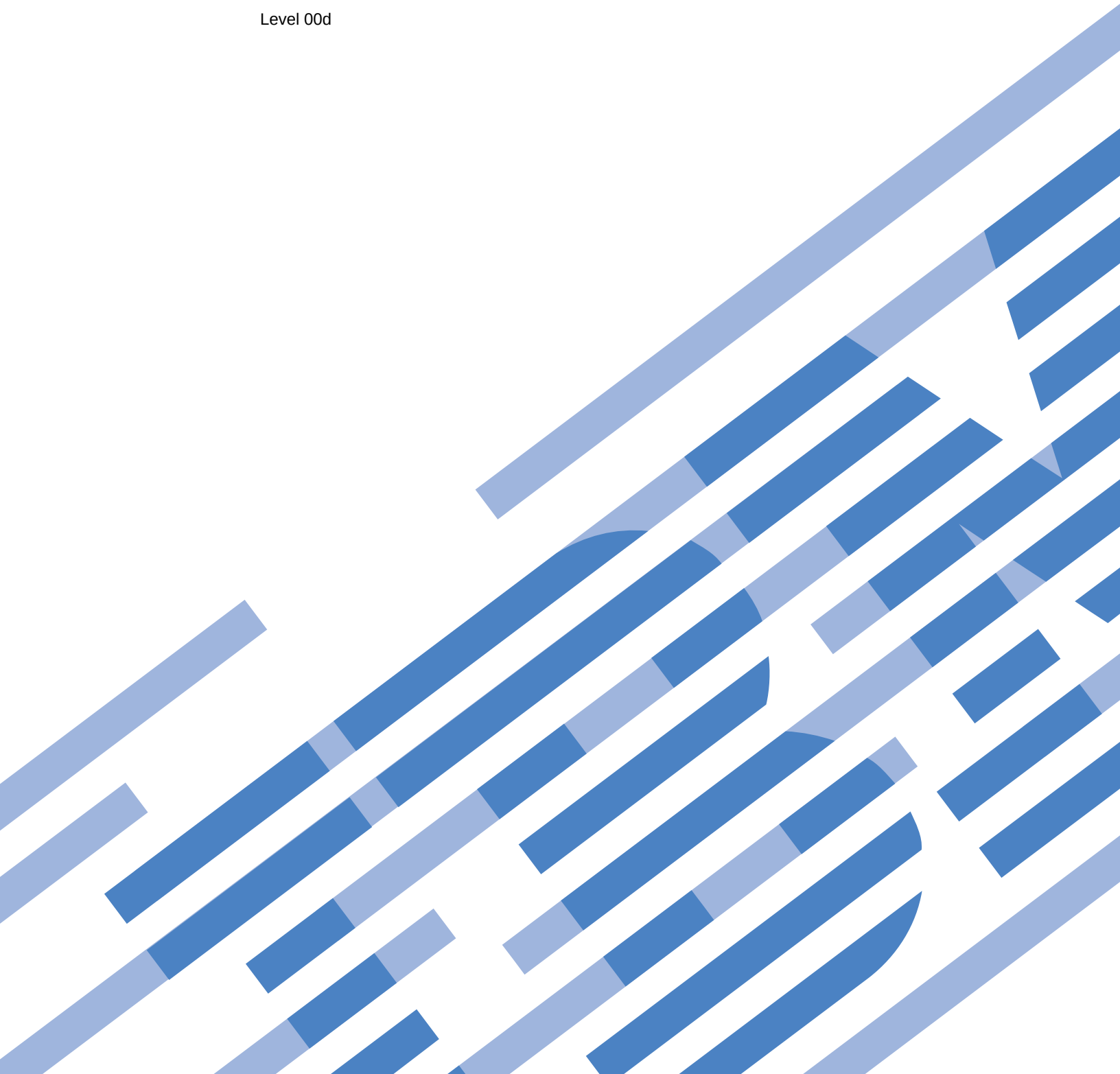

zEnterprise BC12

# Installation Manual for Physical Planning 2828

GC28-6923-00

Level 00d

zEnterprise BC12

# Installation Manual for Physical Planning 2828

GC28-6923-00

Level 00d

**Note:**
Before using this information and the product it supports, be sure to read the information in "Safety" on page v, Appendix G, "Notices," on page 117, and *Systems Environmental Notices and User Guide*, Z125-5823.

This edition, GC28-6923-00, applies to the IBM zEnterprise BC12 (zBC12).

There may be a newer version of this document in **PDF** format available on **Resource Link**.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).

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# Contents



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# 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 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)**

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# About this publication

This publication contains information necessary for planning the physical installation of the IBM zEnterprise® BC12 (zBC12).

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.
- Chapter 9 provides information about operating in a Parallel Sysplex® environment.
- The appendices provide IBM standard symbols, HMC specifications, acoustics, power installation and power loads and a sample cabling schematic and upgrade paths, and frame tie-down information.

## Revisions

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

## Related publications

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

- *Systems Safety Notices*, G229-9054
- *Systems Environmental Notices and User Guide*, Z125-5823
- *zEnterprise BC12 Installation Manual*, GC28-6922
- *System z Planning for Fiber Optic Links (FICON/FCP, Coupling Links, and Open System Adapters)*, GA23-1406
- *System z FICON Channel-to-Channel Reference*, SB10-7157
- *Open System Adapter-Express Integrated Console Controller User's Guide* , SA22-7990
- *zEnterprise System, System z10, System z9 and zSeries Open Systems Adapter-Express Customer's Guide and Reference*, SA22-7935

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

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## 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 zBC12 and is copyrighted and licensed by IBM. Each zBC12 is delivered with Licensed Machine Code that is customized to the specific machine ordered. The Licensed Machine Code enables the zBC12 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 zBC12 requires that the Licensed Machine Code be reinstalled at the new location. See the "Discontinuing the System" section in the *zEnterprise BC12 Installation Manual* for the procedure about relocating a zBC12.

## Accessibility

IBM strives to provide products with usable access for everyone, regardless of age or ability.

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

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

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

## Accessibility features

The following list includes the major accessibility features in System z documentation:

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

## Keyboard navigation

This product uses standard Microsoft Windows navigation keys.

## IBM and accessibility

See the IBM Human Ability and Accessibility Center for more information about the commitment that IBM has to accessibility.

## How to send your comments

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

# Summary of changes

Summary of changes for the *zEnterprise BC12 Installation Manual for Physical Planning*, GC28-6923.

*Table 1. Summary of changes*

| Release level | Date | Changes in level |
|---|---|---|
| 00d | 04/2014 | This revision contains editorial changes and the following technical changes:<br>• Added a note to "Procedure for cutting and placement of floor panels" on page 41. |
| 00c | 01/2014 | This revision contains editorial changes and the following technical changes:<br>• Corrected a host name URL. See "Host names" on page 69. |
| 00b | 01/2014 | This revision contains editorial changes and the following technical changes:<br>• Updated the watertight receptacle information for the 415 VAC power cords. See Table 23 on page 55 "Power plugs and receptacles, and line cord wire specifications" on page 54. |
| 00a | 10/2013 | This revision contains editorial changes and the following technical changes:<br>• Updated graphics and dimensions in "Machine and service clearance areas" on page 32.<br>• Added information about not allowing a mix of AC and DC power and reorganized information in "General electrical power requirements" on page 45.<br>• Corrected the watertight receptacle numbers in "Power plugs and receptacles, and line cord wire specifications" on page 54. |

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# Chapter 1. Introduction

This chapter is intended to help you prepare your physical site for the installation of an IBM zBC12. 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 BC12.

## 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 zBC12 arrives.

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

## Planning for a new computer room

A detailed step-by-step procedure for physically planning a computer room installation is located on the **General Information for Planning a Physical Site** page on Resource Link at *http://www.ibm.com/servers/resourcelink*. On the left navigation pane, click **Planning**, **Physical Planning**, and **General information for planning a physical site** (located under **zSeries & S/390®**).

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# Planning checklist

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

Site Preparation Checklist

| Task/Consideration | Task Assigned (✓) | Target Date | Completed |
|---|---|---|---|
| **CHECKPOINT 1** | | | |
| ○ Designate a person in your organization with the responsibility for all phases of site preparation for this system installation | ☐ | _____ | _____ |
| ○ Review all site planning information with the designated person | ☐ | _____ | _____ |
| ○ Determine who will actually perform each site preparation task and who will control the marking of this checklist | ☐ | _____ | _____ |
| ○ Identify communication needs, including Remote Support Facility, cables, switches, telephones, connection panels, etc | ☐ | _____ | _____ |
| ○ In the Chapter titled, "I/O cabling and connectivity" (in this document), read the information about planning now for future cabling needs. In the same chapter, also read "IBM Site and Facilities Services" | ☐ | _____ | _____ |
| ○ Identify channel needs including: cables, directors, switches, patch panels, etc | ☐ | _____ | _____ |
| ○ Identify other machine/device needs including: changes to any existing equipment | ☐ | _____ | _____ |
| ○ Determine the schedule with your IBM marketing representative and fill in the target dates on this checklist | ☐ | _____ | _____ |
| **CHECKPOINT 2** | | | |
| ○ Lay out the floor plan. Include stationary obstacles, walls, all computer equipment, locations for power, lighting, heating and cooling, water and fire detection and extinguishing equipment | ☐ | _____ | _____ |
| ○ If the level of acoustical noise is a concern, consider arranging the floor layout to avoid areas of excessive noise exposure to employees, and possibly utilize noise control screens or other treatments to reduce noise levels. Some IBM servers have available acoustic doors to reduce noise. Check with your marketing representative to see if your server has such options. | ☐ | _____ | _____ |
| ○ If this is a new computer room, see the course, *General information for planning the physical site* under "Planning / Physical Planning / 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, "I/O cabling and Connectivity" (in this document), read the information about "IBM Site and Facilities Services" and "Customer fiber optic cabling responsibilities" to determine your cabling requirements and responsibilities. Your IBM marketing representative can assist you with this task. Other parts of this chapter include fiber optic channel and adapter descriptions and information about the Fiber Quick Connect feature for FICON channels. | ☐ | _____ | _____ |
| ○ If you are planning for a system that will use FICON channels, InfiniBand, coupling links, or Open System Adapters (OSA), contact your IBM marketing representative to obtain the document, *System z Planning for Fiber Optic Links (FICON/FCP, Coupling Links, and Open System Adapters)*, GA23-1406 | ☐ | _____ | _____ |
| ○ 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 | ☐ | _____ | _____ |

## 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 at *http://www.ibm.com/servers/resourcelink*. This planning aid will include unique physical planning requirements based on your system's specific configuration.

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

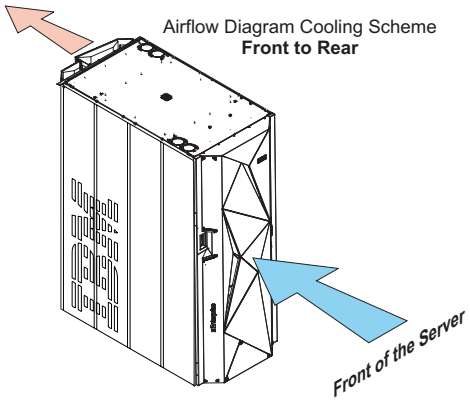
# ASHRAE declaration

ASHRAE Declarations (Metric) for 2828

| ASHRAE Class A2 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 H06, FC 1147 (with 2 PCIe I/O drawers) | 10.7 | 2175 | 3806 | 758 | 78.5 x 157.8 x 201.5 | 3048 | 35 | 21 |

ASHRAE Declarations (English) for 2828

| ASHRAE Class A2 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 H06, FC 1147 (with 2 PCIe I/O drawers) | 10.7 | 1280 | 2240 | 1672 | 30.9 x 62.1 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 (77° F) ambient. Maximum airflow is based on an ambient of 32° C (89° F) for all models.
2. Weights provided assume the optional Integrated Battery Features are installed.
3. For ambient temperatures exceeding 25° C (77° F), the acoustical noise levels of the system may increase significantly as the speeds of the air moving devices increase. See Appendix C, "Acoustics," on page 105 for the declared acoustical noise emission levels for the system under nominal temperature conditions of 23° C plus or minus 2° C (73.4° F plus or minus 3.6° F).
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 zBC12 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 zBC12 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 zBC12 family offers.

The zBC12 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 zBC12. IBM strongly suggests you strive for more than the minimum requirements. The powerful computing zBC12 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:

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*Table 2. Environmental specifications*

| | | |
|---|---|---|
| **Environment, Operating:** [1, 5] | | |
| High ambient temperature | **Long-term recommended**<br>27°C (80.6°F) [4] | **Maximum ambient allowed**<br>35°C (95°F) [4] |
| Low ambient temperature | **Long-term recommended**<br>18° (64.4°F) | **Minimum ambient allowed**<br>10° (50°F) |
| Low end humidity | **Long-term recommended**<br>5.5°C (41°F) dew point | **Minimum relative humidity allowed**<br>20% relative humidity |
| High end humidity | **Long-term recommended**<br>60% relative humidity and 15°C (59°F) dew point | **Maximum relative humidity allowed**<br>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.<br>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) | |
| Relative 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) | |
| Relative 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 | |

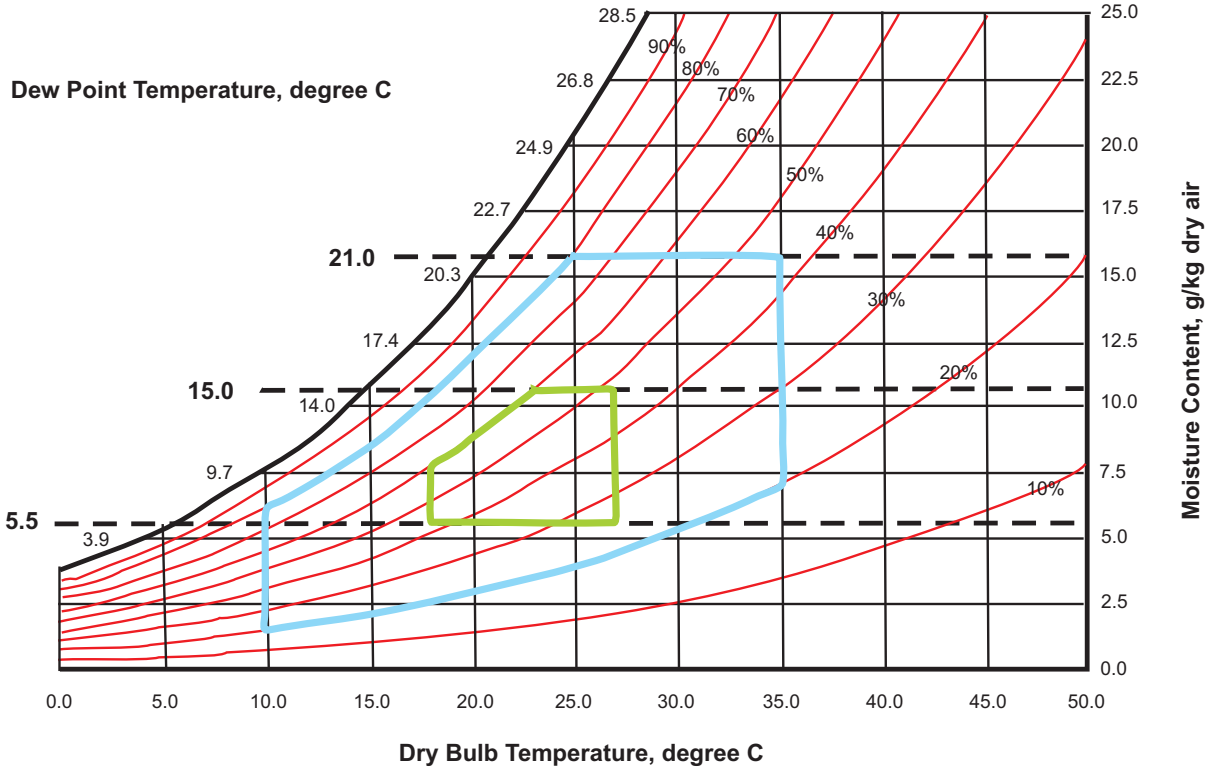
**Notes:**

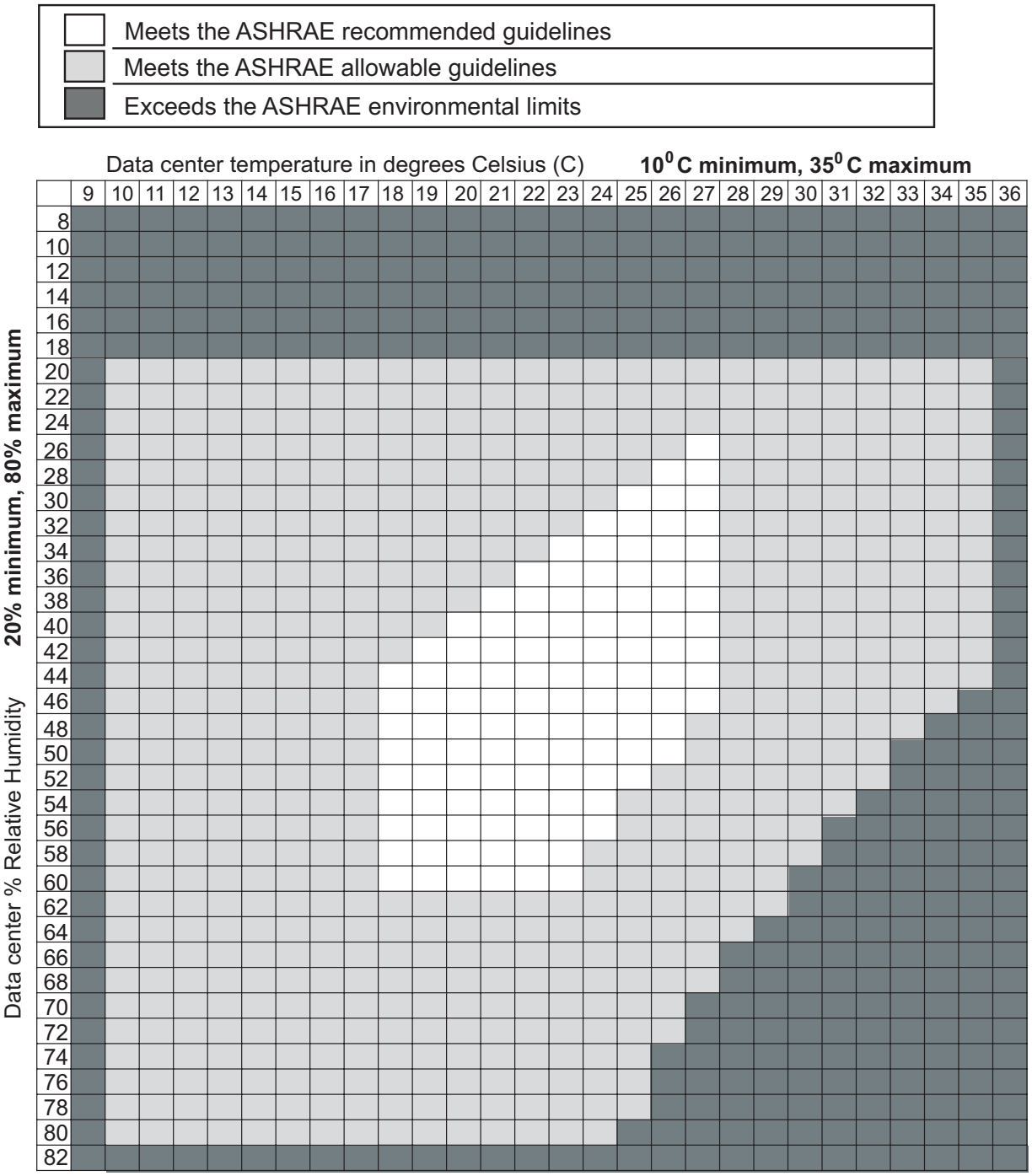
1. Maximum ambient temperature reduces 1ºC (1.8 ºF) for every 300 m (984 ft) over 900 m (2953 ft).
2. ANSI/ISA-S71.04. 1985. "Environmental conditions for process measurement and control systems: Airborne contaminants." Instrument Society of America, Research Triangle Park, NC, 1985.
3. The deliquescent 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 105 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.

## Psychrometric Chart

- SI (metric) units
- Barometric pressure 101.325 kPa (sea level)
- Curved lines represent % of Relative Humidity (RH)
- Vertical lines represent Dry Bulb temperature in degrees Celeius ( C )
- Points on saturation line (100% RH) represent Dew Point temperature in degrees Celcius ( C )






**It is very important the environmental specifications be met immediately in front of the frame of the zBC12 server.** Ideally, it would be best if the temperature and humidity controls are good enough to surround the service area of the zBC12. 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 zBC12 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 zBC12 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 zBC12 IBM may condition provision of repair or replacement of zBC12 or parts on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

*Table 3. Contaminant descriptions*

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

**Notes:**

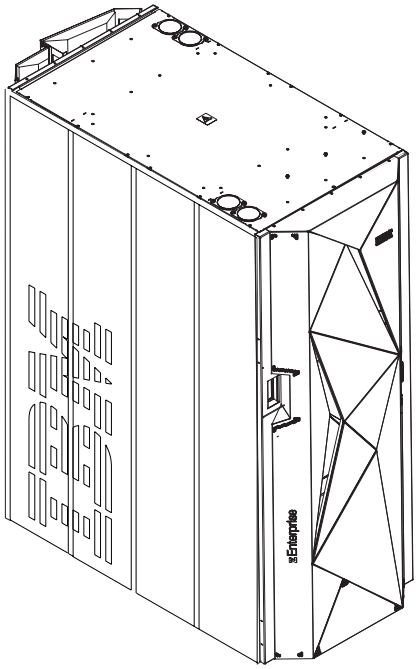
1. ANSI/ISA-71.04.1985. “Environmental conditions for process measurement and control systems: Airborne contaminants.” Instrument Society of America, Research Triangle Park, NC, 1985.
2. The derivation of the equivalence between the rate of copper corrosion product thickness growth in Å/month and the 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 zBC12.

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



Facts you should know about the zBC12:

- The zBC12 is **always** a one-frame system
- In areas that may be prone to seismic events, IBM offers FC 8016 and FC 8017, which provide tie-down hardware. FC 8016 provides tie-down hardware to cover raised floor heights from 152.4 mm (6 inches) to 914.4 mm (36 inches). FC 8017 provides tie-down hardware for nonraised floors. See Appendix F, "Frame tie-down," on page 111 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.
- zBC12 may be installed on a nonraised floor. In a nonraised floor environment, where cables are exposed, refer to local and national electric and safety codes for more information.

  **Note:** If zBC12 is installed on a nonraised floor, the top exit I/O feature (FC 7920) and top exit power feature (FC 7901) must be used.
- zBC12 provides a top exit I/O cabling feature (FC 7920). This consists of two cable towers installed on the left side of the frame.

  zBC12 provides a top exit power cord feature (FC 7901).

  **Note:** If nonraised floor feature is selected, both the top exit I/O feature and top exit power feature must be selected.

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- **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

*Table 4. A frame 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) | 1595 (62.8) | 2015 (79.3) |
| Frame A w/covers and top exit I/O towers | 937 (36.9) | 1595 (62.8) | 2154 (84.8) |

# Shipping specifications

zBC12 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 3213)

If you ordered FC 3213, the internal batteries are shipped **uninstalled**.

## Packaging specifications

*Table 5. A frame 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) | 954 (2102) |
| | | | | |
| **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) | 1226 (2702) |

*Table 6. Cover set packaging specifications*

| 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) | 32.7 (72) |

*Table 7. Top exit I/O towers packaging specifications*

| 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 zBC12 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.

## zBC12 models

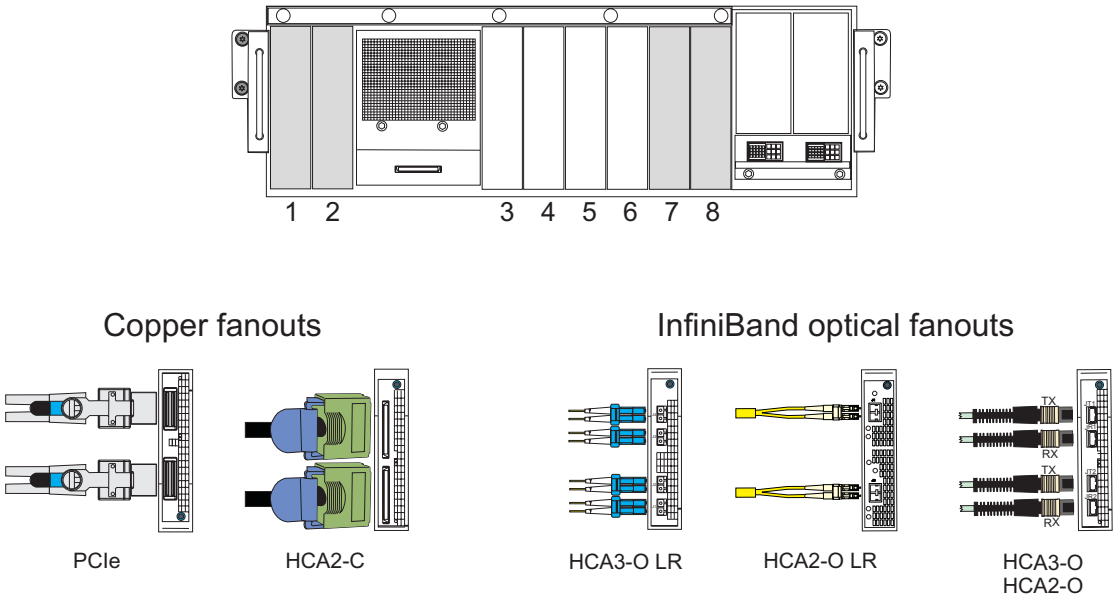
There are two models of the zBC12 server: H06 and H13. These models contain user-definable Processor Units (PUs), System Assist Processors (SAPs), and spare PUs (used to provide uninterrupted computing if there should be a problem with a working PU).

The following table lists the feature codes for each model. You will use the feature codes to place your zBC12 order.

*Table 8. Processor descriptions*

| Feature code | Description |
|---|---|
| 1147 | Model H06, 1 processor drawer |
| 1148 | Model H13, 2 processor drawers |

The following illustration shows where the InfiniBand copper and InfiniBand optical ports can be installed. The actual number of ports for any model is dependent on total system configuration as ordered. Model specifications are described in Table 9 on page 20.




**Note:**

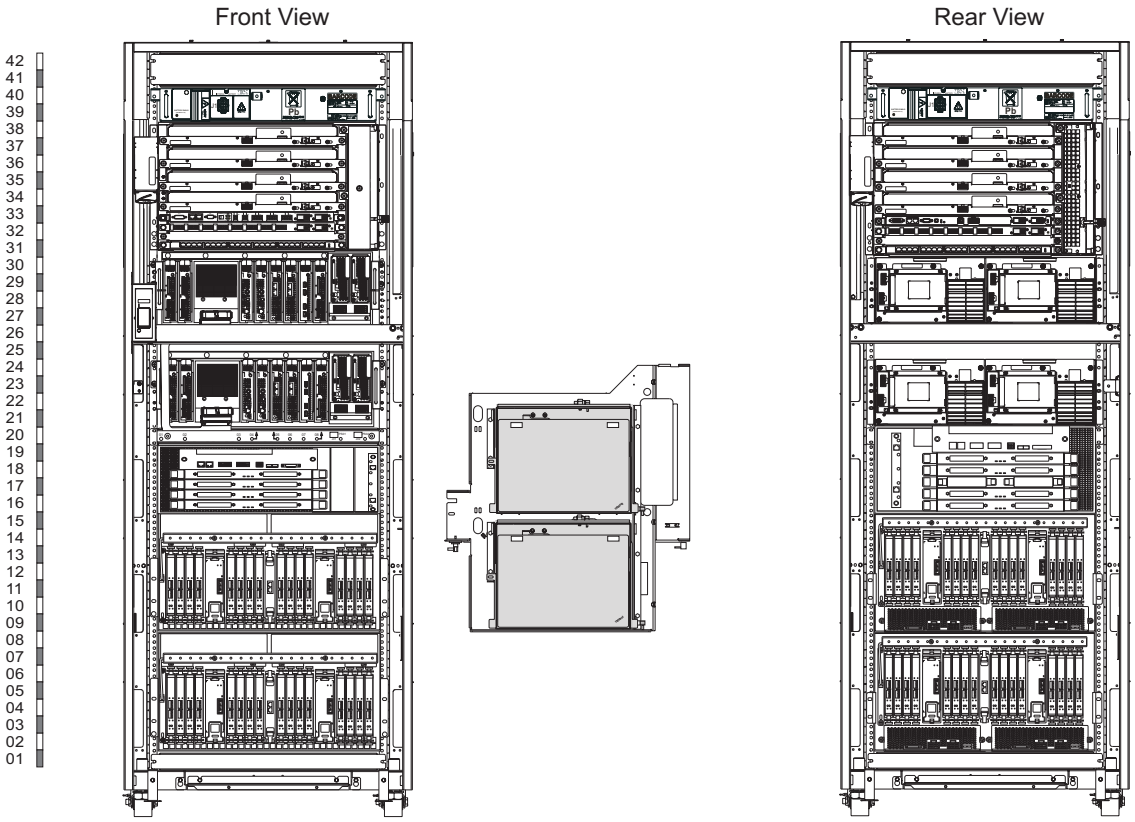
1. Copper cables (for HCA2-C fanout cards) are used to connect the I/O drawers to the processor drawers.
2. Copper cables (for PCIe fanout card) are used to connect the PCIe I/O drawers to the processor drawers.
3. InfiniBand coupling cables, copper cables, and PCIe cables can be installed in slots 1, 2, 7, and 8 in the illustration above. The remaining slots are unavailable for I/O or coupling cable connections.

*Table 9. Model feature codes and options*

| Feature code | Drawer type | Description | CPC I/O connectors |
|---|---|---|---|
| FC 1147 (Model **H06**) | CPC | • 1 CPC drawer<br>• 0-6 CPs<br>• 0-6 IFLs<br>• 0-5 unassigned IFLs<br>• 0-3 zAAPs<br>• 0-3 zIIPs<br>• 0-6 ICFs<br>• 1 IFP<br>• 2 - base SAPs, 0-2 optional SAPs<br>• 0 - spares | • 0 - 16 InfiniBand HCA3-O LR 1x InfiniBand links<br>• 0 - 8 InfiniBand HCA3-O 12x InfiniBand links<br>• 0-8 PCIe I/O drawer cable connections<br>• 0-8 copper I/O drawer cable connections |
| FC 1148 (Model **H13**) | CPC | • 2 CPC drawers<br>• 0-6 CPs<br>• 0-13 IFLs<br>• 0-12 unassigned IFLs<br>• 0-6 zAAPs<br>• 0-6 zIIPs<br>• 0-13 ICFs<br>• 1 IFP<br>• 2 - base SAPs, 0-2 optional SAPs<br>• 2 - spares | • 0 - 32 InfiniBand HCA3-O LR 1x InfiniBand links<br>• 0 - 16 InfiniBand HCA3-O 12x InfiniBand links<br>• 0-16 PCIe I/O drawer cable connections<br>• 0-16 copper I/O drawer cable connections |
| FC 3213 | 1 pair of batteries | • Internal Battery Feature | |
| **Notes:**<br>1. CP - Central Processor<br>2. SAP - System Assist Processor<br>3. IFL - Integrated Facilities for Linux<br>4. ICF - Integrated Coupling Facility<br>5. zAAP - System z Application Assist Processor<br>6. zIIP - System z Integrated Information Processor<br>7. IFP - Integrated Firmware 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 I/O drawers and PCIe I/O drawer. These I/O drawers and PCIe I/O drawers are placed below the processor drawer.

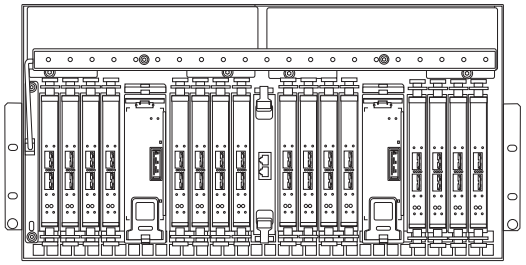



## I/O drawers and PCIe I/O drawers

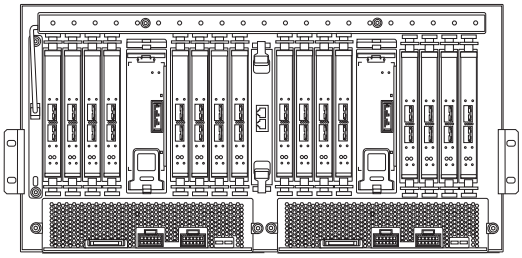
The zBC12 provides I/O adapters in two different packages:

- I/O drawer - 5 EIA units tall - provides 8 adapters, with up to four ports per adapter.
- PCIe I/O drawer - 7 EIA units tall - provides 32 adapters, with two ports per adapter.

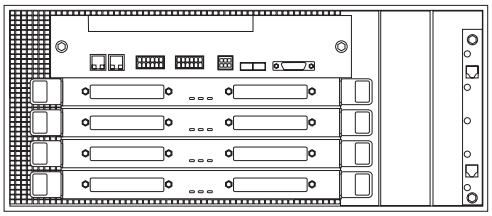
You can have a maximum of eight legacy I/O cards in a zBC12.



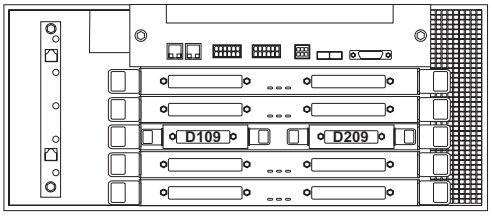
PCIe I/O drawer front view



PCIe I/O drawer rear view



I/O drawer front view




I/O drawer rear view

## System upgrades

Any model of 2098 (System z10™ BC) or 2818 (zEnterprise 114) is upgradeable to any model of zBC12. All upgrades from previous systems will be accomplished by removing the old system (z10 BC or z114) and replacing it with a new zBC12.

## Differences between IBM servers

Comparison information is provided here for those who may be placing a zBC12 on a raised floor with previous IBM single-frame servers.

*Table 10. Differences between single-frame System z servers.*

This table lists the width, depth, height, and maximum weight of all the single-frame System z servers.

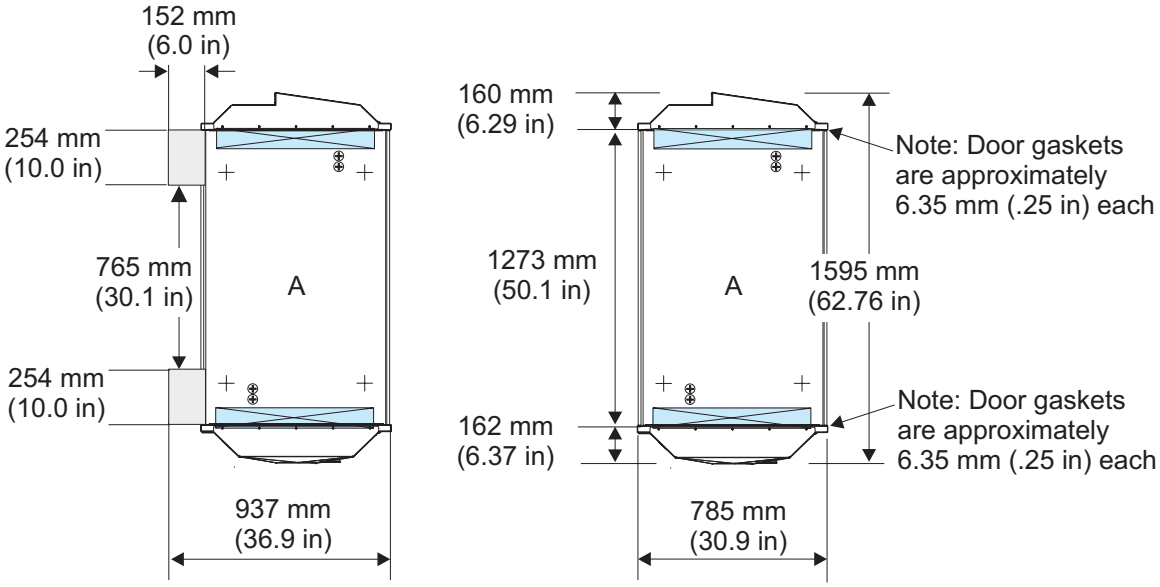
| System Family | Width (with covers) | Depth (with covers) | Height (with covers | Weight (Maximum) |
|---|---|---|---|---|
| zSeries 800 (2066) | 720 mm (28.3 in) | 1148 mm (45.1 in) | 1810 mm (71.3 in) | 545 kg (1201 lbs) |
| zSeries 890 (2086) | 785 mm (30.9 in) | 1577 mm (62.1 in) | 1941 mm (76.4 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) |
| zBC12 (2828) | 785 mm (30.9 in) | 1595 (62.8) | 2015 mm (79.3 in) | 1036 kg (2282 lbs) |
| zBC12 (2828 with I/O towers) | 937 mm (36.9 in) | 1595 (62.8) | 2154 mm (84.8 in) | 1079 kg (2377 lbs) |

All of these servers always consist of one frame.

If you are replacing an existing IBM server, refer carefully to the *zEnterprise BC12 Installation Manual for Physical Planning* (available on the Resource Link at *http://www.ibm.com/servers/resourcelink*) to determine actual differences between your installed IBM server and the zBC12. Plan views, physical dimensions, service clearances, aisle spacing, and power and cooling requirements may be substantially different.

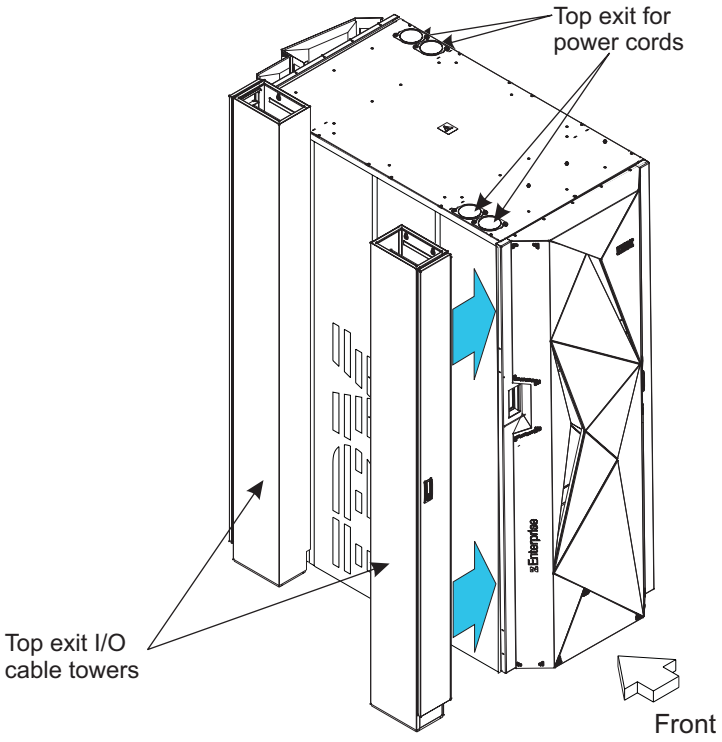
## Plan view

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




| Frame Entry/Exit | Cutout dimension for raised floor | |
|---|---|---|
| | (mm) | (in) |
| Front<br>Rear | 94 x 655<br>94 x 655 | 3.7 x 25.8<br>3.7 x 25.8 |

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 zBC12. All floor loading calculations are intended for a raised floor environment.

*Table 11. Floor loading information - Model H06*

| Maximum | A Frame - Model H06 |
|---|---|
| Weight | 810 kg (1785 lbs) |
| Width | 785 mm (30.9 in) |
| Depth | 1273 mm (50.1 in) |

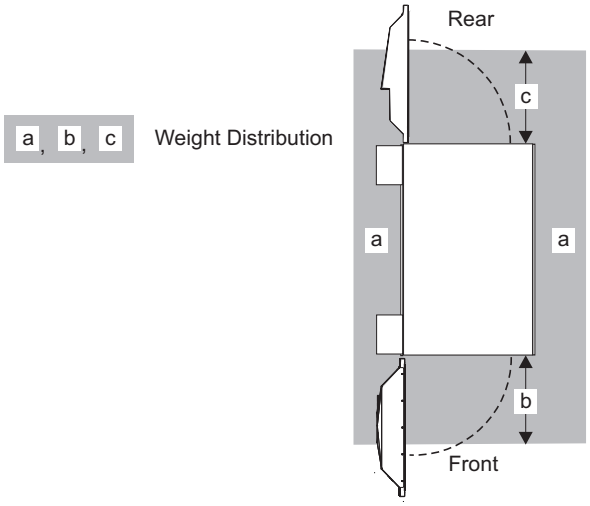
*Table 12. Floor loading information - Model H13*

| Maximum | A Frame - Model H13 |
|---|---|
| Weight | 944 kg (2082 lbs) |
| Width | 785 mm (30.9 in) |
| Depth | 1273 mm (50.1 in) |

**Notes:**

1. Weight includes covers. Width and depth are indicated without covers.
2. Internal battery (FC 3213) adds approximately 101 kg (222 lbs).
3. The optional top exit I/O cabling towers add approximately 43 kg (95 lbs) to the server weight, 152.4 mm (6 in) to the width, and 140 mm (5.5 in) to the height.
4. Balanced power (FC 3003) adds approximately 51 kg (112 lbs).
5. The front cover adds 162 mm (6.37 in) and the rear cover adds 160 mm (6.29 in) to the depth.

The following figure and table show sample floor loading values for the zBC12 server with and without the Internal Battery Feature (3213).




For the floor loading specifications in the following two tables, the numbers given are for a zBC12 Model H13 (two processor drawers, FC 1148) with Integrated Batteries (FC 3213) installed and using the 3-phase Balanced Power (FC 3003) option.

The weight of this server is 1036 kg (2282 lbs).

*Table 13. 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 1079 kg (2377 lbs).

*Table 14. 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 31.

- "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.

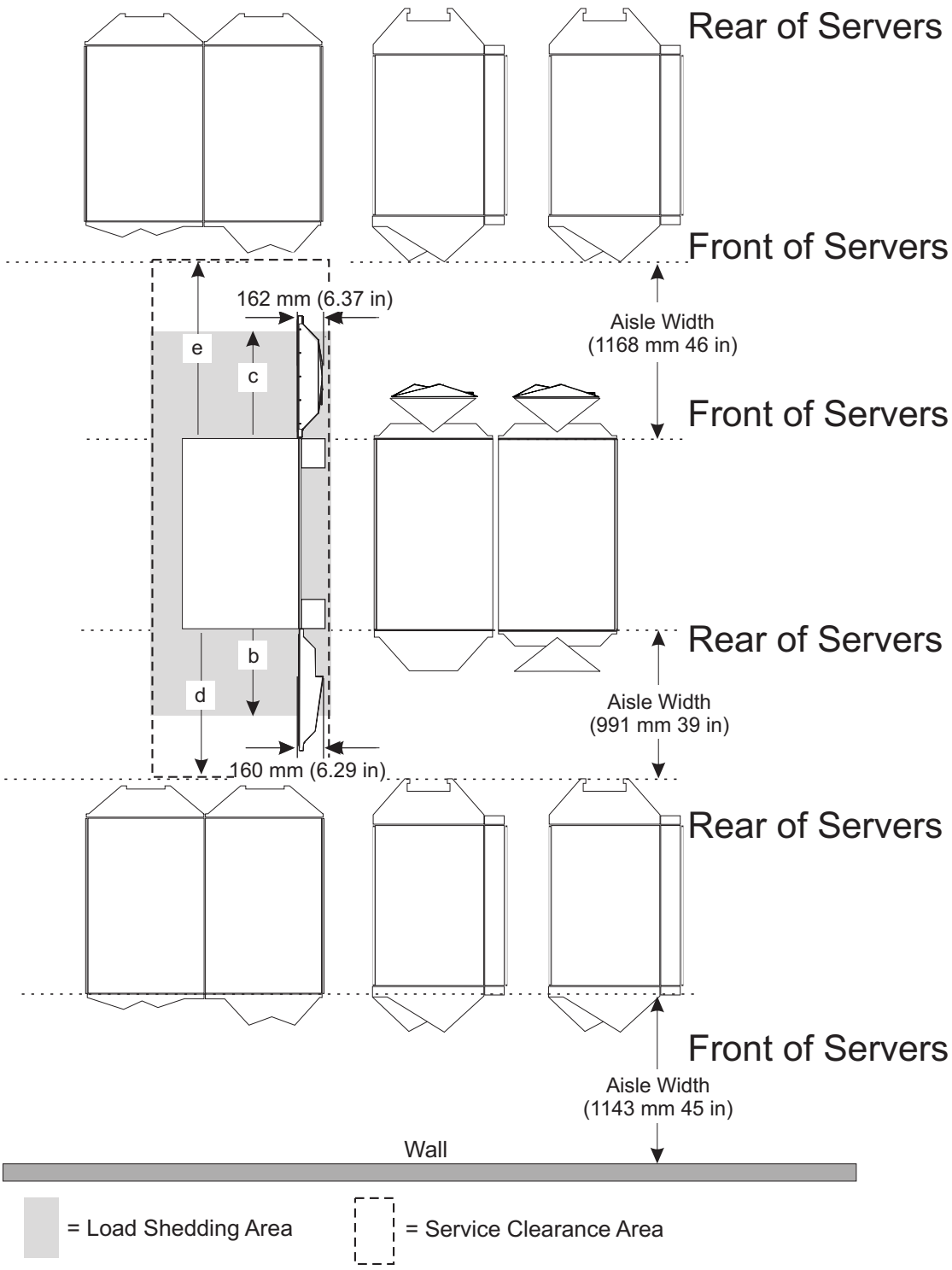



*Figure 1. Aisle and service clearances*

## Machine and service clearance areas

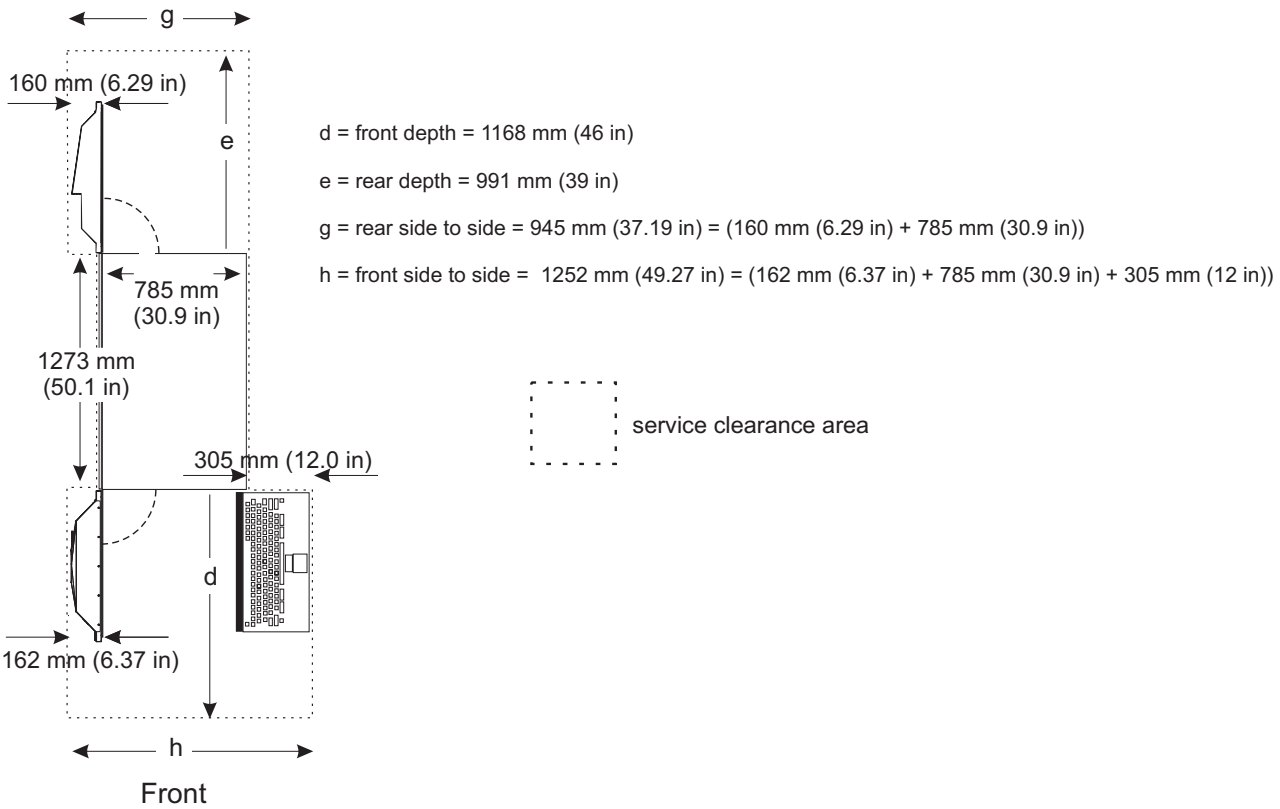
Machine area is the actual floor space covered by the system. Service clearance area includes the machine area, plus additional space required to open the doors and Support Element gate for service access to the system.

*Table 15. Machine area and service clearance area*

| Number of frames | Machine area M² (ft²) | Service clearance area M² (ft²) |
|---|---|---|
| 1 (A) | 1.26 (13.47) without I/O towers | front service clearance = 1.46 (15.74)<br>machine area without doors and without I/O towers = 0.99 (10.75)<br>rear service clearance = 0.94 (10.08) |
| 1 (A) | 1.50 (16.09) with I/O towers | front service clearance = 1.46 (15.74)<br>machine area without doors and with I/O towers = 1.19 (12.84)<br>rear service clearance = 0.94 (10.08) |

**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 zBC12 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.)

- 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 162 mm (6.37 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**).

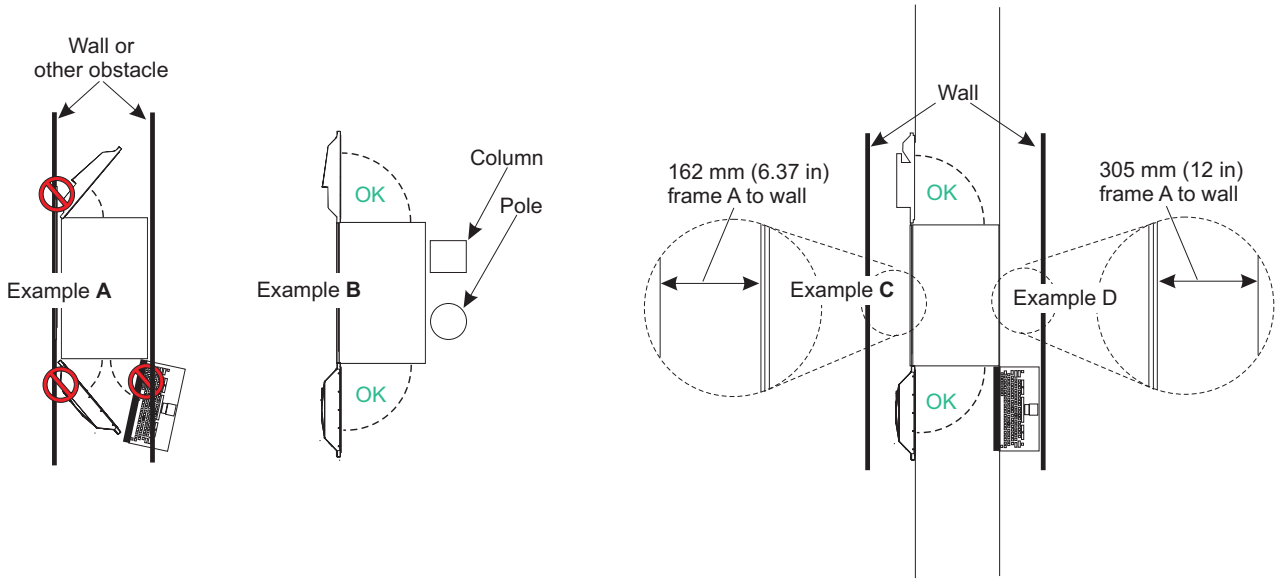


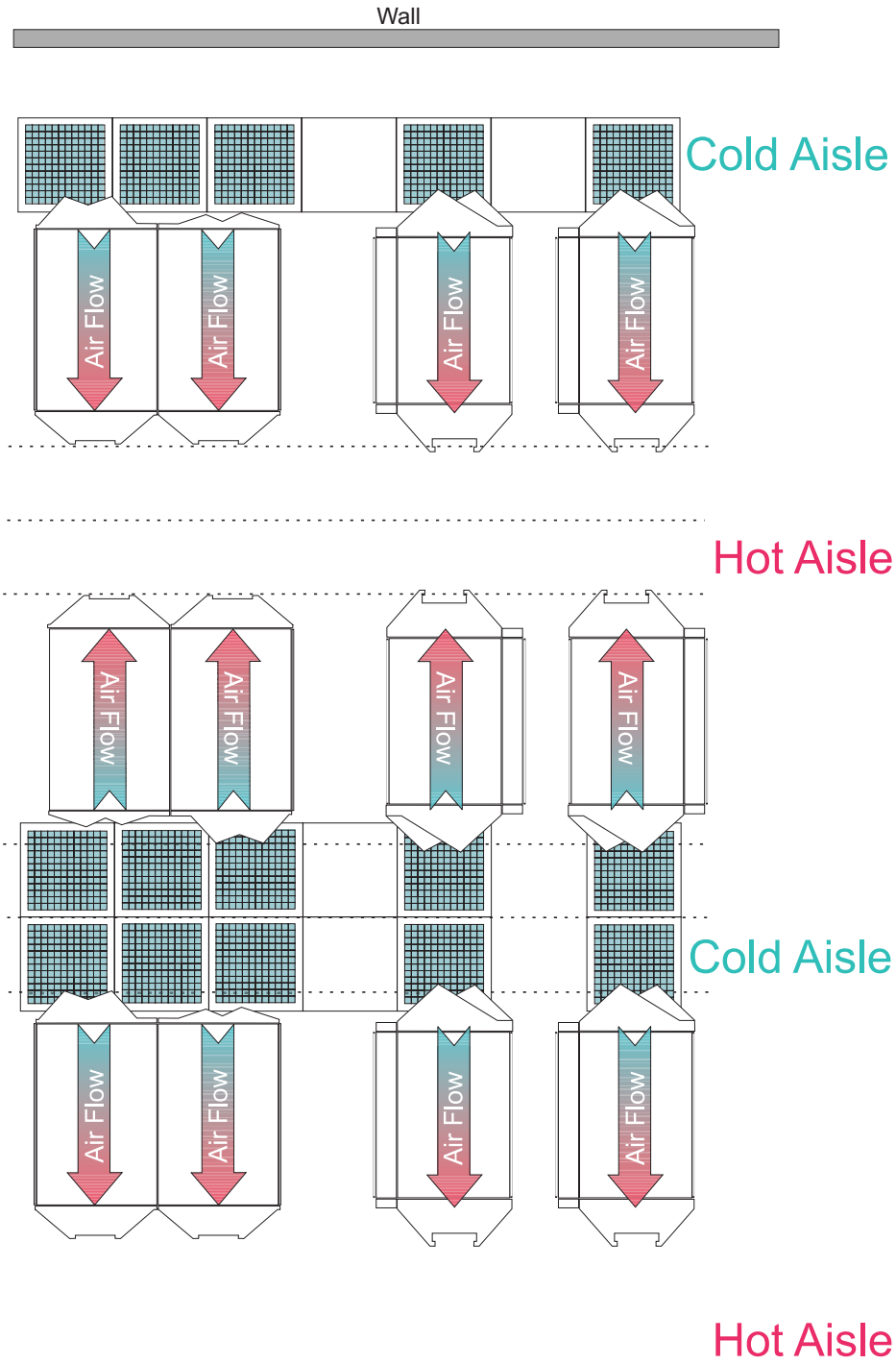

*Figure 2. Detailed service clearances*

## 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 zBC12 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 zBC12.

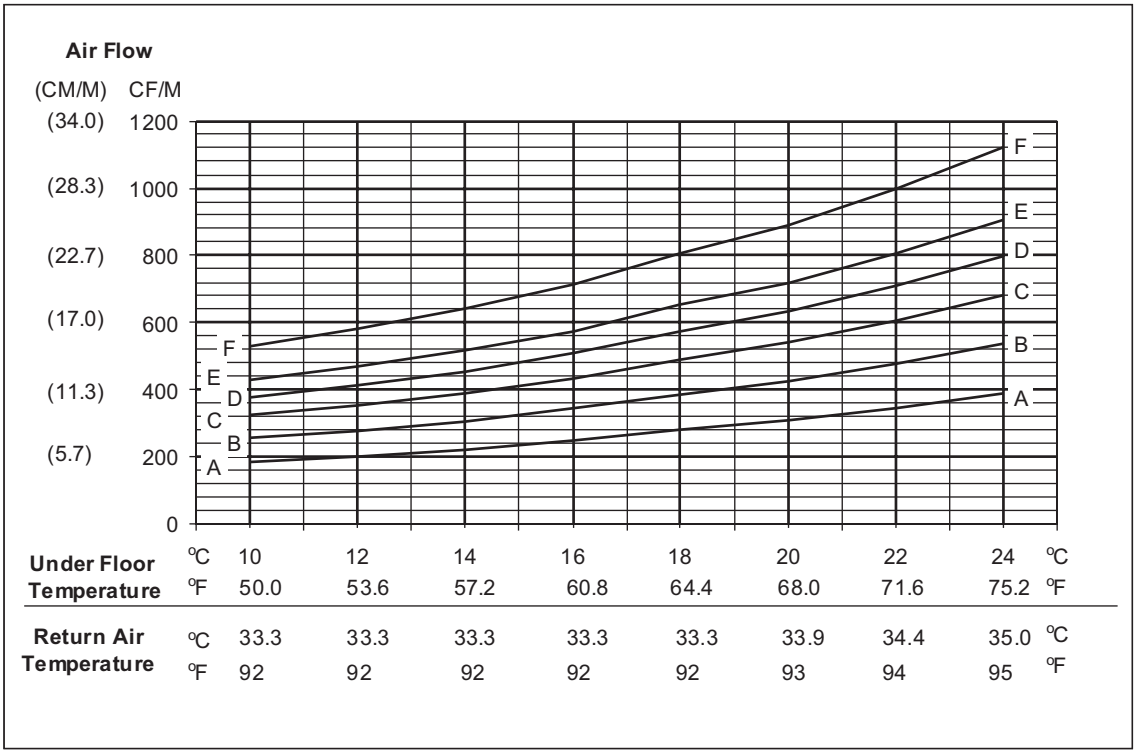



*Table 16. Cooling airflow graph codes- Model H06*

| H06 configurations | Airflow curve from chart |
|---|---|
| 0 I/O drawers | A |
| 1 FC 4000 I/O drawer | A |
| 1 FC 4000 I/O drawer and 1 FC 4009 PCIe I/O drawer | C |
| 1 FC 4009 PCIe I/O drawer | B |
| 2 FC 4009 PCIe I/O drawers | D |
| **Note:** FC 4000 = I/O drawer, FC 4009 = PCIe I/O drawer | |

*Table 17. Cooling airflow graph codes- Model H13*

| H13 configurations | Airflow curve from chart |
|---|---|
| 0 I/O drawers | A |
| 1 FC 4000 I/O drawer | B |
| 1 FC 4000 I/O drawer and 1 FC 4009 PCIe I/O drawer | D |
| 1 FC 4000 I/O drawer and 2 FC 4009 PCIe I/O drawers | F |
| 1 FC 4009 PCIe I/O drawer | C |
| 2 FC 4009 PCIe I/O drawers | E |
| **Note:** FC 4000 = I/O drawer, FC 4009 = 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 zBC12 into an existing multiple-system environment, or when adding additional systems to an installed zBC12, consider the following factors:

- **Thermal interactions**

  Although computer room floor space is valuable, for optimal cooling, it is recommended that zBC12s have a 1220 mm (48 in) aisle between rows of systems to reduce surrounding air temperature. See "Cooling recommendations for the room" on page 34.

- **Floor placement**

  The zBC12 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.

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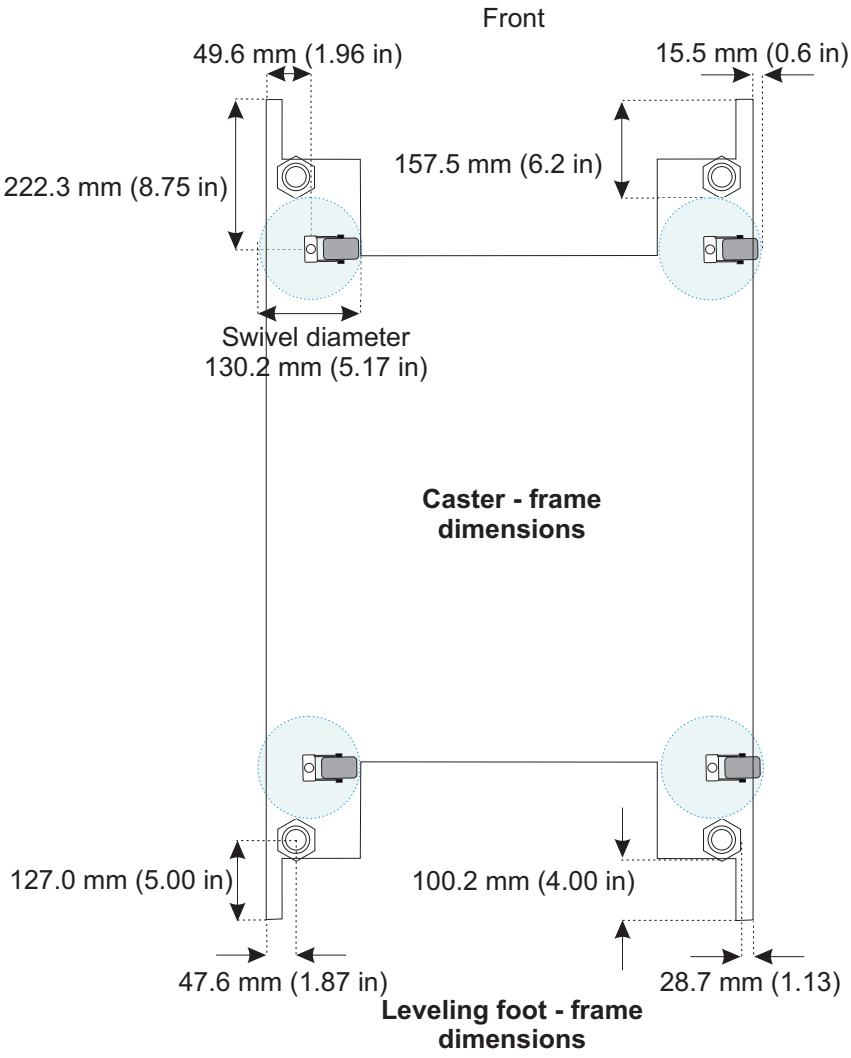
## Casters

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:**

zBC12, fully configured, can weigh in excess of 1078 kg (2375 lbs) **You must be certain that the raised floor on which you are going to install the server is capable of supporting this weight.** Contact your floor tile manufacturer and a structural engineer to verify that your raised floor is safe to support the zBC12.

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

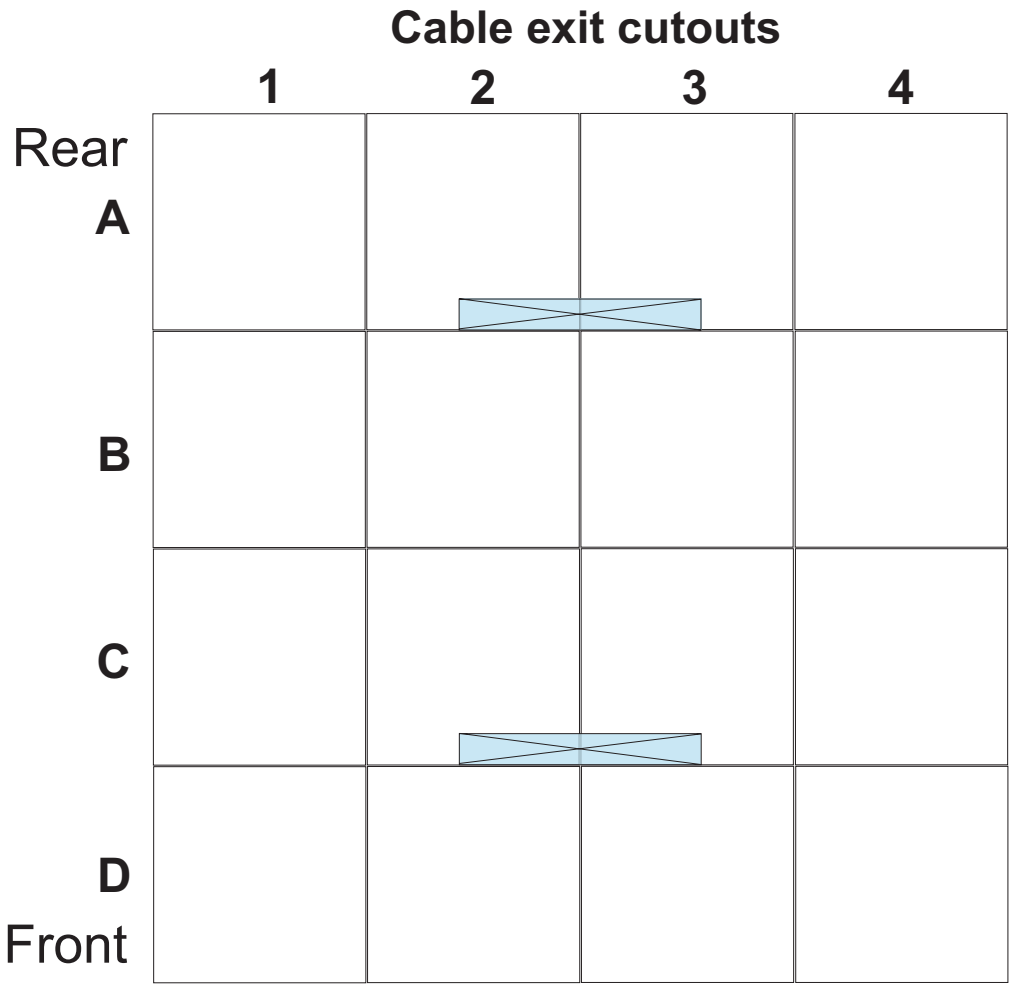
**Ensure adequate floor space is available to place the frames over the floor panels exactly as shown on the drawing**

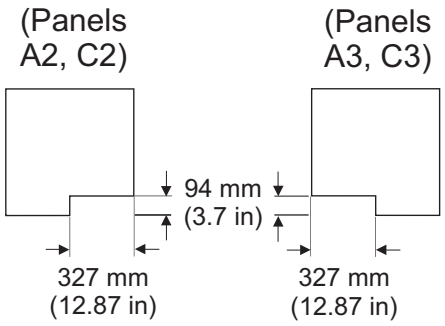
**Note:** Frame template P/N 41T8506 can be ordered by your IBM service representative to assist in the system layout on your raised floor.

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

1. Identify the panels needed, and list the total quantity of each panel required for the installation.
2. Cut the required quantity of panels.
3. Additional panel supports (pedestals) are **recommended** to restore the structural integrity of the cut floor tile panels.
4. When cutting the panels, you must adjust the size of the cut for the thickness of the edge molding you are using. The dimensions shown are finished dimensions.
5. For ease of installation, number each panel as it is cut as shown on the panel specification pages.
6. Use the raised floor diagram to install the panels in the proper positions.
7. 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



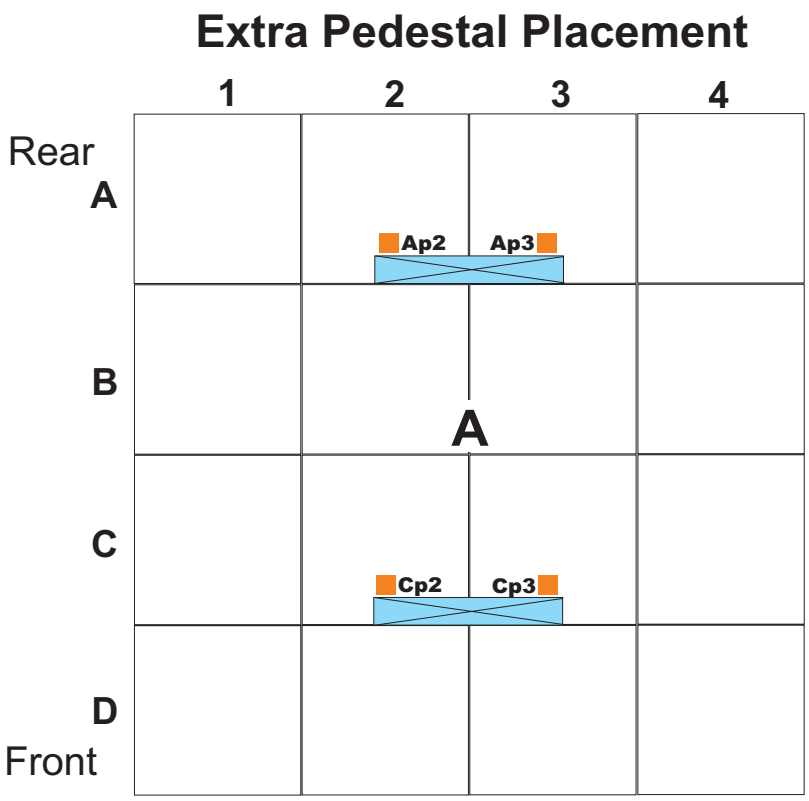




| Frame Entry/Exit | Dimension | |
|---|---|---|
| | (mm) | (in) |
| Front<br>Rear | 94 x 655<br>94 x 655 | 3.7 x 25.8<br>3.7 x 25.8 |

**Important:**

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

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




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

# Chapter 5. Power requirements

## General electrical power requirements

The zBC12 requires the following:

- System frame
  - 50/60 Hz AC or high voltage DC
  - Voltage ranges:
    - AC: 200V to 480V AC, three-phase wiring or single-phase wiring with some restrictions
    - DC: 380V to 520V DC

  The system requires two power feeds, of the types previously described, each with the same nominal voltage. One is connected to the front of the A frame, and one is connected to the rear of the A frame.

  **You cannot use a mix of DC power and AC power. The input power for the zBC12 must be exclusively AC or exclusively DC.**

  Refer to the Appendix D, "Dual power installation," on page 107 for the correct wiring method for your particular power distribution equipment.
- Hardware Management Console

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

## Important power selection considerations

As you select features for zBC12, be aware of the following when choosing server power:

- If you choose single phase power, reference Table 18 on page 47 for the Model H06 or Table 19 on page 48 for the Model H13 to see which I/O drawer or PCIe 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

zBC12 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.

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See Appendix D, “Dual power installation,” on page 107 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.

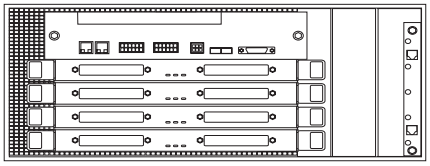
| Supply type | Nominal voltage range (V) | Voltage tolerance (V) | Frequency range (Hz) |
|---|---|---|---|
| Two redundant 3-phase line cords | 200-480 | 180-509 | 47-63 |
| Two redundant single -phase line cords | 200-415 | 180-440 | 47-63 |
| Two redundant DC line cords | 380-520 | 330-550 | N/A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

| 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 |

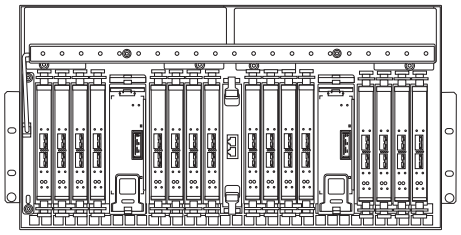
## Power specifications

The following tables provide system power consumption/heat load based on the number of processor drawers and number of I/O drawers or PCIe I/O drawers 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 18. Utility power consumption for zBC12 Model H06 (1 processor drawer)*

| I/O compliment | Environment 1 (kW) | Environment 2 (kW) | Environment 3 (kW) |
|---|---|---|---|
| 0 I/O drawers and 0 PCIe I/O drawers | 1.53 [5] | 1.86 [5] | 1.87 [5] |
| 1 I/O drawer | 2.35 [5] | 2.77 [5] | 2.92 [5] |
| 1 PCIe I/O drawer | 3.05 [5] | 3.48 [5] | 3.53 [5] |
| 1 I/O drawer + 1 PCIe I/O drawer | 3.94 [5] | 4.42 [5] | 4.61 [5] |
| 2 PCIe I/O drawers | 4.59 | 5.09 | 5.17 |

**Notes:**

1. Environmental conditions:
   - Environment 1 = ambient room temperature of less than 28° C **AND** altitude of 3000 ft or less above sea level
   - Environment 2 = ambient room temperature of greater than or equal to 28° C **OR** altitude of greater than 3000 ft above sea level
   - Environment 3 = (ambient room temperature of greater than or equal to 28° C) **AND** (altitude of greater than 3000 ft above sea level **OR** altitude of greater than 6000 ft 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. Indicates that single phase input power is available. There is no balanced power option for single phase input power.

*Table 19. Utility power consumption for zBC12 Model H13 (2 processor drawers)*

| I/O compliment | Environment 1 (kW) | Environment 2 (kW) | Environment 3 (kW) |
|---|---|---|---|
| 0 I/O drawers and 0 PCIe I/O drawers | 2.15 [5] | 2.77 [5] | 2.74 [5] |
| 1 I/O drawer | 3.05 [5] | 3.69 [5] | 3.80 [5] |
| 1 PCIe I/O drawer | 3.73 | 4.40 | 4.41 |
| 1 I/O drawer + 1 PCIe I/O drawer | 4.62 | 5.34 | 5.49 |
| 2 PCIe I/O drawers | 5.24 | 5.97 | 6.02 |
| 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 less than 28º C **AND** altitude of 3000 ft or less above sea level
   - Environment 2 = ambient room temperature of greater than or equal to 28º C **OR** altitude of greater than 3000 ft above sea level
   - Environment 3 = (ambient room temperature of greater than or equal to 28º C) **AND** (altitude of greater than 3000 ft above sea level **OR** altitude of greater than 6000 ft 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. Indicates that single phase input power is available. There is no balanced power option for single phase input power.

## Power estimation tool

The power estimator tool for zBC12 allows you to enter your precise server configuration to produce an estimate of power consumption. You can also use the tool to calculate the weight of your server.

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

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

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

## Power capping

zBC12 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 - 240 VAC | 24A | 30 amps |
| 380 - 415 VAC | 16A | 16 amps |
| 480 VAC | 14A | 20 amps |
| 380 - 520 VDC | 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 3213)

The Internal Battery Feature (IBF), FC 3213, is optional on the zBC12. 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 20. Battery hold-up times for Model H06*

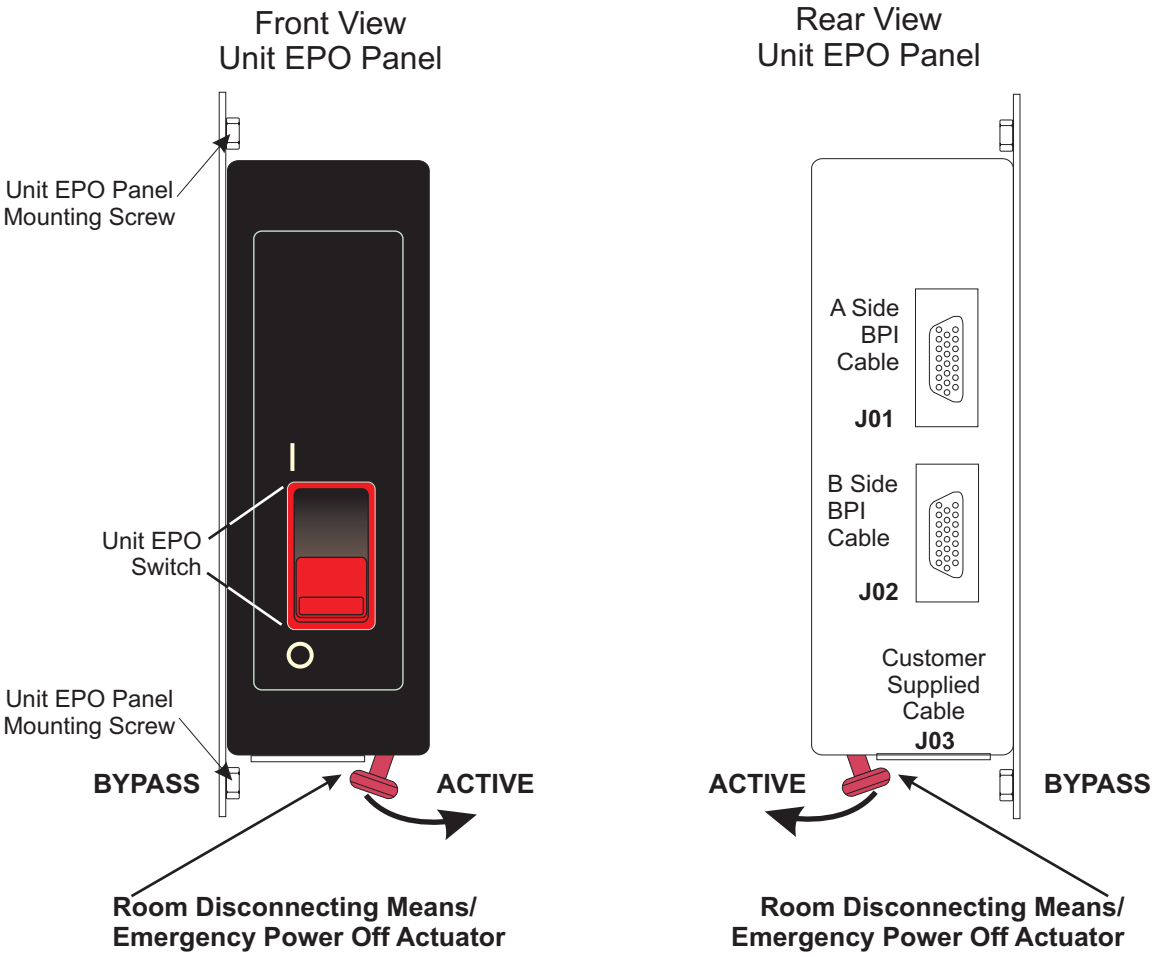
| Model H06 - 1 CPC drawer | hold-up time (minutes) |
|---|---|
| 0 I/O drawers and 0 PCIe I/O drawers | **25** |
| 1 I/O drawer | **18** |
| 1 PCIe I/O drawer | **12** |
| 1 I/O drawer and 1 PCIe I/O drawer | **9** |
| 2 PCIe I/O drawers | **7** |
| **Notes:**<br>1. The numbers shown are approximate for 70° F, batteries no older than 3 years, and full N+1 power (both power supplies in operation).<br>2. Hold-up times are influenced by temperature, battery age, and fault conditions within the system. | |

*Table 21. Battery hold-up times for Model H13*

| Model H13 - 2 CPC drawers | hold-up time (minutes) |
|---|---|
| 0 I/O drawers and 0 PCIe I/O drawers | **15** |
| 1 I/O drawer | **10.5** |
| 1 PCIe I/O drawer | **8.5** |
| 1 I/O drawer and 1 PCIe I/O drawer | **6.5** |
| 2 PCIe I/O drawers | **5** |
| 1 I/O drawer and 2 PCIe I/O drawers | **4** |
| **Notes:**<br>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).<br>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.

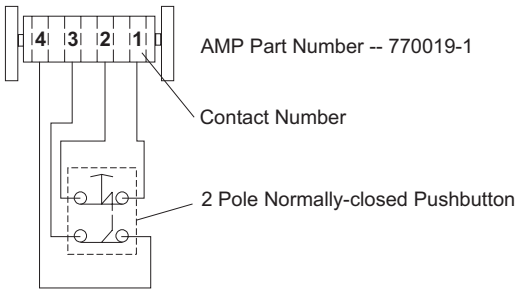



This figure illustrates the back of the machine UEPO panel showing where the room electrical power disconnecting means, or room Emergency Power Off, EPO, cable plugs into the machine. Notice the switch actuator. Once moved to make the cable connection possible, the room disconnecting means / EPO cable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

## Power plugs and receptacles, and line cord wire specifications

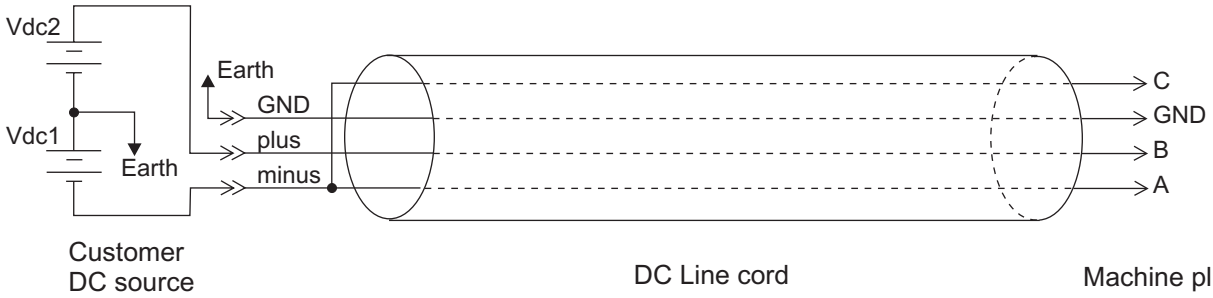
Plugs are shipped with the machine line cords in USA and Canada. Power cords that exit the bottom of the frame are 4250 mm (14 ft.). Top exit power cords are 1829 mm (6 ft). Power plugs in the following table are approved for use with specified models and meet the relevant test laboratory or country/test-house 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**.

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 22. Input voltage range*

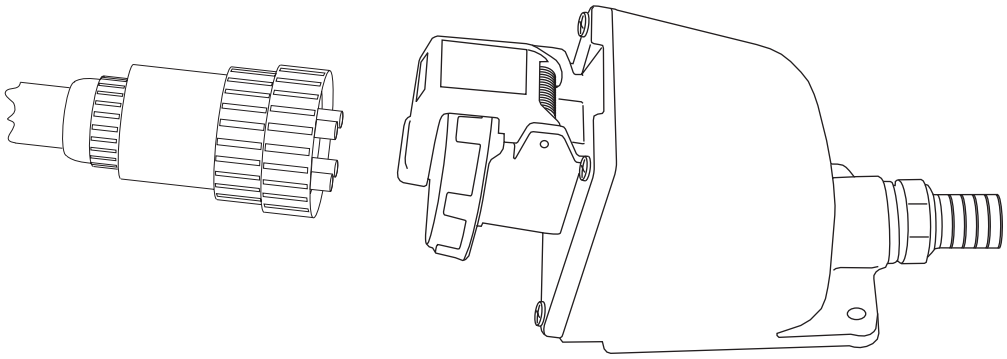
| Parameter | Absolute maximum | Absolute minimum |
|---|---|---|
| Vdc1 + Vdc2 | 550V | 330V |
| Vdc1 | 550V | 0V |
| Vdc2 | 420V | 0V |

*Table 23. Supported power cords*

| System location | Supported power cord feature codes [7] | Watertight plug | Watertight receptacle |
|---|---|---|---|
| USA, Canada, Japan<br>(250 VAC)<br>1 Phase | 8971<br>8990 | 30A IEC-309<br>(provided as part of the cord) | 30A IEC-309 HBL330R6W<br>(not provided) |
| USA, Canada, Japan<br>(250 VAC)<br>3 Phase | 8975<br>8987 | 30A IEC-309<br>(provided as part of the cord) | 30A IEC-309 HBL430R9W<br>(not provided) |
| USA, Canada<br>(415 VAC) | 8957<br>8976 | 30A IEC-309 [8]<br>(provided as part of the cord) | 30A IEC-309 HBL430R6V02<br>(not provided) |
| USA, High Voltage<br>(480 VAC) | 8969<br>8983 | 30A IEC-309<br>(provided as part of the cord) | 30A IEC-309 HBL430R7W<br>(not provided) |
| World Trade<br>(200-240 VAC) | 8970 [6]<br>8972 [6]<br>8988 [6]<br>8991 [6]<br>8998 [6] | No plug provided.<br>Cut end cord.<br>Plug is provided by the customer and is electrician-installed. | (not specified) |
| World Trade<br>(380-415 VAC) | 8970 [6]<br>8972 [6]<br>8988 [6]<br>8991 [6]<br>8998 [6] | No plug provided.<br>Cut end cord.<br>Plug is provided by the customer and is electrician-installed. | (not specified) |
| | | | |
| USA, Canada, Japan<br>(380-520 VDC) | 8966<br>8973 | 30A IEC-309<br>(provided as part of the cord) | 30A IEC-30 HBL330R8WDC<br>(not provided) |
| World Trade<br>(300-600 VDC) | 8964<br>8974 | No plug provided.<br>Cut end cord.<br>Plug is provided by the customer and is electrician-installed. | (not specified) |

**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 mis-wired phase and ground reversal
   - In some cases, a metal backbox may be better for EMI mitigation



You may choose not to use a metal backbox. In this case, please check your local code for specific requirements.

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. Where plugs are provided, Hubbell is the plug supplier.
5. If you choose to use a Hubbell receptacle, do NOT use the Hubbell C-Series Light Industrial 3.
6. This FC can be used in both ranges: 200-240V and 380-415V.
7. See "Line cord wire specifications" on page 59 for descriptions of the power cord feature codes.
8. This plug is dual listed at 30A and 32A.

## 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.

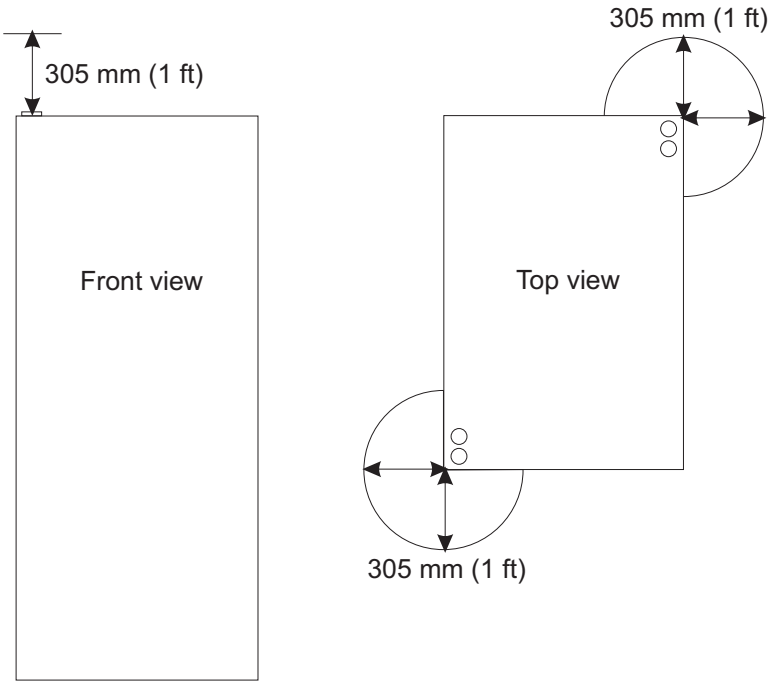
Conduit must not be used as the only grounding means. However, any conduit or cable shield must be connected at both ends in such a way that it is included in the grounding path in parallel with the grounding conductor it contains. Most electrical codes require that branch circuit wiring be located in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

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

## Top exit power cords

zBC12 has the option of top exit power cabling (FC 7901). 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: 8957, 8969, 8970, 8971, 8972, 8973, 8974, and 8975.

## Line cord wire specifications

| Line code usage location | Feature code | AWG # Type # of wires | Number of shields | Connector supplied | Bulk outside diameter mm (in) |
|---|---|---|---|---|---|
| USA, Canada (415 VAC) 3 Phase top exit cord 6 ft. | FC 8957 | #10 AWG Type ST 4 wire | 1 (overall gross shield) | Yes | 18.54 |
| World Trade (380-520 VDC) bottom exit cut cord 14 ft. | FC 8964 | #10 AWG Type ST 4 wire | 1 (overall gross shield) | No | 18.54 |
| USA, Canada, Japan (380-520 VDC) bottom exit cord 14 ft. | FC 8966 | #10 AWG Type ST 4 wire | 1 (overall gross shield) | Yes | 18.54 |
| USA, Canada, Japan (480 VAC) 3 Phase top exit cord 6 ft. | FC 8969 | #10 AWG Type ST 4 wire | 1 (overall gross shield) | Yes | 18.54 |
| World Trade [1, 2] (HiLo VAC) 3 Phase top exit cut cord 14 ft. | FC 8970 | #10 AWG Type ST 4 wire | 1 (overall gross shield) | No | 18.54 |
| USA, Canada, Japan (200-240 VAC) 1 Phase top exit cord 6 ft. | FC 8971 | #10 AWG Type ST 3 wire | 1 (overall gross shield) | Yes | 18.54 |
| World Trade [1, 2] (HiLo VAC) 1 Phase top exit cut cord 14 ft. | FC 8972 | #10 AWG Type ST 3 wire | 1 (overall gross shield) | No | 18.54 |
| USA, Canada, Japan (380-520 VDC) top exit cord 6 ft. | FC 8973 | #10 AWG Type ST 4 wire | 1 (overall gross shield) | Yes | 18.54 |
| World Trade [2] (380-520 VDC) top exit cut cord 14 ft. | FC 8974 | #10 AWG Type ST 4 wire | 1 (overall gross shield) | No | 18.54 |
| USA, Canada, Japan (200-240 VAC) 3 Phase top exit cord 6 ft. | FC 8975 | #10 AWG Type ST 4 wire | 1 (overall gross shield) | Yes | 18.54 |
| USA, Canada (415 VAC) 3 Phase bottom exit cord 14 ft. | FC 8976 | #10 AWG Type ST 4 wire | 1 (overall gross shield) | Yes | 18.54 |
| USA (480 VAC) 3 Phase bottom exit cord 14 ft. | FC 8983 | #10 AWG Type DP-1 4 wire | 1 (overall gross shield) | Yes | 14.48 |

| Line code usage location | Feature code | AWG # Type # of wires | Number of shields | Connector supplied | Bulk outside diameter mm (in) |
|---|---|---|---|---|---|
| USA, Canada, Japan (200-240 VAC) 3 Phase bottom exit cord 14 ft. | FC 8987 | #10 AWG Type ST 4 wire | 1 (overall gross shield) | Yes | 18.54 |
| World Trade [1] (HiLo VAC) 3 Phase bottom exit cut cord 14 ft. | FC 8988 | #10 AWG Type DP-1 4 wire | 1 (overall gross shield) | No | 14.48 |
| USA, Canada, Japan (200-240 VAC) 1 Phase bottom exit cord 14 ft. | FC 8990 | #10 AWG Type ST 3 wire | 1 (overall gross shield) | Yes | 18.54 |
| World Trade [1] (HiLo VAC) 1 Phase bottom exit cut cord 14 ft. | FC 8991 | #10 AWG Type DP-1 3 wire | 1 (overall gross shield) | No | 14.48 |
| World Trade [1] LSZH (HiLo VAC) 3 Phase bottom exit cut cord 14 ft. | FC 8998 | #10 AWG Type DP1 4 wire | 1 (overall gross shield) | No | 15.00 |

**Notes:**

1. HiLo VAC can be used in both ranges: 200-240 VAC or 380-415 VAC.
2. This excludes Canada and Japan.
3. 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 zBC12 is supplied with a pair of integrated ThinkPad Support Elements. 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 zBC12 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 0091 or FC 0092) is required to operate zBC12. FC 0092 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 zBC12, you will need to order FC 0025, Unified Resource Manager and provide two HMCs – one to serve as the primary HMC for the ensemble, and one to serve as the alternate HMC.

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

The machine type and model number of the primary HMC and alternate HMC must be identical. Both must be either FC 0091 or FC 0092. Verify this information by viewing the label on top of the HMC hardware tower. (i.e. For FC 0091, MTM: 7327-PAA. For FC 0092, MTM: 7382-PBC.)

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 will use removable UFDs 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 flat panel display (FC 6096)
  - L2251x - 22-inch flat panel display

  or
  - LT2323p - 23-inch flat panel display

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

An Ethernet switch will not be offered as a configurable feature on zBC12. If an Ethernet switch is needed to manage the Ethernet connection between the Support Elements and HMCs, you must supply

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your own. It is recommended that the Ethernet switch support a speed of 1 Gb. However, if you are upgrading to a zBC12 and Ethernet switch, FC 0070, is found on the base machine, it will be carried forward.

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

Physical specifications for the Hardware Management Console components are located in Appendix B, "Hardware Management Console physical specifications," on page 101.

## Ethernet LAN switch support

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

There must be an Ethernet switch or hub available to connect the Hardware Management Consoles to your LAN. The Ethernet switch or hub is a standalone unit located outside the frame and which operates on building AC power. An Ethernet switch will not be offered as a configurable feature on zBC12. You must supply your own Ethernet switch unless you are upgrading to a zBC12. If you are upgrading to a zBC12 and Ethernet switch, FC 0070, is found on the base machine, it will be carried forward. It is recommended that the Ethernet switch support a speed of 1 Gb.

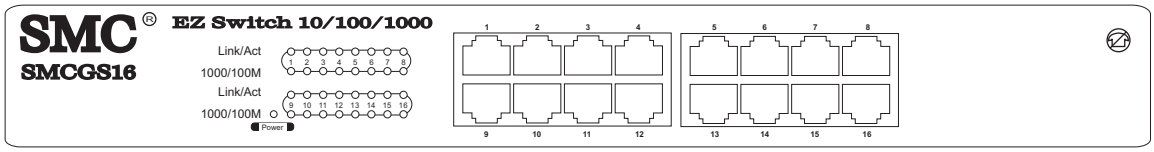
Typical Ethernet switch/hub characteristics:

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

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

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

**Switch Example**




## Ethernet network connection requirements

**MUST READ:**

**This product is not intended to be connected directly or indirectly by any means whatsoever to interfaces of public telecommunications networks.**

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

On the zBC12, 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 Figure 3.)

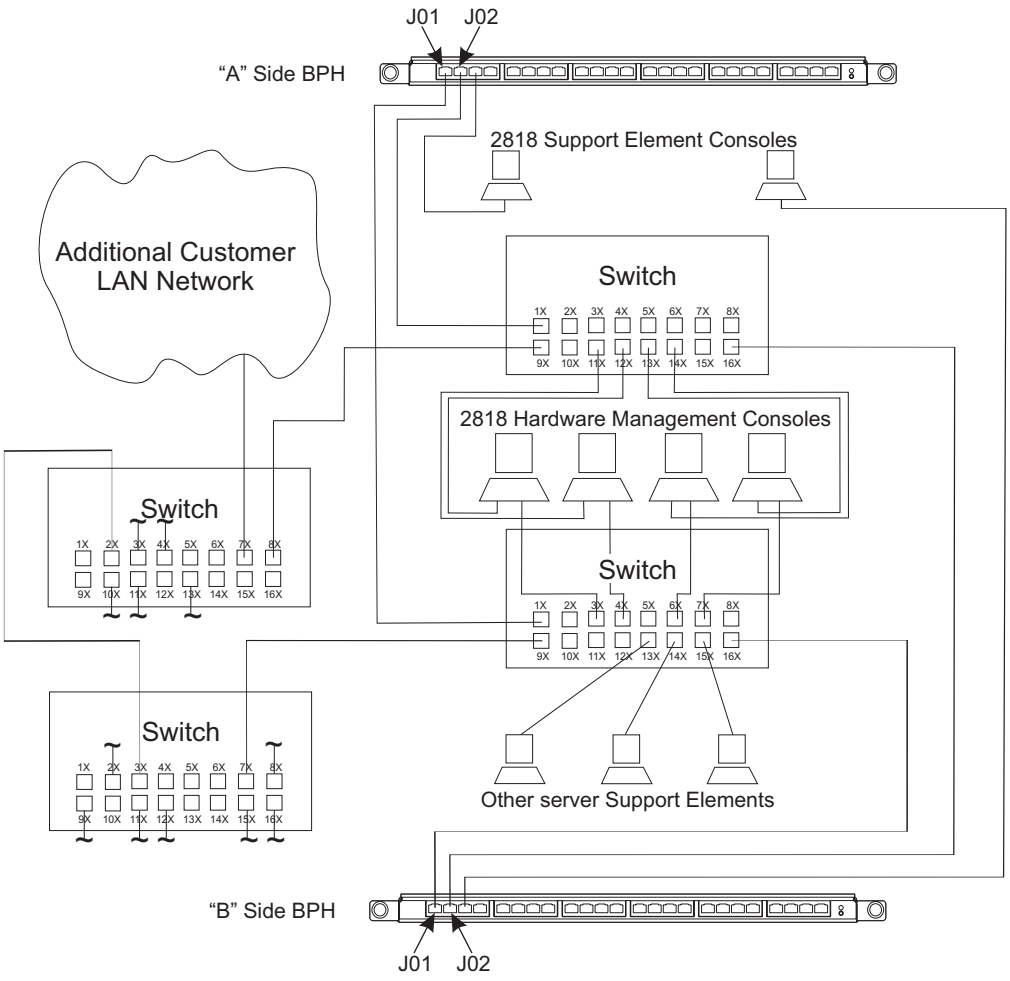



*Figure 3. Two-switch configuration*

This configuration is required because the Support Elements 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.

Figure 4 on page 64 provides general zBC12 Ethernet cabling information and is not intended to illustrate connection to a particular network.

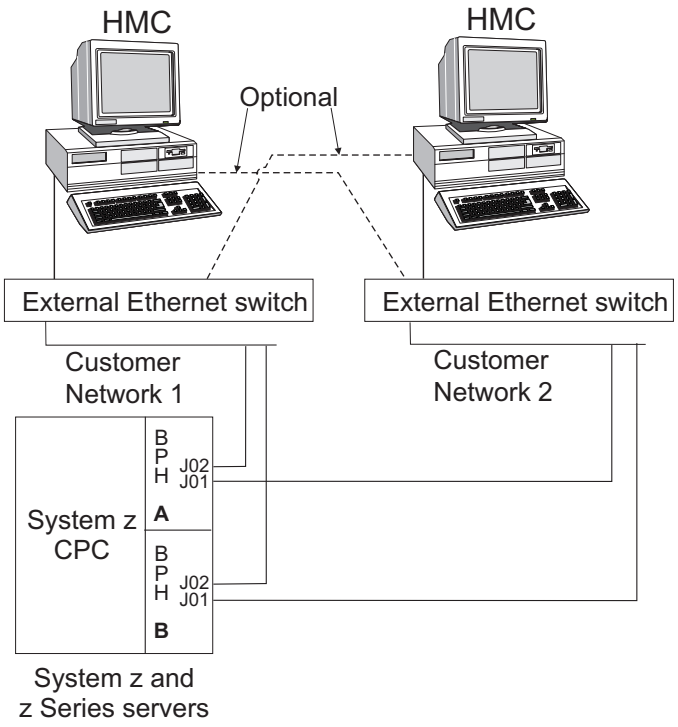



*Figure 4. Ethernet cabling*

## Hardware Management Console and Support Element wiring options

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

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

**Notes on wiring with multiple adapters:**

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

Because HMCs FC 0091 and FC 0092 only come with dual Ethernet features, no additional explanation of wiring scenarios is offered here.

## Trusted Key Entry (TKE)

zBC12 may have a Crypto Express3 (FC 0864), Crypto Express3-1P (FC 0871) or Crypto Express4S FC 0865) 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, Crypto Express3-1P, or Crypto Express4S feature. This console is named the Trusted Key Entry (TKE) workstation.

The TKE workstation, FC 0841 and FC 0842, 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 UFD drive is available for installation of Licensed Machine Code.

**Note:** FC 0841 can only be carried forward.

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

- The Smart Card Reader (SCR) is an optional security device that attaches to the TKE.
- The Smart Card Reader provides swipe card function thus further restricting access to the TKE.
- 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.
- A TKE workstation and the TKE 7.2 or later level code are corequisites for ordering the Smart Card reader.
- Any existing TKE workstation with a code level lower than 7.2 will have to be replaced with a FC 0842 workstation and FC 0872 code (level 7.3) to work with a TKE workstation ordered for your zBC12.
- FC 0884 provides the ability to order additional blank Smart Cards. The Smart Card Reader is a corequisite for ordering additional Smart Cards.

To use the TKE function on zBC12, the Crypto Express3, Crypto Express3-1P, or Crypto Express4S feature, TKE 7.3 code (FC 0872) or TKE 7.2 (FC 0850), 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.

## Planning for an ensemble

If you are planing to use this zBC12 in an ensemble, you must order FC 0025, which supplies the ensemble management code, and you must supply two HMCs (FC 0091 or FC 0092), which manage the ensemble. One of these HMCs is configured as the primary for the ensemble, one as the alternate. This applies to an ensemble with or without a zEnterprise BladeCenter® Extension (zBX).

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

If FC 0025, Unified Resource Manager, is to be used on a single 2828 without a zBX, and if LPAR to LPAR communications is required in a Unified Resource Manager defined VLAN, you must supply an LC Duplex directly-connected cables (not wrap cables, as was previously recommended). Those LC Duplex directly-connected cables plug into the two OSA-Express3 10 GbE features, two OSA-Express4S 10 GbE features, or two OSA-Express5S 10 GbE features (CHPID type OSX).

**Note:**

1. When a zBC12 and FC 0025 (Unified Resource Manager) are ordered without a zBX, eConfig does not force you to order two OSA-Express3 10 GbE features, two OSA-Express4S 10 GbE features, or two OSA-Express5S 10 GbE features; however, those OSA features (OSA-Express3 10 GbE Long Reach (FC 3370), OSA-Express3 10 GbE Short Reach (FC 3371), OSA-Express4S 10 GbE Long Reach (FC 0406), OSA-Express4S 10 GbE Short Reach (FC 0407), OSA-Express5S 10 GbE Long Reach (FC 0415), OSA-Express5S 10 GbE Short Reach (FC 0416)) are required if you plan to use them for LPAR to LPAR communication.
2. The IODF must be shared among participating z/OS® LPARs.

Ensemble network configurations for a zBC12 are as follows:

- Customer-managed management network (with or without zBX)
  - A pair of HMCs (FC 0091 or 0092) with Unified Resource Manager (FC 0025) to control and manage the ensemble. One HMC is configured as the primary, the other as the alternate if the primary HMC fails.
  - Only one pair of HMCs running Unified Resource Manager per ensemble.
- Intranode management (INMN) network (**OSM** CHPID) (with or without zBX)
  - Two ports from two different OSA-Express3 1000BASE-T Ethernet adapters (FC 3367) or OSA-Express5S 1000BASE-T Ethernet adapters (FC 0417) (for redundancy) to provide management capability for a single node through the Unified Resource Manager.
- Intraensemble data (IEDN) network (**OSX** CHPID) (with or without zBX. If without, only if planning for LPAR to LPAR communications)
  - A pair of OSA-Express3 10 GbE adapters, OSA-Express4S 10 GbE adapters, or OSA-Express5S 10 GbE adapters (for redundancy).
  - A pair of 10 Gb loop back cables (customer-supplied) to allow the System z applications to share data on the IEDN between operating system images.
- Customer network connections (**OSD** CHPID) (with or without zBX)
  - For existing network connectivity from System z applications to networks other than the IEDN.

# Chapter 7. Remote Support Facility (RSF) installation planning

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

IBM Remote Support Facility (RSF) is migrating to a new infrastructure. Problem Management (except Viewable Problems), Vital Product Data, and System Availability Data transmissions are now supported using the *enhanced* IBM Service Support System. Access to the *traditional* IBM Service Support System is still required.

Transmission to the enhanced IBM Support System requires a Domain Name Server (DNS) to be available. It must be configured on the call-home server HMC Console or proxy server connecting to the internet.

## Choosing a communications method for remote support

You must choose method for connecting your server to IBM's Service Support System through the Remote Support Facility (RSF):

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

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

Security characteristics of Remote Support Facility communications include:

- Remote Support Facility (RSF) requests are always initiated from the HMC to IBM. No inbound connections are ever initiated from 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 Remote Support Facility (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.

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## 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 IP addresses described in "Server address lists and host names," you can use a direct connection between the HMC and the Internet. The use of Source Network Address Translation (SNAT) and masquerading rules to mask the HMC's source IP address are both acceptable.

**Hardware Management Console Indirect Connection with Proxy Server**

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

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

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

## Server address lists and host names

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

### IPv4 addresses (LMC 2.12.1 and later)

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

- 129.42.26.224
- 129.42.34.224
- 129.42.42.224
- 129.42.56.189
- 129.42.58.189
- 129.42.60.189

### IPv6 addresses (LMC 2.12.1 and later)

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

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

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

- 2620:0:6c0:1::1000
- 2620:0:6c1:1::1000
- 2620:0:6c2:1::1000
- 2620:0:6c0:200:129.42.56.189
- 2620:0:6c1:200:129.42.58.189
- 2620:0:6c2:200:129.42.60.189

### Host names

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

- www-945.ibm.com
- esupport.ibm.com

# 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 zBC12 channel feature connections.
- A description of the Fiber Quick Connect fiber harness feature for FICON cables.

## Top exit I/O cabling

The zBC12 has an optional feature for top exit I/O cabling (FC 7920). These frame towers for I/O top exit will add the following approximate measurements:

*Table 24. Top exit I/O approximate measurements*

| Weight | Width | Height |
|---|---|---|
| 43 kg (95 lbs) | 152.4 mm (6 in) | 2154 (84.8 in) |

All I/O cables can be routed through the top exit towers, including those designated for the Fiber Quick Connect feature. For 2828 servers installed on a nonraised 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.

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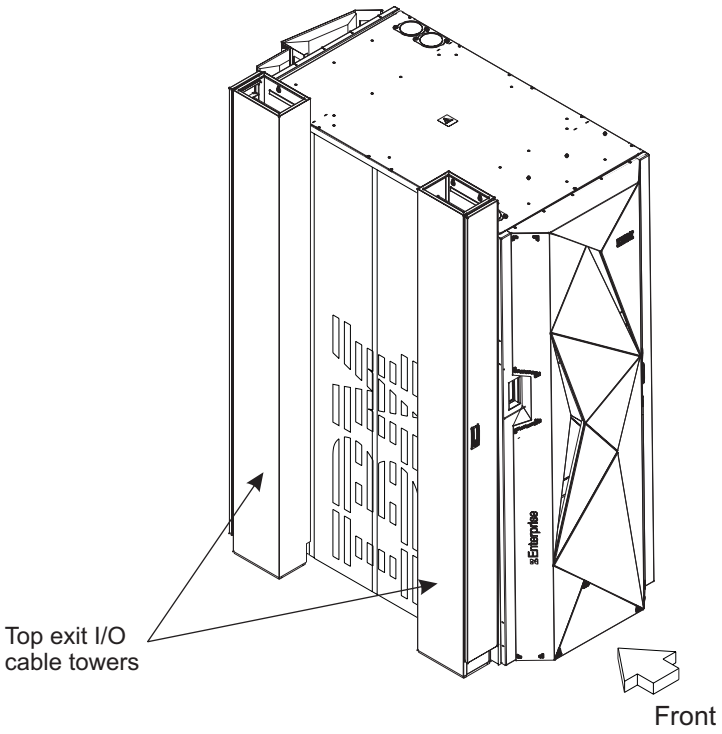



## IBM Site and Facilities Services

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 zBC12, zEC12, z196, z114 System z10®, System z9®, and zSeries (for example, FICON, Coupling Links, OSA-Express) whether the focus is the data center, the Storage Area Network (SAN), the Local Area Network (LAN), or the end-to-end enterprise.

IBM Site and Facilities 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 zBC12, zEC12, z114, z196, z10 EC, z10 BC, z9 EC, z9 BC, z990, and z890 servers. 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 at *http://www.ibm.com/servers/resourcelink* for further details.

## Customer fiber optic cabling responsibilities

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

1. All cable planning and support
2. All purchasing of correct qualified cables
3. All installation of any required fiber optic or OSA Express copper cables
4. All routing of cables to correct front/back floor cutouts for proper installation to the machine
5. If using the top exit I/O feature, you must install toroids on each copper Ethernet cable
6. All labeling of cables with PCHID numbers for proper installation to the machine.

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

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

**Note:** Customer cabling preparation does not include plugging cables into the zBC12.

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

## 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.

## Configuration information

Table 25 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 System z and z/VM® environments.

*Table 25. FICON feature codes*

| Feature code | Description | Fiber type |
|---|---|---|
| FC 3318<br>(2 ports) | FICON Express4-2C SX<br>(Short Wavelength) | single mode 9 micron |
| FC 3321<br>(4 ports) | FICON Express4 LX<br>(Long Wavelength) | single mode 9 micron<br>(unrepeated distance - 10 KM / 6.2 MI) |
| FC 3322<br>(4 ports) | FICON Express4 SX<br>(Short Wavelength) | multimode 50 and 62.5 micron<br>(variable - maximum 860 m / 2822 ft)) |

*Table 25. FICON feature codes (continued)*

| Feature code | Description | Fiber type |
|---|---|---|
| FC 3325<br>(4 ports) | FICON Express8 LX<br>(Long Wavelength) | single mode 9 micron<br>(unrepeated distance - 10 KM / 6.2 MI) |
| FC 3326<br>(4 ports) | FICON Express8 SX<br>(Short Wavelength) | multimode 50 and 62.5 micron<br>(variable - maximum 860 m / 2822 ft) |
| FC 0409 (PCIe)<br>(2 ports) | FICON Express8S LX<br>(Long Wavelength) | single mode 9 micron<br>(unrepeated distance - 10 KM / 6.2 MI) |
| FC 0410 (PCIe)<br>(2 ports) | FICON Express8S SX<br>(Short Wavelength) | multimode 50 and 62.5 micron<br>(variable - maximum 860 m / 2822 ft) |

**Notes:**

- All FICON Express feature codes use LC Duplex connectors.
- Each feature code represents a FICON base adapter with pluggable optic modules.
- Short wavelength and long wavelength optic modules cannot be mixed on the same FICON base adapter.
- See "FICON references" on page 76 for information about link distances and light loss budget.

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

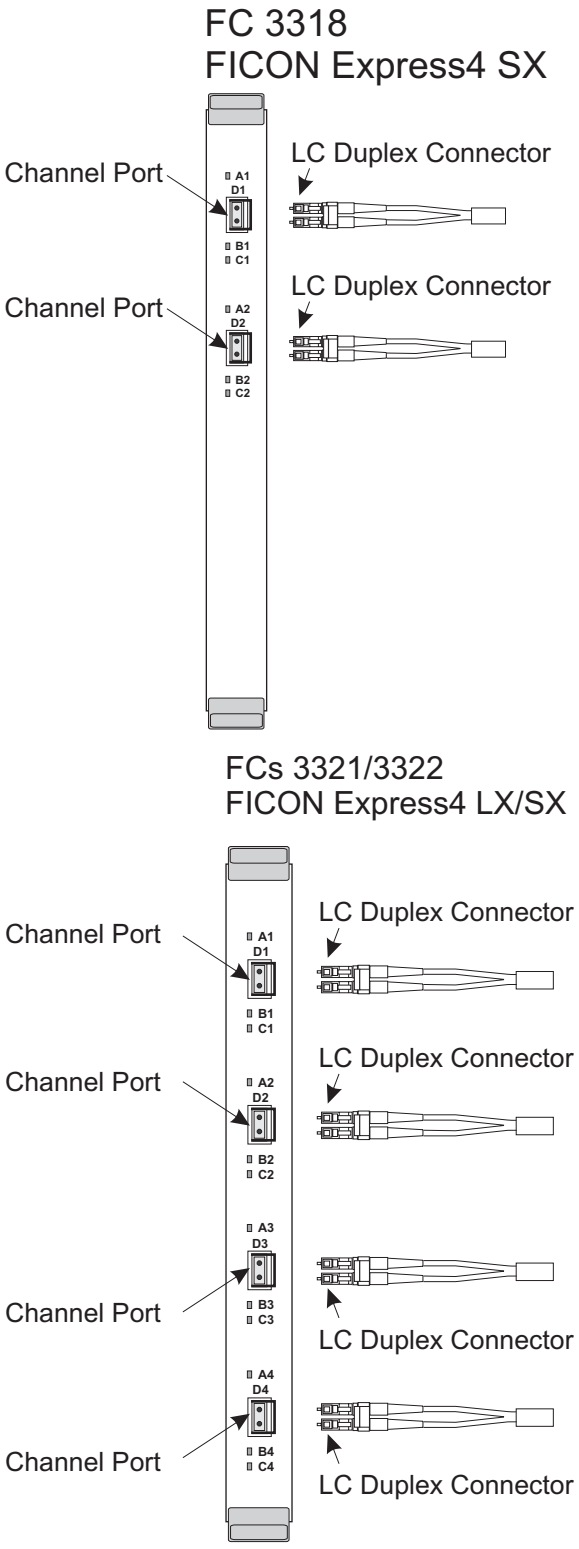



*Figure 5. FICON Express4 features*

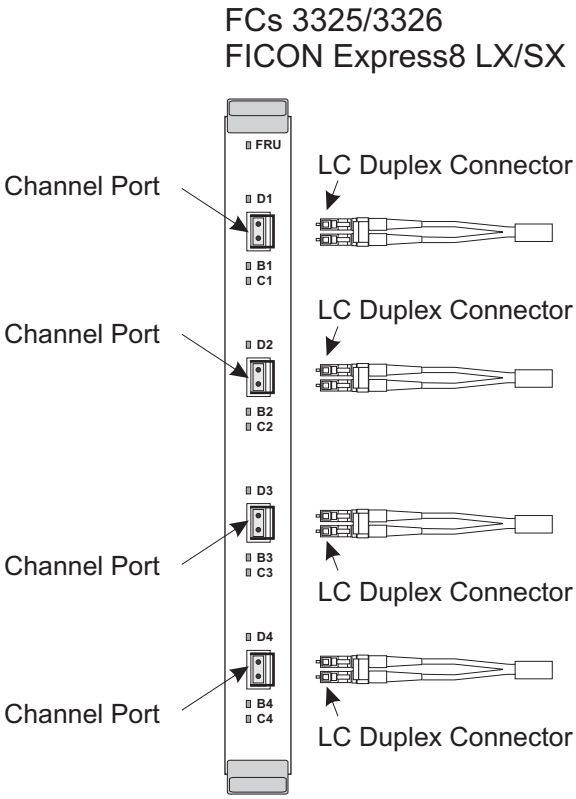



*Figure 6. FICON Express8 features*

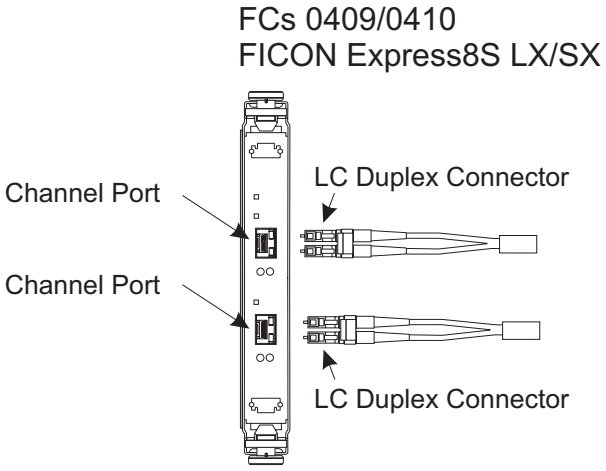



*Figure 7. FICON Express8S features*

## FICON references

For additional information on planning for FICON channels see:

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

## 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 zBC12, zEC12, z114, z196, z10 EC, z10 BC, z9 EC, z9 BC, z990, and z890 systems) at unrepeated distances up to 10 kilometers (6.2 miles).

## Configuration information

Table 26 describes the ISC-3 feature.

*Table 26. ISC feature codes*

| 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 FICON Channel-to-Channel Reference* for information about link distances and light loss budget.

The following figure shows the ISC-3 feature, the links on the daughter cards, and the type of fiber optic connector that plugs into the transceivers.

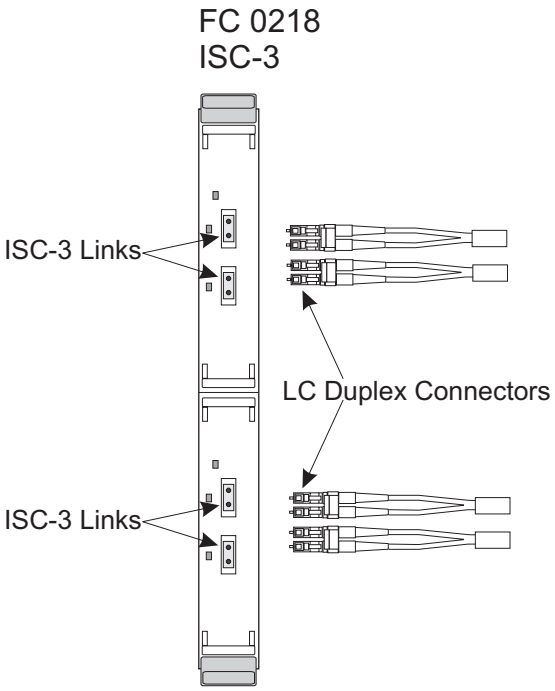



*Figure 8. ISC-3 feature*

## OSA-Express LAN features

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

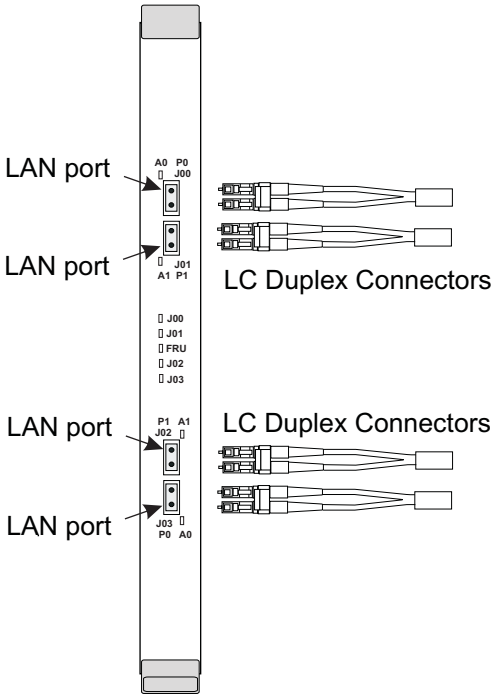
## Configuration information

Table 27 lists the OSA-Express features:

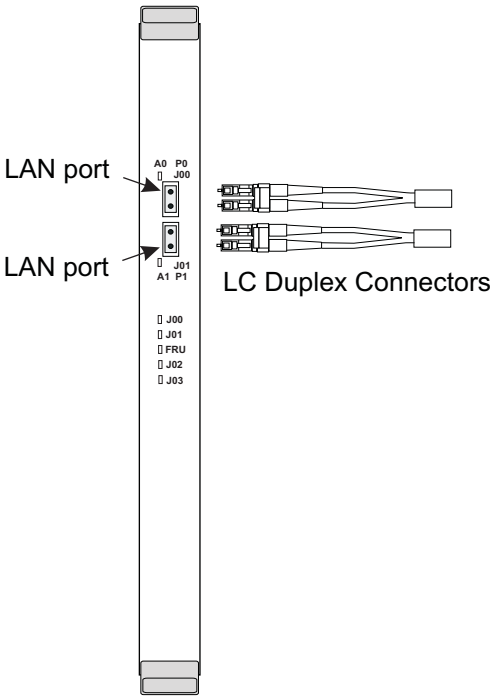
*Table 27. OSA-Express feature codes*

| Feature code | Feature description | Cable description | Connector type |
|---|---|---|---|
| FC 3362 (4 ports) | OSA-Express3 GbE LX | 9 micron single mode | LC Duplex |
| FC 3363 (4 ports) | OSA-Express3 GbE SX | 50 and 62.5 micron multimode | LC Duplex |
| FC 3367 (4 ports) | OSA-Express3 1000BASE-T Ethernet | Category 5 UTP copper wire | RJ-45 |
| FC 3369 (2 ports) | OSA-Express3 1000BASE-T Ethernet (2 ports) | Category 5 UTP copper wire | RJ-45 |
| FC 3370 (2 ports) | OSA-Express3 10 GbE LR | 9 micron single mode | LC Duplex |
| FC 3371 (2 ports) | OSA-Express3 10 GbE SR | 50 or 62.5 micron multimode | LC Duplex |
| FC 3373 (2 ports) | OSA-Express3 GbE SX (2 ports) | 50 and 62.5 micron multimode | LC Duplex |
| FC 0404 (PCIe) (2 ports) | OSA-Express4S GbE LX | 9 micron single mode | LC Duplex |
| FC 0405 (PCIe) (2 ports) | OSA-Express4S GbE SX | 50 and 62.5 micron multimode | LC Duplex |
| FC 0406 (PCIe) (1 port) | OSA-Express4S 10 GbE LR | 9 micron single mode | LC Duplex |
| FC 0407 (PCIe) (1 port) | OSA-Express4S 10 GbE SR | 50 and 62.5 micron multimode | LC Duplex |
| FC 0408 (PCIe) (2 ports) | OSA-Express4S 1000BASE-T | Category 5 UTP copper wire | RJ-45 |
| FC 0413 (PCIe) (2 ports) | OSA-Express5S GbE LX | 9 micron single mode | LC Duplex |
| FC 0414 (PCIe) (2 ports) | OSA-Express5S GbE SX | 50 and 62.5 micron multimode | LC Duplex |
| FC 0415 (PCIe) (1 port) | OSA-Express5S 10 GbE LR | 9 micron single mode | LC Duplex |
| FC 0416 (PCIe) (1 port) | OSA-Express5S 10 GbE SR | 50 and 62.5 micron multimode | LC Duplex |
| FC 0417 (PCIe) (2 ports) | OSA-Express5S 1000BASE-T | Category 5 UTP copper wire | RJ-45 |

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




FC 3373
OSA-Express3
Gigabit Ethernet SX 2-port




FC 3370/3371
OSA-Express3
10 Gigabit Ethernet LR/SR

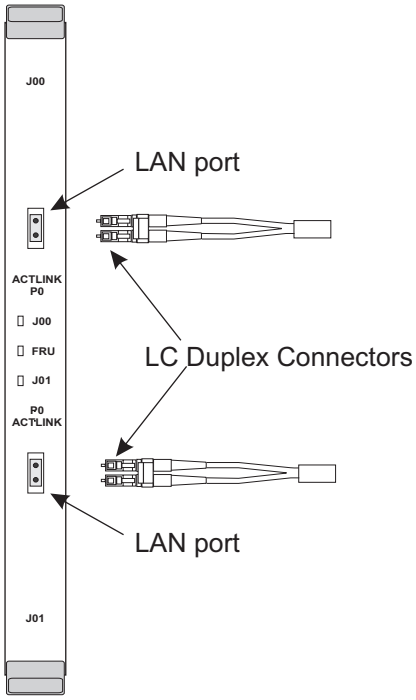



*Figure 9. OSA-Express3 features (1 of 2)*

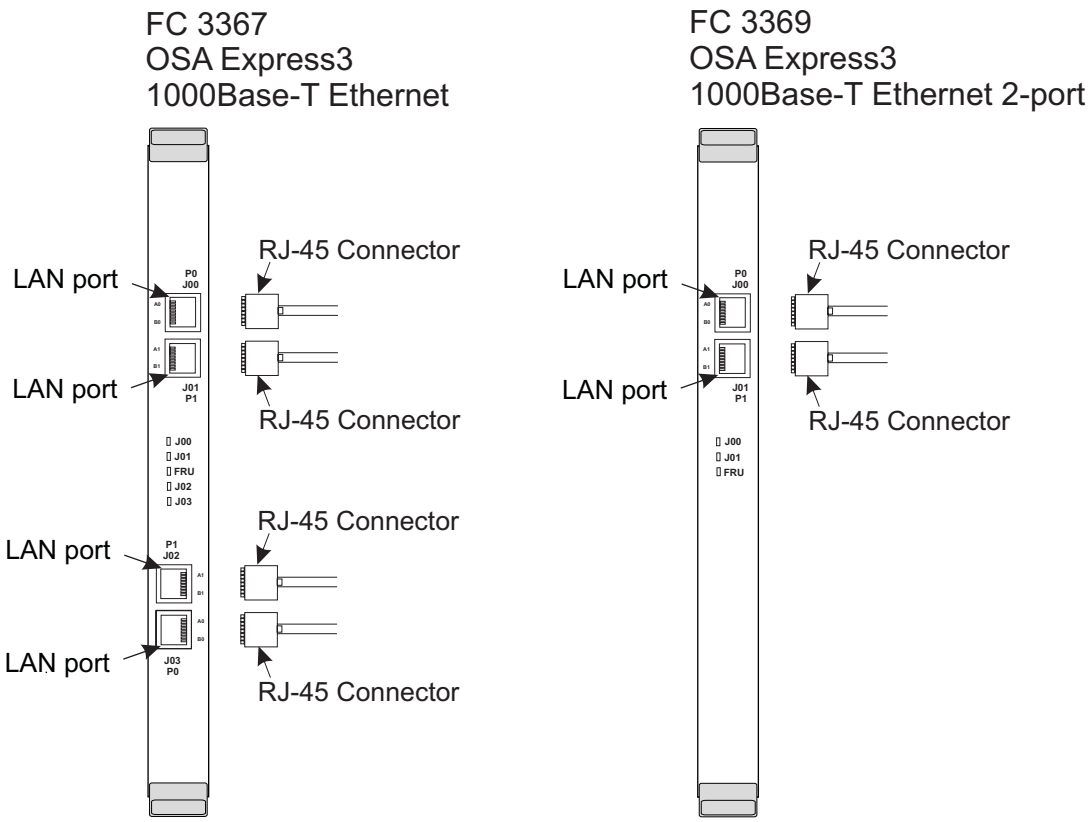



*Figure 10. OSA-Express3 features (2 of 2)*

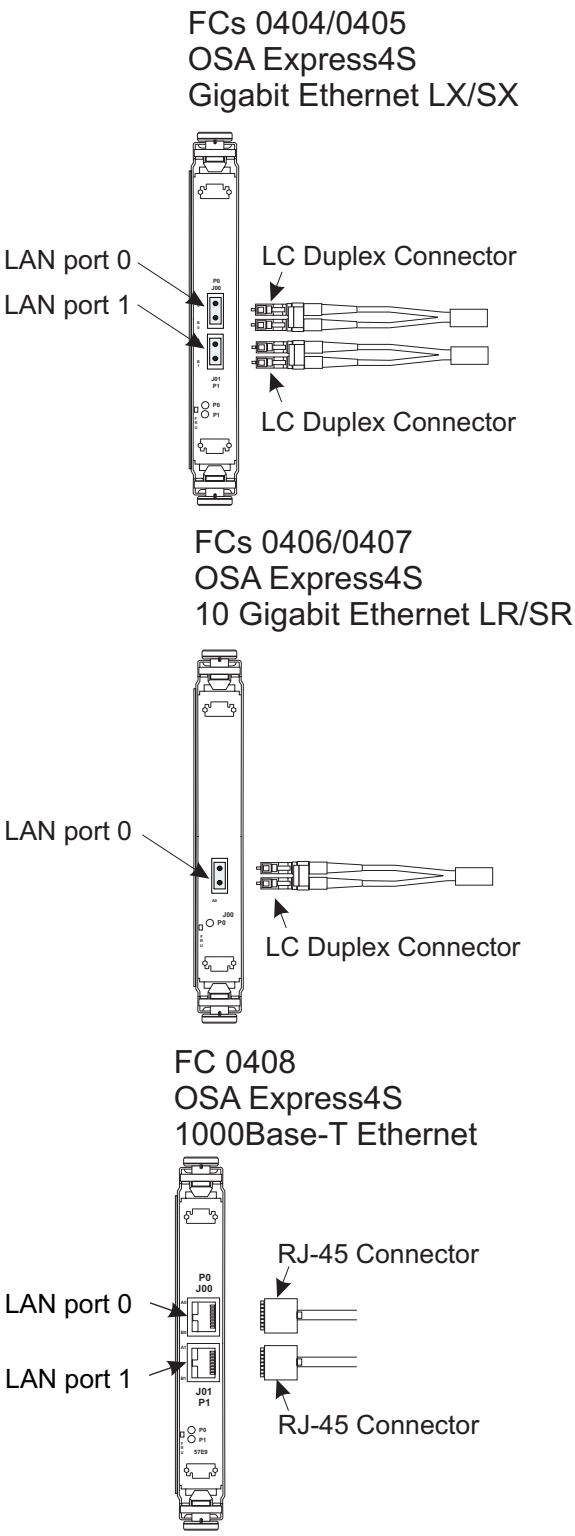



*Figure 11. OSA-Express4S features*

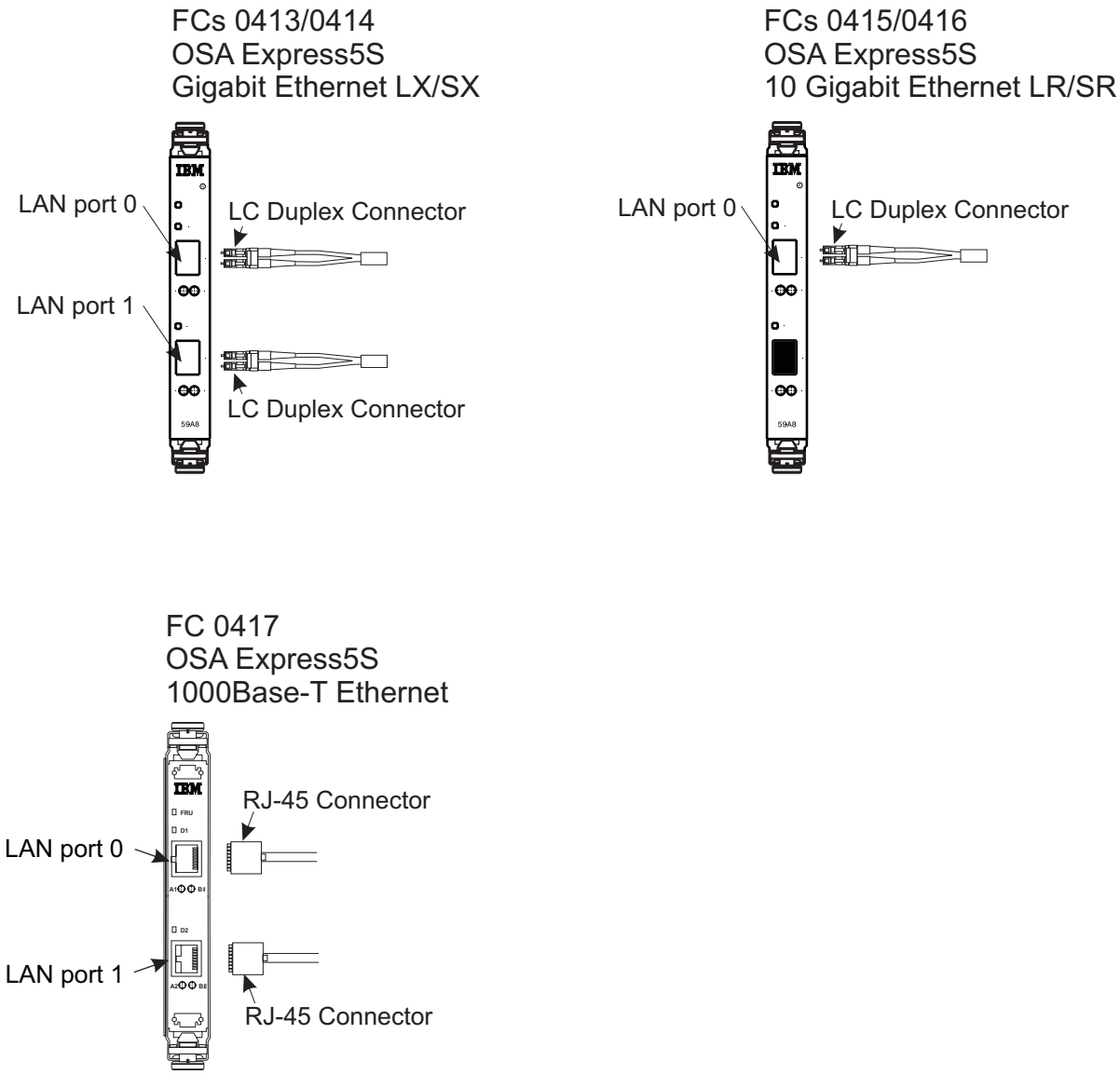



*Figure 12. OSA-Express5S features*

## OSA-Express reference

For additional information on planning for OSA features, see:

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

## I/O interconnect links

An HCA2-C fanout card (FC 0162) supports two copper cable 12x InfiniBand DDR 6 GBps interconnects. These connect to the two IFB-MP cards in an I/O drawer. A single IFB-MP card controls an I/O domain that contains four channel cards.

A PCIe fanout card (FC 0169) supports two copper cable PCIe 8 GBps interconnects. These connect to the two PCI-IN cards in a PCIe I/O drawer. A single PCI-IN card controls an I/O domain that contains eight channel cards.

## 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 zBC12, zEC12, 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 zBC12, zEC12, 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 28. InfiniBand cable part numbers for FC 0171 and FC 0163*

| Part number | Length meters (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 |

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 systems. 1x IFB coupling links support a maximum unrepeated distance of 10 kilometers (6.2 miles) and the maximum repeated distance is 100 kilometers (62 miles) when attached to a qualified DWDM.

A 1x LR InfiniBand fiber optic cable (9 micron single mode) connects directly to a port on the HCA2-O LR or HCA3-O LR fanout card.

**Notes:**

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

*Table 29. InfiniBand feature codes*

| 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 |

## Flash Express (FC 0402)

Flash Express (FC 0402) provides a special programming interface to move data between the Flash Express and host DRAM. It enables z/OS to access blocks of flash storage as storage locations in a logical partition. The Flash Express card is designed to help improve availability and performance.

You can order Flash Express in increments of two, up to a maximum of eight 8 features.

Each pair of Flash Express features requires interconnect cabling and specific plugging rules to manage the pairing.

Flash Express (FC 0402) can only be installed in a PCIe I/O drawers

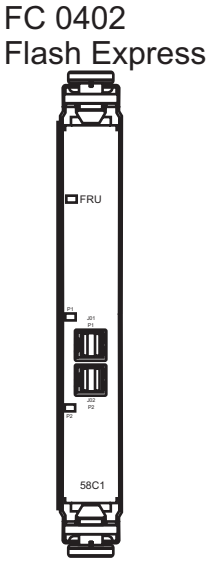



*Figure 13. Flash Express feature*

## Native PCIe adapters

The 10GbE RoCE Express and zEDC Express features utilize industry standard PCIe adapters (called native PCIe adapters). The adaptation layer and the associated ASIC (both of which are part of the FICON, OSA, OSC, Crypto, and Flash features) are no longer needed with 10GbE RoCE Express or zEDC Express. With the elimination of the adaptation layer, the 10GbE RoCE Express and zEDC Express features are designed to offer significant performance. They physically plug into a mother card that provides Vital Product Data (VPD) and hot-plug capability. The features then plug into the PCIe I/O drawer.

Table 30 lists the current supported native PCIe adapters.

*Table 30. Native PCIe adapter feature codes*

| Feature code | Description |
|---|---|
| FC 0411 | 10GbE RoCE Express |
| FC 0420 | zEDC Express |

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

## 10GbE RoCE Express (FC 0411)

RoCE stands for RDMA (Remote Direct Memory Access) over Converged Ethernet. Using 10GbE RoCE Express (FC 0411), RDMA technology is available on Ethernet. RDMA technology provides the capability to allow hosts to logically share memory. 10GbE RoCE Express, in conjunction with an OSA card, enables shared memory communications between two CPCs using a shared switch, which is customer supplied. 10GbE RoCE Express does not use a CHPID number and does not require a CHPID type.

You can use 10GbE RoCE Express to help reduce network latency with memory-to-memory transfers utilizing Shared Memory Communications- Remote Direct Memory Access (SMC-R) in z/OS V2.1. It is transparent to applications and can be used for LPAR-to-LPAR communication on a single z/OS system or server-to-server communication in a multiple CPC environment.

10GbE RoCE Express uses existing Ethernet fabric (switches with Global Pause enabled), and requires a standard 10 GbE switch (CEE enabled switch is not required).

You can order 10GbE RoCE Express in increments of two ports, up to a maximum of 32 ports (16 features). There are two ports per feature. Only one of the two ports is supported by z/OS.

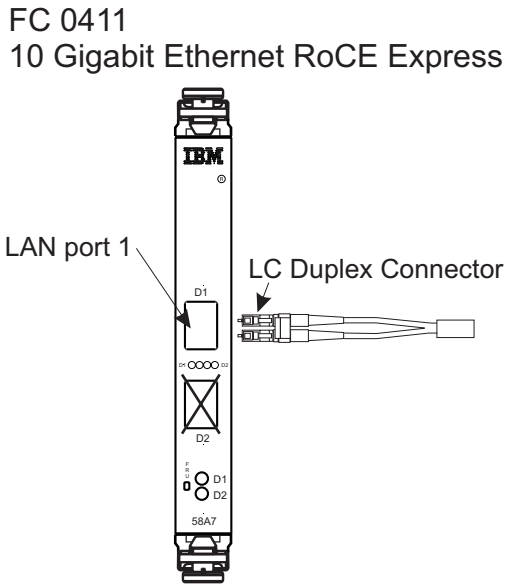



*Figure 14. 10GbE RoCE Express feature*

## zEDC Express (FC 0420)

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

You can order zEDC Express in increments of one feature, up to a maximum of 8 features. Pairing is not required, but highly suggested for reliability and availability purposes.

FC 0420
zEDC Express

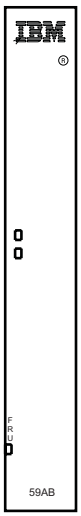



*Figure 15. zEDC Express feature*

## 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.

## Time synchronization

Synchronized time is possible with a zBC12 in a Sysplex environment using Server Time Protocol (STP).

## 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 zBC12, zEC12, z114, z196, z10 EC, z10 BC, z9 EC, z9 BC, z990, z890, and Coupling Facility servers. z9 EC, z9 BC, z990, z890, z900 and z800 servers cannot participate in a Sysplex or the same Coordinated Timing Network (CTN) with zBC12 or zEC12.

## 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 LAN because the NTP client runs on the Support Element. The PPS output of the NTP time server is connected to the PPS input coaxial connector, provided on the OSC/PPS card of the zBC12.

## Connectivity information

The cable for pulse per second is coaxial. You are responsible for supplying these cables.

## Fiber Quick Connect for FICON cabling

Fiber Quick Connect harness cabling, harness brackets and mounting hardware are ordered with the zBC12 as feature codes. The feature codes are:

*Table 31. Fiber Quck Connect feature codes*

| Feature codes | Description |
|---|---|
| 7907 | FQC bracket and mounting hardware |
| 7909 | LC Duplex 2012 mm (6.6 ft.) harness (FICON) |
| 7911 | LC Duplex 2591 mm (8.5 ft.) harness (FICON) |

The Fiber Quick Connect feature enables trunk cables to connect to FICON channels using under-the-cover attachment harnesses. These harnesses are installed when your system is built, and your zBC12 arrives ready to connect the trunk cables at your site.

Figure 16 shows the Fiber Quick Connect feature hardware.

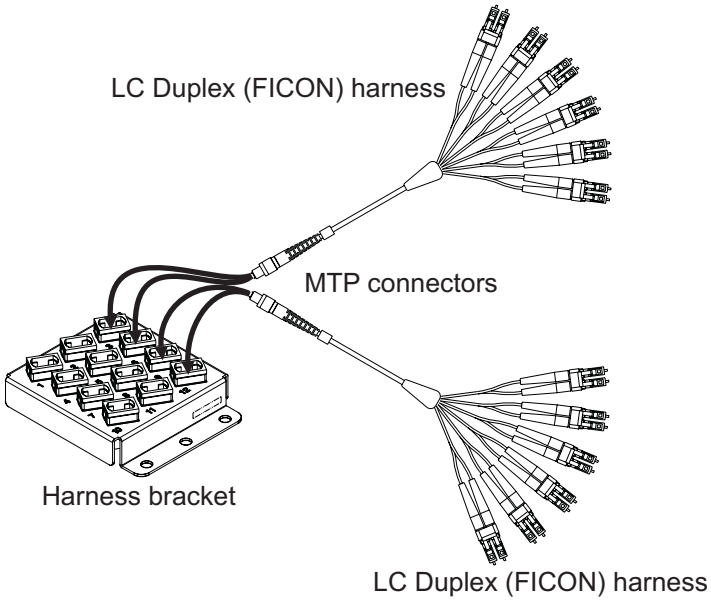



*Figure 16. Fiber Quick Connect feature hardware*

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

The following provides the FQC brackets plugging locations and sequence along the tailgate. Also, see Figure 17 on page 91.

- A-frame front - A00B (1), A00C (2), A00E (3)
- A-frame rear - A00Y (1), A00X (2), A00W (3), A00U (4)

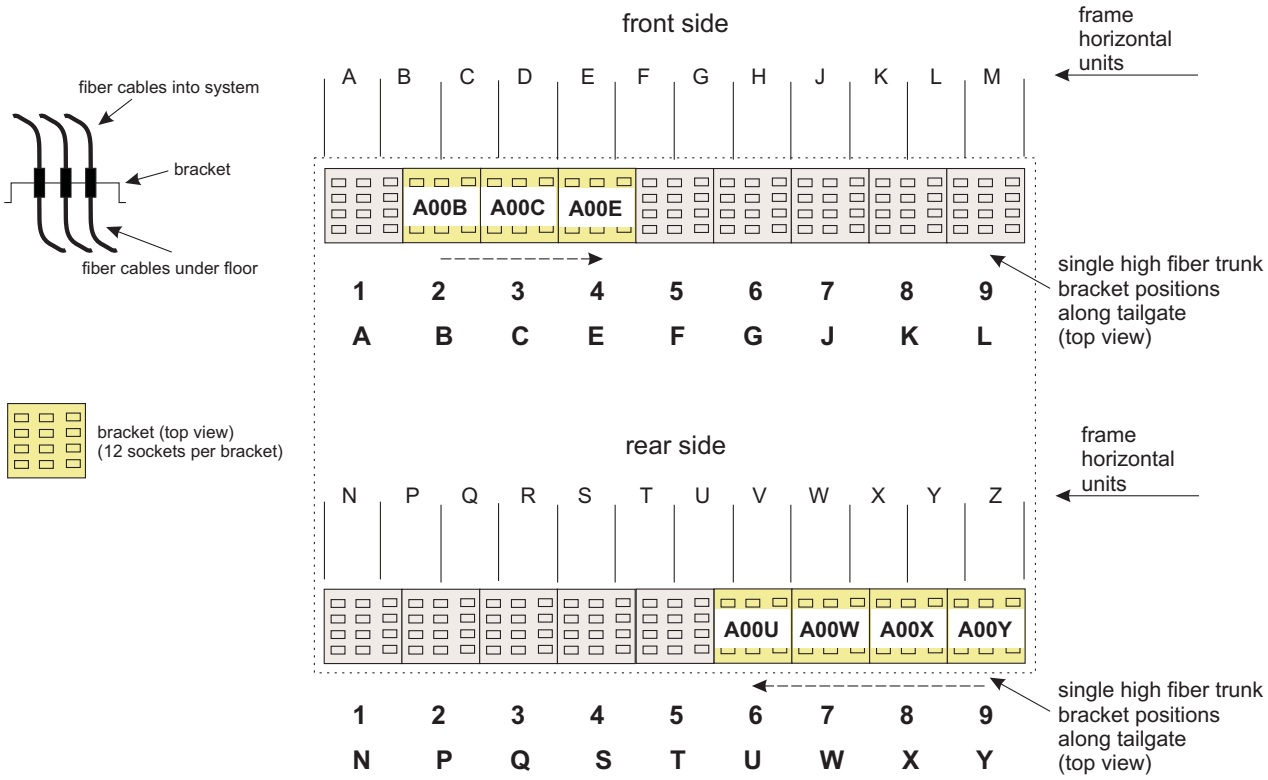



*Figure 17. Fiber Quick Connect - underfloor I/O*

Fiber Quick Connect mounting brackets can also be installed at EIA positions 02, 06, and 10 in the I/O top exit towers. (The harness bracket is installed on the Fiber Quick Connect mounting bracket.)

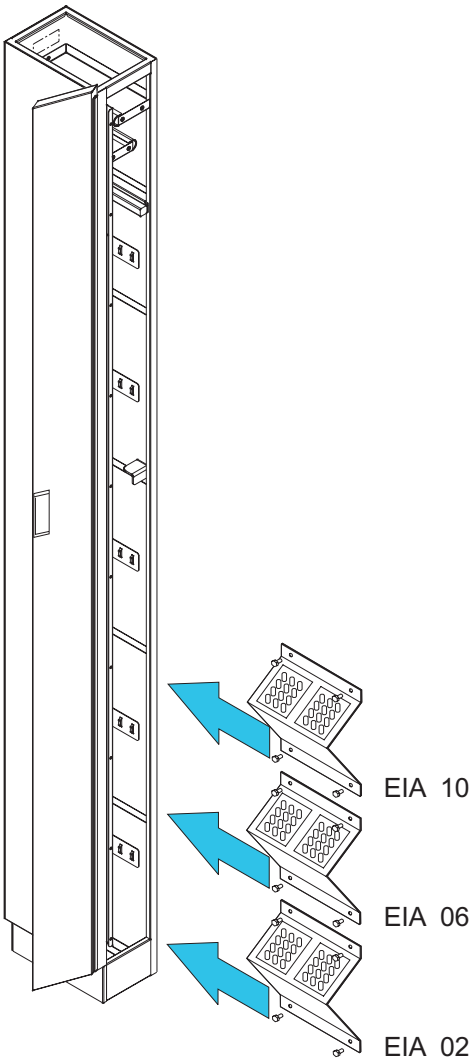



*Figure 18. Fiber Quick Connect - top exit I/O*

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

## Preparing configuration definition

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

### z/VM

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

and HCD users must build an IOCP input data set from a validated work IODF and use this as input to the CHPID Mapping Tool. The CHPID Mapping Tool updates the IOCP input and assigns PCHIDs to the CHPIDs.

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

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

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

## z/VSE®

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

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

## z/OS HCD

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

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

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

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

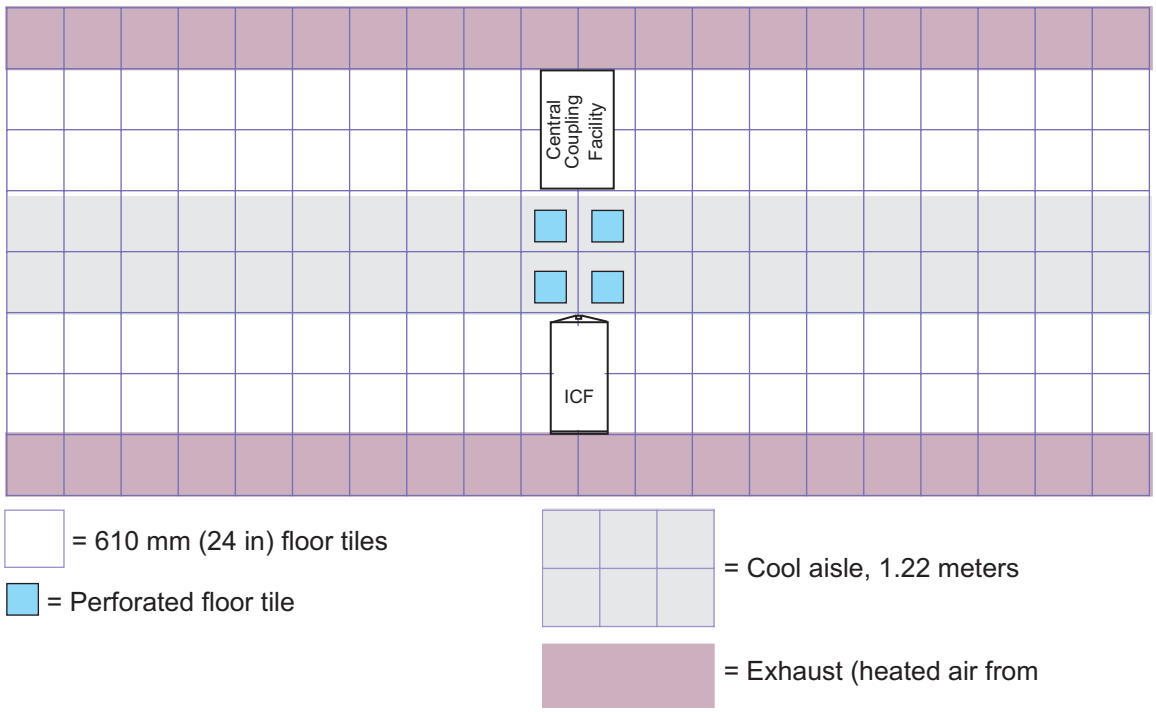
# Chapter 9. Parallel sysplex planning

This chapter is intended to provide guidance to those customers who operate in a Parallel Sysplex environment. A Parallel Sysplex typically involves multiple processors and coupling facilities, shared I/O devices, and a host of interconnection possibilities. Detailed planning for a Parallel Sysplex is essential to meet technical objectives, such as performance and high availability, within the constraints of a specific raised floor configuration. Consider using the Fiber Optic Cabling Service to plan your sysplex environment. A list of tasks the Service can perform is provided under "IBM Site and Facilities Services" on page 72. Different technologies for servers, links and coupling facilities affect your ability to configure a productive sysplex.

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

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

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




   - Use physical planning information for each type of server/coupling facility you intend to add to the Parallel Sysplex to help determine how much floor space you will need.
   - Remember to consider weight distribution, service clearances, power, and cooling for each piece of equipment you want to include.
2. Arrange the sysplex in two rows, with the fronts of servers and coupling facilities facing each other (see the illustration under "Weight distribution and multiple systems" on page 30). Allow a 1.22 meter (48 inch) aisle width between the rows. Although this may be a larger aisle than you have used

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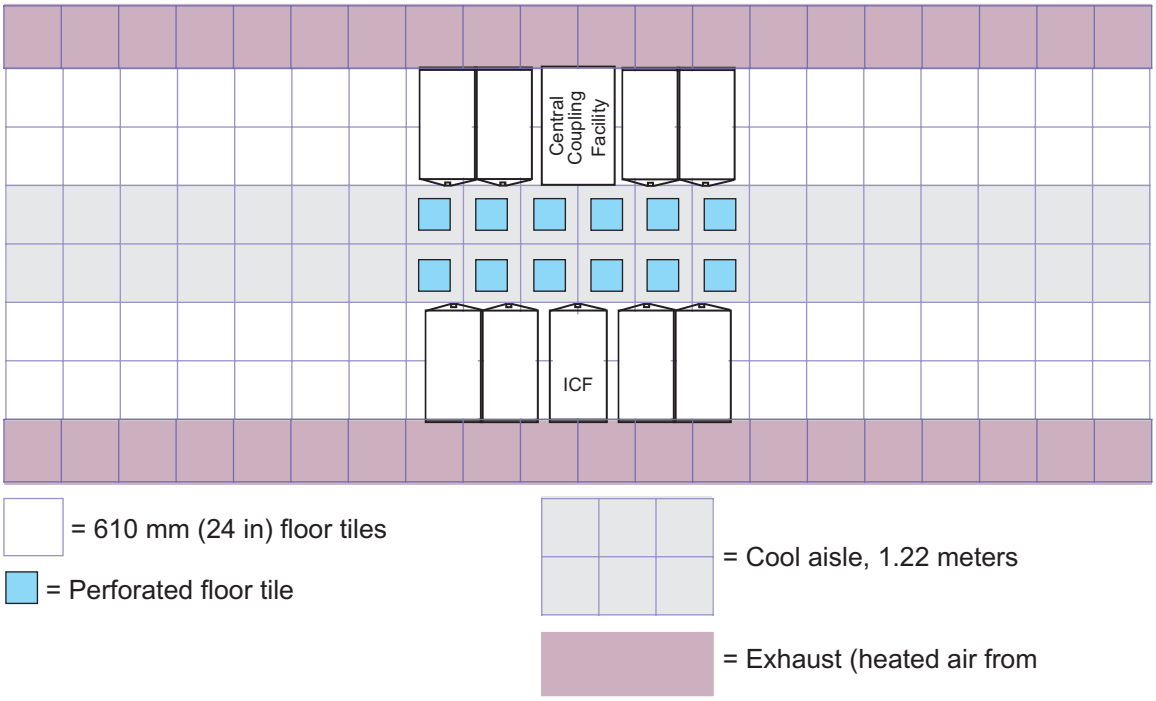
before, your Parallel Sysplex will benefit from the improvement in cooling that a wider aisle provides. (See the illustration under "Cooling recommendations for the room" on page 34.)

**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 InfiniBand fiber optic link cabling. The Sysplex itself may be comprised of servers connected to a Sysplex Timer, servers connected to each other through the Server Timed Protocol feature (STP), or a mixture of both types of connections.

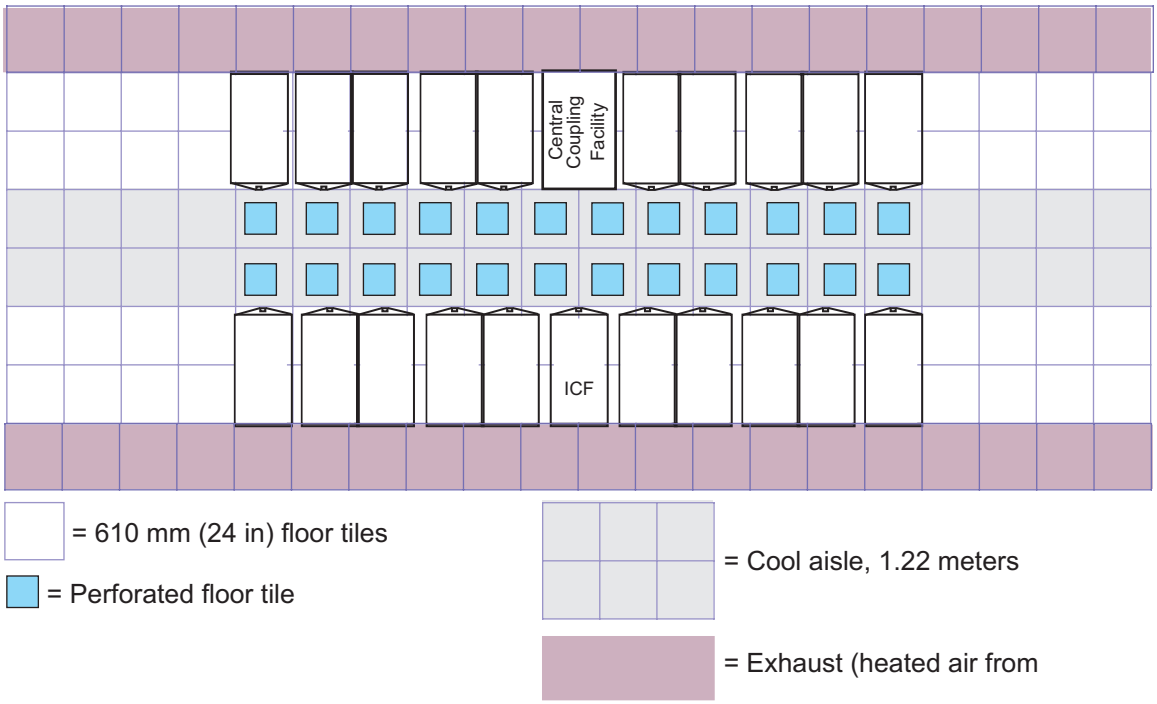
   **Notes:**

   a. 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.

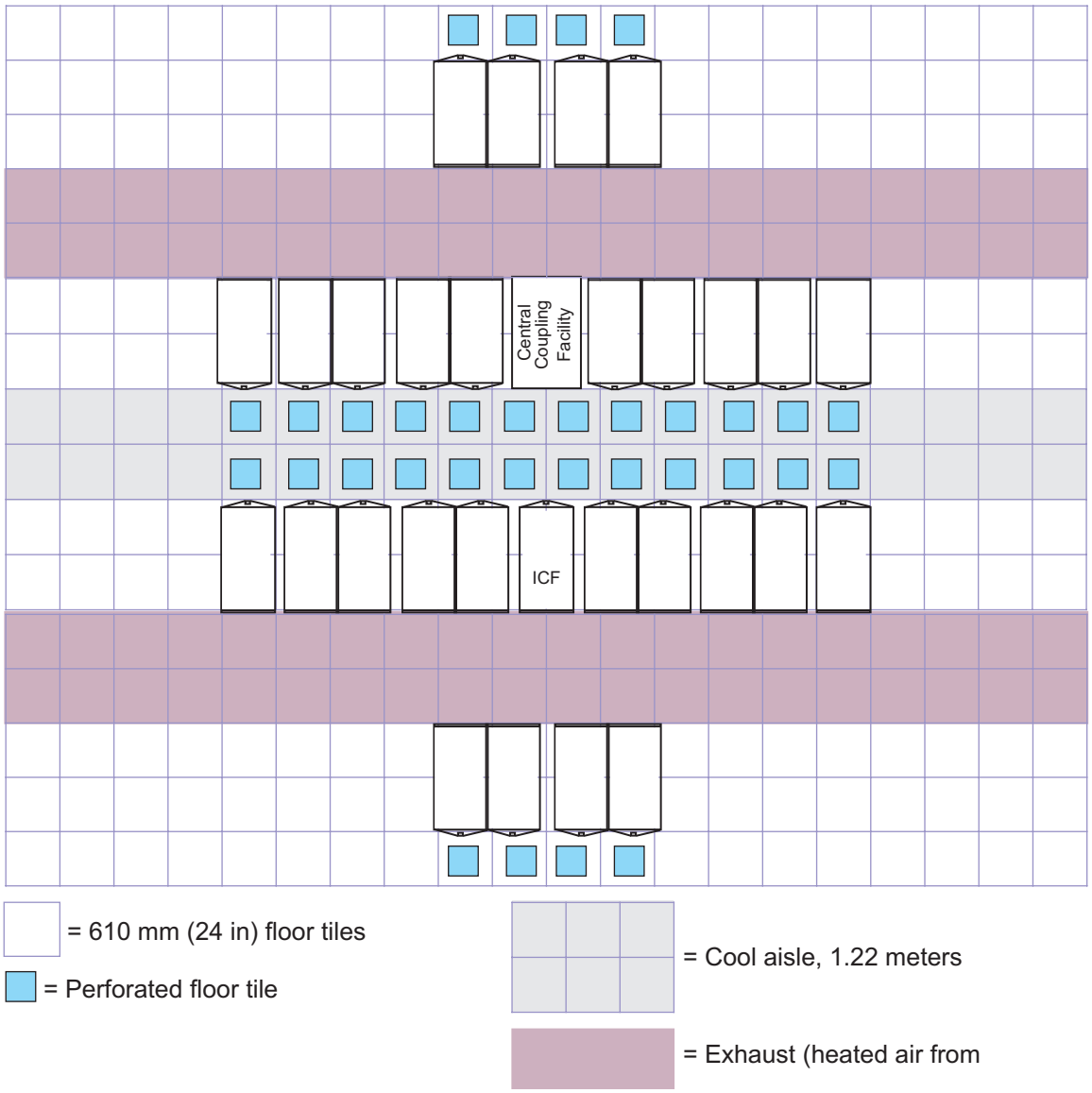
   b. zBC12 has no External Time Reference (ETR) capability.

   c. z9 EC, z9 BC, z990, z890, z900, and z800 cannot participate in a Parallel Sysplex with zBC12. zBC12 can only communicate directly with zBC12, zEC12, z114, z196, z10 BC, and z10 EC.

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




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




By following these guidelines, you will be able to configure a Parallel Sysplex, using the minimum amount of floor space, that meets your performance and availability objectives. The use of technology combinations - zBC12, zEC12, z114, z196, and System z10 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



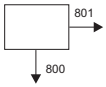
Standard equipment outline
(shows the machine with covers closed)



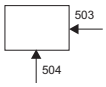
Optional equipment outline


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

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# Appendix B. Hardware Management Console physical specifications

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.

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

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| FC 0092 - Hardware Management Console system unit specifications | |
|---|---|
| Storage (non-operating) | |
| Temperature | 1° to 60° C (33.8° to 140° F) |
| Altitude | 3050 m (10,007 ft) |
| Relative humidity | 5% - 80% |
| Maximum dew point | 29° C (84.2° F) |
| Shipping (non-operating) | |
| Temperature | -40° to 60° C (-40° to 140° F) |
| Altitude | 10,700 m (35,105 ft) |
| Relative humidity | 5% - 100% |
| Maximum dew point | 29° C (84.2° F) |
| 1. Power consumption and heat output vary with the number and type of optional features installed and the power-management optional features in use. | |

| FC 0091 - Hardware Management Console system unit specifications | |
|---|---|
| | |
| **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 | 188 Btu/hr (55 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% |
| 1. Power consumption and heat output vary with the number and type of optional features installed and the power-management optional features in use. | |

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

# Appendix C. Acoustics

This appendix provides information on acoustics for the zBC12 at nominal environmental ambient temperatures of 23ºC plus or minus 2ºC (73.4ºF plus or minus 3.6ºF).

## Acoustical noise emission levels

*Table 32. Acoustical noise emissions (zBC12)* [1, 2, 3]

| 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**: Model H06, one processor drawer and one PCIe I/O drawer. All AMDs at nominal speeds; front and rear acoustical doors installed and closed. | 7.3[4] | 7.3[4] | 55 | 55 |
| **Maximum Configuration:** Model H13, two processor drawers, two PCIe I/O drawers, and one I/O drawer. All AMDs at nominal speeds; front and rear acoustical doors installed and closed. | 7.5[4] | 7.5[4] | 57 | 57 |

**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

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# Appendix D. Dual power installation

The zBC12 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 pair of fully redundant power distribution system within the computer. To take full advantage of the redundancy/reliability that is built into the computer system, the system **must** be powered from two distribution panels.

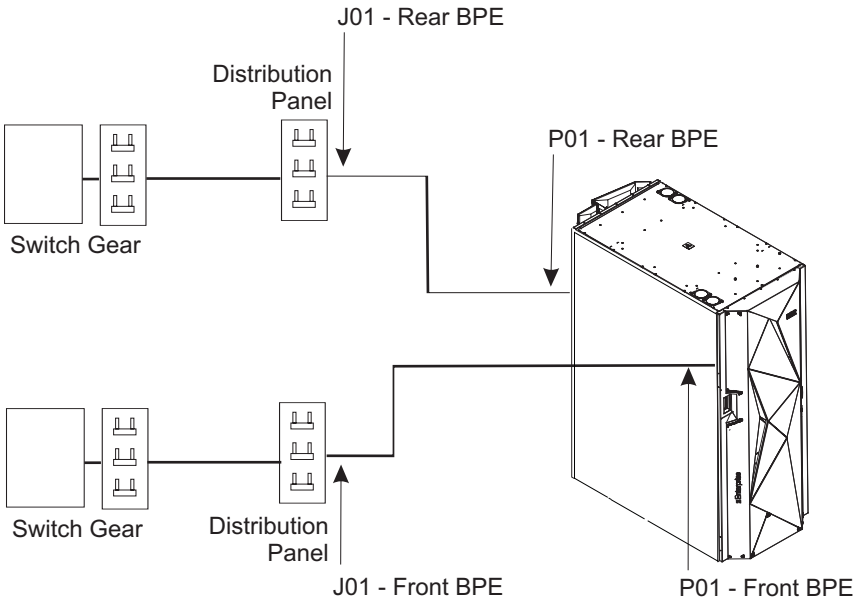
The following shows three examples of redundancy. In these examples, two power cords are identified:

- **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.

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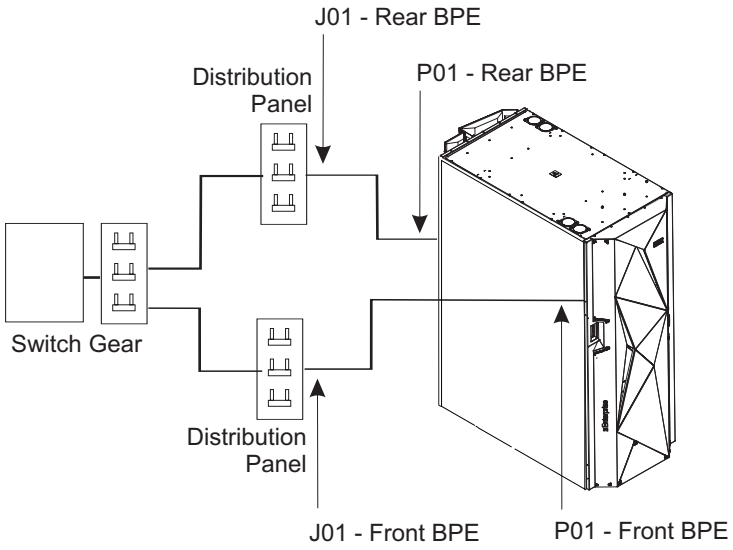
**Example 2 (redundant distribution panel)**

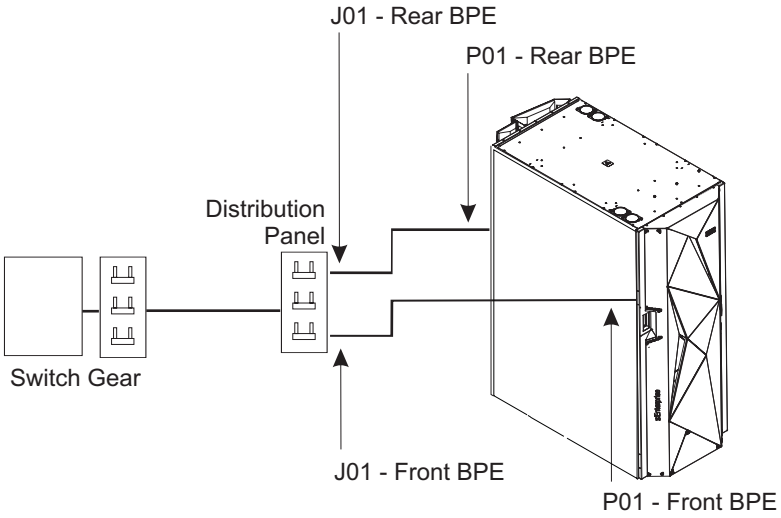
In this example, the computer receives power from two separate power distribution panels. The two distribution panels receive power from the same piece of building switch gear. Most facilities should be able to achieve this level of redundancy. In this case, loss of switch gear (building power) will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

zBC12 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 19 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.

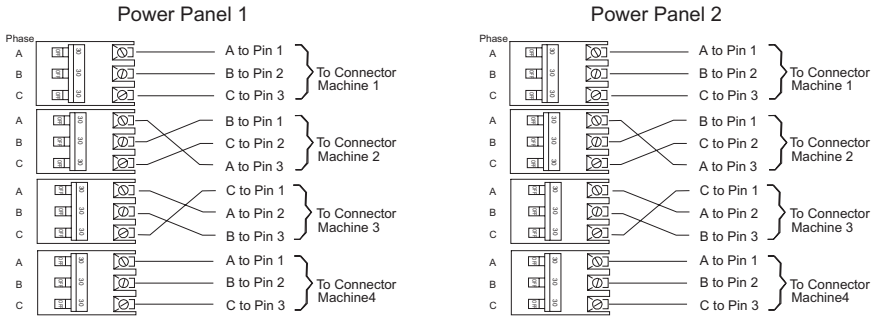



*Figure 19. Power load balancing - three-pole breakers*

The method in Figure 19 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 20 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.

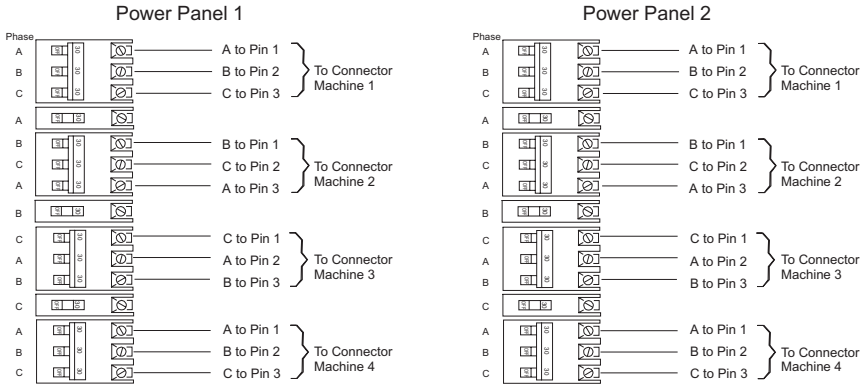



*Figure 20. Power load balancing - alternating three-pole and single-pole breakers*

Figure 21 on page 110 shows another way of distributing the unbalanced load evenly. In this case, the three-pole breakers are alternated with two-pole breakers.

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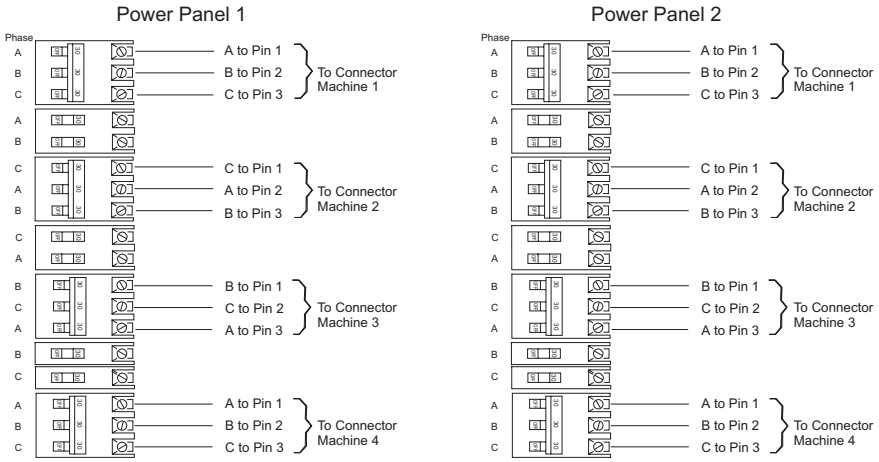


*Figure 21. Power load balancing - alternating three-pole and double-pole breakers*

# 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 8016 is used on a raised floor. FC 8017 is used on a nonraised floor.

## Raised floor frame tie-down

Frame tie-down for the zBC12 on a raised floor is a system of adjustable turnbuckles intended to fasten each corner of the server frames to eyebolts installed in the concrete floor beneath your computer room raised floor. FC 8016 supplies parts to cover raised floor heights from 152.4 mm (6 inches) to 914.4 mm (36 inches).

You are responsible for obtaining the services of a qualified consultant or structural engineer to determine what must be done at your particular location to install **four eyebolts**. These eyebolts should be capable of withstanding the appropriate seismic forces for a frame weighing up to 1078 kg (2375 lbs) with the center of gravity 1270 mm (50 inches) from the ground and at the center of the frame.

## Installing the eyebolts

You are responsible for obtaining and installing the eyebolts that will anchor the frames of your zBC12 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.

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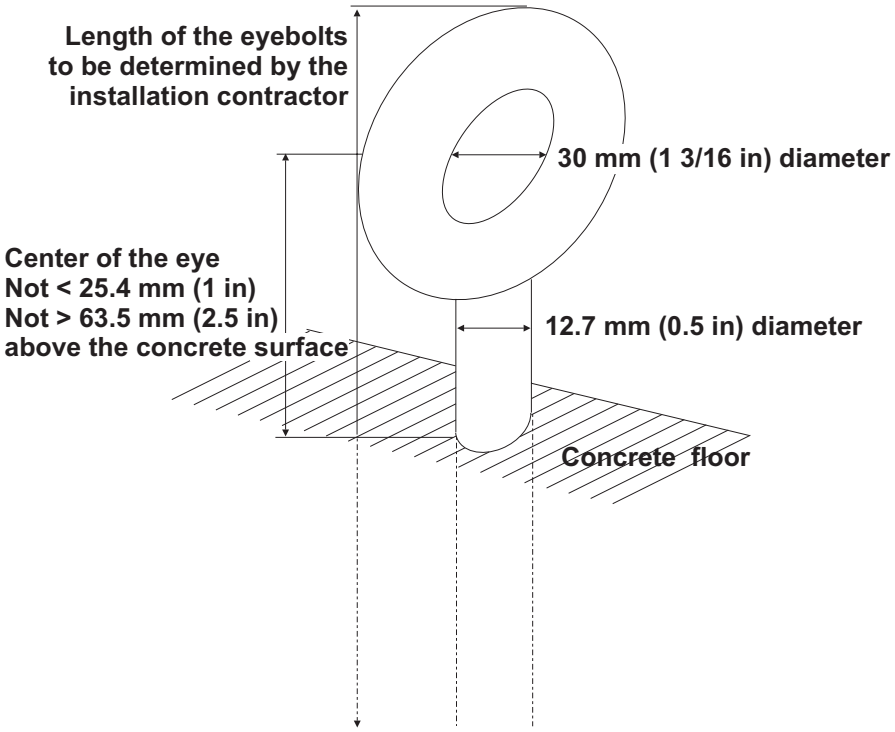
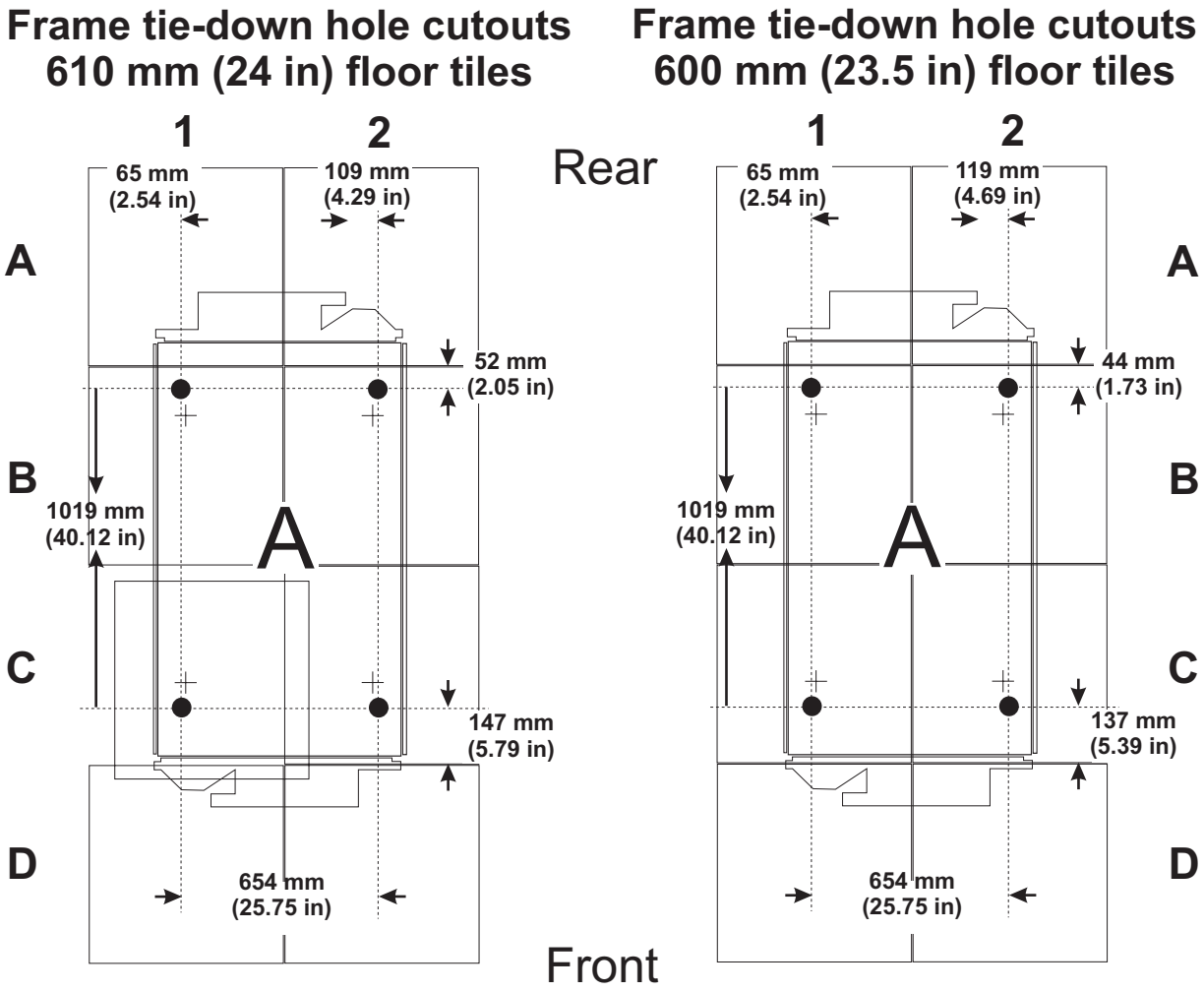

Length of the eyebolts
to be determined by the
installation contractor
30 mm (1 3/16 in) diameter
Center of the eye
Not < 25.4 mm (1 in)
Not > 63.5 mm (2.5 in)
above the concrete surface
12.7 mm (0.5 in) diameter
Concrete floor

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 FC 8016 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 *zEnterprise BC12 Installation Manual*, which is shipped with the server.

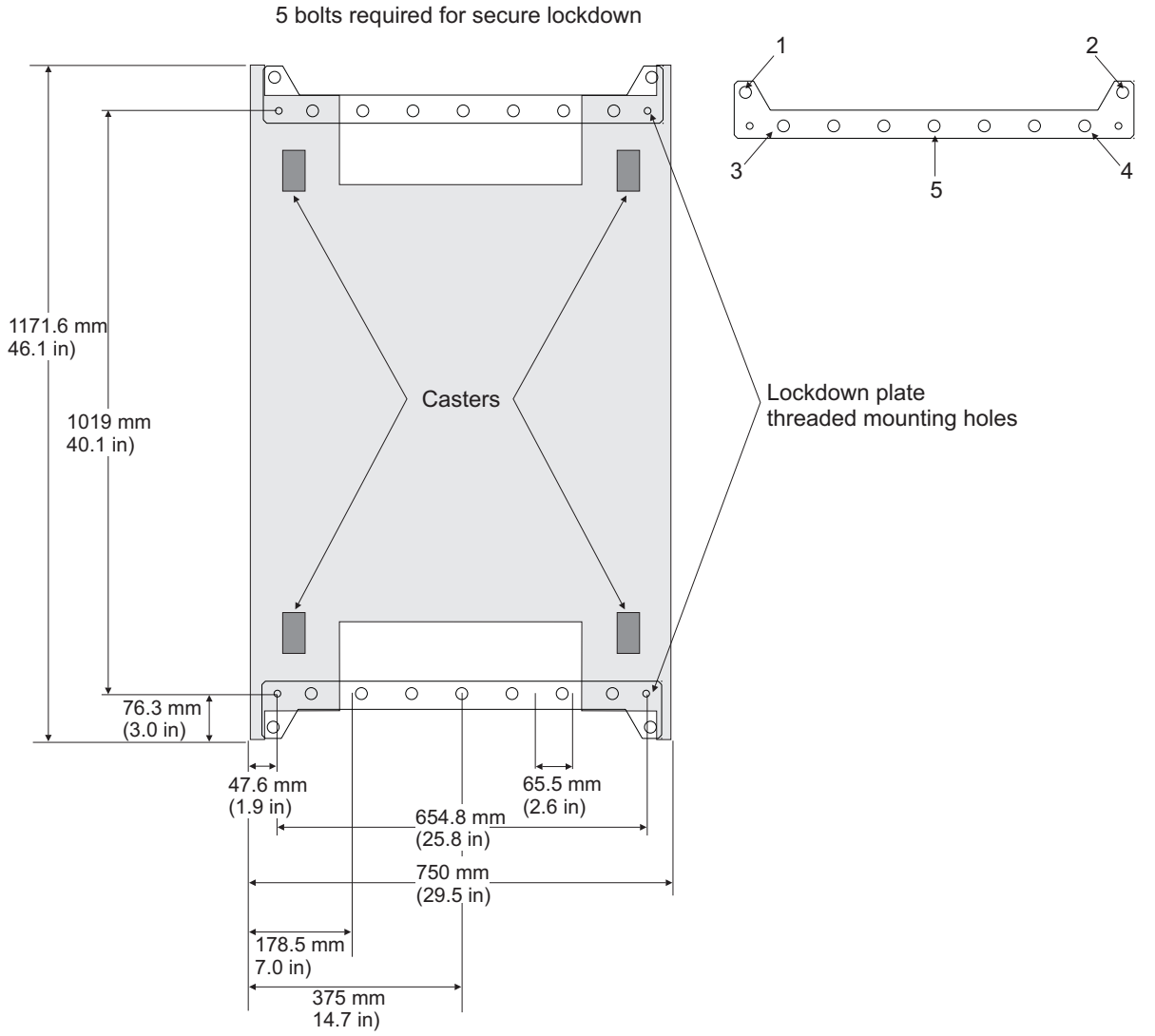
## Nonraised floor frame tie-down

The purpose of this installation instruction is to install a frame tie down kit that will provide hardware for securing an IBM frame to a concrete nonraised floor. This kit (FC 8017) 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 lock down plate** and for securing the front and rear lock down plate to the concrete floor according to the following illustration.

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

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




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

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

# Appendix G. Notices

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

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**Federal Communications Commission (FCC) Statement**

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

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

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

**Canadian Department of Communications Compliance Statement**

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

**Avis de conformlté aux normes du ministère des Communications du Canada**

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

**European Union (EU) Electromagnetic Compatibility Directive**

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

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

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**EC Declaration of Conformity (In German)**

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

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 89/336/EWG zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55022 Klasse A ein.

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

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

Dieses Produkt entspricht dem “Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)“. Dies ist die Umsetzung der EU-Richtlinie 89/336/EWG in der Bundesrepublik Deutschland.

**Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) vom 18. September 1998 (bzw. der EMC EG Richtlinie 89/336) für Geräte der Klasse A.**

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

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

Informationen in Hinsicht EMVG Paragraf 4 Abs. (1) 4:

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

update: 2004/12/07

**People's Republic of China Class A Compliance Statement**

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

声　明

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

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