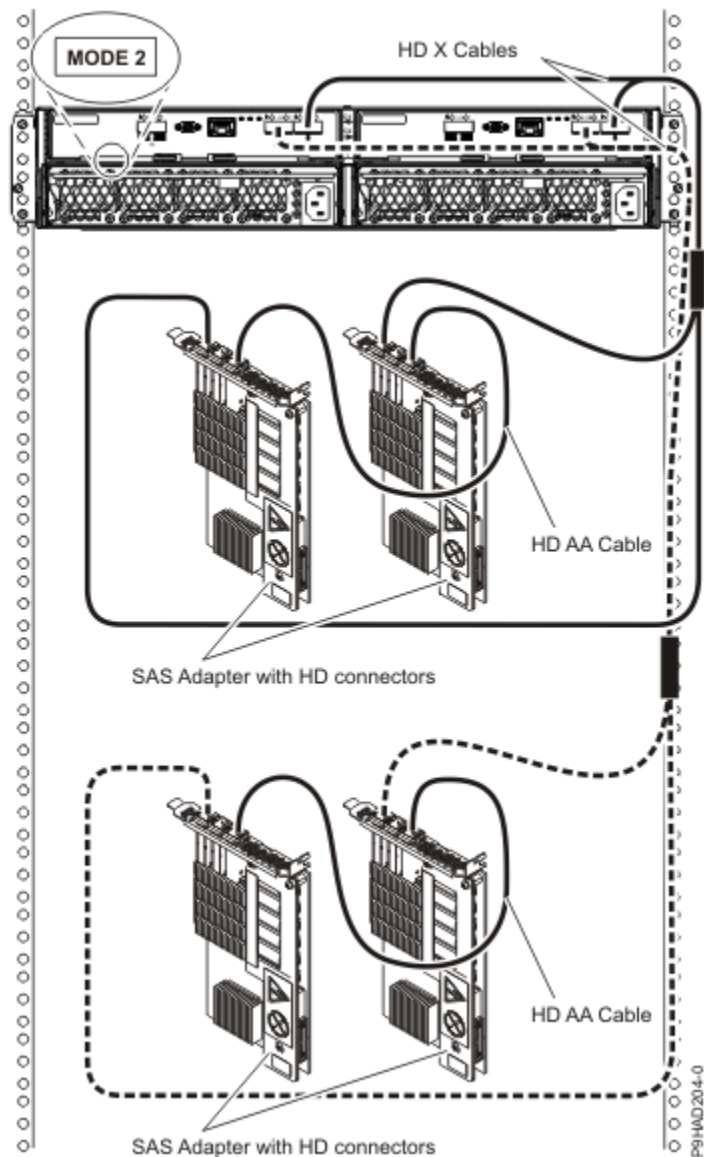


Figure 65. Two RAID SAS adapters with HD connectors to three disk expansion drawers in a multi-initiator HA mode



#### Notes:

- HD AA cable is required.

*Figure 66. Two pairs of RAID SAS adapters with HD connectors to a disk expansion drawer – Mode 2 in a multi-initiator HA mode*

### Internal disk drive sharing

The following information is for use after the FC 5901 SAS Storage adapter is installed. Install the adapter and then return here. For more information about the PCI adapters topic, see .

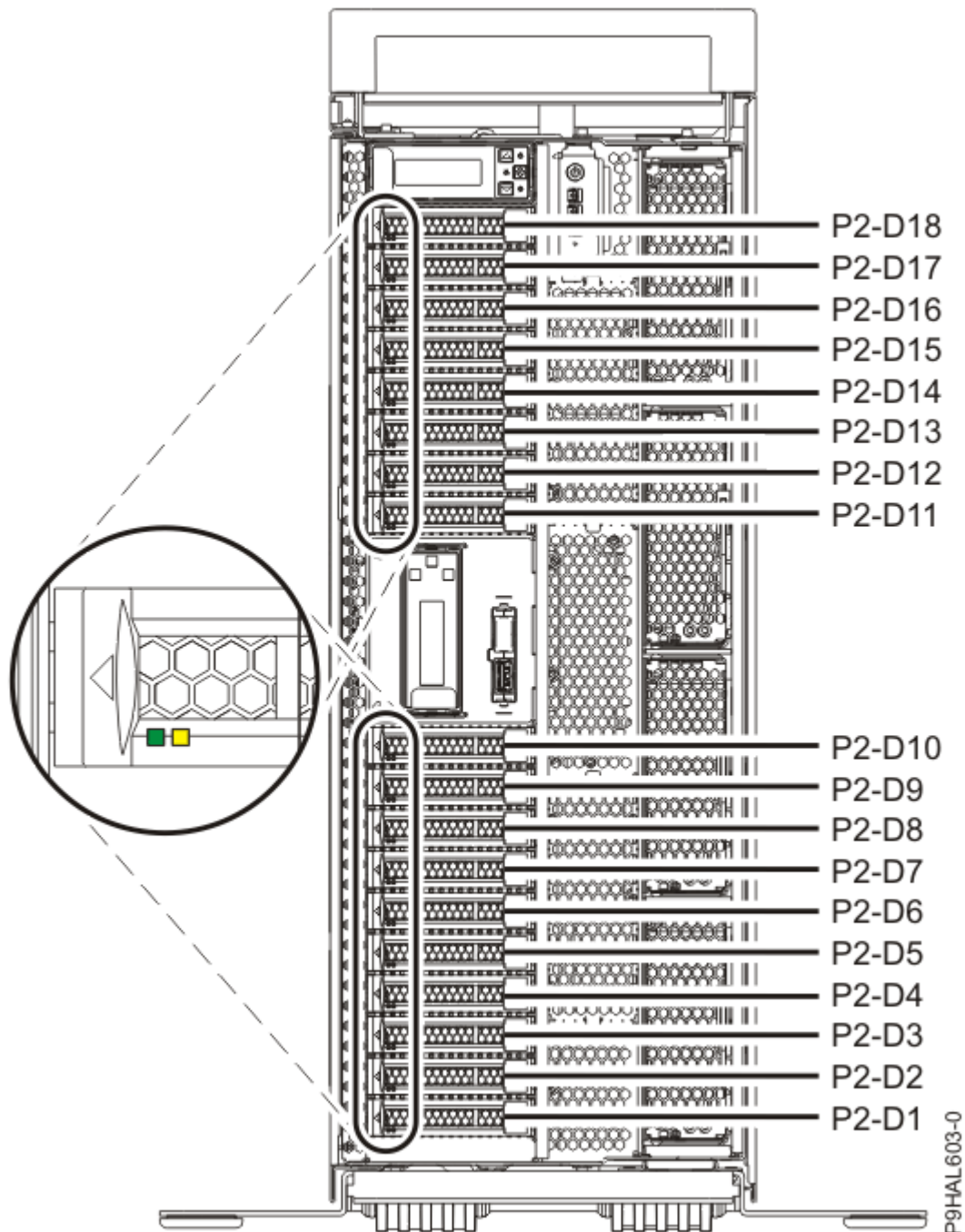
Please review the tasks in the section before you proceed with the following procedure.

This feature allows you to split the internal disks in the system unit enclosure into groups that you can manage separately.

1. Stop and power off the system. For more information, see .
2. Cable a single system unit enclosure by completing the following steps:
  - a. Attach the cable to the SAS port on the rear bulkhead of the system unit enclosure to the top port in the SAS Storage Controller as shown in the following figure.



**Restriction:** Internal disk drive sharing is only available when internal cable feature FC 1815 is installed from the DASD backplane to the read bulkhead of the system unit enclosure. Also FC 5662 175 MB cache RAID - dual IOA enablement card must not be installed. The SAS Storage Controller might be in any of the other slots that support it.



- b. Secure any extra cable.
3. Start the system. For more information, see .
4. Verify that the feature is installed and is working. For more information, see .

With this function installed, two of the six disks (D3 and D6) in the system enclosure is managed by the SAS storage controller adapter.

**Note:** The removable media device is always controlled by the separate embedded SAS controller on the system board.

## SAS cabling for the ESLS storage enclosures

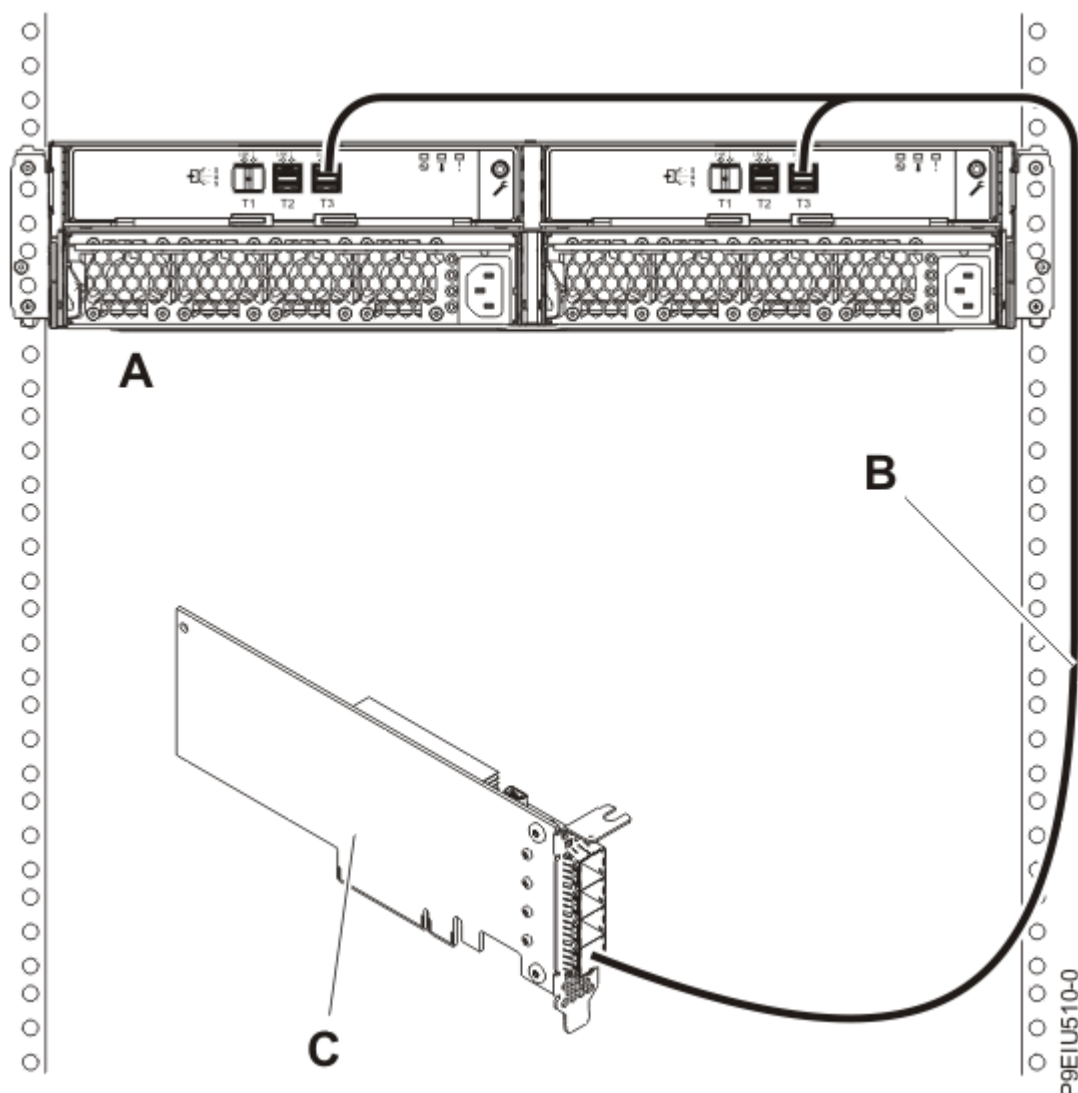
Learn about the different serial-attached SCSI (SAS) cabling configurations that are available for the ESLS storage enclosures.

For more information about connecting ESLS storage enclosures to the system, see *Connecting an ESLS storage enclosure to your system* [Connecting an ESLS storage enclosure to your system \(http://www.ibm.com/support/knowledgecenter/POWER9/p9eiu/p9eiu\\_connect\\_to\\_server.htm\)](http://www.ibm.com/support/knowledgecenter/POWER9/p9eiu/p9eiu_connect_to_server.htm).

## SAS adapter to the ESLS storage enclosures

The following list describes some of the supported configurations for connecting SAS adapters to the ESLS storage enclosures:

1. Single SAS adapter to one ESLS storage enclosure by using a mode 1 connection.
  - Connection by using SAS YO12 cables to connect to the ESLS storage enclosure.



*Figure 67. Mode 1 connection of one ESLS storage enclosure by using a YO12 cable to a single SAS adapter*

2. Single SAS adapter to two ESLL or ESLS storage enclosures by using a mode 1 connection.
  - Connection by using SAS YO12 cables to connect to the ESLS storage enclosure.



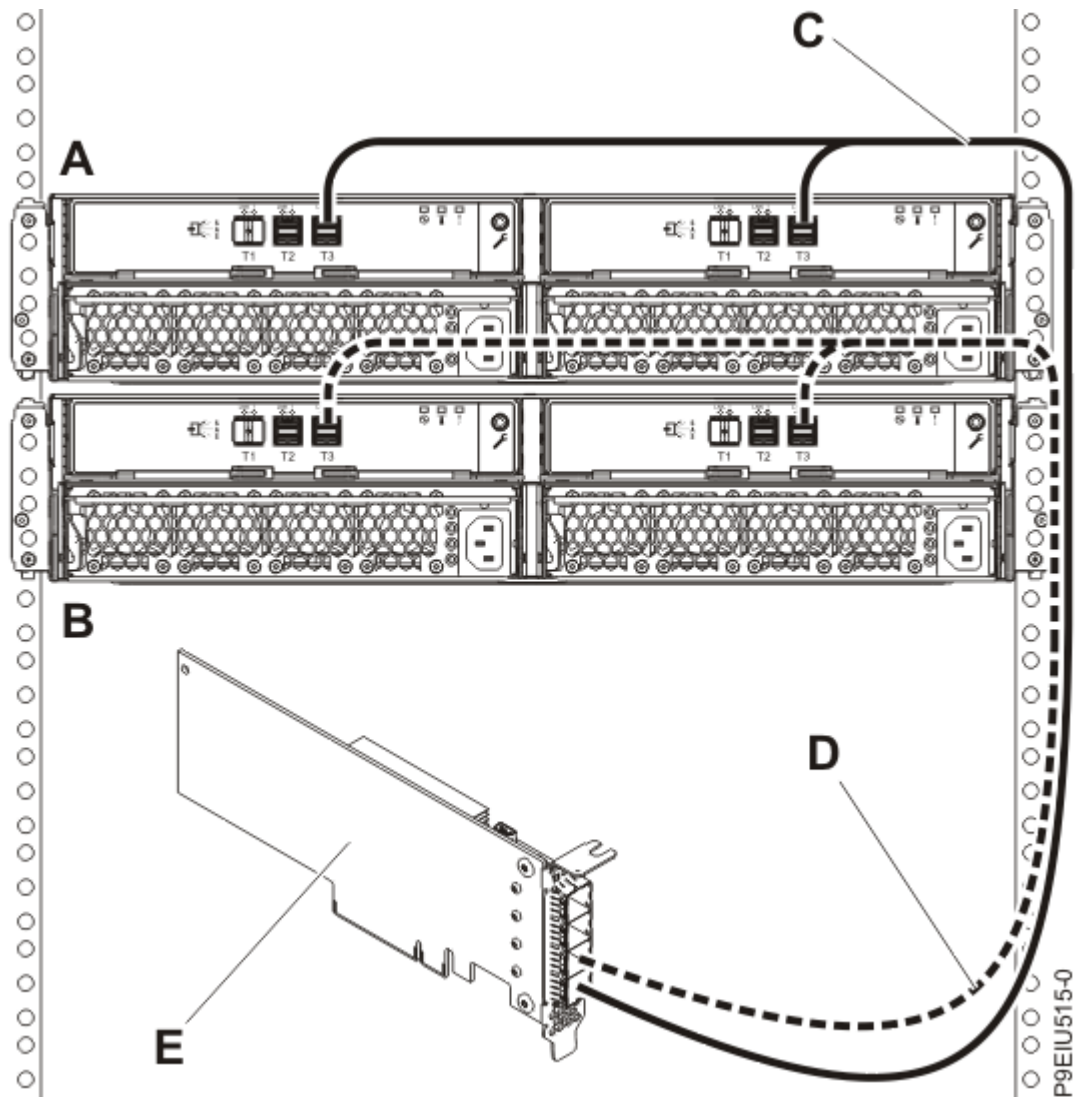
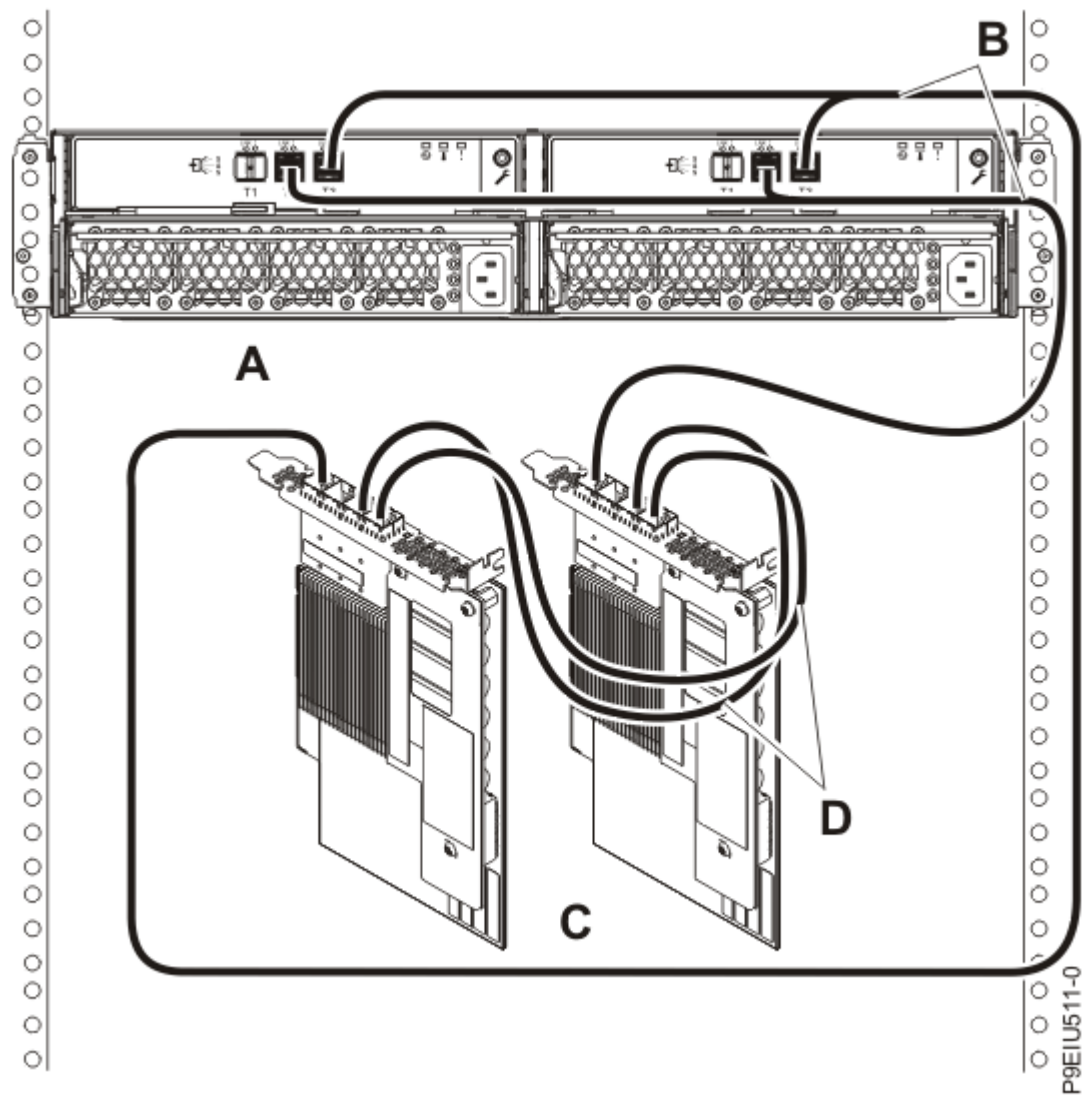


Figure 68. Mode 1 connection of two ESLL or ESLS storage enclosures by using YO12 cables to a single SAS adapter

3. One pair of SAS adapters to one ESLS storage enclosure by using a mode 1 connection.
  - For SAS adapter pairs, you must attach the SAS cables to the same port on both adapters.
  - Connection by using SAS YO12 cables to connect to the ESLS storage enclosure.



*Figure 69. Mode 1 connection of one ESLS storage enclosure by using YO12 cables to one pair of SAS adapters*

4. One pair of SAS adapters to two ESLL or ESLS storage enclosures by using a mode 1 connection.
  - For SAS adapter pairs, you must attach the cables to the same port on both adapters.
  - Connection by using dual SAS YO12 cables to connect to the 5887 enclosure.

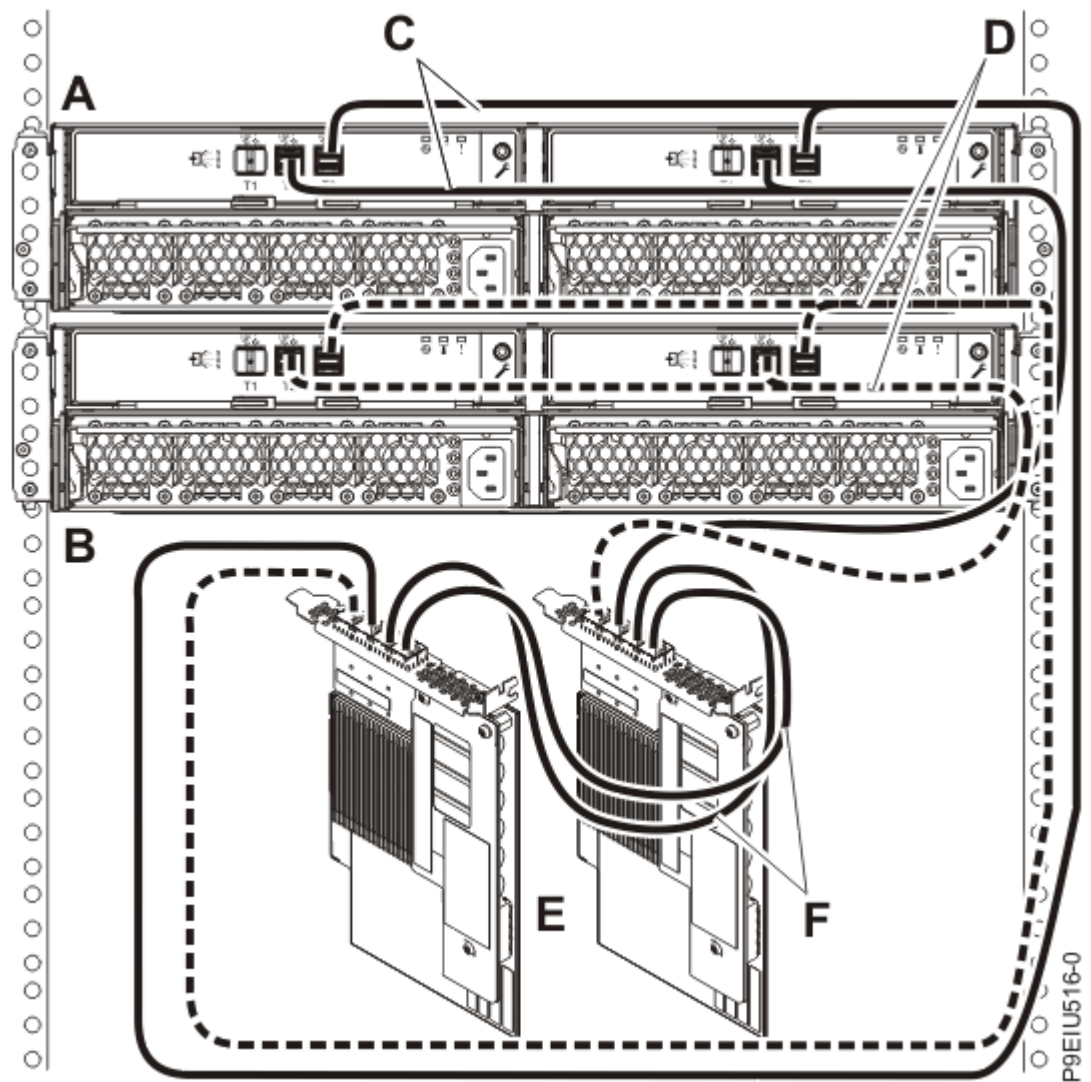
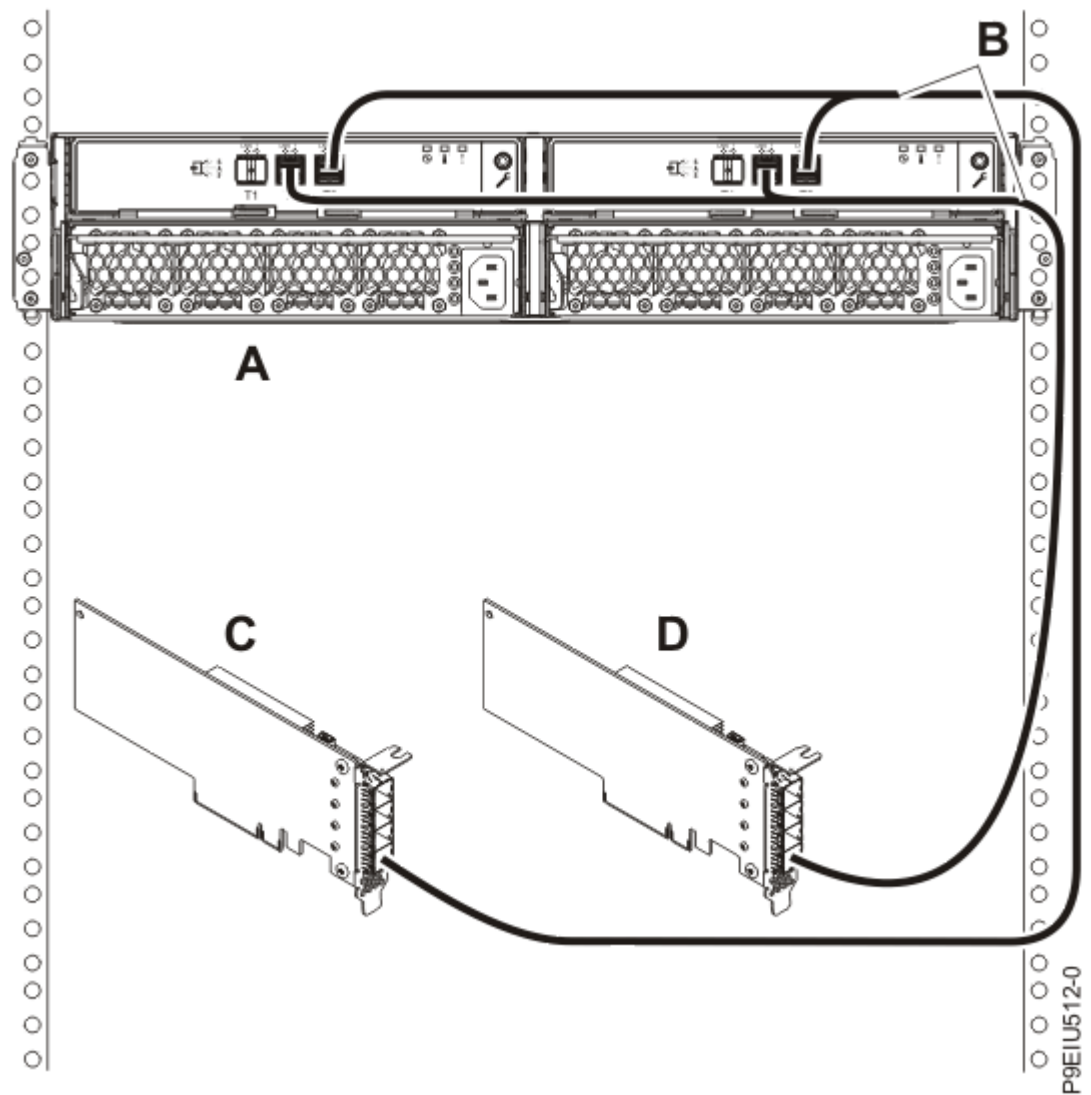


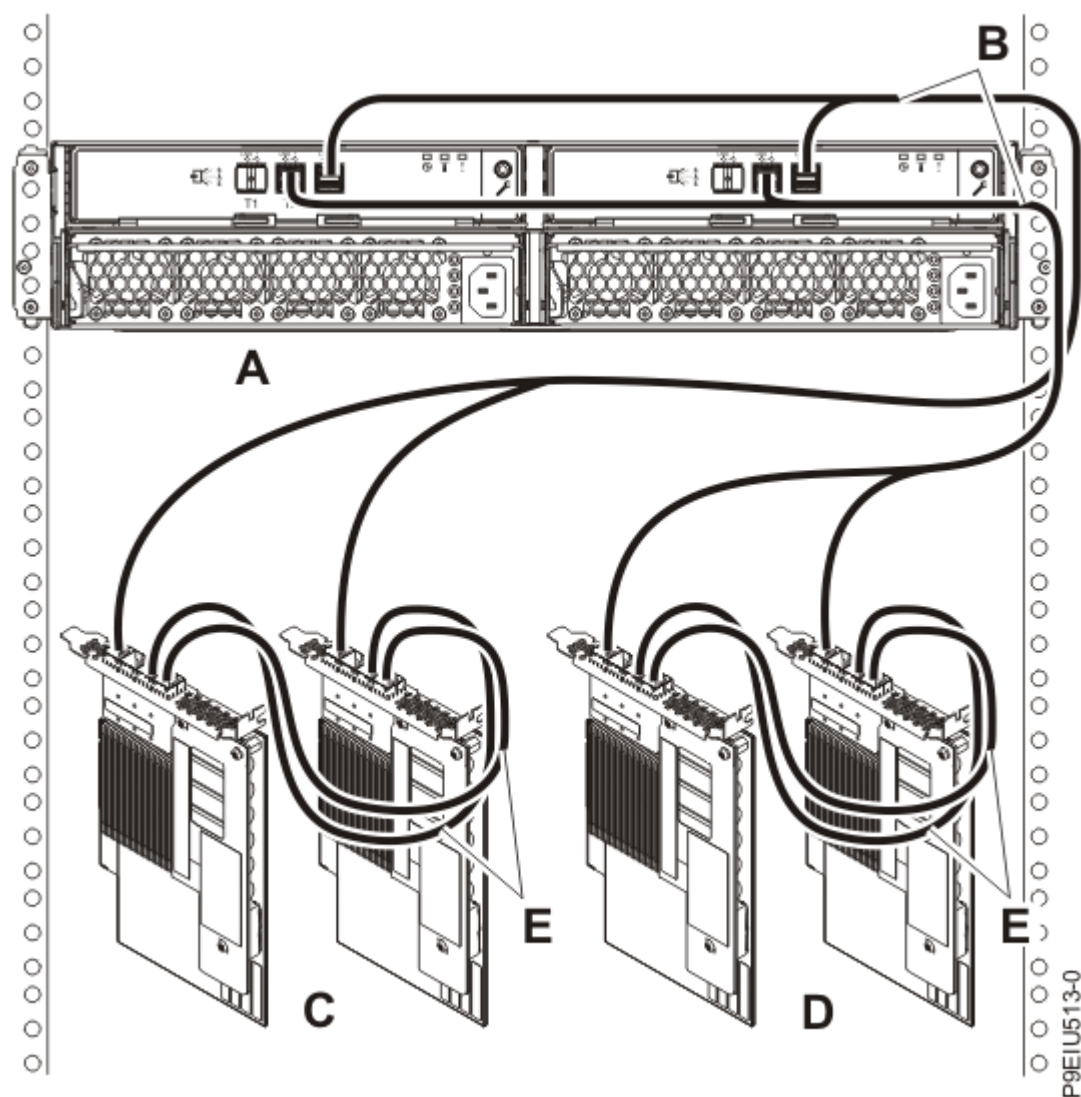
Figure 70. Mode 1 connection of two ESLL or ESLS storage enclosures by using YO12 cables to one pair of SAS adapters

5. Two independent SAS adapters to one ESLS storage enclosure by using a mode 2 connection.
  - Connection by using two SAS YO12 cables to connect to the ESLS storage enclosure.



*Figure 71. Mode 2 connection of ESLS storage enclosure by using YO12 cables to two independent SAS adapters*

6. Two pairs of SAS adapters to one ESLS storage enclosure by using a mode 2 connection.
  - For SAS adapter pairs, you must attach the cables to the same port on both adapters.
  - Connection by using SAS X12 cables to connect to the ESLS storage enclosure.



*Figure 72. Mode 2 connection of one ESLS storage enclosure by using X12 cables to two pairs of SAS adapters*

7. Four independent SAS adapters to one ESLS storage enclosure by using a mode 4 connection.
  - For SAS adapter pairs, you must attach the cables to the same port on both adapters.
  - Connection by using SAS X12 cables to connect to the ESLS storage enclosure.

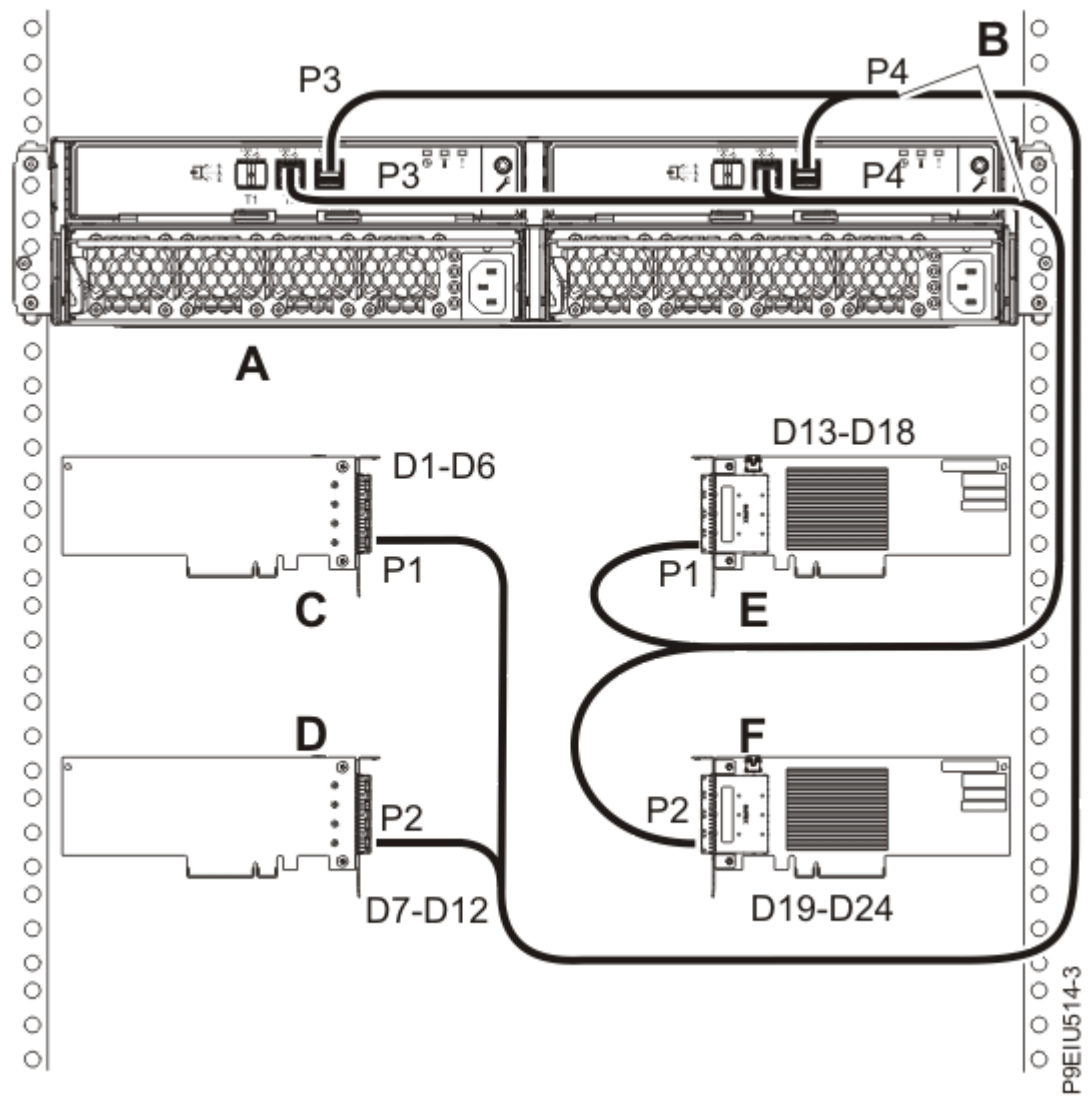


Figure 73. Mode 4 connection of one ESLS storage enclosure by using X12 cables to four independent SAS adapters

---

## Notices

This information was developed for products and services offered in the US.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not grant you any license to these patents. You can send license inquiries, in writing, to:

*IBM Director of Licensing*  
*IBM Corporation*  
*North Castle Drive, MD-NC119*  
*Armonk, NY 10504-1785*  
*US*

INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some jurisdictions do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM websites are provided for convenience only and do not in any manner serve as an endorsement of those websites. The materials at those websites are not part of the materials for this IBM product and use of those websites is at your own risk.

IBM may use or distribute any of the information you provide in any way it believes appropriate without incurring any obligation to you.

The performance data and client examples cited are presented for illustrative purposes only. Actual performance results may vary depending on specific configurations and operating conditions.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

Statements regarding IBM's future direction or intent are subject to change or withdrawal without notice, and represent goals and objectives only.

All IBM prices shown are IBM's suggested retail prices, are current and are subject to change without notice. Dealer prices may vary.

This information is for planning purposes only. The information herein is subject to change before the products described become available.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to actual people or business enterprises is entirely coincidental.



If you are viewing this information in softcopy, the photographs and color illustrations may not appear.

The drawings and specifications contained herein shall not be reproduced in whole or in part without the written permission of IBM.

IBM has prepared this information for use with the specific machines indicated. IBM makes no representations that it is suitable for any other purpose.

IBM's computer systems contain mechanisms designed to reduce the possibility of undetected data corruption or loss. This risk, however, cannot be eliminated. Users who experience unplanned outages, system failures, power fluctuations or outages, or component failures must verify the accuracy of operations performed and data saved or transmitted by the system at or near the time of the outage or failure. In addition, users must establish procedures to ensure that there is independent data verification before relying on such data in sensitive or critical operations. Users should periodically check IBM's support websites for updated information and fixes applicable to the system and related software.

## Homologation statement

This product may not be certified in your country for connection by any means whatsoever to interfaces of public telecommunications networks. Further certification may be required by law prior to making any such connection. Contact an IBM representative or reseller for any questions.

## Accessibility features for IBM Power servers

---

Accessibility features assist users who have a disability, such as restricted mobility or limited vision, to use information technology content successfully.

### Overview

The IBM Power servers include the following major accessibility features:

- Keyboard-only operation
- Operations that use a screen reader

The IBM Power servers use the latest W3C Standard, [WAI-ARIA 1.0](http://www.w3.org/TR/wai-aria/) ([www.w3.org/TR/wai-aria/](http://www.w3.org/TR/wai-aria/)), to ensure compliance with [ICT Accessibility 508 Standards and 255 Guidelines](https://www.access-board.gov/ict/) (<https://www.access-board.gov/ict/>) and [Web Content Accessibility Guidelines \(WCAG\) 2.0](http://www.w3.org/TR/WCAG20/) ([www.w3.org/TR/WCAG20/](http://www.w3.org/TR/WCAG20/)). To take advantage of accessibility features, use the latest release of your screen reader and the latest web browser that is supported by the IBM Power servers.

The IBM Power servers online product documentation in IBM Documentation is enabled for accessibility. For more information about IBM's commitment to accessibility, see the IBM accessibility website at [IBM Accessibility](https://www.ibm.com/able/) (<https://www.ibm.com/able/>).

### Keyboard navigation

This product uses standard navigation keys.

### Interface information

The IBM Power servers user interfaces do not have content that flashes 2 - 55 times per second.

The IBM Power servers web user interface relies on cascading style sheets to render content properly and to provide a usable experience. The application provides an equivalent way for low-vision users to use system display settings, including high-contrast mode. You can control font size by using the device or web browser settings.

The IBM Power servers web user interface includes WAI-ARIA navigational landmarks that you can use to quickly navigate to functional areas in the application.



## Vendor software

The IBM Power servers include certain vendor software that is not covered under the IBM license agreement. IBM makes no representation about the accessibility features of these products. Contact the vendor for accessibility information about its products.

## Related accessibility information

In addition to standard IBM help desk and support websites, IBM has a TTY telephone service for use by deaf or hard of hearing customers to access sales and support services:

TTY service  
800-IBM-3383 (800-426-3383)  
(within North America)

For more information about the commitment that IBM has to accessibility, see [IBM Accessibility](http://www.ibm.com/able) ([www.ibm.com/able](http://www.ibm.com/able)).

## Privacy policy considerations

---

IBM Software products, including software as a service solutions, (“Software Offerings”) may use cookies or other technologies to collect product usage information, to help improve the end user experience, to tailor interactions with the end user, or for other purposes. In many cases no personally identifiable information is collected by the Software Offerings. Some of our Software Offerings can help enable you to collect personally identifiable information. If this Software Offering uses cookies to collect personally identifiable information, specific information about this offering’s use of cookies is set forth below.

This Software Offering does not use cookies or other technologies to collect personally identifiable information.

If the configurations deployed for this Software Offering provide you as the customer the ability to collect personally identifiable information from end users via cookies and other technologies, you should seek your own legal advice about any laws applicable to such data collection, including any requirements for notice and consent.

For more information about the use of various technologies, including cookies, for these purposes, see IBM’s Privacy Policy at <http://www.ibm.com/privacy> and IBM’s Online Privacy Statement at <http://www.ibm.com/privacy/details> the section entitled “Cookies, Web Beacons and Other Technologies” and the “IBM Software Products and Software-as-a-Service Privacy Statement” at <http://www.ibm.com/software/info/product-privacy>.

## Trademarks

---

IBM, the IBM logo, and [ibm.com](http://ibm.com) are trademarks or registered trademarks of International Business Machines Corp., registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the web at [Copyright and trademark information](#).

INFINIBAND, InfiniBand Trade Association, and the INFINIBAND design marks are trademarks and/or service marks of the INFINIBAND Trade Association.

The registered trademark Linux® is used pursuant to a sublicense from the Linux Foundation, the exclusive licensee of Linus Torvalds, owner of the mark on a worldwide basis.

## Electronic emission notices

---

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

## Class A Notices

The following Class A statements apply to the IBM servers that contain the Power11 processor and its features unless designated as electromagnetic compatibility (EMC) Class B in the feature information.

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

The following Class A statements apply to the servers.

### Canada Notice

CAN ICES-3 (A)/NMB-3(A)

### European Community and Morocco Notice

This product is in conformity with the protection requirements of Directive 2014/30/EU of the European Parliament and of the Council on the harmonization 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 non-recommended modification of the product, including the fitting of non-IBM option cards.

This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

Warning: This equipment is compliant with Class A of CISPR 32. In a residential environment this equipment may cause radio interference.

### Germany Notice

#### **Deutschsprachiger EU Hinweis: Hinweis für Geräte der Klasse A EU-Richtlinie zur Elektromagnetischen Verträglichkeit**

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2014/30/EU zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55022 / EN 55032 Klasse A ein.

Um dieses sicherzustellen, sind die Geräte wie in den Handbüchern beschrieben zu installieren und zu betreiben. Des Weiteren dürfen auch nur von der IBM empfohlene Kabel angeschlossen werden. IBM übernimmt keine Verantwortung für die Einhaltung der Schutzanforderungen, wenn das Produkt ohne Zustimmung von IBM verändert bzw. wenn Erweiterungskomponenten von Fremdherstellern ohne Empfehlung von IBM gesteckt/eingebaut werden.

EN 55032 Klasse A Geräte müssen mit folgendem Warnhinweis versehen werden:

"Warnung: Dieses ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funk-Störungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen zu ergreifen und dafür aufzukommen."

#### **Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten**

Dieses Produkt entspricht dem "Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)". Dies ist die Umsetzung der EU-Richtlinie 2014/30/EU in der Bundesrepublik Deutschland.

#### **Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) (bzw. der EMC Richtlinie 2014/30/EU) für Geräte der Klasse A**

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen.

Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:  
International Business Machines Corp.  
New Orchard Road

Armonk, New York 10504  
Tel: 914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:  
IBM Deutschland GmbH  
Technical Relations Europe, Abteilung M456  
IBM-Allee 1, 71139 Ehningen, Germany  
Tel: +49 (0) 800 225 5426  
email: HalloIBM@de.ibm.com

Generelle Informationen:

**Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022 / EN 55032 Klasse A.**

## **Japan Electronics and Information Technology Industries Association (JEITA) Notice**

(一社) 電子情報技術産業協会 高調波電流抑制対策実施  
要領に基づく定格入力電力値 : IBM Documentationの各製品  
の仕様ページ参照

This statement applies to products less than or equal to 20 A per phase.

高調波電流規格 JIS C 61000-3-2 適合品

This statement applies to products greater than 20 A, single phase.

高調波電流規格 JIS C 61000-3-2 準用品

本装置は、「高圧又は特別高圧で受電する需要家の高調波抑制対策ガイドライン」対象機器（高調波発生機器）です。

- 回路分類 : 6 (単相、P F C回路付)
- 換算係数 : 0

This statement applies to products greater than 20 A per phase, three-phase.

高調波電流規格 JIS C 61000-3-2 準用品

本装置は、「高圧又は特別高圧で受電する需要家の高調波抑制対策ガイドライン」対象機器（高調波発生機器）です。

- 回路分類 : 5 (3相、P F C回路付)
- 換算係数 : 0

## **Japan Voluntary Control Council for Interference (VCCI) Notice**

この装置は、クラス A 機器です。この装置を住宅環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

VCCI-A

### Korea Notice

이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

### People's Republic of China Notice

**警告：在居住环境中，运行此设备可能会造成无线电干扰。**

### Russia Notice

**ВНИМАНИЕ!** Настоящее изделие относится к классу А.  
В жилых помещениях оно может создавать радиопомехи, для снижения которых необходимы дополнительные меры

### Kingdom of Saudi Arabia Notice

قد يتسبب هذا المنتج في حدوث تداخل إذا تم استخدامه في المناطق السكنية.

ويجب تجنب هذا الاستخدام ما لم يتخذ المستخدم تدابير خاصة لتقليل الانبعاثات الكهرومغناطيسية لمنع التداخل مع استقبال البث الإذاعي والتلفزيوني.

تحذير: هذا الجهاز متوافق مع الفئة أ من SASO CISPR 32

في البيئة السكنية، قد يتسبب هذا الجهاز في حدوث تداخل لاسلكي.

### Taiwan Notice

**CNS 13438:**

警告使用者：  
此為甲類資訊技術設備，  
於居住環境中使用時，可  
能會造成射頻擾動，在此  
種情況下，使用者會被要  
求採取某些適當的對策。

**CNS 15936:**

**警告：為避免電磁干擾，本產品不應安裝或使用於住宅環境。**

### IBM Taiwan Contact Information:

台灣IBM 產品服務聯絡方式：  
台灣國際商業機器股份有限公司  
台北市松仁路7號3樓  
電話：0800-016-888

## United States Federal Communications Commission (FCC) Notice

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.

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

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Responsible Party:  
International Business Machines Corporation  
New Orchard Road  
Armonk, NY 10504  
Contact for FCC compliance information only: [fccinfo@us.ibm.com](mailto:fccinfo@us.ibm.com)

## United Kingdom Notice

This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

## Class B Notices

The following Class B statements apply to features designated as electromagnetic compatibility (EMC) Class B in the feature installation information.

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

## Canada Notice

CAN ICES-3 (B)/NMB-3(B)

## European Community and Morocco Notice

This product is in conformity with the protection requirements of Directive 2014/30/EU of the European Parliament and of the Council on the harmonization 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 non-recommended modification of the product, including the fitting of non-IBM option cards.

## German Notice

### Deutschsprachiger EU Hinweis: Hinweis für Geräte der Klasse B EU-Richtlinie zur Elektromagnetischen Verträglichkeit

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2014/30/EU zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55022/ EN 55032 Klasse B ein.

Um dieses sicherzustellen, sind die Geräte wie in den Handbüchern beschrieben zu installieren und zu betreiben. Des Weiteren dürfen auch nur von der IBM empfohlene Kabel angeschlossen werden. IBM übernimmt keine Verantwortung für die Einhaltung der Schutzanforderungen, wenn das Produkt ohne Zustimmung von IBM verändert bzw. wenn Erweiterungskomponenten von Fremdherstellern ohne Empfehlung von IBM gesteckt/eingebaut werden.

#### **Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten**

Dieses Produkt entspricht dem "Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)". Dies ist die Umsetzung der EU-Richtlinie 2014/30/EU in der Bundesrepublik Deutschland.

#### **Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) (bzw. der EMC Richtlinie 2014/30/EU) für Geräte der Klasse B**

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen.

Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:  
International Business Machines Corp.  
New Orchard Road  
Armonk, New York 10504  
Tel: 914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:  
IBM Deutschland GmbH  
Technical Relations Europe, Abteilung M456  
IBM-Allee 1, 71139 Ehningen, Germany  
Tel: +49 (0) 800 225 5426  
email: HalloIBM@de.ibm.com

Generelle Informationen:

**Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55032 Klasse B**

#### **Japan Electronics and Information Technology Industries Association (JEITA) Notice**

(一社) 電子情報技術産業協会 高調波電流抑制対策実施  
要領に基づく定格入力電力値 : IBM Documentationの各製品  
の仕様ページ参照

This statement applies to products less than or equal to 20 A per phase.

高調波電流規格 JIS C 61000-3-2 適合品

This statement applies to products greater than 20 A, single phase.

高調波電流規格 JIS C 61000-3-2 準用品

本装置は、「高圧又は特別高圧で受電する需要家の高調波抑制対策ガイドライン」対象機器（高調波発生機器）です。

- ・回路分類 : 6 (単相、P F C回路付)
- ・換算係数 : 0

This statement applies to products greater than 20 A per phase, three-phase.

## 高調波電流規格 JIS C 61000-3-2 準用品

本装置は、「高圧又は特別高圧で受電する需要家の高調波抑制対策ガイドライン」対象機器（高調波発生機器）です。

- 回路分類 : 5 (3相、PFC回路付)
- 換算係数 : 0

### Japan Voluntary Control Council for Interference (VCCI) Notice

この装置は、クラス B 機器です。この装置は、住宅環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。

取扱説明書に従って正しい取り扱いをして下さい。

VCCI-B

### Taiwan Notice

台灣IBM 產品服務聯絡方式：  
台灣國際商業機器股份有限公司  
台北市松仁路7號3樓  
電話：0800-016-888

### United States Federal Communications Commission (FCC) Notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an IBM-authorized dealer or service representative for help.

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

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

(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Responsible Party:

International Business Machines Corporation  
New Orchard Road

## Terms and conditions

---

Permissions for the use of these publications are granted subject to the following terms and conditions.

**Applicability:** These terms and conditions are in addition to any terms of use for the IBM website.

**Personal Use:** You may reproduce these publications for your personal, noncommercial use provided that all proprietary notices are preserved. You may not distribute, display or make derivative works of these publications, or any portion thereof, without the express consent of IBM.

**Commercial Use:** You may reproduce, distribute and display these publications solely within your enterprise provided that all proprietary notices are preserved. You may not make derivative works of these publications, or reproduce, distribute or display these publications or any portion thereof outside your enterprise, without the express consent of IBM.

**Rights:** Except as expressly granted in this permission, no other permissions, licenses or rights are granted, either express or implied, to the publications or any information, data, software or other intellectual property contained therein.

IBM reserves the right to withdraw the permissions granted herein whenever, in its discretion, the use of the publications is detrimental to its interest or, as determined by IBM, the above instructions are not being properly followed.

You may not download, export or re-export this information except in full compliance with all applicable laws and regulations, including all United States export laws and regulations.

IBM MAKES NO GUARANTEE ABOUT THE CONTENT OF THESE PUBLICATIONS. THE PUBLICATIONS ARE PROVIDED "AS-IS" AND WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT, AND FITNESS FOR A PARTICULAR PURPOSE.





