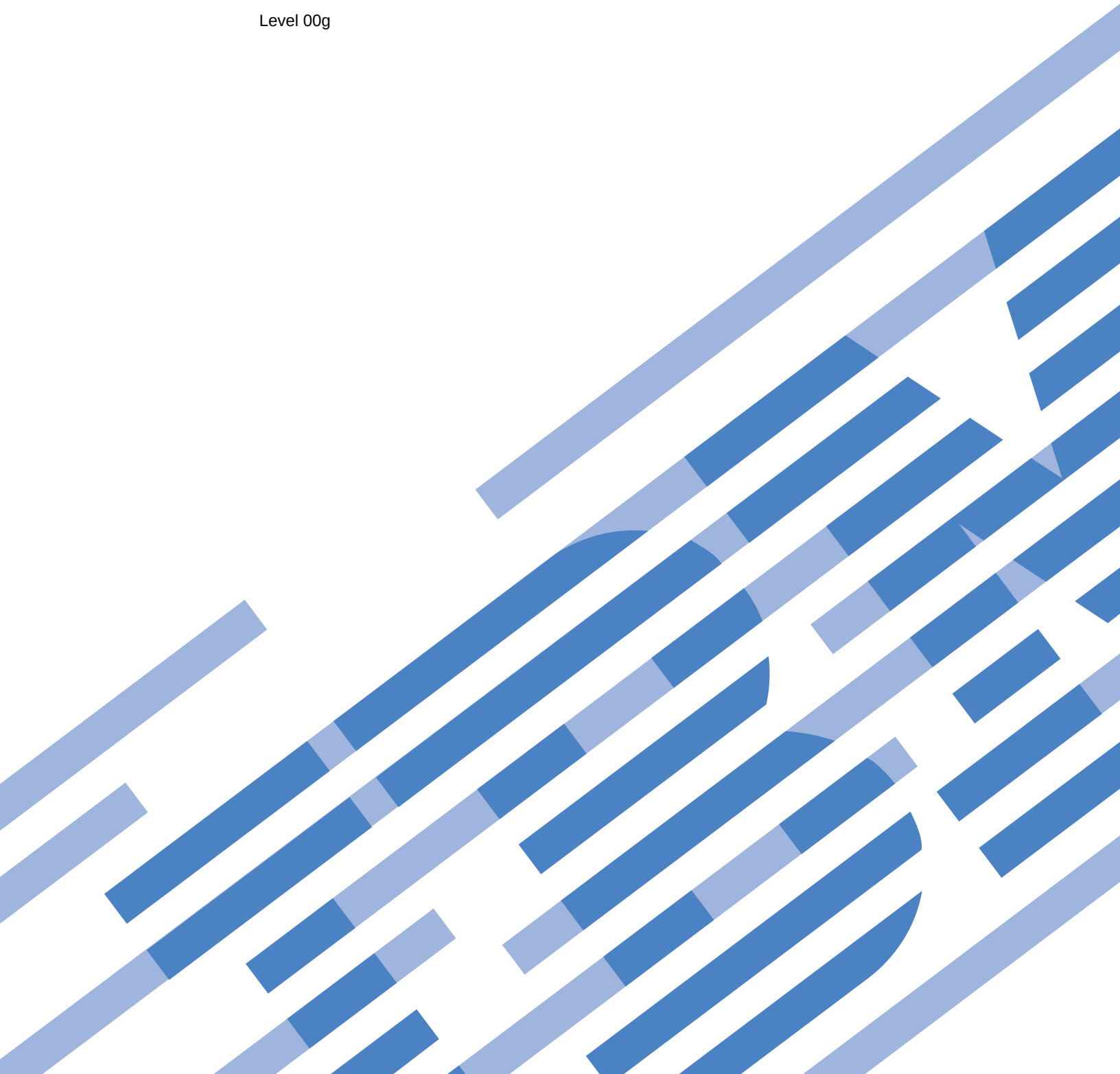

zEnterprise 114

Installation Manual for Physical Planning 2818

GC28-6907-00

Level 00g

zEnterprise 114

Installation Manual for Physical Planning 2818

GC28-6907-00

Level 00g

Note:
Before using this information and the product it supports, be sure to read the information in "Safety" on page v, Appendix H, "Notices," on page 105, and *Systems Environmental Notices and User Guide*, Z125-5823.

This edition, GC28-6907-00, applies to the IBM zEnterprise 114 (z114).

There may be a newer version of this document in **PDF** format available on **Resource Link**.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. A newer version is indicated by a lowercase, alphabetic letter following the form number suffix (for example: 00a, 00b, 01a, 01b).

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 IBM® 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 System z® models can use I/O cards such as, ESCON®, FICON®, Open Systems Adapter (OSA), InterSystem Channel-3 (ISC-3), 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 IBM zEnterprise 114 (z114) server.

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 internal battery feature 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.
- The Appendices provide IBM standard symbols, environmental specifications, acoustics, power installation and power loads, a sample cabling schematic and upgrade paths.

Revisions

A technical change to the text is indicated by a vertical bar (|) to the left of the change.

Related publications

For related publications, go to Resource Link® at *http://www.ibm.com/servers/resourcelink*, and click **Library** from the navigation bar on the left. Then select the server product.

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

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 IBM z114 and is copyrighted and licensed by IBM. Each z114 is delivered with Licensed Machine Code that is customized to the specific machine ordered. The Licensed Machine Code enables the z114 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 z114 requires that the Licensed Machine Code be reinstalled at the new location. The procedure for relocating a z114, “Discontinuing the System”, is in the *zEnterprise 114 Installation Manual*.

Accessibility

This publication is in Adobe Portable Document Format (PDF) and should be compliant with accessibility standards. If you experience difficulties using this PDF file you can request a web-based format of this publication. 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 request, 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.

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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).

Summary of changes

Summary of changes for the *zEnterprise 114 Installation Manual for Physical Planning*, GC28-6907.

Table 1. Summary of changes

Release level	Date	Changes in level
00g	10/2013	This revision contains editorial changes and the following technical changes: • Updated the graphics in Appendix D, "Dual power installation," on page 95.
00f	10/2013	This revision contains editorial changes and the following technical changes: • Updated graphics and dimensions in "Machine and service clearance areas" on page 30.

Chapter 1. Introduction

This chapter is intended to help you prepare your physical site for the installation of an IBM z114. 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 IBM zEnterprise 114.

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 z114 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 (http://www.ibm.com/servers/resourcelink). On the left navigation pane, click **Planning**, **Physical Planning**, and **General information for planning a physical site** (located under **zSeries & S/390®**).

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, modems, switches, telephones, connection panels, etc	☐	_____	_____
○ In the Chapter titled, “Cabling and Connectivity” (in this document), read the information about planning now for future cabling needs. In the same chapter, read also about “zSeries Fiber Cabling 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 / zSeries” on Resource Link (*http://www.ibm.com/servers/resourcelink*)	☐	_____	_____
○ Order communication equipment cables, modems, switches, telephones, connection panels, etc	☐	_____	_____
○ Order channel equipment cables, directors, switches, patch panels, etc. In the Chapter titled, “Cabling and Connectivity” (in this document), read the information about “zSeries Fiber Cabling Services” 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 and ESCON channels.	☐	_____	_____
○ If you are planning for a system that will use ESCON or FICON channels, InfiniBand, coupling links, or Open System Adapters (OSA), contact your IBM marketing representative to obtain the document, *Fiber Optic Planning (ESCON, FICON, Coupling Links, and Open System Adapters*, GA23-0367	☐	_____	_____
○ Order other machines/devices, including changes to any existing equipment	☐	_____	_____

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	☐	_____	_____
○ 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 IBM 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	☐	_____	_____
○ 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 and modems	☐	_____	_____

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?	☐	_____	_____
○ 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. 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.

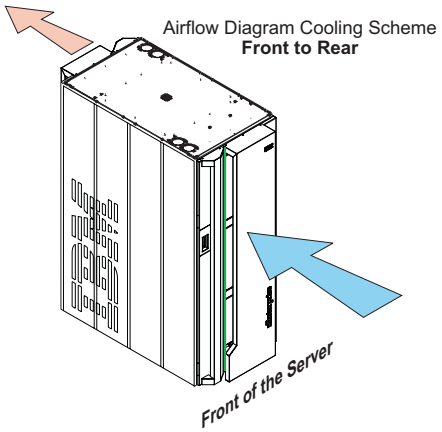
ASHRAE declaration

ASHRAE Declarations (Metric) for 2818

ASHRAE Class 1 Description	Typical Heat Release	Airflow Nominal (1)	Airflow Maximum (1)	Max Weight (2)	Overall System Dimensions	Maximum Elevation (5)	Maximum Dry Bulb Temperature (5)	Maximum Dew Point (5)
	kBTU	m3/hr	m3/hr	kg	W x D x H (cm)	m	C°	C°
Typical Configuration Model M05, FC 1135 (with 2 PCIe I/O drawers)	10.7	2175	3806	758	78.4 x 157.4 x 201.5	3048	35	21

ASHRAE Declarations (English) for 2818

ASHRAE Class 1 Description	Typical Heat Release	Airflow Minimum (1)	Airflow Maximum (1)	Weight (2)	Overall System Dimensions	Maximum Elevation (5)	Maximum Dry Bulb Temperature (5)	Maximum Dew Point (5)
	kBTU	cfm	cfm	lbs	W x D x H (in)	ft	F°	F°
Typical Configuration Model M05, FC 1135 (with 2 PCIe I/O drawers)	10.7	1280	2240	1672	30.9 x 62.0 x 79.3	10,000	95	69.8



Notes:

1. Airflow is designed to increase as the local ambient room temperature increases. Nominal airflow assumes 25° C ambient. Maximum airflow is based on an ambient of 32° C.
2. Weights provided assume the optional Internal Battery Features are installed.
3. For ambient temperatures exceeding 25° C, the acoustical noise levels of the system may increase significantly as the speeds of the air moving devices increase. See Appendix C, "Acoustics," on page 93 for the declared acoustical noise emission levels for the system under nominal temperature conditions (23° C plus or minus 2°C).
4. Maximum ambient reduces 1° C (1.8° F) for every 300 m (984 ft) over 900 m (2953 ft).
5. 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 z114 family of IBM servers is among the most powerful group of mainframe processors ever built. Technology improvements have placed these servers 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 z114 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 z114 family offers.

The z114 operates in an ASHRAE Class 2 environment.

Environmental specifications are presented in two categories: Required and Recommended. Obviously, meeting the required specifications is prerequisite to using the z114. IBM strongly suggests you strive for more than the minimum requirements. The powerful computing z114 provides generates a great deal of heat. That heat must be removed from the equipment to keep it operating at peak efficiency. Cooling the servers can result in condensation on critical internal parts, leading to equipment failure, unless the computer room environment is adequately maintained to prevent it. That's where operating your data center with the goal of reaching recommended specifications instead of just the required numbers will pay off for you.

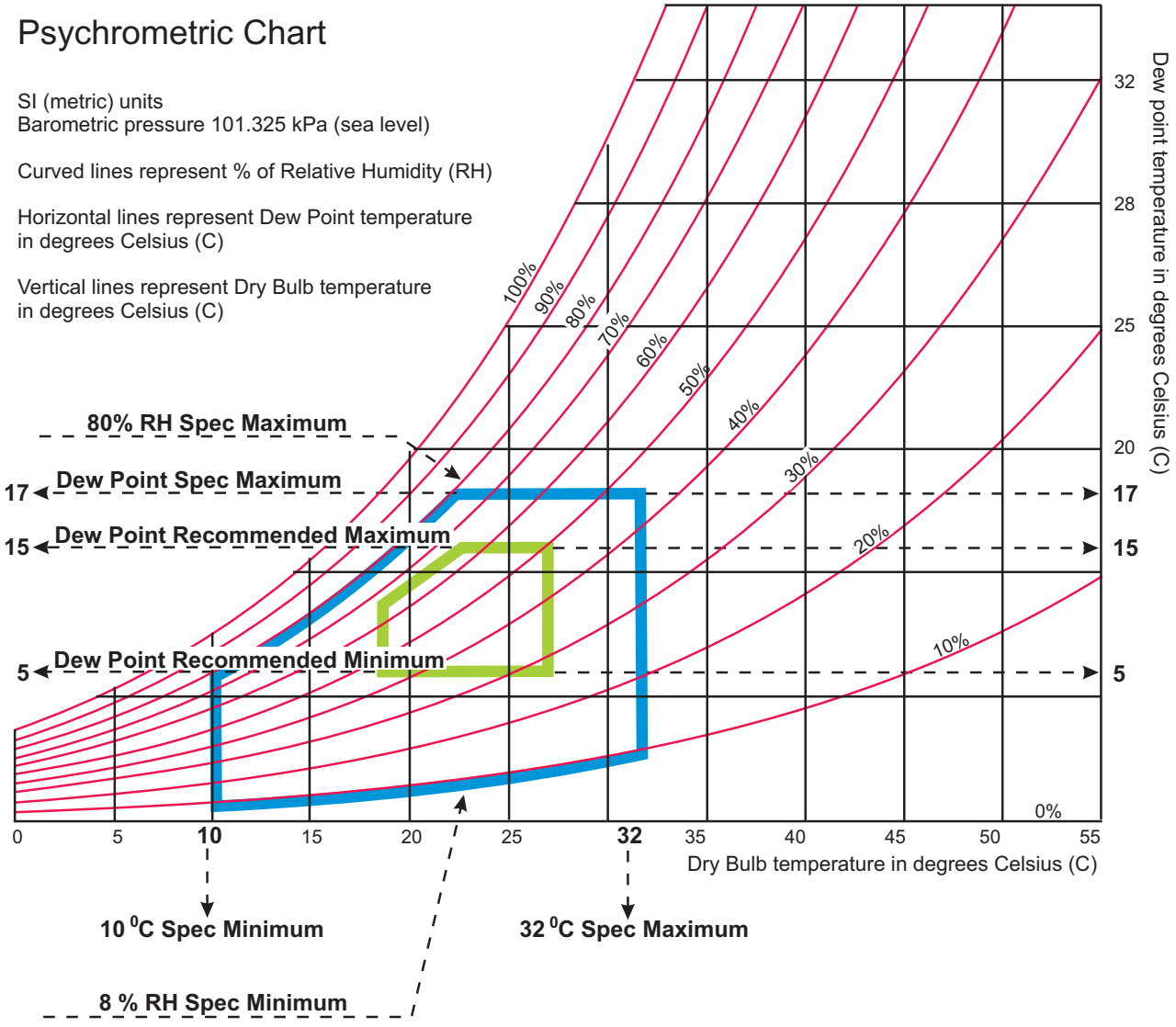
Unless otherwise noted on individual specification pages, the following environmental specifications, based on an altitude from sea level to 900 meters (2953 feet), apply:

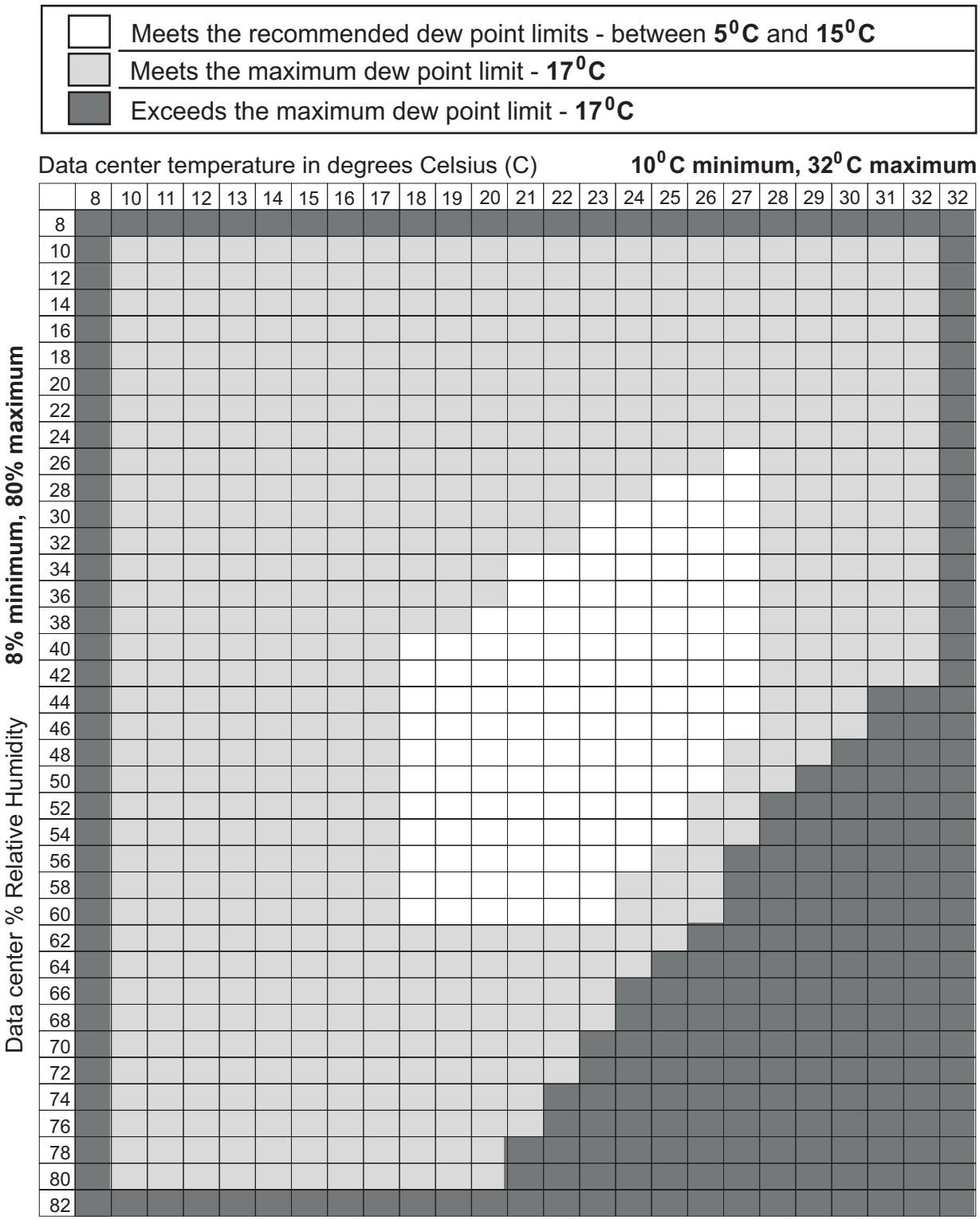
Environment, Operating: [1, 5]		
High Ambient Temperature	**Long-term recommended** 27°C (80.6°F) [4]	**Maximum ambient allowed**35°C (95°F) [4]
Low Ambient Temperature	**Long-term recommended**18° (64.4°F)	**Minimum ambient allowed**10° (50°F)
Low end humidity	**Long-term recommended**5.5°C (41.9°F) dew point	**Minimum relative humidity allowed**20%
High end humidity	**Long-term recommended**60% relative humidity and 15°C (59°F) dew point	**Maximum relative humidity allowed**80% relative humidity and 21°C (69.8°F) dew point
Gaseous contamination	Class G1 as per ANSI/ISA S71.04–1985 [2]	
Particulate contamination	1. Room air must be filtered continuously using appropriate filters. 2. The deliquescent relative humidity of the particulate contamination shall be more than 80% [3]	
Environment, Nonoperating: [5]		
Temperature	5°C (45°F) to 41°C (113°F)	
Rel Humidity	8% - 80%	
Maximum Dew Point	Less than 27°C (80.6°F)	
Gaseous contamination	Class G1 as per ANSI/ISA S71.04–1985 [2]	
Environment, shipping:		
Temperature	-40°C (-40°F) to 60°C (140°F)	
Rel Humidity	5% - 100% (no condensation)	
Wet Bulb	Less than 29°C (84.2°F)	
Shipping package	IBM-approved 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	Less than 29°C (84.2°F)	
Shipping package	IBM-approved vapor barrier bag with desiccant	

Notes:

1. Maximum ambient temperature reduces 1ºC (1.8 ºF) for every 300 m (984 ft) over 900 m (2953 ft).
2. ANSI/ISA-S71.04. 1985. "Environmental conditions for process measurement and control systems: Airborne contaminants." Instrument Society of America, Research Triangle Park, NC, 1985.
3. The deliquescent relative humidity of particulate contamination is the relative humidity at which dust absorbs enough water to become wet and promote ionic conduction.
4. For ambient temperatures exceeding 25ºC (77ºF), the acoustical noise levels of the system may increase significantly as the speeds of the air moving devices increase. See Appendix C, “Acoustics,” on page 93 for the declared acoustical noise emission levels for the system under nominal temperature conditions of 23ºC plus or minus 2ºC (73.4ºF plus or minus 3.6ºF).
5. The machine should be in an environment that satisfies the operating environment specifications for at least one day before it is powered on.

The following illustrations reiterate the environmental specifications in graphic form.





It is very important the environmental specifications be met immediately in front of the frame of the z114 server. Ideally, it would be best if the temperature and humidity controls are good enough to surround the service area of the z114. If you are able to exceed the required conditions, focus your efforts to provide the best quality air at the bottom front of the server.

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 IBM 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 z114 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 z114 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 IBM determines that the levels of particulates or gases in your environment have caused damage to the z114 IBM may condition provision of repair or replacement of z114 or parts on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

Table 2. 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.

Table 2. Contaminant Descriptions (continued)

Contaminant	Description
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:

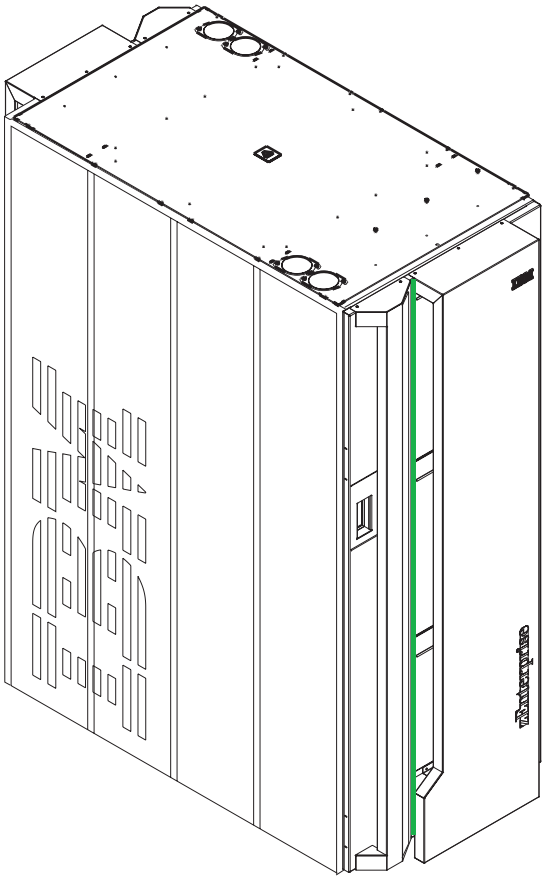
1. ANSI/ISA-71.04.1985. "Environmental conditions for process measurement and control systems: Airborne contaminants." Instrument Society of America, Research Triangle Park, NC, 1985.
2. The derivation of the equivalence between the rate of copper corrosion product thickness growth in Å/month and the 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 IBM representative for assistance in monitoring the environment.

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

Chapter 3. Models and physical specifications

This chapter provides the following detailed information for the IBM z114.

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



Facts you should know about the z114:

- The z114 is **always** a one-frame system
- In areas that may be prone to seismic events, IBM offers Feature Code 8012 which provides tie-down hardware for various height raised floors. Feature Code 8013 provides tie-down hardware for non-raised floors. See Appendix F, “Frame tie-down,” on page 99 for more information.
- There are separate shipping containers for the covers for the frame
- **Installation on a raised floor is recommended but not mandatory**. Refer to your national electric code if you have questions about routing data processing cables in exposed areas.
- The z114 may be installed on a non-raised floor. In a non-raised floor environment, where cables are exposed, refer to local and national electric and safety codes for more information.
- The z114 has optional top exit cabling towers that allow both power cord and I/O cables to be routed out of the top of the server to overhead cable raceways, eliminating both on-floor and under-floor cable clutter.

Note: If you elect to use top exit cabling on a **non-raised floor**, your server will be configured for **both** top exit I/O and top exit power cord. If you elect to keep the power cord on the floor, your I/O cabling must also exit onto the floor.

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

Physical dimensions

Frame-Cover Combination	Width mm (in)	Depth mm (in)	Height mm (in)
Frame A w/o covers	750 (29.5)	1273 (50.1)	2015 (79.3)
Frame A w/covers	785 (30.9)	1584 (62.0)	2027 (79.8)
Frame A w/covers and top exit I/O towers	937 (36.9)	1584 (62.0)	2153 (84.8)

Shipping specifications

z114 servers are shipped two ways:

- Packaged systems are protected with an antistatic poly bag and heavy cardboard and roll on their own casters. This packaging is used only in the 48 contiguous United States.
- Crated systems are protected with wooden shipping boxes and are mounted on pallets requiring commercial lift transportation. This packaging is used for all servers shipped anywhere except the 48 contiguous United States.

Height reduction - FC 9975

If you have doorways with openings less than 2032 mm (80.0 in) high, you should order Feature Code 9975. This feature reduces the frame height to 1809 mm (71.2 in). The top portion of the frames are shipped in a separate carton, as are the frame side covers.

Internal battery - FC 3212

If you ordered Feature Code 3212, the internal batteries are shipped **uninstalled**.

Packaging Specifications

Packaged frame	Width mm (in)	Depth mm (in)	Height mm (in)	Max Weight kg (lb)
Packaged frame A	822 (32.4)	1306 (51.4)	2027 (79.8)	953 (2100)
Crated frame	**Width mm (in)**	**Depth mm (in)**	**Height mm (in)**	**Max Weight kg (lb)**
Crated frame A	927 (36.5)	1410 (55.5)	2225 (87.6)	1225 (2700)

Cover set	Width mm (in)	Depth mm (in)	Height mm (in)	Weight kg (lb)
Frame A	997 (39.3)	610 (24.0)	2248 (88.5)	31.8 (70)

Top exit I/O towers	Width mm (in)	Depth mm (in)	Height mm (in)	Weight kg (lb)
Frame A	666.85 (26.3)	571.5 (22.5)	2133.6 (84.0)	86.2 (190.0)

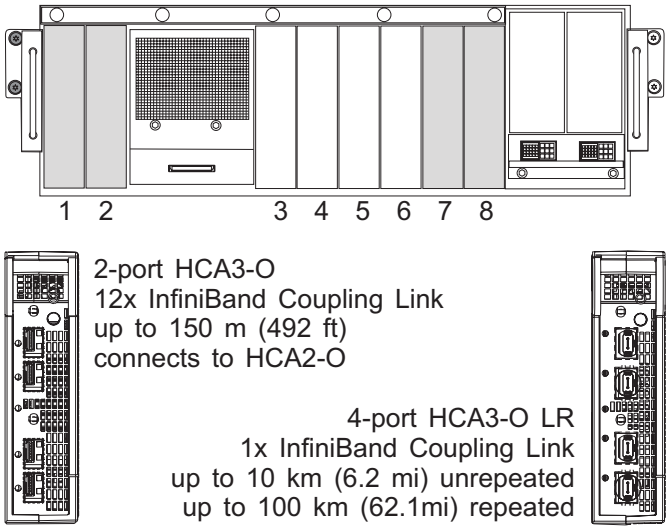
Important:

The z114 is comprised of some of the most sophisticated and complex electronic equipment ever integrated into one computer. As such, this hardware needs to be protected from negative environmental impacts to ensure the utmost reliability. One of the key factors affecting this reliability is moving the system from the loading dock into the controlled environment of your computer room on the day it is delivered.

To ensure that optimum environmental conditions are maintained, work with your marketing representative to schedule the delivery at a time when you can transport the system components from the point of delivery to the computer room destination without unnecessary delay. Prompt handling upon arrival will prevent any possibility of a problem caused by exposure to temperature extremes, severe weather, or high humidity.

z114 models

There are two models of the z114 server: M05 and M10. 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 the Feature Code table on the next page.



Note:

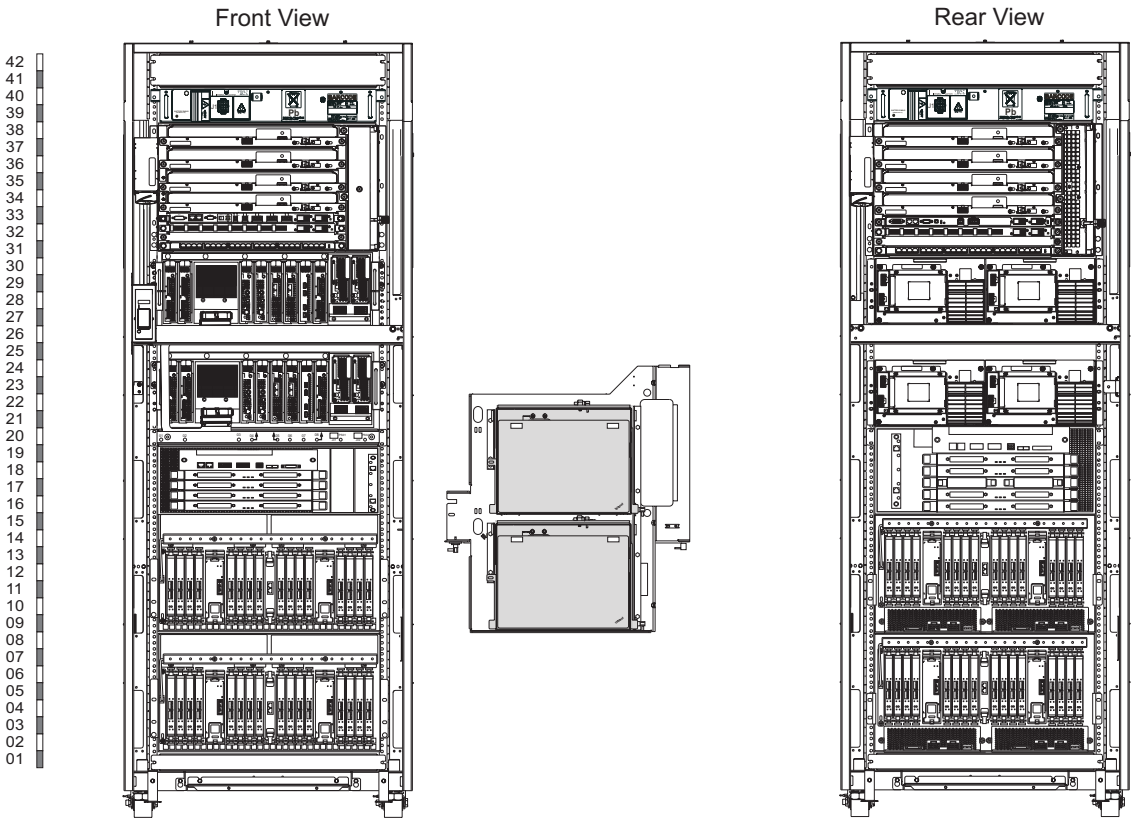
1. InfiniBand copper cables are used to connect I/O drawers to the processor.
2. PCIe cables are used to connect PCIe I/O drawers to the processor.
3. InfiniBand coupling cables, InfiniBand copper cables, and PCIe cables can be installed in slots 1, 2, 7, and 8 in the illustration above. The remaining slots are unavailable for I/O or coupling cable connections.

Feature Code	Drawer Type	Description	CPC I/O Connectors
FC 1135 (Model **M05**)	CPC	• 1 CPC drawer • 0-5 CPs • 0-5 IFLs/unassigned IFLs • 0-2 zAAPs • 0-2 zIIPs • 0-5 ICFs • 2 standard SAPs • 0-2 additional SAPs • 0 - spares	• 0 - 16 InfiniBand HCA3-O LR 1x InfiniBand links • 0 - 8 InfiniBand HCA3-O 12x InfiniBand links • 0-8 PCIe I/O drawer cable connections • 0-8 InfiniBand copper I/O drawer cable connections
FC 1136 (Model **M10**)	CPC	• 2 CPC drawers • 0-5 CPs • 0-10 IFLs/unassigned IFLs • 0-5 zAAPs • 0-5 zIIPs • 0-10 ICFs • 2 standard SAPs • 0-2 additional SAPs • 2 - spares	• 0 - 32 InfiniBand HCA3-O LR 1x InfiniBand links • 0 - 16 InfiniBand HCA3-O 12x InfiniBand links • 0-16 PCIe I/O drawer cable connections • 0-16 InfiniBand copper I/O drawer cable connections
FC 3212	1 pair of batteries	• Internal Battery Feature	
Note: 1. CP - Central Processor 2. SAP - System Assist Processor 3. IFL - Integrated Facilities for Linux 4. ICF - Integrated Coupling Facility 5. zAAP - System z Application Assist Processor 6. zIIP - System z Integrated Information Processor			

Additionally, as shown below:

- Internal batteries (for emergency backup power) are placed in the top most position in the A frame
- The system processor is located in the Central Processor Complex (CPC) drawer(s).
- The system power supply is contained in the top of the frame, below the battery positions.
- Input/Output features are installed in Input/Output (I/O) drawers. These I/O drawers are placed below and above the processor drawer.

Note: Because the second processor drawer is installed **above** the first processor, if this is a Model 10, I/O drawers can only be placed **below** the processor drawers.



System upgrades

Any model of 2096 (System z9® BC) or 2098 (System z10™ BC) is upgradeable to any model of z114. All upgrades from previous systems will be accomplished by removing the old system (z9 BC or System z10 BC) and replacing it with a new one (z114).

Differences between IBM servers

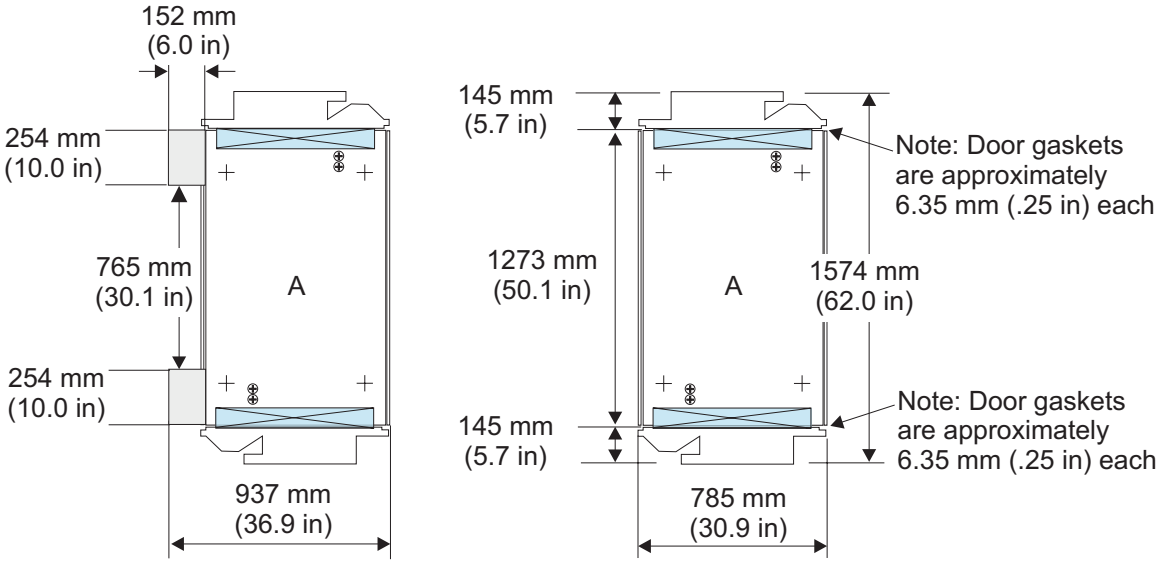
Comparison information is provided here for those who may be placing a z114 on a raised floor with previous IBM single-frame servers.

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)	1027 kg (2263 lbs)

All of these servers always consist of one frame.

If you are replacing an existing IBM server, refer carefully to the *zEnterprise 114 Installation Manual for Physical Planning* (available on the Resource Link web site) to determine actual differences between your installed IBM server and the z114. Plan views, physical dimensions, service clearances, aisle spacing, and power and cooling requirements may be substantially different.

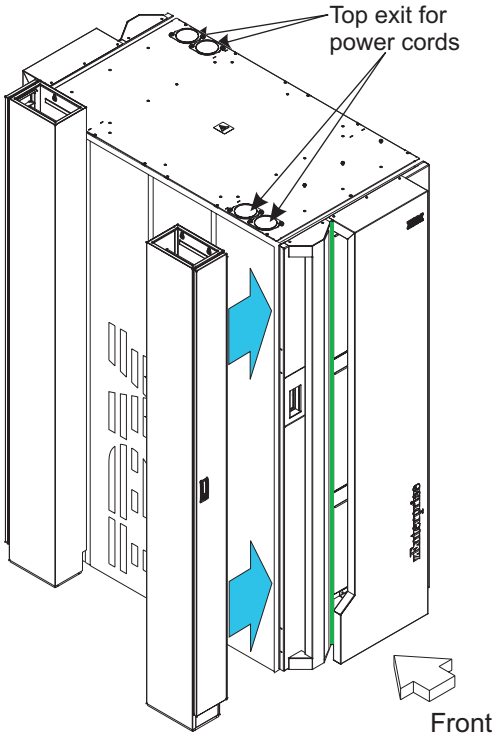
Plan view



Frame Entry/Exit	Dimension	
	(mm)	(in)
Front Rear	94 x 655 94 x 655	3.7 x 25.8 3.7 x 25.8

The plan view on the left shows the additional width required for top exit I/O cabling towers, FC 7920.

Note: For installations planning to use top exit power cords, the frame openings for these cords are on the top of the left front and right rear corners of the frame.



Weight distribution

The following table shows weights and dimensions used to calculate floor loading for the z114. All floor loading calculations are intended for a raised floor environment.

Table 3. Floor loading information - Model M05

Maximum	A Frame - Model M05
Weight kg (lbs)	847 (1867)
Width mm (in)	785 (30.9)
Depth mm (in)	1273 (50.1)

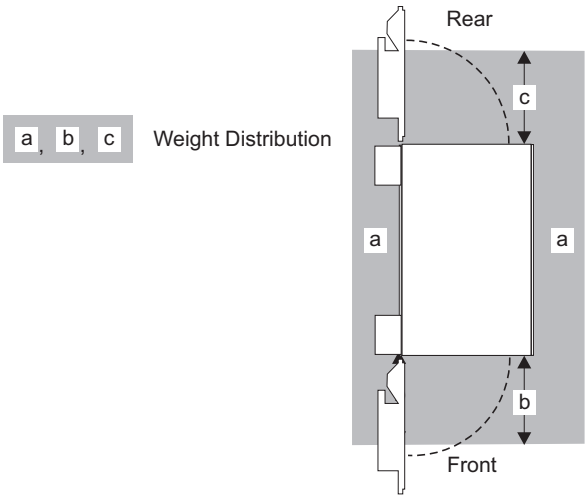
Table 4. Floor loading information - Model M10

Maximum	A Frame - Model M10
Weight kg (lbs)	946 (2086)
Width mm (in)	785 (30.9)
Depth mm (in)	1273 (50.1)

Notes:

1. Weight includes covers. Width and depth are indicated without covers.
2. Internal battery (FC 3212) adds approximately 103 kg (226 lbs).
3. The optional top exit I/O cabling towers add approximately 43 kg (95 lbs) to the server weight, 152 mm (6 in) to the width, and 117 mm (4.7) to the height.
4. Balanced power (FC 3002) adds approximately 51 kg (112 lbs).

The following figure and table show sample floor loading values for the z114 server with and without the Internal Battery Feature (3212).



For the floor loading specifications in the following two tables, the numbers given are for a z114 Model M10 (two processor drawers, FC 1136) with Integrated Batteries (FC 3212) installed and using the 3-phase Balanced Power (FC 3003) option.

The weight of this server is 1099.5 kg (2424 lbs).

Table 5. Floor loading for servers **without** *top exit I/O FC 7920*

Example #	'a' (sides) mm (in)	'b' (front) mm (in)	'c' (rear) mm (in)	Floor Load kg/m^2 (lbs/ft^2)
1	25 (1.0)	254 (10.0)	254 (10.0)	846.44 (173.36)
2	25 (1.0)	508 (20.0)	508 (20.0)	686.33 (140.57)
3	25 (1.0)	762 (30.0)	762 (30.0)	584.38 (119.69)
4	254 (10.0)	254 (10.0)	254 (10.0)	583.78 (119.57)
5	254 (10.0)	508 (20.0)	508 (20.0)	481.96 (98.71)
6	254 (10.0)	762 (30.0)	762 (30.0)	417.13 (85.44)
7	508 (20.0)	254 (10.0)	254 (10.0)	451.81 (92.54)
8	508 (20.0)	508 (20.0)	508 (20.0)	379.28 (77.68)
9	508 (20.0)	762 (30.0)	762 (30.0)	333.10 (68.22)
10	762 (30.0)	254 (10.0)	254 (10.0)	378.80 (77.59)
11	762 (30.0)	508 (20.0)	508 (20.0)	322.48 (66.05)
12	762 (30.0)	762 (30.0)	762 (30.0)	286.61 (58.70)

The weight of this server is 1142.6 kg (2519 lbs).

Table 6. Floor loading for servers **with** *top exit I/O FC 7920*

Example #	'a' (sides) mm (in)	'b' (front) mm (in)	'c' (rear) mm (in)	Floor Load kg/m^2 (lbs/ft^2)
1	25 (1.0)	254 (10.0)	254 (10.0)	N/A
2	25 (1.0)	508 (20.0)	508 (20.0)	N/A
3	25 (1.0)	762 (30.0)	762 (30.0)	N/A
4	254 (10.0)	254 (10.0)	254 (10.0)	603.02 (123.51)
5	254 (10.0)	508 (20.0)	508 (20.0)	496.93 (101.78)
6	254 (10.0)	762 (30.0)	762 (30.0)	429.38 (87.94)
7	508 (20.0)	254 (10.0)	254 (10.0)	465.51 (95.34)
8	508 (20.0)	508 (20.0)	508 (20.0)	389.94 (79.87)
9	508 (20.0)	762 (30.0)	762 (30.0)	341.82 (70.01)
10	762 (30.0)	254 (10.0)	254 (10.0)	389.44 (79.76)
11	762 (30.0)	508 (20.0)	508 (20.0)	330.75 (67.74)
12	762 (30.0)	762 (30.0)	762 (30.0)	293.39 (60.09)
Note: Rows 1-3 are **N/A** because frame-to-frame spacing must be at least 152 mm (5.5 in) with top exit cable towers installed.				

All measurements are taken from the outside edge of the machine frame, without covers, unless specifically described otherwise.

Minimum weight distribution is shown in the shaded area of Figure 1 on page 29.

- “a” = side dimension
- “b” = front dimension
- “c” = rear dimension

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 **991 mm (39 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 **991 mm (39 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.

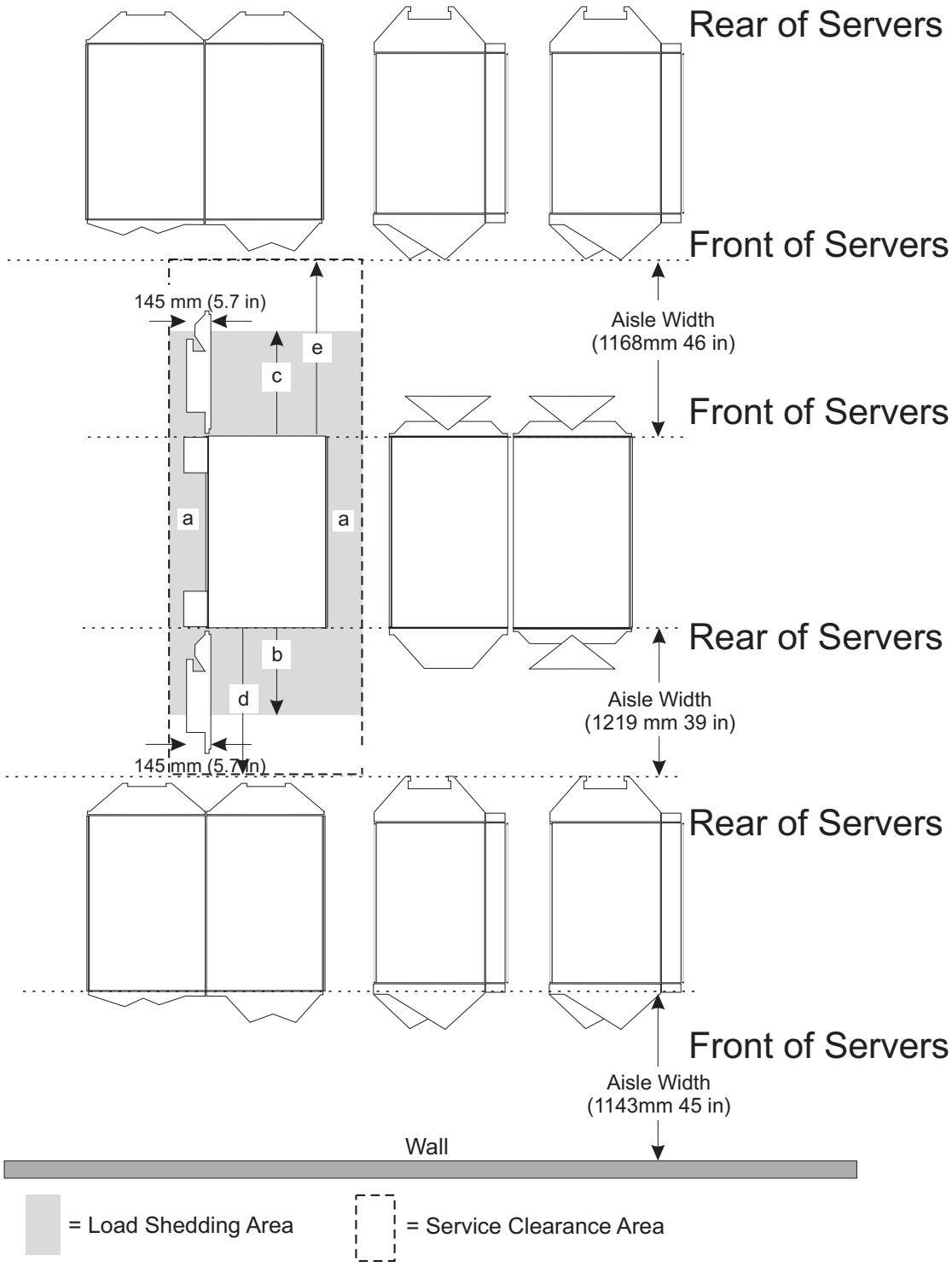


Figure 1. Aisle and service clearances

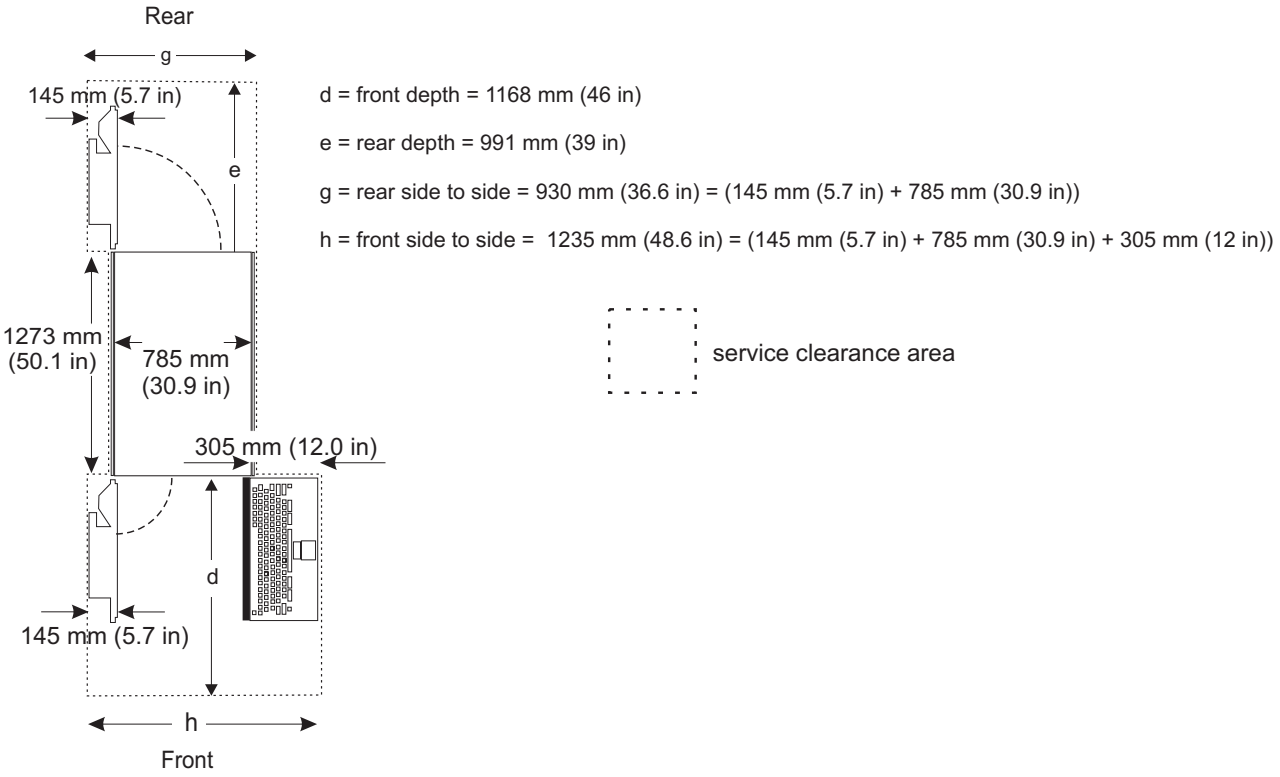
Machine and service clearance areas

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 covers for service access to the system.

Number of frames	Machine area M² (ft²)	Service clearance area M² (ft²)
1 (A)	1.23 (13.2) without I/O towers	front service clearance = 1.43 (15.53) machine area without doors and without I/O towers = 0.9 (10.75) rear service clearance = 0.93 (9.92)
1 (A)	1.47 (15.8) with I/O towers	front service clearance = 1.46 (15.62) machine area without doors and without I/O towers = 1.19 (12.84) rear service clearance = 0.93 (10.00)

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.
3. The I/O top exit towers, FC 7920, are **optional**. Service clearance is **not shown** for these towers.



The front and rear doors access all of the serviceable area in the z114 server. 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 2 on page 31.)

- The left side cover of the A frame cannot be placed adjacent to a wall because of the front and back doors. The right side cover of the A frame cannot be placed adjacent to a wall because of the Support Element gate (Example **A**), but can be positioned next to obstacles such as poles or columns (Example **B**).
- The front cover on frame A opens 145 mm (5.7 in) wider than the width of the frame plus side cover (Example **C**). The Support Element gate on frame A opens 305 mm (12 in) wider than the width of the frame plus side cover (Example **D**).

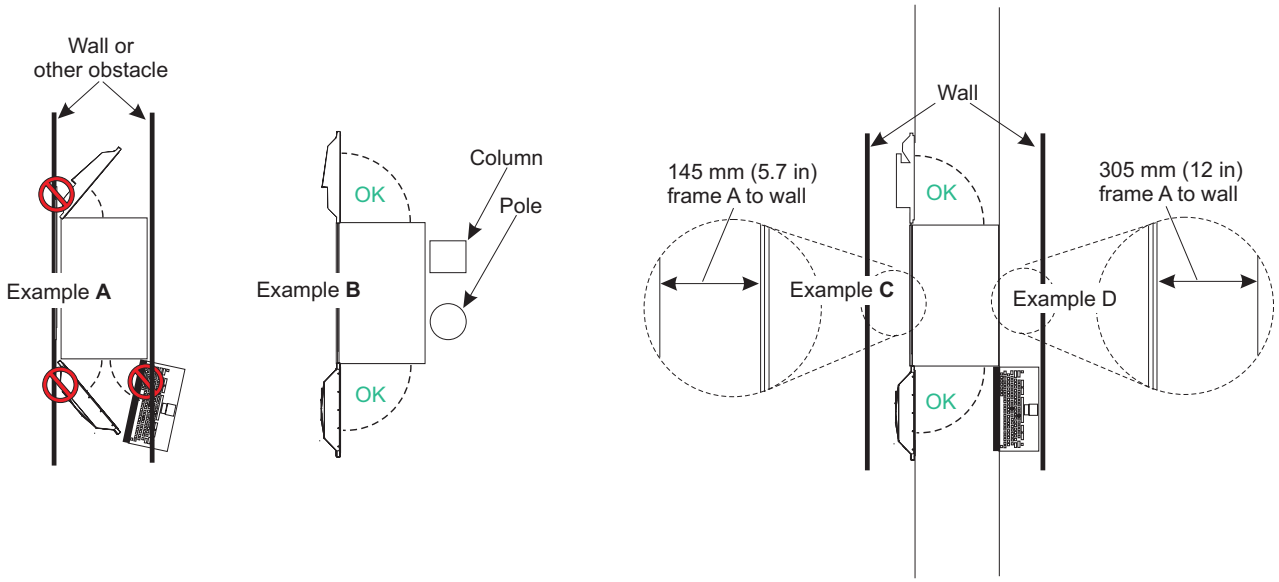


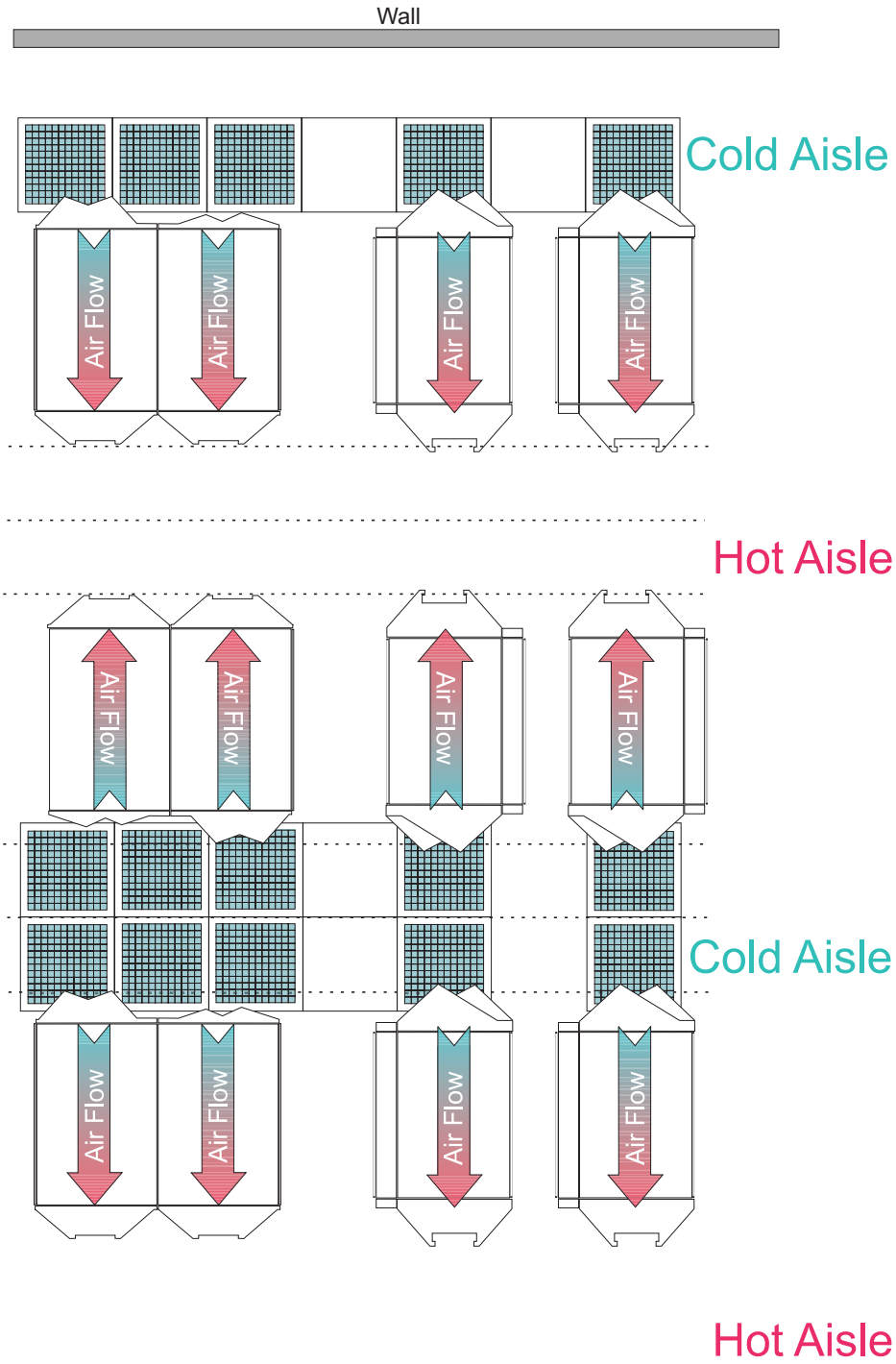
Figure 2. Detailed service clearances

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 z114 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.


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 chart and tables show how much cooling airflow is recommended for the z114.

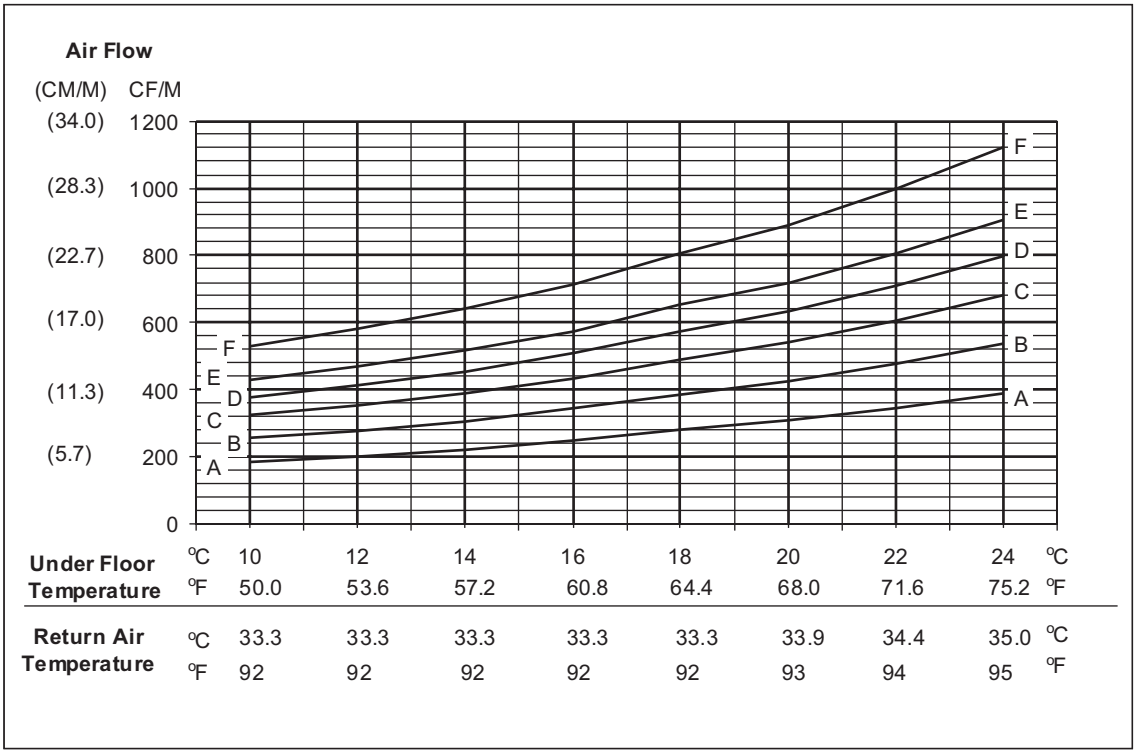


Table 7. Cooling airflow graph codes- Model M05

M05 configurations	Airflow curve from chart
0 I/O drawers	A
1 FC 4000 I/O drawer	A
2 FC 4000 I/O drawers	B
3 FC 4000 I/O drawers	C
4 FC 4000 I/O drawers	D
1 FC 4000 I/O drawer and 1 FC 4003 PCIe I/O drawer	C
2 FC 4000 I/O drawers and 1 FC 4003 PCIe I/O drawer	D
1 FC 4003 PCIe I/O drawer	B
2 FC 4003 PCIe I/O drawers	D
Note: FC 4000 = I/O drawer, FC 4003 = PCIe I/O drawer	

Table 8. Cooling airflow graph codes- Model M10

M10 configurations	Airflow curve from chart
0 I/O drawers	A
1 FC 4000 I/O drawer	B
2 FC 4000 I/O drawers	C
3 FC 4000 I/O drawers	D
1 FC 4000 I/O drawer and 1 FC 4003 PCIe I/O drawer	D
2 FC 4000 I/O drawers and 1 FC 4003 PCIe I/O drawer	E
1 FC 4000 I/O drawer and 2 FC 4003 PCIe I/O drawers	F
1 FC 4003 PCIe I/O drawer	C
2 FC 4003 PCIe I/O drawers	E
Note: FC 4000 = I/O drawer, FC 4003 = PCIe I/O drawer	

The values in the chart above are for a typical computer room environment:

- Room inlet air = 24ºC
- Customer water inlet = 17ºC
- Altitude = up to 457 meters (1500 feet) above sea level.

Considerations for multiple system installations

When integrating a z114 into an existing multiple-system environment, or when adding additional systems to an installed z114, consider the following factors:

- **Thermal interactions**

  Although computer room floor space is valuable, for optimal cooling, it is recommended that z114 BCs have a 1220 mm (48 in) aisle between rows of systems to reduce surrounding air temperature. See "Cooling recommendations for the room" on page 32.

- **Floor placement**

  The z114 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

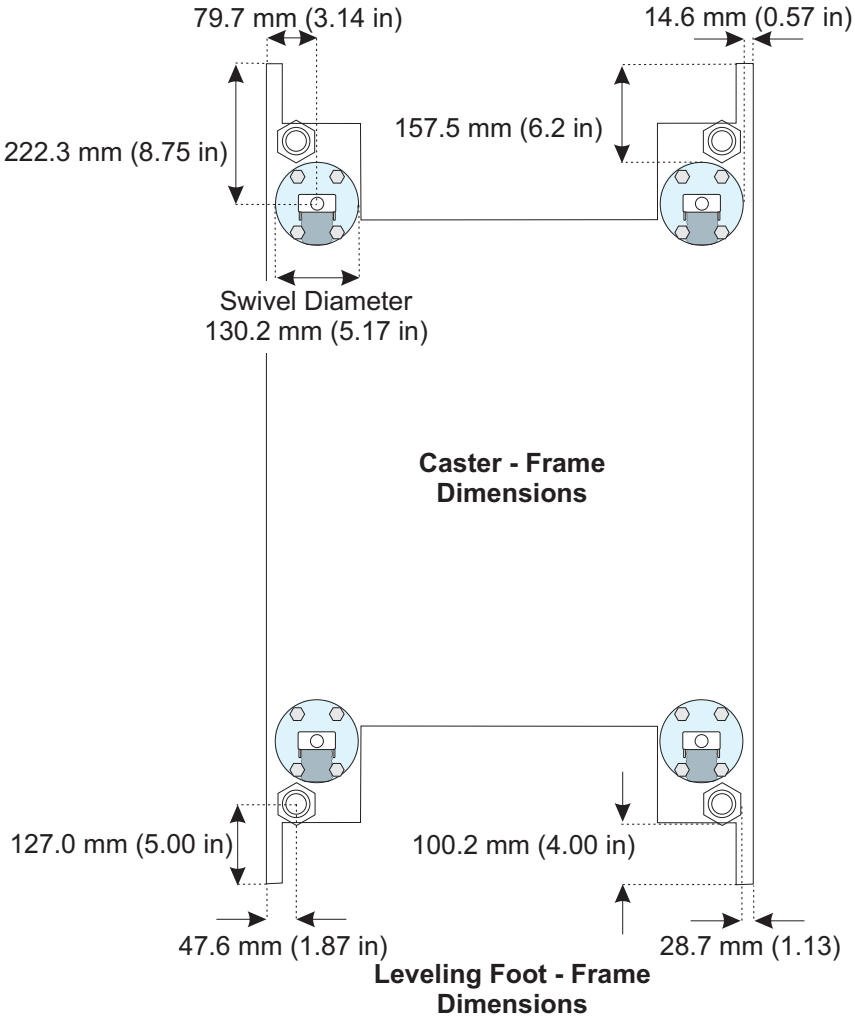
This chapter provides recommendations and requirements for making the necessary openings in the raised floor for installation.

The drawings on the following pages are intended only to show relative positions and accurate dimensions of floor cutouts. They are **not** machine templates and are **not** drawn to scale.

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.

Casters

The following illustration shows the physical dimensions around the casters. When planning for both the movement and positioning of the system, be aware that each caster swivels in a circle slightly larger than 130 mm (5.1 in) in diameter. Exercise caution when working around floor cutouts.



Procedure for cutting and placement of floor panels

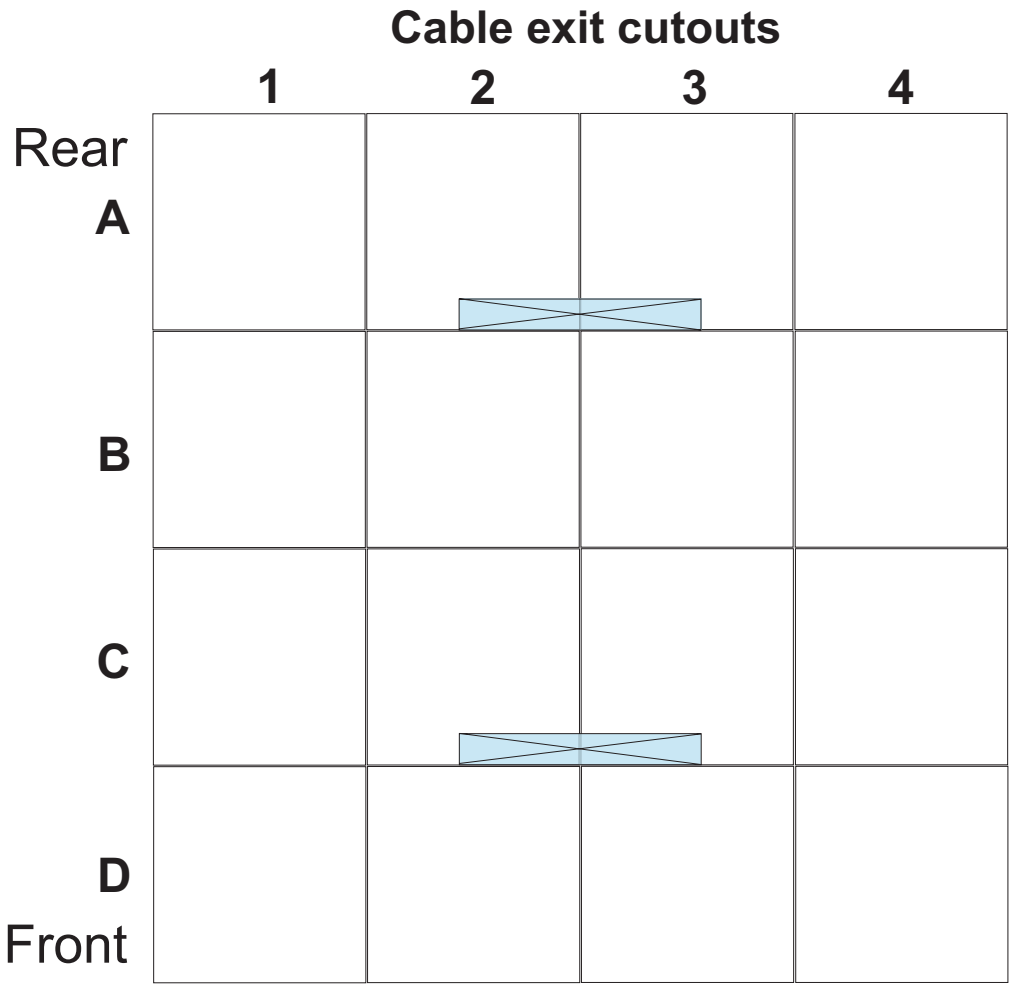
Important:

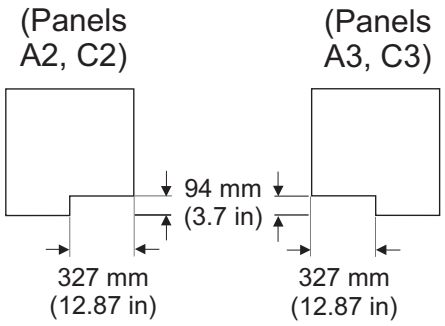
Depending on the floor panel type, additional panel supports (pedestals) may be necessary to maintain the structural integrity of an uncut panel, or to restore the integrity of a cut floor panel.

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

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. You will need two **uncut** floor tiles to temporarily replace A2 and A3 during the physical placement of the frames. After frame placement, the uncut tiles can be removed and the cut tiles for A2 and A3 replaced in the floor.

Raised floor with 610 mm (24 in) or 600 mm (23.5 in) floor panels



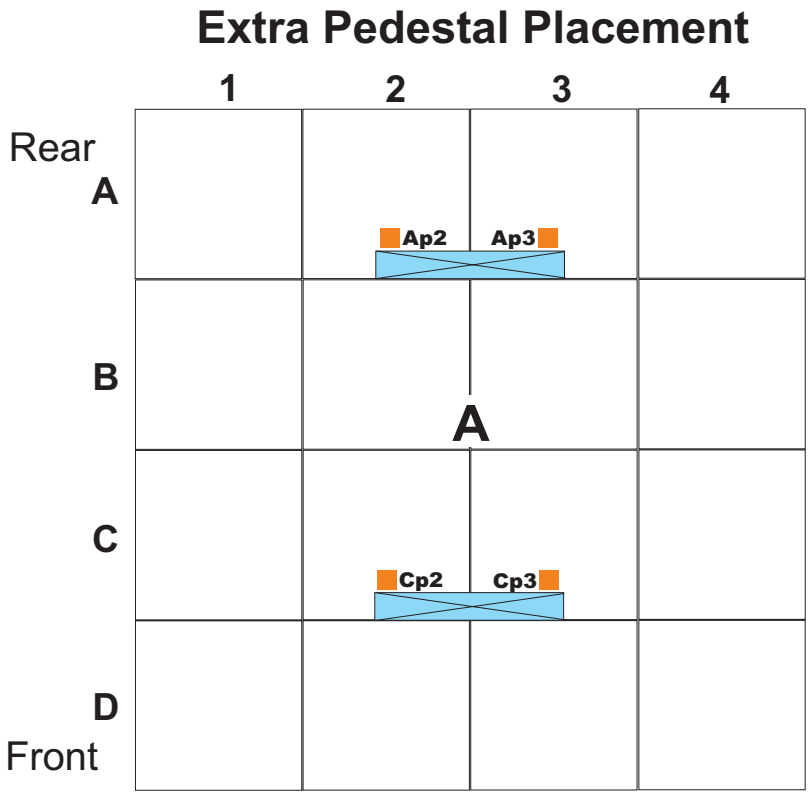


Frame Entry/Exit	Dimension	
	(mm)	(in)
Front	94 x 655	3.7 x 25.8
Rear	94 x 655	3.7 x 25.8

Important:

Extra pedestals may be placed as shown below.

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.

Chapter 5. Power requirements

General requirements

1. **Two** identical three-phase feeds to the A frame - one to the front, one to the rear, **OR** two identical single phase feeds to the A frame - one to the front, one to the rear.

   Note: Refer to the Appendix D, "Dual power installation," on page 95 for the correct wiring method for your particular power distribution equipment.
2. One single-phase feed for customer-supplied service outlets for the Hardware Management Console and its modem.

The z114 requires 3 customer power feeds:

The service outlets require standard 100V to 130V or 200V to 240V, 50/60Hz, single-phase power.

z114 operates with:

- 50/60Hz AC power
- Voltages ranging from 200V to 480V
- Three-phase or single phase wiring

Important power selection considerations

As you select features for your z114 server, be aware of the following when choosing server power:

- If you choose single phase power, reference Table 9 on page 45 for the Model M05 z114 or Table 10 on page 46 for the Model M10 to see which I/O drawer configurations are compatible.
- If you choose single phase power, you will have unbalanced power.
- If you choose three phase power, you may have either balanced or unbalanced power, depending on server configuration.
  - Standard: The machine has only 1 BPR installed, no matter what the model or configuration is. The power result is always **Unbalanced A**.
  - Balanced Power Plan Ahead, FC 3003: adds two more Bulk Power Regulators. With 3 BPRs, the power result is always **Balanced**.

Power installation considerations

z114 operates from two fully-redundant power supplies. These redundant power supplies each have their own line cord, allowing the system to survive the loss of customer power to either line cord. If power is interrupted to one of the power supplies, the other power supply will pick up the entire load and the system will continue to operate without interruption. Therefore the line cord for each power supply must be wired to support the entire power load of the system.

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

For the most reliable availability, the line cords in the front (A) and the rear (B) of the A frame should be powered from different PDUs. The A line cord exits the front of the A frame and should be connected to one PDU. The B line cord exits the rear of the A frame and should be connected to a different PDU than the A line cord.

See Appendix D, "Dual power installation," on page 95 for examples of typical redundant wiring facilities.

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.

The utility current distribution across the phase conductors (phase current balance) depends on the system configuration. Each front end power supply is provided with phase switching redundancy. The loss of an input phase is detected and the total input current is switched to the remaining phase pair without any power interruption. Depending on the configuration input power draw, the system can run from several minutes to indefinitely in this condition. Since most single phase losses are transients which recover in seconds, this redundancy provides protection against virtually all single phase outages.

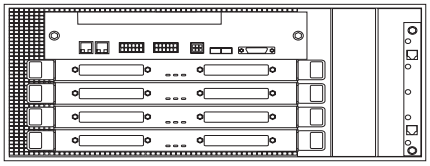
Supply type	Nominal voltage range (V)	Voltage tolerance (V)	Frequency range (Hz)
Two redundant 3-phase line cords	200-480	180-509	47-63
Two redundant single -phase line cords	200-415	180-440	47-63
Two redundant DC line cords	380-520	330-550	N/A

Source type	Frequency	Input voltage range (V)	Rated input current (A)
Single or Three-phase power	50/60 Hz	200 - 240V	24A
Single or Three-phase power	50/60 Hz	380 - 415V	16A
Three-phase power	50/60 Hz	480V	14A
DC	N/A	380 - 520V	24A

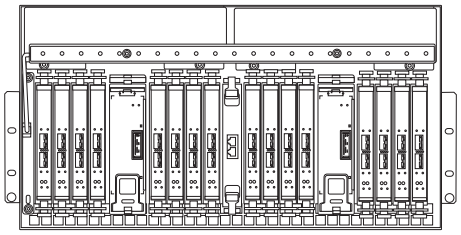
Power specifications

The following tables provide system power consumption/heat load based on the number of processor drawers and number of I/O drawers of both types with maximum configurations.

I/O drawer



PCIe I/O drawer



Power is shown as maximum values for worst case I/O configurations. Your actual power usage will be something less than shown here.

Table 9. Utility power consumption for z114 Model M05 (1 processor drawer)

I/O compliment	Environment 1 (kW)	Environment 2 (kW)	Environment 3 (kW)
0 I/O drawers	1.53	1.86	1.87
1 I/O drawer	2.35	2.77	2.92
1 PCIe I/O drawer	3.05	3.48	3.53
2 I/O drawers	3.25	3.69	3.97
1 I/O drawer + 1 PCIe I/O drawer	3.92	4.42	4.61
3 I/O drawers	4.13	4.62	5.06
2 PCIe I/O drawers	4.59	5.09	5.17
2 I/O drawers + 1 PCIe I/O drawer	4.79	5.30	5.63
4 I/O drawers	4.98	5.51	6.09

Notes:

1. Environmental conditions:
   - Environment 1 = ambient room temperature of 28º C, and altitude of 3000 ft or less above sea level.
   - Environment 2 = ambient room temperature of 28º C, and altitude of 3000 ft to 6000 ft above sea level.
   - Environment 3 = ambient room temperature of 28º C, and altitude of 6000 ft or more above sea level.
2. Three phase input power is available on all configurations.
3. A balanced three phase option is available by adding two BPRs per side. Available for all configurations.
4. DC input power is available on all configurations. There is no balanced power option for DC input.
5. Single phase input power is available on the shaded configurations shown above. There is no balanced power option for single phase input power.

Table 10. Utility power consumption for z114 Model M10 (2 processor drawers)

I/O compliment	Environment 1 (kW)	Environment 2 (kW)	Environment 3 (kW)
0 I/O drawers	2.15	2.77	2.74
1 I/O drawer	3.05	3.69	3.80
1 PCIe I/O drawer	3.73	4.40	4.41
2 I/O drawers	3.92	4.62	4.87
1 I/O drawer + 1 PCIe I/O drawer	4.62	5.34	5.49
3 I/O drawers	4.82	5.55	5.95
2 PCIe I/O drawers	5.24	5.97	6.02
2 I/O drawers + 1 PCIe I/O drawer	5.48	6.23	6.53
1 I/O drawer + 2 PCIe I/O drawers	6.14	6.92	7.11

Notes:

1. Environmental conditions:
   - Environment 1 = ambient room temperature of 28º C, and altitude of 3000 ft or less above sea level.
   - Environment 2 = ambient room temperature of 28º C, and altitude of 3000 ft to 6000 ft above sea level.
   - Environment 3 = ambient room temperature of 28º C, and altitude of 6000 ft or more above sea level.
2. Three phase input power is available on all configurations.
3. A balanced three phase option is available by adding two BPRs per side. Available for all configurations.
4. DC input power is available on all configurations. There is no balanced power option for DC input.
5. Single phase input power is available on the shaded configurations shown above. There is no balanced power option for single phase input power.

Power estimation tool

The Power estimator tool for z114 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 configuration.

Log on to Resource Link with any userid. Navigate to **Planning**, then to **Tools**, then to **Power Estimation Tools**. 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 Monitor task for current and historical power consumption.

Power capping

z114 supports power capping which gives the customer the ability to limit the maximum power consumption and reduce cooling requirements (especially with zBx). To use power capping, FC 0020, Automate Firmware Suite, must be ordered. This feature is used to enable the Automate suite of functionality associated with the IBM zEnterprise Unified Resource Manager. The Automate suite includes representation of resources in a workload context, goal-oriented monitoring and management of resources, and energy management. The Automate suite is included in the base zCPC at no charge for CPs, zIIPs, and zAAPs.

Customer circuit breakers

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

Input Voltage Range (V)	System Rated Current (A)	Circuit Breaker
200 - 240V	24A	30 amps
380 - 415V	16A	16 amps
480V	14A	20 amps
380 - 520VDC	24A	30A DC/32A DC W/T

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: System z server design incorporates Electromagnetic Interference filter capacitors required to block electrical noise from penetrating the power grid. A characteristic of filter capacitors, during normal operation, is high leakage currents. Depending on the server configuration, this leakage current can reach 350mA (350 milliamps). For most reliable operation, **Ground Fault Circuit Interrupter (GFCI), Earth Leakage Circuit Breaker (ELCB) or Residual Current Circuit Breaker (RCCB) type circuit breakers are not recommended for use with System z servers.** By internal design and grounding, System z servers are fully certified for safe operation (compliance with IEC, EN, UL, CSA 60950-1).

However, if leakage detection circuit breakers are required by local electrical practice, **the breakers should be sized for a leakage current rating not less than 500mA** in order to reduce the risk of server outage caused by erroneous and spurious tripping.

Internal battery feature (FC 3212)

The Internal Battery Feature (IBF), FC 3212, is optional on the z114. In the event of input power interruption to the system, the internal battery feature will provide sustained system operation for the times listed in the following table.

Table 11. Battery hold-up times for Model M05

Model M05 - 1 CPC drawer	hold-up time (minutes)
0 I/O drawers	**33**
1 I/O drawer	**19**
1 PCIe I/O drawer	**13**
2 I/O drawers	**11**
1 I/O drawer and 1 PCIe I/O drawer	**10**
3 I/O drawers	**9.2**
2 PCIe I/O drawers	**9.2**
2 I/O drawers and 1 PCIe I/O drawer	**8**
4 I/O drawers	**7.3**

Notes:

1. The numbers shown are approximate for 70° F, batteries no older than 3 years, and full N+1 power (both power supplies in operation).
2. Hold-up times are influenced by temperature, battery age, and fault conditions within the system.

Table 12. Battery hold-up times for Model M10

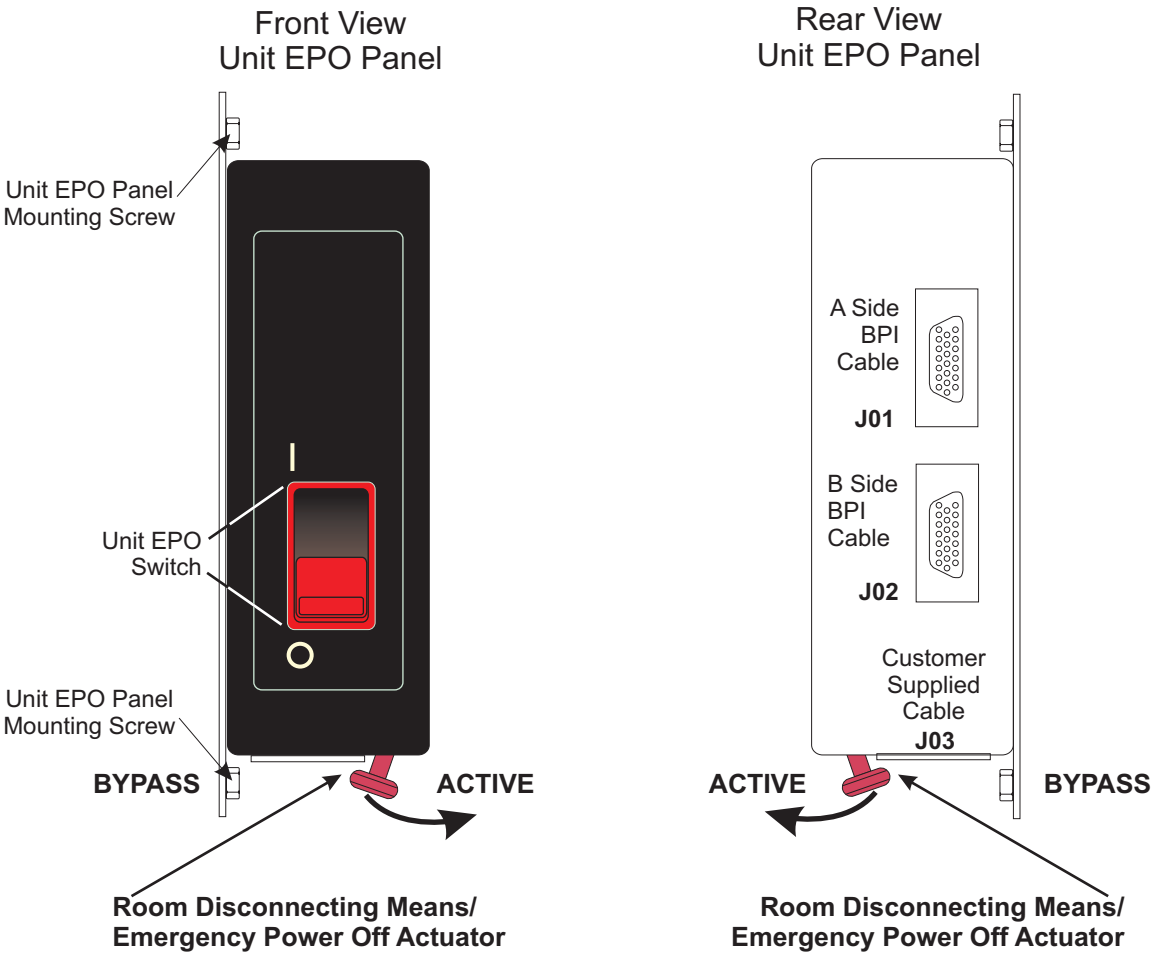
Model M10 - 2 CPC drawers	hold-up time (minutes)
0 I/O drawers	**20**
1 I/O drawer	**12**
1 PCIe I/O drawer	**10.5**
2 I/O drawers	**9.5**
1 I/O drawer and 1 PCIe I/O drawer	**8.5**
3 I/O drawers	**7**
2 PCIe I/O drawers	**7**
2 I/O drawers and 1 PCIe I/O drawer	**6**
1 I/O drawer and 2 PCIe I/O drawers	**5.3**

Notes:

1. The numbers shown are approximate for 70° F, batteries no older than 3 years, and full N+1 power (both power supplies in operation).
2. Hold-up times are influenced by temperature, battery age, and fault conditions within the system.

Unit emergency power off (UEPO)

There is a unit emergency power off (UEPO) switch on the front of the primary frame (A Frame) of each system. When tripped, the UEPO switch will immediately disconnect utility and battery power from the machine functional unit. Utility power is confined to the machine power compartment. All volatile data will be lost.

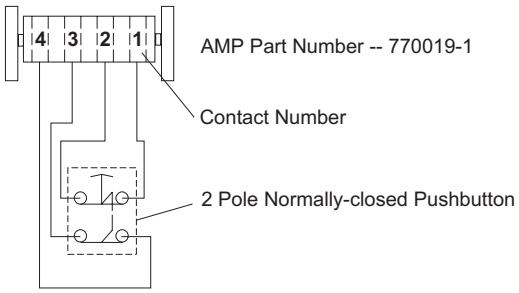


This figure illustrates the back of the machine UEPO panel showing where the room electrical power disconnecting means, or room Emergency Power Off, EPO, cable plugs into the machine. Notice the switch actuator. Once moved to make the cable connection possible, the room disconnecting means / EPO cable must be installed for the machine to power on.

Computer room emergency power off (EPO)

When the internal battery backup feature is installed and the room disconnecting means / EPO is tripped, the batteries will engage and the computer will continue to run. It is possible to attach the computer room disconnecting means / EPO system to the machine UEPO switch. When this is done, tripping the room disconnecting means / EPO will disconnect all power from the line cords and the internal battery backup unit. In this event all volatile data will be lost.

To incorporate the IBF into the room disconnecting means / Emergency Power Off (EPO) systems, a cable must be made to connect to the back of the system UEPO panel. The following diagram illustrates how this connection is made.



Room UEPO Switch Schematic

In this figure an AMP connector 770019-1 is needed to connect to the system UEPO panel. For room disconnecting means / EPO cables using wire sizes #20 AWG to #24 AWG use AMP pins part number 770010-4. The permissible resistance of the customer connection is 5 Ohms Maximum (~200' of #24 AWG).

Grounding specifications

Every three-phase circuit must contain three-phase conductors and an insulated equipment-grounding conductor. 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. IBM recommends that the ground wire be the same size as the phase conductor wires.

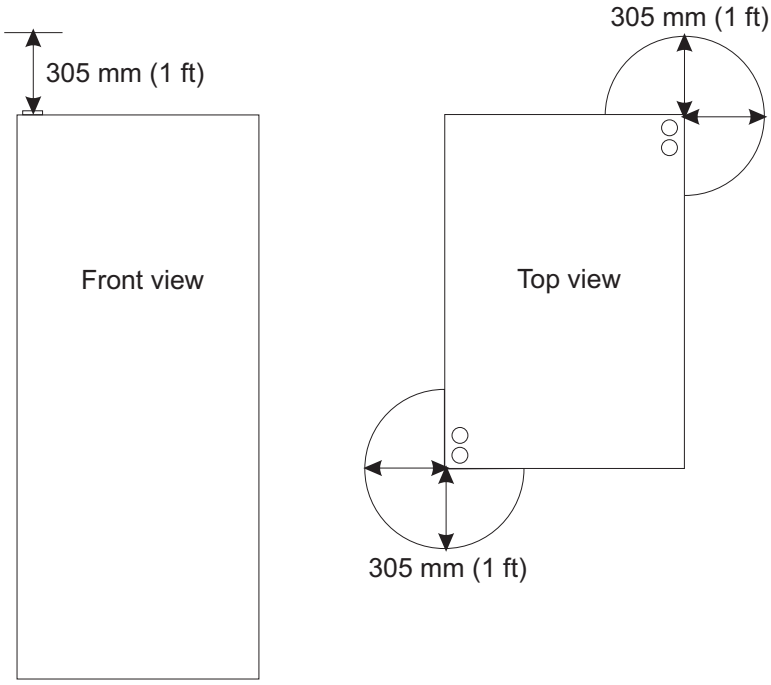
Conduit must not be used as the only grounding means. However, any conduit or cable shield must be connected at both ends in such a way that it is included in the grounding path in parallel with the grounding conductor it contains. Most electrical codes require that branch circuit wiring be located in 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.

There is information about additional recommendations and requirements for equipment grounding on IBM's **Resource Link**Web site (http://www.ibm.com/servers/resourcelink). See "**General Information for Planning a Physical Site**".

Top exit power cords

The z114 has the option of top exit cabling (FC 7901). This includes the power cords. There are several power cord options specifically made for top exit, and you must choose one of these if you wish to have the power cords exit through the top of the server. The top exit power cords are manufactured with additional hardware that mounts the cord to the frame of the machine and provides an EMC seal at the same time.

If you are planning for top exit power cords, 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.



For power cord top exit, choose from the following power cord feature codes: 8969, 8970, 8971, 8972, 8973, 8974, and 8975.

Power plugs, receptacles, and line cord wire specifications

Plugs are shipped with the machine line cords in USA and Canada. Power cords that exit the bottom of the frame are 4250 mm (14 ft.). Top exit power cords are 1829 mm (6 ft). Power plugs in the following table 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.

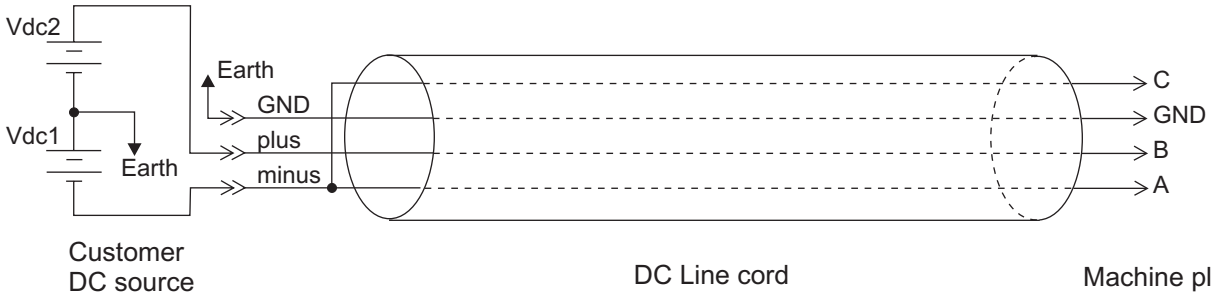
For countries that require other types of plugs or receptacles, the system is shipped without plugs on the line cords, and you are responsible for supplying and installing both plugs and receptacles.

Important:

There are **five** wires inside the cut cord 3-phase cable. There are the three phase wires, one ground wire and there a is fifth, small diameter wire, connected to the cable shield, that acts as a drain. This drain wire must be connected to the **cable ground, NOT neutral**.

DC power cord

The DC power cord is illustrated below.



The DC feed is on the **B** line. The **C** and **A** lines are the DC return. The crimp between the **C** line and **A** line is internal on cords with a customer plug. For cut end cords, the **C** and **A** lines must both be tied to the negative side of the source because all four wires exit the cord body separately. Reference the following table for DC voltage information.

Table 13. Input voltage range

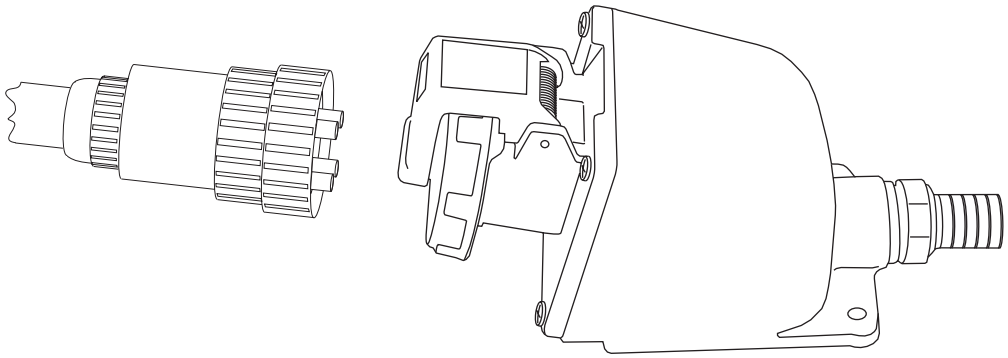
Parameter	Absolute maximum	Absolute minimum
Vdc1 + Vdc2	550V	330V
Vdc1	550V	0V
Vdc2	420V	0V

System Location	Style AWG # of wires	Watertight plug	Watertight receptacle
FC 8964 (380-520 VDC) 14 ft. cut end	Type ST #10 AWG 4 wire	(not provided - see Note 3 on page 56)	(not specified - see Note 3 on page 56)
FC 8966 (380-520 VDC) 14 ft.	Type ST #10 AWG 4 wire	30A IEC-309 (provided as part of the cord)	330R8WDC (not provided)
FC 8969 (480 VAC) 3 Phase 6 ft. top exit	Type ST #10 AWG 4 wire	30A IEC-309 (provided as part of the cord)	30A IEC-309 430 R7W (not provided)
FC 8970 (HiLo VAC) 3 Phase 14 ft. top exit cut-end	Type ST #10 AWG 4 wire	(not provided - see Note 3 on page 56)	(not specified - see Note 3 on page 56)
FC 8971 (200-240 VAC) 1 Phase 6 ft. top exit	Type ST #10 AWG 3 wire	30A IEC-309 (provided as part of the cord)	30A IEC-309 330 R6W (not provided)
FC 8972 (HiLo VAC) 1 Phase 14 ft. top exitcut-end	Type ST #10 AWG 3 wire	(not provided - see Note 3 on page 56)	(not specified - see Note 3 on page 56)
FC 8973 (380-520 VDC) 6 ft. top exit	Type ST #10 AWG 4 wire	30A IEC-309 (provided as part of the cord)	30A IEC-309 430 R9W (not provided)
FC 8974 (380-520 VDC) 14 ft. top exit cut-end	Type ST #10 AWG 4 wire	(not provided - see Note 3 on page 56)	(not specified - see Note 3 on page 56)
FC 8975 (200-240 VAC) 3 Phase 6 ft. top exit	Type ST #10 AWG 4 wire	30A IEC-309 (provided as part of the cord)	30A IEC-309 430 R9W (not provided)
FC 8983 USA, Canada, Japan, EU (480 VAC) three-phase / 14 ft.	Type DP-1 #10 AWG 4 wire	30A IEC-309 (provided as part of the cord)	30A IEC-309 430 R7W (not provided)
FC 8987 USA, Canada, Japan, EU (200-240 VAC) three-phase / 14 ft.	Type ST #10 AWG 4 wire	30A IEC-309 (provided as part of the cord)	30A IEC-309 430 R9W (not provided)
FC 8988 World Trade (HiLo VAC) three-phase / 14 ft.	Type DP-1 #10 AWG 4 wire	(not provided - see Note 3 on page 56)	(not specified - see Note 3 on page 56)
FC 8990 USA, Canada, Japan, EU (200-240 VAC) single-phase / 14 ft.	Type ST #10 AWG 3 wire	30A IEC-309 (provided as part of the cord)	30A IEC-309 330 R6W (not provided)
FC 8991 World Trade (HiLo VAC) single-phase / 14 ft.	Type DP-1 #10 AWG 3 wire	(not provided - see Note 3 on page 56)	(not specified - see Note 3 on page 56)

System Location	Style AWG # of wires	Watertight plug	Watertight receptacle
FC 8998 World Trade LSZH (HiLo VAC) three-phase / 14 ft.	Type DP1-1-LS #10 AWG 4 wire	(not provided - see Note 3)	(not specified - see Note 3)

Notes:

1. IBM continues to strongly recommend the use of 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 miswired 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.
2. 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.
3. The power cord set(s) provided are for use only with this product.
4. LSZH = low smoke, zero halogen

Wire colors for cut-end cords

Wire Number	Color	Description
Line 1	Brown	Phase 1 (labeled "PH-1" on the wire insulation
Line 2	Black	Phase 2 (labeled "PH-2" on the wire insulation
Line 3	Gray	Phase 3 (labeled "PH-3" on the wire insulation
Ground	Green/Yellow	Ground (labeled "GND" on the wire insulation
Drain	clear or uninsulated	Cable shield - must be connected to GROUND

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, local codes apply.

Service outlet (customer-supplied)

A duplex service tool outlet should be installed within 1.5 m (5 ft) of the system frame. The power requirement is 110V/120V for USA and Canada (other power requirements are country dependent). The service tool outlets should be fed from the same power source as the system. The service tool outlet should be placed on a separate circuit breaker so it can be used when the processor frame circuit breaker is off.

Chapter 6. Hardware Management Console and Support Element communications

Support Element

The z114 is supplied with a pair of integrated ThinkPad Support Elements (SEs). One is always active while the other is strictly an alternate. Power for the Support Elements is supplied by the server power supply, and there are no additional power requirements.

Unlike previous servers, the internal LAN for the Support Elements on the z114 server connects to the Bulk Power Hub. There is an additional connection from the hub to the Hardware Management Console utilizing the VLAN capability of the server.

Hardware Management Console

A Hardware Management Console (FC 0084, FC 0090, or FC 0091) is required to operate a z114 server. FC 0091 is the HMC that will ship on new orders. A single console can support multiple System z servers and can be located remotely to the physical sites.

If you plan to use the ensemble capabilities of the zEnterprise 196, you will need to order FC 0025, Unified Resource Manager, and provide two additional HMCs, one to serve as the primary HMC for the ensemble, one to serve as the alternate HMC.

The machine type and model number of the primary HMC and alternate HMC must be identical. Both must be **either** Feature Code 90 **or** Feature Code 91. Verify this information by viewing the label on top of the HMC hardware tower (i.e. MTM: 7327-PAA).

The Hardware Management Console consists of:

- A processor or system unit, including two Ethernet LAN adapters, capable of operating at 10, 100, or 1000 Mbps and a DVD RAM to install Licensed Machine Code (LMC)
- A flat panel display (described below)
- A keyboard and
- A mouse.

The console requires a customer-supplied table to hold the following:

- The keyboard and mouse
- A 22-inch flat panel display, 22.0 inches viewable (FC 6096)
- Possibly, a modem. Some geographies will still receive an external modem, while most will include an internal modem.

The Hardware Management Console requires three 110/120V outlets for USA and Canada. (Other power requirements are country dependent.)

You may select from one to ten Ethernet switches, FC 0070, on your server order. The default selection for FC 0070 is zero (0).

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 91. Physical specifications for the IBM 7852-400 modem are located in “Modems” on page 67.

If you have a Hardware Management Console with DVD RAM capability, you may be able to reuse it on your z114 server. Check with your local IBM marketing representative.

IBM Hardware Management Console Feature Codes 0084, 0090, and 0091 can all be used on the zEnterprise 114.

Ethernet LAN switch support

Important:

You must install an Ethernet switch or hub to which the HMC(s) are connected. Only an Ethernet switch or hub may be connected to the customer ports J01 and J02 on the Bulk Power Hub (BPH). To provide redundancy for the HMC(s), both hubs (one on the "A" side or front of the server, and one on the "B" side, or rear of the server) should be used.

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.

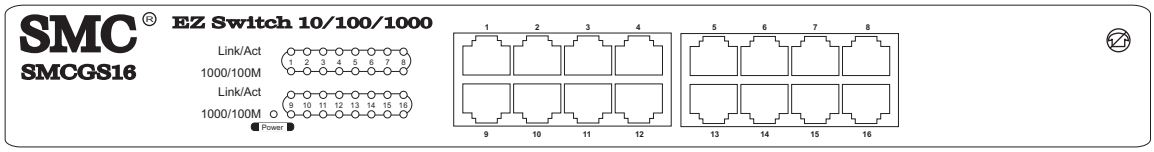
An Ethernet switch or hub is a standalone unit located outside the frame and which operates on building AC power. The particular unit you have received is based on availability at the time of shipment. A customer-supplied switch or hub may be used as long as it matches the specifications of the switch or hub that IBM supplies.

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.

Switch Example



Ethernet network connection requirements

Important:

On the z114, the install team must connect the Ethernet adapters for any HMC(s) into an Ethernet switch. This switch can then be connected to J01 and J02 on the Bulk Power Hubs. (See the illustration below).

IBM offers an Ethernet switch under Feature Code 0070. For z114, the default is a quantity of 0 for FC 0070. You must specify how many Ethernet switch Feature Codes 0070 you want on your server order. You may also use another manufacturer's switch, or an existing switch instead. Regardless of whose switch you use, there must be a switch available to connect the Hardware Management Consoles to your LAN.

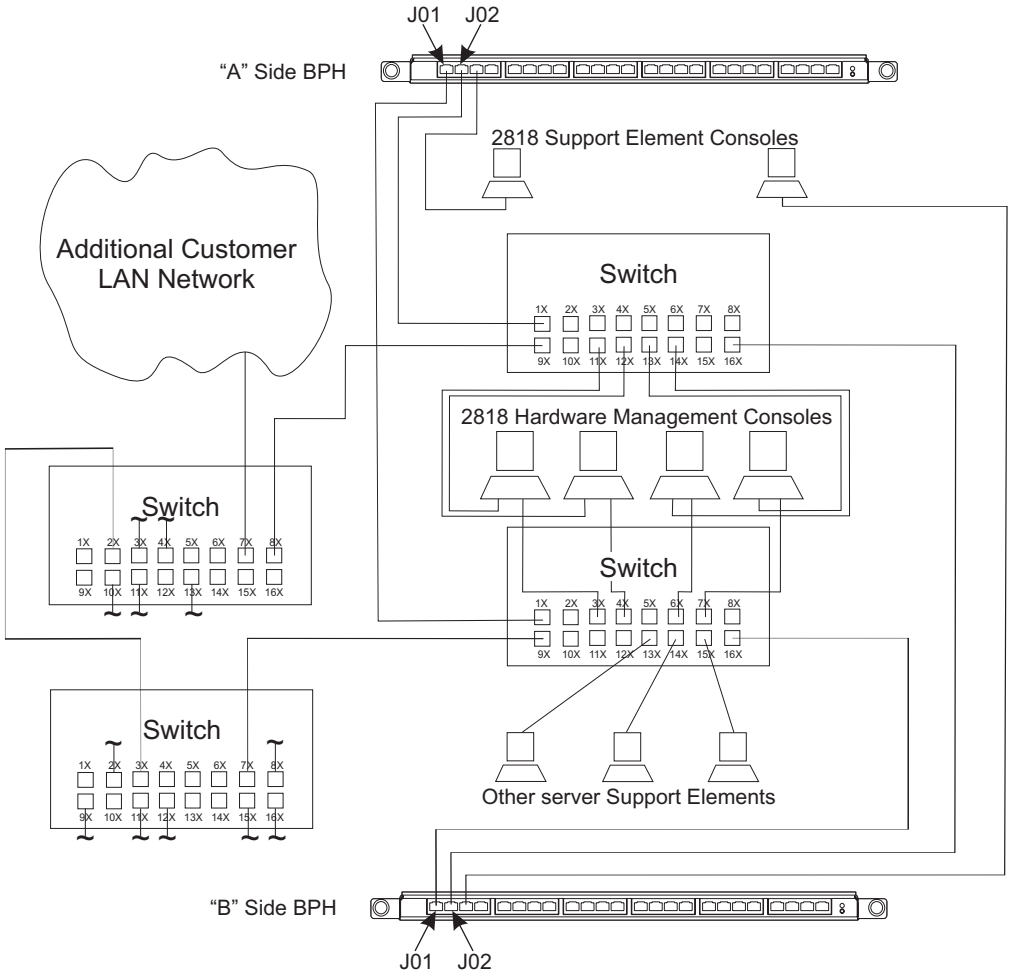
To provide redundancy for the HMC(s), two switches should be used.

On the z114, the install team must connect the Ethernet adapters for any HMC(s) into an Ethernet switch. This switch can then be connected to J01 and J02 on the Bulk Power Hubs. (See the illustration below).

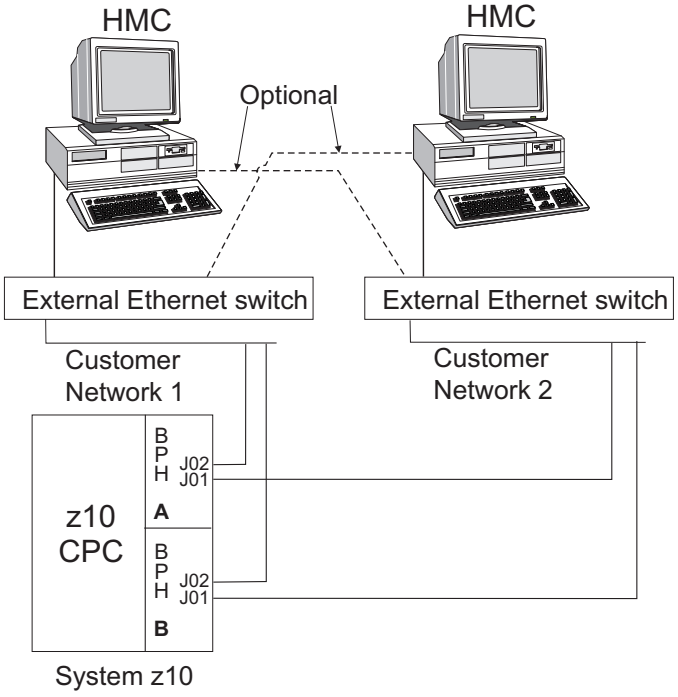
This configuration is required since the SEs have no external connection to the HMCs, and communicate only through the Bulk Power Hubs.

Notes:

1. Only Ethernet switches can connect to the customer ports J01 and J02 on the Bulk Power Hubs.
2. Never connect an HMC directly to J01 and J02 on the Bulk Power Hubs.
3. Never connect customer LANs to any ports other than J01 and J02 on the Bulk Power Hubs.
4. Customer **LAN 1 should be plugged into J02** on the Bulk Power Hubs. Customer **LAN 2 should be plugged into J01** on the Bulk Power Hubs.



The following illustration provides general z114 Ethernet cabling information and is not intended to illustrate connection to a particular network.



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. Multiple Ethernet LAN adapters in a Support Element allow two different Hardware Management Consoles to have independent paths to that SE, or to provide redundant paths from one HMC to that SE. The intent is to help ensure a path to the server from an HMC if there is a failure or outage in one of the networks.
3. When configuring multiple adapters the address must be defined in different subnets.

Because HMC FCs 0084, 0090, and 0091 only come with dual Ethernet features, no additional explanation of wiring scenarios is offered here.

Trusted Key Entry (TKE)

The z114 server may have a Crypto Express3 feature for applications where extensive data security is required. For these systems, there is a separate console available for authorized access to the Crypto Express3 feature. This console is named the Trusted Key Entry (TKE) workstation.

The TKE workstation, FC 0841, includes a system unit, 559 mm (22 inch) flat panel display, mouse, keyboard, and line cord. The built-in Ethernet adapter supports a link data rate of 10, 100, or 1000 Mbps. A DVD RAM drive is available for installation of Licensed Machine Code.

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 0887, 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:

1. The Smart Card Reader (SCR) is an optional security device that attaches to the TKE.
2. The Smart Card Reader provides swipe card function thus further restricting access to the TKE.
3. Feature Code 0885, contains 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 SCR and the communication path between the SCR and the TKE workstation.
4. A TKE workstation and the TKE 7.1 or later level code are co-requisites for ordering the Smart Card reader.
5. Any existing TKE workstation with a code level lower than 7.1 will have to be replaced with a FC 0841 workstation and FC 0867 code (level 7.1) to work with a TKE workstation ordered for your z114 server.
6. FC 0884 provides the ability to order additional blank Smart Cards. The Smart Card Reader is a co-requisite for ordering additional Smart Cards.

To use the TKE function on z114 servers, the Crypto Express3 feature, TKE 7.1 code (FC 0867), and CP Assist for Cryptographic Function (FC 3863) must be installed.

The 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.

Chapter 7. Remote Support Facility (RSF) installation planning

The Remote Support Facility (RSF) provides communication to a centralized IBM support network for problem reporting and service, as well as providing a means for remote operation of the Hardware Management Console. You may use either an Internet or modem connection for communicating with IBM's Remote Support Facility.

Choosing a communications method for remote support

You have three choices for connecting to IBM's Service Support System through the 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.
- Use a modem. This method compared to a direct or indirect Internet is more costly (telephone line, associated equipment, and monthly charges) and slower.

The benefits of either a direct or indirect connection to the Internet will facilitate more rapid problem resolution for your enterprise.

An Internet-based Remote Support Facility (RSF) connection is recommended unless your enterprise security policies prohibit HMC communication with the Internet. 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:

- RSF requests are always initiated from the HMC to IBM. No inbound connections are ever initiated from IBM's Service Support System.
- All transferred data is encrypted in a high-grade Secure Sockets Layer (SSL) method.
- When the HMC initiates a connection to RSF, it validates the trusted host by its digital signature issued for the IBM Service 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 SSL 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 destinations described under "Server address lists," 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. You can configure the proxy server to limit the specific IP addresses to which the HMC can connect. See the "Server address lists" for the IP addresses to use.

Server address lists

Whether you are using a direct connection (the HMC only) or an indirect connection (with a proxy server) for Internet access, the HMC utilizes the following IP addresses and port 443 for all Internet activity:

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

Table 14. IPv4 addresses

LMC 2.10.1 and later IPv4 addresses
129.42.26.224
129.42.34.224
129.42.42.224

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:

Table 15. IPv6 addresses

LMC 2.10.0 and later IPv6 addresses
2620:0:6C0:1::1000
2620:0:6C1:1::1000
2620:0:6C2:1::1000

Ordering telecommunication service

The following section describes the telephone line and modem requirements for the Hardware Management Console Remote Support Facility (RSF).

It is the customer's responsibility to arrange for installation and all costs of common-carrier equipment.

One telephone line is required for **each** modem installed.

Note: It is recommended that CPCs be assigned to more than one Hardware Management Console phone server.

When ordering telecommunications service, be prepared to identify the following:

- The type of telephone jack required (country dependent)
- The long distance carrier
- The selection of either dual tone multi-frequency (DTMF) or rotary (pulse) to be installed
- Installer of the telephone wiring and jack

The telephone line must be a dial-up (public switched network) analog type* with 24-hour, 7-day-a-week availability.

Note: *Digital telephone lines must not be used.

Modems

IBM no longer supplies external modems to connect with the Remote Support Facility (RSF). The expectation is that many customers will use broadband facilities for this purpose. Some geographies will receive an internal modem (Machine Type 9234) with a Hardware Management Console FC 0090 or FC 0091. For those who still want or need to use an external modem, specifications are included below. The general specifications of the supported modems (33K bps and 56K bps models) are:

- Data rate:
  - v34 - 36K bps and below
  - v90 - 56K bps and below
- Tone or pulse dialing
- Standards:
  - v34 - 36K bps:
    - Data: v.34, v.32bis, v.22bis4
    - Error correction: v.42
    - Data compression: v.42 Class 5; v.42bis
  - v90 - 56K bps:
    - Data: v.90 - 56 Kflex, enhanced v.34 and below
    - Error correction: v.42
    - Data compression: Class 5; v.42bis
- Connectors: 1 DB-25F (RS-232C/D), 3 RJ11s
- Country dependent telecommunication cable: 4.6 m (15 ft.)
- Power requirements:
  - v34 - 36K bps:
    - Country dependent wall mount transformer
    - 90-130VAC or 230VAC, single-phase 50/60 Hz
  - v90 - 56K bps:

  - Country dependent line cord: 1.8 m (6 ft.)
  - 100-240VAC, single-phase 50/60 Hz
- Operating temperature requirements: 0-50 °C (32-120 °F)
- Operating relative humidity: 25-80% (no condensation)
- Weight: .9 kg (2.0 lb)
- Size:
  – Width: 158 mm (6.2 in)
  – Depth: 229 mm (9 in)
  – Height: 36 mm (1.4 in)
- Certifications: See the documentation supplied with the modem.

Important:

In countries where the IBM Hardware Management Console modem is not approved by the national communication authority a modem is needed which is in accordance with CCITT standard V.26bis that meets the following specifications:

- Line speed - 9600 bps or greater
- Command set - AT command set for Asynchronous
- Mode - Asynchronous
- Connection - Switched public network

It is the responsibility of the country to approve a local modem in these cases using local procedures.

Chapter 8. Cabling and connectivity

Before you place your cable order, consider your future growth needs. You may wish to order cables longer than you need right now to avoid expansion problems in the future.

As processor packaging evolves, internal locations for various cable connections may shift, necessitating longer cables, even though the floor locations of connected devices have not changed.

Following are:

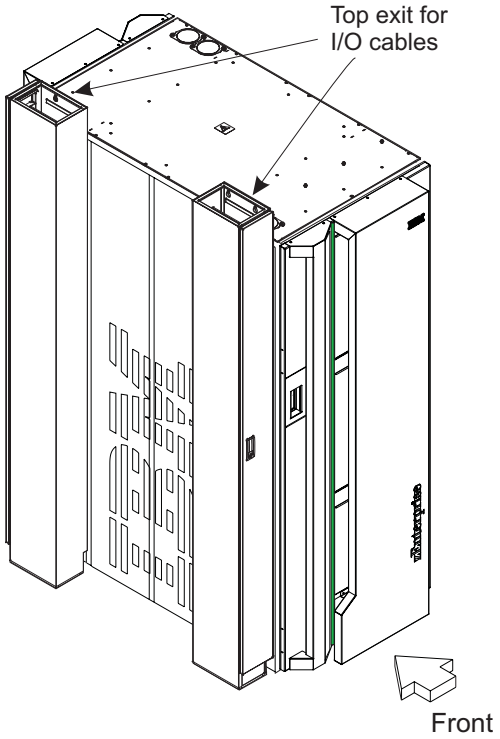
- A description of the top exit cabling option.
- A description of the IBM Site and Facilities Services.
- A list of customer fiber optic cabling responsibilities if the services are not elected.
- A description of the z114 channel feature connections.
- A description of the Fiber Quick Connect fiber harness feature for ESCON and FICON cables.

Top exit I/O cabling

The z114 has an optional feature for top exit I/O cabling (FC 7920). These frame towers for I/O top exit will add approximately 43 kg (95 lbs) to the server weight, 152 mm (6 inches) to the width, and 117 mm (4.6 in) to the height.

All I/O cables can be routed through the top exit towers, including those designated for the Fiber Quick Connect feature. For 2818 servers installed on a non-raised floor, this can be the ideal solution for I/O cabling.

The top exit towers are installed on the left side of the server (viewed from the front) and are mounted to the side of the frame at the corners. A short left side cover fits between the towers.



IBM Site and Facilities Services

IBM Site and Facilities Services has a comprehensive set of scalable solutions to address IBM 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 System z, and zSeries (for example, ESCON, 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 Services 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 z114s, z196, z10 EC, z10 BC, z9 EC, z9 BC, z990, and z890. 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 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 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 front/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.

FICON channel feature

The FICON Express8S feature and the FICON Express8 feature deliver up to 8 Gbps link data rate to servers, switches, control units and storage devices. The FICON Express4 feature delivers up to 4 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. FICON channels can coexist with ESCON channels on z114 server models.

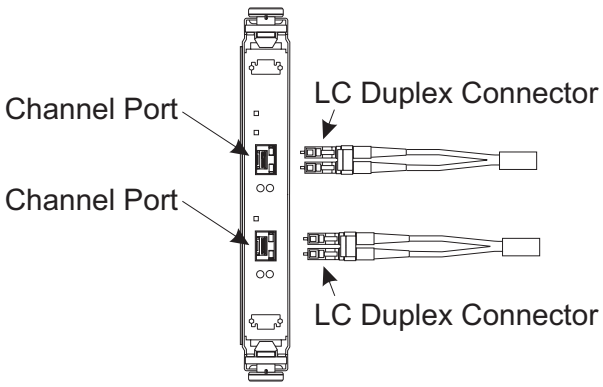
Configuration information

The table below lists the FICON features. These features support two modes of operation:

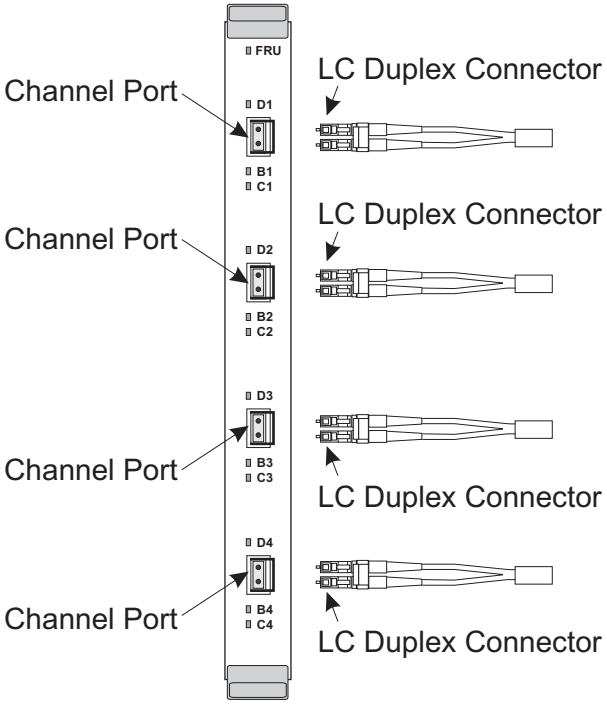
- FC - native FICON
- FCP - Fibre Channel Protocol - attachment to SCSI disks in Linux on z114 and z/VM® environments.

Feature Code	Description	Fiber Type
0409 (2 ports)(PCIe)	FICON Express8S LX (Long Wavelength)	single mode 9 micron (unrepeated distance - 10 KM / 6.2 MI)
0410 (2 ports)(PCIe)	FICON Express8S SX (Short Wavelength)	multimode 50 and 62.5 micron (variable - maximum 860 m / 2822 ft))
3325 (4 ports)	FICON Express8 LX (Long Wavelength)	single mode 9 micron (unrepeated distance - 10 KM / 6.2 MI)
3326 (4 ports)	FICON Express8 SX (Short Wavelength)	multimode 50 and 62.5 micron (variable - maximum 860 m / 2822 ft))
3321 (4 ports)	FICON Express4 LX (Long Wavelength)	single mode 9 micron (unrepeated distance - 10 KM / 6.2 MI)
3322 (4 ports)	FICON Express4 SX (Short Wavelength)	multimode 50 and 62.5 micron (variable - maximum 860 m / 2822 ft))
3323 (2 ports)	FICON Express4 LX (Long Wavelength)	single mode 9 micron (unrepeated distance - 4 KM / 2.5 MI)
3324 (4 ports)	FICON Express4 LX (Long Wavelength)	single mode 9 micron (unrepeated distance - 4 KM / 2.5 MI)

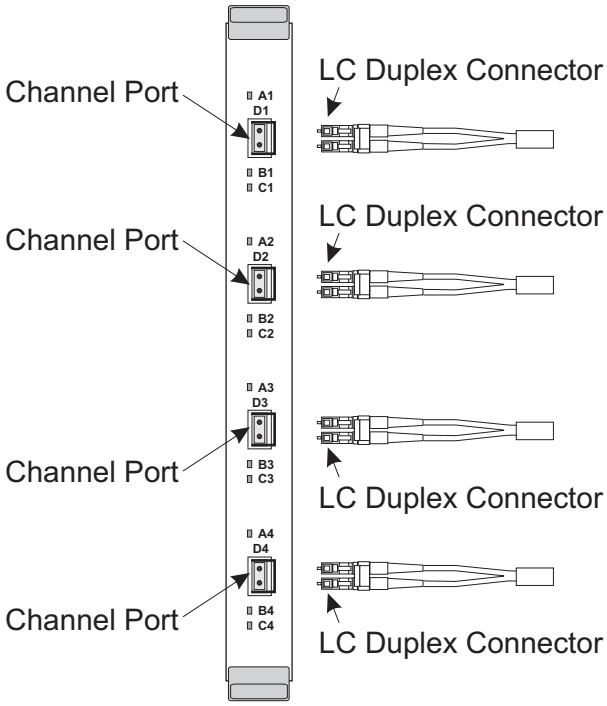
FCs 0409/0410
FICON Express8S



FCs 3325/3326
FICON Express8



FCs 3321/3322/3324
FICON Express4



1. PCIe FICON Feature Codes 0409 and 0410 have two channels per feature.
2. FICON Feature Codes 3319, 3320, 3321, 3322, 3324, 3325, and 3326 have four channels per feature.
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 I/O cage.

See "FICON references" for information about link distances and light loss budget.

FICON references

For additional information on planning for FICON channels see:

- *System z Planning for Fiber Optic Links (ESCON, FICON, Coupling Links, and Open System Adapters)*, GA23-0367
- *System z Fibre Channel Connection (FICON) I/O Interface Physical Layer*, SA24-7172
- *System z ESCON and FICON Channel-to-Channel Reference*, SB10-7034.

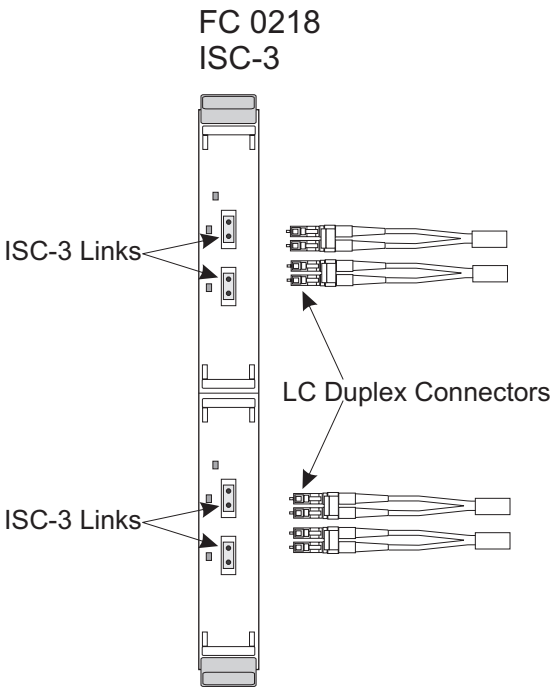
ISC-3 link feature

ISC-3 links provide Parallel Sysplex® connectivity between a coupling facility and production systems using z/OS® operating systems. ISC-3 links operate at 2 Gbps in peer mode (connection between other z114s, z196, z10 EC, z10 BC, z9 EC, z9 BC, z990, and z890.systems) at un-repeated distances up to 10 kilometers (6.2 miles).

Configuration information

The table below describes the ISC-3 feature.

Feature Code	Description	Fiber Type	Connector Type
FC 0218	2-Port ISC-3	9 micron single mode	LC Duplex



- ISC-3 links are comprised of:
  - FC 0218 - A “daughter” adapter card with two ISC-3 ports per card.
  - FC 0217 - A “mother” card into which can be plugged two “daughter” cards.
  - FC 0219 - LMC that activates the ports on a “daughter” card. Each port on a “daughter” card is activated individually.
  - The “mother” card, two “daughter” cards, and the individual port LMC can combine to provide up to four ports per ISC-3 adapter.

    Note: On an initial system order, any request for more than two ISC-3 ports automatically generates a minimum of two FCs 0217. This ensures maximum ISC-3 availability and efficiency.
- The system configuration tool places the ISC-3 feature port LMC across an appropriate number of cards for high availability.
- See *System z ESCON and FICON Channel-to-Channel Reference*, SB10-7034, for information about link distances and light loss budget.

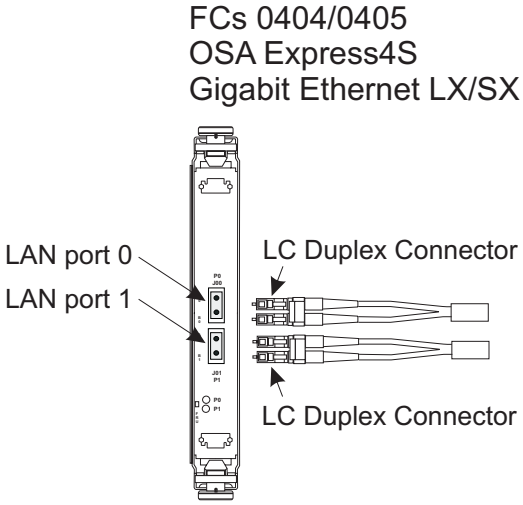
OSA-Express LAN features

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

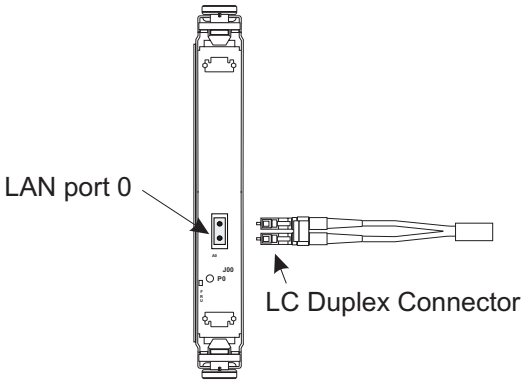
Configuration information

The table below lists the OSA-Express features.

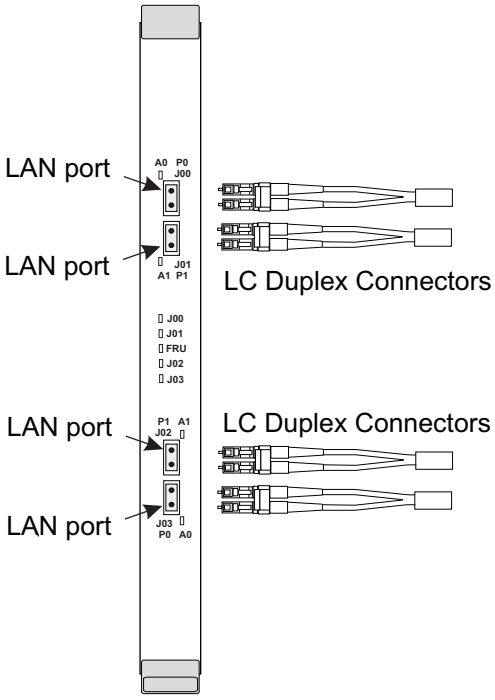
Feature Code	Feature Description	Cable Description	Connector Type
FC 0406 OSA-Express4S (PCIe)	1-Port LR 10 Gigabit Ethernet	9 micron single mode	LC Duplex
FC 0407 OSA-Express4S (PCIe)	1-Port SR 10 Gigabit Ethernet	50 and 62.5 micron multimode	LC Duplex
FC 0404 OSA-Express4S (PCIe)	2-Port LX Gigabit Ethernet	9 micron single mode	LC Duplex
FC 0405 OSA-Express4S (PCIe)	2-Port SX Gigabit Ethernet	50 and 62.5 micron multimode	LC Duplex
FC 3362 OSA-Express3	4-Port LX Gigabit Ethernet	9 micron single mode	LC Duplex
FC 3363 OSA-Express3	4-Port SX Gigabit Ethernet	50 and 62.5 micron multimode	LC Duplex
FC 3373 OSA-Express3	2-Port SX Gigabit Ethernet	50 and 62.5 micron multimode	LC Duplex
FC 3367 OSA-Express3	4-Port 1000 Base-T Ethernet	Category 5 UTP copper wire	RJ-45
FC 3369 OSA-Express3	2-Port 1000 Base-T Ethernet	Category 5 UTP copper wire	RJ-45
FC 3370 OSA-Express3	2-Port LR 10 Gigabit Ethernet	9 micron single mode	LC Duplex
FC 3371 OSA-Express3	2-Port SR 10 Gigabit Ethernet	50 or 62.5 micron multimode	LC Duplex



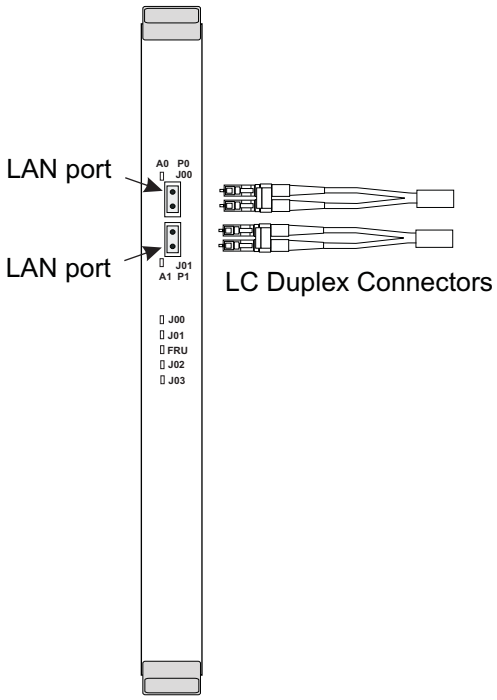
FCs 0406/0407
OSA Express4S
10 Gigabit Ethernet LR/SR



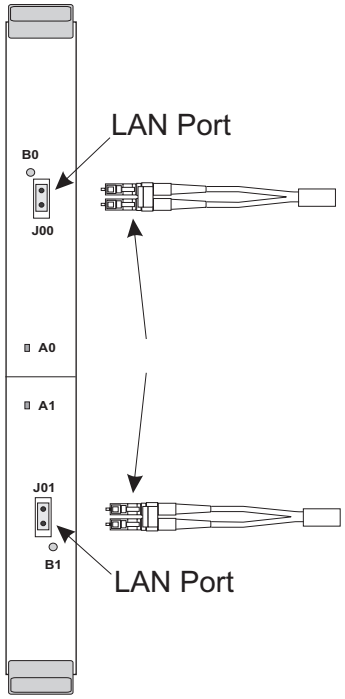
FCs 3362/3363
OSA-Express3
Gigabit Ethernet LX/SX



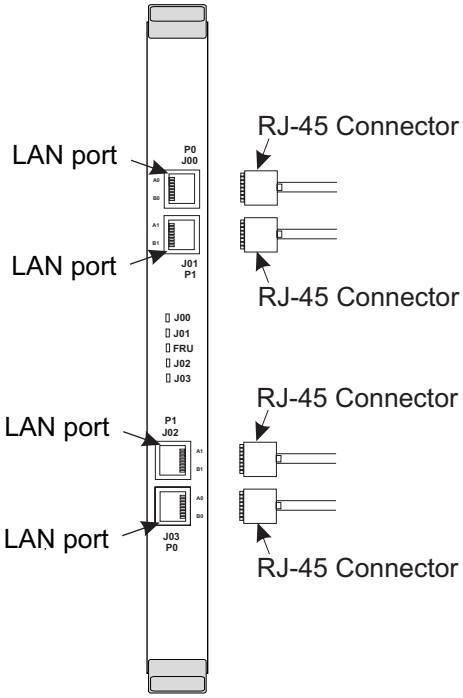
FC 3373
OSA-Express3
Gigabit Ethernet SX 2-port



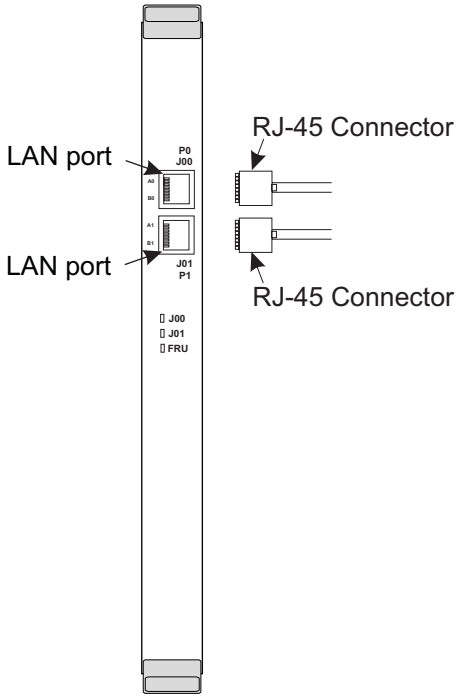
FCs 3364 and 3365
Gigabit Ethernet



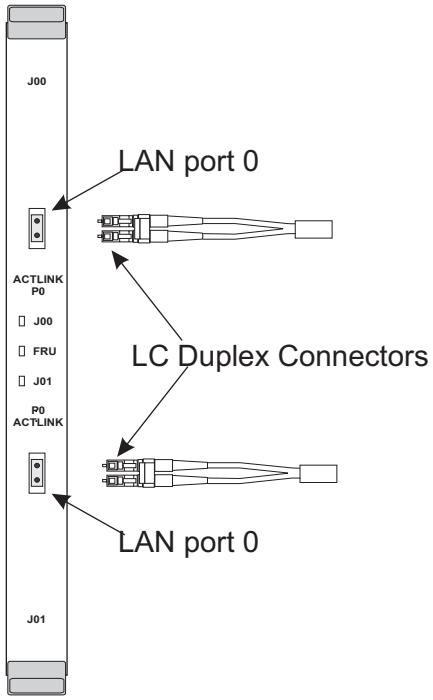
FC 3367
OSA Express3
1000Base-T Ethernet



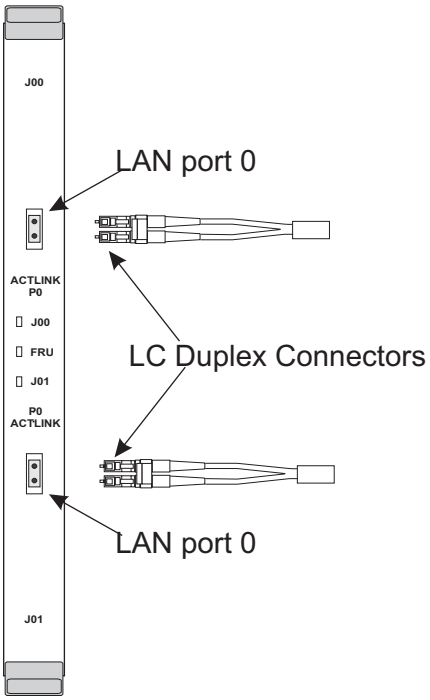
FC 3369
OSA Express3
1000Base-T Ethernet 2-port



FC 3370
10 Gigabit Ethernet LR



FC 3371
10 Gigabit Ethernet SR



OSA-Express reference

For additional information on planning for OSA features see:

- *System z Planning for Fiber Optic Links (ESCON, FICON, Coupling Links, and Open System Adapters)*, GA23-0367
- *Open System Adapter-Express Integrated Console Controller User's Guide* , SA22-7990
- *zEnterprise, System z10, System z9 and zSeries Open Systems Adapter-Express Customer's Guide and Reference*, SA22-7935

Time synchronization

Synchronized time is possible with a z114 server in a Sysplex environment using Server Time Protocol (STP).

z900 and z800 servers cannot participate in a Sysplex with z114.

Server time protocol

Server Time Protocol (FC 1021) requires no special cables to create timing links with other servers. Depending on the distance between servers in a timing network, you may use ISC-3 or InfiniBand fiber optic cables to create the Sysplex. STP can be installed on z114, z196, z10 EC, z10 BC, z9 EC, z9 BC, z990, z890, and Coupling Facility servers.

Server Time Protocol (STP) supports two types of Coordinated Timing Networks (CTNs) : Mixed and STP-only.

- A Mixed CTN is a timing network that contains a collection of servers (CPCs), and has at least one STP-configured server (CPC) stepping to timing signals provided by the Sysplex Timer. The CTN ID must have a valid STP network ID and the ETR network ID must be in the range of 0 to 31.
- The STP-only CTN is a timing network that contains a collection of servers (CPCs) configured to be in STP timing mode.

Pulse per second

An STP-only CTN has the capability of configuring as its External Time Source (ETS) 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 (SE) LAN, because the NTP client runs on the SE. The PPS output of the NTP time server is connected to the PPS input coaxial connector, provided on the oscillator card of the z114 server.

Connectivity information

- See *System z Planning for Fiber Optic Links (ESCON, FICON, Coupling Links, and Open System Adapters)*, GA23-0367, for information about link distances and light loss budget.
- The cable for pulse per second is coaxial.

You are responsible for supplying these cables.

InfiniBand fiber optic links

The HCA3-O feature (FC 0171) and HCA2–O feature (FC 0163) support 12x InfiniBand for coupling communication between systems. If you are planning to install 12x InfiniBand links, you will have to place connected servers no further than 150 meters (492 feet) from each other.

12x InfiniBand provides up to a 6.0 GBps fiber optic connection between z114 and z196 servers, and up to 3.0 GBps between z10 and z9 servers. A 12x InfiniBand fiber optic cable (50 micron multimode OM3) connects directly to an HCA2-O port on a z114, z196 or z10 fanout card and to an HCA1-O port on a z9 fanout card.

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

Table 16. InfiniBand cable part numbers for FCs 0163, and 0167 on System z servers

Part Number	Length-Meters	Length-Feet
41V2466	10.0 m	32.8 ft
15R8844	13.0 m	42.7 ft
15R8845	15.0 m	49.2 ft
41V2467	20.0 m	65.6 ft
41V2468	40.0 m	131.2 ft
41V2469	80.0 m	262.4 ft
41V2470	120.0 m	393.7 ft
41V2471	150.0 m	492.1 ft
42V2083	Custom	Custom

The HCA3-O LR feature (FC 0170) and the HCA2-O LR feature (FC 0168) support 1x Long Reach (LR) InfiniBand and provides up to a 5.0 Gbps fiber optic connection between z114 and z196 servers.

A 1x LR InfiniBand fiber optic cable (9 micron single mode) connects directly to an HCA2-O LR port on a fanout card on a z114 or z196 server.

Note:

1. InfiniBand will not connect to z990 or z890.
2. You must supply InfiniBand cables as you do with other fiber optic systems (FICON, ESCON, OSA).

Feature Code	Description	Fiber Type	Connector Type
FC 0171	HCA3-O	SX laser 50 micron	MPO
FC 0163	HCA2–O	SX laser 50 micron	MPO
FC 0170	HCA3-O LR	9 micron single mode	LC Duplex
FC 0168	HCA2-O-LR	9 micron single mode	LC Duplex

Cryptographic coprocessor

The cryptographic coprocessor cards have no usable cable connections. There are a pair of connectors for each of the two coprocessors on each feature card, but they are not to be used by customer personnel.

Fiber quick connect ESCON and FICON cabling

Fiber Quick Connect harness cabling, harness brackets and mounting hardware are ordered with the z114 server as feature codes. The feature codes are:

Table 17. Fiber Quck Connect feature codes

Fiber Quick Connect (FQC) Feature Codes	
7832	FQC bracket and mounting hardware
7830	MT-RJ 2591 mm (8.5 ft.) harness (ESCON)
7833	MT-RJ 1067 mm (3.5 ft.) harness (ESCON)
7834	MT-RJ 1524 mm (5.0 ft.) harness (FICON)
7835	MT-RJ 1829 mm (6.0 ft.) harness (ESCON)
7836	LC Duplex 2012 mm (6.6 ft.) harness (ESCON)
7837	LC Duplex 2591 (8.5 ft.) harness (FICON)

The Fiber Quick Connect feature enables trunk cables to connect to FICON or ESCON channels using under-the-cover attachment harnesses. These harnesses are installed when your system is built, and your z114 arrives ready to connect the trunk cables at your site.

If you are planning to use the Fiber Quick Connect feature for FICON or ESCON 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 IBM installation planning representative, IBM product specialist, or IBM service representative will provide you with the information necessary to contact Networking Services.

Power Sequence Control (PSC)

The z114 offers the option of Power Sequence Control for specific I/O. There can be two PSC boxes, one in the front of the frame and one in the rear. It is possible to control power-on to 32 I/O devices.

Chapter 9. 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, 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, 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, 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.

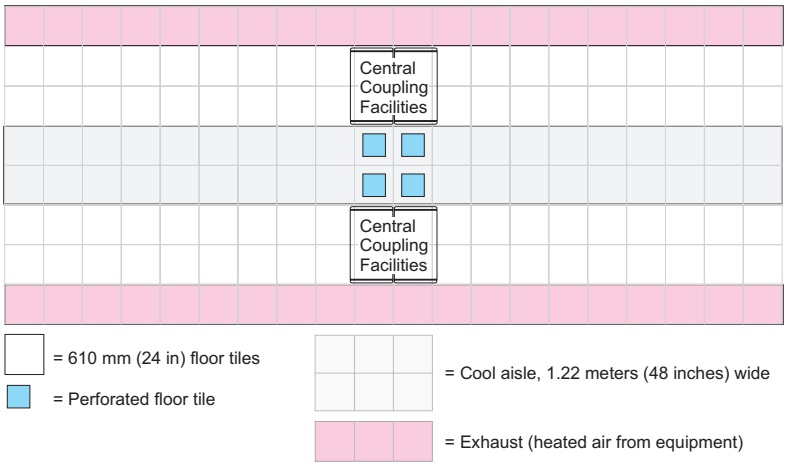
Chapter 10. Parallel sysplex

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 zSeries Fiber Optic Cabling Service to plan your sysplex environment. A list of tasks the Service can perform is provided under "IBM Site and Facilities Services" on page 70. Different technologies for servers, links and coupling facilities affect your ability to configure a productive sysplex. Following are some guidelines to help you better plan for multiple system interconnection.

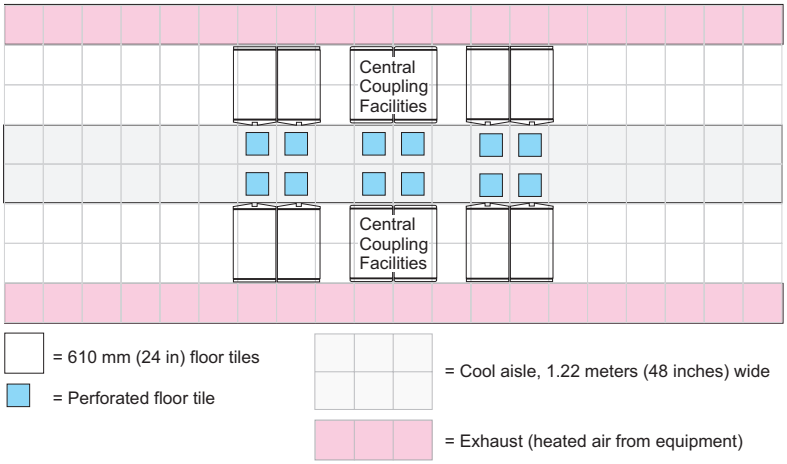
The basic premise for a successful Parallel Sysplex installation is to centralize the physical location of the coupling facilities, and then position the sysplex servers around that center.

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 28). 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 32).

   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.



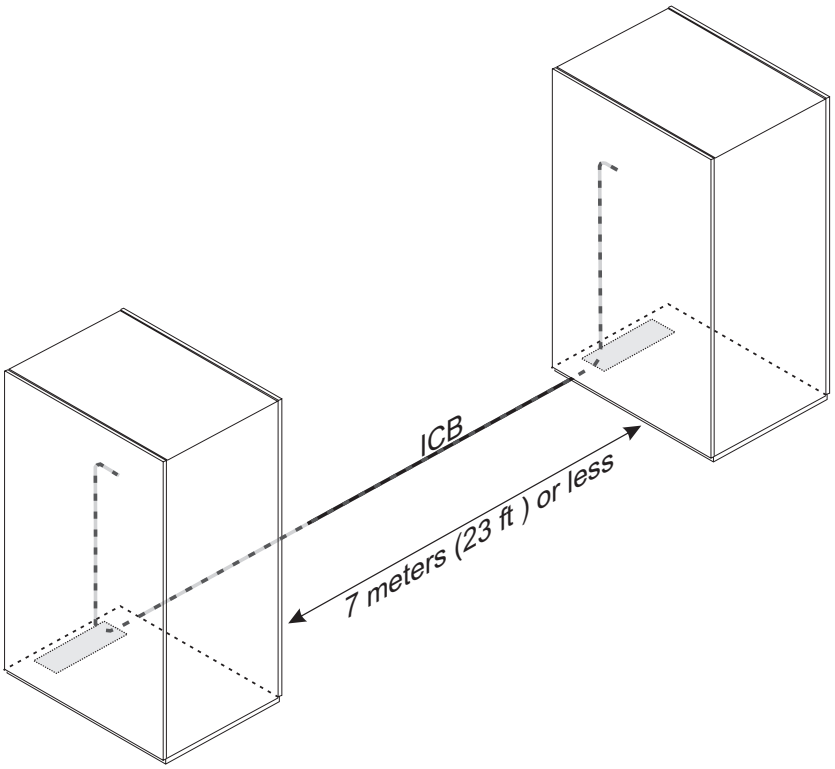
3. Sysplex connections can be made using ISC-3 and ICB-2, ICB-3, ICB-4, and InfiniBand fiber optic link cabling. The Sysplex itself may be comprised of servers connected through an ECF/ETR feature to a Sysplex Timer, servers connected to each other through the Server Timed Protocol feature (STP), or a mixture of both types of connections.

   Notes:

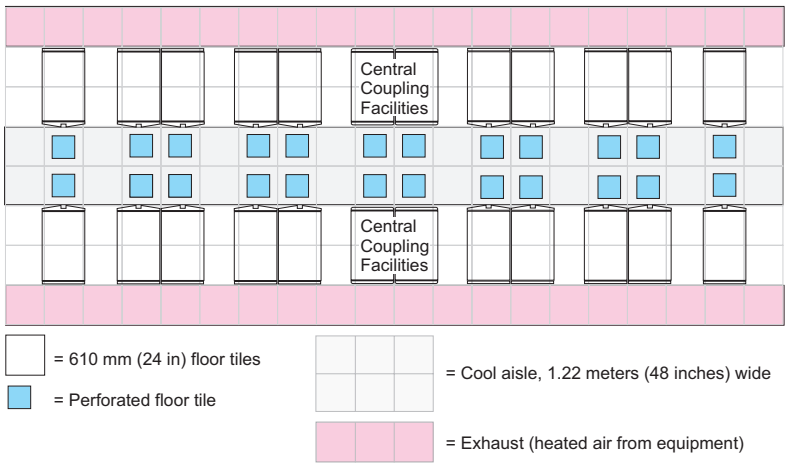
   a. Note that ICB cabling is no longer available for the z114. Beginning with the z196, the preferred method of server to server connection is through InfiniBand cabling, which extends the sysplex possibilities to 150 m (492 feet) with Infiniband 12x cabling or up to 10 km (6.2 mi) and beyond with Infiniband 1X cabling.

   b. zSeries 900 and zSeries 800 servers may not participate in a Parallel Sysplex with z10, z9, and zEnterprise servers.

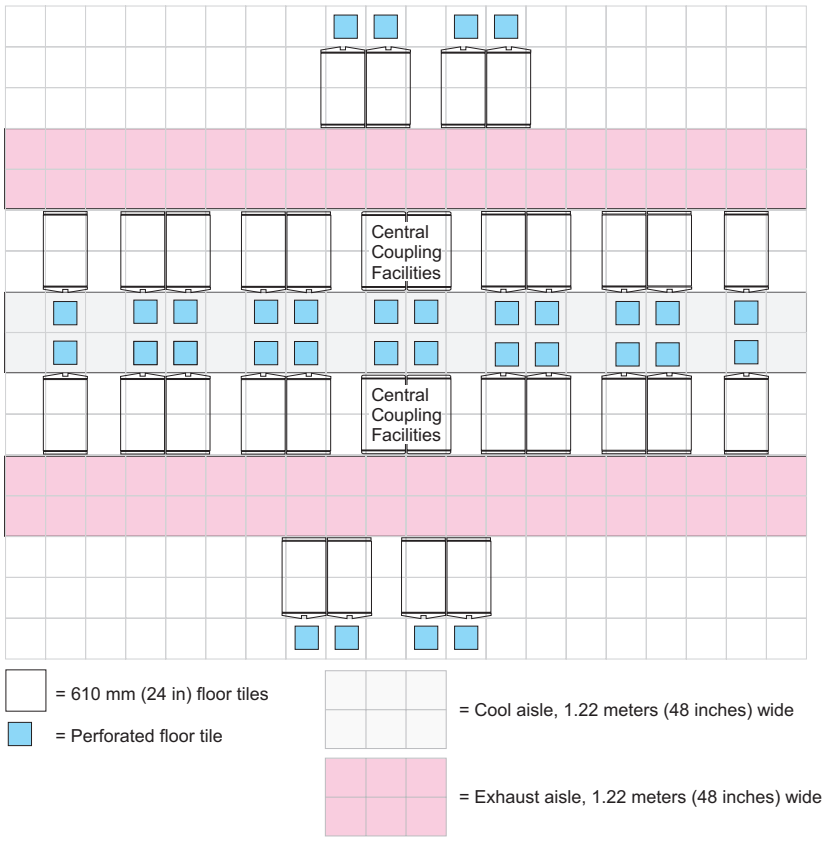
   c. z196 and z114 servers can communicate directly in a Sysplex environment with z10, z9, zSeries 990 and zSeries 890.



4. As the Parallel Sysplex grows, add new servers evenly on either side of the central coupling facilities.



5. As the Parallel Sysplex evolves, you may eventually exceed the 7 meter usable length of ICB cables at the ends of a two-row configuration. At this point, it is possible to add rows, using ISC links or InfiniBand links, which provide connectivity over greater distances than ICB 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 - zEnterprise, System z, zSeries, and S/390 servers 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 ◕.

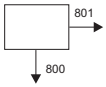
Swinging Gate

Standard equipment outline
(shows the machine with covers closed)

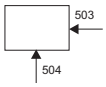
Optional equipment outline

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

Note: This appendix will contain 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.

FC 0084/0090/0091 - Hardware Management Console System Unit

Dimensions	
Height	438 mm (17.3 in.)
Width	216 mm (8.5 in.)
Depth	540 mm (21.3 in.)
Weight minimum configuration as shipped	16.3 kg (36 lbs.)
Weight maximum configuration	25.2 kg (56 lbs.)
Input Power[1]	
Voltage switch setting 115 Vac	
Low range input voltage	100 Vac - 127 Vac
Input frequency range	47 - 53 Hz
Voltage switch setting 230 Vac	
High range input voltage	200 Vac - 240 Vac
Input frequency range	57 - 63 Hz
Input kilovolt-amperes (kVA) (approximate)	
Minimum configuration as shipped	0.20 kVA
Maximum configuration	0.55 kVA
Output Power[1]	
Heat output in British thermal units (Btu) (approximate)	
Minimum configuration	630 Btu/hr (185 watts)
Maximum configuration	1784 Btu/hr (523 watts)
Environmentals	
Server On - 0 to 914 m (2998 ft)	10° to 35° C (50° to 95° F)
Server On - 914 m (2998 ft) to 2133.6 m (7000 ft)	10° to 32° C (50° to 89.6° F)
Server Off - to 2133 m (7000 ft)	10° to 43° C (50° to 109.4° F)
Shipping	-40° to 60° C (-40° to 140° F)
Humidity Range (operating and storage)	8% - 80%
Note: Power consumption and heat output vary with the number and type of optional features installed and the power-management optional features in use.	

Note: When planning the work area for the Hardware Management Console, remember to allow a suitable space for a full-size keyboard and mouse.

FC 6096 - Flat Panel Display 558.7 mm (22.0 inch) TFT LCD

Dimensions	
Height	406.0 mm (15.98 in.)
Width	514.4 mm (20.25 in.)
Depth	239.8 mm (9.44 in.)
Weight with stand	6.2 kg (20.5 lbs)
Input Power	
Input voltage	100 Vac - 240 Vac (+/- 10%)
Input frequency range	50/60 Hz + or - 3 Hz
Rated Current	1.5 Amps
Power Consumption	
Normal operation:	< 45 watts
Standby/Suspend:	< 2 watts (analog or digital)
Active off:	< 1 watt (at 100 VAC and 240 VAC)
Environmentals	
Temperature	
Operating	10° to 45° C (50° to 113° F)
Storage	-20° to 60° C (-4° to 140° F)
Shipping	-20° to 60° C (-4° to 140° F)
Humidity	
Operating	10% to 80%
Storage	5% to 90%
Shipping	5% to 90%

Note: When planning the work area for the Hardware Management Console, remember to allow a suitable space for a full-size keyboard and mouse.

Appendix C. Acoustics

This appendix provides information on acoustics for the z114 at nominal environmental ambient temperatures of 23ºC plus or minus 2ºC (73.4ºF plus or minus 3.6ºF).

Acoustical noise emission levels

Product Configuration	Declared A-Weighted Sound Power Level $L_{WAd\ (B)}$		Declared A-Weighted Sound Pressure Level $L_{pAm\ (dB)}$	
	Operating (B)	Idling (B)	Operating (dB)	Idling (dB)
Typical Configuration: One processor node, one PCIe-based I/O drawer and one STI-based I/O drawer. All AMDs at nominal speeds; front and rear acoustical doors installed and closed.	7.2[4]	7.2[4]	54	54
Maximum Configuration: Two processor nodes, two PCIe-based I/O drawers, and one STI-based I/O drawer. All AMDs at nominal speeds; front and rear acoustical doors installed and closed.	7.4[4]	7.4[4]	56	56

Notes:

1. L_{WAd} is the (upper limit) A-weighted sound power level. L_{pAm} is the mean A-weighted sound pressure level at the 1-meter bystander position.
2. All measurements are made in conformance with ISO 7779, and reported in conformance with ISO 9296.
3. **B** and **dB** are the abbreviations for **bels** and **decibels**, respectively. 1B = 10dB.
4. Meets IT Product Noise Limits for "Generally Attended Data Center" per Statskontoret Technical Standard 26:6.

Relevant international standards:

- Measurements: ISO 7779
- Declaration: ISO 9296

Appendix D. Dual power installation

The z114 model is designed with a fully redundant power system. Each computer has two line cords attached to two power input ports which, in turn, power a 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. Here we will present three examples of redundancy.

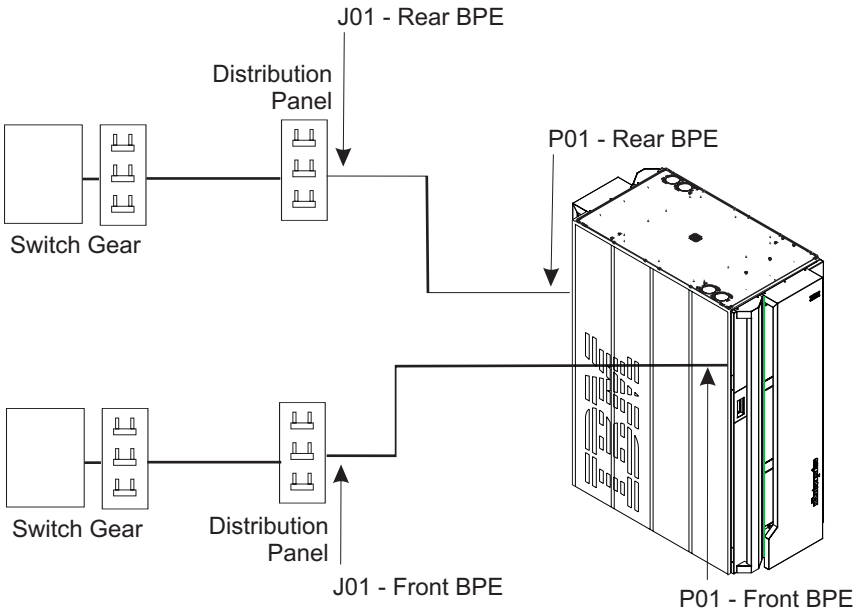
The following shows three examples of redundancy. In these examples, two power cords are identified:

- **P01 - Front BPE** and **J01 - Front BPE** are the labels identifying the ends of one of the power cords. **P01 - Front BPE** is the label identifying the end of the power cord that connects to the top BPE jack in the front of the frame and **J01 - Front BPE** is the label identifying the end of the same power cord that connects to the customer power distribution unit.
- **P01 - Back BPE** and **J01 - Back BPE** are the labels identifying the ends of one of the power cords. **P01 - Back BPE** is the label identifying the end of the power cord that connects to the top BPE jack in the back of the frame and **J01 - Back BPE** 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)

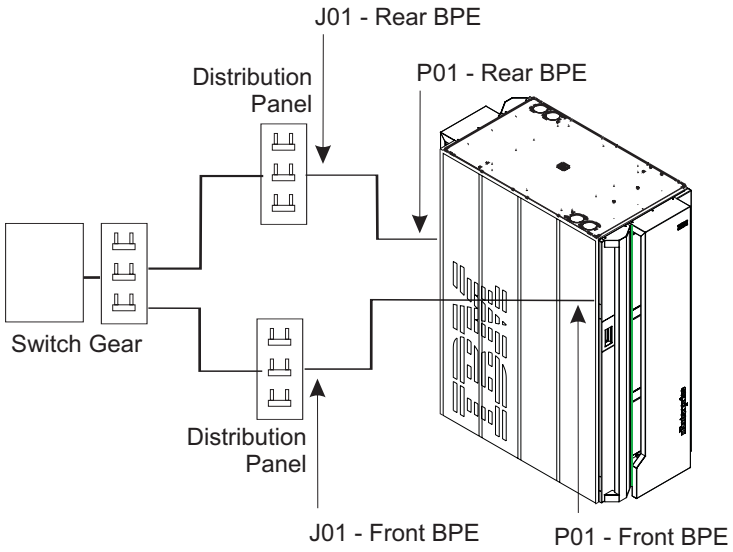
In this example, the computer receives power from two separate power distribution panels. Each distribution panel receives power from a separate piece of building switch gear.

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)

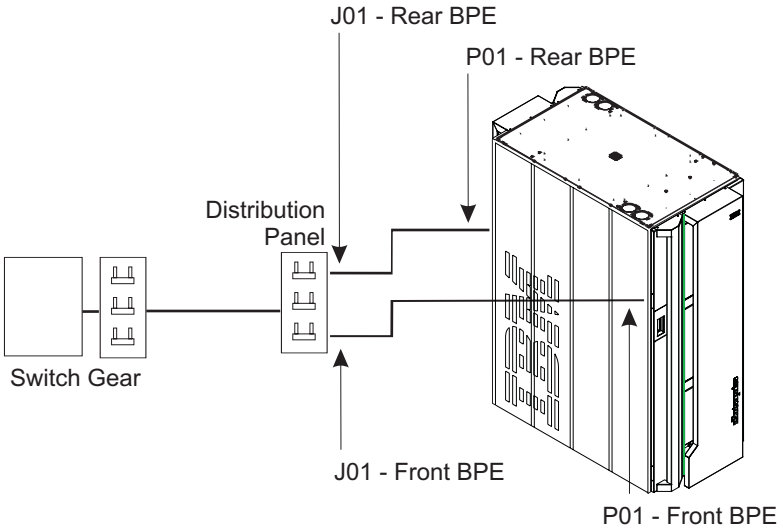
In this example, the computer receives power from two separate power distribution panels. The two distribution panels receive power from the same piece of building switch gear. Most facilities should be able to achieve this level of redundancy. In this case, loss of switch gear (building power) will 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 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 least recommended.



Appendix E. Balancing power panel loads

For z114 models that use three phase power, depending on the system configuration, the phase currents can be fully balanced or unbalanced. For each possible drawer configuration (processor and I/O combinations), any given system presents a balanced or unbalanced load. If several unbalanced system configurations are fed from the same power panel, the load on that panel will be unbalanced. Two phase currents will be equal and both will be, nominally, 57.8% of the current on the third phase. Figure 3 is an example of feeding several loads of this type from two power panels in a way that balances the load among the three phases.

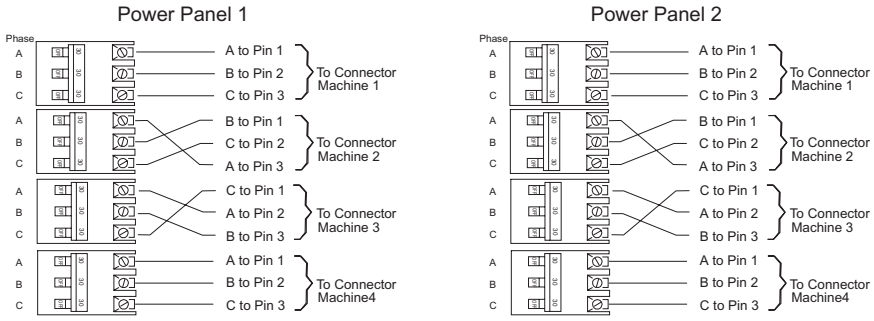


Figure 3. Power load balancing - three-pole breakers

The method in Figure 3 requires that the connection from the three poles of each breaker to the three phase pins of a connector be varied. Some electricians may prefer to maintain a consistent wiring sequence from the breakers to the connectors.

Figure 4 shows a way to balance the load without changing the wiring on the output of any breakers. The three-pole breakers are alternated with single-pole breakers. This way the three-pole breakers don't all begin on Phase A.

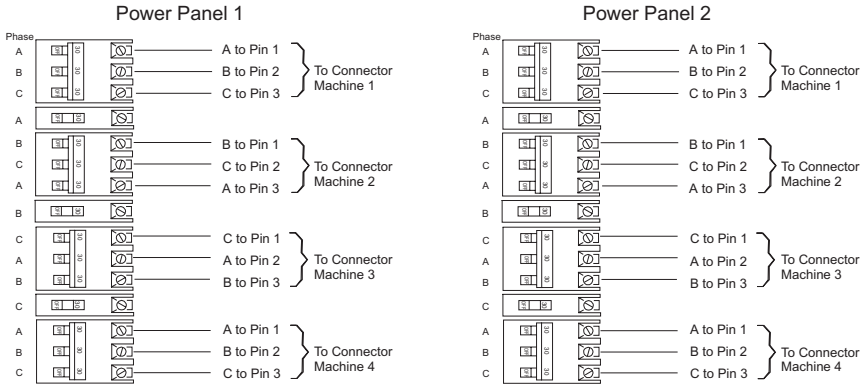


Figure 4. Power load balancing - alternating three-pole and single-pole breakers

Figure 5 on page 98 shows another way of distributing the unbalanced load evenly. In this case, the three-pole breakers are alternated with two-pole breakers.

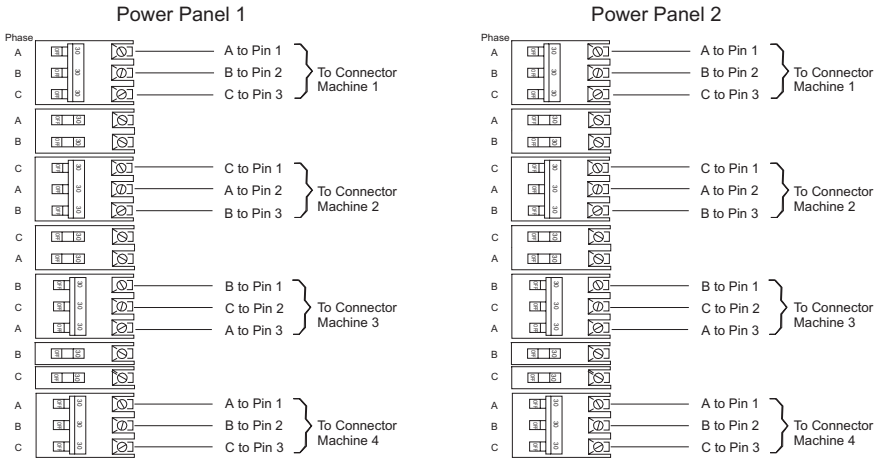


Figure 5. Power load balancing - alternating three-pole and double-pole breakers

Appendix F. Frame tie-down

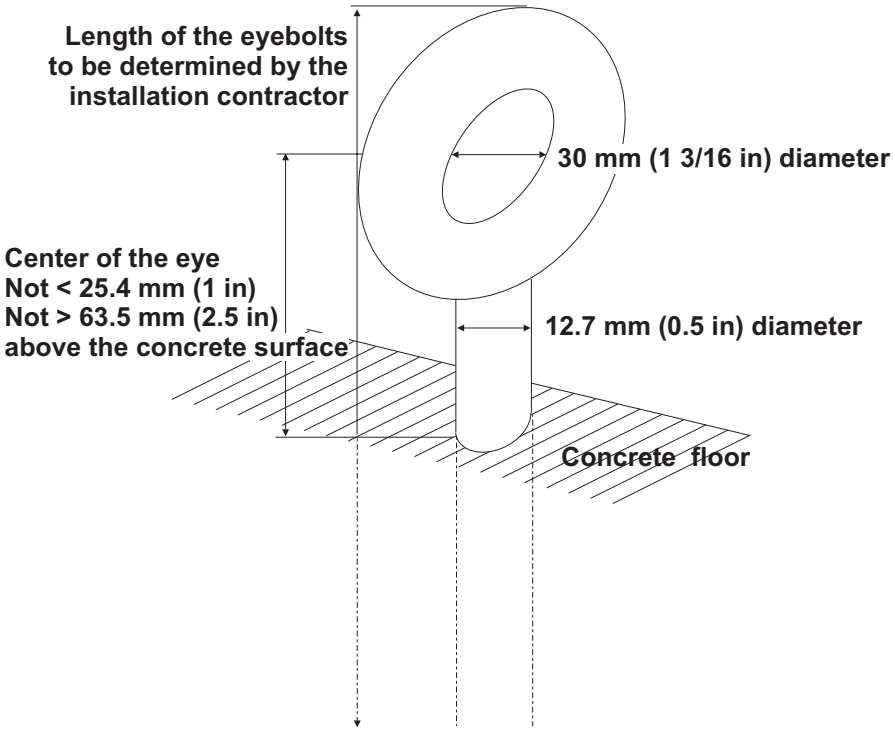
The purpose of this installation instruction is to describe how to install a frame tie down kit that will provide frame ruggedizing and the floor tie down hardware for securing an IBM frame. The kit is designed to help secure the frame and its contents from damage when exposed to vibrations and shocks such as those in a seismic event.

FC 8012 is used on a raised floor. FC 8013 is used on a nonraised floor

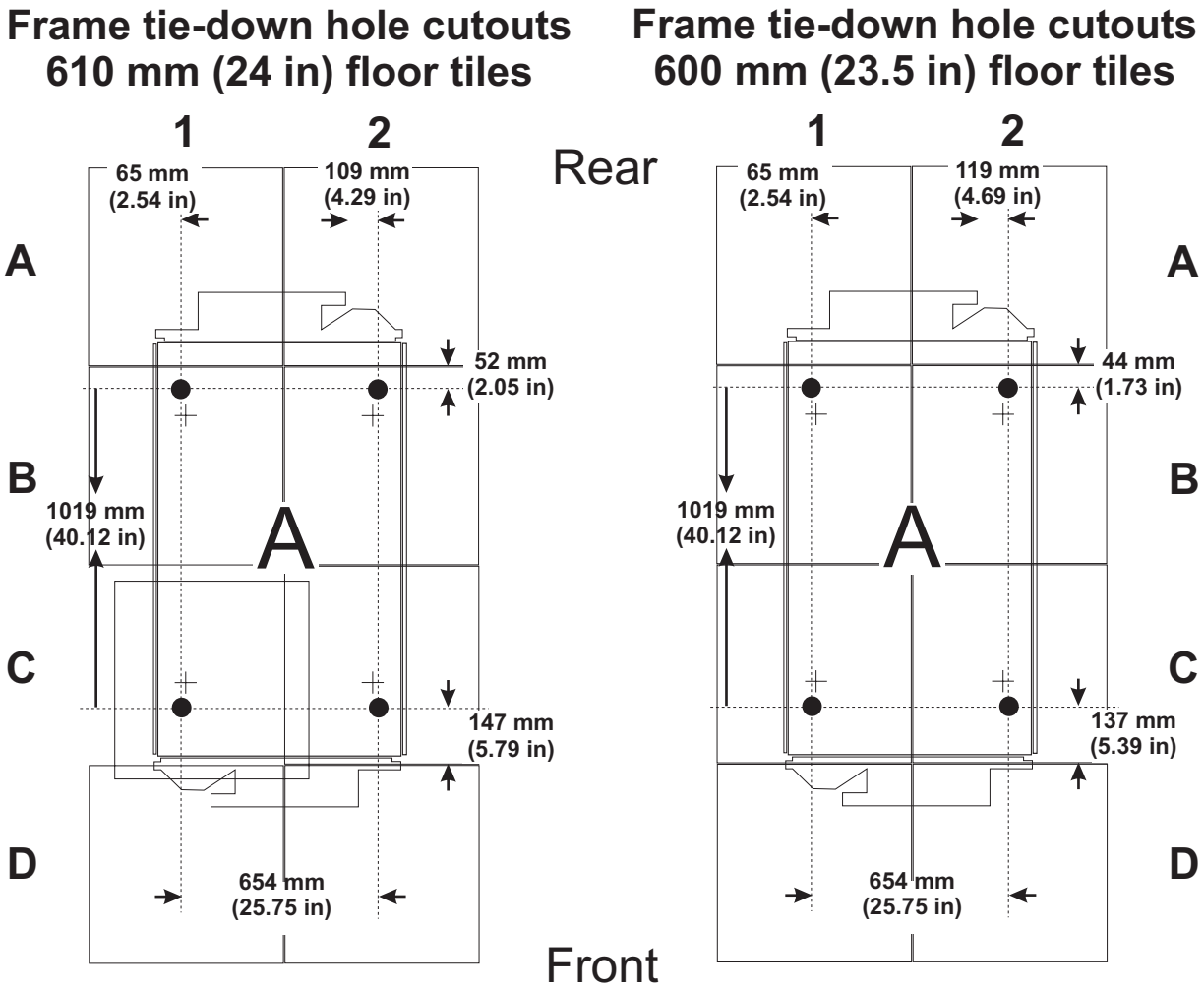
Installing the eyebolts

You are responsible for obtaining and installing the eyebolts that will anchor the frames of your z114 server. Following are the specifications for the eyebolts:

- 12.7 mm (0.5 in) diameter, 13 threads per inch (length to be determined by the qualified contractor who will perform the eyebolt installation)
- Inside diameter of the eye not smaller than 30 mm (1 3/16 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.
- Able to withstand a pull force of 975.2 kg (2150 lbs)



Regardless of which kit you need, 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 remainder of the parts involved in either Feature Code 8012 or 8013 include:

- Side-to-side support bars at EIA unit 38, front and rear
- New side-to-side support bars, to stiffen the frame
- A triangular support bar, hung on two hinges and secured with a vertical stop
- A latch for the triangular support bar
- A pair of stabilizer bars that rest on the raised floor between the corners of each frame
- Four turnbuckle assemblies with fastening hardware that extend through the raised floor and are secured to the eyebolts
- Heavier cover door latches.

These additional tie-down parts are installed along with the server. The installation instructions are included as an appendix in the z114 *zEnterprise 114 Installation Manual*, shipped with the server.

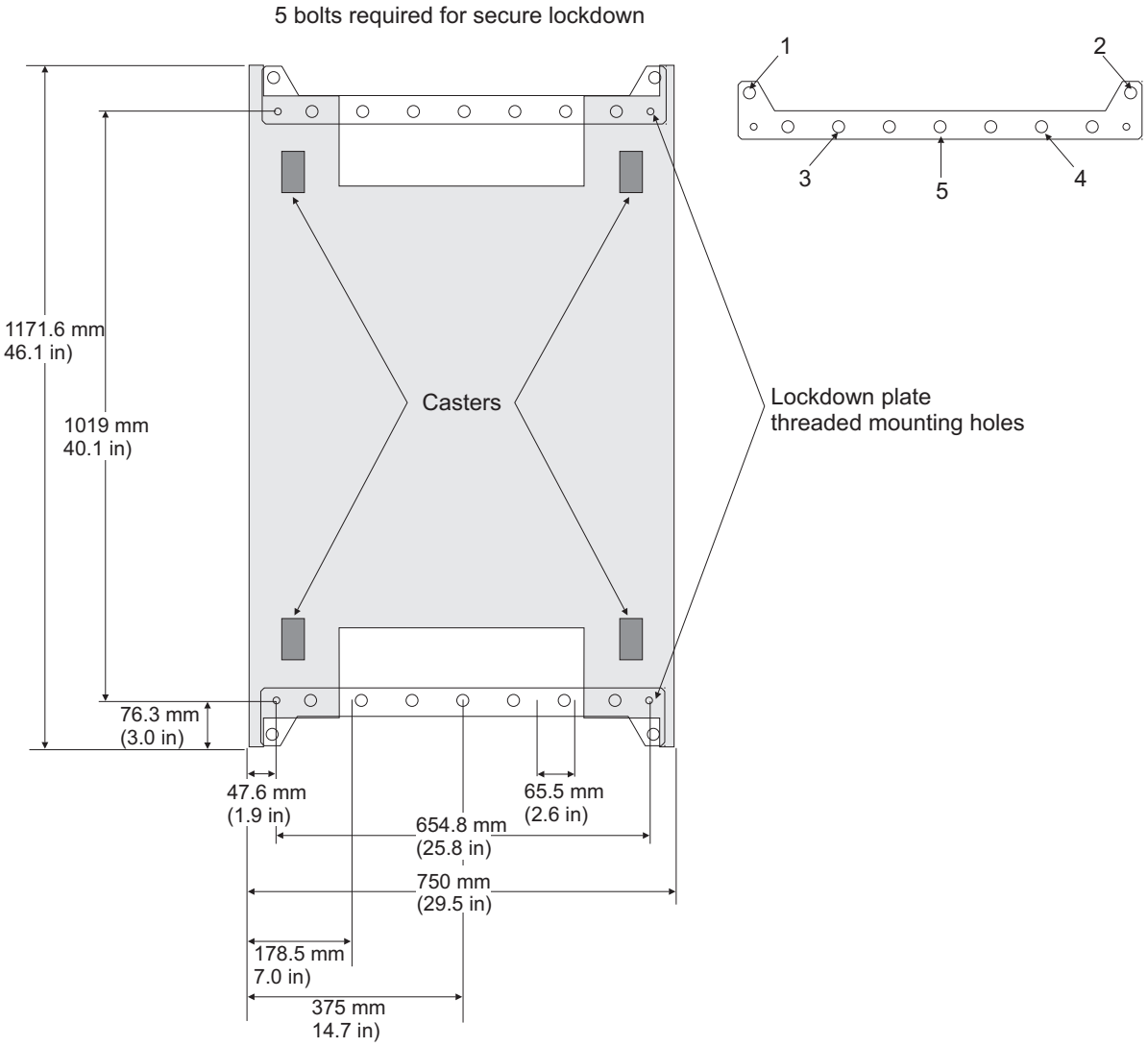
Appendix G. Nonraised floor frame tie-down

The purpose of this installation instruction is to install a frame tie down kit that will provide hardware for securing an IBM frame to a concrete non-raised floor. This kit (FC 8013) 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 **five anchors per stabilizer**, securing the front and rear stabilizers to the concrete floor according to the following illustration.

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

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



The stabilizer fasteners should be heavy duty sleeve anchors, 12 mm (0.5 in) in diameter, capable of withstanding a minimum allowable tensile load in concrete of 1025.1 kg (2260 lb) and a minimum allowable shear load in concrete of 2111.5 kg (4655 lb). 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 stabilizer. Remove the stabilizer to position the server frame. Then reinstall the stabilizer and the fasteners before the service provider begins the installation.

Appendix H. Notices

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EC Declaration of Conformity (In German)

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

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Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten

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Verantwortlich für die Konformitätserklärung nach Paragraf 5 des EMVG ist die IBM Deutschland GmbH, 70548 Stuttgart.

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update: 2004/12/07

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