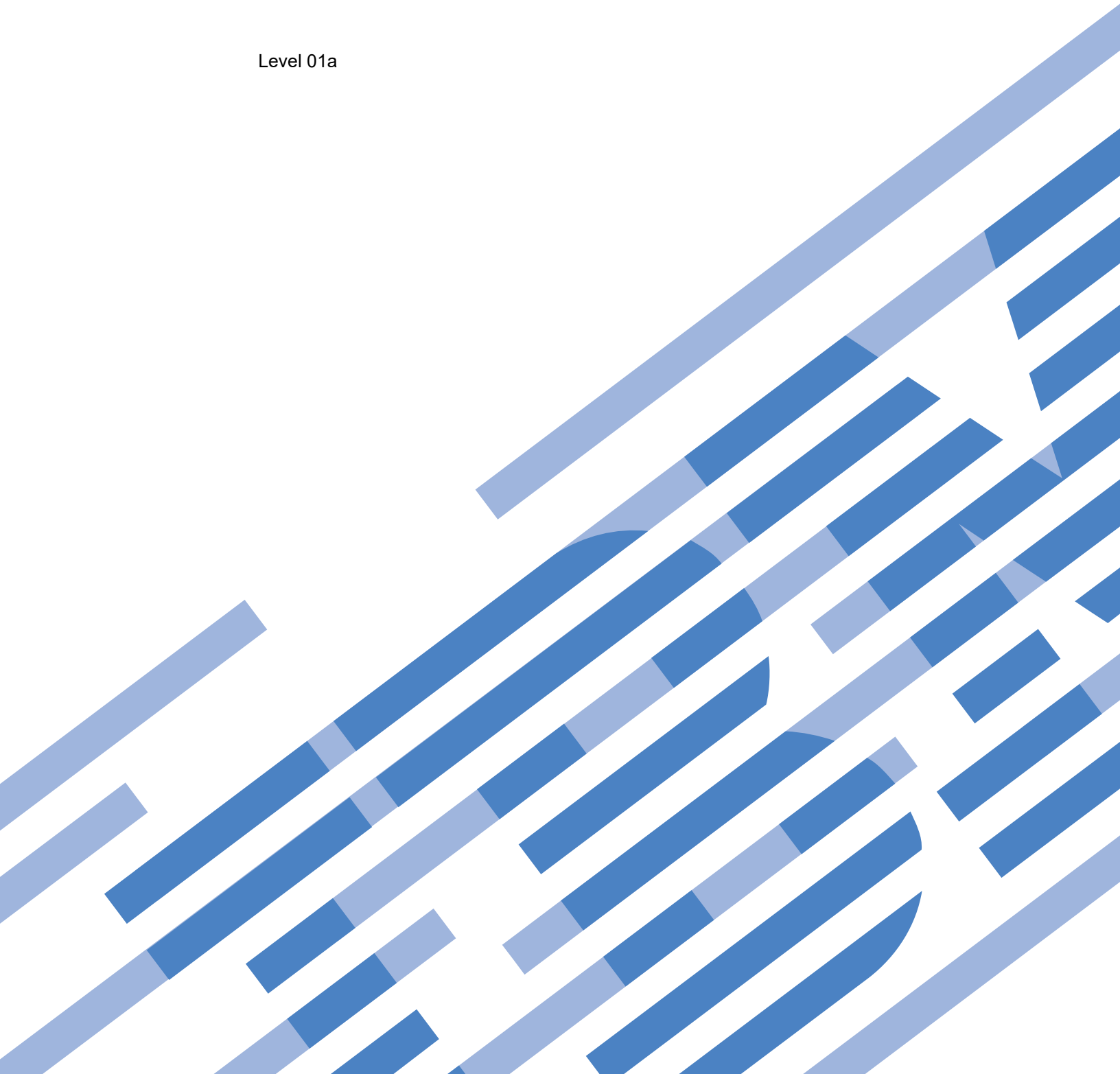
IBM

3907

Installation Manual for Physical Planning All Models

GC28-6974-01

Level 01a



3907

Installation Manual for Physical Planning All Models

GC28-6974-01

Note:
Before you use this information and the product it supports, be sure to read the information in "Safety" on page v, Appendix F, "Notices," on page 163, and *Environmental Notices and User Guide*, Z125-5823.

This edition, GC28-6974-01a, applies to the IBM z14 Model ZR1 (z14 Model ZR1) and IBM LinuxONE Rockhopper II (Rockhopper II). This edition replaces GC28-6974-01.

There may be a newer version of this document in **PDF** format available on **Resource Link**. Go to *http://www.ibm.com/servers/resourcelink* and click on **Library** on the navigation bar.

Contents

Safety

Safety notices

Safety notices may be printed throughout this guide. **DANGER** notices warn you of conditions or procedures that can result in death or severe personal injury. **CAUTION** notices warn you of conditions or procedures that can cause personal injury that is neither lethal nor extremely hazardous. **Attention** notices warn you of conditions or procedures that can cause damage to machines, equipment, or programs.

World trade safety information

Several countries require the safety information contained in product publications to be presented in their translation. If this requirement applies to your country, a safety information booklet is included in the publications package shipped with the product. The booklet contains the translated safety information with references to the US English source. Before using a US English publication to install, operate, or service this product, you must first become familiar with the related safety information in the *Systems Safety Notices*, G229-9054. You should also refer to the booklet any time you do not clearly understand any safety information in the US English publications.

Laser safety information

All IBM® Z® (Z) and IBM LinuxONE™ (LinuxONE) models can use I/O cards such as FICON®, Open Systems Adapter (OSA), InterSystem Channel-3 (ISC-3), zHyperLink Express, or other I/O features which are fiber optic based and utilize lasers (short wavelength or long wavelength lasers).

Laser compliance

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

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. (C027)

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

About this publication

This publication contains information necessary for planning the physical installation of the 3907.

Unless otherwise stated, throughout this document, "3907" refers to the IBM z14™ Model ZR1 (z14 ZR1) and IBM LinuxONE Rockhopper™ II Model LR1 (Rockhopper II).

Figures included in this document illustrate concepts and are not necessarily accurate in content, appearance, or specific behavior.

What is included in this publication

This publication contains the following chapters and appendices:

- Chapter 1 provides an introduction to planning for your system and a planning checklist.
- Chapter 2 contains important computer room environmental information.
- Chapter 3 gives plan views, service clearances, weight distribution, and cooling information for the system.
- Chapter 4 contains information on preparation of the raised floor.
- Chapter 5 provides power and line cord information.
- Chapter 6 includes information on Hardware Management Console and Support Element communications.
- Chapter 7 contains Remote Support Facility installation planning.
- Chapter 8 discusses cable connectivity information.
- Chapter 9 provides information about operating in a Parallel Sysplex® environment.
- The appendices provide standard symbols, HMC specifications, cabling specification, 16U feature requirements, and power cabling schematic.

Related publications

Publications that you will find helpful and that you should use along with this publication are in the following list. You can access these books from Resource Link® at *http://www.ibm.com/servers/resourcelink*, and click **Library** from the navigation bar on the left. Then select the server product.

- *Systems Safety Notices*, G229-9054
- *Environmental Notices and User Guide*, Z125-5823
- *3907 Installation Manual*, GC28-6973
- *Planning for Fiber Optic Links (FICON/FCP, Coupling Links, Open System Adapters, and zHyperLink Express)*, GA23-1408
- *FICON Channel-to-Channel Reference*, SB10-7174
- *Open System Adapter-Express Integrated Console Controller Dual Port User's Guide* , SA23-2266
- *Open Systems Adapter-Express Customer's Guide and Reference*, SA22-7935

In addition to these references, there is general computer room planning information on Resource Link at *http://www.ibm.com/servers/resourcelink*.

Related HMC and SE console information

Hardware Management Console (HMC) and Support Element (SE) information can be found on the console help system.

Licensed Machine Code

Licensed Machine Code is provided in accordance with the terms and conditions of the applicable IBM® Customer Agreement or other applicable written agreement between the Customer and IBM.

Licensed Machine Code (LMC) is a fundamental component of the 3907 and is copyrighted and licensed by IBM. Each 3907 is delivered with Licensed Machine Code that is customized to the specific machine ordered. The Licensed Machine Code enables the 3907 to operate in accordance with its Official Published Specifications.

Model upgrades, feature additions, and system engineering changes may require updated Licensed Machine Code for the system. Updated Licensed Machine Code replaces the existing Licensed Machine Code.

Relocation of a 3907 requires that the Licensed Machine Code be reinstalled in the server at the new location. See the "Discontinuing the System" section in the *3907 Installation Manual* for the procedure about relocating a 3907.

Accessibility

Accessible publications for this product are offered in EPUB format and can be downloaded from Resource Link at http://www.ibm.com/servers/resourcelink.

If you experience any difficulty with the accessibility of any IBM Z® and IBM LinuxONE information, go to Resource Link at http://www.ibm.com/servers/resourcelink and click **Feedback** from the navigation bar on the left. In the **Comments** input area, state your question or comment, the publication title and number, choose **General comment** as the category and click **Submit**. You can also send an email to reslink@us.ibm.com providing the same information.

When you send information to IBM, you grant IBM a nonexclusive right to use or distribute the information in any way it believes appropriate without incurring any obligation to you.

Accessibility features

The following list includes the major accessibility features in IBM Z and IBM LinuxONE documentation, and on the Hardware Management Console and Support Element console:

- Keyboard-only operation
- Interfaces that are commonly used by screen readers
- Customizable display attributes such as color, contrast, and font size
- Communication of information independent of color
- Interfaces commonly used by screen magnifiers
- Interfaces that are free of flashing lights that could induce seizures due to photo-sensitivity.

Keyboard navigation

This product uses standard Microsoft Windows navigation keys.

Consult assistive technologies

Assistive technology products such as screen readers function with our publications, the Hardware Management Console, and the Support Element console. Consult the product information for the specific assistive technology product that is used to access the EPUB format publication or console.

IBM and accessibility

See http://www.ibm.com/able for more information about the commitment that IBM has to accessibility.

How to send your comments

Your feedback is important in helping to provide the most accurate and high-quality information. Send your comments by using Resource Link at http://www.ibm.com/servers/resourcelink. Click **Feedback** on the navigation bar on the left. You can also send an email to reslink@us.ibm.com. Be sure to include the name of the book, the form number of the book, the version of the book, if applicable, and the specific location of the text you are commenting on (for example, a page number, table number, or a heading).

Revisions

A technical change from the previous edition of this document is indicated by a vertical line (|) to the left of the change.

Summary of changes

Summary of changes for the *3907 Installation Manual for Physical Planning*, GC28-6974.

Table 1. Summary of changes

Release level	Changes in level
01a	This revision contains editorial changes and the following technical changes: • Important note added to "IBM Adapter for NVMe (FC 0435)" on page 109.
01	This revision contains editorial changes and the following technical changes: • Changes to the "Planning checklist" on page 2 and "z/OS HCD" on page 116 to include Dynamic I/O for Standalone Coupling Facility considerations. • Important note added to Chapter 3, "Models and physical specifications," on page 23. • "Supported power cords" on page 70 is updated to include the additional Wall plug option, RS 9P33UO, for FC 7938 (IBM P/N 39M5418). • "Trusted Key Entry (TKE)" on page 81 is updated to include TKE 9.1 License Internal Code enhancements. • "FICON channel feature" on page 91 is updated to include the following new features for IBM LinuxONE Rockhopper II only: – FCP Express32S LX (FC 0438) – FCP Express32S SX (FC 0439) • "OSA-Express features" on page 95 is updated to include the new OSA-Express7S 25 GbE feature (FC 0429) • "Native PCIe adapters" on page 104 is updated to include the following new features: – 25 GbE RoCE Express2 (FC 0430) added to "IBM RoCE Express and RoCE Express2" on page 105 – "IBM Adapter for NVMe (FC 0435)" on page 109 - IBM LinuxONE Rockhopper II only
00b	This revision contains editorial changes and the following technical changes: • Changes to the "Planning checklist" on page 2 to include Earthquake kit considerations. • Changes to the left side service clearance area in "Machine and service clearance areas" on page 35. • Changes to "Earthquake kit - Frame-stiffening and frame tie-down" on page 42. • Added a note to the "Configuration information" on page 95 in "OSA-Express features" on page 95.
00a	This revision contains editorial changes and the following technical changes: • Change to Chapter 2, "Environmental specifications," on page 9 • Change to "Shipping and packaging specifications" on page 32 • Changes to "Casters" on page 59 • Change to "Example" on page 149 in Appendix D, "16U Reserved feature (FC 0617)," on page 139

Chapter 1. Introduction

This chapter is intended to help you prepare your physical site for the installation of an 3907. Marketing and Installation Planning Representatives are also available to help you with installation planning. Proper planning for your new system will facilitate a smooth installation and fast system start up.

The use of the terms, “server”, “processor”, “system” and “all models” in this publication refer to the 3907.

System planning

As part of your system planning activity, you will make decisions about where to locate your equipment, who will operate the system, and so on. A good plan ensures that the equipment and materials are ready to use when the 3907 arrives.

The type of software (operating system and application programs) that you intend to use must support the features and devices on the system. You should already be familiar with your software requirements, but may want to contact your IBM marketing representative for information on planning for the software.

Planning for a new computer room

A detailed step-by-step procedure for physically planning a computer room installation is located on the **General Information for Planning a Physical Site** page on Resource Link at *http://www.ibm.com/servers/resourcelink*. On the left navigation pane, click **Planning**, **Physical Planning**, and **General information for planning a physical site**.

Planning checklist

The following checklist identifies installation tasks and responsibilities sequentially, and is designed for new installations. If you have to renovate your site, you may need a longer planning cycle.

Site Preparation Checklist

Task/Consideration	Task Assigned ( ) ✓	Target Date	Completed
CHECKPOINT 1			
○ Designate a person in your organization with the responsibility for all phases of site preparation for this system installation	☐	_____	_____
○ Review all site planning information with the designated person	☐	_____	_____
○ Determine who will actually perform each site preparation task and who will control the marking of this checklist	☐	_____	_____
○ Identify communication needs, including Remote Support Facility, cables, switches, telephones, connection panels, etc	☐	_____	_____
○ In the Chapter titled, "I/O cabling and connectivity" (in this document), read the information about planning now for future cabling needs. In the same chapter, also read "IBM Site and Facilities Services"	☐	_____	_____
○ Identify channel needs including: cables, directors, switches, patch panels, etc	☐	_____	_____
○ Identify other machine/device needs including: changes to any existing equipment	☐	_____	_____
○ Determine the schedule with your IBM marketing representative and fill in the target dates on this checklist	☐	_____	_____
CHECKPOINT 2			
○ Lay out the floor plan. Include stationary obstacles, walls, all computer equipment, locations for power, lighting, heating and cooling, water and fire detection and extinguishing equipment	☐	_____	_____
○ If the level of acoustical noise is a concern, consider arranging the floor layout to avoid areas of excessive noise exposure to employees, and possibly utilize noise control screens or other treatments to reduce noise levels. Some IBM servers have available acoustic doors to reduce noise. Check with your marketing representative to see if your server has such options.	☐	_____	_____
○ If this is a new computer room, see the course, *General information for planning the physical site* under "Planning --> Physical Planning" on Resource Link (*http://www.ibm.com/servers/resourcelink*)	☐	_____	_____
○ To assist in site planning, a 3-D graphic file to be used with CAD software is available on Resource Link (*http://www.ibm.com/servers/resourcelink*). Click "Planning / Physical Planning." Then under the specific machine, click "STP 3-D graphic files."	☐	_____	_____
○ Order communication equipment cables, modems, switches, telephones, connection panels, etc	☐	_____	_____
○ Order channel equipment cables, directors, switches, patch panels, etc. In the Chapter titled, "I/O cabling and Connectivity" (in this document), read the information about "IBM Site and Facilities Services" and "Customer fiber optic cabling responsibilities" to determine your cabling requirements and responsibilities. Your IBM marketing representative can assist you with this task. Other parts of this chapter include fiber optic channel and adapter descriptions and information about the Fiber Quick Connect feature for FICON channels.	☐	_____	_____
○ If you are planning for a system that will use FICON channels, InfiniBand, coupling links, or Open System Adapters (OSA), contact your IBM marketing representative to obtain the document, *Planning for Fiber Optic Links (FICON/FCP, Coupling Links, Open System Adapters, and zHyperLink Express),* GA23-1408	☐	_____	_____
Order other machines/devices, including changes to any existing equipment.	☐	_____	_____
○ Order the *Earthquake kit - Frame-stiffening and tie-down* feature if you require frame ruggedizing to secure the frame and its contents from damage when exposed to vibrations and shocks as those in a seismic event.	☐	_____	_____

Site Preparation Checklist

Task/Consideration	Task Assigned (✓)	Target Date	Completed
CHECKPOINT 3			
○ The computer room is prepared for computer equipment service clearance and floor loading, physical placement based on logical priority, cabling restrictions, and shock and vibration considerations, and electromagnetic compatibility/interference If the *Earthquake kit - Frame-stiffening and tie-down* feature (FC 8006) was ordered, install the following Raised floor: 4 eyebolts in concrete floor Non-raised floor: 8 anchors and 2 lockdown plates in concrete floor	☐	_____	_____
○ Emergency and backup operations planning includes provisions for fire detection, prevention, extinguishing, and control equipment, and storm protection and damage recovery procedures	☐	_____	_____
○ There is workspace around equipment, including passageways for movement of people and machines, and includes consideration for lighting and possible areas of high acoustic noise	☐	_____	_____
○ Office equipment and space, including furniture, vending, meeting, and entrance/exit areas have adequate lighting, heating/cooling, and acoustics	☐	_____	_____
○ Material and data storage provisions have been satisfied	☐	_____	_____
○ Schedule and make changes to existing programs as required	☐	_____	_____
○ Schedule and make changes to existing machines/devices as required	☐	_____	_____
○ Arrange for installation of cables between work stations, controllers, modems, switches, etc	☐	_____	_____
○ Arrange for installation of new power receptacles and wiring	☐	_____	_____
○ Define a training program for employees	☐	_____	_____
CHECKPOINT 4			
○ Computer room power should be completed. electrically clean, dedicated circuits for all computer equipment sufficient power provided to avoid outages caused by power transients protection from lightning damage	☐	_____	_____
○ Backup power batteries or generators, if required	☐	_____	_____
○ Branch circuits, grounding, conduits, phase rotation, emergency controls, to local electrical code and equipment guidelines	☐	_____	_____
○ An adequate number of computer equipment and convenience outlets have been provided in the locations where they are to be used	☐	_____	_____
○ Computer room personnel are adequately trained in power procedures, including emergency situations	☐	_____	_____
○ Review the progress of the communications, channel, and adapter cabling. Identify and resolve problems and schedule conflicts	☐	_____	_____
○ Review the system configuration to make sure there are no physical problems and that the configuration meets your needs.	☐	_____	_____

Site Preparation Checklist

Task/Consideration	Task Assigned (✓)	Target Date	Completed
CHECKPOINT 5			
○ Air conditioning installation is complete capacity and controls provided for automatic temperature and humidity levels filtration system is adequate and maintenance plan established regular monitoring and testing	☐	_____	_____
○ Training for computer room personnel	☐	_____	_____
○ If you have elected to do your own I/O cabling, as cables begin to arrive, start installing and labeling them. Label power receptacles as they are installed	☐	_____	_____
○ Complete the Systems Assurance Product Review with your marketing representative or Business Partner and the system installers	☐	_____	_____
○ Carefully measure the delivery path from the shipper drop-off point to the raised floor install location. Accurate measurements now may prevent installation delays later	☐	_____	_____
CHECKPOINT 6			
○ Complete communication equipment installation, cables, modems, switches, telephones, connection panels, etc	☐	_____	_____
○ Complete the Remote Support Facility installation LAN and communication cables, switches, patch panels, etc	☐	_____	_____
○ Prepare IOCP input statements or HCD definitions	☐	_____	_____
○ If you are planning to use dynamic I/O for a standalone coupling facility, configure your HCD definition accordingly	☐	_____	_____
○ Use the CHPID Mapping Tool on Resource Link to help assign PCHIDs to CHPIDs	☐	_____	_____
○ If you have elected to do your own I/O cabling, complete the checkout of system cables as much as possible. Verify that the cables are properly routed, protective end caps are in place, that the processor ends of the cables are safely out of the way for system installation, and that cable safety procedures are followed	☐	_____	_____
○ Complete the checkout of the power cables. Test for continuity and polarity, proper grounding, correct phase wiring, and general power safety considerations	☐	_____	_____
○ Complete the required changes to the existing programs and data processing units	☐	_____	_____
○ Install communication facilities, such as telephone lines	☐	_____	_____

Site Preparation Checklist

Task/Consideration	Task Assigned (✓)	Target Date	Completed
CHECKPOINT 7			
○ Are there any new applications that must be installed/ tested before the new system arrives?	☐	_____	_____
○ Do you need to conduct training with computer room personnel:			
- Safety?	☐	_____	_____
- Security?	☐	_____	_____
- Operations?	☐	_____	_____
- Other?	☐	_____	_____
○ Are there any outstanding hardware changes that need to be made to existing:			
- Computer equipment?	☐	_____	_____
- Communications equipment?	☐	_____	_____
- Site facilities?	☐	_____	_____
○ Is the system configuration ready for installation:			
- IOCP input?	☐	_____	_____
- CHPIDs?	☐	_____	_____
○ Do you have a comprehensive channel cabling plan in place:			
- Are all cables either ordered or on hand?	☐	_____	_____
- Do you have a reliable installer ready to go?	☐	_____	_____
- Are plans in place for cable connection at remote devices?	☐	_____	_____
- Is there a system test plan?	☐	_____	_____
- Are you prepared to provide cable labels or labeling information?	☐	_____	_____
- Are protective end cap devices in place on all cable connectors?	☐	_____	_____
- Are cables routed and coiled out of the way for installation?	☐	_____	_____
○ Is the path for moving the new equipment:			
- Wide enough?	☐	_____	_____
- High enough?	☐	_____	_____
- Free of obstructions?	☐	_____	_____
- Ramps ready, if necessary?	☐	_____	_____
○ Are floor panels ready? If the *Earthquake kit - Frame-stiffening and tie-down* feature (FC 8006) was ordered, has the following hardware been installed? Raised floor: 4 eyebolts in concrete floor Non-raised floor: 8 anchors and 2 lockdown plates in concrete floor	☐	_____	_____
○ Is all furniture and miscellaneous equipment in place or out of the way for installation?	☐	_____	_____
○ Is your setup team trained and ready for the arrival of the new equipment?	☐	_____	_____
○ Complete the site preparation	☐	_____	_____
ARRIVAL OF NEW EQUIPMENT			
○ Move unit(s) to installation location.	☐	_____	_____
○ Place the units according to machine clearance dimensions provided in "Machine and service clearance areas" (in this document).	☐	_____	_____
○ Unpack unit(s) according to instructions.	☐	_____	_____
○ Call your service provider to install the unit(s).	☐	_____	_____

Customized planning aid

A customized planning aid will be available for your system one day after receipt of your order in manufacturing. You may obtain access to this aid by registering on Resource Link at *http://www.ibm.com/servers/resourcelink*. This planning aid will include unique physical planning requirements based on your system's specific configuration.

It is important to note here that the planning aid is not intended to replace this manual. You should be familiar with the contents of this document before you attempt to use the planning aid.

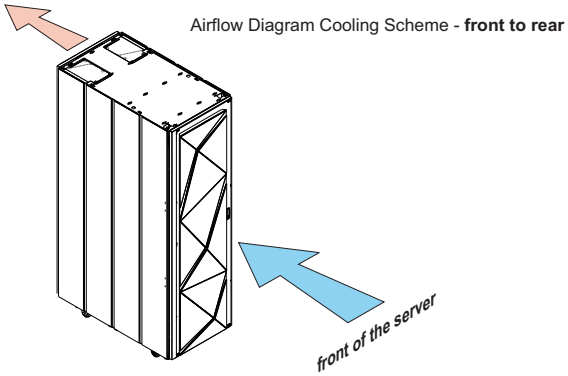
ASHRAE declaration

ASHRAE Declarations (Metric) for 3907

ASHRAE Class A3 Description	Typical Heat Release	Airflow Minimum (1)	Airflow Nominal (1)	Airflow Maximum (1)	Max Weight (2)	Overall System Dimensions (3)	Maximum Elevation (4, 5, 6)	Maximum Dry Bulb Temperature (4, 5)	Maximum Dew Point (6)
	kW	m3/hr	m3/hr	m3/hr	kg	W x D x H (cm)	m	C°	C°
Typical Configuration Model ZR1, FC 0200 or Model LR1, FC 0300 (with 1 PCIe+ I/O drawer and with 2 CPs)	5.3	850 (Zone 1)	990 (Zone 2)	1800 (Zone 6)	794	62.5 x 120.4 x 201.9	3048 (28°C, 80% RH)	40 (900 m, 40% RH)	24

ASHRAE Declarations (English) for 3907

ASHRAE Class A3 Description	Typical Heat Release	Airflow Minimum (1)	Airflow Nominal (1)	Airflow Maximum (1)	Max Weight (2)	Overall System Dimensions (3)	Maximum Elevation (4, 5, 6)	Maximum Dry Bulb Temperature (4, 5)	Maximum Dew Point (6)
	kBTU/hr	cfm	cfm	cfm	lbs	W x D x H (in)	ft	F°	F°
Typical Configuration Model ZR1, FC 0200 or Model LR1, FC 0300 (with 1 PCIe+ I/O drawer and with 2 CPs)	18.1	500 (Zone 1)	583 (Zone 2)	1060 (Zone 6)	1751	24.6 x 47.4 x 79.5	10,000 (82°F, 80% RH)	104 (2953 ft, 40% RH)	75.2



Notes:

1. Airflow is designed to increase as the local ambient room temperature and/or altitude increases. Minimum airflow assumes an ambient temperature below 23° C (73° F) and altitude below 457 m (1500 ft). Nominal airflow assumes an ambient temperature of 25° C (77° F) and an altitude below 457 m (1500 ft). Maximum airflow is based on an ambient temperature of 40° C (104° F) or an altitude of 914 m (3000 ft).
2. Weights provided assume the optional tie-down kit (FC 8006) is NOT installed.
3. Dimensions do not include top exit cabling feature (FC 7917)
4. For ambient temperatures exceeding 25° C (77° F), the acoustical noise levels of the system may increase significantly as the speeds of the air moving devices increase. See “Acoustics” on page 20 for the declared acoustical noise emission levels for the system under nominal temperature conditions of 23° C plus or minus 2° C (73.4° F plus or minus 3.6° F).
5. Maximum ambient reduces 1° C (1.8° F) for every 175 m (574 ft) over 900 m (2953 ft). At 3048 m (10,000 ft), maximum allowable ambient temperature is 28° C (82° F).

6. See the elevation label () or tropical climate label () in the *Systems Safety Notices* document to determine **if** there are any elevation limitations or tropical climate limitations for your country.

Chapter 2. Environmental specifications

The 3907 is among the most powerful group of mainframe processors ever built. Technology improvements have placed the 3907 in the top levels of Reliability, Availability, and Serviceability. But it takes more than premium computer equipment to achieve these goals. The data center environment must be able to support the demands that 3907 capability requires. On the following pages, environmental specifications are presented in tabular and graphic forms to emphasize how important it is that you provide the conditions necessary to utilize all of the power the 3907 offers.

The 3907 operates in an ASHRAE (3rd edition) Class 3 environment.

Environmental specifications are presented in two categories: Recommended and Allowable. Obviously, meeting the required specifications is prerequisite to using the 3907. It is strongly suggested that you strive for a long-term operating environment within the recommended specification range. The powerful computing the 3907 provides generates a great deal of heat that must be removed from machine. Operating your data center most of the time within the recommended specifications ranges instead of the allowable range will enhance its overall resiliency, energy efficiency, and reliability.

Unless otherwise noted on individual specification pages, the following environmental specifications, based on an altitude from sea level to 900 meters (2953 feet), apply:

Table 2. Environmental specifications - table format

Environment, Operating: [9]		
	Recommended [1]	**Allowable** [2,3,4,5,6]
Temperature	18°C - 27°C (64.4°F - 80.6°F)	5°C - 40°C (41°F - 104°F)
Low end moisture	5.5°C (41.9°F) dew point	-12°C (10.4°F) dew point and 8% relative humidity
High end moisture	60% relative humidity and 15°C (59°F) dew point	24°C (72.5°F) dew point and 85% relative humidity
Gaseous contamination	Severity level G1 according to ANSI/ISA S71.04-1985 [7,8]	
Particulate contamination	Cleanliness level of ISO 14644-1 Class 8 [8]	
Allowable environment, nonoperating: [10]		
Temperature	5°C (45°F) to 45°C (113°F)	
Relative humidity	8% - 85%	
Maximum dew point	27°C (80.6°F)	
Gaseous contamination	Severity level G1 as per ANSI/ISA 71.04-1985 [7,8]	
Environment, shipping: [9]		
Temperature	-40°C (-40°F) to 60°C (140°F)	
Relative humidity	5% - 100% (no condensation)	
Maximum wet bulb temperature	29°C (84.2°F)	
Shipping package	IBM-approved crate with vapor barrier bag with desiccant	
Environment, storage:		
Temperature	1°C (33.8°F) to 60°C (140°F)	
Relative humidity	5% -80% (no condensation)	
Wet bulb	29°C (84.2°F)	
Shipping package	IBM-approved crate with vapor barrier bag with desiccant	

Notes:

1. The recommended operating environment specifies a long-term operating environment that can result in the greatest resiliency, energy efficiency, and reliability.
2. The allowable operating environment represents where the equipment has been tested to verify functionality. Due to the stresses that operating in the allowable envelope can place on the equipment, these envelopes should be used for short-term operation, not continuous operation (e.g. in the case of a cooling failure).
3. Must derate the maximum allowable temperature 1°C (1.8°F)/175 m (574 ft) above 900 m (2953 ft) up to a maximum allowable elevation of 3050 m (~10,000 ft).
4. The minimum humidity level is the larger absolute humidity of the -12°C (10.4°F) dew point and the 8% relative humidity. These 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. See Figure 1 on page 12 for a graphical explanation of the envelope.
5. For temperatures in the allowable envelope, the acoustical noise levels of the system may increase significantly as the speeds of the air moving devices increase. See “Acoustics” on page 20 for the declared acoustical noise emission levels for the system.
6. Moisture levels lower than 0.5°C (32.9°F) dew point, but not lower than the low end moisture limit, can be accepted if appropriate control measures are implemented to limit the generation of static electricity on personnel and equipment in the data center. All personnel and mobile

furnishings/equipment must be connected to the ground via an appropriate static control system. The following items are considered the minimum requirements:

a. Conductive materials
   1) Conductive flooring
   2) Conductive footwear on all personnel that go into the data center, including visitors
   3) All mobile furnishings/equipment to be made of conductive or static dissipative materials
b. During maintenance on any hardware, a properly functioning wrist strap must be used by personnel who contacts the system.

7. ANSI/ISA-S71.04. 1985. "Environmental conditions for process measurement and control systems: Airborne contaminants." Instrument Society of America, Research Triangle Park, NC, 1985.
8. See "Conductive contamination" on page 18 for details of the requirements for gaseous and particulate contamination.
9. See "System acclimation" on page 15 for guidance on how long the system must be acclimated before being attached to power.
10. Equipment has been removed from original shipping container and installed but powered down. The allowable non-operating environment is provided to define the environmental range that an unpowered system should be able to experience short-term without being damaged. It assumes that the system has not been contaminated with low deliquescent relative humidity dust, which could damage the equipment and require the system to dry out before powering on. (See "Conductive contamination" on page 18 for details.) Under all conditions, the environment must remain non-condensing. The allowable non-operating environment is meant for abnormal conditions (ie. power or cooling failure). It is expected that the data center will return conditions to the recommended operating conditions within a short period of time. The allowable non-operating environment is not meant to be used for periodic, planned changes from an operating to non-operating condition.

Figure 1 shows the environmental specifications in **line graph** format.

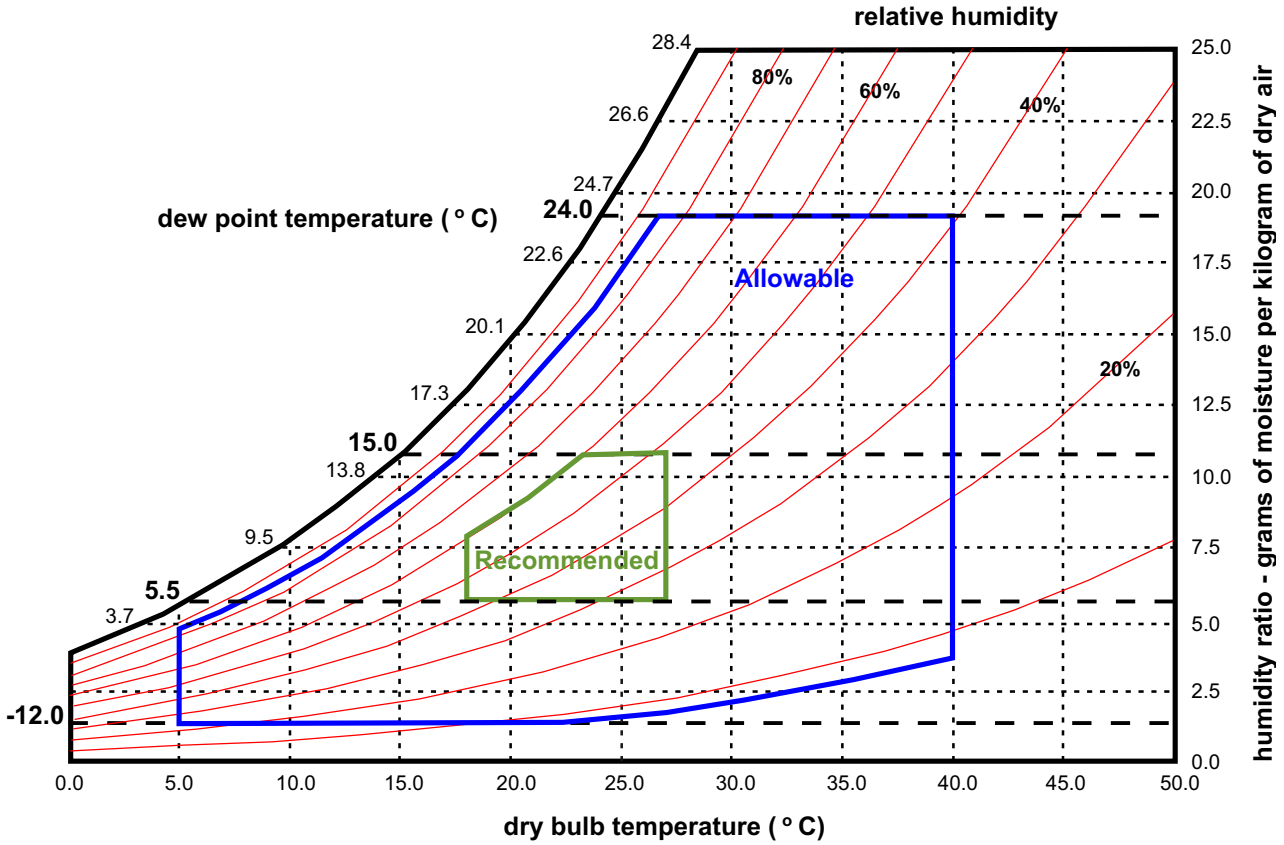


Figure 1. Environmental operating specifications - line graph format

Notes:

1. Psychrometric chart is shown in SI (metric) units and a barometric pressure 101.325 kPa (sea level).
2. The recommended operating environment specifies a long-term operating environment that can result in the greatest reliability and energy efficiency.
3. The allowable operating environment represents where the equipment has been tested to verify functionality. Due to the stresses that operating in the allowable envelope can place on the equipment, these envelopes should be used for short-term operation, not continuous operation, for example in the case of a cooling failure.
4. Must derate the maximum allowable temperature 1°C (1.8°F)/175 m (574 ft) above 900 m (2953 ft) up to a maximum allowable elevation of 3050 m (~10,000 ft).
5. For temperatures in the allowable envelope, the acoustical noise levels of the system may increase significantly as the speeds of the air moving devices increase. See “Acoustics” on page 20 for the declared acoustical noise emission levels for the system.
6. Moisture levels lower than 0.5°C (32.9°F) dew point, but not lower than the low end moisture limit, can be accepted if appropriate control measures are implemented to limit the generation of static electricity on personnel and equipment in the data center. All personnel and mobile furnishings/equipment must be connected to the ground via an appropriate static control system. The following items are considered the minimum requirements:
   a. Conductive materials
      1) Conductive flooring
      2) Conductive footwear on all personnel that go into the data center, including visitors
      3) All mobile furnishings/equipment to be made of conductive or static dissipative materials.

b. During maintenance on any hardware, a properly functioning wrist strap must be used by personnel who contacts the system.

Figure 2 shows the environmental specifications in **bar graph** format.

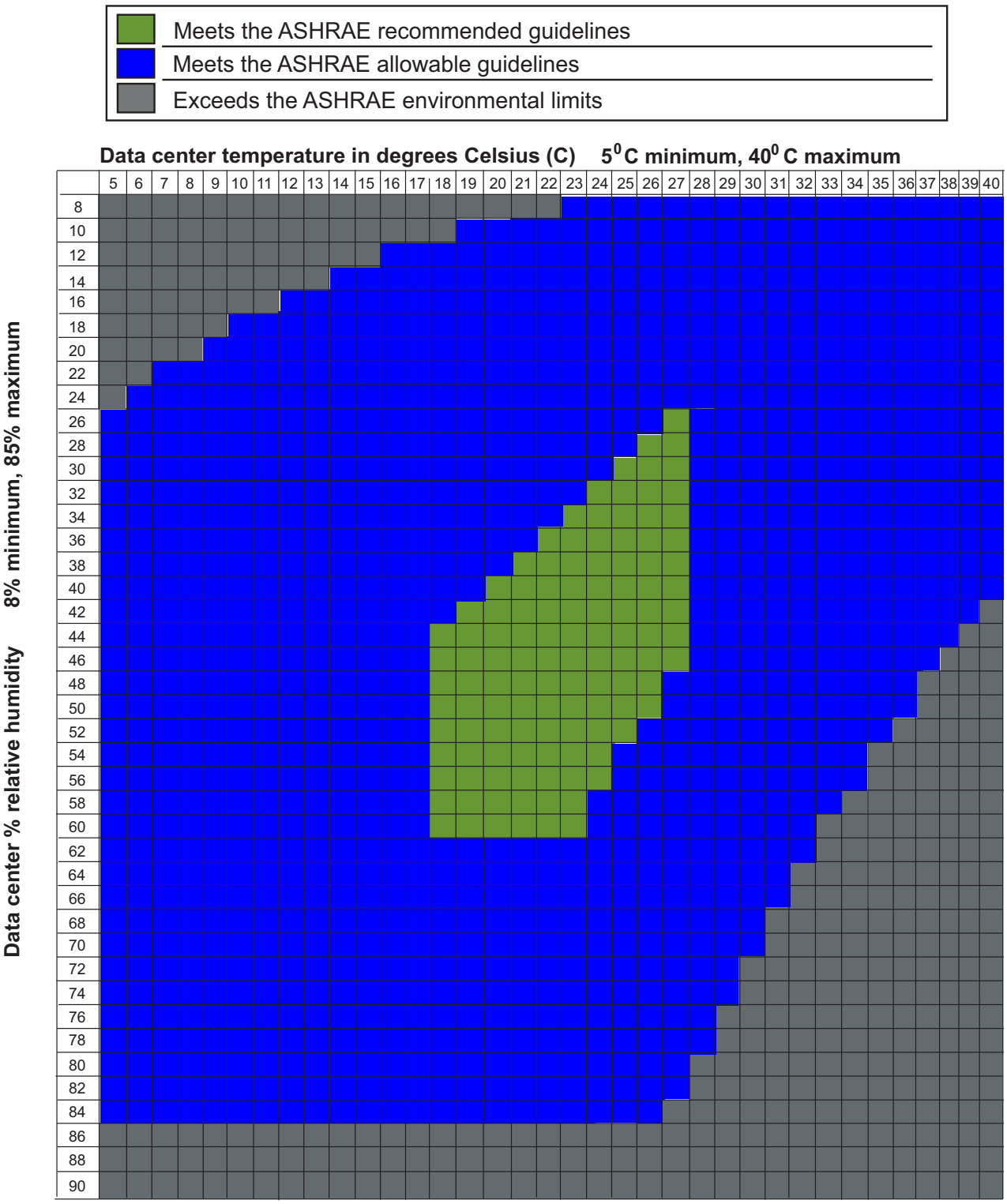


Figure 2. Environmental operating specifications - bar graph format

Notes:

1. Graph is shown in SI (metric) units and a barometric pressure 101.325 kPa (sea level).

2. The recommended operating environment specifies a long-term operating environment that can result in the greatest reliability and energy efficiency.
3. The allowable operating environment represents where the equipment has been tested to verify functionality. Due to the stresses that operating in the allowable envelope can place on the equipment, these envelopes should be used for short-term operation, not continuous operation, for example in the case of a cooling failure.
4. Must derate the maximum allowable temperature 1°C (1.8°F)/175 m (574 ft) above 900 m (2953 ft) up to a maximum allowable elevation of 3050 m (~10,000 ft).
5. For temperatures in the allowable envelope, the acoustical noise levels of the system may increase significantly as the speeds of the air moving devices increase. See "Acoustics" on page 20 for the declared acoustical noise emission levels for the system.
6. In the allowable operating environment, moisture levels lower than 0.5°C (32.9°F) dew point, but not lower than the low end moisture limit, can be accepted if appropriate control measures are implemented to limit the generation of static electricity on personnel and equipment in the data center. All personnel and mobile furnishings/equipment must be connected to the ground via an appropriate static control system. The following items are considered the minimum requirements:
   a. Conductive materials
      1) Conductive flooring
      2) Conductive footwear on all personnel that go into the data center, including visitors
      3) All mobile furnishings/equipment to be made of conductive or static dissipative materials
   b. During maintenance on any hardware, a properly functioning wrist strap must be used by personnel who contacts the system.

It is very important the environmental specifications be met immediately in front of the frame of the 3907. Ideally, it would be best if the temperature and humidity controls are good enough to surround the service area of the 3907.

System acclimation

Server and storage equipment (racks and frames) should be gradually acclimated to the surrounding environment before being powered on.

When server and storage equipment is shipped in a climate where the outside temperature is below the dew point of the destination indoor location, condensation and frost will naturally form on the cooler inside and outside surfaces of the equipment when brought indoors. All IBM products are tested and verified to withstand these phenomena produced under these circumstances. As long as sufficient time is provided to allow the hardware to gradually acclimate to the indoor environment before attaching it to electrical power, there should be no issues with long term reliability of the product.

General recommendations

- DO NOT attach power to the product before the recommended acclimation time. Attaching power may cause some features to enter into a stand-by mode even before the product has been formally switched on.
- Product must be acclimated before attaching to power to avoid shorts and other damage due to wet or moist components. Use of vapor barrier bags and/or desiccant does not negate the need for acclimation.
- If the install/staging area environment allows it, DO leave the product in the full package, or at least the inner plastic bag, for the recommended time as shown in the following tables. This helps minimize condensation directly on or within the product.

- Acclimate the product away from perforated tiles or other direct sources of forced air convection to minimize excessive condensation on or within the equipment. DO NOT blow room air at the product to acclimate it faster as this can *increase* moisture accumulation within the product and may also cause dust from the room to adhere to moist surfaces.
- If possible, try to acclimate the system in environments where the temperature is greater than 15°C (59°F), the relative humidity is less than 60%, and the dewpoint is less than 27°C (80°F) to minimize the acclimation time. Cold, humid environments will lead to greater acclimation times.
- There are certain situations where some or all coolant water shipped in blue containers can freeze. Freezing of the coolant does not effect the container integrity or the anti-corrosive chemical-water solution. However, the blue container must be completely thawed, back to liquid state, and allowed to come to room temperature, before transferring the coolant to a Fill/Drain tool.

Determining system acclimation time

Note: Use the following information to determine the system acclimation time, unless otherwise stated by product specific install instructions.

1. Determine the shipping condition and lowest temperature the product was exposed to in the 48 hours prior to it being moved to the staging area or final installation area. Work with your representative if you don't have this information..
   - Use Table 3 on page 17 if the minimum temperature was between -40°C (-40°F) and -20°C (-4°F). Shipments conducted in cold weather or in cold climes and which were not conveyed in climate-controlled trucking will need to use this table.
   - Use Table 4 on page 17 if the minimum temperature was between -20°C (-4°F) and 0°C (32°F). Shipments conducted in cold weather or in cold climes and which were not conveyed in climate-controlled trucking will need to use this table.
   - Use Table 5 on page 17 if the minimum temperature was between 0°C (32°F) and 15°C (59°F). Shipments conducted in chilly to mild weather and which were not conveyed in climate-controlled trucking may use this table. Air shipments followed by transport in warmer conditions may also use this table. If air shipment was followed by non-climate controlled transport in very cold or cold conditions, then use Table 3 on page 17 and Table 4 on page 17, respectively.
   - Use Table 6 on page 18 if the minimum temperature was greater than 15°C (59°F). Shipments conducted in warm/hot weather or in climate controlled conditions may use this table. If shipments were transported by air less than 48 hours prior to delivery, this table may not be used. Refer to Table 3 on page 17, Table 4 on page 17, or Table 5 on page 17 instead.
2. Once the appropriate acclimation table has been identified, determine the acclimation zone (AA-D) for your environment. Determine the *minimum* temperature and *maximum* relative humidity of the room where the product will be acclimated. If the temperature falls between two tabulated values, use the *lower* tabulated temperature. If the relative humidity falls between two tabulated values, use the *higher* tabulated relative humidity.
3. Once the acclimation zone has been determined, use Table 7 on page 18 to determine the acclimation requirements for the system. For example, if the acclimation zone was determined to be C, then you will need to acclimate the system in its packaging (or bag) for 24 hours, then remove the packaging, and then acclimate for an additional 24 hours for a total of 48 hours.
4. Once the system has been acclimated as recommended, verify that both the outer surface of the frame and inner circuit boards/components of the system are free of moisture. A system may appear dry on the outside but may still be wet inside. If moisture is present, continue to acclimate the system without the packaging for an additional 12 hours before reverifying that it is dry. Continue acclimating and reverifying in 12 hour intervals while moisture persists. If moisture is still found to be present after a week, please contact an IBM representative for assistance and to troubleshoot the environment in which the system is acclimating.

Table 3. Acclimation zone table for shipments conducted in non-climate controlled and extreme cold weather conditions (-40°C / -40°F to -20°C / -4°F)

extreme cold: -40° C (-40° F) to -20° C (-4° F)		room temperature -- deg C (deg F)								
		5 (41)	10 (50)	15 (59)	20 (68)	25 (77)	30 (86)	35 (95)	40 (104)	45 (113)
room relative humidity %	8	D	C	C	C	C	B	B	B	B
	20	D	C	C	C	C	C	B	B	B
	40	D	D	C	C	C	C	C	C	X
	60	D	D	D	C	C	C	C	X	X
	80	X	D	D	D	D	C	X	X	X
	85	X	X	D	D	D	D	X	X	X

Table 4. Acclimation zone table for shipments conducted in non-climate controlled and very cold weather conditions (-20°C / -4°F to 0°C / 32°F)

very cold: -20° C (-4° F) to 0° C (32° F)		room temperature -- deg C (deg F)								
		5 (41)	10 (50)	15 (59)	20 (68)	25 (77)	30 (86)	35 (95)	40 (104)	45 (113)
room relative humidity %	8	C	C	B	B	B	B	B	B	B
	20	C	C	C	B	B	B	B	B	B
	40	D	C	C	C	C	C	B	B	X
	60	D	D	C	C	C	C	C	X	X
	80	X	D	D	C	C	C	X	X	X
	85	X	X	D	D	C	C	X	X	X

Table 5. Acclimation zone table for shipments conducted in non-climate controlled and cool weather conditions (0°C / 32°F to 15°C / 59°F). Shipments via air may use this table if subsequent transport and storage was in warmer conditions.

cool: 0° C (32° F) to 15° C (59° F)		room temperature -- deg C (deg F)								
		5 (41)	10 (50)	15 (59)	20 (68)	25 (77)	30 (86)	35 (95)	40 (104)	45 (113)
room relative humidity %	8	C	C	B	B	B	B	B	B	B
	20	C	C	B	B	B	B	B	B	B
	40	D	C	C	B	B	B	B	B	X
	60	D	C	C	C	C	C	B	X	X
	80	X	D	D	C	C	C	X	X	X
	85	X	X	D	D	C	C	X	X	X

Table 6. Acclimation zone table for shipments conducted in non-climate controlled but warm weather conditions or for shipments conducted in climate controlled trucking (15°C / 59°F and above). Shipments conducted via air may not use this table.

warm: 15° C (59° F) and above		room temperature -- deg C (deg F)								
		5 (41)	10 (50)	15 (59)	20 (68)	25 (77)	30 (86)	35 (95)	40 (104)	45 (113)
room relative humidity %	8	AA	AA	AA	AA	AA	AA	AA	AA	AA
	20	AA	AA	AA	AA	AA	AA	AA	AA	AA
	40	AA	AA	AA	AA	AA	AA	AA	A	X
	60	AA	AA	AA	A	A	A	A	X	X
	80	AA	A	A	C	B	B	X	X	X
	85	AA	A	A	C	C	C	X	X	X

Table 7. Acclimation recommendation

Zone	In bag + Out of bag	Total
AA	0 hours + 6 hours	6 hours
A	0 hours + 24 hours	24 hours
B	12 hours + 12 hours	24 hours
C	1 day + 1 day	2 days
D	2 days + 2 days	4 days
X	Acclimation not recommended in this zone. Contact an IBM representative for assistance.	

Conductive contamination

Semiconductors and sensitive electronics used in current Information Technology equipment have allowed for the manufacture of very high density electronic circuitry. While new technology allows for significant increases or capacity in a smaller physical space, it is susceptible to contamination, especially contamination particles that will conduct electricity. Since the early 1990s, it has been determined that data center environments may contain sources of conductive contamination. Contaminants include; carbon fibers, metallic debris such as aluminum, copper and steel filings from construction, and zinc whiskers from zinc-electroplated materials used in raised floor structures.

Although very small, and at times not easily seen without the visual aide of magnifying lenses, this type of contamination can have disastrous impact on equipment availability and reliability. Errors, component damage and equipment outages caused by conductive contamination can be difficult to diagnose. Failures may be at first attributed to other more common factors such as lightning events or electrical power quality or even just presumed to be defective parts.

The most common conductive contamination in raised-floor data centers is what is known as zinc whiskers. It is the most common because it is frequently found on the underside of certain types of access floor tiles. Typically, the wood core style floor tile has a flat steel bottom. The steel may be coated with zinc either by a hot dip galvanize process or by zinc electroplate. The zinc electroplate steel exhibits a phenomena which appears as whisker-like growths on the surface. These small particles of approximately 1-2 mm (.04-.08 in.) in length, can break away from the surface and get pulled into the cooling air stream. Eventually they my be ingested by the equipment air, settle on a circuit board and create a problem. If you suspect that you may have this type of problem, contact your service representative.

Airborne particulates (including metal flakes or particles) and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might pose a risk to the

3907 that is described in this document. Risks that are posed by the presence of excessive particulate levels or concentrations of harmful gases include damage that might cause the 3907 to malfunction or cease functioning altogether. This specification sets forth limits for particulates and gases that are intended to avoid such damage. The limits must not be viewed or used as definitive limits because numerous other factors, such as temperature or moisture content of the air, can influence the impact of particulates or environmental corrosives and gaseous contaminant transfer. In the absence of specific limits that are set forth in this document, you must implement practices that maintain particulate or gas levels that are consistent with the protection of human health and safety. If it is determined that the levels of particulates or gases in your environment have caused damage to the 3907, there may be a provision of repair or replacement of 3907 or parts on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

Table 8. Contaminant descriptions

Contaminant	Description
Gaseous contamination	Severity level G1 as per ANSI/ISA 71.04-1985[1] which states that the reactivity rate of copper coupons shall be less than 300 Angstroms per month (Å/month, ~ 0.0039 µg/cm^2-hour weight gain).[2] In addition, the reactivity rate of silver coupons shall be less than 300 Å/month (~ 0.0035 µg/cm^2-hour weight gain).[3] The reactive monitoring of gaseous corrosivity should be conducted approximately 2 inches (5 cm) in front of the rack on the air inlet side at one-quarter and three-quarter frame height off the floor or where the air velocity is much higher.
Particulate contamination	Data centers must meet the cleanliness level of ISO 14644-1 class 8. For data centers without airside economizer, the ISO 14644-1 class 8 cleanliness may be met simply by the choice of the following filtration: • The room air may be continuously filtered with MERV 8 filters. Air entering a data center may be filtered with MERV 11 or preferably MERV 13 filters. • For data centers with airside economizers, the choice of filters to achieve ISO class 8 cleanliness depends on the specific conditions present at that data center. The deliquescent relative humidity of the particulate contamination should be more than 60% RH.[4] Data centers must be free of zinc whiskers.[5]

Notes:

1. ANSI/ISA-71.04.1985. "Environmental conditions for process measurement and control systems: Airborne contaminants." Instrument Society of America, Research Triangle Park, NC, 1985.
2. The derivation of the equivalence between the rate of copper corrosion product thickness growth in Å/month and the rate of weight gain assumes that Cu_2S and Cu_2O grow in equal proportions.
3. The derivation of the equivalence between the rate of silver corrosion product thickness growth in Å/month and the rate of weight gain assumes that Ag_2S is the only corrosion product.
4. The deliquescent relative humidity of particulate contamination is the relative humidity at which the dust absorbs enough water to become wet and promote corrosion and/or ion migration.
5. Surface debris is randomly collected from 10 areas of the data center on a 1.5-cm diameter disk of sticky electrically conductive tape on a metal stub. If examination of the sticky tape in a scanning electron microscope reveals no zinc whiskers, the data center is considered free of zinc whiskers.
6. If there is any question about potential corrosive gases or level of particulates, contact your representative for assistance in monitoring the environment.

Beyond the specific information provided in this document, it is recommended that the customer's facility meet the general guidelines published in the *American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook*.

Acoustics

This section provides information on acoustics for the 3907 at nominal environmental ambient temperatures of 23ºC plus or minus 2ºC (73.4ºF plus or minus 3.6ºF).

Acoustical noise emission levels

Table 9. Acoustical noise emissions for 3907 [1, 2, 3, 4, 5]

Declared noise emission values in accordance with ISO 9296						
Product configuration	**Declared mean A-weighted sound power level, $L_{WA,m}$ (B)**		**Declared mean A-weighted emission sound pressure level, $L_{pA,m}$ (dB)**		**Statistical adder for verification, K_v (B)**	
	Operating	**Idling**	**Operating**	**Idling**	**Operating**	**Idling**
Typical configuration: • M/T 3907 Model ZR1 or Model LR1 • One PCIe+ I/O drawer installed • All air moving devices at nominal speeds • Front and rear doors installed and closed	7.2[6]	7.2[6]	56	56	0.3	0.3
Maximum configuration: • M/T 3907 Model ZR1 or Model LR1 • Four PCIe+ I/O drawers installed • All air moving devices at nominal speeds • Front and rear doors installed and closed	7.6[7]	7.6[7]	61	61	0.3	0.3
Typical configuration: • M/T 3907 Model ZR1 or Model LR1 • One PCIe+ I/O drawer installed • Operation based on a 35ºC, 1000 m operating environment • Front and rear doors installed and closed	8.5[8]	8.5[8]	69	69	0.3	0.3
Maximum configuration: • M/T 3907 Model ZR1 or Model LR1 • Four PCIe+ I/O drawers installed • Operation based on a 35º C, 1000 m operating environment • Front and rear doors installed and closed	8.7[8]	8.7[8]	71	71	0.3	0.3

Notes:

1. Declared level $L_{WA,m}$ is the mean A-weighted sound power level. Declared level $L_{pA,m}$ is the mean A-weighted sound pressure level at the 1-meter bystander position.
2. 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 will be 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).
3. The quantity $L_{WA,c}$ (formerly called $L_{WA,d}$), can be computed from the sum of $L_{WA,m}$ and K_v.
4. All measurements are made in conformance with ISO 7779, and reported in conformance with ISO 9296.
5. **B** and **dB** are the abbreviations for **bels** and **decibels**, respectively. 1B = 10dB.
6. Meets IT Product Noise Limits for "Generally Attended Data Center" per Statskontoret Technical Standard 26:6.
7. Meets IT Product Noise Limits for "Generally Unattended Data Center" per Statskontoret Technical Standard 26:6.
8. **Notices:** Government regulations (such as those prescribed by OSHA or European Community Directives) may govern noise level exposure in the workplace and may apply to you and your server installation. The actual sound pressure levels in your installation depend upon a variety of 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 a variety of additional factors, including the duration of employees' exposure and whether employees wear hearing protection. It is recommended that you consult with qualified experts in this field to determine whether you are in compliance with the applicable regulations.

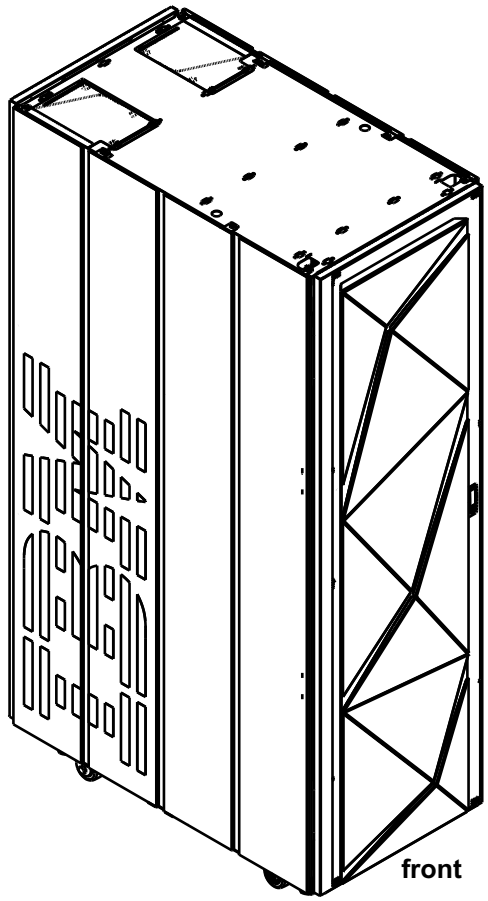
Relevant international standards:

- Measurements: ISO 7779
- Declaration: ISO 9296

Chapter 3. Models and physical specifications

This chapter provides the following detailed information for the 3907.

- Model and frame descriptions
- Shipping specifications
- Plan view and specifications
- Weight distribution data and service clearances information



Facts about the 3907:

- The 3907 is **always** a one-frame system
- In areas that might be prone to seismic events, internal frame stiffener brackets and tie-down hardware (FC 8006) are available. FC 8006 provides tie-down hardware to cover raised floor heights from 228.6 mm - 330.2 mm (9 in - 13 in), 304.8 mm - 558.8 mm (12 in - 22 in), and 304.8 mm - 914.4 mm (12 in - 36 in). FC 8006 also provides tie-down hardware for nonraised floors. See “Earthquake kit - Frame-stiffening and frame tie-down” on page 42 for more information.
- There are separate shipping containers for the covers for the frame
- The 3907 may be installed on a raised floor or a nonraised floor.

  Where cables may be exposed, refer to your local and national electric and safety codes.

  If you are planning an installation on a raised floor in Canada, the installation must be in accordance with Section 12-020 of the machine. In any country, refer to your national electric code if you have questions about routing data processing cables in exposed areas.

- For the 3907, bottom exit cabling (for power and I/O) and top exit cabling (for power and I/O) are supported. For bottom exit cabling, you must order the bottom exit feature (FC 7919). For top exit cabling, you can either order the top exit feature (FC 7917) or you can route the cables directly through the top of the frame. You can use both bottom exit cabling and top exit cabling.

  The following I/O cabling and power cabling combinations are supported on both a raised floor or a nonraised floor:

  – Bottom I/O and bottom power
  – Bottom I/O and top power
  – Top I/O and bottom power
  – Top I/O and top power

  See Appendix C, “Top exit cabling and bottom exit cabling specifications,” on page 137 for more information on top exit cabling and bottom exit cabling.
- For the 3907, a 16U Reserved feature (FC 0617) is available. This feature allows you to have 16U of flexible space in the rack to populate with other devices, for example, other servers, switches, and storage elements. See Appendix D, “16U Reserved feature (FC 0617),” on page 139 for details.
- If this 3907 contains more than two PCIe+ I/O drawers or if you are installing the 16U Reserved feature (FC 0617), you must install spine cable management hardware. This hardware allows you to route the cables from the PCIe-2 I/O drawers and the processor drawer to the middle of the frame, which provides accessibility for servicing a machine. The cables can be routed to the bottom of the frame or to the top of the frame.

Important: When an incline or ramp needs to be traversed during system transport, the angle of inclination must be less or equal to 10^{o} degrees. Angles that are greater than 10^{o} degrees, pose a safety hazard as well as expose the potential for the system rack to bottom out while transitioning to or from the level surface.

Physical dimensions

This section lists the dimensions for the following:

- A frame
- Top exit feature
- Height reduction feature

A frame

Table 10. A frame dimensions

Frame-cover combination	Width mm (in)	Depth mm (in)	Height mm (in)
Frame A w/o covers	600 (23.6)	1070 (42.1)	2015 (79.3)
Frame A w/covers	624 (24.6)	1204 (47.4)	2020 (79.5)
Frame A w/covers and top exit feature	624 (24.6)	1204 (47.4)	2133 (84.0)

Top exit feature (FC 7917)

The top exit cabling enclosure is installed on the top of the machine in the rear. The following table provides the dimensions and weight for the top exit cabling enclosure (FC 7917):

Table 11. Top exit cabling enclosure (FC 7917) measurements

Weight	Width	Depth	Height
5.4 kg (12 lbs)	599 mm (23.58 in)	310 mm (12.20 in)	117.5 mm (4.63 in)

Height reduction feature (FC 9975)

3907 is composed of a 42 EIA A-frame. The base frame is 40 EIA with a 2U removable top hat.

If you have doorways that will not fit the 3907, you should order FC 9975. FC 9975 reduces the frame height to 1900 mm (74.8 in). With FC 9975, the 2U top hat, the primary Support Element, and the alternate Support Element are shipped in a separate boxes.

z14 Model ZR1 and Rockhopper II Model LR1 feature codes

z14 Model ZR1 and Rockhopper II Model LR1 each contain four feature codes based on the maximum number of configurable PUs. Table 12 lists the feature codes. You will use the feature codes to place your z14 Model ZR1 or Rockhopper II Model LR1 order.

Table 12. Processor descriptions

Feature code	Description
0636	Model ZR1/Model LR1 1 CP SCMs Maximum 4 configurable PUs
0637	Model ZR1/Model LR1 2 CP SCMs Maximum 12 configurable PUs
0638	Model ZR1/Model LR1 4 CP SCMs Maximum 24 configurable PUs
0639	Model ZR1/Model LR1 4 CP SCMs Maximum 30 configurable PUs

These models contain user-definable Processor Units (PUs), System Assist Processors (SAPs), and spare PUs (used to provide uninterrupted computing if there should be a problem with a working PU). Model specifications are described in Table 13 on page 27 and Table 14 on page 28.

Table 13. Model ZR1 (FC 0200) configurable PUs and options

Feature code	Description
FC 0636 (Max 4 configurable PUs)	• 1 CPC drawer • 0-4 CPs • 0-4 IFLs • 0-3 uIFLs • 0-2 zIIPs • 0-4 ICFs • 1 IFP • 2 - base SAPs • 0-2 optional SAPs • 1 - spare • I/O links: – 0 - 8 IBM Integrated Coupling Adapter (ICA) SR links
FC 0637 (Max 12 configurable PUs)	• 1 CPC drawer • 0-6 CPs • 0-12 IFLs • 0-11 uIFLs • 0-8 zIIPs • 0-12 ICFs • 1 IFP • 2 - base SAPs • 0-2 optional SAPs • 1 - spare • I/O links: – 0 - 8 ICA SR links
FC 0638 (Max 24 configurable PUs)	• 1 CPC drawer • 0-6 CPs • 0-24 IFLs • 0-23 uIFLs • 0-12 zIIPs • 0-24 ICFs • 1 IFP • 2 - base SAPs • 0-2 optional SAPs • 1 - spare • I/O links: – 0 - 8 ICA SR links
FC 0639 (Max 30 configurable PUs)	• 1 CPC drawer • 0-6 CPs • 0-30 IFLs • 0-29 uIFLs • 0-12 zIIPs • 0-30 ICFs • 1 IFP • 2 - base SAPs • 0-2 optional SAPs • 1 - spare • I/O links: – 0 - 8 ICA SR links
CP - Central Processor **SAP** - System Assist Processor **IFL** - Integrated Facilities for Linux **ICF** - Integrated Coupling Facility **zIIP** - IBM z Integrated Information Processor **IFP** - Integrated Firmware Processor	

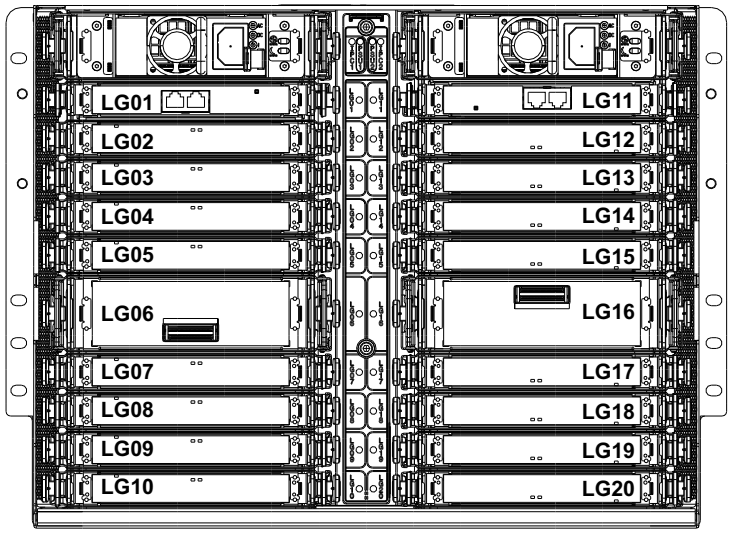
Table 14. Model LR1 (FC 0300) configurable PUs and options

Feature code	Description
FC 0636 (Max 4 configurable PUs)	• 1 CPC drawer • 0-1 CPs ** • 1-4 IFLs • 0-3 uIFLs • 0 zIIPs • 0 ICFs • 1 IFP • 2 - base SAPs, 0-2 optional SAPs • 1 - spare • I/O links: – 0 - 8 ICA SR links
FC 0637 (Max 12 configurable PUs)	• 1 CPC drawer • 0-1 CPs ** • 1-12 IFLs • 0-11 uIFLs • 0 zIIPs • 0 ICFs • 1 IFP • 2 - base SAPs • 0-2 optional SAPs • 1 - spare • I/O links: – 0 - 8 ICA SR links
FC 0638 (Max 24 configurable PUs)	• 1 CPC drawer • 0-1 CPs ** • 1-24 IFLs • 0-23 uIFLs • 0 zIIPs • 0 ICFs • 1 IFP • 2 - base SAPs • 0-2 optional SAPs • 1 - spare • I/O links: – 0 - 8 ICA SR links
FC 0639 (Max 30 configurable PUs)	• 1 CPC drawer • 0-1 CPs ** • 1-30 IFLs • 0-29 uIFLs • 0 zIIPs • 0 ICFs • 1 IFP • 2 - base SAPs • 0-2 optional SAPs • 1 - spare • I/O links: – 0 - 8 ICA SR links
CP - Central Processor **SAP** - System Assist Processor **IFL** - Integrated Facilities for Linux **ICF** - Integrated Coupling Facility **zIIP** - IBM z Integrated Information Processor **IFP** - Integrated Firmware Processor ** 1 CP for GDPS Virtual Appliance	

PCIe+ I/O drawers

The 3907 supports up to four PCIe+ I/O drawers. Each drawer is 8 EIA units tall. Each drawer:

- Provides 16 adapters, with two ports per adapter, over two domains. They are plugged in locations LG02, LG03, LG04, LG05, LG07, LG08, LG09, LG10, LG12, LG13, LG14, LG15, LG17, LG18, LG19, and LG20.
- Requires 2 PCIe Gen3 Interconnect cards (FC 0401) plugged as both domains will initially be activated. They are plugged in locations LG06 and LG16.
- Requires 2 FSPs plugged in locations LG01 and LG11.



PCIe+ I/O drawer rear view

System upgrades

The following upgrades are supported:

- 2965 (z13s® Models N10 and N20) to 3907 (z14 Model ZR1)
- 3907 (Rockhopper II Model LR1) to 3907 (z14 Model ZR1)

The following upgrades are not supported:

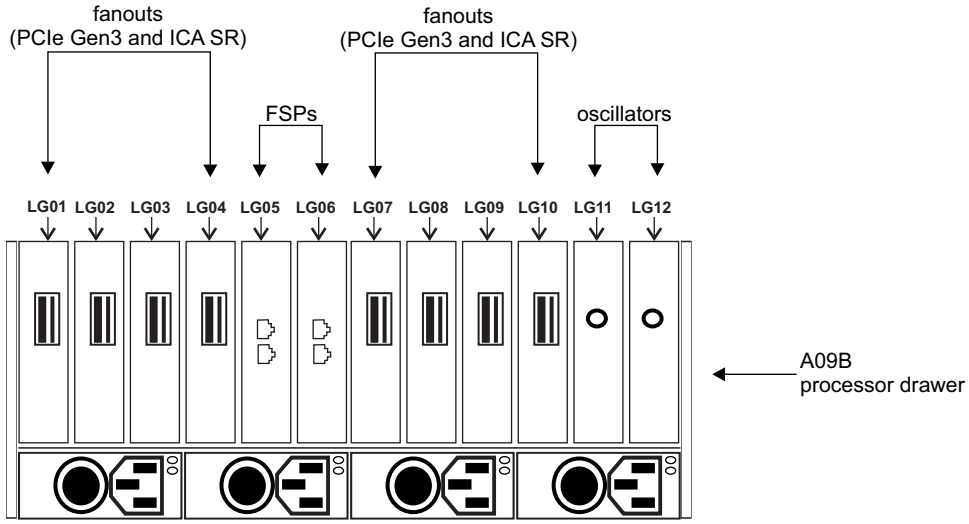
- 2828 (zEnterprise® BC12 Models H06 and H13) to 3907 (z14 Model ZR1)
- 3907 (z14 Model ZR1) to 3907 (Rockhopper II Model LR1)
- 3907 (z14 Model ZR1) to any 3906 model
- 2965 (Rockhopper Models L10 and L20) to 3907 (z14 Model ZR1)

An upgrade includes all frames, support cards, and new I/O features.

Processor drawer

3907 supports one processor drawer. The processor drawer is 5 EIA units tall. The processor drawer:

- Provides fanouts (PCIe Gen3 and OCA SR) plugged in locations LG01, LG02, LG03, LG04, LG07, LG08, LG09, and LG10.
- Requires two FSPs plugged in locations LG06 and LG16.
- Requires two oscillators plugged in locations LG11 and LG12.



Shipping and packaging specifications

This section includes shipping and packaging information for the following:

- A frame
- Cover set
- Top exit feature
- Height reduction feature

A frame packaging

The 3907 is shipped in an Arbobox and wrapped in a vapor barrier bag with desiccant packages in the bottom rear of the box. There is also a tilt indicator on a label located on the external side of the box. If the indicator is red, the label instructs you on what you should do next. Also, when you open the box, there is a humidity card attached to the machine. This card identifies the humidity level of the environment in the box, shows a scale to determine the valid range for the humidity, and instructs you on what you should do if the humidity is not within the appropriate range.

Table 15. A frame packaging specifications

	Width mm (in)	Depth mm (in)	Height mm (in)	Weight kg (lb)
Crated frame A	939.8 (37)	1333.5 (52.5)	2286.0 (90)	748.4 (1650)

Cover set packaging

Table 16. Cover set packaging specifications

	Width mm (in)	Depth mm (in)	Height mm (in)	Weight kg (lb)
cover set	457.2 (18)	2133.6 (84)	1016.0 (40)	49.9 (110)
side cover pack	1511.3 (59.5)	2184.4 (86)	330.2 (13)	

Top exit feature packaging

The top exit feature is wrapped in a poly bag for packaging.

Table 17. Top exit feature packaging specifications

	Width mm (in)	Depth mm (in)	Height mm (in)	Weight kg (lb)
top exit enclosure	596.9 (23.5)	317.5 (12.5)	120.65 (4.75)	5.44 (12)

Height reduction feature packaging

If the height reduction feature (FC 9975) is ordered, the top hat, primary Support Element, and alternate Support Element are shipped in separate boxes.

Table 18. Height reduction feature packaging specifications

	Width mm (in)	Depth mm (in)	Height mm (in)	Weight kg (lb)
top hat	660.4 (26)	1117.6 (44)	406.4 (16)	34.1 (75)
primary Support Element	609.6 (24) **	1016.0 (40) **	355.6 (14) **	25.0 (55)
alternate Support Element	609.6 (24) **	1016.0 (40) **	355.6 (14) **	25.0 (55)
Note: ** For two Support Element boxes stacked together on one pallet, the specifications are 609.6 mm x 1016.0 mm x 584.2 mm (24 in x 40 in x 23 in).				

Differences between IBM servers

Comparison information is provided here for those who may be placing a 3907 on a raised floor with another IBM single-frame servers.

Table 19. Differences between single-frame servers

System Family	Width (with covers)	Depth (with covers)	Height (with covers	Weight (Maximum)
zSeries 800 (2066)	720 mm (28.3 in)	1148 mm (45.1 in)	1810 mm (71.3 in)	545 kg (1201 lbs)
zSeries 890 (2086)	785 mm (30.9 in)	1577 mm (62.1 in)	1941 mm (76.4 in)	785 kg (1730 lbs)
z9® BC (2096)	785 mm (30.9 in)	1577 mm (62.1 in)	1941 mm (76.4 in)	785 kg (1730 lbs)
z10™ BC (2098)	785 mm (30.9 in)	1806 mm (71.1 in)	2027 mm (79.8 in)	953 kg (2100 lbs)
z114 (2818)	785 mm (30.9 in)	1574 mm (62.0 in)	2027 mm (79.8 in)	953 kg (2168 lbs)
z114 (2818 with I/O towers)	937 mm (36.9 in)	1574 mm (62.0 in)	2144 mm (84.4 in)[1]	1027 kg (2263 lbs)
zBC12 (2828)	785 mm (30.9 in)	1595 (62.8)	2015 mm (79.3 in)	1036 kg (2282 lbs)
zBC12 (2828 with I/O towers)	937 mm (36.9 in)	1595 (62.8)	2154 mm (84.8 in)[1]	1079 kg (2377 lbs)
z13s or Rockhopper (2965)	785 mm (30.9 in)	1595 (62.8)	2015 mm (79.3 in)	1209 kg (2665 lbs)[2]
z13s or Rockhopper (2965 with I/O towers)	937 mm (36.9 in)	1595 (62.8)	2154 mm (84.8 in)[1]	1245 kg (2743 lbs)[2]
z14 Model ZR1 or Rockhopper II Model LR1 (3907)	624 mm (24.6 in)[3]	1204 mm (47.4 in)	2022 mm (79.5 in)	789 kg (1739.45 lb)[4]
z14 Model ZR1 or Rockhopper II Model LR1 (3907 with top exit feature)	624 mm (24.6 in)[3]	1204 mm (47.4 in)	2140 mm (84.3 in)	794 kg (1750.47 lb)[4]

Notes:

1. This height includes the cable management bracket.
2. This weight does not include the weight (54.43 kg (120 lb)) for the tie-down feature (FC 8021 or FC 8022).
3. This width dimension includes optional side covers.
4. This weight does not include the weight (35 kg (77.17 lb)) for the tie-down feature (FC 8006).

All of these servers always consist of one frame.

If you are replacing an existing machine, refer to the *Installation Manual for Physical Planning* for the existing machine and the *3907 Installation Manual for Physical Planning* (available on the Resource Link at *http://www.ibm.com/servers/resourcelink*) to determine actual differences between your existing installed machine and the 3907. Plan views, physical dimensions, service clearances, aisle spacing, and power and cooling requirements may be substantially different.

Machine and service clearance areas

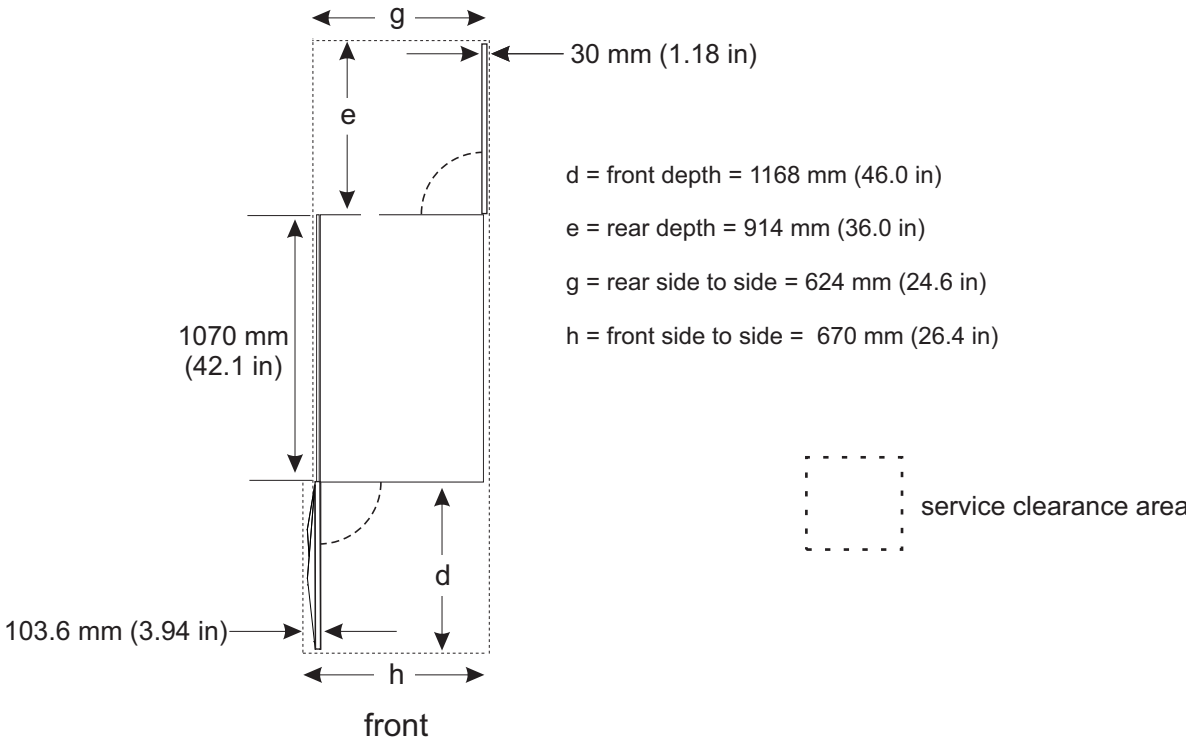
Machine area is the actual floor space covered by the system. Service clearance area includes the machine area, plus additional space required to open the doors for service access to the system.

Table 20. Machine area and service clearance area

Model	Machine area M² (ft²)	Service clearance area M² (ft²)
ZR1 andLR1	0.751 (8.08)	front service clearance = 0.783 (8.43) machine area without doors and side covers = 0.642 (6.91) rear service clearance = 0.570 (6.14)

Notes:

1. Machine area includes installed covers.
2. Service clearance area must be free of all obstacles. Units must be placed in a way that all service areas are accessible. The weight distribution clearance area extending beyond the service clearance area, such as the area at the outside corners of the units, may contain support walls and columns.



The front and rear doors access all of the serviceable area in the 3907. The system requires specific service clearances to ensure the fastest possible repair in the unlikely event that a part may need to be replaced. Failure to provide enough clearance to open the front and rear covers will result in extended service time.

The following describes some service clearance conditions that must be followed. (See Figure 3 on page 36.)

- The left side cover of the frame cannot be placed adjacent to a wall because of the front and back doors (Example **A**), but can be positioned next to obstacles such as poles or columns (Example **B**).
- The front cover on frame opens 103.6 mm (4.1 in) wider than the width of the frame plus side cover. However, for service repairs, the left side of the front of the machine should be positioned at least 457.2 mm (18 in) from the wall (Example **C**). The right side of the front of the machine should be positioned at least 103.6 mm (4.1 in) from the wall (Example **D**).

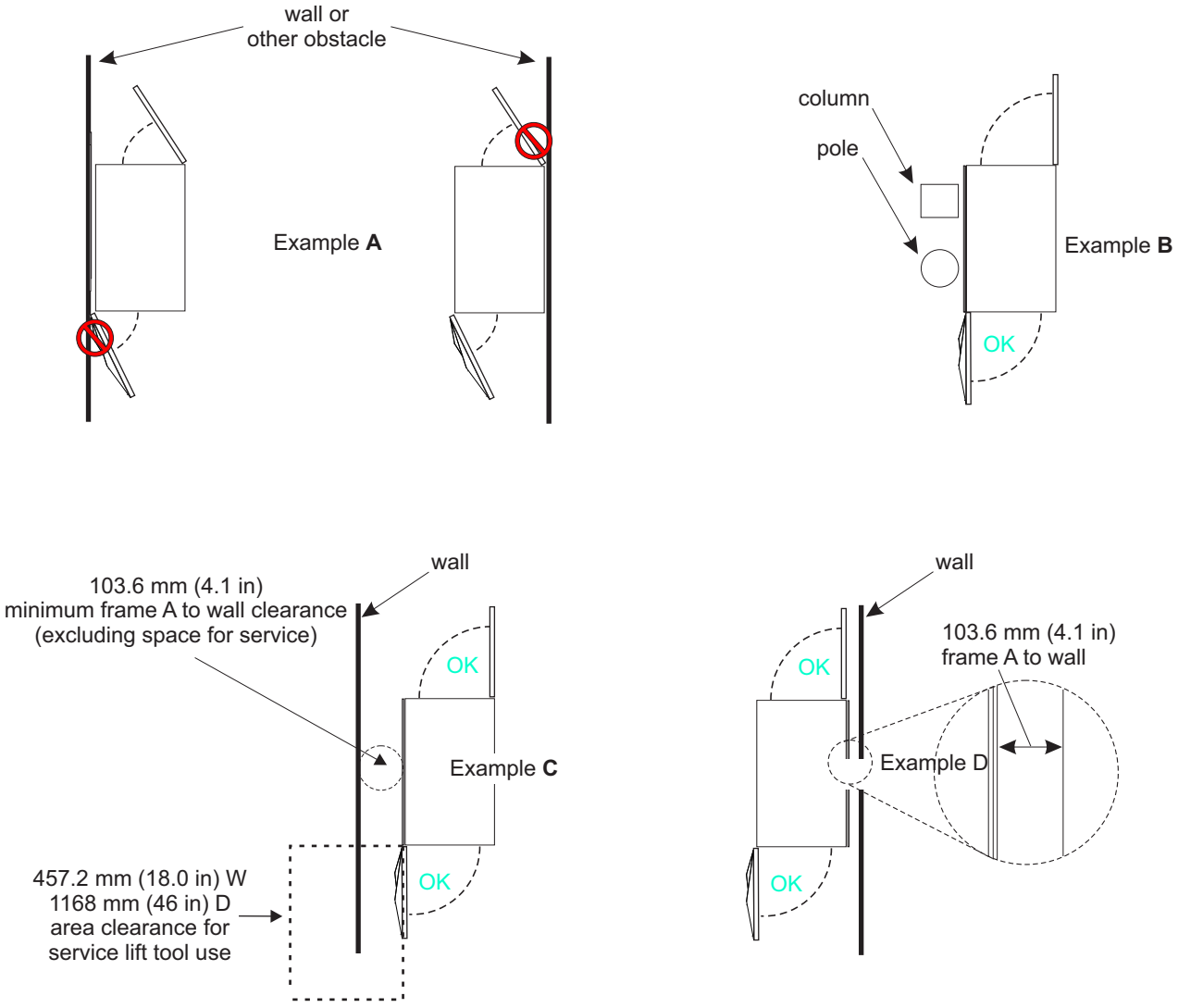


Figure 3. Detailed service clearances

Weight distribution

The following table shows weights and dimensions used to calculate floor loading for the 3907. All floor loading calculations are intended for a raised floor environment.

Table 21. Floor loading information

Model	Number of PCIe+ I/O drawers	Width mm (in)	Depth mm (in)	Maximum weight kg (lb)
ZR1 or LR1	0	600 mm (23.6 in)	1070 mm (43.1 in)	443 kg (976.65 lb)
ZR1 or LR1	1	600 mm (23.6 in)	1070 mm (43.1 in)	524 kg (1155.22 lb)
ZR1 or LR1	2	600 mm (23.6 in)	1070 mm (43.1 in)	614 kg (1353.64 lb)
ZR1 or LR1	3	600 mm (23.6 in)	1070 mm (43.1 in)	703 kg (1549.85 lb)
ZR1 or LR1	4	600 mm (23.6 in)	1070 mm (43.1 in)	789 kg (1739.45 lb)

Notes:

1. Width and depth dimensions do no include external covers.
2. Weight includes covers. The weight does not include the weight for the tie-down feature (FC 8006). The internal rack stiffening hardware adds approximately 36 kg (80 lb) to the overall system weight.
3. The optional top exit feature (FC 7917) adds approximately 5.4 kg (12 lbs) to the weights in the table.
4. The front cover adds 103.6 mm (4.08 in) and the rear cover adds 30 mm (1.18 in) to the overall depth.
5. The side covers add 24 mm (0.94 in) to the overall width.
6. The side covers are optional. This allows the 3907 to be located side-by-side (“in-row” or “end-row”) without impacting the floor grid. If the 3907 is standing alone or the impact to the floor grid is not a concern, the side covers should be installed.

Table 22 shows sample floor loading values for the 3907. The values are based on the following:

- The weight of the machine is 789 kg (1740 lb), which includes the weight of the covers. This does not include the weight of the tie-down feature (FC 8006) (36 kg (80 lb)). This does not include the weight of the optional top exit feature (5.4 kg (12 lb)).
- All measurements are taken from the outside edge of the machine frame, without covers, unless specifically described otherwise.
- K_1 (live load - kg/m^2) is 75.
  K_2 (raised floor load - kg/m^2) is 50

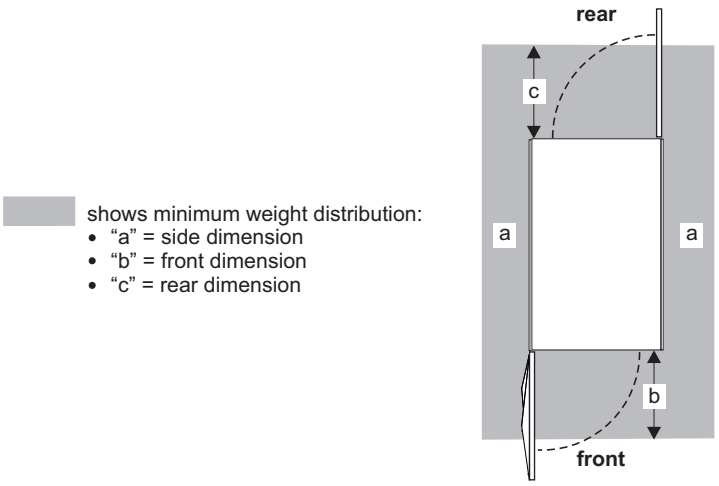


Table 22. Floor loading values for the 3907

"a" (sides) mm (in)	"b" (front) mm (in)	"c" (rear) mm (in)	Floor load kg/m^2 (lbs/ft^2)
0 (0)	305 (12.0)	305 (12.0)	860 (176.2)
0 (0)	610 (24.0)	610 (24.0)	664 (136.1)
0 (0)	914 (36.0)	914 (36.0)	551 (112.8)
305 (12.0)	305 (12.0)	305 (12.0)	490 (100.3)
305 (12.0)	508 (20.0)	610 (24.0)	405 (82.9)
305 (12.0)	762 (30.0)	914 (36.0)	348 (71.3)
610 (24.0)	305 (12.0)	305 (12.0)	367 (75.3)
610 (24.0)	610 (24.0)	610 (24.0)	303 (62.0)
610 (24.0)	914 (36.0)	914 (36.0)	265 (54.4)
914 (36.0)	305 (12.0)	305 (12.0)	307 (62.8)
914 (36.0)	610 (24.0)	610 (24.0)	258 (52.9)
914 (36.0)	914 (36.0)	914 (36.0)	230 (42.7.2)

System weight examples

Following is a table that provides weight estimates for minimum, typical, and maximum configurations on the 3907. The Power Estimator tool includes weight data and has the capability to provide a more accurate weight for your particular configuration. See “Power estimation tool” on page 68.

Table 23. Weights for minimum, typical, and maximum machine configurations

Model	Minimum weight kg (lbs)	Typical weight kg (lbs)	Maximum weight kg (lbs)	Top exit feature weight kg (lb)	Earthquake feature kg (lbs)
ZR1 or LR1	371 (817.92)	644 (1419.78)	789 (1739.45)	5.4 (12)	35 (77.17)

Note:

1. All weights include all covers.
2. Maximum weight includes four fully-populated PCIe+ I/O drawers.
3. The additional weight for features are valid for the maximum system power of each configuration.
4. Actual weight will vary and can only be determined by an exact specification of content.

Weight distribution and multiple systems

Under typical conditions, service clearances of adjacent products may be overlapped but weight distribution areas should not be overlapped. If weight distribution clearances are overlapped, the customer should obtain the services of a qualified consultant or structural engineer to determine floor loading. Regardless of floor loading, minimum service and aisle clearances must be observed:

- Rear dimension “d” is **914 mm (36.0 in)**.
- Front dimension “e” is **1168 mm (46 in)**.
- Both “d” and “e” are measured from the frame edge (without covers) to the nearest obstacle.
- Cover opening dimensions are also shown.

Note that aisle clearances are not the same between rows of front-facing and rear-facing covers. Front-facing rows require **1168 mm (46 in)** of clearance while rear-facing rows need a **minimum** of **914 mm (36.0 in)**.

For physical planning purposes, you must verify system placement considering:
- Weight distribution
- Power availability
- Power access
- Machine and service clearance area
- Air conditioning delivery
- Chilled water delivery
- Thermal interaction
- Cable locations
- Floor tile cutouts.

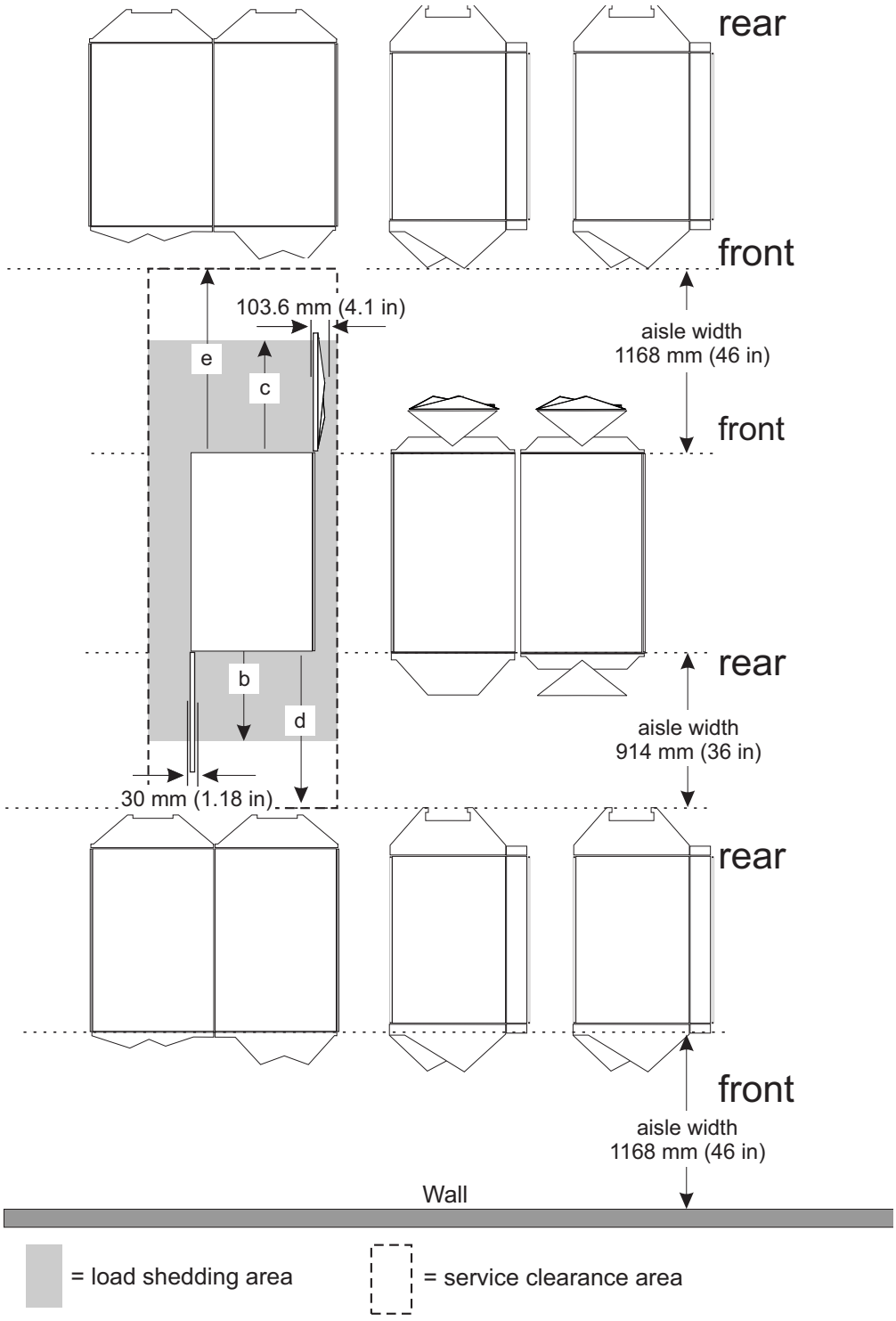


Figure 4. Aisle and service clearances

Earthquake kit - Frame-stiffening and frame tie-down

The purpose of this section is to describe the parts used to install an earthquake kit (FC 8006) that will provide frame ruggedizing and the floor tie-down hardware for securing a 3907 frame. The kit is designed to help secure the frame and its contents from damage when exposed to vibrations and shocks such as those in a seismic event.

FC 8006 is used on a raised floor and a nonraised floor.

Frame stiffener

Figure 5 shows the parts for the inner frame stiffener component of the earthquake kit.

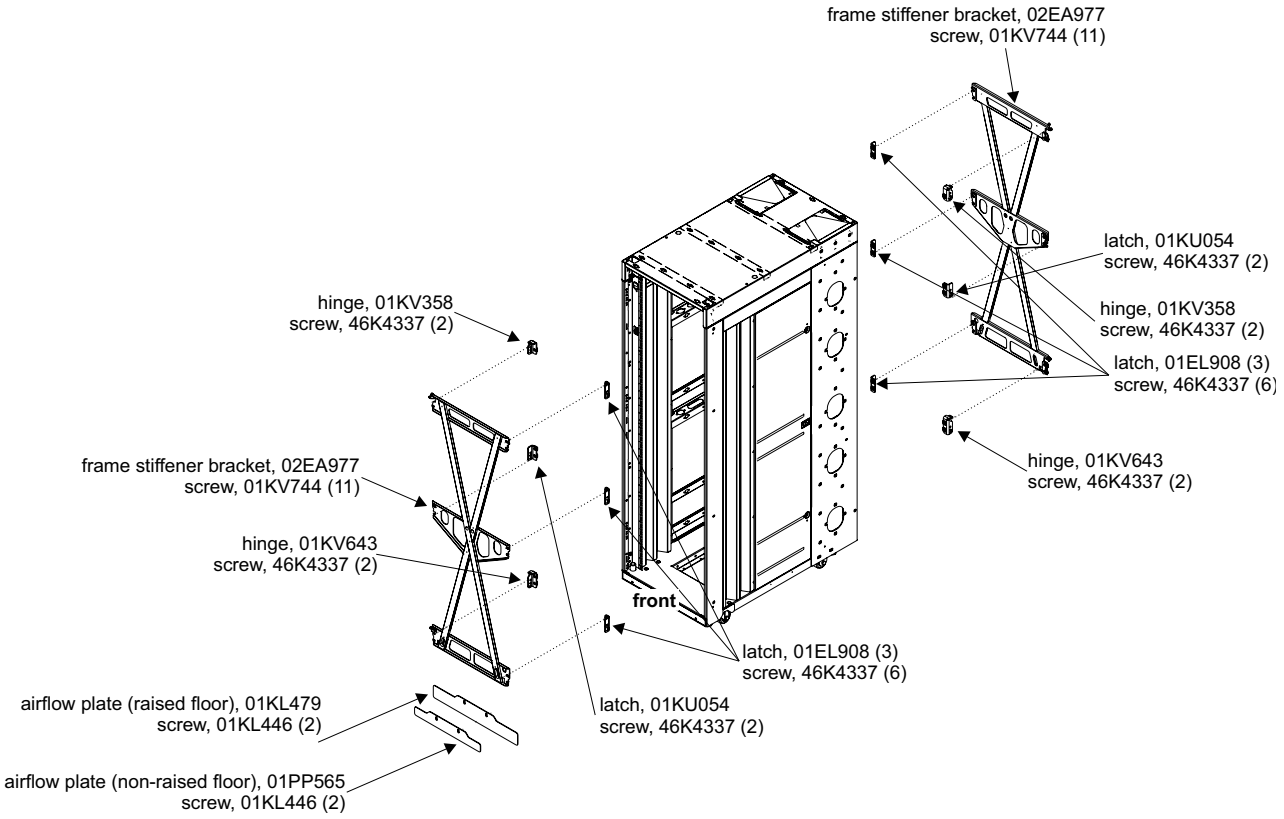


Figure 5. Frame stiffening parts list

Raised floor frame tie-down

Frame tie-down for the 3907 on a raised floor is a system of adjustable turnbuckles intended to fasten each corner of the server frames to eyebolts installed in the concrete floor beneath your computer room raised floor. FC 8006 supplies parts to cover raised floor heights from 241.3 mm to 1320.8 mm (9.5 in - 52 in).

Measure the height from the concrete floor to the top of the raised floor as indicated in Figure 6 on page 43.

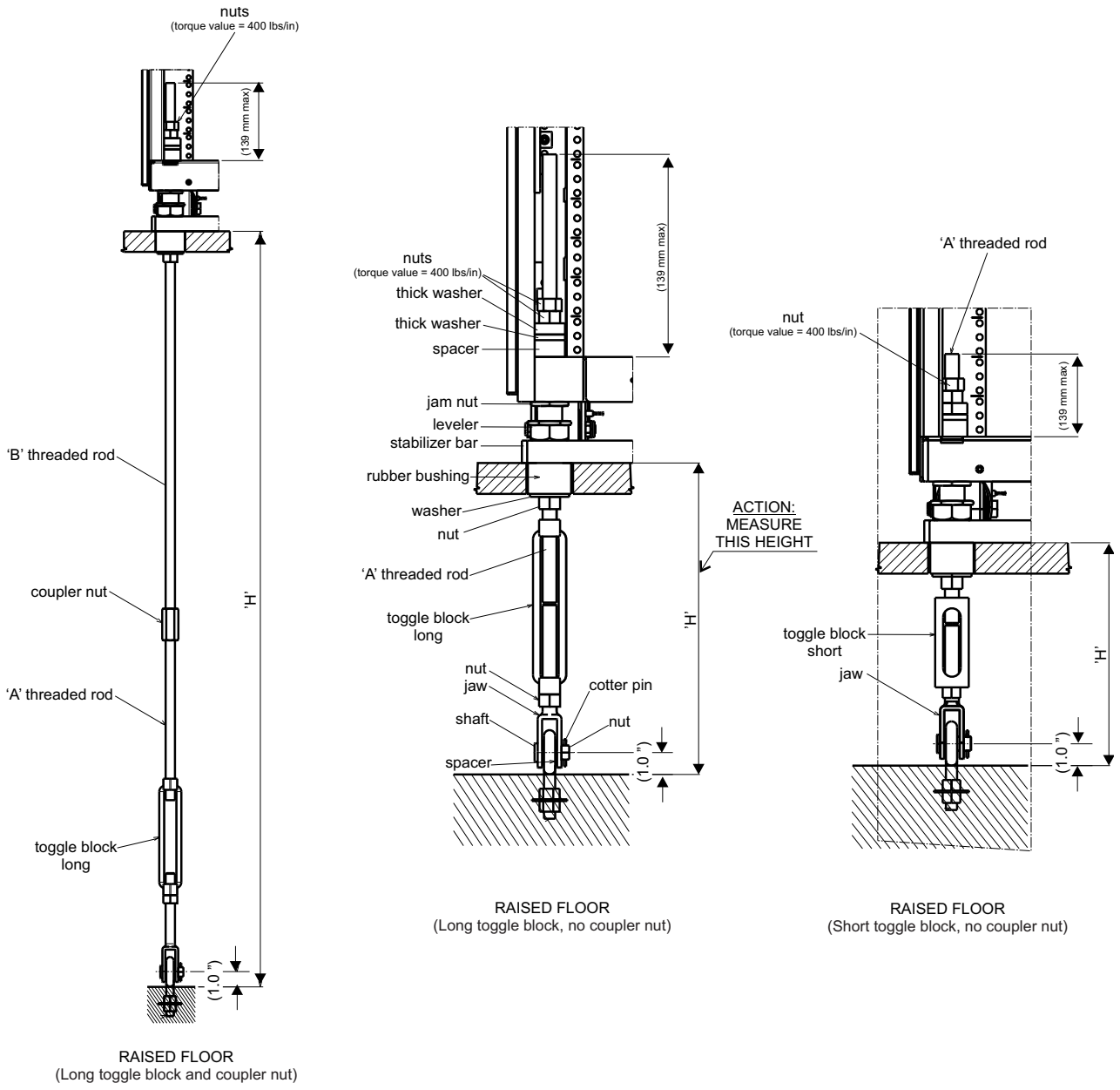


Figure 6. Turnbuckle assembly

Use the raised floor height (specified as **'H'**) and Table 24 to determine the specific hardware that you need to select from the frame tie-down kit.

Table 24. Configuration table

Raised floor height 'H'	Toggle block	Coupler nut	Threaded rod length 'A'	Threaded rod length 'B'
9.5'' to 13''	Short	No	12''	-
13'' to 17.5''	Long	No	12''	-
17.5'' to 25.5''	Long	No	20''	-
21.5'' to 29.5''	Long	No	24''	-
29.5'' to 37.5''	Long	Yes	12''	20''
33.5'' to 41.5''	Long	No	36''	-

Table 24. Configuration table (continued)

Raised floor height 'H'	Toggle block	Coupler nut	Threaded rod length 'A'	Threaded rod length 'B'
41.5'' to 49.5''	Long	Yes	20''	24''
45.5'' to 52''	Long	Yes	12''	36''

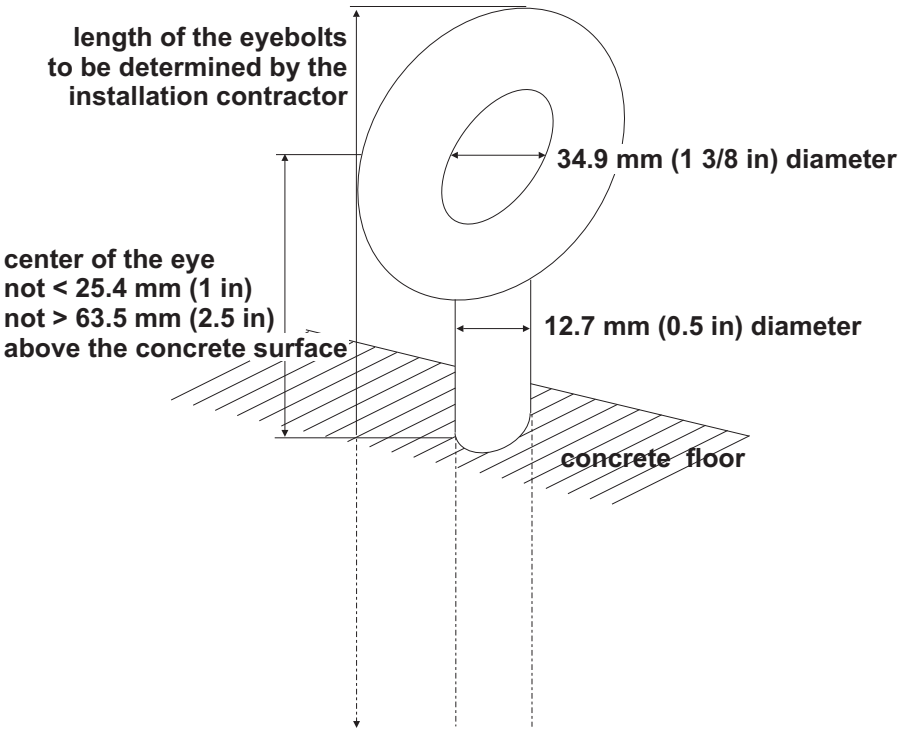
Important: Make a note of the measurement information and hardware selection, as it will be needed later in the server installation.

You are responsible for obtaining the services of a qualified consultant or structural engineer to determine what must be done at your particular location to install **four eyebolts**. These eyebolts should be capable of withstanding the appropriate seismic forces for a frame weighing up to 1308 kg (2885 lbs) with the center of gravity 1270 mm (50 inches) from the bottoms of the frame casters and at the center of the frame.

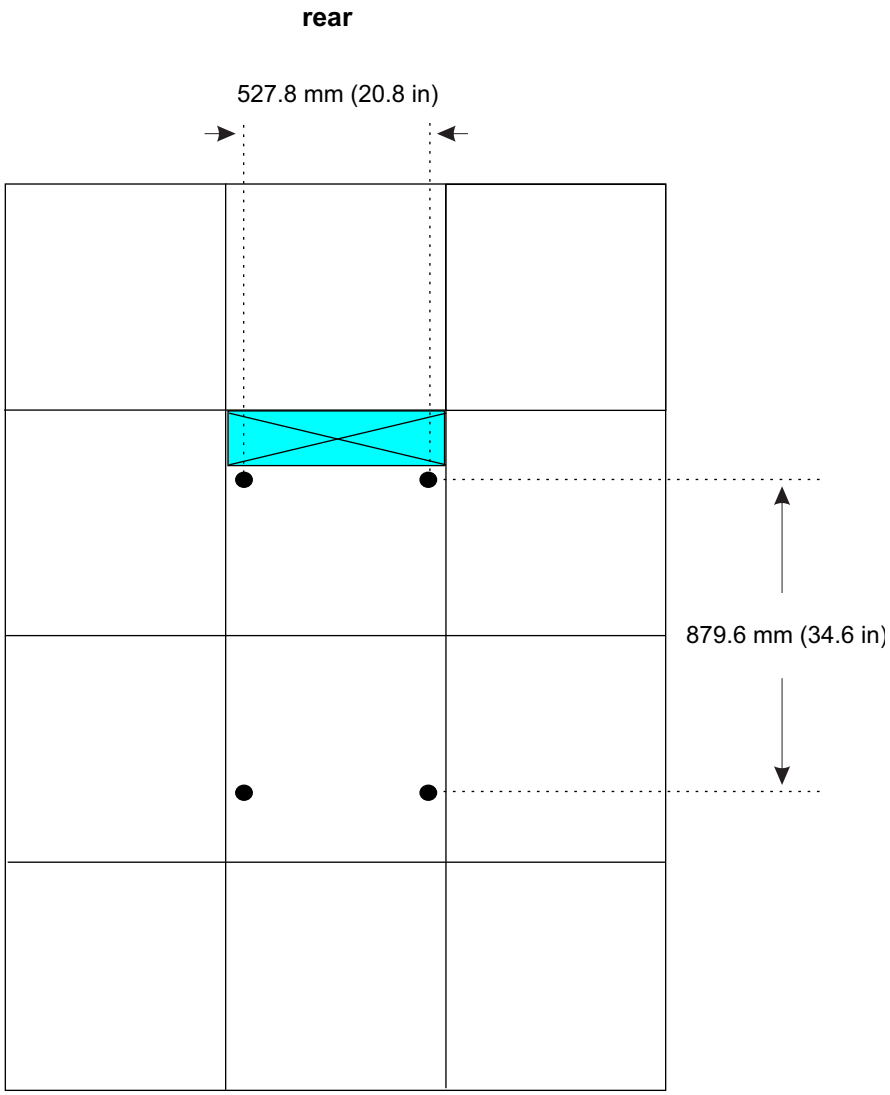
Installing the eyebolts

You are responsible for obtaining and installing the eyebolts that will anchor the frames of 3907. Following are the specifications for the eyebolts:

- The minimum pull out force is 4000 lbs (17.8 kN)
- Inside diameter of the eyebolt is not smaller than 34.9 mm (1 3/8 in)
- Installed so that the center of the eye is not less than 25.4 mm (1 in) nor more than 63.5 mm (2.5 in) from the surface of the concrete floor.



Regardless of length of the turnbuckles, the following illustration shows where to cut the floor panels for the turnbuckles to pass through to the eyebolts set in the concrete floor beneath.



Additional floor panel pedestals may be necessary to restore structural integrity to the raised floor after making the circular cuts for the turnbuckles. Consult your flooring manufacturer for recommendations.

The installation instructions are included in the *3907 Installation Manual*, which is shipped with the server.

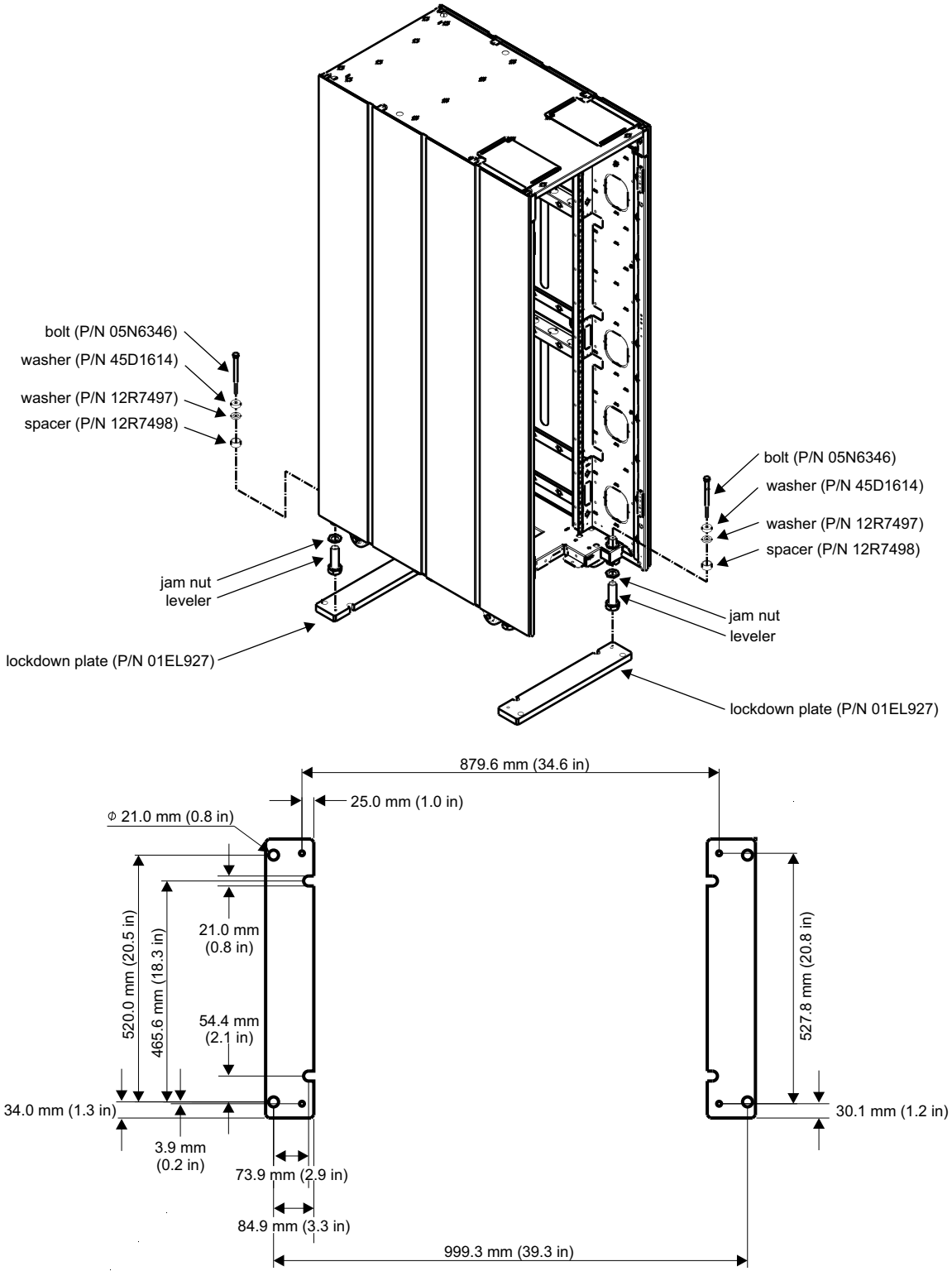
Nonraised floor frame tie-down

The purpose of this installation instruction is to install a frame tie down kit that will provide hardware for securing the frame to a concrete nonraised floor. This kit (FC 8006) is designed to help secure the frame and its contents from damage when exposed to vibrations and shocks such as those in a seismic event.

You are responsible for obtaining the services of a qualified consultant or structural engineer to determine what must be done at your particular location to install **4 anchors per plate (8 anchors per frame)** and for securing the front and rear lock down plate to the concrete floor according to the following illustration.

Contact your marketing representative well ahead of server delivery to obtain the lock down plate so that the site will be ready when the server arrives.

Use the following illustrations to plan carefully where the anchors that secure the stabilizers must be installed.



floor bolt hole pattern

The lock down plate to concrete fasteners should be a **heavy duty expansion anchor**. The contractor you engage to install the stabilizers will determine the length of the anchors.

When the server arrives, remove the fasteners from either the front or rear lockdown plate. Remove the lockdown plate to position the server frame. Then reinstall the lockdown plate and the fasteners before the service provider begins the installation.

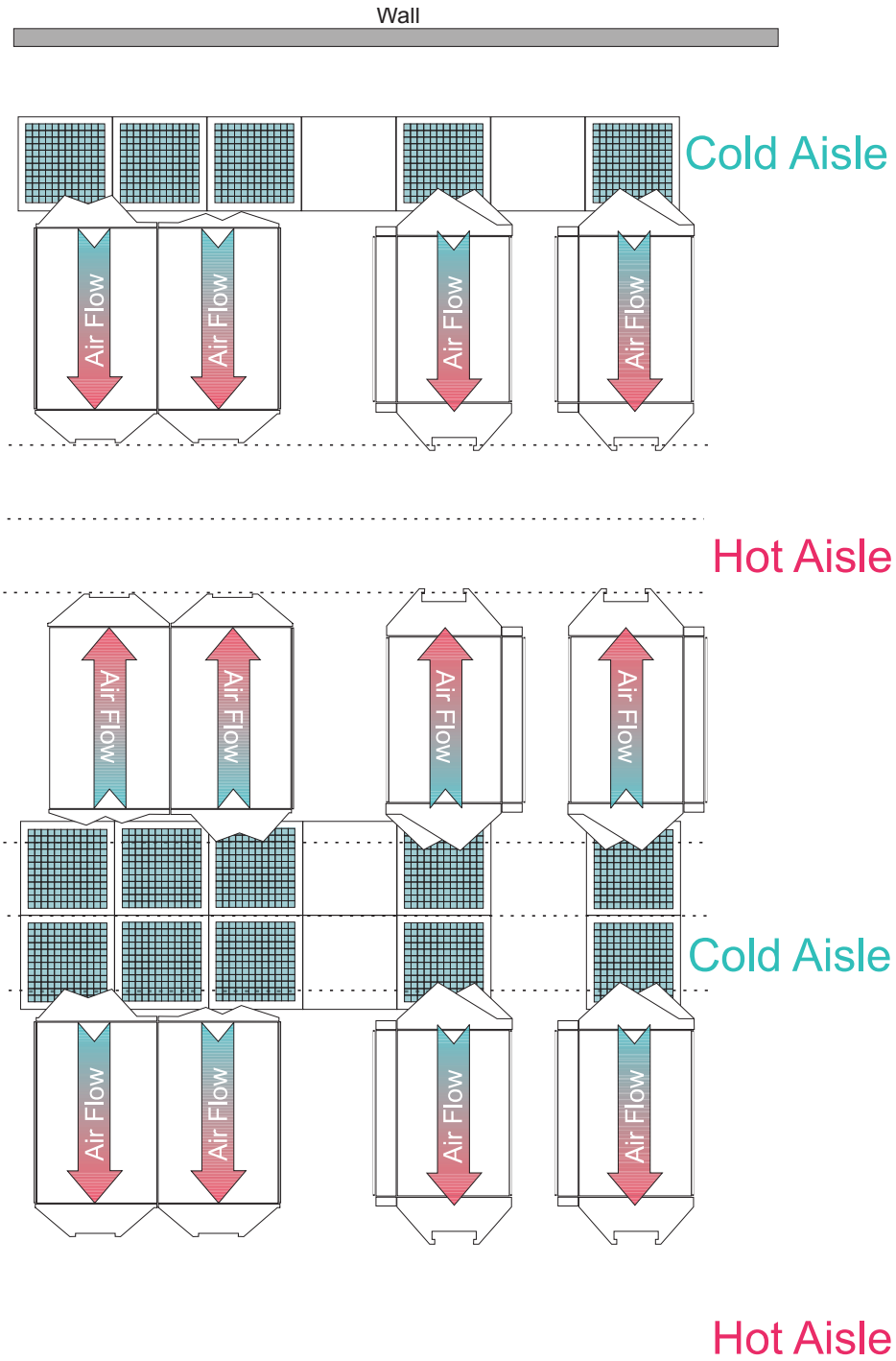
Cooling recommendations for the room

The following illustration does not represent any particular server machine type, and is intended only to show hot and cold airflow and the arrangement of server aisles on the raised floor.

A typical 3907 uses chilled air, provided from under the raised floor, to cool the system. As shown below, rows of servers must face front-to front. Chilled air is usually provided through perforated floor panels placed in rows between the fronts of servers (the **cold** aisles shown in the figure). Perforated tiles generally are not be placed in the hot aisles. (If your particular computer room causes the temperature in the hot aisles to exceed limits of comfort for activities like system service, you may add as many perforated tiles as necessary to create a satisfactory comfort level.) Heated exhaust air exits the computer room above the computing equipment.

Refer to Chapter 2, “Environmental specifications,” on page 9 for specific data regarding temperature, humidity, and gaseous and particulate contamination.

Level 01a


Wall
Cold Aisle
Air Flow
Air Flow
Air Flow
Air Flow
Hot Aisle
Air Flow
Air Flow
Air Flow
Air Flow
Cold Aisle
Air Flow
Air Flow
Air Flow
Air Flow
Hot Aisle

The following tables show how much cooling airflow is recommended for the 3907.

data center air flow requirements
1 processor drawer
0 PCIe+ I/O drawers

ambient temperature F^{o} (C^{o})	altitude ft (m)				
	< 1,500 (457)	< 3,100 (945)	< 6,000 (1,829)	< 10,000 (3,048)	>= 10,000 (3,048)
<= 73 (23)	290	340	390	500	750
<= 81 (27)	340	390	500	620	750
<= 88 (31)	390	500	620	680	750
<=95 (35)	500	620	680	750	750
<= 104 (40)	620	680	750	750	750
>104 (40)	750	750	750	750	750

cubic feet per minute (CFM)

Figure 7. Air flow requirements - 1 processor drawer and 0 PCIe+ I/O drawers

data center air flow requirements
1 processor drawer
1 PCIe+ I/O drawers

ambient temperature F° (C°)	altitude ft (m)				
	< 1,500 (457)	< 3,100 (945)	< 6,000 (1,829)	< 10,000 (3,048)	>= 10,000 (3,048)
<= 73 (23)	490	570	660	790	1210
<= 81 (27)	570	660	790	930	1210
<= 88 (31)	660	790	930	1040	1210
<=95 (35)	790	930	1040	1210	1210
<= 104 (40)	930	1040	1210	1210	1210
>104 (40)	1210	1210	1210	1210	1210

cubic feet per minute (CFM)

Figure 8. Air flow requirements - 1 processor drawer and 1 PCIe+ I/O drawer

data center air flow requirements
1 processor drawer
2 PCIe+ I/O drawers

ambient temperature F^O (C^O)	altitude ft (m)				
	< 1,500 (457)	< 3,100 (945)	< 6,000 (1,829)	< 10,000 (3,048)	>= 10,000 (3,048)
<= 73 (23)	680	800	920	1090	1660
<= 81 (27)	800	920	1090	1250	1660
<= 88 (31)	920	1090	1250	1400	1660
<=95 (35)	1090	1250	1400	1660	1660
<= 104 (40)	1250	1400	1660	1660	1660
>104 (40)	1660	1660	1660	1660	1660

cubic feet per minute (CFM)

Figure 9. Air flow requirements - 1 processor drawer and 2 PCIe+ I/O drawers

data center air flow requirements
1 processor drawer
3 PCIe+ I/O drawers

ambient temperature F^{o} (C^{o})	altitude ft (m)				
	< 1,500 (457)	< 3,100 (945)	< 6,000 (1,829)	< 10,000 (3,048)	>= 10,000 (3,048)
<= 73 (23)	880	1030	1190	1380	2120
<= 81 (27)	1030	1190	1380	1560	2120
<= 88 (31)	1190	1380	1560	1760	2120
<=95 (35)	1380	1560	1760	2120	2120
<= 104 (40)	1560	1760	2120	2120	2120
>104 (40)	2120	2120	2120	2120	2120

cubic feet per minute (CFM)

Figure 10. Air flow requirements - 1 processor drawer and 3 PCIe+ I/O drawers

data center air flow requirements
1 processor drawer
4 PCIe+ I/O drawers

ambient temperature F° (C°)	altitude ft (m)				
	< 1,500 (457)	< 3,100 (945)	< 6,000 (1,829)	< 10,000 (3,048)	>= 10,000 (3,048)
<= 73 (23)	1080	1260	1450	1670	2580
<= 81 (27)	1260	1450	1670	1880	2580
<= 88 (31)	1450	1670	1880	2120	2580
<=95 (35)	1670	1880	2120	2580	2580
<= 104 (40)	1880	2120	2580	2580	2580
>104 (40)	2580	2580	2580	2580	2580

cubic feet per minute (CFM)

Figure 11. Air flow requirements - 1 processor drawer and 4 PCIe+ I/O drawers

Hot and cold aisle cooling containment

More frequently, data centers are using hot and cold aisle cooling containment solutions to help with managing airflow, eliminating hot spots and improving energy efficiency. In most cases, the 3907 system can be used within these aisle cooling containment solutions. Below are general guidelines for assessing the installation of a 3907 in a hot or cold aisle cooling containment solution.

- Partitions used in the aisle cooling containment solution should be self-supporting and not attach to the rack for structural integrity.
- Care should be taken to ensure that the appropriate service clearances are maintained when the system is installed in the cooling containment solution. (See "Machine and service clearance areas" on page 35.)
- Consideration should be given to the airflow requirements of the 3907 system under the intended and abnormal operating conditions to assure sufficient airflow can be provided, particularly in cold aisle cooling containment systems. (See "Cooling recommendations for the room" on page 48.)
- Care should be taken to assure that racks across the aisle will not negatively impact the 3907 operation or conversely the impact of the 3907 on other rack equipment.

If you have questions regarding the installation of the 3907 in a hot or cold aisle cooling containment solution, please consult your installation planning representative. To assist in planning for a hot and cold aisle cooling containment system, 3-D graphic files for use with computer aided design software have been made available via Resource Link .

Additionally, with the tendency for hot aisle cooling containment systems to contain warmer and warmer temperatures, service personnel working in these areas must be more cognizant of heat stress hazards and be prepared to work safely under such conditions. Workers who are exposed to extreme heat or work in hot environments may be at risk of heat stress, which is the body's reaction to high temperatures. Preventing heat stress and being proactive about addressing its symptoms can eliminate or drastically reduce potential health risks associated with heat exposure. A common measure, the heat index, combines temperature and relative humidity to establish the human-perceived equivalent temperature, or how hot it "feels". This measure is used frequently in public health communications and can also be applied to hot work environments. The US Department of Labor developed the OSHA Heat Safety Tool app located at *Occupational Safety and Health Administration* for both the Android and iPhone platforms. The OSHA Heat Stress Tool can be used as a screening tool to allow workers to calculate the heat index for their work site by entering the temperature (degrees F) and % humidity. Based on the calculated heat index, the app displays a risk level including protective measures that should be taken for the risk level. For IBM Service personnel wanting more information, please consult *Working in Temperature Extremes Within Data Centers*.

Considerations for multiple system installations

When integrating a 3907 into an existing multiple-system environment, or when adding additional systems to an installed 3907, consider the following factors:

- **Thermal interactions**

  Although computer room floor space is valuable, for optimal cooling, it is recommended that 3907 machines have a 1220 mm (48 in) aisle between rows of systems to reduce surrounding air temperature. See “Cooling recommendations for the room” on page 48.

- **Floor placement**

  The 3907 must be precisely placed for the cable openings to match the floor cutouts. There is +/- 5 mm (0.2") tolerance for positioning the frame in relation to the floor tiles. This tolerance assumes edging around the tile cutouts that does not exceed 15 mm (0.6 in) width.

- **Floor loading**

  When trying to optimize floor space utilization, floor loading weight distribution rules may be inadvertently violated by overlapping weight distribution areas of adjacent machines. Obtain the services of a qualified structural engineer if you are uncertain of the floor load assessment for your computer room.

Chapter 4. Guide for raised floor preparation

This chapter provides recommendations and requirements for making the necessary openings in the raised floor for installation.

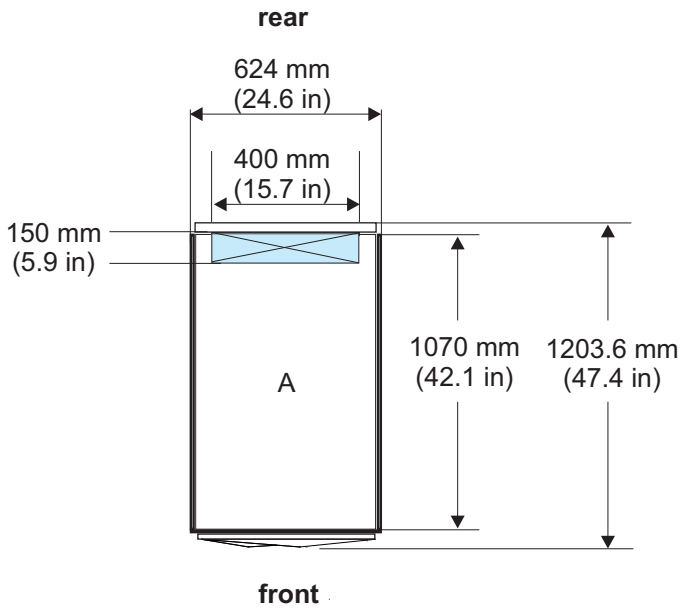
The drawings on the following pages are intended only to show relative positions and accurate dimensions of floor cutouts.

Raised floor cutouts should be protected by electrically non-conductive molding, appropriately sized, with edges treated to prevent cable damage and to prevent casters from rolling into the floor cutouts.

Plan view for raised floor bottom exit cabling configuration

Figure 12 shows the maximum and typical cutouts for the 3907 on the raised floor for bottom exit cabling.

typical cut-out



Frame Entry/Exit	Cutout dimensions for raised floor	
	(mm)	(in)
maximum	100 x 600	3.9 x 23.6
typical	150 x 400	5.9 x 15.7

maximum cut-out

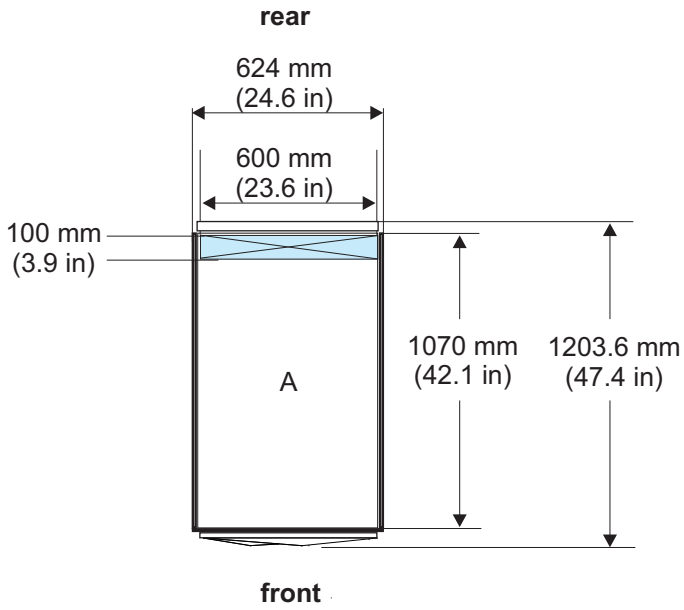
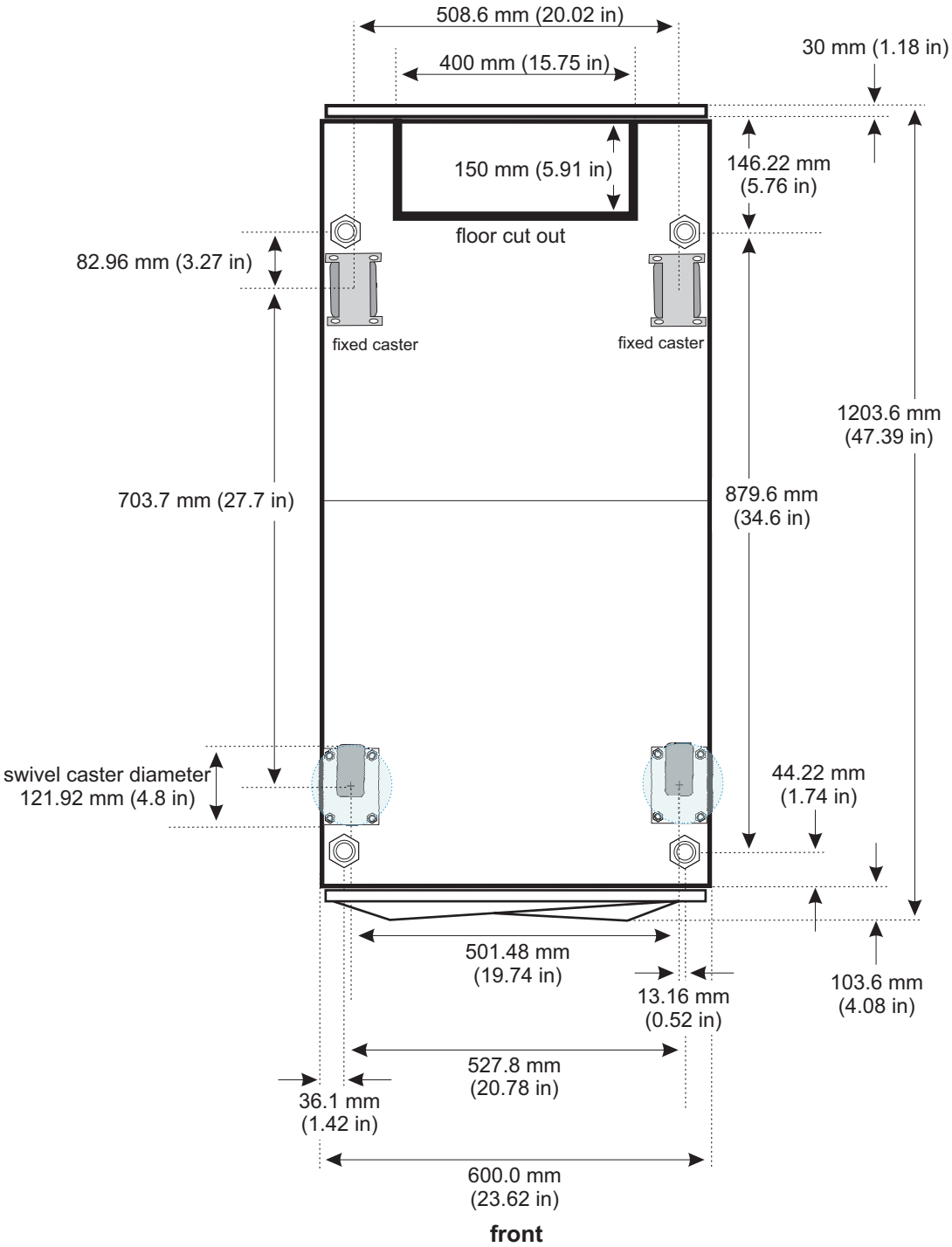


Figure 12. Cut-out layout

Casters

The following illustration shows the physical dimensions around the casters. When positioning the server, be aware that the front casters swivels in a circle slightly larger than 121.92 mm (4.8 in) in diameter. The rear casters are stable. Exercise care when working around floor panel cutouts.



Procedure for cutting and placement of floor panels

Important:

3907, fully configured, can weigh 829 kg (1827.63 lbs). **You must be certain that the raised floor on which you are going to install the server is capable of supporting this weight.** Contact your floor tile manufacturer and a structural engineer to verify that your raised floor is safe to support the 3907.

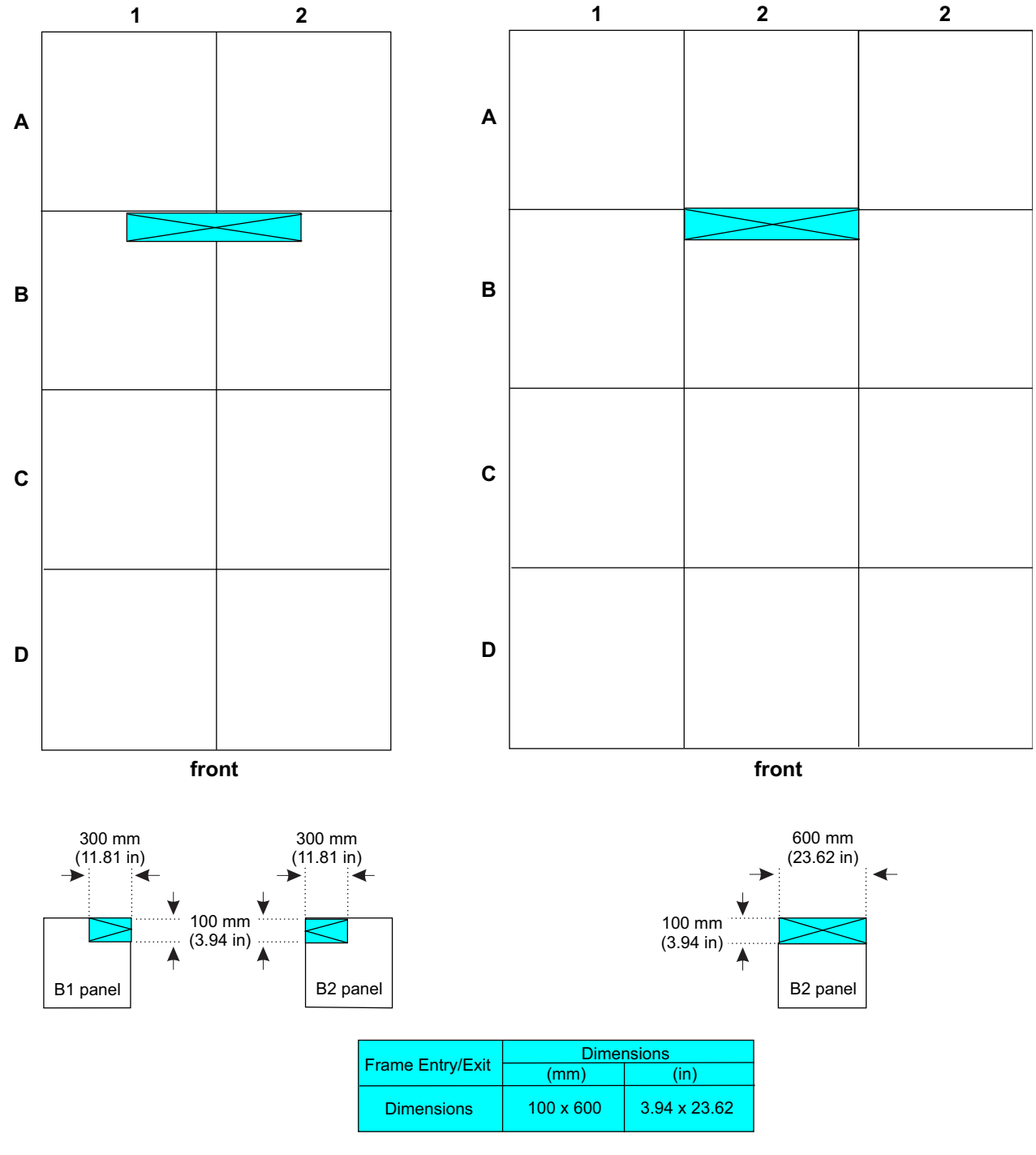
Depending on the floor panel type, additional panel supports (pedestals) may be necessary to maintain the structural integrity of an uncut panel, or to restore the integrity of a cut floor panel. Consult the panel manufacturer and the structural engineer to ensure that the panel can sustain the concentrated loads.

Ensure adequate floor space is available to place the frames over the floor panels exactly as shown on the drawing

DANGER: Heavy equipment — personal injury or equipment damage might result if mishandled. (D006)

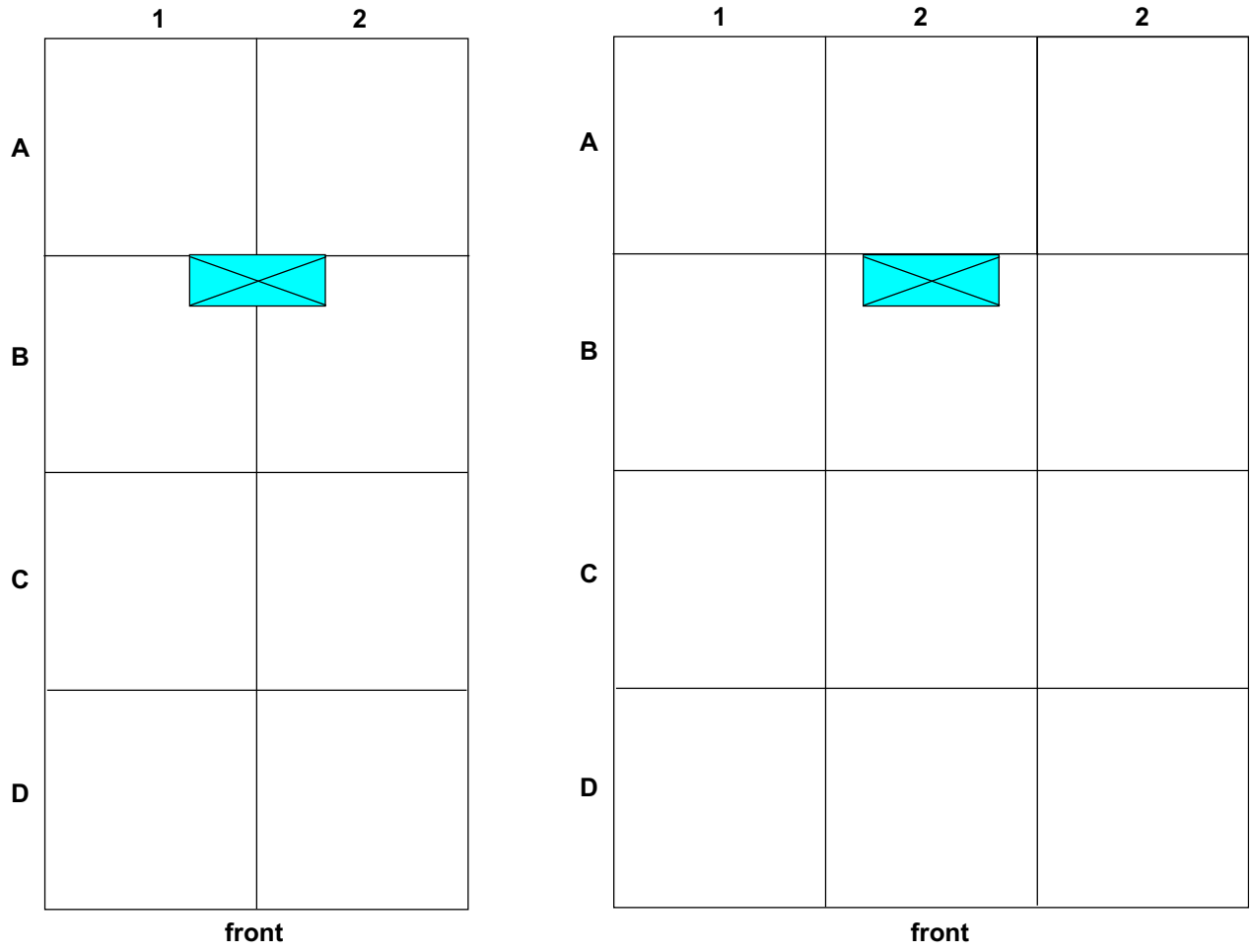
1. Identify the panels needed, and list the total quantity of each panel required for the installation.
2. Cut the required quantity of panels.
3. Additional panel supports (pedestals) are **recommended** to restore the structural integrity of the cut floor tile panels.
4. When cutting the panels, you must adjust the size of the cut for the thickness of the edge molding you are using. The dimensions shown are finished dimensions.
5. For ease of installation, number each panel as it is cut as shown on the panel specification pages.
6. Use the raised floor diagram to install the panels in the proper positions.
7. During the physical placement of the frames, you will need either two **uncut** floor tiles to temporarily replace B1 and B2 or one **uncut** floor tile to temporarily replace B2. After frame placement, the uncut tiles can be removed and the cut tiles placed in the floor.

Raised floor with 600 mm (23.5 in) floor panels



Frame Entry/Exit	Dimensions	
	(mm)	(in)
Dimensions	100 x 600	3.94 x 23.62

Figure 13. Floor cutouts - 100 mm (3.94 in) x 600 mm (23.62 in)



Frame Entry/Exit	Dimensions	
	(mm)	(in)
Dimensions	150 x 400	5.91 x 15.75

Figure 14. Floor cutouts - 150 mm (5.91 in) x 400 mm (15.75 in)

Important:

Extra pedestals may be placed as shown in the following figure.

These extra pedestals are recommendations. You must decide which, if any, of these recommendations to use.

All pedestals should be adjusted to just contact the underside of each floor panel **before** the frames are rolled into place. Depending on your floor panel type, additional supports (pedestals) may be necessary to restore the structural integrity of cut panels.

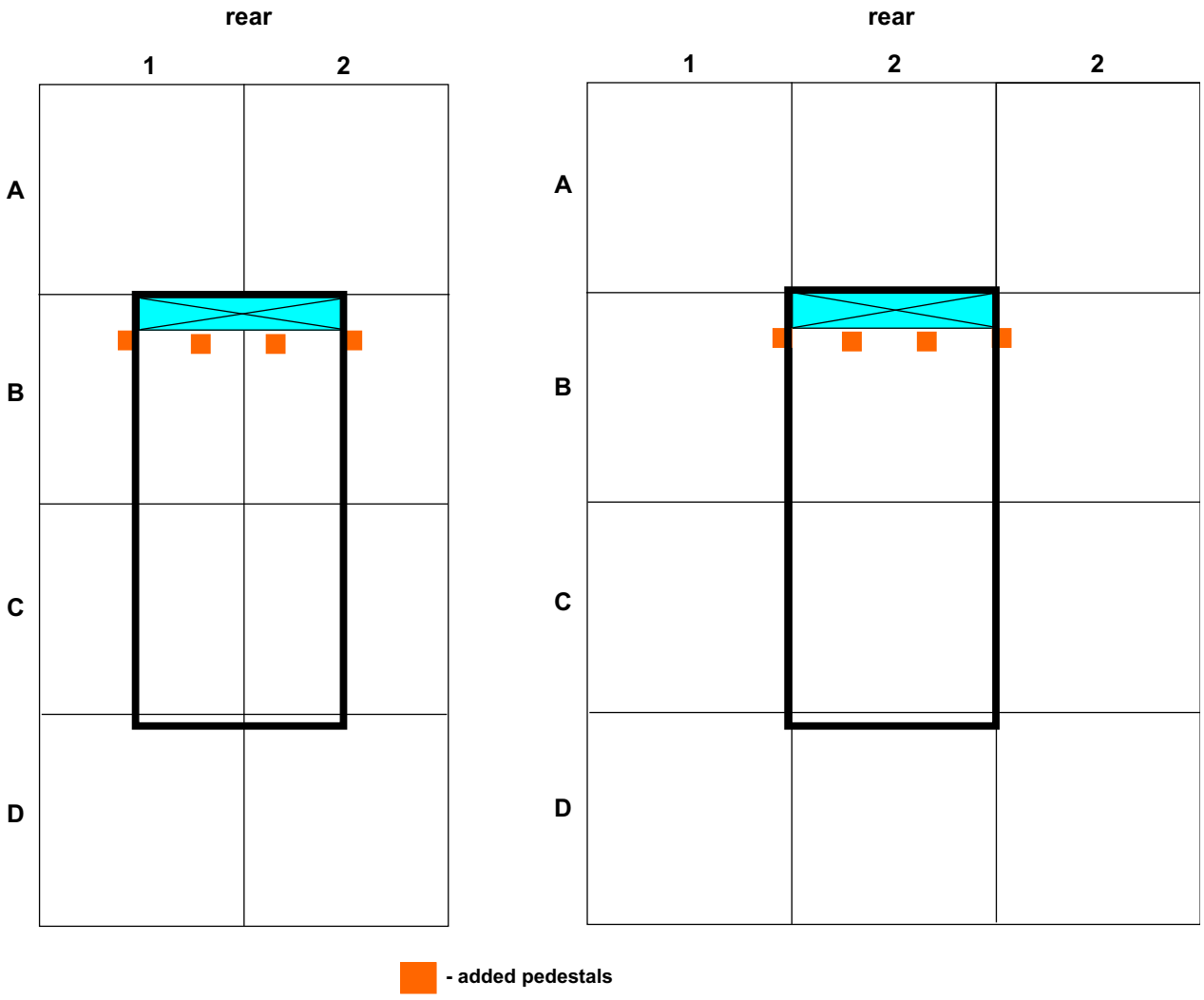


Figure 15. Added pedestals - 100 mm (3.94 in) x 600 mm (23.62 in)

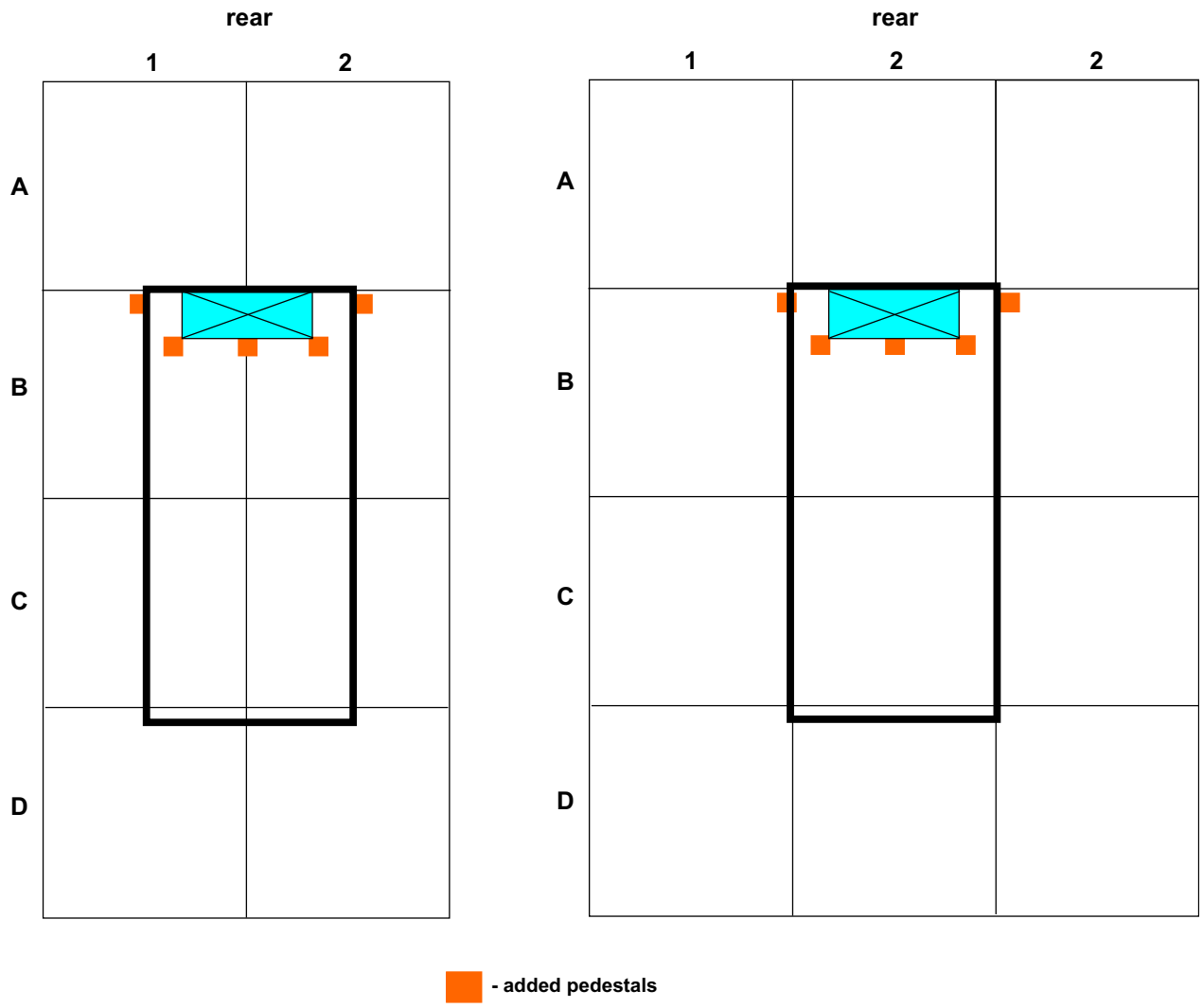


Figure 16. Added pedestals - 150 mm (5.91 in) x 400 mm (15.75 in)

Chapter 5. Power requirements

General electrical power requirements

3907 requires the following power requirements:

- System frame
  - 50/60 Hz AC
  - Voltage ranges:
    - 200V to 240V AC, single-phase wiring
    - 24 amp

  The system requires two or four line cords depending on the number of PDUs installed.

  Refer to the Appendix E, "Dual power installation," on page 155 for the correct wiring method for your particular power distribution equipment.
- Hardware Management Console

  For HMC FC 0092, a single-phase feed from a customer-supplied service outlet. The outlet must provide 100V to 130V or 200V to 240V 50/60 Hz single-phase AC power.

  For HMC FC 0095 and HMC FC 0082, a single-phase feed from a customer-supplied service outlet. The outlet must provide 90 Vrms to 137 Vrms or 180 Vrms to 265 Vrms 47/63 Hz single-phase AC power.

  For HMC FC 0094, HMC FC 0096, and HMC FC 0083, the customer must supply a PDU that provides C13 outlets for the three C13/C14 power jumper cables.

Important power selection considerations

As you select features for 3907, be aware of the following when choosing server power:

- You can route the power cords through the bottom of the machine, the top of the machine, or both the top and bottom. To route the power cords through the bottom of the machine, you must install the bottom exit cabling feature (FC 7919). To route the power cords through the top of the machine, you can either install the top exit cabling feature (FC 7917) or route the power cables directly through the top of the frame.

Power installation considerations

3907 operates from two to four power cords, depending on system configuration, which provide redundant attachment to the electrical utility. When properly connected to independent branch circuits, they provide system immunity to most types of power outage. See Appendix E, "Dual power installation," on page 155 for examples of typical redundant wiring facilities.

Note: The power cord sets provided are for use only with this product.

The power supplies at the front end of the system use active resistive load synthesis. Harmonic distortion of the current waveform is small enough that it need not be considered in planning the installation. The power factor is typically 0.95 or higher.

Supply type	input voltage	input frequency	input current rating
two to four single phase power cords	200-240 VAC (180-256 VAC with tolerance)	50/60 Hz (47 to 63 Hz with tolerance)	24A

PDU specifications

The following tables provide the number of PDUs and number of line cords required based on the number of processor drawers and the number of I/O units in the machine configuration.

Table 25. Number of PDUs installed

Number of I/O units	Number of PDUs and line cords
0	2
1	2
2	4
3	4
4	4

Power specifications

The following tables provide system power consumption based on the number of PUs and the number of PCIe+ I/O drawers with maximum configurations.

PCIe+ I/O drawer

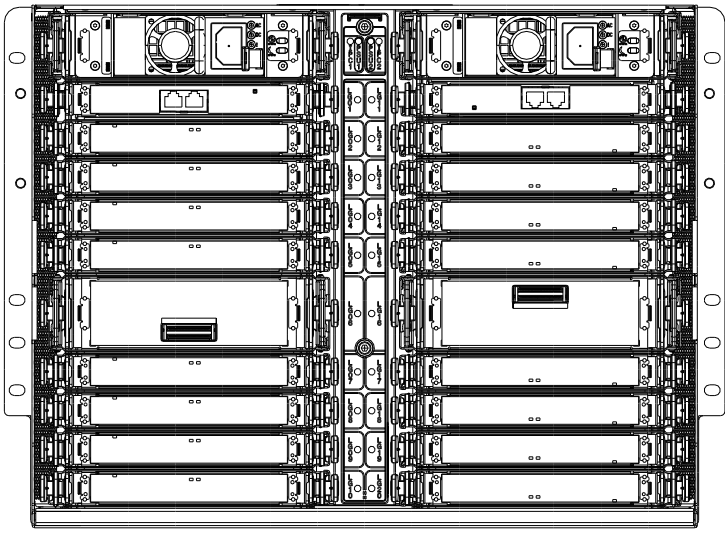


Table 26. Utility power consumption

FC (PUs)	number of drawers				
	0	**1**	**2**	**3**	**4**
0636 maximum 4 PUs	1.36 kW	2.26 kW	-	-	-
0637 maximum 12 PUs	1.77 kW	2.67 kW	3.58 kW	-	-
0638 maximum 24 PUs	2.59 kW	3.48 kW	4.39 kW	5.29 kW	6.12 kW
0639 maximum 30 PUs	2.59 kW	3.48 kW	4.39 kW	5.29 kW	6.12 kW

Note:

- The power used in this table assumes the process drawer and PCIe+ I/O drawers are plugged to the maximum with highest power features (ie. memory and I/O adapters and fanouts). Also assumed is that maximum ambient temperature is used.
- Typical configurations and data center conditions will result in lower power. A calculator available on Resource Link permits the calculation of power and weight for specific configurations and environmental conditions.

Power estimation tool

The power estimator tool for 3907 allows you to enter your precise server configuration to produce an estimate of power consumption. You can also use the tool to calculate the weight of your server.

Log on to Resource Link at *http://www.ibm.com/servers/resourcelink*. Navigate to **Tools**, then to **Power and weight estimation**. Specify the quantity for the features that are installed in your machine. This tool estimates the power consumption for the specified configuration. The tool does not verify that the specified configuration can be physically built.

Note: The exact power consumption for your machine will vary. The object of the tool is to produce an estimation of the power requirements to aid you in planning for your machine installation.

Actual power consumption after installation can be confirmed using the HMC **Monitors Dashboard** task.

Customer circuit breakers

The following table shows the maximum circuit breaker ratings based on input voltage.

Table 27. Circuit breaker ratings based on input voltage

Input Voltage Range (V)	System Rated Current (A)	Circuit Breaker
200 - 240 VAC	24A	30 amps

It is recommended, for simplicity and ease of upgrades, that the circuit breaker ratings in this table be used on all power cords for all installations. The actual power drawn (heat load) by any configuration will not be affected.

Note: Small currents can appear on the server earth ground connection under normal server operation.

For most reliable operation, circuit breakers that react to currents detected on ground (e.g. Earth Leakage Circuit Breakers or Residual Current Circuit Breakers) are not recommended for use with 3907. By internal design and grounding, 3907 is fully certified for safe operation without them (meets IEC, EN, UL, CSA 60950-1 standards).

However, if leakage detection circuit breakers are required by local electrical practice, they can be used down to 100 mA. To safeguard against spurious tripping:

1. The Data Center ground grid should be constructed in accordance with best practices to avoid significant voltage gradients.
2. The facility power infrastructure should be as reliable as possible.
3. The utility connections from the breaker panel to the two or four power cord inputs should be reasonably equal in length or at least no one connection should be much shorter than the others.

If spurious tripping is experienced, corrections must be made in one or more of the above areas.

Supported power cords

Plugs are shipped with the machine line cords for every country. Power plugs listed in Table 28 are approved for use with specified models and meet the relevant test laboratory or country/test-house standards. The power plug must be connected to a correctly wired and grounded receptacle. The customer is responsible for receptacle wiring.

Table 28. Supported power cords

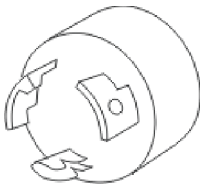
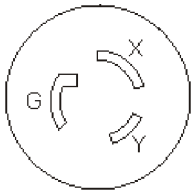
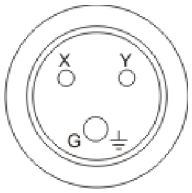
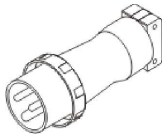
Feature code **Countries** **Voltage** **Amperage** **Phase** **Length** **Wall plug**	**IBM shipped plug (on cord)**	**View of plug**	**Connector (on cord) customer end (female contacts)**	**Receptacle (on wall) (female contacts)**	**IBM part number of cord**
FC 7937 USA, CNN [2], Latin America, Japan —— 200 - 240 VAC —— 30 A plug (24 A derated) —— single phase —— 4.3 m (14 ft) —— NEMA L6-30 (twist lock)	plug type (showing pins): NEMA L6-30P 		connector type: NEMA L6-30R	receptacle type: NEMA L6-30R 	39M5416
FC 7938 USA, CNN [2], Latin America, Japan —— 200 - 240 VAC —— 30 A plug (24 A derated) —— single phase —— 4.3 m (14 ft) —— RS 3750DP or RS 9P33UO (Watertight)	plug type (showing pins): 3750DP 		connector type: 3933 or 9C33U0	receptacle type: 9R33U0W or 3753 	39M5418

Table 28. Supported power cords (continued)

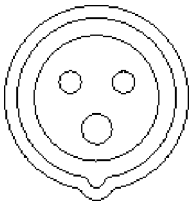
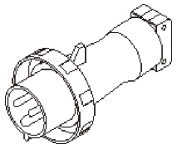
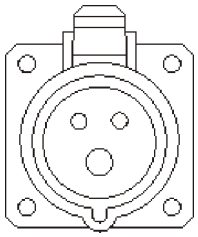
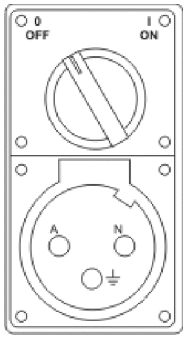
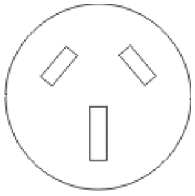
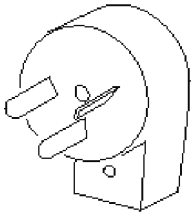
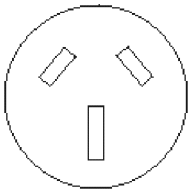
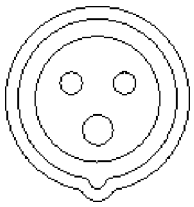
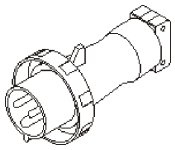
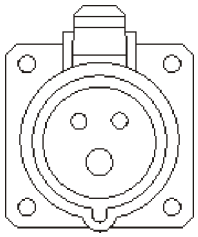
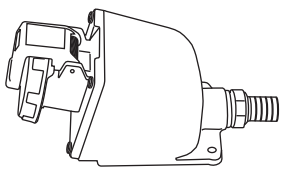
Feature code Countries Voltage Amperage Phase Length Wall plug	IBM shipped plug (on cord)	View of plug	Connector (on cord) customer end (female contacts)	Receptacle (on wall) (female contacts)	IBM part number of cord
FC 7939 AP, EMEA —— 230 VAC —— 32 A —— single phase —— 4.3 m (14 ft) —— IEC 309, P+N+G	plug type (showing pins): HBL332P6W 		connector type: HBL332C6W	receptacle type: HBL332R6W 	39M5414
FC 7940 Australia and New Zealand —— 230 - 240 VAC —— 32A —— single phase —— 4.3 m (14 ft) —— PDL	plug type (showing pins): 56P332 		connector type: 56CR332	receptacle type: 56CV332 	39M5419
FC 7941 Korea —— 220 VAC —— 30 A plug (24 A derated) —— single phase —— 4.3 m (14 ft) —— Korean plug SJ-P3302	plug type (showing pins): KP 32A 		connector type: KP	receptacle type: KP 	39M5420

Table 28. Supported power cords (continued)

Feature code Countries Voltage Amperage Phase Length Wall plug	IBM shipped plug (on cord)	View of plug	Connector (on cord) customer end (female contacts)	Receptacle (on wall) (female contacts)	IBM part number of cord
FC 7943 World Trade [1] —— 230 VAC —— 32 A —— single phase —— 4.3 m (14 ft) —— IEC 309, P+N+G —— low smoke, halogen-free	plug type (showing pins): HBL332P6W 		connector type: HBL332R6W	receptacle type: HBL332R6W 	01PP883

Notes:

1. Except US, Japan, Australia, Korea, India, China, and all CNN.
2. This includes the following geographies: Bahamas, Turks & Caicos, Barbados, Burmuda, Guyana, Caymon Islands, Canada, Jamaica, Dutch Caribbean, Aruba, Bonnaire, Curacao, St. Marten NA, Anguilla, Antigua, BVI Tortola, Montserrat, St. Kitts & Nevis, St. Lucia, Dominica, Grenada, St. Vincent, Suriname Trinidad.
3. It is strongly recommend to use a metal backbox (**example** shown below) with our line cords using IEC-309 plugs. Although in-line connectors and nonmetallic backboxes are available and compatible, they are not recommended. These recommendations are based on the metal backbox providing:
   - An added level of protection against a mis-wired phase and ground reversal
   - In some cases, a metal backbox may be better for EMI mitigation

   You may choose not to use a metal backbox. In this case, please check your local code for specific requirements.
4. The customer must obtain the appropriate plugs and receptacles, based on existing electrical codes, where those plugs and receptacles are not provided with the system. These customer-provided plugs and receptacles should be installed by qualified electricians.
5. The power cord set(s) provided are for use only with this product.
6. If you choose to use a Hubbell receptacle, do NOT use the Hubbell C-Series Light Industrial 3.

Grounding specifications

Every single-phase 120 volt branch circuit (used for the Hardware Management Console and service outlets) must contain one phase conductor, a neutral conductor, and an insulated equipment-grounding conductor.

For 200 VAC through 240 VAC installations worldwide, the equipment-grounding conductor must match local electrical codes and must be green with or without one or more yellow stripes on the insulation. It is recommended that the ground wire be the same size as the phase conductor wires.

Conduit must not be used as the only grounding means. However, any conduit or cable shield must be connected at both ends in such a way that it is included in the grounding path in parallel with the grounding conductor it contains. Most electrical codes require that branch circuit wiring be located in metallic conduit, or be made from shielded cable, if located under a raised floor. Even when not required by local regulations, some form of shield around the branch circuit wiring is strongly recommended as a means of reducing coupling of high-frequency electrical noise into signal and control cables.

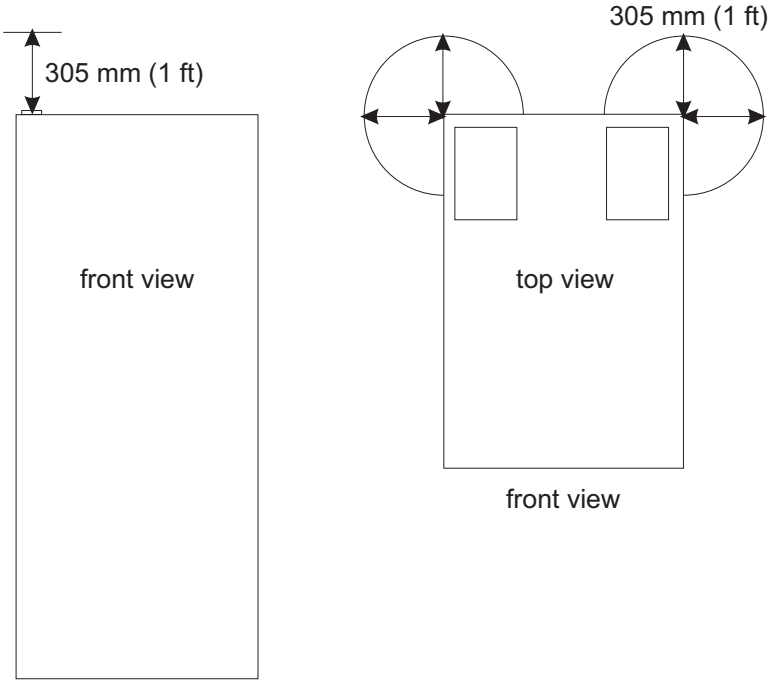
For information about additional recommendations and requirements for equipment grounding, go to Resource Link at *http://www.ibm.com/servers/resourcelink*. See **General Information for Planning a Physical Site**.

Power cabling

You can route power cables:

- Through the top of the frame using the top exit cabling (FC 7917)
- Directly through the top of the frame
- Through the bottom of the frame using the bottom exit cabling feature (FC 7919).

If you are planning to route the power cables through the top of the frame, your receptacle must drop to within 305 mm (1 ft) of the top of the frame and be no further than 305 mm (1 ft) from the front door or side cover of the frame.



See Appendix C, "Top exit cabling and bottom exit cabling specifications," on page 137 for information on the top exit cabling feature (FC 7917) and the bottom exit cabling feature (FC 7919).

Line cord wire specifications

Line code usage location	Feature code	AWG # Type # of wires	Connector supplied	Bulk outside diameter mm (in)
USA, CNN, Latin America, Japan (200 - 240 VAC) 14 ft	FC 7937	#10 AWG Type SJT	Yes	15.0 (0.59)
USA, CNN, Latin America, Japan (200 - 240 VAC) 14 ft	FC 7938	#10 AWG Type SJT	Yes	15.0 (0.59)
AP, EMEA (230 VAC) 14 ft	FC 7939	#12 AWG Type HAR	Yes	16.0 (0.63)
Australia and New Zealand (230 - 240 VAC) 14 ft	FC 7940	#12 AWG Type HAR	Yes	16.0 (0.63)
Korea (220 VAC) 14 ft	FC 7941	#12 AWG Type HAR	Yes	16.0 (0.63)
World Trade (230 VAC) 14 ft low smoke, halogen-free	FC 7943	#12 AWG HAR/LSZH	Yes	16.0 (0.63)

Line physical protection

In US installations, the line cord must meet National Electric Code (NEC) requirements. When line cords are run on the surface of the floor, they must be protected against physical damage (See NEC 645-5). For other countries, the line cord requirements must meet local codes.

Chapter 6. Hardware Management Console and Support Element communications

Support Element

3907 is supplied with dual 1U 2461 Support Elements (2461-SE2). The two Support Elements share a single keyboard and display managed by a KVM switch.

Note: Throughout the rest of this document, "Support Elements" refers to the dual 2461 Support Elements.

Power for the Support Elements is supplied by the 3907 power supply, and there are no additional power requirements.

The Support Elements on the 3907 connects to the LAN via the customer network switch. Then the Support Elements connect to the Ethernet switches in the 3907. The Hardware Management Console also connects to the LAN via the customer network switch.

Hardware Management Console

A Hardware Management Console (FC 0092, FC 0094, FC 0095, FC 0096, FC 0082, or FC 0083) is required to operate 3907. The previous HMCs (FC 0092, FC 0094, FC 0095, or FC 0096) can be carried forward. A single console can support multiple machines and can be located remotely to the physical sites.

If you plan to use the ensemble capabilities of 3907, you will need to order FC 0025, Unified Resource Manager and provide two HMCs - one to serve as the primary HMC for the ensemble, and one to serve as the alternate HMC.

Note: In addition to performing ensemble-related tasks for any CPC in the ensemble, the primary HMC can perform all non-ensemble tasks on a CPC, whether it is a member of an ensemble or not a member of an ensemble.

The machine type and model number of the primary HMC and alternate HMC must be identical. Both must be either FC 0092, FC 0094, FC 0095, FC 0096, FC 0082, or FC 0083. Compare the machine type from the serial number label to ensure that both machines have the same machine type.

The Hardware Management Console consists of:

- The Hardware Management Console (FC 0092) consists of:
  - A processor or system unit, including two Ethernet LAN adapters, capable of operating at 10, 100, or 1000 Mbps and will use removable UFDs to install Licensed Machine Code (LMC)
  - A flat panel display
  - A keyboard and
  - A mouse
  - The console requires a customer-supplied table to hold the following:
    - The keyboard and mouse
    - A flat panel display (FC 6096)

  See Appendix B, "Hardware Management Console physical specifications," on page 125 for physical specification of HMC (FC 0092) and the flat panel display (FC 6096).
- The Hardware Management Console (FC 0095 and FC 0082) consists of:

  - A processor or system unit, including two Ethernet LAN adapters, capable of operating at 10, 100, or 1000 Mbps and will use removable UFDs to install Licensed Machine Code (LMC)
  - Optional keyboard (FC 0153)
  - Optional mouse (FC 0152)
  - Optional display (FC 6096)
  - The console requires a customer-supplied table to hold the keyboard, mouse, and display.

  The 1U HMC system unit and the 1U keyboard/display unit must be mounted in two adjacent 1U locations in the ergonomic zone in the rack. The following are recommendations for placement of the 1723-8BX keyboard/display unit into the customer supplied rack:
  - If you are standing when using the 1723-8BX keyboard/display unit, place the unit in EIU locations 21, 22, or 23.
  - If you are sitting when using the 1723-8BX keyboard/display unit, place the unit in EIU locations 12, 13, or 14.
  - For special accommodations, you need to make adjustments in the placement of the 1723-8BX keyboard/display unit in the rack that meet your needs.

  See Appendix B, “Hardware Management Console physical specifications,” on page 125 for physical specifications of HMC (FC 0095 or FC 0082) and the flat panel display (FC 6096).
- The Hardware Management Console (FC 0094, FC 0096, andFC 0083) consists of:
  - 1U HMC system unit, including two Ethernet LAN adapters, capable of operating at 10, 100, or 1000 Mbps and will use removable UFDs to install Licensed Machine Code (LMC)
  - 1U console unit that holds the flat panel display and the keyboard
  - Three C13/C14 10 amp power jumper cables (2.8 m (9 ft))
  - The customer must provide the following:
    - A rack to hold the 1U Hardware Management Console and the 1U console unit
    - Three power receptacles, which provides C13 outlets for the C13/C14 power jumper cables -- two for the 1U HMC system unit and one for the display/keyboard unit.

    The 1U HMC system unit and the 1U keyboard/display unit must be mounted in two adjacent 1U locations in the ergonomic zone in the rack. The following are recommendations for placement of the1723-8BX keyboard/display unit into the customer supplied rack:
    - If you are standing when using the 1723-8BX keyboard/display unit, place the unit in EIU locations 21, 22, or 23.
    - If you are sitting when using the 1723-8BX keyboard/display unit, place the unit in EIU locations 12, 13, or 14.
    - For special accommodations, you need to make adjustments in the placement of the 1723-8BX keyboard/display unit in the rack that meet your needs.
    -

  See Appendix B, “Hardware Management Console physical specifications,” on page 125 for physical specifications of FC 0094, FC 0096, FC 0083, the flat panel display (FC 6096), and the 1723-8BX keyboard/display unit.

The Hardware Management Console (FC 0092, FC 0095, and FC 0082) requires two 110/120V outlets for USA and Canada. The Hardware Management Console (FC 0094, FC 0096, and FC 0083) uses three PDU plug positions (two for the 1U HMC unit, and one for the 1723-8BX display/keyboard unit) for USA and Canada. (Other power requirements are country dependent.)

An Ethernet switch will not be offered as a configurable feature on 3907. If an Ethernet switch is needed to manage the Ethernet connection between the Support Elements and HMCs, you must supply your own. It is recommended that the Ethernet switch support a speed of 1 Gb. However, if you are upgrading to a 3907 and Ethernet switch, FC 0070, is found on the base machine, it will be carried forward.

The Ethernet switch requires a single 110/120V outlet for USA and Canada. (Other power requirements are country dependent.)

Physical specifications for the Hardware Management Console components are located in Appendix B, “Hardware Management Console physical specifications,” on page 125.

Ethernet LAN switch support

The following is general information relevant to many Ethernet switches. Refer to the manufacturer's User's Guide that came with your switch or hub for installation instructions.

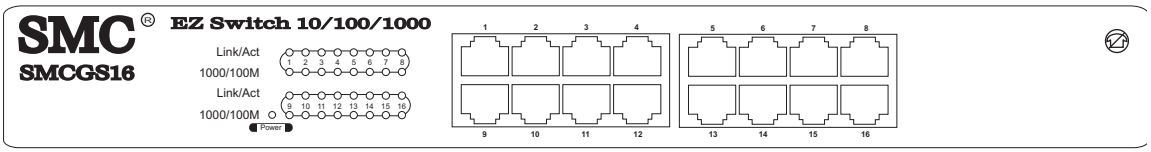
There must be an Ethernet switch or hub available to connect the Hardware Management Consoles to your LAN. The Ethernet switch or hub is a standalone unit located outside the frame and which operates on building AC power. An Ethernet switch will not be offered as a configurable feature on the 3907. You must supply your own Ethernet switch unless you are upgrading to a 3907. If you are upgrading to a 3907 and Ethernet switch, FC 0070, is found on the base machine, it will be carried forward. It is recommended that the Ethernet switch support a speed of 1 Gb.

Typical Ethernet switch/hub characteristics:
- 16 auto-negotiation ports
- 10/100/1000 Mbps data rate
- Full or half duplex operation
- Auto-MDIX on all ports
- Port Status LEDs
- 100 to 240 VAC, 50 or 60 Hz power

Ethernet switches supporting auto-MDIX on all ports use a straight-through cable between any two ports.

To provide redundancy for the HMCs, two switches or hubs should be used.

Switch Example



Ethernet network connection requirements

MUST READ:

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.

The preceding statement does NOT exclude using the network for private communications, such as connection to the Remote Support Facility.

On the 3907, the install team must connect the Ethernet adapters for any HMC(s) into an Ethernet switch. This switch can then be connected to J03 and J04 on the Support Elements. (See Figure 17 on page 80.)

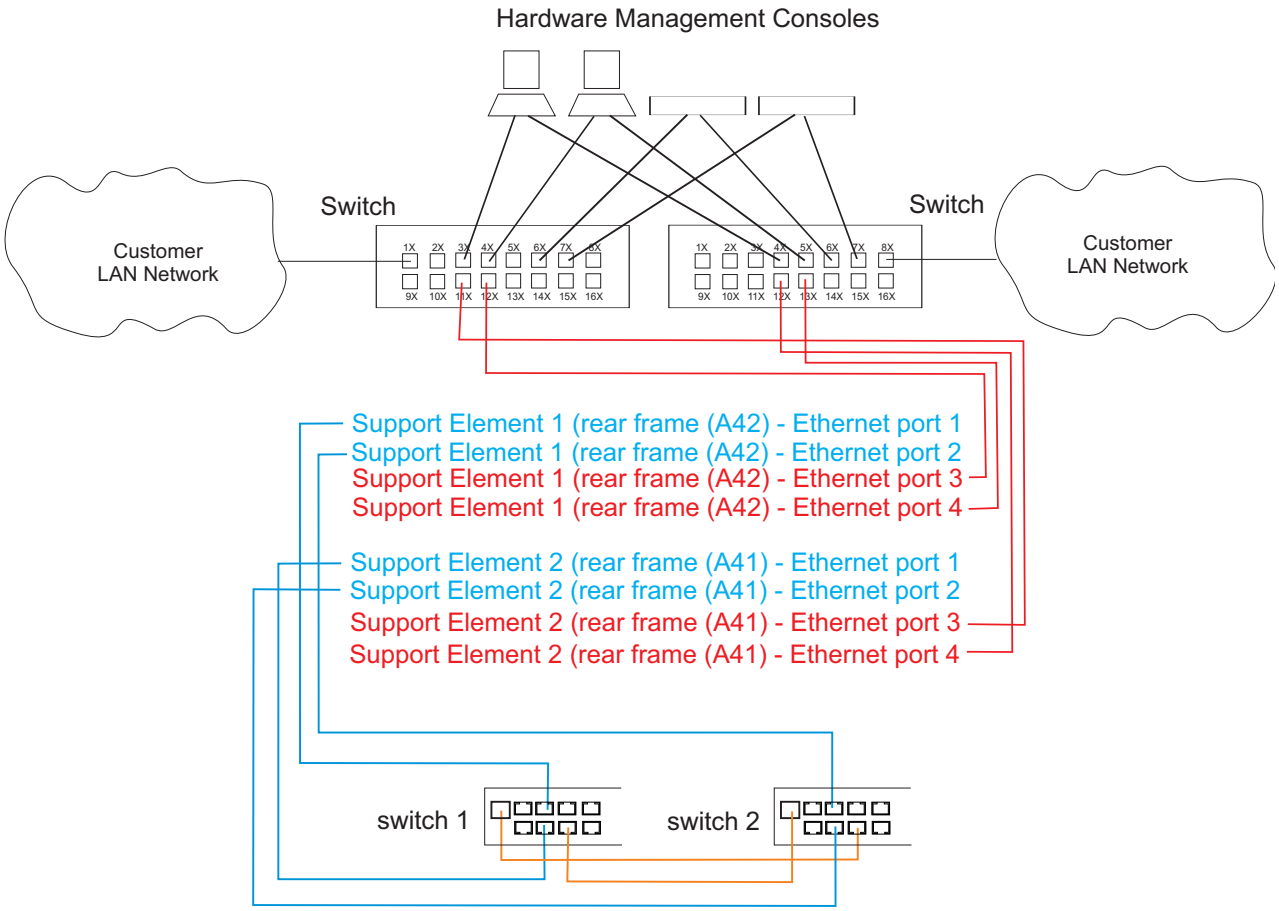


Figure 17. Two-switch configuration

Notes:

1. Connect customer LANs, via Ethernet switches, to Ethernet ports J03 and J04 on the Support Element servers. Customer **LAN 1 should be plugged into Ethernet port J03** on the Support Elements. Customer **LAN 2 should be plugged into Ethernet J04** on the Support Elements.
2. Never connect an HMC directly to Ethernet ports J03 and J04 on the Support Elements.

Hardware Management Console and Support Element wiring options

A local Hardware Management Console must be connected to its Support Elements using Local Area Network (LAN) wiring. The Hardware Management Console and the Support Elements both come with Dual Ethernet LAN adapters.

The communication protocol (TCP/IP) used in Support Element to Hardware Management Console communication is defined for both adapters in the Support Elements.

Notes on wiring with multiple adapters:

1. The Hardware Management Console supports dual Ethernet paths to Support Elements. This allows automatic redundant network paths so that the failure of a single network has no affect on Hardware Management Console to Support Element communication.
2. When configuring multiple adapters the address must be defined in different subnets.

Trusted Key Entry (TKE)

3907 may have a Crypto Express5S (FC 0890) or a Crypto Express6S (FC 0893) feature for applications where extensive data security is required. For these systems, there is a separate console available for authorized access to the Crypto Express5S (FC 0890) or a Crypto Express6S (FC 0893) feature. This console is named the Trusted Key Entry (TKE) workstation.

TKE 9.1 (FC 0880) is required to manage a Crypto Express5S or a Crypto Express6S and the additional domains provided on the Crypto Express5S or the Crypto Express6S on a 3907.

The TKE workstations (FC 0849, TKE 2461-TW1 (FC 0081), and TKE 2461-TW2 (FC 0086)) include a system unit, flat panel display, mouse, keyboard, and line cord. The TKE workstations (TKE 2461-SE1 (FC 0080) and TKE 2461-SE2 (FC 0085)) include a system unit and a 1U console unit that holds the flat panel display and the keyboard. The built-in Ethernet adapter supports a link data rate of 10, 100, or 1000 Mbps. The built-in Ethernet adapter supports a link data rate of 10, 100, or 1000 Mbps.

FC 0842, FC 0847, FC 0097, and FC 0098 can only be carried forward; however, to use with the 3907, they must be converted by replacing the installed Crypto adapter card with a 4768 TKE Crypto adapter card (FC 0844).

- Mouse feature (FC 0152), keyboard feature (FC 0155), and monitor feature (FC 6096) are optional for use with TKE (FC 0081) and TKE (FC 0086).

  Keyboard/monitor/mouse feature (FC 0156) is optional for use with TKE (FC 0080) and TKE (FC 0085).

The TKE workstation attaches to the customer LAN, providing a security-rich, flexible method of providing master key and operational key entry to locally and remotely managed Cryptographic Coprocessor features.

TKE with optional Smart Card Reader, FC 0885 or FC 0891, allows access to and use of confidential data on the Smart Card, protected by a user defined personal identification number (PIN) code providing secure storage, access, transport and entry of master and operational key parts into the TKE workstation. The following characteristics pertain to the Smart Card Reader:

- The Smart Card Reader is an optional security device that attaches to the TKE.
- TKE logon profiles can be placed on smart cards, which provide enhanced control over the sign on processes.
- FC 0885 and FC 0891 contain two Smart Card Readers, two serial port “Y” adapters, two serial cables, and 20 blank smart cards. The cables provide both power source for the Smart Card Reader and the communication path between the Smart Card Reader and the TKE workstation.
- A TKE workstation and the TKE 7.2 or later level code are corequisites for ordering the Smart Card Reader.
- FC 0884, FC 0892, and FC 0900 provide the ability to order additional blank Smart Cards. The Smart Card Reader is a corequisite for ordering additional Smart Cards.
- If you currently have the Smart Card Reader feature (FC 0885) and Additional Smart Card feature (FC 0884), they can only be carried forward to TKE 9.1 as follows:
  - The smart card readers can be used on TKE 9.1 without any restrictions.
  - If you have initialized any smart cards as CA, TKE, IBM Enterprise PKCS#11 (EP11), or MCA smart cards, you can use them on your TKE 9.1 system without any restrictions.
  - If you have initialized any smart cards as IA or KPH smart cards, you can use them on your TKE 9.1 for migration tasks done with Crypto Express4S or below modules.
  - If you have initialized any smart cards as IA or KPH smart cards, you cannot use them for migration tasks done with Crypto Express5S or Crypto Express6S modules.

Note: If data will eventually be applied to a Crypto Express5S, the collect and apply migration tasks must be performed from a TKE 9.1 using IA and KPH smart cards that were initialized on TKE 9.1.

– A smart card from FC 0885 or 0884 can be initialized as any one of the 6 types (CA, TKE, EP11, MCA, IA or KPH) of smart cards on TKE 9.1.

To use the TKE function on 3907, Crypto Express5S (FC 0890), Crypto Express6S (FC 0893), TKE 9.1 code (FC 0880), and CP Assist for Cryptographic Function (FC 3863) must be installed.

TKE workstation requires two 110/120 volt outlets in the U.S. and Canada. Power requirements vary in other countries.

LAN connections

LAN cabling is a customer responsibility. To connect the TKE workstation with Ethernet to a LAN, a Category 5 Unshielded Twisted Pair (UTP) cable terminated with an RJ-45 connector is required.

Planning for an ensemble

If you are planing to use this z14 model ZR1 in an ensemble, you must order FC 0025, which supplies the ensemble management code, and you must supply two HMCs (FC 0092, FC 0094, FC 0095, FC 0096, FC 0082, FC 0083), which manage the ensemble. One of these HMCs is configured as the primary for the ensemble, one as the alternate.

Note: It is important to note that these two HMCs, if ordered, must be installed on the same Ethernet subnet, to insure redundancy.

If FC 0025, Unified Resource Manager, is to be used on a single z14 model ZR1, and if LPAR to LPAR communications is required in a Unified Resource Manager defined VLAN, you must supply an LC Duplex directly-connected cables (not wrap cables, as was previously recommended). Those LC Duplex directly-connected cables plug into the two OSA-Express4S 10 GbE features, two OSA-Express5S 10 GbE features, or two OSA-Express6S 10 GbE features (CHPID type OSX).

Notes:

- When a z14 model ZR1 and FC 0025 (Unified Resource Manager) are ordered, eConfig does not force you to order two OSA-Express4S 10 GbE features, two OSA-Express5S 10 GbE features, or two OSA-Express6S 10 GbE features; however, those OSA features (OSA-Express4S 10 GbE Long Reach (FC 0406), OSA-Express4S 10 GbE Short Reach (FC 0407), OSA-Express5S 10 GbE Long Reach (FC 0415), OSA-Express5S 10 GbE Short Reach (FC 0416), OSA-Express6S 10 GbE Long Reach (FC 0424), OSA-Express6S 10 GbE Short Reach (FC 0425)) are required if you plan to use them for LPAR to LPAR communication.
- The IODF must be shared among participating z/OS® LPARs.

Ensemble network configurations for a z14 model ZR1 are as follows:

- z14 model ZR1 can be in an ensemble with one or more z14 model ZR1 / z14 models M01, M02, M03, M04, and M05 / z13 / z13s / zEC12 / zBC12 / z196 / z114 machines, zBX Model 004 machines, zBX Model 003 machines (attached to zEC12 or zBC12), and/or zBX Model 002 machines (attached to z196 or z114).
- Customer-managed management network (with or without zBX)
  - A pair of HMCs (0092, 0094, 0095, 0096, FC 0082, or FC 0083) with Unified Resource Manager (FC 0025) to control and manage the ensemble. One HMC is configured as the primary, the other as the alternate if the primary HMC fails.
  - Only one pair of HMCs running Unified Resource Manager per ensemble.
- Intranode management (INMN) network (**OSM** CHPID)
  - Two ports from two different OSA-Express6S 1000BASE-T Ethernet adapters (FC 0426) (for redundancy) to provide management capability for a single node through the Unified Resource Manager.
- Intraensemble data (IEDN) network (**OSX** CHPID with a zBX in the ensemble or single node without a zBX for LPAR to LPAR communications)

  A z14 model ZR1 ensemble that has multiple nodes and no zBX cannot utilize the IEDN.
  - zBX in the ensemble, each node can have a connected pair of OSA-Express4S 10 GbE adapters, OSA-Express5S 10 GbE adapters, or Express6S 10 GbE adapters (for redundancy).
  - Single node (with no zBX) will have a pair of 10 Gb loop back cables (customer-supplied) to allow the applications to share data on the IEDN between operating system images.
- Customer network connections (**OSD** CHPID)
  - For existing network connectivity from IBM Z applications to networks other than the IEDN.

Chapter 7. Remote Support Facility (RSF) installation planning

The Remote Support Facility (RSF) provides communication to a centralized support network for problem reporting and service, as well as providing a means for remote operation of the Hardware Management Console. Communication with the Remote Support Facility is provided using an Internet connection.

All transmissions are supported using the IBM enhanced support system. Transmission to the support system requires a Domain Name Server (DNS) to be available. It must be configured on the call-home server HMC or proxy server connecting to the internet.

All z14 Hardware Management Consoles require connections to the IBM enhanced support system. If the z14 Hardware Management Console is supporting older systems, the connections to the legacy support system are also required.

Choosing a communications method for remote support

You must choose method for connecting your server to support system through the Remote Support Facility (RSF):

- A direct connection from the Hardware Management Console to the Internet. This method is fast, reliable and uses the external customer firewall to control the connection.
- An indirect connection from the Hardware Management Console to the Internet using a proxy server. This method has the advantages of the direct connection plus it allows your enterprise the added control of the proxy. Potential additional advantages include the possibilities of logging and audit facilities using the proxy server.

The following information is designed to provide your networking team with the information they need to enable the Hardware Management Console to connect securely to the Internet.

Security characteristics of Remote Support Facility communications include:

- Remote Support Facility (RSF) requests are always initiated from the HMC to IBM. No inbound connections are ever initiated from support system.
- All data is transferred using encrypted sockets.
- When the HMC initiates a connection to Remote Support Facility (RSF), it validates the trusted host by its digital signature issued for the support system.
- Data sent to IBM consists solely of hardware problem information and configuration data. No application or customer data is transmitted.

Using the internet for remote support

The HMC can be enabled to connect directly to the Internet or to connect indirectly, through a proxy server that you provide. The decision to use either a direct or indirect Internet connection for remote support depends on the security and networking requirements of your enterprise.

Hardware Management Console Direct Internet Connection

If your Hardware Management Console can be connected to the Internet, and the external firewall can be set to allow established TCP packets to flow outbound to the IP addresses described in "Server address lists and host names," you can use a direct connection between the HMC and the Internet. The use of Source Network Address Translation (SNAT) and masquerading rules to mask the HMC's source IP address are both acceptable.

Hardware Management Console Indirect Connection with Proxy Server

For the Hardware Management Console to communicate successfully, your proxy server must allow connections to port 443.

When using an indirect connection, you can choose whether the proxy is to be directed to connect to the support system using an IP address or using a host name. You can control the set of targets for that proxy using either a host name or IP address, depending upon the security policies of your installation. See "Server address lists and host names" for the list of host names and IP addresses.

If your installation requires host name addressing, your proxy must be configured with a Domain Name Server.

Server address lists and host names

The internet-facing HMC or SSL Proxy requires outbound TCP/IP connections to be allowed to port 443 using the IP addresses that correspond the internet protocol used.

Note: If the HMC 2.14.0 is managing older machines (z13, z13s, z12 EC, z12 BC, etc.), it will connect to the legacy IP addresses or legacy proxy name. If the HMC 2.14.0 is managing a 3906 or 3907, it will connect to the non-legacy IP addresses or non-legacy proxy name.

IPv4 addresses (LMC 2.12.1 and later)

Internet connectivity using IPv4 requires outbound connectivity to the following IP addresses:

- 129.42.54.189
- 129.42.56.189
- 129.42.60.189
- 129.42.26.224 (traditional - legacy support)
- 129.42.42.224 (traditional - legacy support)
- 129.42.50.244 (traditional - legacy support)

IPv6 addresses (LMC 2.12.1 and later)

Internet Protocol version 6 (IPv6) vastly extends the range of available IP addresses. Although IPv6 is not required for remote support facility connection, IBM now offers the capability to migrate to IPv6.

The customer requires that the alternate HMC and the primary HMC are not to be connected to the same switch, then the alternate HMC and the primary HMC must be defined on the same subnet and IPV6 multicast must flow both ways between the two HMCs.

Internet connectivity using IPv6 requires outbound connectivity to the following IP addresses:

- 2620:0:6c0:200:129.42.54.189
- 2620:0:6c0:200:129.42.56.189
- 2620:0:6c2:200:129.42.60.189
- 2620:0:6c0:1::1000 (traditional - legacy support)

- 2620:0:6c2:1::1000 (traditional - legacy support)
- 2620:0:6c4:1::1000 (traditional - legacy support)

Host names

If a proxy is used to connect to the Internet and your installation requires host names to be used for connections, your proxy must accept connections to the following host names:

- esupport.ibm.com
- www-945.ibm.com (traditional - legacy support)

Chapter 8. I/O cabling and connectivity

This chapter includes the following:

- A description of the top exit cabling and bottom exit cabling features.
- A description of the IBM Site and Facilities Services.
- A list of customer fiber optic cabling responsibilities if the services are not elected.
- A description of the 3907 channel feature connections.
- A description of the Fiber Quick Connect fiber harness feature for FICON cables.

I/O cabling

You can route I/O cables:

- Through the top of the frame using the top exit cabling (FC 7917) with FQC (Fiber Quick Connect)
- Through the top of the frame using the top exit cabling (FC 7917) without FQC (Fiber Quick Connect)
- Directly through the top of the frame
- Through the bottom of the frame using the bottom exit cabling feature (FC 7919) with FQC (Fiber Quick Connect)
- Through the bottom of the frame using the bottom exit cabling feature (FC 7919) without FQC (Fiber Quick Connect)
- Through the bottom of the frame or to the top of the frame using the spine cable management hardware if the 3907 contains more than two PCIe+ I/O drawers or if you are installing the 16U Reserved feature (FC 0617).

See Appendix C, “Top exit cabling and bottom exit cabling specifications,” on page 137 for information on the top exit cabling feature (FC 7917) and the bottom exit cabling feature (FC 7919).

IBM Site and Facilities

IBM Site and Facilities has a comprehensive set of scalable solutions to address cabling requirements, from product-level to enterprise-level for small, medium, and large enterprises. These services fall into two major categories:

- IBM Facilities Cabling Services - fiber transport system
- IBM IT Facilities Assessment, Design, and Construction Services - optimized airflow assessment for cabling.

Planning and installation services for individual fiber optic cable connections are available. An assessment and planning for IBM Fiber Transport System (FTS) trunking components can also be performed.

These services are designed to be right-sized for your products or the end-to-end enterprise, and to take into consideration the requirements for all of the protocols and media types supported on z14 (Model ZR1), Rockhopper II, z14 (models M01, M02, M03, M04, M05), Emperor II, z13s, Rockhopper, z13®, Emperor, zBC12, zEC12, z114, z196, z10 BC, z10 EC, z9 BC, z9 EC, z890, and z990 machines (for example, FICON, Coupling Links, OSA-Express) whether the focus is the data center, the Storage Area Network (SAN), the Local Area Network (LAN), or the end-to-end enterprise.

IBM Site and Facilities are designed to deliver convenient, packaged services to help reduce the complexity of planning, ordering, and installing fiber optic cables. The appropriate fiber cabling is selected based upon the product requirements and the installed fiber plant.

The services are packaged as follows:

- Under IBM Facilities Cabling Services, there is the option to provide IBM Fiber Transport System (FTS) trunking commodities (fiber optic trunk cables, fiber harnesses, panel-mount boxes) for connecting to other z14 (Model LR1), Rockhopper II, z14 (models M01, M02, M03, M04, M05), Emperor II, z13s, Rockhopper, z13, Emperor, zBC12, zEC12, z114, z196, z10 BC, z10 EC, z9 BC, z9 EC, z890, and z990 machines. IBM can reduce the cable clutter and cable bulk under the floor. An analysis of the channel configuration and any existing fiber optic cabling is performed to determine the required FTS trunking commodities. IBM can can also help organize the entire enterprise. This option includes enterprise planning, new cables, fiber optic trunking commodities, installation, and documentation.
- Under IBM IT Facilities Assessment, Design, and Construction Services there is the Optimized Airflow Assessment for Cabling option to provide you with a comprehensive review of your existing data center cabling infrastructure. This service provides an expert analysis of the overall cabling design required to help improve data center airflow for optimized cooling, and to facilitate operational efficiency through simplified change management.

Refer to the **Services** section of Resource Link at *http://www.ibm.com/servers/resourcelink* for further details.

Customer fiber optic cabling responsibilities

If you choose to plan and install your own I/O cabling, these are the specific tasks you must complete.

1. All cable planning and support
2. All purchasing of correct qualified cables
3. All installation of any required fiber optic or OSA-Express copper cables
4. All routing of cables to correct back floor cutouts for proper installation to the machine
5. All labeling of cables with PCHID numbers for proper installation to the machine.

Failure to accomplish these cabling tasks properly could lead to additional service charges during the machine installation in order to correct any problems incurred.

All jumper cables, cable components, and connector options are available through IBM Global Services. Contact your IBM installation planning representative, IBM product specialist, or IBM Connectivity Services specialist for details.

Note: Customer cabling preparation does not include plugging cables into the 3907.

CAUTION: Servicing of this product or unit is to be performed by trained service personnel only. (C032)

FICON channel feature

The FCP Express32S feature delivers up to 32 Gbps link data rate to servers, switches, control units and storage devices. The FICON Express 16S+ and FICON Express16S features deliver up to 16 Gbps link data rate to servers, switches, control units and storage devices. The FICON Express8S feature delivers up to 8 Gbps link data rate to servers, switches, control units and storage devices. FICON channels offer fast, efficient data transfer while allowing reuse of currently installed single mode and multimode fiber optic cables.

Configuration information

Table 29 lists the FICON features. These features support two modes of operation:

- FC - native FICON
- FCP - Fibre Channel Protocol - attachment to SCSI disks in Linux on z Systems® and z/VM® environments.

Table 29. FICON feature codes

Feature code	Description	Fiber type
FC 0438 (PCIe) (2 ports)	FCP Express32S LX (Long Wavelength)	single mode 9 micron (unrepeated distance - 10 KM / 6.2 MI)
FC 0439 (PCIe) (2 ports)	FCP Express32S SX (Short Wavelength)	multimode 50 and 62.5 micron (variable - maximum 860 m / 2822 ft))
FC 0427 (PCIe) (2 ports)	FICON Express16S+ LX (Long Wavelength)	single mode 9 micron (unrepeated distance - 10 KM / 6.2 MI)
FC 0428 (PCIe) (2 ports)	FICON Express16S+ SX (Short Wavelength)	multimode 50 and 62.5 micron (variable - maximum 860 m / 2822 ft)
FC 0418 (PCIe) [1] (2 ports)	FICON Express16S LX (Long Wavelength)	single mode 9 micron (unrepeated distance - 10 KM / 6.2 MI)
FC 0419 (PCIe) [1] (2 ports)	FICON Express16S SX (Short Wavelength)	multimode 50 and 62.5 micron (variable - maximum 860 m / 2822 ft)
FC 0409 (PCIe) [1] (2 ports)	FICON Express8S LX (Long Wavelength)	single mode 9 micron (unrepeated distance - 10 KM / 6.2 MI)
FC 0410 (PCIe) [1] (2 ports)	FICON Express8S SX (Short Wavelength)	multimode 50 and 62.5 micron (variable - maximum 860 m / 2822 ft)

Notes:

1. FCP Express32S LX and FCP Express32S SX are only available with IBM LinuxONE. If carried forward, function is limited to FCP only.
2. FICON Express8S LX, FICON Express8S SX, FICON Express16S LX, and FICON Express16S SX can only be carried forward. These features are only available with z14 Model ZR1.
3. All FICON Express® feature codes use LC Duplex connectors.
4. Each feature code represents a FICON base adapter with pluggable optic modules.
5. Short wavelength and long wavelength optic modules cannot be mixed on the same FICON base adapter.
6. Short wavelength and long wavelength features (FICON adapters) can coexist in the same PCIe+ I/O drawer.

See “FICON references” on page 94 for information about link distances and light loss budget.

The following illustrations show the FICON features, the ports on the feature, and the type of connector used.

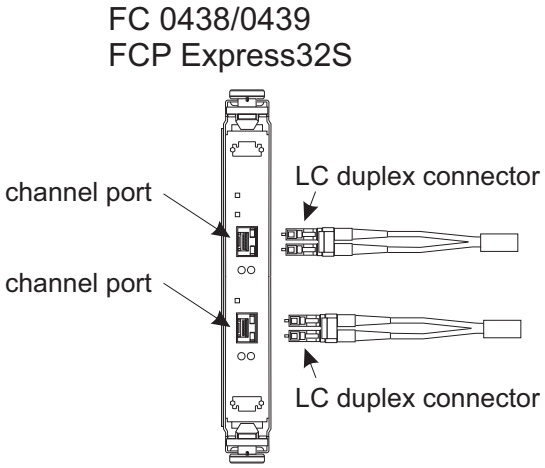


Figure 18. FCP Exress32S feature

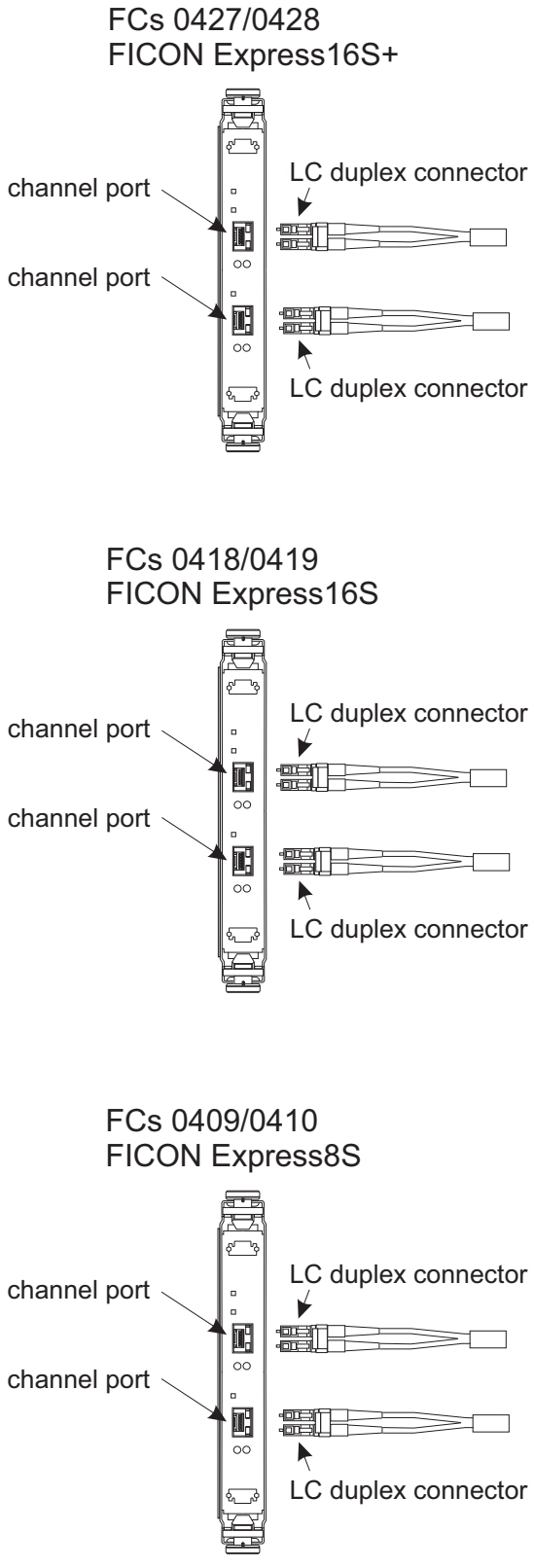


Figure 19. FICON Express features

FICON references

For additional information on planning for FICON channels see:

- *Planning for Fiber Optic Links (FICON/FCP, Coupling Links, Open System Adapters, and zHyperLink Express)*
- *FICON Channel-to-Channel Reference*

OSA-Express features

Open Systems Adapter-Express (OSA-Express) features enable connectivity to industry-standard local area networks (LANs).

Configuration information

Table 30 lists the supported OSA-Express features.

Table 30. OSA-Express feature codes

Feature code	Feature description	Cable description	Connector type
FC 0429 (PCIe) (1 port)	OSA-Express7S 25 GbE SR	50 and 62.5 micron multimode	LC Duplex
FC 0422 (PCIe) (2 ports)	OSA-Express6S GbE LX	9 micron single mode	LC Duplex
FC 0423 (PCIe) (2 ports)	OSA-Express6S GbE SX	50 and 62.5 micron multimode	LC Duplex
FC 0424 (PCIe) (1 port)	OSA-Express6S 10 GbE LR	9 micron single mode	LC Duplex
FC 0425 (PCIe) (1 port)	OSA-Express6S 10 GbE SR	50 and 62.5 micron multimode	LC Duplex
FC 0426 (PCIe) (2 ports)	OSA-Express6S 1000BASE-T	Category 5 UTP copper wire	RJ-45
FC 0413 (PCIe) [1] (2 ports)	OSA-Express5S GbE LX	9 micron single mode	LC Duplex
FC 0414 (PCIe) [1] (2 ports)	OSA-Express5S GbE SX	50 and 62.5 micron multimode	LC Duplex
FC 0415 (PCIe) [1] (1 port)	OSA-Express5S 10 GbE LR	9 micron single mode	LC Duplex
FC 0416 (PCIe) [1] (1 port)	OSA-Express5S 10 GbE SR	50 and 62.5 micron multimode	LC Duplex
FC 0417 (PCIe) [1] (2 ports)	OSA-Express5S 1000BASE-T	Category 5 UTP copper wire	RJ-45
FC 0404 (PCIe) [1] (2 ports)	OSA-Express4S GbE LX	9 micron single mode	LC Duplex
FC 0405 (PCIe) [1] (2 ports)	OSA-Express4S GbE SX	50 and 62.5 micron multimode	LC Duplex
FC 0406 (PCIe) [1] (1 port)	OSA-Express4S 10 GbE LR	9 micron single mode	LC Duplex
FC 0407 (PCIe) [1] (1 port)	OSA-Express4S 10 GbE SR	50 and 62.5 micron multimode	LC Duplex
Notes: 1. This feature can only be carried forward. This feature is only available with z14 Model ZR1.			

Note: When configuring your IBM LinuxONE environment, if IBM Dynamic Partition Manager (DPM) is required, two OSA-Express 1000BASE-T adapters are needed for internal usage by DPM. Additional OSA or RoCE Express features must be ordered for system connectivity to data center networks.

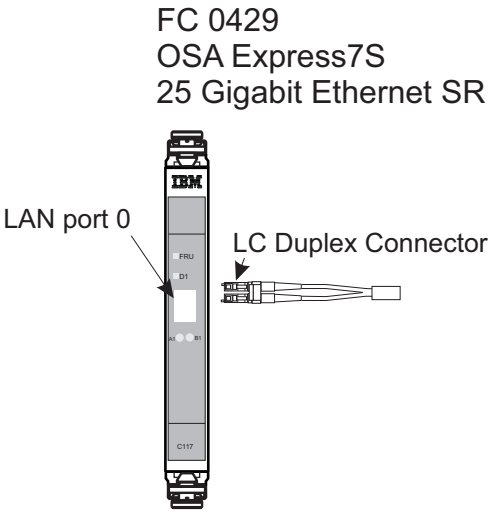


Figure 20. OSA-Express7S 25 GbE feature

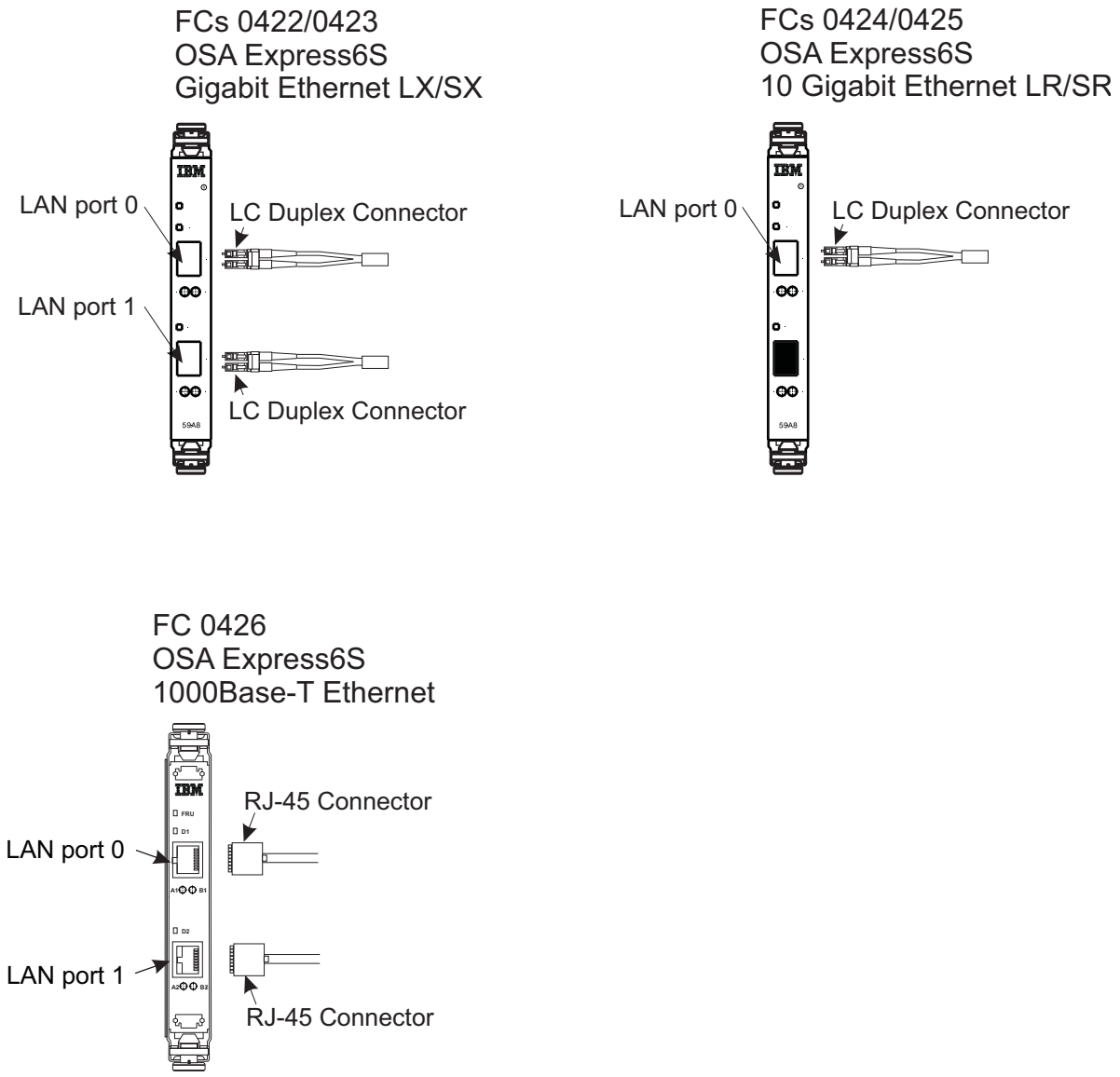


Figure 21. OSA-Express6S features

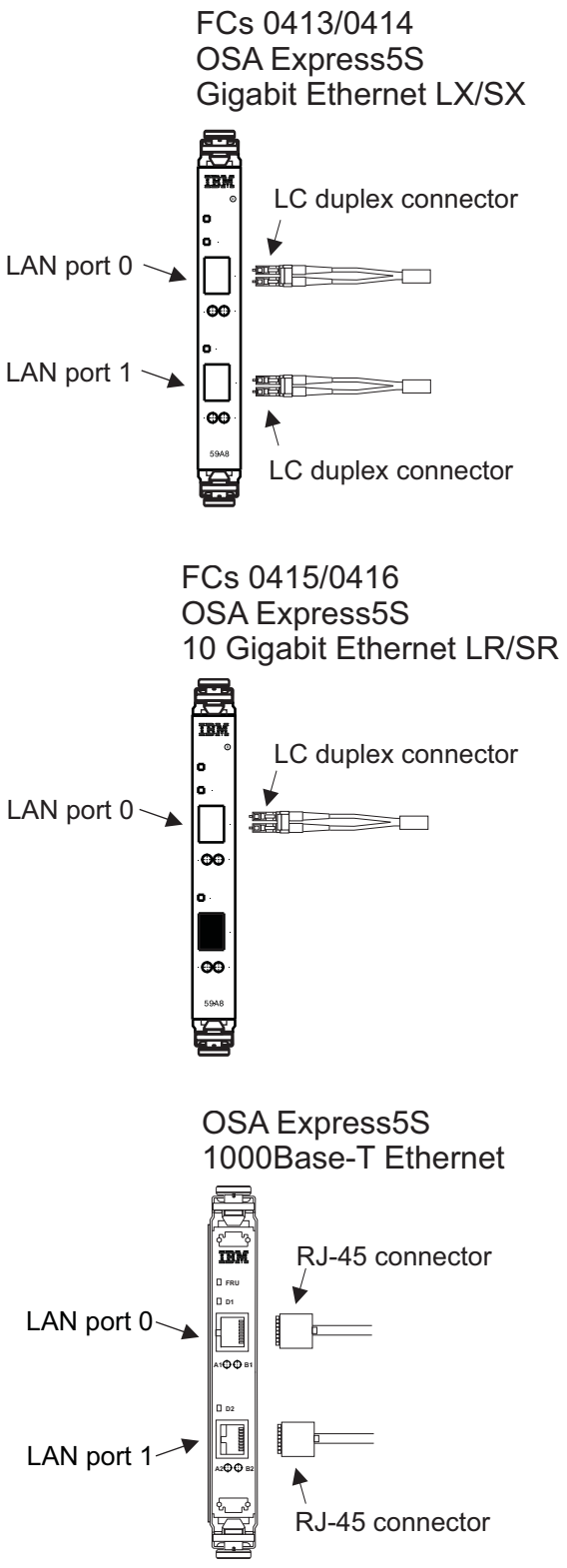


Figure 22. OSA-Express5S features

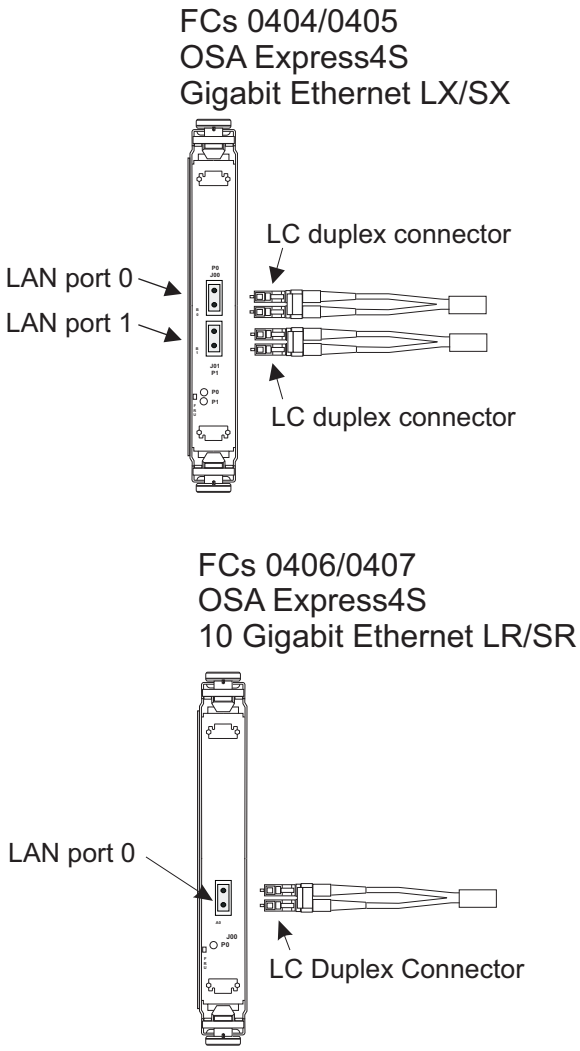


Figure 23. OSA-Express4S features

OSA-Express reference

For additional information on planning for OSA features, see:

- *Open System Adapter-Express Integrated Console Controller Dual Port User's Guide*
- *Open Systems Adapter-Express Customer's Guide and Reference*
- *Planning for Fiber Optic Links (FICON/FCP, Coupling Links, Open System Adapters, and zHyperLink Express)*

I/O interconnect fanout cards

A PCIe Gen3 fanout card (FC 0173) supports one copper PCIe 16 GBps interconnect cable. PCIe Gen3 cables are used to connect the processor drawer to the PCIe+ I/O drawers.

Coupling link fanout cards

The 3907 supports the following coupling features.

Feature code	Description	Maximum # of features	Maximum connections	Order increments per feature	Fiber type	Connector type
FC 0172	ICA SR	8	16 links	2 links	SX laser 50 micron	MTP
FC 0433	Coupling Express LR	16	32 links	2 links	9 micron single mode	LC Duplex

Note:

1. FC 0172 and FC 0433 can be carried forward or can be purchased on a new build. These features are only available with z14 Model ZR1.

Integrated Coupling Adapter (ICA) SR feature (FC 0172)

ICA SR feature (FC 0172) supports PCIe Gen3 for coupling communication between systems, and it resides in the PCIe fanout slot in the CPC drawer. If you are planning to install PCIe Gen3 links, you will have to place connected servers no further than 150 meters (492 feet) from each other.

PCIe Gen3 provides up to a 16.0 GBps* fiber optic connection between z14 (Models M01, M02, M03, M04, M05, ZR1), z13s and z13 machines. A PCIe Gen3 fiber optic cable (150 m - 50 micron multimode OM4; 100 m - 50 micron multimode OM3) connects directly to a port on the ICA SR fanout card. It is recommended that you order ICA SR cabling through Anixter or IBM Global Technology Services® to get IBM qualified cables. For more information, see *Planning for Fiber Optic Links (FICON, Coupling Links, Open System Adapters, and zHyperLink Express)* .

Note: * The link data rates, (for example, 6.0 GBps, 8.0 GBps, and 5 Gbps), do not represent the performance of the links. The actual performance is dependent upon many factors including latency through the adapters, cable lengths, and the type of workload.

You can order ICA SR (FC 0172) in increments of one feature (2 ports), up to a maximum of 8 features (16 ports).

The following cables are all simplex 24-fiber cable assemblies, SX laser 50 micron, using MTP connectors on both ends.

Table 31. ICA SR cable part numbers

Part number	Length meters (feet)	Cable type
00JA687	8.0 m (26.3 ft)	OM4
00LU282	10.0 m (32.9 ft)	OM4
00LU283	13.0 m (42.7 ft)	OM4
00JA688	15.0 m (49.3 ft)	OM4
00JA689	20.0 m (65.7 ft)	OM4
00LU284	40.0 m (131.3 ft)	OM4
00LU285	80.0 m (262.5 ft)	OM4
00LU286	120.0 m (393.8 ft)	OM4
00LU287	150.0 m (492.2 ft)	OM4
00LU288	custom length < 150.0 m (492.2 ft)	OM4
00JJ548	8.0 m (26.3 ft)	OM3
00LU290	10.0 m (32.9 ft)	OM3
00LU291	13.0 m (42.7 ft)	OM3
00JJ549	15.0 m (49.3 ft)	OM3
00JJ550	20.0 m (65.7 ft)	OM3
00LU292	40.0 m (131.3 ft)	OM3
00LU293	80.0 m (262.5 ft)	OM3
00LU294	100.0 m (328.1 ft)	OM3
00LU295	custom length < 100.0 m (328.1 ft)	OM3

Coupling Express LR feature (FC 0433)

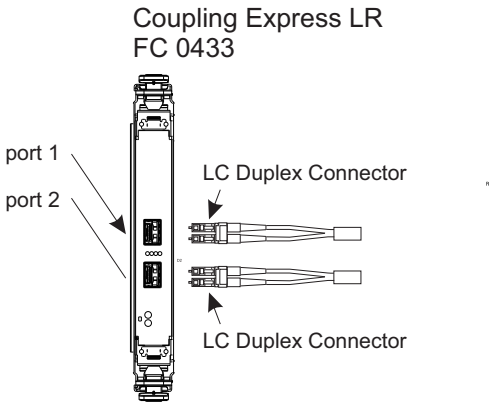
Coupling Express LR feature (FC 0433) supports 10 GbE RoCE for long-distance point-to-point coupling communications between z14 (Model ZR1), z14 (Models M01, M02, M03, M04, M05), z13s and z13 machines. The Coupling Express LR adapter connects to a card slot in a PCI+ I/O drawer (for z14 (Model ZR1)) and a PCIe I/O drawer (for z14 (Models M01, M02, M03, M04, M05), z13s and z13).

Coupling Express LR is a two-port, Ethernet-based coupling card with a data rate of 10.0 GBps* and a maximum unrepeated distance of 10 km and a maximum repeated distance of 100 km with a qualified Dense Wavelength Division Multiplexing (DWDM) device. Coupling Express LR utilizes a 9 micron single mode cable that connects to the Coupling Express LR card using LC Duplex connectors on both ends. Coupling Express LR can only connect to another Coupling Express LR. It is recommended that you order Coupling Express LR cabling through IBM Global Technology Services to get IBM qualified cables. For more information, see *Planning for Fiber Optic Links (FICON/FCP, Coupling Links, Open System Adapters, and zHyperLink Express)*.

Note: * The link data rates, (for example, 6.0 GBps, 8.0 GBps, 5 Gbps, and 10 Gbps), do not represent the performance of the links. The actual performance is dependent upon many factors including latency through the adapters, cable lengths, and the type of workload.

You can order Coupling Express LR in increments of one feature (2 ports), up to a maximum of 16 features (32 ports). Coupling Express LR supports up to four CHPIDs per port.

Coupling Express LR requires the presence of an IFP processor.



IBM Virtual Flash Memory (FC 0614)

IBM Virtual Flash Memory (FC 0614) is designed to help improve application availability and to handle paging workload spikes.

Ordering IBM Virtual Flash Memory (FC 0614) may cause memory DIMMS to be installed when the machine is configured. Each feature provides 512 GB of memory. You can order up to four features.

Note: There is a possibility that ordering IBM Virtual Flash Memory may reduce the maximum orderable customer memory for a given model.

Native PCIe adapters

The following features utilize industry standard PCIe adapters (called native PCIe adapters). They physically plug into a mother card that provides Vital Product Data (VPD) and hot-plug capability. The features then plug into the PCIe+ I/O drawer.

Table 32. Native PCIe adapter feature codes

Feature code	Description
FC 0430	25 GbE RoCE Express2
FC 0411	10 GbE RoCE Express
FC 0412	10 GbE RoCE Express2
FC 0420	IBM zEDC Express
FC 0431	IBM zHyperlink Express
FC 0435	IBM Adapter for NVMe

These native cards do not have CHPID assignments. They have Virtual Functions (VFs) that are defined in IOCP/HCD. PCHIDs are still applicable with native cards.

IBM RoCE Express and RoCE Express2

RoCE stands for RDMA (Remote Direct Memory Access) over Converged Ethernet. Using any of the following IBM RoCE Express adapters, RDMA technology is available on Ethernet.

- 25 GbE RoCE Express2
- 10 GbE RoCE Express2
- 10 GbE RoCE Express

RDMA technology provides the capability to allow hosts to logically share memory. An IBM RoCE Express adapter, in conjunction with an OSA card, enables shared memory communications between two CPCs using a shared switch, which is customer supplied.

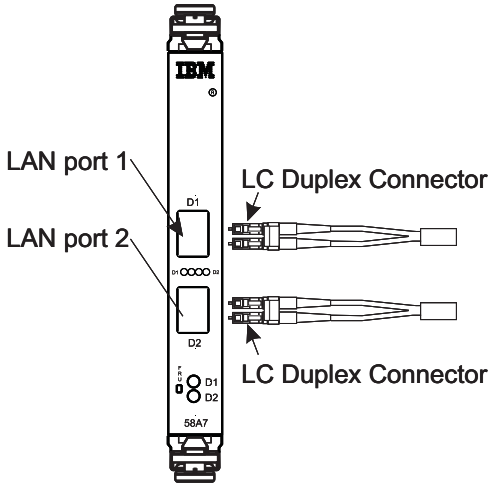
IBM RoCE Express adapters provide the following:

- Reduce network latency with memory-to-memory transfers utilizing Shared Memory Communications - Remote Direct Memory Access (SMC-R) in z/OS V2.1. It is transparent to applications and can be used for LPAR-to-LPAR communication on a single z/OS system or server-to-server communication in a multiple CPC environment.
- Support single root I/O virtualization (SR-IOV). SR-IOV is a standard specification to help promote interoperability. 10 GbE or 25 GbE RoCE Express2 provide increased virtualization allowing RoCE to be extended to more workloads.
- Support Virtual Functions (VFs)
  - 10 GbE RoCE Express supports 31 Virtual Functions (VFs) per PCHID
  - 10 GbE or 25 GbE RoCE Express2 support 127 Virtual Functions (VFs) per physical port for a total of 254 VFs per PCHID

Notes:

- A CHPID number or CHPID type is not required.
- You can order all IBM RoCE Express adapters in increments of two ports, up to a maximum of 8 ports (4 features). There are two ports per feature.
- IBM RoCE Express adapters require the presence of an IFP processor.
- IBM RoCE Express adapters use existing Ethernet fabric (switches with Global Pause enabled), and requires a standard 10 GbE or 25 GbE switch depending on the speed specified (CEE enabled switch is not required).
- 25 GbE RoCE Express2 requires the connection endpoint to also be 25 GbE RoCE Express2.

FC 0430
25 Gigabit Ethernet RoCE Express2



FC 0411
10 Gigabit Ethernet RoCE Express
and
FC 0412
10 Gigabit Ethernet RoCE Express2

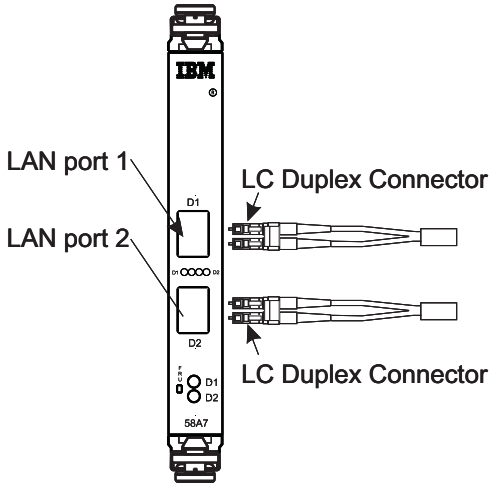


Figure 24. RoCE Express and RoCE Express2 features

IBM zEnterprise Data Compression (zEDC) Express (FC 0420)

The zEDC Express feature and the zEnterprise Data Compression (zEDC) acceleration capability in z/OS are designed to help improve cross-platform data exchange, reduce CPU consumption, and save disk space. zEDC Express is designed to allow higher write rates for SMF data when hardware compression is enabled. zEDC Express can be shared by up to 15 LPARs.

There is one port per adapter. You can order zEDC Express by ports, in increments of one port, up to a maximum of eight ports. Pairing is not required, but highly suggested for reliability and availability purposes.

zEDC Express requires the presence of an IFP processor. The zEDC Express card requires a customer supplied cable.

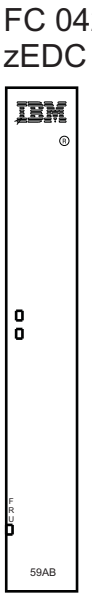


Figure 25. zEDC Express feature

IBM zHyperLink Express (FC 0431)

The zHyperLink Express feature provides the following:

- Improves I/O latency for IBM Z access to disk storage
- Increases scalability of IBM Z transaction processing
- Avoids client re-engineering of applications and middleware
- Allows consolidation of increased work onto z/OS database products
- Potentially lowers software licensing costs when running on IBM storage

With zHyperLink Express:

- Only native LPAR is supported
- All data transfers must be 16-byte aligned and with the length being a multiple of 16 bytes

zHyperLink Express is a 2-port adapter with a data rate of 8.0 GBps and a maximum unrepeated distance of 150 m. You can order the zHyperLink Express feature in increments of one feature. You can have up to sixteen 2-port adapters (32 ports total). Each port can have up to 127 Virtual Functions, which is 127 FIDs. No physical FIDs.

zHyperLink Express requires a customer-supplied 24x MTP-MTP cable for each port. Two fiber type options are available with specifications supporting different distances for zHyperLink Express:

- OM4 and OM5: 50/125 micrometer multimode fiber optic cable with a fiber bandwidth @ wavelength: 4.7 GHz-km @ 850 nm.
- OM3: 50/125 micrometer multimode fiber optic cable with a fiber bandwidth @ wavelength: 2.0 GHz-km @ 850 nm.

For more information about these specifications, see “Integrated Coupling Adapter (24x PCIe) 50 micron multimode physical layer” in *Planning for Fiber Optic Links, GA23-1408*.

This feature resides in a card slot in the PCIe I/O drawer.

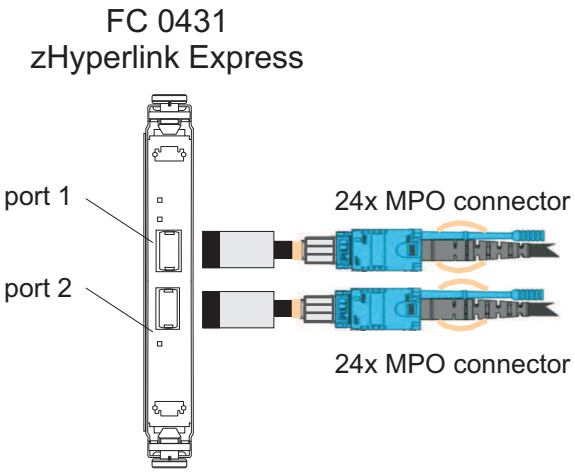


Figure 26. zHyperLink Express feature

IBM Adapter for NVMe (FC 0435)

The IBM Adapter for NVMe (Non-Volatile Memory Express) feature utilizes NVMe to provide IBM LinuxONE Rockhopper II fast access to data stored on Solid State Drives (SSDs). NVM Express® is an open collection of standards and information to fully expose the benefits of non-volatile memory in all types of computing environments from mobile to data center. NVMe™ is designed from the ground up to deliver high bandwidth and low latency storage access for current and future NVMe technologies.

IBM Adapter for NVMe details:

- Only available with IBM LinuxONE Rockhopper II
- A zero port, single PCHID adapter card
- Order in increments of 1 feature, with maximum of 16 features

IBM provides the adapter card into which a vendor NVMe SSD can be plugged. The NVMe SSD is customer supplied and installed into the IBM adapter card by the IBM service representative.

Important:

Once installed, any future servicing of the customer supplied NVMe SSD requires a service contract to be in place. The servicing or replacement of the NVMe SSD by an IBM Service Representative is **not** covered under Warranty or Maintenance Agreement.

Attention: The selection and purchase of the SSDs in this feature is the responsibility of the client. The *IBM LinuxONE NVMe white paper (70019570-USEN-00)* (https://www.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=70019570USEN&) lists the performance of SSDs that IBM has tested for LinuxONE. IBM can only comment on the reliability and performance of SSDs that have been tested. The client assumes all risk in, and IBM is not responsible for, the use of SSDs as the functionality or performance may vary.

Notes

- Hot plug or removal is **not** supported. Use IBM Service support when installing or removing SSDs.
- The NVMe SSD must meet the following optional specification items:
  - Support 64 bit PCIe addressing
  - Support Host Controlled Thermal Management
  - Support Thermal Throttling
  - Support single port PCIe x4 only
- Linux on Z:
  - Ubuntu 18.04 LTS with service
  - IBM is working with its Linux distribution partners to include support in future distributions releases
- Specifications:
  - NVM Express 1.2b
  - PCI Express Base Specification Rev 3.1
  - Enterprise SSD Form Factor Version 1.0a (Single Port Only)
  - PCI Express Card Electro-Mechanical Spec. Rev 3.0
- Form Factor:
  - U.2 2.5" (15 mm) Form factor U.2-compatiable connector (formerly SFF-8639)
  - 25W max power consumption

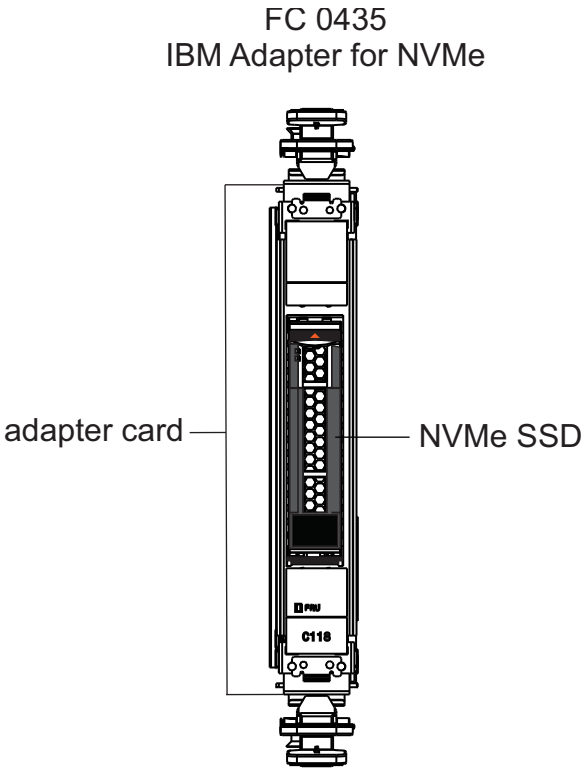


Figure 27. IBM Adapter for NVMe feature

The IBM Adapter for NVMe feature resides in the PCIe+ and PCIe I/O drawer.

Regional Crypto Enablement (RCE) Vendor 1

If Regional Crypto Enablement (RCE) Vendor 1 (FC 0901) was ordered, airflow plates will be installed in the slots in the PCIe+ I/O drawer designated for the RCE Vendor 1 cards. Before the representative installs any RCE Vendor 1 cards, the following conditions must be satisfied:

- The customer must provide the RCE Vendor 1 cards from a reliable vendor. IBM does not supply these RCE Vendor 1 cards.
- The customer must have a Linux LPAR partition established prior to the installation of the RCE Vendor 1 cards.
- The system must be in Service Code 33 prior to adding the RCE Vendor 1 cards.
- The plug location of each RCE Vendor 1 card must be identified. They will be located in the CHPID report that the customer uses. You can obtain this information directly from the customer or obtain the report from *http://www.ibm.com/servers/resourcelink* (Tools --> CHPID Mapping Tool).

Note: Installation of RCE Vendor 1 (FC 0901) is not covered under the machine installation. It requires a local service contract for the representative to recover time and material expenses.

You can order RCE Vendor 1 in increments of one feature, up to a maximum of 8 features.

Time synchronization

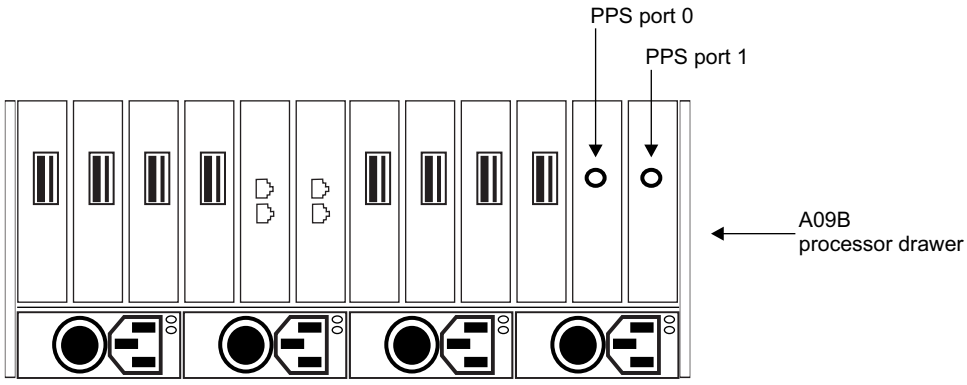
Synchronized time is possible with a 3907 in a Sysplex environment using Server Time Protocol (STP). STP supports Coordinated Timing Networks (CTNs) where the 3907 machines in the network are configured to be in STP timing mode.

Server time protocol

Server Time Protocol (FC 1021) requires no special cables to create timing links with other servers. You can use PCIe Gen3 (ICA SR feature (FC 0172) fiber optic cables or Coupling Express LR (FC 0433) Ethernet cables to create the Sysplex. z14 (Model ZR1) can participate in a timing network with z14 (Model ZR1), Rockhopper II, z14 (Models M01, M02, M03, M04, M05), Emperor II, z13, Emperor, z13s, and Rockhopper.

Pulse per second

An STP CTN has the capability of configuring as its time source a Network Time Protocol (NTP) time server that has a pulse per second (PPS) output signal. This type of external time device is available worldwide from several vendors that provide network timing solutions. Typically, the NTP output of the time server is connected to the Support Element LAN because the NTP client runs on the Support Element. The PPS output of the NTP time server is connected to the PPS input coaxial connector provided on the oscillator card on the 3907.



The pulse per second (PPS) port on the oscillator cards requires a signal with the characteristics listed in Table 33. Your network timing solution vendor can assist with the necessary cabling and signal distribution hardware required to meet these characteristics for your specific machine installation.

With a low signal loss PPS distribution, timing solutions can be achieved that exceed 150 feet (45 meters) between the last distribution point and the oscillator card PPS port.

For the input signal received at the oscillator card PPS port, the rise time/fall time of the PPS signal must be shorter as 50 microseconds.

Table 33. PPS signal characteristics

	Unit of measure	Minimum	Typical	Maximum
Voltage Level LOW	volt	0		0,15
Voltage Level HIGH	volt	3,2		5,2
Rise time	microsecond			50
Fall time	microsecond			50
Pulse width	millisecond	50	125	450

Ordering PPS cables

If you are planning to place this server in an STP-only Coordinated Timing Network using NTP with pulse per second as the external time source, you must supply the coaxial cables that connect the 3907 to the NTP server providing the PPS signal.

Fiber Quick Connect for FICON cabling

Fiber Quick Connect harness cabling, harness brackets, and mounting hardware are ordered with the 3907 as feature codes. The feature codes are:

Table 34. Fiber Quck Connect feature codes

Feature codes	Description
7934	FQC bracket and mounting hardware
7935	LC Duplex (6.6 ft.) harness (FICON)

The Fiber Quick Connect feature enables trunk cables to connect to FICON channels using under-the-cover attachment harnesses. These harnesses are installed when your system is built, and your 3907 arrives ready to connect the trunk cables at your site.

Figure 28 shows the Fiber Quick Connect feature hardware.

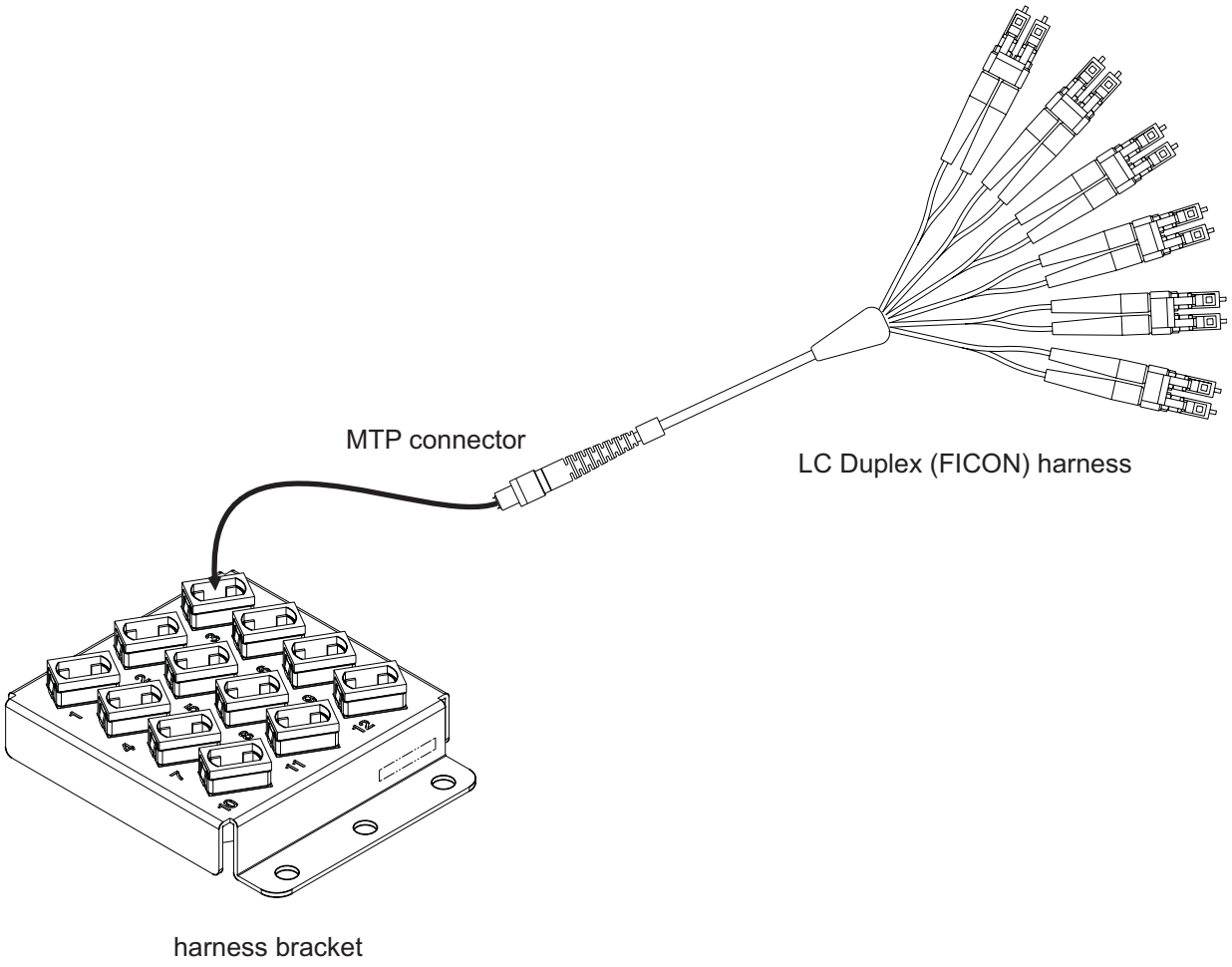


Figure 28. Fiber Quick Connect feature hardware

The harness brackets use an MTP connector, and the FICON connectors are routed to the feature cards the frame.

Figure 29 provides the FQC brackets plugging locations along the tailgate. Figure 30 provides the FQC brackets plugging locations on the top exit feature.

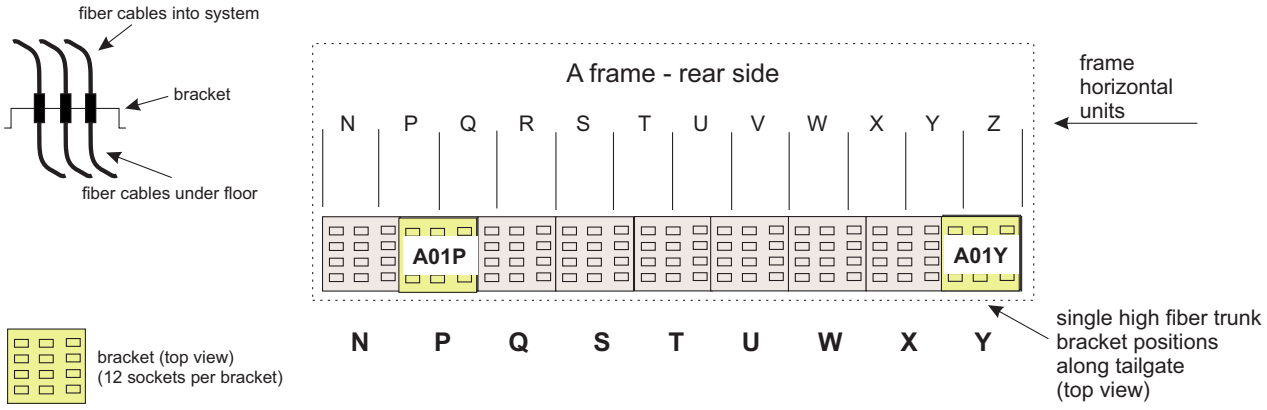


Figure 29. Fiber Quick Connect mounting brackets - bottom exit

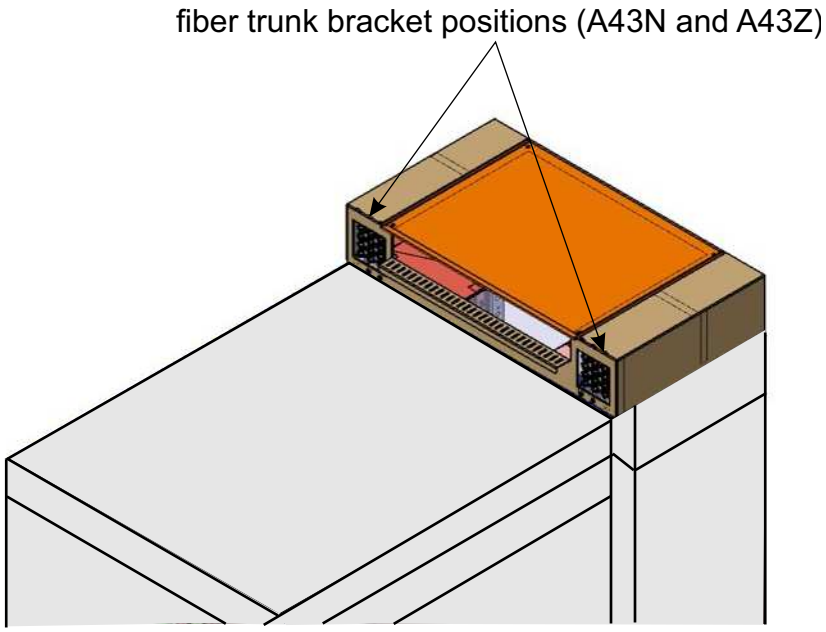


Figure 30. Fiber Quick Connect mounting brackets - top exit

If you are planning to use the Fiber Quick Connect feature for FICON channels, contact IBM Networking Services for assistance. Networking Services will help you plan for the trunking cabling solution that meets your individual system requirements. Your installation planning representative, product specialist, or service representative will provide you with the information necessary to contact Networking Services.

Preparing configuration definition

The customer is responsible for preparing a definition of the I/O configuration for the new processor. You should use the PCHID report from the order process configurator as a guide for planning and defining the new configuration. Depending on the current operating environment there may be several methods for accomplishing this.

z/VM

If you use HCM and HCD, develop the configuration using HCM and HCD. Otherwise, develop the IOCP statements necessary to define your configuration and use the level of the ICP IOCP program that supports the new processor to verify the input statements. You do not need to initially assign PCHID values to the channel paths in your configuration. You can use the CHPID Mapping Tool, available from Resource Link at *http://www.ibm.com/servers/resourcelink*, to aid you in assigning PCHIDs to CHPIDs. HCM and HCD users must build an IOCP input data set from a validated work IODF and use this as input to the CHPID Mapping Tool. The CHPID Mapping Tool updates the IOCP input and assigns PCHIDs to the CHPIDs.

Note: An IOCP input file that was created by HCM and HCD without PCHIDs must be migrated back into HCM and HCD after PCHID numbers have been added to the file by the CHPID Mapping Tool. An IOCDS can then be written from a production IODF or IOCP statements can be built for the install diskette.

If you are installing a new processor, transfer the IOCP statements for your configuration to a diskette. If necessary, the IOCP input file can be compressed using a zip-compatible program. When the new system arrives, give the diskette containing the IOCP input statements to the install team.

If you are installing a new processor, instead of using a diskette you can remotely write the IOCDS from an HCD that is running on an installed CPC in the same HMC cluster. Inform the install team that plans are in place to use the "Build and manage S/390® microprocessor IOCDSs" option in HCD to write the IOCDS.

z/VSE®

Develop the IOCP statements necessary to define your configuration and use the level of the ICP IOCP program that supports the new processor to verify the input statements. You do not need to initially assign PCHID values to the channel paths in your configuration. You can use the CHPID Mapping Tool, available from Resource Link at *http://www.ibm.com/servers/resourcelink*, to aid you in assigning PCHIDs to CHPIDs. The CHPID Mapping Tool updates the IOCP input and assigns PCHIDs to the CHPIDs.

If you are installing a new processor, transfer the IOCP statements for your configuration to a diskette. If necessary, the IOCP input file can be compressed using a zip-compatible program. When the new system arrives, give the diskette containing the IOCP input statements to the install team.

z/OS HCD

Develop the configuration using HCD. You do not need to initially assign PCHID values to the channel paths in your configuration. You can use the CHPID Mapping Tool, available from Resource Link at *http://www.ibm.com/servers/resourcelink*, to aid you in assigning PCHIDs to CHPIDs. Build an IOCP input data set from a validated work IODF and use this as input to the CHPID Mapping Tool. The CHPID Mapping Tool updates the IOCP input and assigns PCHIDs to the CHPIDs. Migrate the modified IOCP input file back into HCD after PCHID numbers have been added to the file by the CHPID Mapping Tool. An IOCDS can then be written in preparation for an upgrade using a production IODF.

Note: An IOCP input file that was created by HCD without PCHIDs must be migrated back into HCD after PCHID numbers have been added to the file by the CHPID Mapping Tool. An IOCDS can then be written from a production IODF or IOCP statements can be built for the install diskette.

If you are installing a new processor, build an IOCP input data set for your configuration from a production IODF and transfer the IOCP statements to a diskette. In the unlikely event that the IOCP input file exceeds the capacity of the diskette, the IOCP input file can be compressed using a zip-compatible program. When the new system arrives, give the diskette containing the IOCP input statements to the install team.

If you are installing a new processor, instead of using a diskette you can remotely write the IOCDS from an HCD that is running on an installed CPC in the same HMC cluster. Inform the install team that plans are in place to use the "Build and manage S/390 microprocessor IOCDSs" option in HCD to write the IOCDS.

Dynamic I/O for Standalone Coupling Facility enables dynamic activation of a new or changed IODF on a standalone coupling facility CPC, without requiring a re-IML or power-on reset (POR). This capability requires z14 GA2 firmware support on the coupling facility CPC as well as the CPC where the HCD system is running. If you are planning to use the Dynamic I/O for Standalone Coupling Facility capability on a CPC, you must use HCD to configure your IODF/IOCDS appropriately for that CPC. No IODF/IOCDS updates are required on the CPC where the HCD itself is running. For more information, see *z/OS HCD User's Guide, SC34-2669*.

Chapter 9. Parallel sysplex planning

This chapter is intended to provide guidance to those customers who operate in a Parallel Sysplex environment. A Parallel Sysplex typically involves multiple processors and coupling facilities, shared I/O devices, and a host of interconnection possibilities. Detailed planning for a Parallel Sysplex is essential to meet technical objectives, such as performance and high availability, within the constraints of a specific raised floor configuration. Consider using the Fiber Optic Cabling Service to plan your sysplex environment. A list of tasks the Service can perform is provided under "IBM Site and Facilities" on page 89. Different technologies for servers, links and coupling facilities affect your ability to configure a productive sysplex.

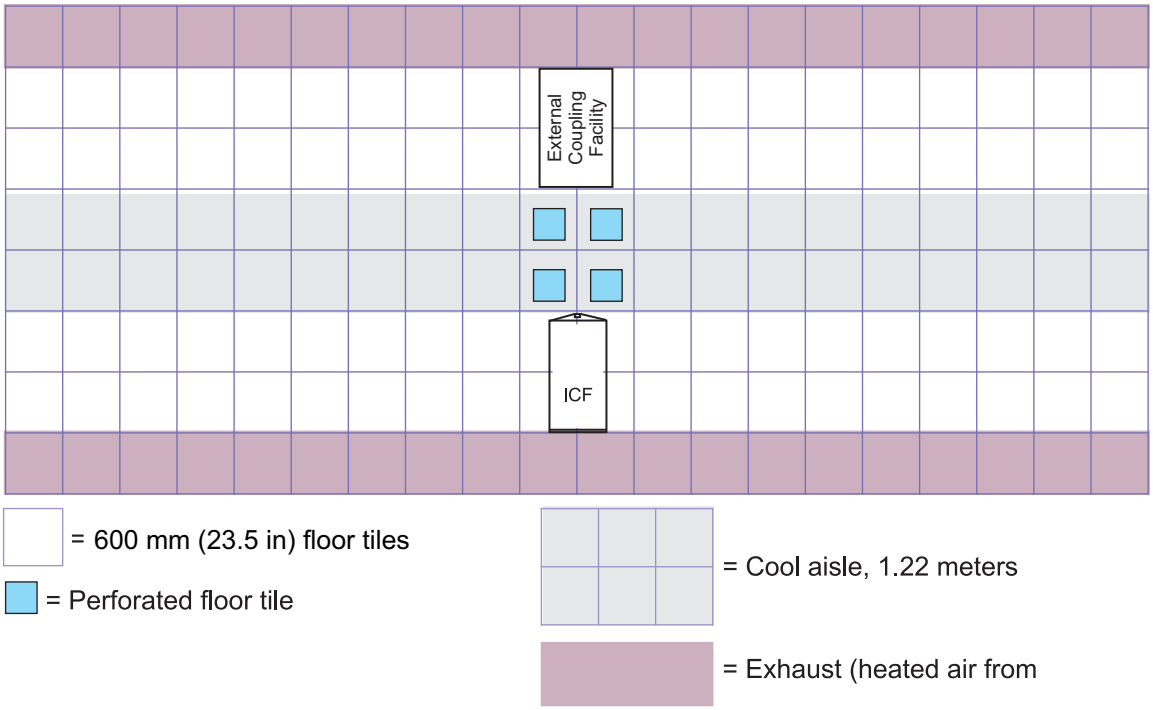
The basic premise for a successful Parallel Sysplex installation is to centralize the physical location of the coupling facilities, and then position the sysplex servers around that center. Servers can be placed side-to-side. In addition to bringing the servers closer to the coupling facility, placing your server side-to-side provides for better management of hot and cold air flow.

Note:

1. z14 ZR1 can only participate in an STP-only timing network.
2. z14 ZR1 can only communicate directly with z14 (Models ZR1, M01, M02, M03, M04, M05), z13, and z13s.

Following are some guidelines to help you better plan for multiple system interconnection. These are example configurations that would minimize the distance to the coupling facility.

1. Position the coupling facilities (or servers with internal coupling facilities) in the center of an open area of raised floor large enough to accommodate all of the servers and other coupling facilities to which you want to connect.

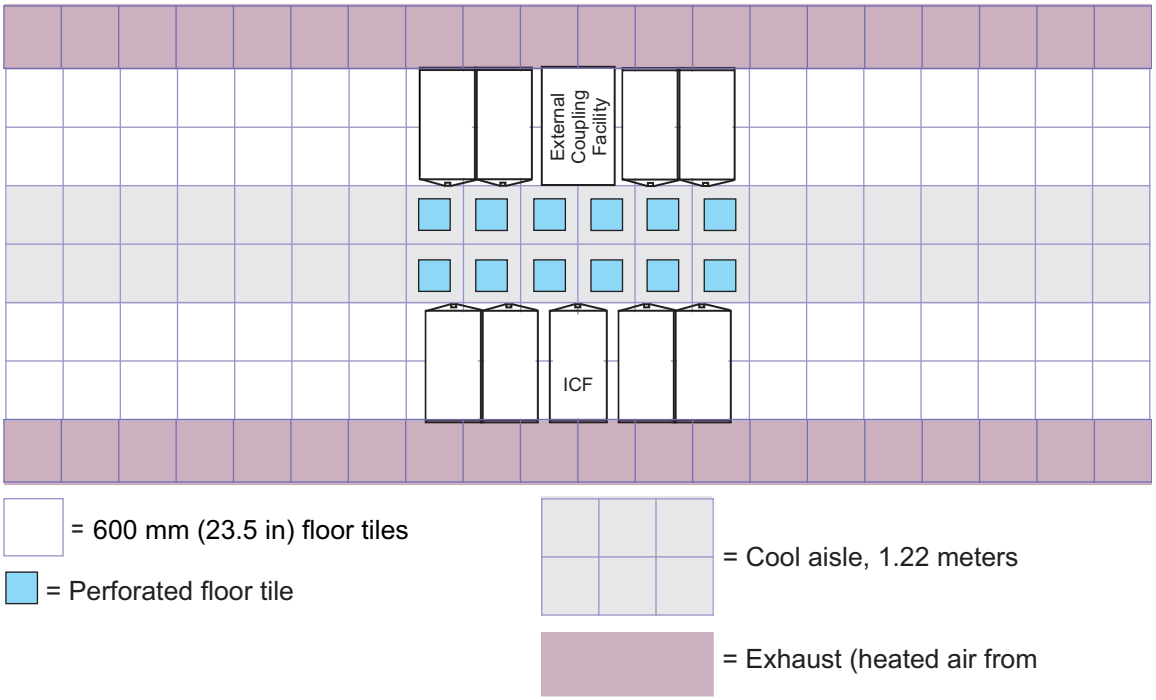


- Use physical planning information for each type of server/coupling facility you intend to add to the Parallel Sysplex to help determine how much floor space you will need.

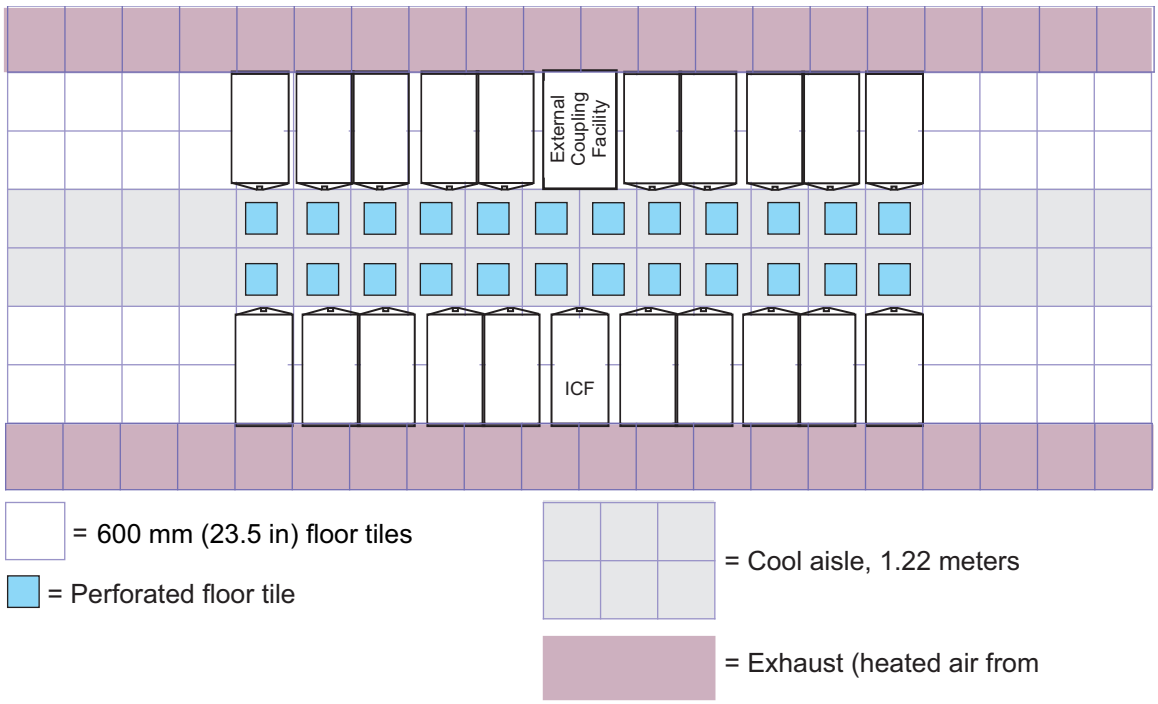
- Remember to consider weight distribution, service clearances, power, and cooling for each piece of equipment you want to include.

2. Arrange the sysplex in two rows, with the fronts of servers and coupling facilities facing each other (see the illustration under "Weight distribution and multiple systems" on page 40). Allow a 1.22 meter (48 inch) aisle width between the rows. Although this may be a larger aisle than you have used before, your Parallel Sysplex will benefit from the improvement in cooling that a wider aisle provides. (See the illustration under "Cooling recommendations for the room" on page 48.)

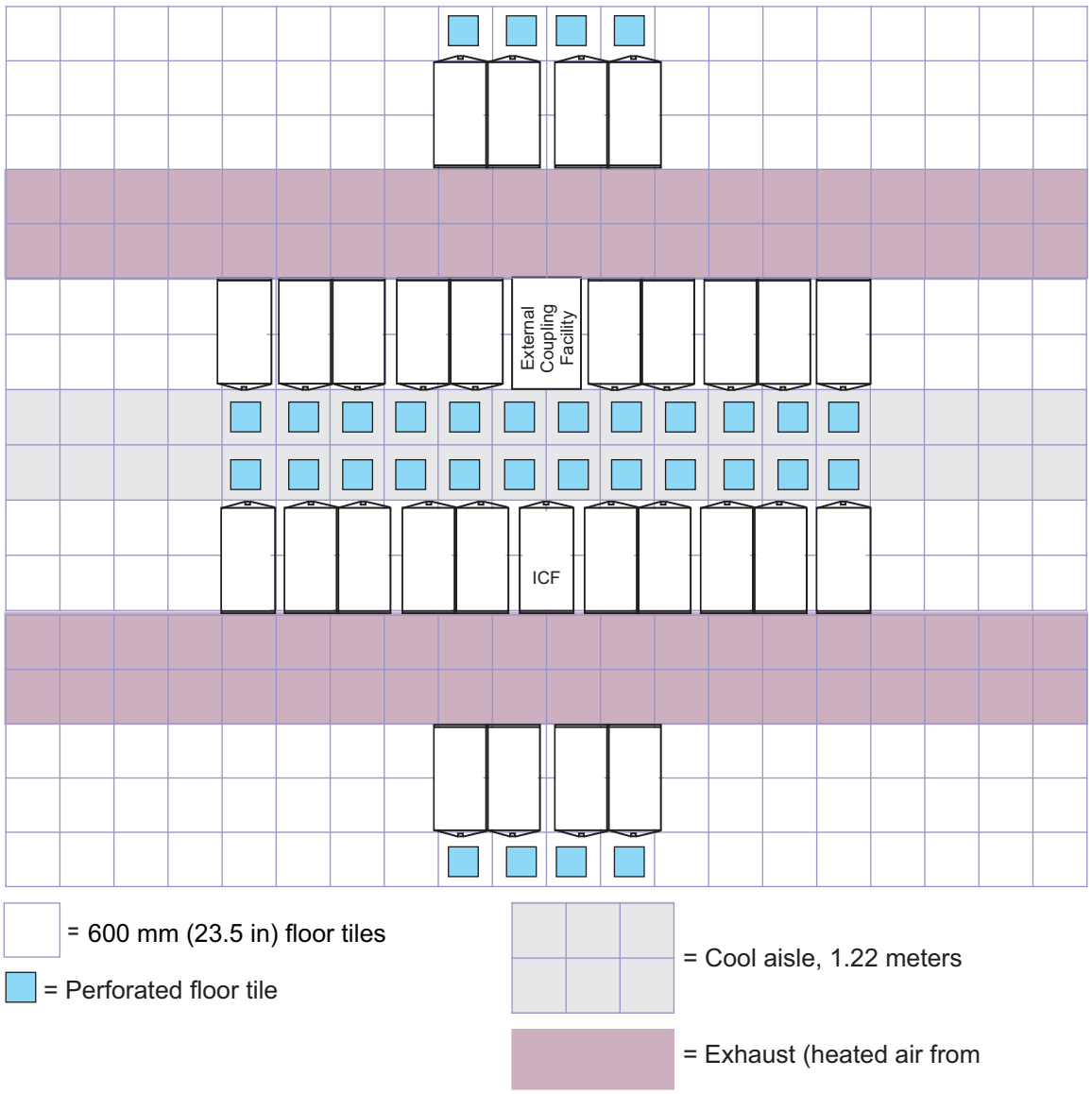
   Note: The system air flow illustration shows a minimum aisle width of 941 mm (37 in). Although this width is adequate for a congested computer room floor, it is the **minimum** you should use. An aisle 1.22 m (48 in) wide will better serve the cooling and cabling needs of a Parallel Sysplex configuration.



3. Sysplex connections can be made using Coupling Express LR or ICA SR cabling.
4. As the Parallel Sysplex grows, add new servers evenly on either side of the central coupling facilities.



5. As the Parallel Sysplex evolves, it is possible to add rows using Coupling Express LR or ICA SR links, which provide connectivity over greater distances than previous links. With the equipment in these new rows centered on the original central coupling facilities, the Parallel Sysplex now assumes the shape of a diamond.



By following these guidelines, you will be able to configure a Parallel Sysplex, using the minimum amount of floor space, that meets your performance and availability objectives. The use of technology combinations - z14 (Model ZR1, M01, M02, M03, M04, M05), z13, and z13s machines and coupling facilities - may complicate your physical planning, but the basic strategies outlined here will result in a successful Parallel Sysplex environment.

Appendix A. IBM standard symbols

In Plan Views:

Cable Entry and Exit Area in the base of the machine. Locating dimensions are measured from the edge of the frame, not the cover. This does not indicate the floor cutout.

Cable Exit Area, recommended

Power Cord exit, 50/60 Hz

Power Cord exit, 400 Hz

Power cords are supplied in 4.2 m (14 ft) lengths unless otherwise noted on the specification page. The length is measured from the symbol ⊕ or ◕.

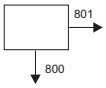
Swinging Gate

Standard equipment outline
(shows the machine with covers closed)

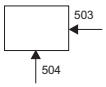
Optional equipment outline

Customer Engineer
Indicator Panel

In Cabling Schematics:



Indicates a cable group coming from a machine



Indicates a cable group going to a machine

Service Area Boundary
(Service clearances are measured from the machine with covers closed)

Casters
Locating dimensions are measured from the edge of the frame, not the cover.

Leveling pads or glides
(90 mm [3 1/2 in] typical diameter)
Locating dimensions are measured from the edge of the frame, not the cover.

Legs

Non-raised floor cable exit

Meter location

Unit Emergency Switch

Hinged Covers

Single

Bifold

Offset Bifold

Appendix B. Hardware Management Console physical specifications

This section contains information for the Hardware Management Console components applicable at the time of publication (determined by the edition notice at the front of this document). Specifications for your Hardware Management Console may differ from those presented below.

Notes for FC 0083 and FC 0096 and FC 0094:

- When planning to use the rack mounted HMC (FC 0083), HMC (FC 0096) or HMC (FC 0094), you must provide the rack where the HMC and console unit (holding the keyboard and display) are installed. It is recommended that you install the rack-mounted HMC below the keyboard/display in the customer-provided rack.
- For USA and Canada, the HMC (FC 0083), HMC (FC 0096), and HMC (FC 0094) uses two PDU plug positions for the two AC power supplies in the server. (Other power requirements are country dependent.)
- Do not block any air vents; usually 15 cm (6 in) of space provides proper airflow.
- Do not leave open spaces above or below an installed server in your rack cabinet. To help prevent damage to server components, always install a blank filler panel to cover the open space and to help ensure proper air circulation.
- Install the server only in a rack cabinet with perforated doors.
- Plan the device installation starting from the bottom of the rack cabinet.
- Install the heaviest device in the bottom of the rack cabinet.
- Do not extend more than one device out of the rack cabinet at the same time.
- Connect the server to a properly grounded outlet.
- Do not overload the power outlet when you install multiple devices in the rack cabinet.
- For FC 0083 and FC 0096, install the server in a rack that has a minimum depth of 28.25 in (720 mm) and maximum depth of 30 in (762 mm).
- For FC 0094, install the server in a rack that meets the following requirements:
  - Minimum depth of 70 mm (2.76 in) between the front mounting flange and inside of the front cover.
  - Minimum depth of 157 mm (6.18 in) between the rear mounting flange and inside of the rear cover.
  - Minimum depth of 718 mm (28.27 in) and maximum depth of 762 mm (30 in) between the front and rear mounting flanges to support the use of the cable management arm.

  The maximum distance between the front and the rear EIA rails of the rack is 810 mm (31.9 in).

Table 35. Hardware Management Console (FC 0083 and FC 0096) specifications

FC 0083 and FC 0096 - Hardware Management Console system unit specifications	
Dimensions	
Height	4.45 cm (1.75 in)
Width	48.26 cm (19 in)
Depth	71.12 cm (28.0 in)
Weight maximum configuration	15.97 kg (35.2 lb)
Power consumption	
Maximum power supply rating	up to 900W
Working level	200W
Input Power[1]	
Low range input voltage	90 Vrms - 137 Vrms
High range input voltage	180 Vrms - 265 Vrms
Input frequency range	47 - 63 Hz
Input kilovolt-amperes (kVA) (approximate)	
Minimum configuration	0.134 kVA
Maximum configuration	0.988 kVA
Environmentals	
Server On	
Temperature	0° to 40° C (32° to 104° F)
Humidity, non-condensing:	
Dew point	-12° C (10.4° F)
Relative humidity	5% - 90%
Storage (non-operating)	
Temperature	-40° to 70° C (-40° to 158° F)
Relative humidity	5% - 100%
1. Power consumption and heat output vary with the number and type of optional features installed and the power-management optional features in use.	

Table 36. Hardware Management Console (FC 0094) specifications

FC 0094 - Hardware Management Console system unit specifications	
Dimensions	
Height	43 mm (1.7 in.)
Width	429 mm (16.9 in.)
Depth	734 mm (28.9 in.)
Weight maximum configuration	16.4 kg (36.16 lbs.)
Input Power[1]	
Low range input voltage	100 VAC - 127 VAC
High range input voltage	200 VAC - 240 VAC
Input frequency range	50 - 60 Hz
Input kilovolt-amperes (kVA) (approximate)	
Minimum configuration	0.14 kVA
Maximum configuration	0.90 kVA
Output Power[1]	
Heat output in British thermal units (Btu) (approximate)	
Minimum configuration	461 Btu/hr (135 watts)
Maximum configuration	2900 Btu/hr (850 watts)
Environmentals	
Server On	
Temperature with altitude: 0 to 950 m (3117 ft)	5° to 40° C (41° to 104° F)
Temperature with altitude: greater than 950 m (3117 ft)	derated 1°C (33.8° F) per 175 m (575 ft)
Temperature at maximum altitude 3050 m (10,007 ft)	5° to 28° C (41° to 82.4° F)
Humidity, non-condensing:	
Dew point	-12° C (10.4° F)
Relative humidity	8% - 85%
Maximum dew point	24° C (75.2° F)
Server Off	
Temperature	5° to 45° C (41° to 113° F)
Relative humidity	8% - 85%
Maximum dew point	27° C (80.6° F)
Storage (non-operating)	
Temperature	1° to 60° C (33.8° to 140° F)
Altitude	3050 m (10,007 ft)
Relative humidity	5% - 80%
Maximum dew point	29° C (84.2° F)
Shipping (non-operating)	
Temperature	-40° to 60° C (-40° to 140° F)
Altitude	10,700 m (35,105 ft)
Relative humidity	5% - 100%
Maximum dew point	29° C (84.2° F)

Table 36. Hardware Management Console (FC 0094) specifications (continued)

FC 0094 - Hardware Management Console system unit specifications
1. Power consumption and heat output vary with the number and type of optional features installed and the power-management optional features in use.

Notes for FC 0082 and FC 0095:

- When installing the chassis, ensure that a minimum free air space is available around the system. The installation should have a minimum of 4 in -6 in (101 mm -152 mm) behind the chassis and 7 in - 8 in(178 mm - 203 mm) in front of the chassis. Any front cabinet doors or access aisles must accommodate a 2461 HMC (FC 0082 and FC 0095) front chassis clearance of at least 7.0 in (178 mm) in order to provide proper clearance for the fan FRU. Ideally, a chassis clearance of 0.5 in -1.5 in (13 mm -38 mm) above the system is desirable.
- The 2461 HMC (FC 0082 and FC 0095) is designed with ruggedness in mind, however, precautions should be observed to ensure safe and reliable performance. Place the chassis on a flat, stable surface capable of supporting both the system weight and any anticipated peripherals. Installation area should be secure and free from danger of liquid or airborne contaminants that could damage internal components as well as supporting all airflow requirements.
- To protect internal components from electrostatic damage, be sure to observe the following precautions when handling or storing the system:
  - The 2461 HMC (FC 0082 and FC 0095) has a net chassis weight of approximately 41.0 lbs. (18.59 kg). Use proper lifting techniques when moving and installing the system.
  - When removing or installing boards and sub-components, keep these components in their static-shielded bag and/or packaging until you are ready to for component installation.
  - Handle the sub-components by their edges.
  - Do not touch any sub-component I/O connector pins. Do not apply pressure or attach labels to the board-level subcomponents.
  - Use a personal grounding system, such as a wrist or heel strap(s) or ground yourself frequently by touching the metal chassis of the system before handling any subcomponents.
  - Ensure the systems external power source has a solid connection to an earth ground.
  - Use antistatic padding on all work surfaces when installing or removing subcomponents.
  - Avoid static-inducing carpeted areas.

Table 37. Hardware Management Console (FC 0082 and FC 0095) specifications

CPU: • 3.2 GHz Intel Xeon E3-1225 v3 **Memory:** • Minimum: 32 GB • Maximum: 32 GB • Type: DDR3, ECC • Slots: 4 • Supports: 32 GB **Optical drive:** • Slim-line DVD drive **Hard drive:** • 1 TB SATA hard drive **Video:** • AST2400 **Fans:** • Two side-removable hot-swap fans **Power supply:** • One AC – Maximum power supply is rated up to 900W – Working level is 200W **Integrated function:** • Six Intel l350 Ethernet ports • One Intel l210 management Ethernet port • Eight USB ports	**Environment:** **Operating:** • Temperature: 0ºC - 40ºC (32ºF - 104ºF) • Altitude: 3050 m (~10,000 ft) • Relative humidity: 5% - 90% @ -12ºC (10.4ºF) dew point, non-condensing **Storage (non-operating):** • Temperature: -40ºC - 70ºC (-40ºF - 158ºF) • Relative humidity: 5% - 100% **Air flow:** • 350LFM continuous airflow **Size:** • Height: 439.2 mm (17.29 in) • Depth: 492.25 mm (19.38 in) • Width: 215.9 mm (8.5 in) • Weight: approximately 18.59 kg (41.0 lb)	**Electrical input:** • Sine-wave input (47-63 Hz) required • Input voltage low range: – Minimum: 90 Vrms – Maximum: 137 Vrms • Input voltage high range: – Minimum: 180 Vrms – Maximum: 265 Vrms • Input kilovolt-amperes (kVA), approximately: – Minimum: 0.134 kVA – Maximum: 0.988 kVA

Notes for FC 0092: When planning the work area for the Hardware Management Console, remember to allow a suitable space for a full-size keyboard, flat panel display, and mouse.

Table 38. Hardware Management Console (FC 0092) specifications

FC 0092 - Hardware Management Console system unit specifications	
Dimensions	
Height	425 mm (16.74 in.)
Width	176 mm (6.93 in.)
Depth	635 mm (25.00 in.)
Weight minimum configuration as shipped	20.0 kg (44.10 lbs.)
Weight maximum configuration	29.7 kg (65.48 lbs.)
Input Power[1]	
Low range input voltage	100 VAC - 127 VAC
High range input voltage	200 VAC - 240 VAC
Input frequency range	50 - 60 Hz
Input kilovolt-amperes (kVA) (approximate)	
Minimum configuration as shipped	0.12 kVA
Maximum configuration	0.90 kVA
Output Power[1]	
Heat output in British thermal units (Btu) (approximate)	
Minimum configuration	392 Btu/hr (115 watts)
Maximum configuration	2900 Btu/hr (850 watts)
Environmentals	
Server On	
Temperature with altitude: 0 to 950 m (3117 ft)	5° to 40° C (41° to 104° F)
Temperature with altitude: greater than 950 m (3117 ft)	derated 1°C (33.8° F) per 175 m (575 ft)
Temperature at maximum altitude 3050 m (10,007 ft)	5° to 28° C (41° to 82.4° F)
Humidity, non-condensing:	
Dew point	-12° C (10.4° F)
Relative humidity	8% - 85%
Maximum dew point	24° C (75.2° F)
Server Off	
Temperature	5° to 45° C (41° to 113° F)
Relative humidity	8% - 85%
Maximum dew point	27° C (80.6° F)
Storage (non-operating)	
Temperature	1° to 60° C (33.8° to 140° F)
Altitude	3050 m (10,007 ft)
Relative humidity	5% - 80%
Maximum dew point	29° C (84.2° F)
Shipping (non-operating)	
Temperature	-40° to 60° C (-40° to 140° F)

Table 38. Hardware Management Console (FC 0092) specifications (continued)

FC 0092 - Hardware Management Console system unit specifications	
Altitude	10,700 m (35,105 ft)
Relative humidity	5% - 100%
Maximum dew point	29° C (84.2° F)

1. Power consumption and heat output vary with the number and type of optional features installed and the power-management optional features in use.

Notes for 1U console unit (keyboard/display unit):

The 1U console units (keyboard/display units) include:

- FC 0148 (for the 2461 HMC tower unit)
- FC 0154 (for the 2461 HMC rack-mounted unit)
- FC 0157 (for the 2461 TKE tower unit)
- FC 0156 (for the 2461 TKE rack-mounted unit)
- 1723-8BX

- The following are recommendations for placement of the keyboard/display unit into the customer supplied rack:
  - If you are standing when using the keyboard/display unit, place the unit in EIU locations 21, 22, or 23.
  - If you are sitting when using the keyboard/display unit, place the unit in EIU locations 12, 13, or 14.
  - For special accommodations, you need to make adjustments in the placement of the keyboard/display unit in the rack that meet your needs.
- For USA and Canada, the keyboard/display unit uses one PDU plug position for the AC power supply in the keyboard/display. (Other power requirements are country dependent.)
- Elevated operating ambient - If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment might be greater than room ambient. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature (Tma) specified by the manufacturer.
- Reduced air flow - Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised.
- Mechanical loading - Mounting of the equipment in the rack should be such that a hazardous condition is not achieved due to uneven mechanical loading.
- Circuit overloading - Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on overcurrent protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.
- Reliable earthing - Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (for example, use of power strips).

Table 39. 1U console unit (display/keyboard unit) specifications (FC 0148 (for the 2461 HMC tower unit), FC 0154 (for the 2461 HMC rack-mounted unit), FC 0157 (for the 2461 TKE tower unit), FC 0156 (for the 2461 TKE rack-mounted unit)

1U console unit (display/keyboard unit) specifications (FC 0148 (for the 2461 HMC tower unit)) (FC 0154 (for the 2461 HMC rack-mounted unit)) (FC 0157 (for the 2461 TKE tower unit)) (FC 0156 (for the 2461 TKE rack-mounted unit))	
Dimensions	
Height	45 mm (1.75 in) (in stored position)
Width	440 mm (17.3 in) (main chassis only, slide-rails not included)
Depth	440 mm (17.3 in) (chassis only, bezel in front not included, cable-management arm not included)
Weight	(11 lb) - Console Unit (25 lb) - Console Option Kit
LCD panel	
Size	17.3 inch diagonal
Display area (horizontal x vertical)	381.99 mm x 214.91 mm
Type	TFT active matrix
Pixel pitch (horizontal x vertical)	0.1989 (H) x 0.1989 (V) mm
Input Power	
Input voltage	AC - 100-240 VAC - 1 A
Input frequency range	50-60 Hz
Power Consumption	
Standard usage	9 watts
Maximum	11 watts
Power supply maximum	36 watts
Power saving	< 1 watt (at 100 VAC and 240 VAC)
Environmentals - Temperature	
Operating	0° to 50° C (32° to 122° F)
Storage	-20° to 60° C (-4° to 140° F)
Environmentals - Humidity	
Operating	20% to 90%
Storage	10% to 90%
Environmentals - Altitude	
Operating	Maximum 3000 meters
Storage	Maximum 3000 meters

Table 40. 1U standard console, type 1723-8BX specifications

1U standard console, type 1723-8BX specifications	
Dimensions	
Height	44 mm (1.75 in) (display in stored position)
Width	434 mm (17 in) (main chassis only, slide-rails not included, faceplate not included)
Depth	434 mm (17 in) (chassis behind EIA mounting flange, bezel in front of EIA flange not included, cable-management arm not included)
Weight	10.4 kg (23 lb)
LCD panel	
Size	18.5-inch diagonal
Display area (horizontal x vertical)	409.8 x 230.4 mm
Type	TFT active matrix
Pixel pitch (horizontal x vertical)	300 x 300 per triad
Input Power	
Input voltage	100 VAC - 240 VAC
Input frequency range	47 - 63 Hz
Power Consumption	
Normal operation	17 watts
Active off	< 1 watt (at 100 VAC and 240 VAC)
Environmentals - Temperature	
Operating	0° to 50° C (32° to 122° F)
Storage	-20° to 60° C (-4° to 140° F)
Environmentals - Humidity	
Operating	10% to 80%
Storage	5% to 95%

Table 41. Flat panel display specifications

Flat panel display specifications			
	L2251x - Flat panel display 558.7 mm (22.0 inch) (FC 6096)	**LT2323p - Flat panel display 584.2 mm (23.0 inch)**	**T2324p - Flat panel display 584.2 mm (23.0 inch)**
Dimensions			
Height	406.0 mm (15.98 in)	403.9 mm (15.90 in)	472.5 mm (18.60 in) [1]
Width	514.4 mm (20.25 in)	547.8 mm (21.57 in)	545.8 mm (21.49 in)
Depth	239.8 mm (9.44 in)	186.0 mm (7.32 in)	264.1 mm (10.39 in)
Weight with stand	6.2 kg (20.5 lbs)	5.74 kg (12.65 lbs)	5.40 kg (11.90 lbs)
Input Power			
Input voltage	100 VAC - 240 VAC (+/- 10%)	100 VAC - 240 VAC (+/- 10%)	100 VAC - 240 VAC (+/- 10%)
Input frequency range	50/60 Hz + or - 3 Hz	50/60 Hz + or - 3 Hz	50/60 Hz + or - 3 Hz
Rated Current	1.5 amps	1.5 amps	1.5 amps
Power Consumption			
Normal operation	< 45 watts	< 20 watts	< 21 watts (typical) < 49 (maximum)
Standby/ Suspend	< 2 watts (analog or digital)	< 0.5 watts (analog or digital)	< 0.5 watts (analog or digital)
Active off	< 1 watt (at 100 VAC and 240 VAC)	< 0.5 watt (at 100 VAC and 240 VAC)	< 0.3 watt (at 100 VAC and 240 VAC)
Environmentals - Temperature			
Operating	10° to 45° C (50° to 113° F)	0° to 40° C (32° to 104° F)	0° to 45° C (32° to 113° F)
Storage	-20° to 60° C (-4° to 140° F)	-20° to 60° C (-4° to 140° F)	-20° to 60° C (-4° to 140° F)
Shipping	-20° to 60° C (-4° to 140° F)	-20° to 60° C (-4° to 140° F)	-20° to 60° C (-4° to 140° F)
Environmentals - Humidity			
Operating	10% to 80%	10% to 80%	10% to 80%
Storage	5% to 90%	5% to 95%	5% to 95%
Shipping	5% to 90%	5% to 95%	5% to 95%

Notes:

1. This measurement is the distance from the tabletop to the top of the panel using the supplied stand.

Appendix C. Top exit cabling and bottom exit cabling specifications

On a raised floor, you can route power cables and I/O cables through the top of the frame **and** through the bottom of the frame. On a non-raised floor, you can route power cables and I/O cables through the top of the frame.

Top exit cabling specifications

For top exit cabling, you can use the top exit cabling feature (FC 7917) or you can route the cables directly through the top of the frame.

Top exit cabling - top exit cabling enclosure (FC 7917):

Cables can exit from the front of the top exit cabling enclosure or the rear of the top exit cabling depending on how you installed the top exit cabling enclosure. The cable retainer bracket (P/N 01PP055) must be attached to the top exit cabling enclosure at the location (front or rear) from which you want the cables to exit. (Figure 31 shows the cables exiting from the front of the top exit cabling enclosure.)

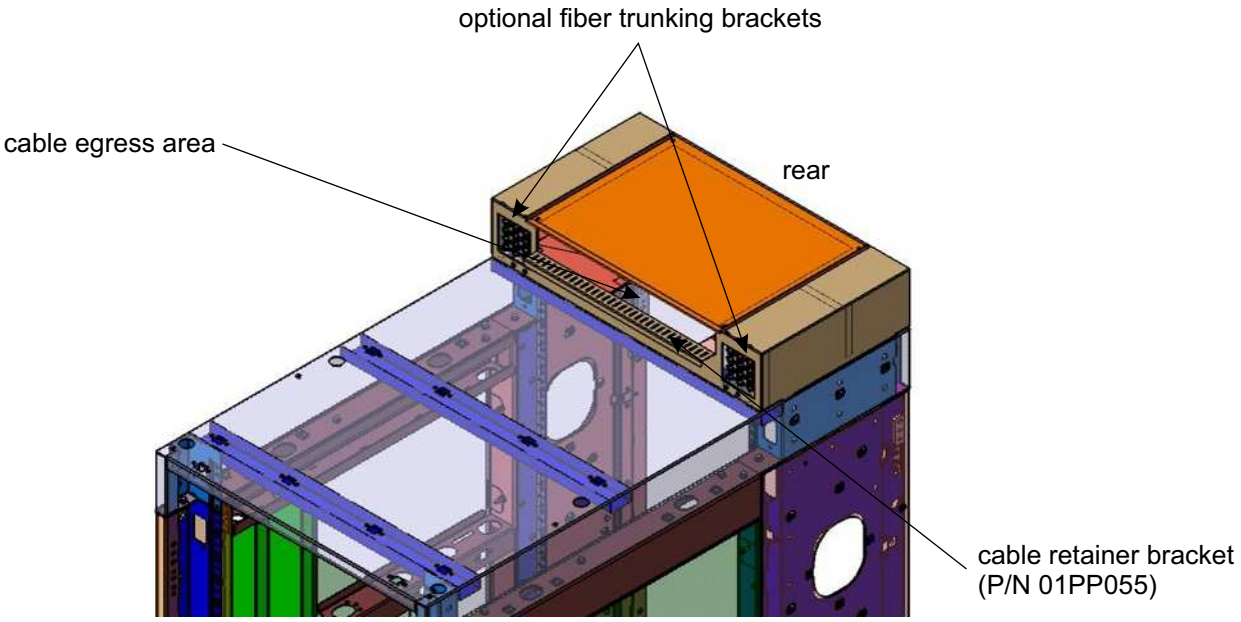
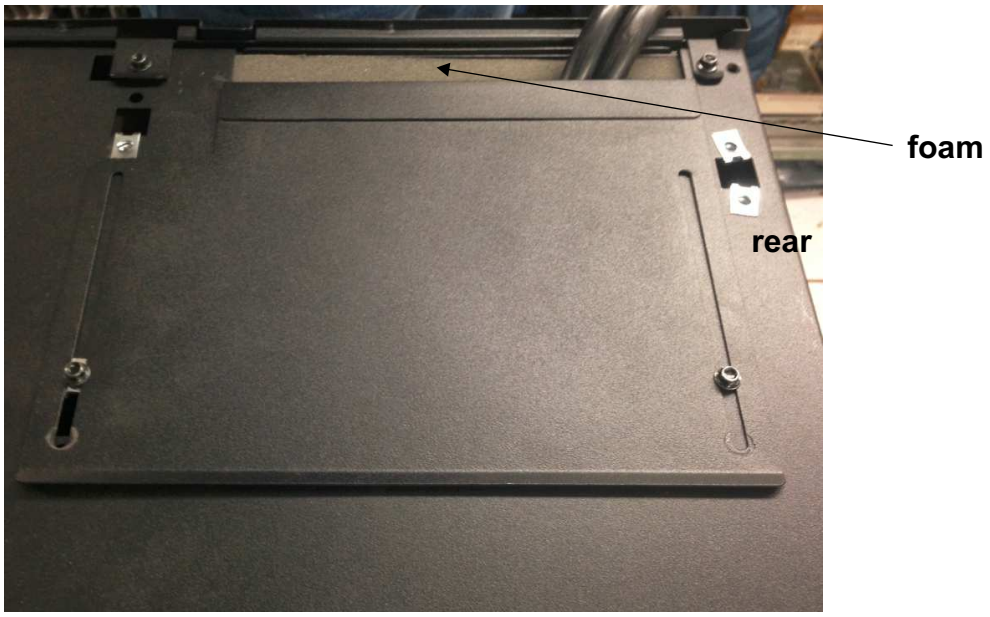


Figure 31. Top exit cabling feature - cables exiting from the front of the top exit cabling enclosure

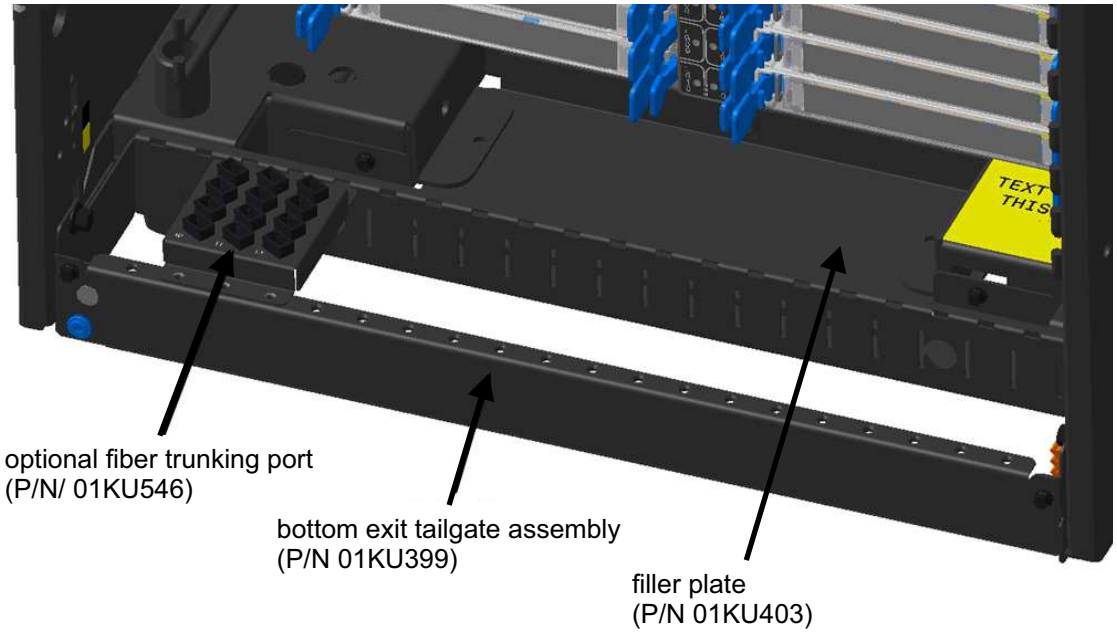
Top exit cabling - route directly through the top of the frame

When routing cables directly through the top of the frame, there are two sliding plates on the top of the frame (one on each side of the rear of the frame) that can be opened partially and any gaps can be eliminated with self-sticking foam.



Bottom exit cabling specifications

For bottom exit cabling, you must use the bottom exit cabling feature (FC 7919).



Appendix D. 16U Reserved feature (FC 0617)

For a customer with two or fewer PCIe+ I/O drawers, the 16U Reserved feature (FC 0617) provides a 16U reserved area in the 3907 machine for customer owned components to be installed. FC 0617 is available as a new build or as an MES.

Note: FC 0617 supports a maximum of two PCIe+ I/O drawers. If you anticipate a future MES that would require a third or fourth PCIe+ I/O drawer, you should not order FC 0617. You cannot add a third or fourth PCIe+ I/O drawer if you ordered FC 0617.

Before customer components are installed, the 3907 must be completely installed (this includes the completion of unpacking, assembly, connecting power, initial power up, and general diagnostic testing for the new 3907). Then the Business Partner or customer can install the customer's components. However, if there is a need to install a 2461 HMC in the 16U reserved area to complete the install, you can install the 2461 HMC in the 16U reserved area. Instructions for installing the 1U HMC are located in the installation manual.

This appendix describes the requirements and restrictions the customer and installer must understand for usage of this feature to help minimize the likelihood of disruption to the 3907. This feature is provided as a convenience on an “as is” basis, and under no circumstance will either the machine warranty, or maintenance services, cover issues caused by components installed in the 16U reserved area. This information in this appendix includes statements regarding power draw, weight limits, location of the components to be added, safety and electrical certifications, cabling, and environmental specifications. It also provides the layout of the IBM Z components within the rack and a self-check list.

The certifications identified on the 3907 itself, in this document or other materials provided by IBM, pertain to the 3907 as delivered by IBM. Components installed by the customer may impact the certifications, and it is the customer's responsibility to determine whether the component, and the 3907 with the component installed, meets the certification requirements in the geography where the machine will be used.

Note: The customer components installed in the 16U reserved area cannot connect to the 3907 Ethernet switches, Support Elements, or KVM switch.

Checklist

Before installing components into the 16U reserved area, you need to gather the following information for each device you want to install into the 16U reserved area. This information is needed to determine the list of devices satisfies the requirements for the 16U reserved area.

- Power input requirements (wattage) for each device to ensure the wattage is below the allowable requirement. (Refer to Power requirements for details.)
- Number of power outlets needed for each device to ensure the total number of power outlets needed is below the available power outlets. (Refer to Power requirements for details.)
- Height and weight of each device to ensure the weight per EIA unit of each device falls within the allowable limit. (Refer to Weight and dimensional requirements for details.)
- Altitude of datacenter to determine the airflow requirement (CMF) for the 3907 configuration. (Refer to “Cooling recommendations for the room” on page 48 for details.)
- Temperature of air supplied to the IT equipment rack (cold aisle) in the datacenter to determine the airflow requirement (CMF) for the 3907 configuration. (Refer to “Cooling recommendations for the room” on page 48 for details.)

Requirements and restrictions

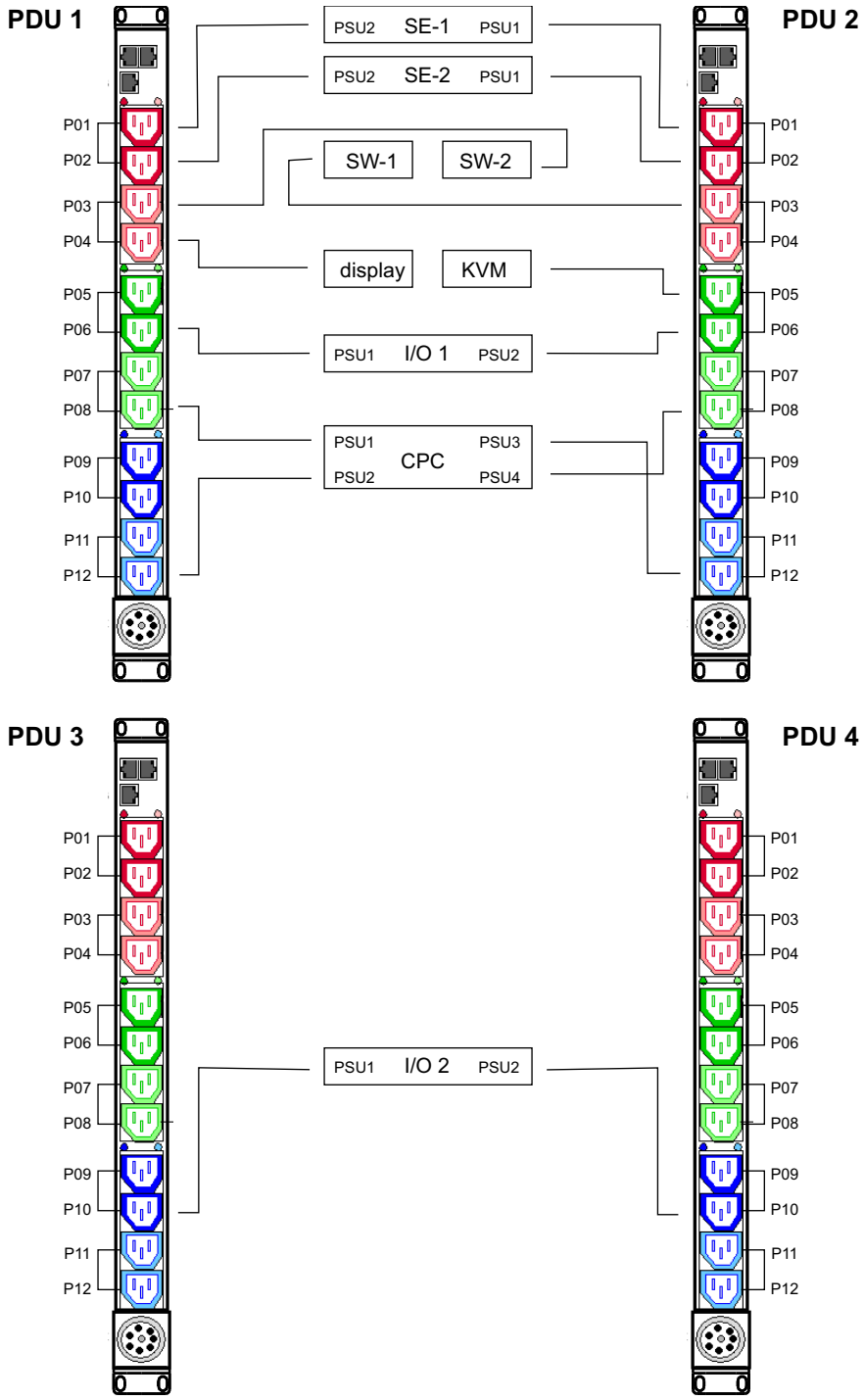
Attention: Only a "qualified installer" can install components into the 16U reserved area. At a minimum, to be a "qualified installer," you must read and fully understand the following information:

__ • **Power requirements**

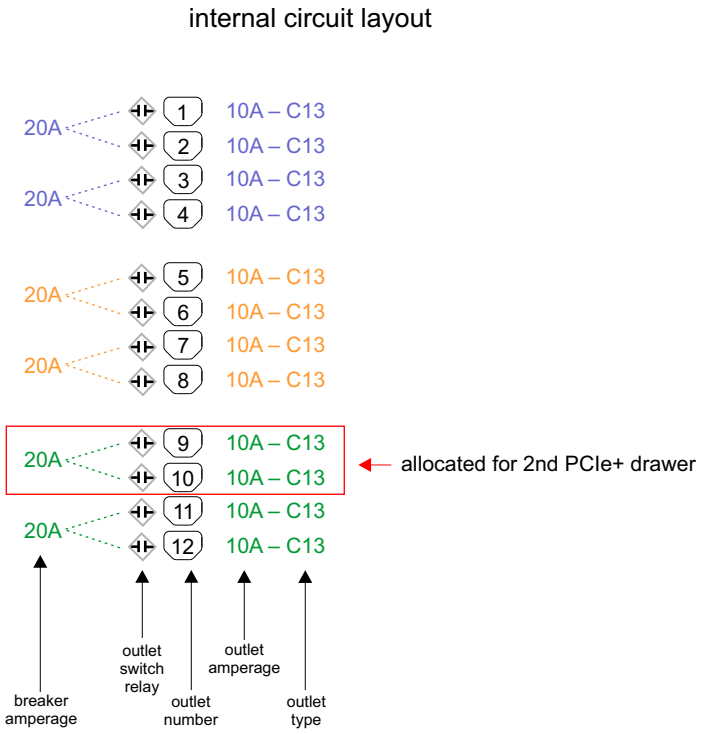
– PDU 1 and PDU 2 are restricted for IBM Z use only. Outlets 9 and 10 in both PDU 3 and PDU 4 are also restricted for IBM Z use.

Note: Power cords plugged into these locations cannot be unplugged or moved. Failure to follow this warning may adversely impact the operation of the z14 ZR1, including a possible system outage.

Non-IBM Z components have access to a total of 20 outlets (10 outlets in PDU 3 and 10 outlets in PDU 4).



– There is a maximum of 10A for any outlet, and a maximum of 16A per pair of outputs.



– The total power capacity available for the non-IBM Z components in the 16U reserved area is 3400W.

  Note: To determine the wattage, you multiply the ampere (or amps) by volts. The ampere (or amps) is the amount of electricity used. Voltage measures the force or pressure of the electricity.

– Redundant PDUs (PDU 3 and PDU 4) are supplied so that non-IBM Z components added to the 16U reserved area can be redundantly plugged across two PDUs to ensure concurrent service of PDUs.

  This may require that some components that are added in the 16U reserved area either have a redundant power supply added (for example, redundant power supply location in an HMC or switch), or the components themselves set up to redundantly mirror each other (for example, install two mirrored switches in order to ensure high availability).

– Similar to other 19" standard racks, the power breaker is maintained separately from the rack. Therefore, the power breaker strategy must be evaluated.

__ • **Weight and dimensional requirements**

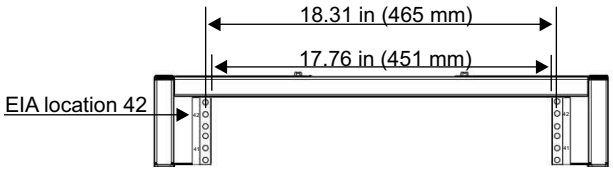
– Components must be no more than 45 lbs (20.4 kg) weight per EIA location. For example, a 4U unit can weigh up to 180 lbs (81.65 kg).

– When populating the 16U reserved area, line cord lengths, component weight and length, and serviceability of the components must be evaluated before installing the components.

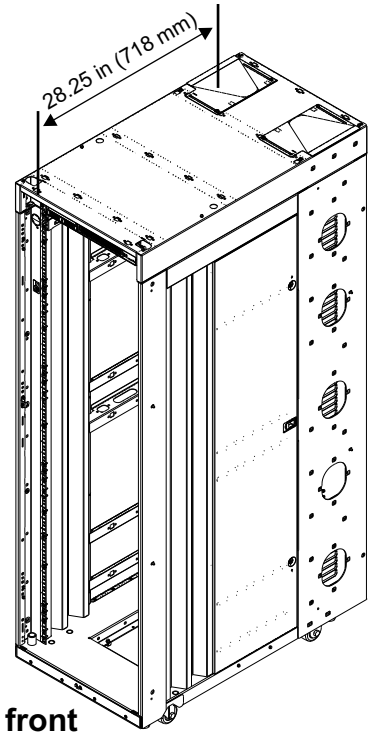
  Most customers place the lighter components in the higher open EIA locations and the heavier components in the lower open EIA locations.

– A display/keyboard unit should not be installed in the first location of the 16U reserved area because it will interfere with the frame latch.

– Components must fit within a 19" rack EIA rail-to-rail width (18.31 in (465 mm) active area) and accommodate round rail holes.



– Component rails must fit within a 28.25 in (718 mm) EIA rail-to-rail depth. Content must not extend beyond the face of the front vertical EIA rail more than 1.00 in (25 mm) and the face of the rear vertical EIA rails more than 3.94 in (100 mm).

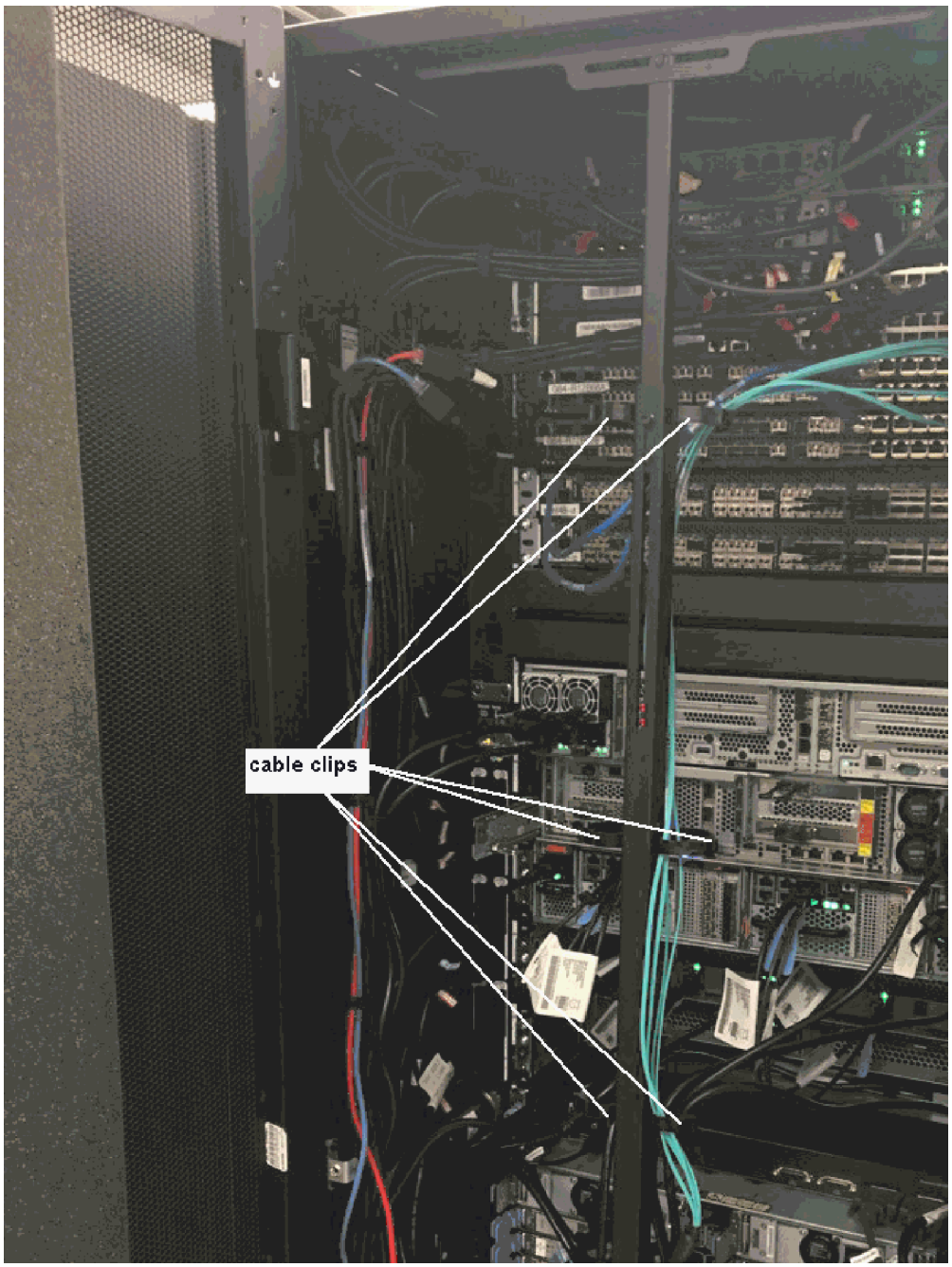


__ • **Safety and electrical certifications**

– Only components that have safety and electrical certifications that are valid for the country or geographical location where the unit will be installed. Components to be installed must show safety certification labels required for server components in your country (e.g. UL, TUC). The IBM Z maintains certifications in various geographies. Other vendors may have a different methodology for certifications. In some cases, this information may need to be required from the component manufacturer.

– Follow the component labeling to determine if the component is a single-person or multiple-person lift.

__ • **Cabling requirements**



– Cabling must be dressed appropriately so it does not block the front or rear IBM Z components, which would result in reduced airflow and, therefore, increased component temperatures. Route the cables along the spine cable management hardware through the cable clips or along the sides of the rack to ensure proper airflow.
– Cabling must be dressed appropriately so access to IBM Z upgrade or repair locations is not blocked or restricted. Additional cable lengths may be required to route cables to allow access. Route the cables along the spine cable management hardware or along the sides of the rack to ensure future access for upgrade or repair.

  If an service representative is called for an upgrade or repair to the IBM Z machine and access to the machine is blocked or restricted, that activity will be delayed or discontinued until access is restored.

__ • **Environmental requirements**

– Liquid-based systems **cannot** be added to the 16U reserved area, as humidity monitoring is active in the 3907.
– Acoustic information
  - The 3907 supports acoustic class 1B (principle configuration, nominal operating environment) with a worst case operating environment projection is L_{WAu} = 9.2B.

    Note: Rack-level acoustic noise level is determined by all the components, including any non-IBM Z components.
  - Excessively loud non-IBM Z components will negatively impact the overall acoustic characteristics of the system and, therefore, render the supplied cover set (if used) to be insufficient to reduce the noise level below safety/regulatory requirements. In this case, added hearing protection labeling and/or operator hearing suppression devices may be required.
– Air flow and thermal considerations
  - Airflow direction must be front-to-back (other airflow orientation could lead to hot exhaust air being recirculated back to the front of the drawers).
  - For non-3907 component being installed in the 16U reserved area that require air flow and do not consume the full depth of the slot (example: switches, networking), install the provided perforated plates (and not blank filler plates) to the corresponding opposing side of the same slot to ensure proper airflow. For example, if two 1U switches were installed at the back of the frame, install a 2U perforated plate at the front of the frame in the same slot locations where the switches were installed at the back.
  - In addition to providing the airflow required for the 3907 configuration, as described in "Cooling recommendations for the room" on page 48, provide any additional required airflow as specified by the manufacturer(s) of the equipment installed in the 16U reserved area. However, do not exceed the following limits for additional air flow to the 16U reserved area to ensure that there is no cooling impact to the 3907 components.

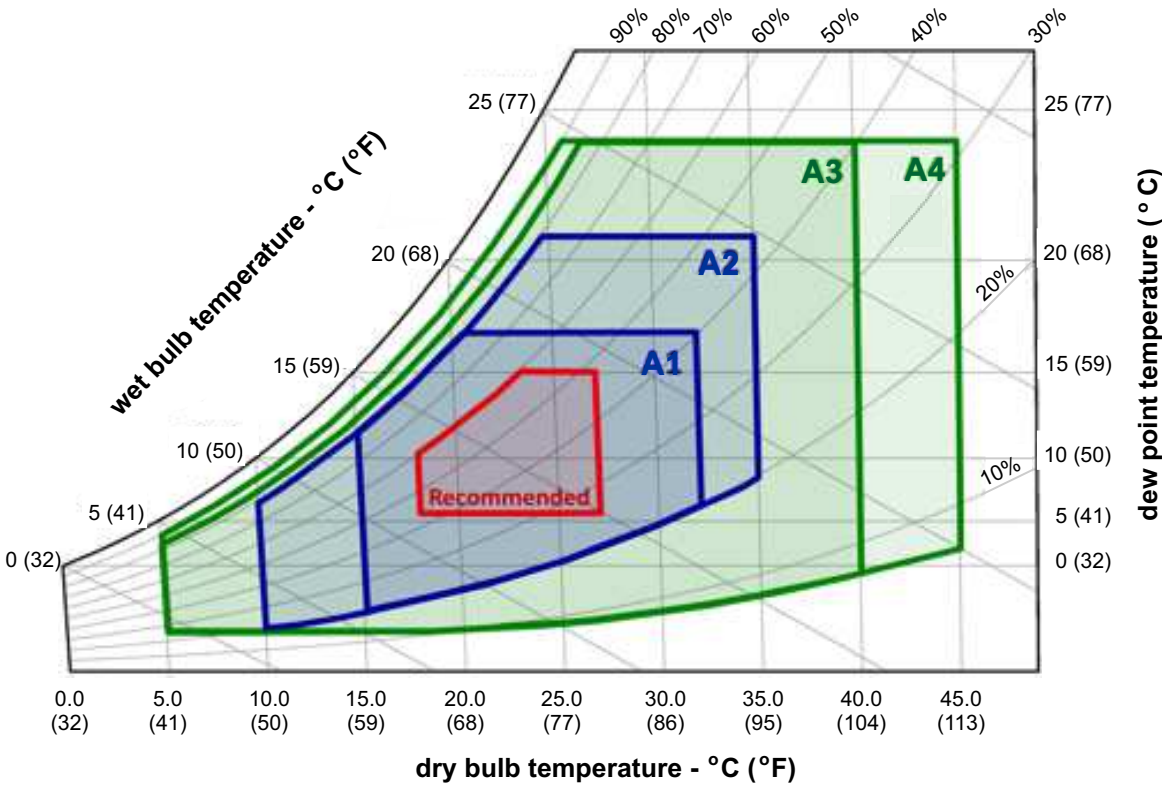
Table 42. Additional airflow (CFM)

Datacenter environment description	Additional airflow maximum
cold aisle less than 81° F and less than 1500 ft (457 m)	500 CFM
cold aisle greater than 81° F or greater than 1500 ft (457 m)	800 CFM

  - Cabling must be dressed appropriately so it does not block the front or rear IBM Z components, which would result in reduced airflow and, therefore, increased component temperatures. Route the cables along the spine cable management hardware or along the sides of the rack to ensure proper airflow.
  - All unused space in the 16U reserved area must be blocked with front and rear filler plates.
– ASHRAE information

  The 3907 is designed to operate in an ASHRAE A3 environmental class.

  However, the machine operating classification is determined by the component with the lowest supported environmental class level. All 3907 components currently meet ASHRAE A3 environmental class level. Therefore, any non-IBM Z components with ASHRAE class below A3 will lower/restrict the ASHRAE class of the full rack, and any non-IBM Z components supporting an A4 environment will be restricted to an A3 operating class given the definition implied by the IBM Z components.



__ • **Contacts**
  – If there are any questions or concerns regarding the requirements of the 16U reserved area, contact your IBM Technical Sales team for additional support.

Layout of IBM Z components in the frame

When ordering FC 0617, the following IBM Z components are installed in the frame (See Figure 32 on page 147):
- Two Support Elements
- Two rack switches
- A display, keyboard, and KVM
- A processor drawer
- 0, 1, or 2 PCIe+ I/O drawers
- Four PDUs
- If 0 or 1 PCIe+ I/O drawer is ordered, five ballasts (P/N 01KL444) are installed in the bottom of the frame to prevent the machine from tipping

When ordering FC 0617, the following IBM Z components are shipped with the machine and need to be installed:
- Filler plates to block any unused space in the 16U reserved area to control proper air flow
- 2U perforated filler plates to enable air flow to partial depth, forced air-cooled assemblies (such as, Storage Area Network switches and Ethernet switches)
- Basic cable management items, including the spine cable management hardware (P/N 01PP900)

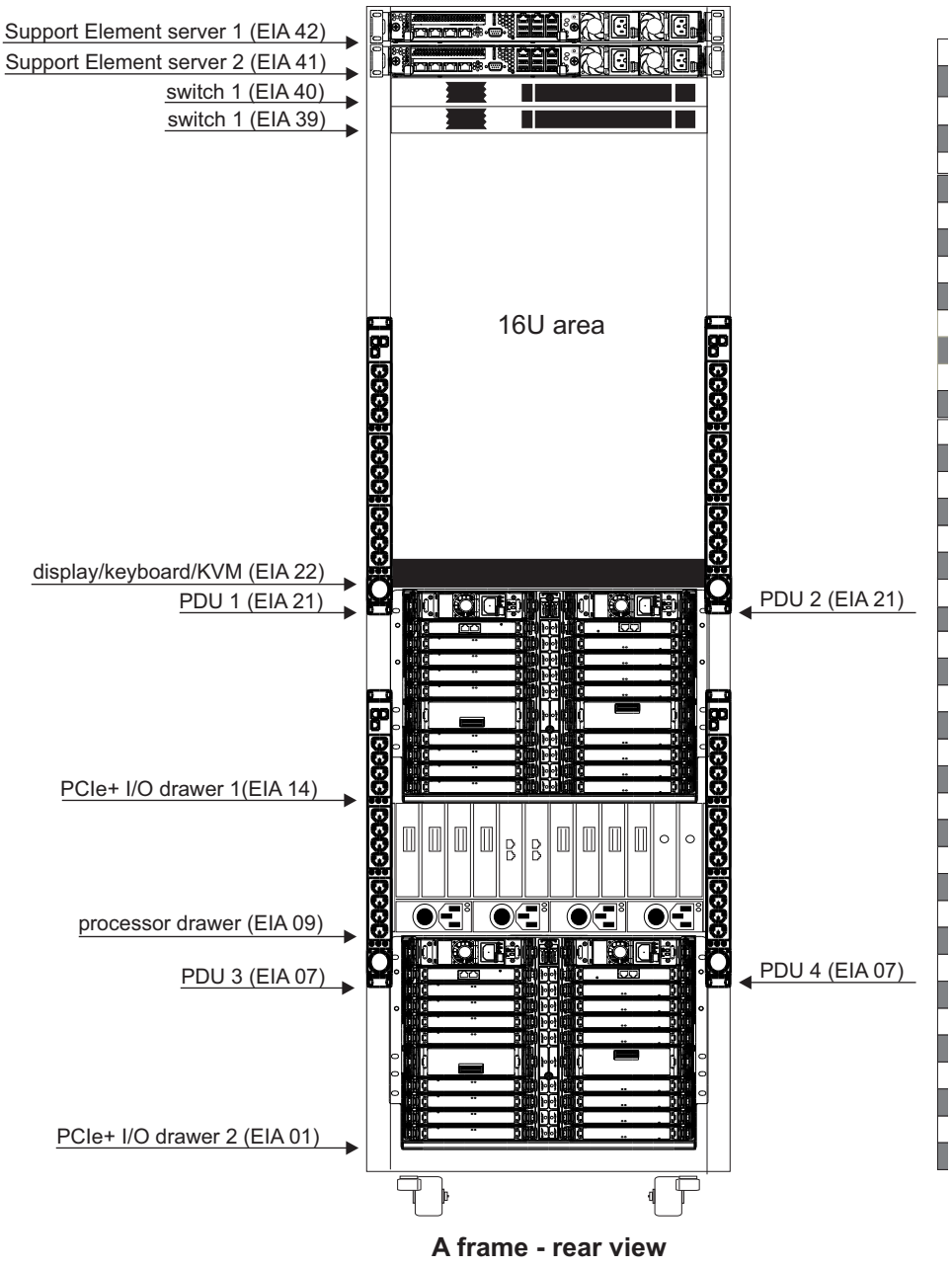


Figure 32. IBM Z components installed when ordering 16U Reserved feature (FC 0617)

Self-check for people installing components into the 16U reserved area

The customer must ensure that they and whomever is installing components into the 16U reserved area understands the information beginning in "Requirements and restrictions" on page 140. After reading the requirements and restrictions about using the 16U reserved area, the party installing components or working in the 16U reserved area must complete the following:

__ • Have read and understood the power plugging locations and requirements for usage of the Power Distribution Units (PDU) with the 3907.

For example, plug locations 9 and 10 in PDU 3 and PDU 4 are reserved for IBM use only. The remaining locations are for components in the 16U reserved area. Qualified installers must understand the voltage limits, maximum current limits, and have planned considerations for single-phase power input.

(For details, see Power requirements.

__ • Have read and understood the considerations and requirements for redundant plugging of additional components.

(For details, see Power requirements.

__ • Have read and understood the weight and dimensional restrictions for components being considered for the 16U reserved area.

For example, the rack depth for the 3907 may vary from other racks, so rail kits must be able to meet the correct depth.

(For details, see Weight and dimensional requirements.)

__ • Have read and understood the need to select only components that have safety and electrical certifications that are valid for the country or geographical location that the unit will be installed.

(For details, see Safety and electrical certifications.)

__ • Have understood the need to route cables so access to 3907 upgrade or repair locations is not blocked or restricted.

In addition, additional cable lengths may be required in order to route cables to allow access.

(For details, see Cabling requirements.)

__ • Have read and understood the air flow and thermal considerations described in Environmental requirements.

Components to be added must be evaluated for internal fans and for their ability to be housed within an enclosed rack cover door set. Thermal and cooling information may need to be requested from the component manufacturer. Also, liquid cooled components **cannot** be installed into the 16U reserved area.

If there are any question or concerns regarding the requirements of the 16U reserved area, the installer must contact the Technical Sales team for additional support.

Example

Note: The following is only an example. The values used in this example are based on the values when this document was released. See the manufacturers specifications for updated specifications.

Example

This configuration consists of installing the following components into a 3907 machine with one processor drawer, two PCIe+ I/O drawers, altitude 1400 ft, and ambient temperature 90º F:

- One 1U 2461 HMC (FC 0083)
- One 1U keyboard/monitor/mouse (FC 0154)
- Two SAN switches (2498-F48)
- One IBM Storwise V7000 Midrange Disk System

Table 43. Component specifications

Component	Quantity	Height (mm)	# of EIA units	Weight (kg)	Power (watts)	# of power cords
1U 2461 HMC FC 0083	1	44.5	1	16.0	200	2
keyboard/monitor/mouse FC 0154	1	44	1	10.4	25	1
SAN switch #1 2498-F48	1	43	1	9.2	110	1
SAN switch #2 2498-F48	1	43	1	9.2	110	1
IBM V7000 24-bay control enclosure	1	88	2	25.2	410	2
TOTAL		**262.5**	**6**	**70.0**	**855**	7

Calculations:

- The weights for each component per EIA is 16.0 kg, 10.4 kg, 9.2 kg, 9.2 kg, 12.6 kg (25.2 kg/2). Each weight per EIA unit is below the maximum weight allowed – 20.4 kg (45 lb).
- The power consumption for the listed components is 855 watts. This is below the maximum power consumption allowed for the 16U reserved area – 3400 watts.
- The maximum number of available outlets in PDU 3 and PDU 4 is 20. The number of power cords being used for the listed component is 7. There is an adequate number of outlets available in PDU 3 and PDU4 – 20 available outlets.
  - For the 1U 2461 HMC (FC 0083), plug one of the power cords into PDU 3 and one of the power cords into PDU 4, for redundancy.
  - For the keyboard/monitor/mouse (FC 0154), plug the one power cord into either one of the two PDUs. If possible, and to simplify servicing, attempt to leave the corresponding location on the other PDU unused (so it can be used in case the plugged PDU is called for servicing).
  - For one of the SAN switches, plug the one power cord into PDU 3. For the other SAN switch, plus the one power cord into PDU 4.
  - For the IBM V7000, plug one of the power cords into PDU 3 and one of the power cords into PDU 4, for redundancy.

Note: Make sure you DO NOT use outlet 9 or outlet 10 in either PDU 3 or PDU4.

- According to the Figure 9 on page 52, the airflow CFM value for a 3907 machine with one processor drawer, two PCIe+ I/O drawers, and altitude of 1400 ft, and an ambient temperature of 90° F is 920 CFM.

  Because we do not know the manufacturer airflow requirements and because the ambient temperature is greater than 81° F, an additional 800 CFM is added.

  So the datacenter needs to provide the 3907 with a maximum of 1720 (920 + 800) CFM.

  All equipment air flow is front to back in this example, therefore satisfying the air flow directionality requirement.

Note: Some components are installed from front of frame, and other components are installed from rear of frame; therefore, take care when planning airflow.

Removing and reinstalling the spine cable management hardware

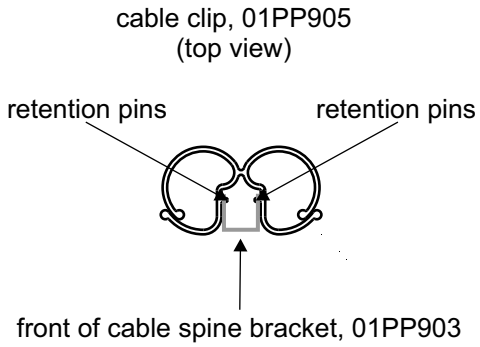
You may need to remove the spine cable management hardware in order to install components into the 16U reserved area. Once the components are installed, you then need to reinstall the spine cable management hardware.

Removing the spine cable management hardware

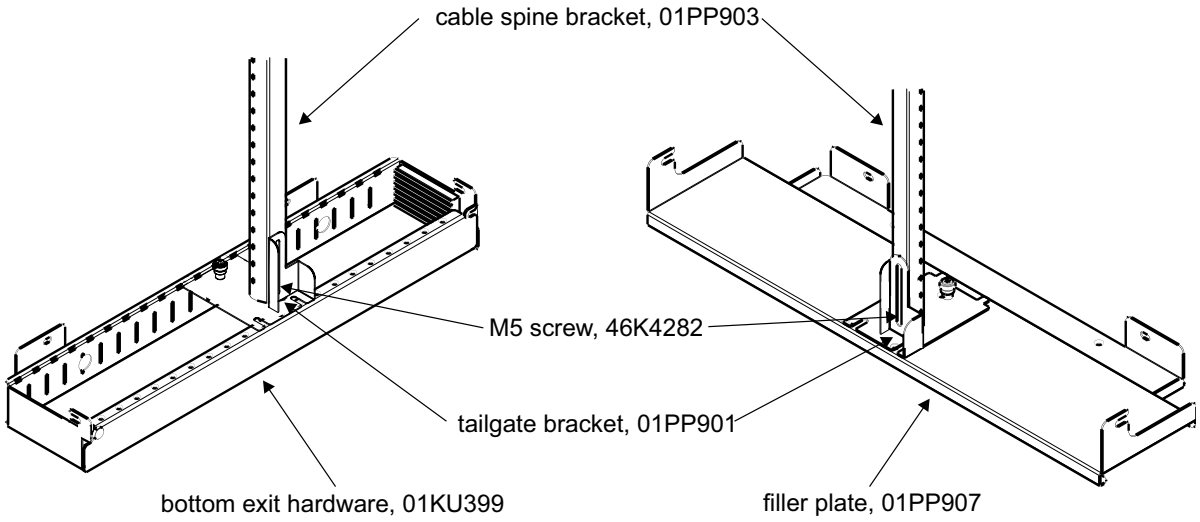
To remove the spine cable management hardware, use the following steps:

__ 1. Remove the cables from within the cable clips (P/N 01PP905) that are attached to the cable spine bracket (P/N 01PP903).

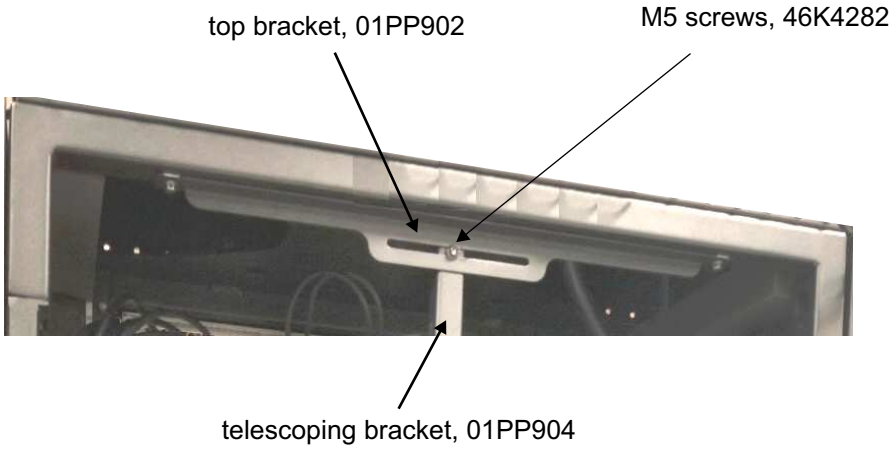
__ 2. Remove the cable clips (P/N 01PP905) from the cable spine bracket (P/N 01PP903).



__ 3. Remove the one M5 screw (P/N 46K4282) that is securing the cable spine bracket (P/N 01PP903) to the tailgate bracket (P/N 01PP901).



__ 4. Remove the one M5 screw (P/N 46K4282) that is securing the telescoping bracket (P/N 01PP904) to the top bracket (P/N 01PP902).

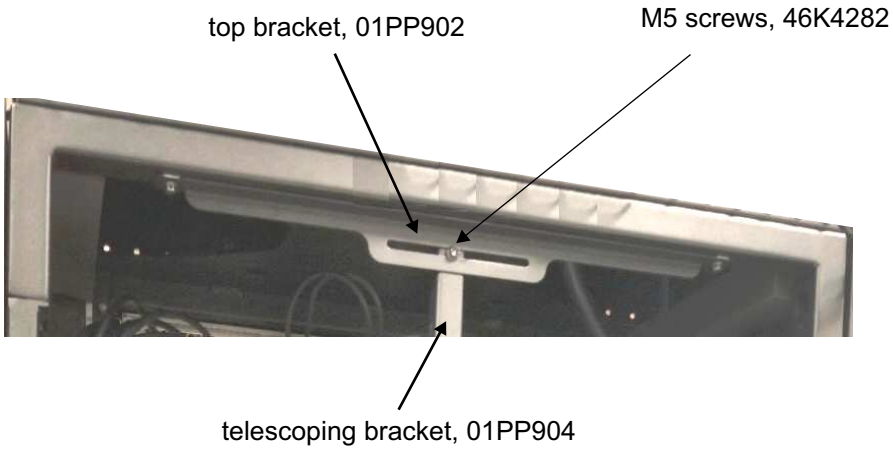


__ 5. Remove the cable spine bracket and telescoping bracket. Make sure you save the screws for future use.

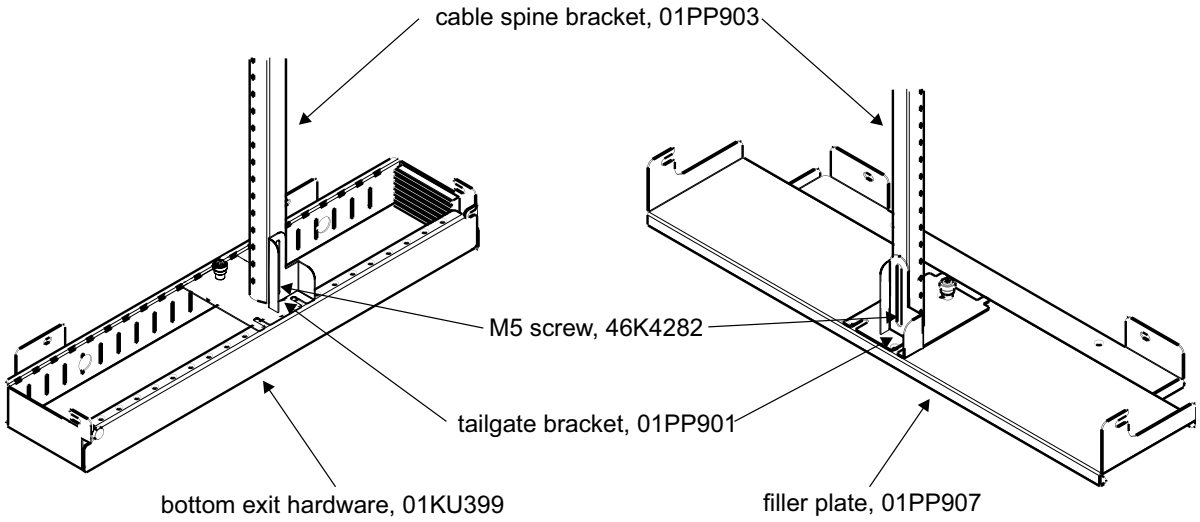
Reinstalling the spine cable management hardware

To reinstall the spine cable management hardware, use the following steps:

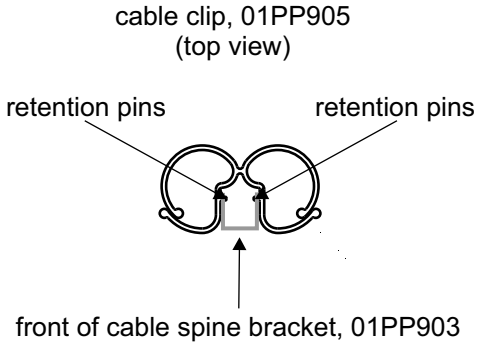
__ 1. Attach the telescoping bracket (P/N 01PP904) to the top bracket (P/N 01PP902) using one M5 screws (P/N 46K4282).



__ 2. Attach the cable spine bracket (P/N 01PP903) to the tailgate bracket (P/N 01PP901) using one M5 screw (P/N 46K4282).



__ 3. Attach the cable clips (P/N 01PP905) to the cable spine bracket (P/N 01PP903) by first docking one of the retention pins into the hole on the cable spine bracket and then bending the clip to dock the other retention pin.



__ 4. Route and secure the cables inside the cable clips (P/N 01PP905).

Appendix E. Dual power installation

3907 is designed with a fully redundant power system. Each computer has either two/four line cords attached to two/four power input ports which, in turn, power a pair of fully redundant power distribution system within the computer. To take full advantage of the redundancy/reliability that is built into the computer system, the system **must** be powered from two distribution panels.

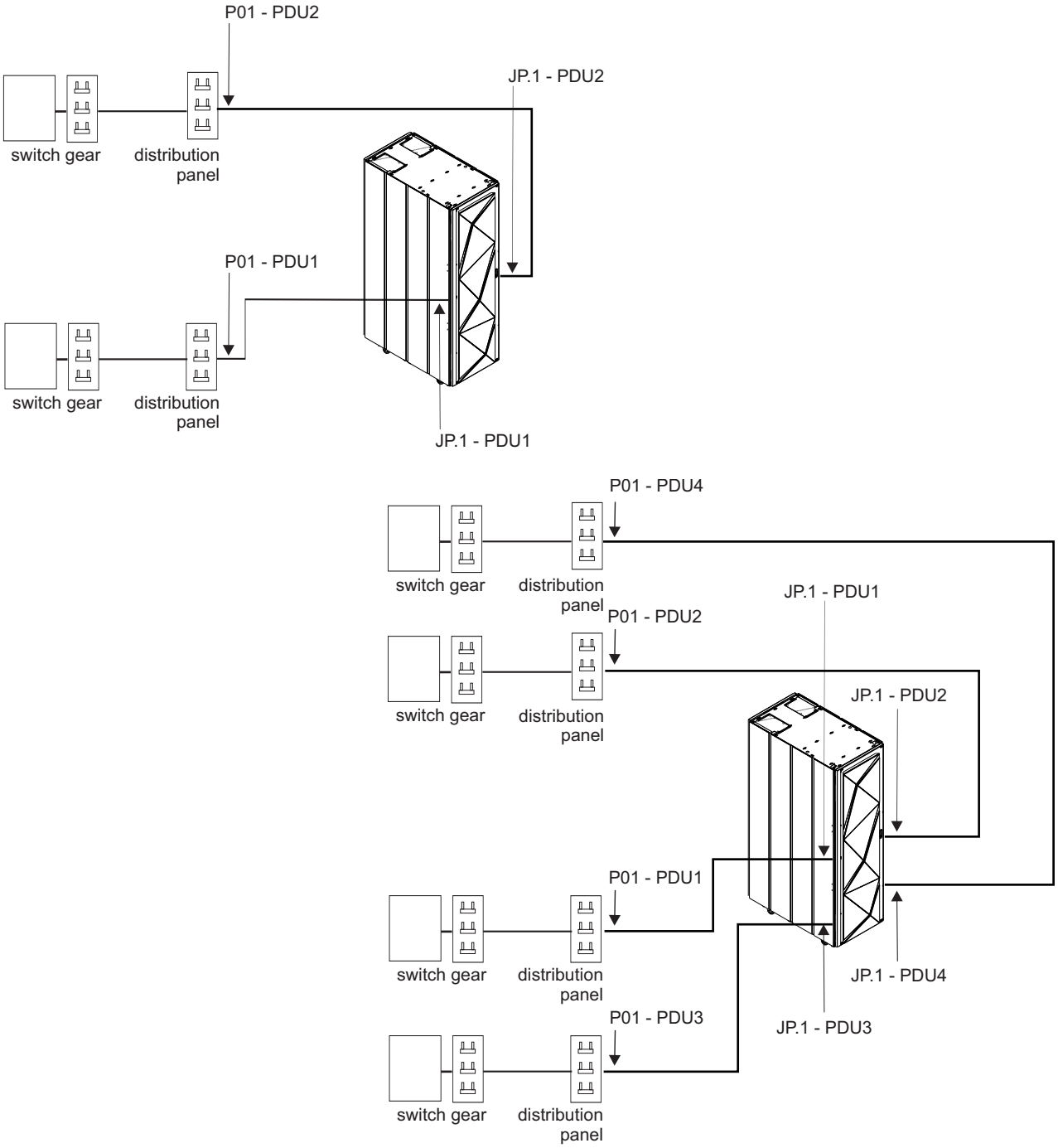
The following shows three examples of redundancy. In these examples, two power cords are identified:

- **JP.1 - PDU1** and **P01 - PDU1** are the labels identifying the ends of one of the power cords. **JP.1 - PDU1** is the label identifying the end of the power cord that connects to the JP.1 jack in PDU 1 (A21NPDU1) and **P01 - PDU1** is the label identifying the end of the same power cord that connects to the customer power distribution unit.
- **JP.1 - PDU2** and **P01 - PDU2** are the labels identifying the ends of one of the power cords. **JP.1 - PDU2** is the label identifying the end of the power cord that connects to the JP.1 jack in PDU 2 (A21ZPDU2) and **P01 - PDU2** is the label identifying the end of the same power cord that connects to the customer power distribution unit.
- **JP.1 - PDU3** and **P01 - PDU3** are the labels identifying the ends of one of the power cords. **JP.1 - PDU3** is the label identifying the end of the power cord that connects to the JP.1 jack in PDU 3 (A07NPDU3) and **P01 - PDU3** is the label identifying the end of the same power cord that connects to the customer power distribution unit.
- **JP.1 - PDU4** and **P01 - PDU4** are the labels identifying the ends of one of the power cords. **JP.1 - PDU4** is the label identifying the end of the power cord that connects to the JP.1 jack in PDU 4 (A07ZPDU4) and **P01 - PDU4** is the label identifying the end of the same power cord that connects to the customer power distribution unit.

Example 1 (redundant distribution panel and switch gear)

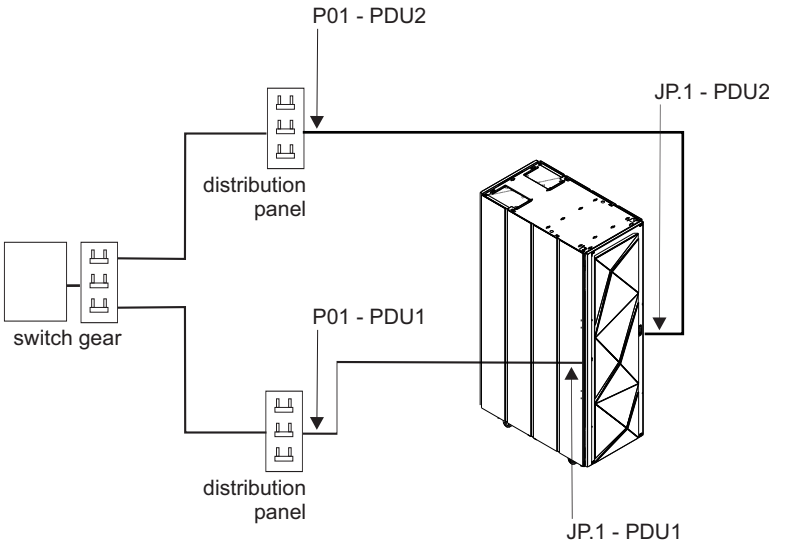
In this example, the computer receives power from two separate power distribution panels. Each distribution panel receives power from a part in separate building switch gears.

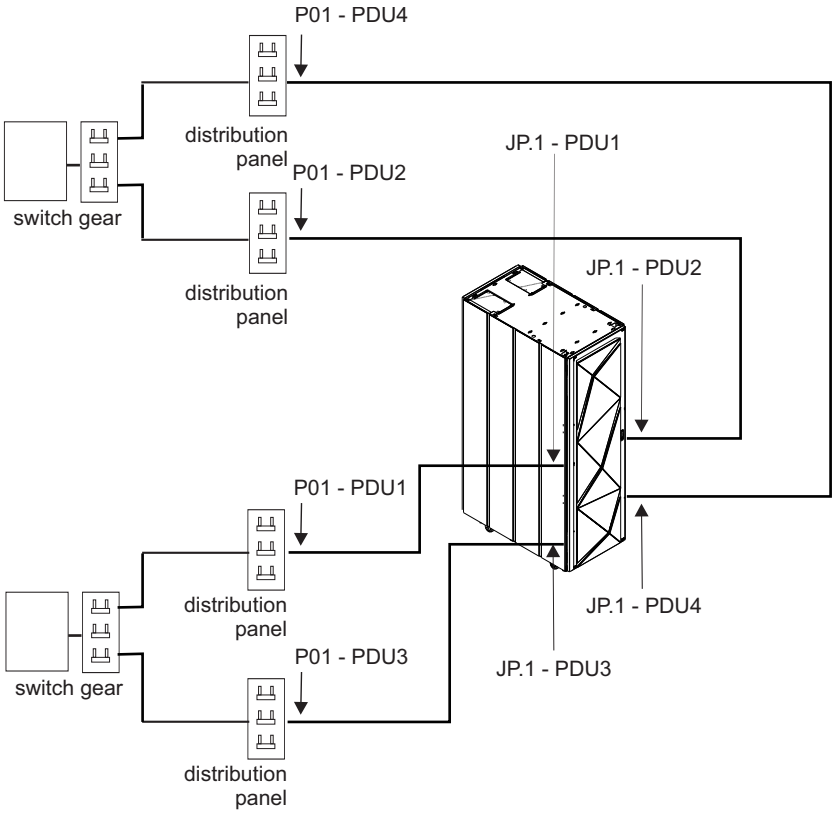
This type of power distribution will not result in system outage in the event of a power failure at either switch great or either distribution panels.



Example 2 (redundant distribution panel)

In this example, the computer receives power from two separate power distribution panels. Two distribution panels receive power from a separate part of one building switch gear. Most facilities should be able to achieve this level of redundancy. In this case, loss of switch gear (building power) will result in system outage, but loss of one distribution panel will not.

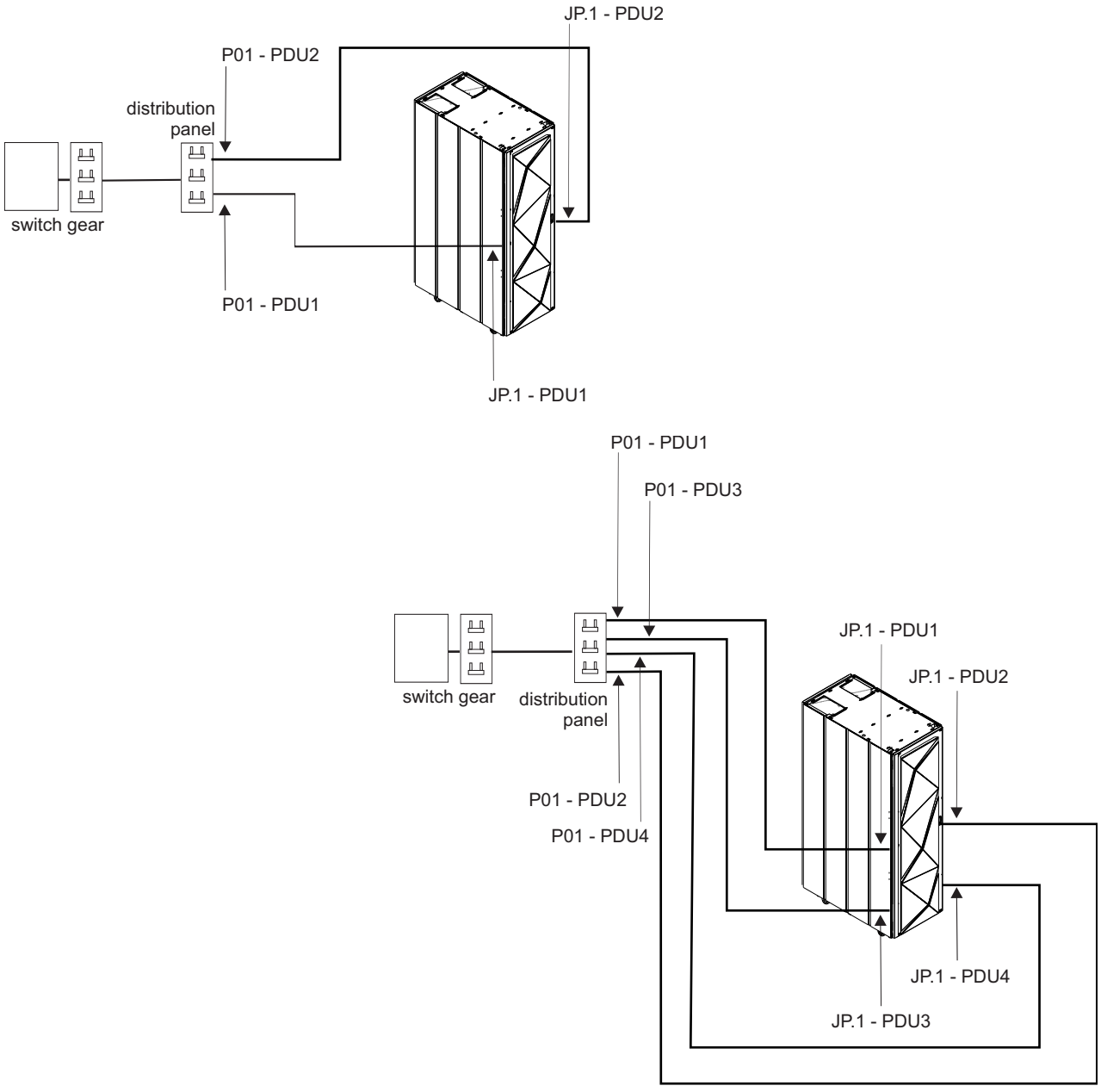




Example 3 (single distribution panel)

In this example, the computer receives power from two/four separate circuit breakers in a single power panel. This **does not** make use of the redundancy provided by the processor. It is, however, acceptable if a second power distribution panel is not available.

This type of power distribution will result in system outage in the event of a power failure at either the switch gear or the distribution panel. This power distribution is **not** recommended.



Recommended phase connections

This section includes recommended phase connections.

Single phase derived from 3 phase Delta (North America, Japan, and any other low voltage countries)

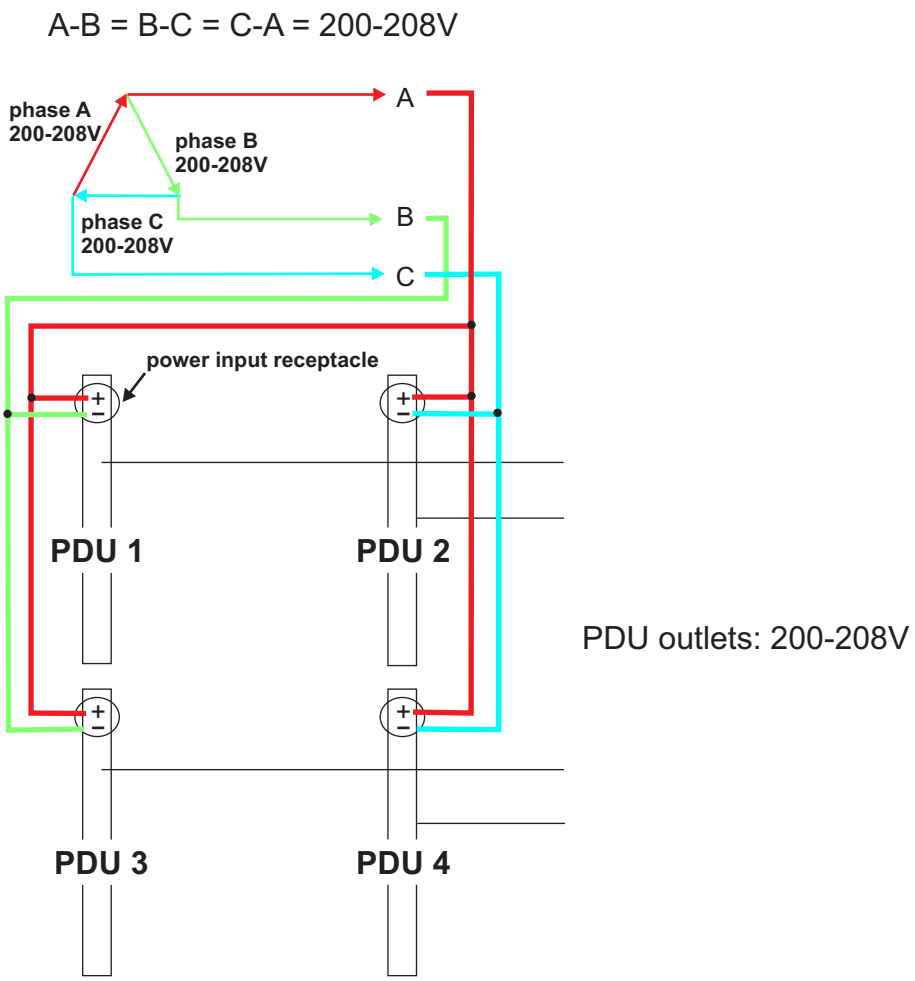


Figure 33. Single phase derived from 3 phase Delta

For most reliable connection to the input power, the left side PDUs (PDU 1 and PDU 3) should be connected to one phase pair and the right side PDUs (PDU 2 and PDU 4) to a different phase pair. The recommended connections are:

left side PDUs (PDU 1 and PDU 3)		right side PDUs (PDU 2 and PDU 4)
A-B	(shown in the example)	C-A
C-A		B-C
A-B		B-C
C-A		A-B
B-C		C-A
B-C		A-B

A given phase pair from a distribution panel should never cross from the left side PDUs (PDU 1 and PDU 3) to the right side PDUs (PDU 2 and PDU 4). (See the previous information in this appendix on dual feed.)

It may not be possible to determine which phases are common when fed from two different distribution panels, or the source voltage may not be derived from the input power as shown in the Figure 33 on page 159. In any case, it is always best to following the directions described in the previous information in this appendix on dual feed.

Single phase derived from 3 phase Wye (most countries world wide)

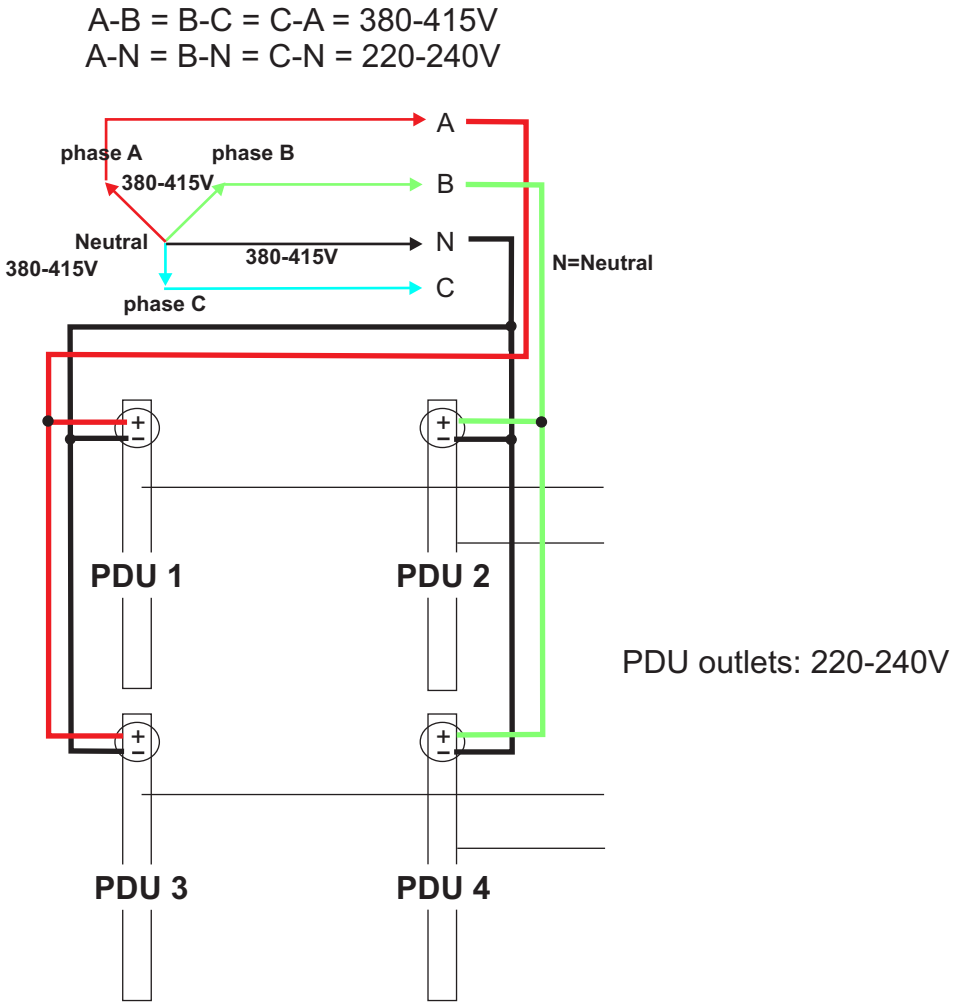


Figure 34. Single phase derived from 3 phase Wye

For most reliable connection to the input power, the left side PDUs (PDU 1 and PDU 3) should be connected to one phase and neutral, and the right side PDUs (PDU 2 and PDU 4) to a different phase and neutral. The recommended connections are:

left side (PDU 1 and PDU 3)		**right side (PDU 2 and PDU 4)**
A-N	(shown in the example)	B-N
A-N		C-N
B-N		C-N
B-N		A-N
C-N		A-N
C-N		B-N

A given phase pair from a distribution panel should never cross from the left side PDUs (PDU 1 and PDU 3) to the right side PDUs (PDU 2 and PDU 4). (See the previous information in this appendix on dual feed.)

It may not be possible to determine which phases are common when fed from two different distribution panels, or the source voltage may not be derived from the input power as shown in the Figure 34. In any

case, it is always best to following the directions described in the previous information in this appendix on dual feed.

Appendix F. 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.

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.

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 enterprise is entirely coincidental.

Trademarks

IBM, the IBM logo, and ibm.com® are 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” at www.ibm.com/legal/copytrade.shtml.

Linux is a registered trademark of Linus Torvalds in the United States, other countries, or both.

Microsoft and Windows are trademarks of Microsoft Corporation in the United States, other countries, or both.

Other company, product, or service names may be trademarks or service marks of others.

Class A Notices

The following Class A statements apply to this IBM product. The statement for other IBM products intended for use with this product will appear in their accompanying manuals.

Federal Communications Commission (FCC) Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. 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.

Industry Canada Compliance Statement

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

Avis de conformité à la réglementation d'Industrie Canada

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

European Community Compliance Statement

This product is in conformity with the protection requirements of EU Council Directive 2014/30/EU on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to European Standard EN 55032. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

European Community contact:
IBM Deutschland GmbH
Technical Regulations, Department M372
IBM-Allee 1, 71139 Ehningen, Germany
Tele: +49 (0) 800 225 5423 or +49 (0) 180 331 3233
email: halloibm@de.ibm.com

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

VCCI Statement - Japan

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

The following is a summary of the Japanese VCCI statement above:

This is a Class A product based on the standard of the VCCI Council. If this equipment is used in a domestic environment, radio interference may occur, in which case the user may be required to take corrective actions.

Japan JIS C 61000-3-2 Compliance

（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： Knowledge Centerの各製品の仕様ページ参照

For products less than or equal to 20 A per phase, the following statement applies:

高調波電流規格 JIS C 61000-3-2 適合品

For products greater than 20 A, single-phase, the following statements apply:

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、ＰＦＣ回路付）
換算係数：０

For products greater than 20 A per phase, three-phase, the following statements apply:

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

Electromagnetic Interference (EMI) Statement - People's Republic of China

声　明

此为Ａ级产品，在生活环境中，
该产品可能会造成无线电干扰。
在这种情况下，可能需要用户对其
干扰采取切实可行的措施。

Declaration: This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may need to perform practical action.

Electromagnetic Interference (EMI) Statement - Taiwan

警告使用者:
這是甲類的資訊產品，在
居住的環境中使用時，可
能會造成射頻干擾，在這
種情況下，使用者會被要
求採取某些適當的對策。

The following is a summary of the Taiwan EMI statement above:

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

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

Electromagnetic Interference (EMI) Statement - Korea

이 기기는 업무용(A급)으로 전자파적합등록을 한 기기이오니
판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의
지역에서 사용하는 것을 목적으로 합니다.

Germany Compliance Statement

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 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 EG 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 Regulations, Abteilung M372

IBM-Allee 1, 71139 Ehningen, Germany
Tel: +49 (0) 800 225 5423 or +49 (0) 180 331 3233
email: halloibm@de.ibm.com

Generelle Informationen:

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

Electromagnetic Interference (EMI) Statement - Russia

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

Printed in USA

GC28-6974-01