z BladeCenter Extension

Installation Manual for Physical Planning 2458-004

GC27-2630-00

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GC27-2630-00

Note:
Before using this information and the product it supports, read the information in "Safety" on page v, Appendix G, "Notices," on page 77, and *IBM Systems Environmental Notices and User Guide*, Z125-5823.

This edition, GC27-2630-00, applies to the IBM z BladeCenter Extension (zBX) Model 004.

There may be a newer version of this document in a **PDF** file available on **Resource Link**. Go to *http://www.ibm.com/servers/resourcelink* and click **Library** on the navigation bar. A newer version is indicated by a lowercase, alphabetic letter following the form number suffix (for example: 00a, 00b, 01a, 01b).

Contents

Safety

Safety notices

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

World trade safety information

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

Laser safety information

All IBM z Systems™ 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)

About this publication

This publication contains information necessary for the physical planning of an upgrade from an IBM zEnterprise® BladeCenter® Extension (zBX) Model 002 to an IBM z BladeCenter Extension (zBX) Model 004 or from an IBM zEnterprise BladeCenter Extension (zBX) Model 003 to an IBM z BladeCenter Extension (zBX) Model 004. It also contains physical planning information necessary for relocation of a zBX Model 004.

Note: You can only upgrade from a zBX Model 002 or zBX Model 003 to a zBX Model 004. You cannot order a new zBX Model 004.

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 zBX Model 004.
- Chapter 2 provides environmental specifications for your zBX Model 004.
- Chapter 3 provides plan views, service clearances, weight distribution, and cooling information for the zBX Model 004.
- Chapter 4 contains information on preparation of the raised floor.
- Chapter 5 provides power requirements, specifications, and installation considerations.
- Chapter 6 provides the HMCs that are supported and HMC considerations.
- Chapter 7 contains Remote Support Facility (RSF) installation planning information.
- Chapter 8 provides top-of-rack switch connection information.
- The Appendices provide IBM standard symbols, environmental specifications, acoustics, power installation and power loads, a sample cabling schematic and upgrade paths.

Related publications

Other 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 IBM Resource Link® at *http://www.ibm.com/servers/resourcelink* under the **Library** section.

- *Systems Safety Notices*, G229-9054
- *IBM z BladeCenter Extension Model 004 Installation Manual*, GC27-2629
- *IBM z Systems Ensemble Planning Guide*, GC27-2631
- *Systems Environmental Notices and User Guide*, Z125-5823
- *Thermal Guidelines for Data Processing Environments*
- *American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook*

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

Related HMC and SE console information

Hardware Management Console (HMC) and Support Element (SE) information can be found on the console help system, or on the IBM Knowledge Center at http://www.ibm.com/support/knowledgecenter/ (Select **z Systems** on the navigation bar, and then select your server).

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 zBX and is copyrighted and licensed by IBM. Each zBX is delivered with Licensed Machine Code that is customized to the specific machine ordered. The Licensed Machine Code enables the zBX 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 an zBX requires that the Licensed Machine Code be reinstalled at the new location. The procedure for relocating a zBX, "Discontinuing the System," is located in the *IBM z BladeCenter Extension Model 004 Installation Manual*.

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 z Systems 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 z Systems 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 photo-sensitivity.

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).

Chapter 1. Introduction

This publication is intended to help you prepare your physical site for the installation of a zBX Model 004, whether it be an upgrade to a zBX Model 004 from a zBX Model 002 or zBX Model 003 or a relocation of a zBX Model 004. Marketing and installation planning representatives are also available to help you with planning. Proper planning for your new zBX will facilitate a smooth installation and fast system startup.

As part of your system planning activity, you will make decisions about the location of your machines, environmental statistics, power supply criteria, raised floor versus nonraised floor considerations, data connections, and who will operate the system. A good plan ensures that the equipment and materials are ready to use when the zBX arrives.

Figure 1 shows a full, four rack configuration. It shows the INMN and IEDN top-of-rack switch locations, the Support Element locations, the keyboard and display locations, PDU locations, and BladeCenter locations on rack B. It also shows the PDU locations and BladeCenter locations on rack C, rack D, and rack E.

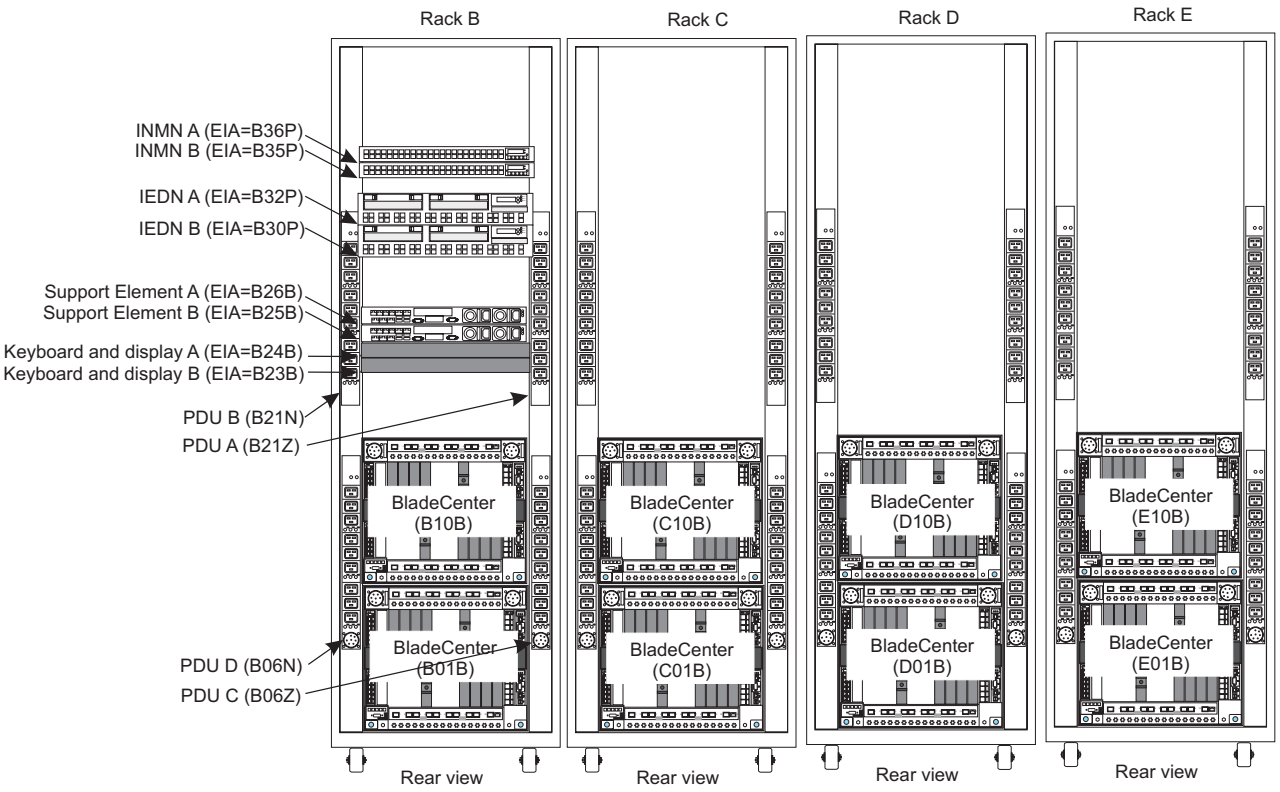
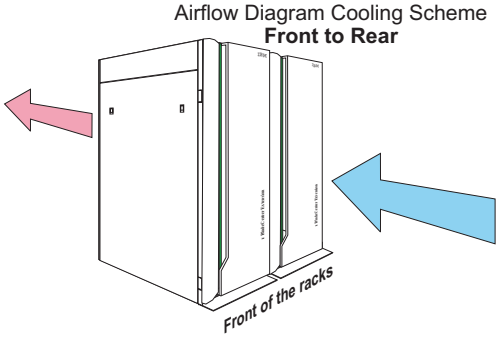


Figure 1. zBX Model 004 configuration

ASHRAE declaration

ASHRAE Declarations (Metric) for 2458-004 1, 2, 3, or 4 racks

ASHRAE Class A2 Description	Typical Heat Release	Airflow Nominal	Airflow Maximum	Max Weight	Overall System Dimensions	Maximum Elevation (2)	Maximum Dry Bulb Temperature (2)	Maximum Dew Point (2)
	kBTU	m3/hr	m3/hr	kg	W x D x H (mm)	m	C°	C°
1 BladeCenter 7 blades	12.3	898	1394	300	648 X 1099 X 2027	3050	35	21
1 BladeCenter 14 blades	20.5	898	1394	400	648 X 1099 X 2027	3050	35	21
2 BladeCenters 28 blades	39.9	1795	2788	738	648 X 1099 X 2027	3050	35	21
3 BladeCenters 42 blades	59.3	2693	4182	987	1296 X 1099 X 2027	3050	35	21
4 BladeCenters 56 blades	78.7	3590	5576	1237	1296 X 1099 X 2027	3050	35	21
5 BladeCenters 70 blades	98.1	4488	6970	1486	1944 X 1099 X 2027	3050	35	21
6 BladeCenters 84 blades	117.5	5386	8364	1736	1944 X 1099 X 2027	3050	35	21
7 BladeCenters 98 blades	136.9	6283	9758	1985	2592 X 1099 X 2027	3050	35	21
8 BladeCenters 112 blades	156.3	7181	11152	2235	2592 X 1099 X 2027	3050	35	21

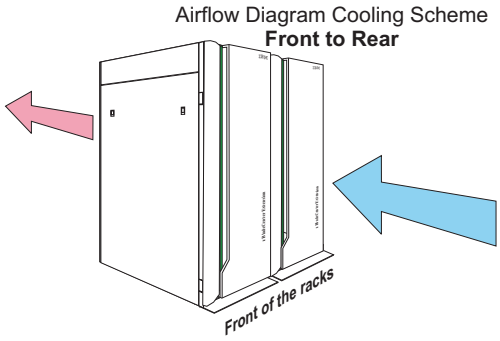


Notes:

1. Maximum ambient reduces 1° C (1.8° F) for every 300 m (984 ft) over 900 m (2953 ft).
2. 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.

ASHRAE Declarations (English) for 2458-004 1, 2, 3, or 4 racks

ASHRAE Class A2 Description	Typical Heat Release	Airflow Nominal	Airflow Maximum	Max Weight	Overall System Dimensions	Maximum Elevation (2)	Maximum Dry Bulb Temperature (2)	Maximum Dew Point (2)
	kBTU	cfm	cfm	lbs	W x D x H (in)	ft	F°	F°
1 BladeCenter 7 blades	12.3	528	820	660	25.6 X 43.3 X 79.9	10,006	95	69.8
1 BladeCenter 14 blades	20.5	528	820	880	25.6 X 43.3 X 79.9	10,006	95	69.8
2 BladeCenters 28 blades	39.9	1056	1640	1628	25.6 X 43.3 X 79.9	10,006	95	69.8
3 BladeCenters 42 blades	59.3	1584	2460	2178	51.1 X 43.3 X 79.9	10,006	95	69.8
4 BladeCenters 56 blades	78.7	2112	3280	2728	51.1 X 43.3 X 79.9	10,006	95	69.8
5 BladeCenters 70 blades	98.1	2640	4100	3278	76.6 X 43.3 X 79.9	10,006	95	69.8
6 BladeCenters 84 blades	117.5	3168	4920	3828	76.6 X 43.3 X 79.9	10,006	95	69.8
7 BladeCenters 98 blades	136.9	3696	5740	4378	102.1 X 43.3 X 79.9	10,006	95	69.8
8 BladeCenters 112 blades	156.3	4224	6560	4928	102.1 X 43.3 X 79.9	10,006	95	69.8



Notes:

1. Maximum ambient reduces 1° C (1.8° F) for every 300 m (984 ft) over 900 m (2953 ft).
2. 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

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

Note: These specifications are the same as the . If your data center is operating properly, you already have acceptable environmental conditions for the 2458.

Table 1. Operating environmental specifications in table format

Environment, operating:		
High Ambient Temperature	**Long-term recommended** 27°C (80.6°F)	**Maximum ambient allowed** 35°C (95°F)
Low Ambient Temperature	**Long-term recommended** 18°C (64.4°F)	**Minimum ambient allowed** 10°C (50°F)
Low end humidity	**Long-term recommended** 5.5°C (41.9°F) dew point	**Minimum relative humidity allowed** 20% relative humidity
High end humidity	**Long-term recommended** 60% relative humidity and 15°C (59°F) dew point	**Maximum relative humidity allowed** 80% relative humidity and 21°C (69.8°F) dew point
Gasious contamination	Class G1 as per ANSI/ISA S71.04–1985 [1]	
Particulate contamination	1. Room air must be filtered continuously using appropriate filters. 2. The deliquescent relative humidity of the particulate contamination shall be more than 80%. [2]	
Note: 1. ANSI/ISA-S71.04. 1985. "Environmental conditions for process measurement and control systems: Airborne contaminants." Instrument Society of America, Research Triangle Park, NC, 1985. 2. The deliquescent relative humidity of particulate contamination is the relative humidity at which dust absorbs enough water to become wet and promote ionic conduction.		

Table 2. Nonoperating environmental specifications in table format

Environment, nonoperating:[1]	
Temperature	5°C (41°F) to 45°C (113°F)
Relative humidity	8% - 80% R/H
Maximum dew point	Less than 27°C (80.6°F)
Gaseous contamination	Class G1 as per ANSI/ISA S71.04–1985 [1]
Note: 1. The machine should be in an environment that satisfies the operating environment specifications for at least one day before it is powered on.	

Table 3. Shipping environmental specifications in table format

Environment, shippings:	
Temperature	-40°C (-40°F) to 60°C (140°F)
Relative humidity	5% - 100% R/H (no condensation)
Web bulb	Less than 29°C (84.2°F)
Shipping package	IBM-approved vapor barrier bag with desiccant

Table 4. Storage environmental specifications in table format

Environment, storage:	
Temperature	1°C (33.8°F) to 60°C (140°F)
Relative humidity	5% - 80% R/H (no condensation)
Web bulb	Less than 29°C (84.2°F)
Shipping package	IBM-approved vapor barrier bag with desiccant

Note: Prior to the installation of an IBM system, careful consideration should be given to the computer room environment. 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*.

Conductive contamination

Attention:

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 zBX 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 zBX 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 zBX IBM may condition

provision of repair or replacement of zBX or parts on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

Table 5. 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/cm2-hour weight gain).[2] In addition, the reactivity rate of silver coupons shall be less than 300 Å/month (≈ 0.0035 µg/cm2-hour weight gain).[3] The reactive monitoring of gaseous corrosivity should be conducted approximately 2 inches (5 cm) in front of the rack on the air inlet side at one-quarter and three-quarter frame height off the floor or where the air velocity is much higher.
Particulate contamination	Data centers must meet the cleanliness level of ISO 14644-1 class 8. For data centers without airside economizer, the ISO 14644-1 class 8 cleanliness may be met simply by the choice of the following filtration: • The room air may be continuously filtered with MERV 8 filters. Air entering a data center may be filtered with MERV 11 or preferably MERV 13 filters. • For data centers with airside economizers, the choice of filters to achieve ISO class 8 cleanliness depends on the specific conditions present at that data center. The deliquescent relative humidity of the particulate contamination should be more than 60% RH.[4] Data centers must be free of zinc whiskers.[5]

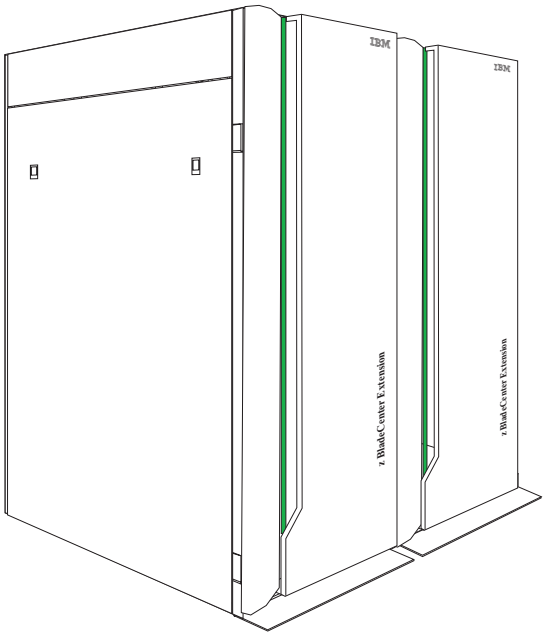
Note:

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 Cu2S and Cu2O 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 Ag2S 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.

Chapter 3. Models and physical specifications

This chapter provides the following detailed information for the IBM zBX Model 004.

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



Facts you should know about the zBX Model 004:

- The zBX Model 004 will consist of the existing zBX Model 002 or zBX Model 003 configuration. No new racks or chassis can be added.
- The racks are shipped as separate units, fastened together at install time
- There are separate shipping containers for the covers for each rack
- The zBX Model 004 may be located on a non-raised floor. In a non-raised floor environment, where cables are exposed, refer to local and national electric and safety codes for more information.
- **If you are planning an installation on a raised floor in Canada**, the installation must be in accordance with Section 12-020 of the CEC. In any country, refer to your national electric code if you have questions about routing data processing cables in exposed areas.

Physical dimensions

Frame-cover combination	Width mm (in)	Depth mm (in)	Height mm (in)
Frame B with covers	648 (25.6)	1099 (43.3)	2027 (79.9)
Frame B and C with covers	1296 (51.1)	1099 (43.3)	2027 (79.9)
Frame B, C, and D with covers	1944 (76.6)	1099 (43.3)	2027 (79.9)
Frame B, C, D, and E with covers	2592 (102.1)	1099 (43.3)	2027 (79.9)

Note:

1. The rear acoustic door adds 191 mm (7.6 in) to the depth of the rack.
2. The rear heat exchanger door adds 143 mm (5.7 in) to the depth of the rack.
3. The top exit feature adds 177 mm (7.0 in) to the height of each rack.

Shipping specifications

zBX racks are shipped mounted on pallets and use heavy external packaging requiring commercial lift transportation. This packaging is used for all zBX racks shipped anywhere.

Height reduction - FC 0570

If you have doorways with openings less than 2032 mm (80.0 in) high, you should order FC 0570. This feature reduces the frame height to 1754 mm (69.1 in). The top portion of the frames are shipped in a separate carton, as are the frame side covers.

Shipping dimensions

Palletized frames	Width mm (in)	Depth mm (in)	Height mm (in)	Max Weight kg (lb)
Americas	912 (36.0)	1295 (51.0)	2125 (83.7)	1034 (2280.0)
Palletized frames	**Width mm (in)**	**Depth mm (in)**	**Height mm (in)**	**Max Weight kg (lb)**
World Trade	912 (36.0)	1295 (51.0)	2125 (83.7)	1064 (2346.1)

Important:

The zBX 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.

zBX Model 004 configurations

The following blades/optimizers can be installed in the 2458-004:

- Optimizers
  - IBM WebSphere® DataPower® Integration Appliance XI50 for zEnterprise
- IBM blades
  - Select IBM POWER7® blades
  - Select IBM System x® blades

IBM System x blades, IBM POWER7 blades, and IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise optimizers may be installed together in the same BladeCenter, in any quantity, up to their maximum number.

IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise

When upgrading to a zBX Model 004, you can only carry forward existing IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise optimizers from the zBX Model 002 or zBX Model 003. The following table lists the minimum number of BladeCenters required based on the number of optimizers.

Feature code	Quantity	Minimum # of BladeCenters required
0611 IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise	up to 07	1 BladeCenter containing 7 optimizers
0611 IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise	up to 14	2 BladeCenters containing 14 optimizers
0611 IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise	up to 21	3 BladeCenters containing 21 optimizers
0611 IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise	up to 28	4 BladeCenters containing 28 optimizers

Select IBM POWER7 blades

When upgrading to a zBX Model 004, you can carry forward your existing select POWER7 blades and you can order select POWER7 blades to fill the existing BladeCenters. You cannot order new BladeCenters. You are responsible for procuring and installing the blades. The feature code for select POWER7 blades is 0612, and you must supply the quantity of these blades to IBM, regardless of where you obtain them, so that the proper entitlement and enablement may be built to send with the racks and BladeCenters. Instructions for how to install a blade can be found in the "Planning for IBM blades" chapter in the *IBM z Systems Ensemble Planning Guide*. The following table lists the minimum number of BladeCenters required based on the number of optimizers.

Feature code	Quantity	Minimum # of BladeCenters required
0612 select IBM POWER7 blades	01-14	1 BladeCenter
0612 select IBM POWER7 blades	15-28	2 BladeCenters
0612 select IBM POWER7 blades	29-42	3 BladeCenters
0612 select IBM POWER7 blades	43-56	4 BladeCenters
0612 select IBM POWER7 blades	57-70	5 BladeCenters
0612 select IBM POWER7 blades	71-84	6 BladeCenters
0612 select IBM POWER7 blades	85-98	7 BladeCenters
0612 select IBM POWER7 blades	99-112	8 BladeCenters

Select IBM System x blades

When upgrading to a zBX Model 004, you can carry forward your existing select IBM System x blades and you can order select IBM System x blades to fill the existing BladeCenters. You cannot order new BladeCenters. You are responsible for procuring and installing the blades. The feature code for IBM System x blades is 0613, and you must supply the quantity of these blades to IBM, regardless of where you obtain them, so that the proper entitlement and enablement may be built to send with the racks and BladeCenters. Instructions for how to install a blade can be found in the "Planning for IBM blades" chapter in the *IBM z Systems Ensemble Planning Guide*. The following table lists the minimum number of BladeCenters required based on the number of optimizers.

Feature code	Quantity	Minimum # of BladeCenters required
0613 select IBM System x blades	01-14	1 BladeCenter
0613 select IBM System x blades	15-28	2 BladeCenters
0613 select IBM System x blades	29-42	3 BladeCenters
0613 select IBM System x blades	43-56	4 BladeCenters

System upgrades

You can upgrade from a zBX Model 002 to a zBX Model 004 or from a zBX Model 003 to a zBX Model 004. However, the zBX Model 004 configuration will consist of the zBX Model 002 configuration or zBX Model 003 configuration from which you upgraded. You cannot order new racks or BladeCenters.

When upgrading to a zBX Model 004, you can only carry forward existing IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise optimizers from the zBX Model 002 or zBX Model 003. Four racks can contain up to 28 IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise optimizers.

When upgrading to a zBX Model 004, you can carry forward your existing select POWER7 blades and you can order select POWER7 blades to fill the existing BladeCenters. Four racks can contain up to 112 select IBM POWER7 blades.

When upgrading to a zBX Model 004, you can carry forward your existing select IBM System x blades and you can order select IBM System x blades to fill the existing BladeCenters. Four racks can contain up to 56 select IBM System x blades.

Other options

You may want to consider the following option:

- A Hardware Management Console (FC 0094). This is a 43 mm (1.7 in) high, rack mounted Hardware Management Console that is installed in a customer supplied frame.

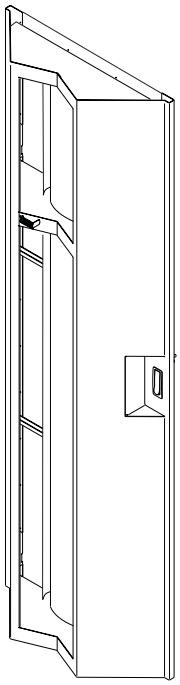
  Based on the language selected when ordering FC 0094, the appropriate 1723-8BX display/keyboard unit will be shipped with the Hardware Management Console unit. For USA geography, English is the only language identified. For all other geographies, there is a list of language options. The display/keyboard unit is also installed in the customer supplied frame.

The following options can be carried forward when you upgrade to a zBX Model 004:

- Height reduction (FC 0570). This feature separates the racks into a 36 EIA unit lower part and a removable 6 EIA unit upper part, allowing the rack to fit through doorways that are less than standard height.
- A Hardware Management Console (FC 0091 or FC 0092) with a 6096 flat panel monitor. For Hardware Management Console (FC 0091), you must ensure the RAM has been upgraded from 8GB to 16GB.

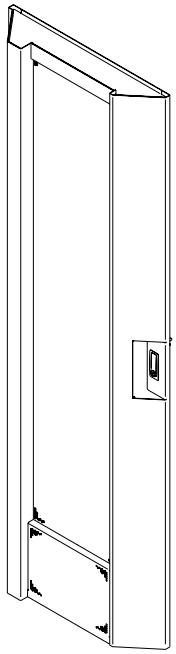
- Top exit support (FC 0545). This feature allows you to route I/O and power cabling through the top of the zBX rack on a raised floor or nonraised floor. No special hardware is required.

- A rear acoustic door (FC 0543).



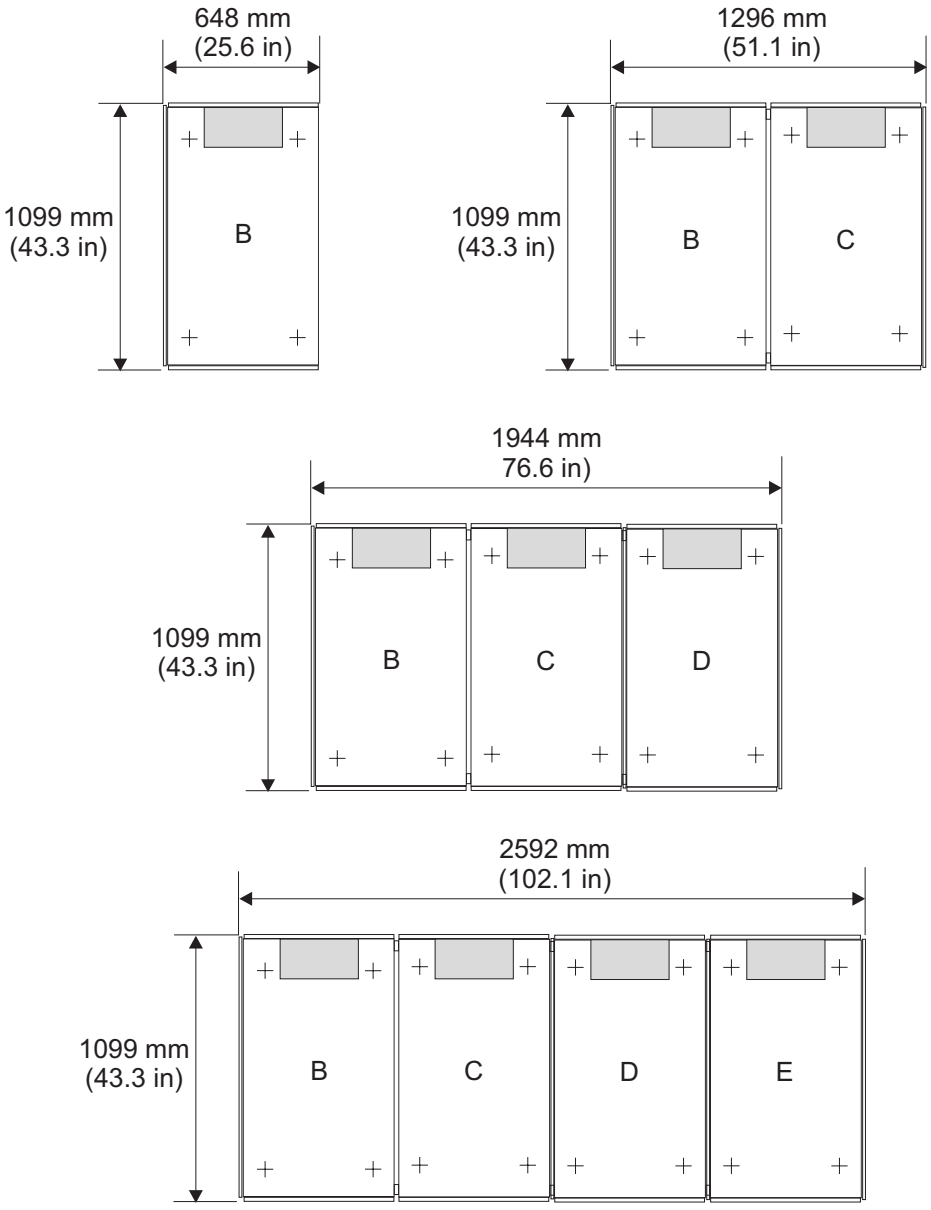
Acoustic door
FC 0543

- A rear heat exchanger door (FC 0540) to provide additional cooling for larger clusters of blades.



Heat exchanger door
FC 0540

Plan view

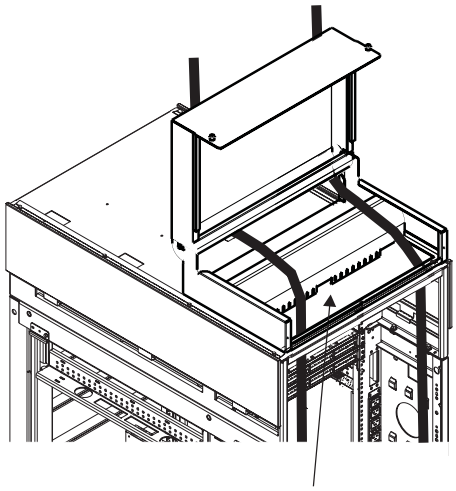


Rack Entry/Exit	Cutout dimension for raised floor	
	(mm)	(in)
Rear	152 x 305	6 x 12

Note:

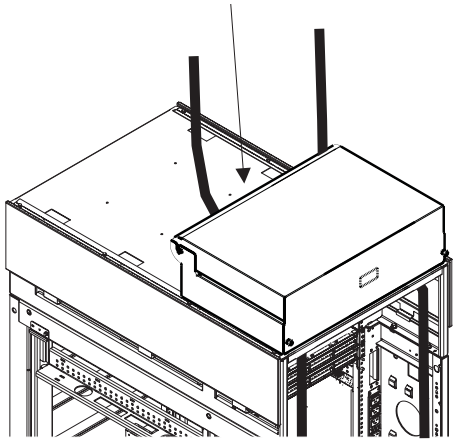
1. The rear acoustic door adds 191 mm (7.6 in) to the depth of the rack.
2. The rear heat exchanger door adds 143 mm (5.7 in) to the depth of the rack.

If you plan to use the top exit feature, there is an opening for the power cords and cables on the top front of the rack and on the back of the top exit feature.



top of the rack and bottom of the top exit feature
for power cords and cables

back of top exit feature
for power cords and cables



Weight distribution

The following table shows weights and dimensions used to calculate floor loading for the zBX Model 004 (racks B and C). Floor loading calculations are intended for a raised floor environment.

Table 6. Floor loading calculations

Description	Weight kg (lbs)
IBM POWER7 - rack B with 28 blades	656 (1447)
IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise - rack B with 14 optimizers	637 (1405)
IBM System x - rack B with 28 blades	690 (1522)
IBM POWER7 - racks B and C with 56 blades	1231 (2715)
IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise - racks B and C with 28 optimizers	1193 (2631)
IBM System x - rack B and C with 56 blades	1304 (2876)
Description	**Measurement - mm (in)**
Width - rack B with 28 blades/optimizers	648 (25.6)
Width - racks B and C with 56 blades/optimizers	1296 (51.1)
Rack depth	1099 (43.3)
Service clearance - front	1219 (48.0)
Service clearance - rear	762 (30.0)

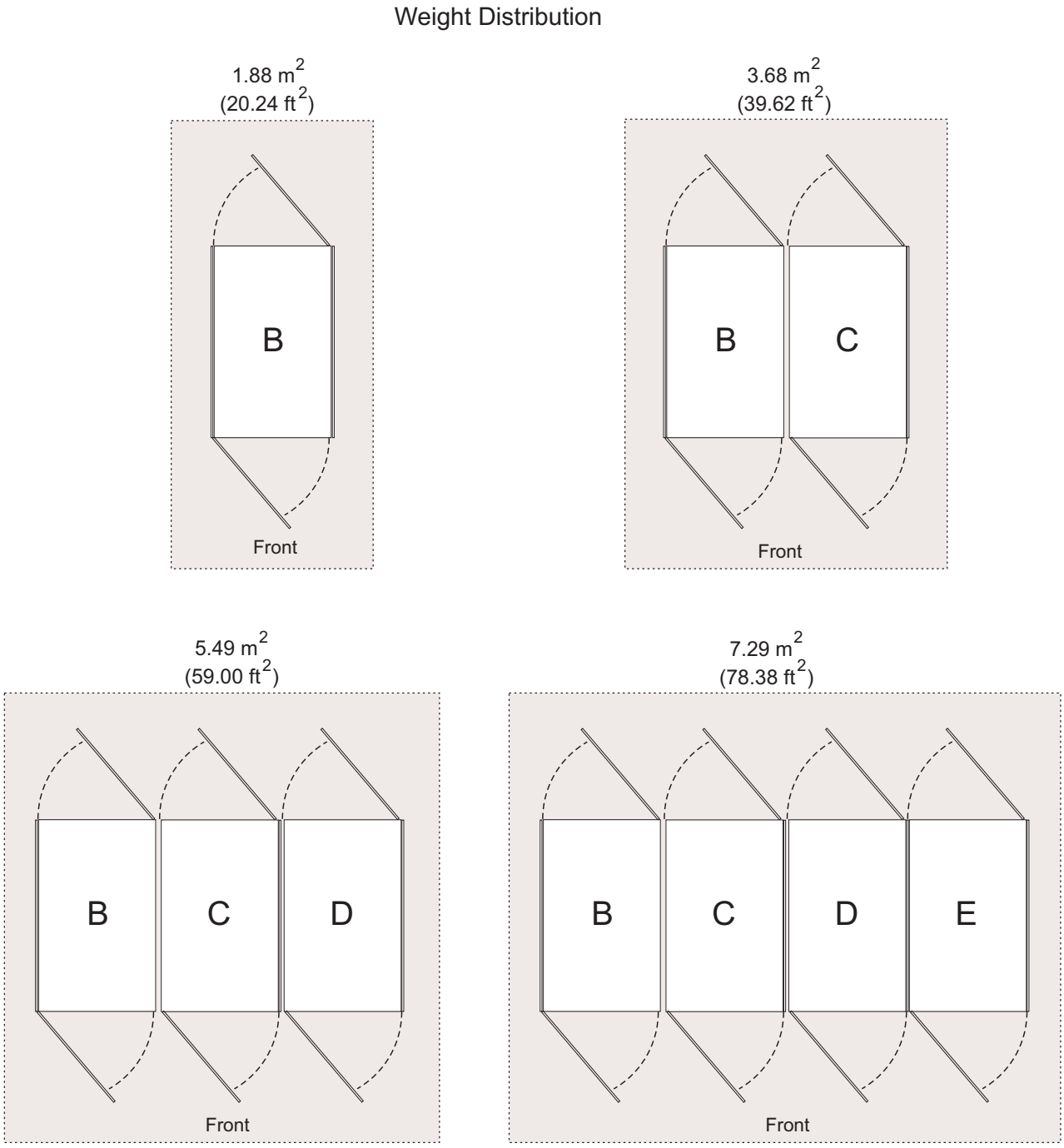
Notes:

1. Weight includes covers. Width and depth are indicated with covers.
2. For a two-rack zBX, weight is based on maximum configuration, not the addition of the maximum weight of each frame.
3. The optional top exit feature adds 177 mm (7.0 in) to the height and 9.8 kg (21.5 lb) to the weight of each rack.

Table 7. Weights for individual blades.

Blade type	Weight
IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise	7.4 kg (16.4 lb)
IBM POWER7	4.4 kg (9.6 lb)
IBM System x	5.6 kg (12.4 lb)

The following figure shows floor loading values for the zBX racks, fully populated.



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.

For physical planning purposes, you must verify system placement considering:

- Weight distribution
- Power® availability
- Power access
- Machine and service clearance area
- Air conditioning delivery
- Thermal interaction
- Cable locations
- Floor tile cutouts.

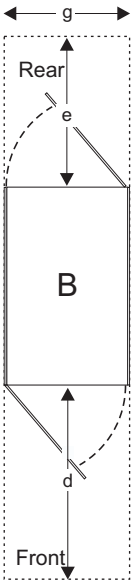
Machine and service clearance areas

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

Number of racks	Machine area M^2 (ft^2)	Service clearance area M^2 (ft^2)
1 (B)	.72 (7.75)	2.0 (21.53)
2 (B + C)	1.43 (15.40)	4.0 (43.06)
3 (B + C + D)	2.14 (23.04)	6.0 (64.59)
4 (B + C + D + E)	2.85 (30.68)	8.0 (86.12)

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.

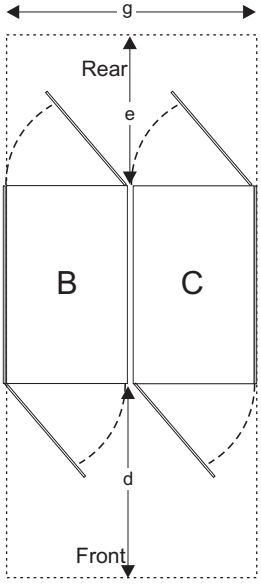


Minimum Service Clearances

d = 1219 mm (48 in) - front

e = 762 mm (30 in) - rear

g = 648 mm (25.5 in) - side to side

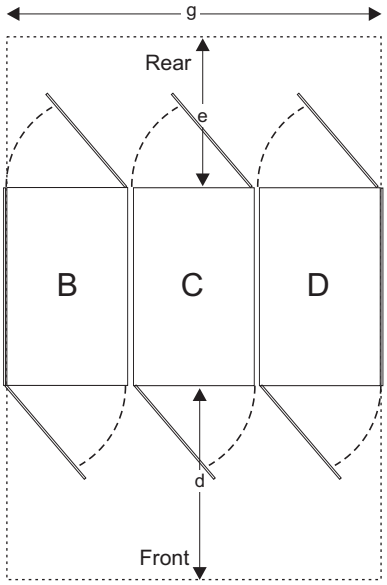


Minimum Service Clearances

d = 1219 mm (48 in) - front

e = 762 mm (30 in) - rear

g = 1296 mm (51 in) - side to side

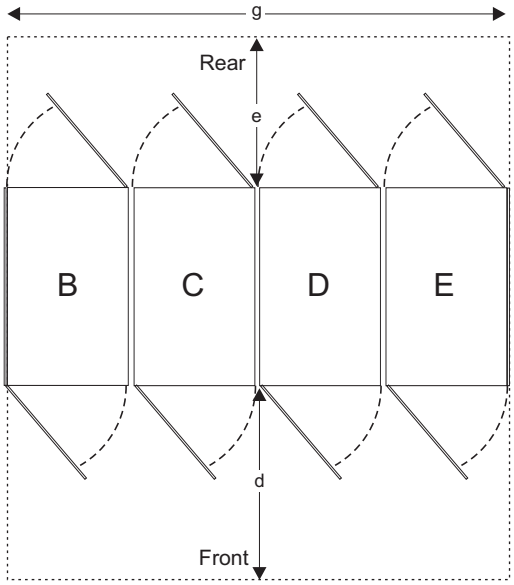


Minimum Service Clearances

d = 1219 mm (48 in) - front

e = 762 mm (30 in) - rear

g = 1944 mm (77 in) - side to side



Minimum Service Clearances

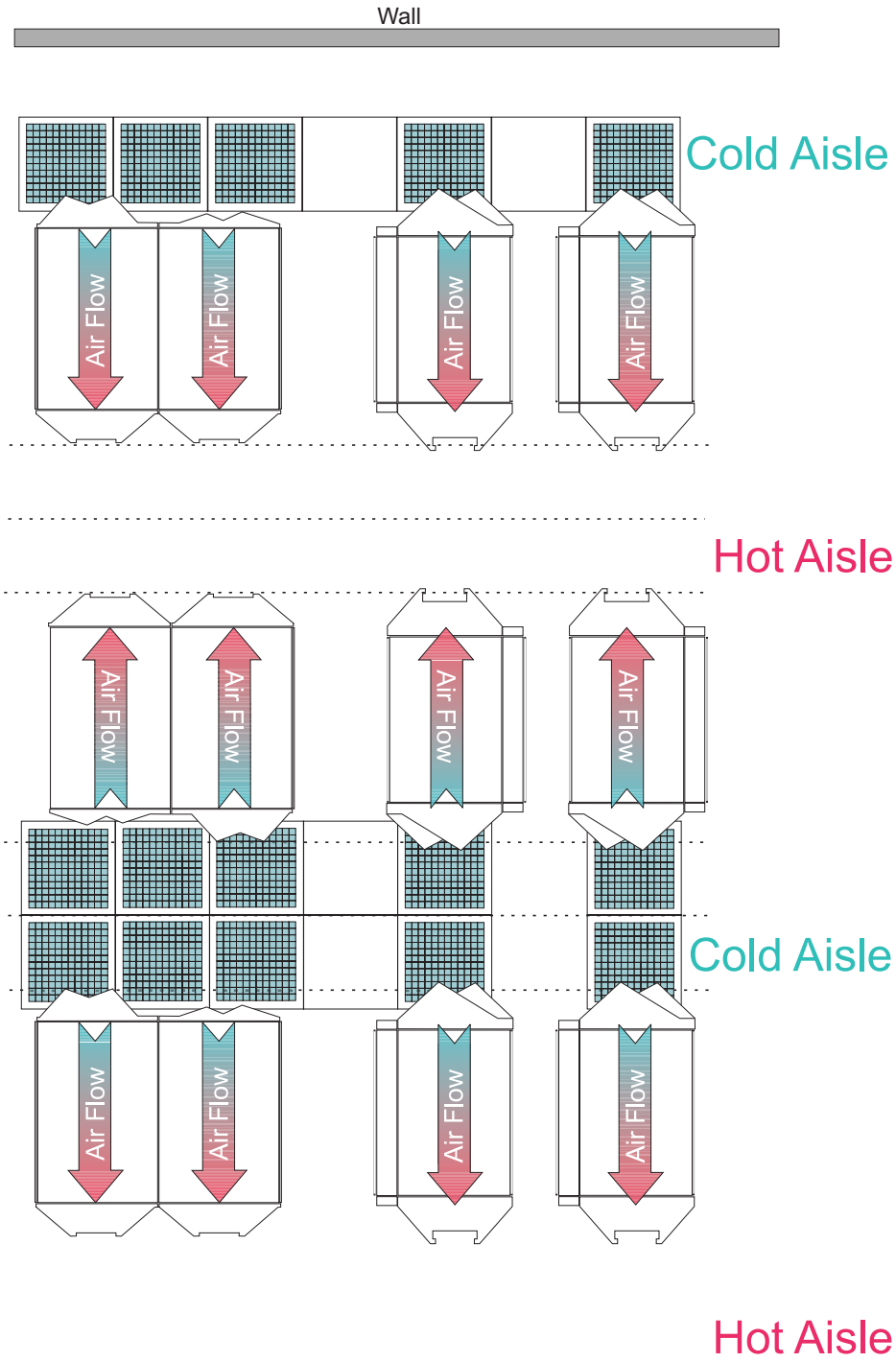
d = 1219 mm (48 in) - front

e = 762 mm (30 in) - rear

g = 2592 mm (102.1 in) - side to side

Cooling recommendations

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



A typical zBX uses chilled air, provided from under the raised floor, to cool the system. As shown, 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.

Considerations for multiple system installations

When integrating a zBX into an existing multiple-system environment, consider the following factors:

- **Thermal interactions**

  Although computer room floor space is valuable, for optimal cooling, it is recommended that zBX have a 1220 mm (48.1 in) aisle between rows of systems to reduce surrounding air temperature. See "Cooling recommendations" on page 23.
- **Floor placement**

  The zBX must be carefully placed for the cable openings to match the floor cutouts.
- **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

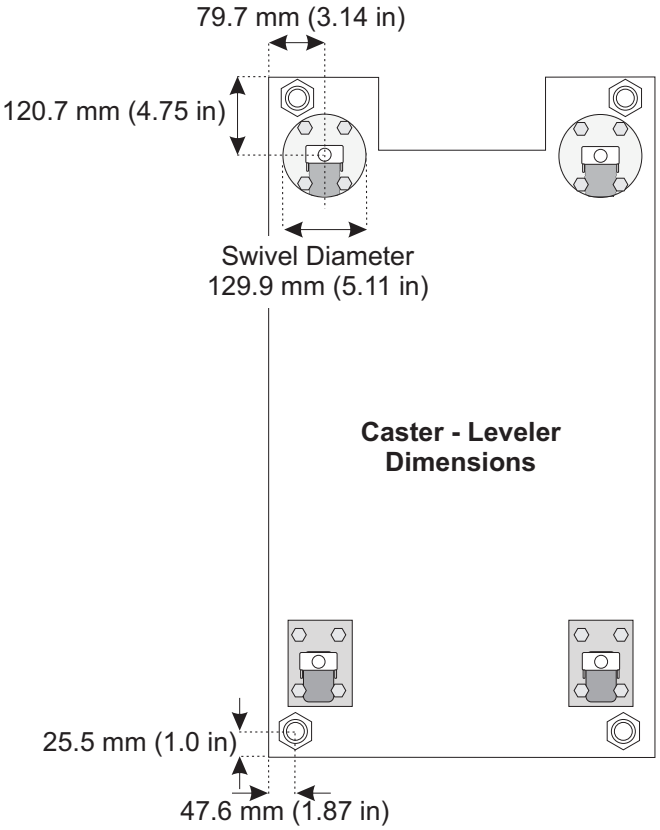
This chapter provides recommendations and requirements for making the necessary openings in the raised floor for installation.

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 nonconductive molding, appropriately sized, with edges treated to prevent cable damage and to prevent casters from rolling into the floor cutouts.

Casters

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



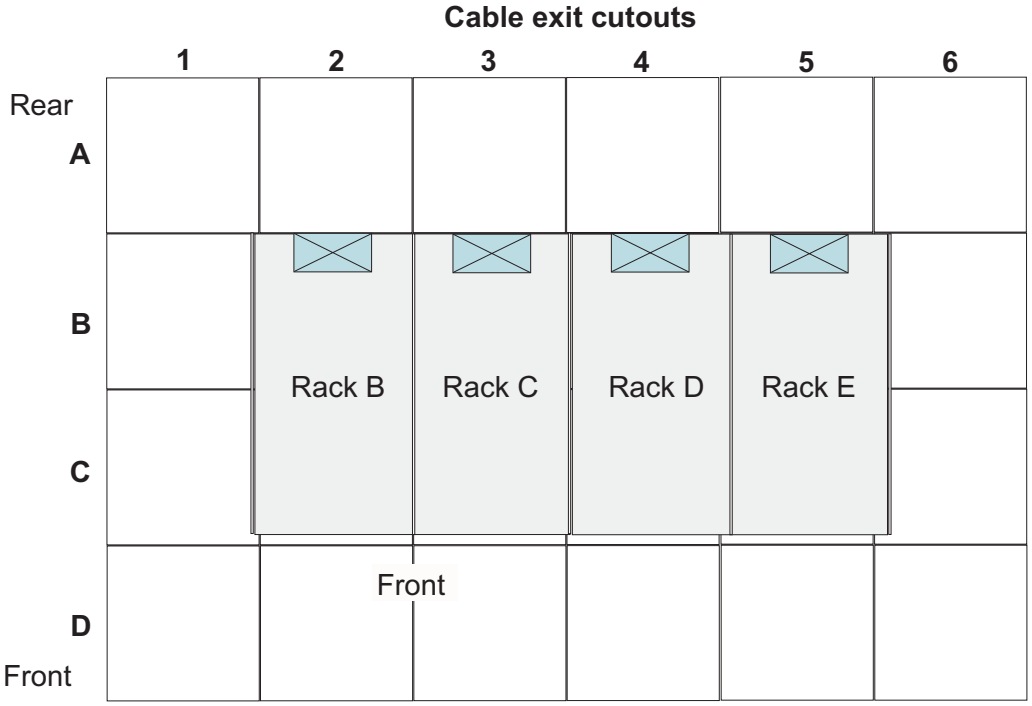
Procedure for cutting and placement of floor panels for raised floor

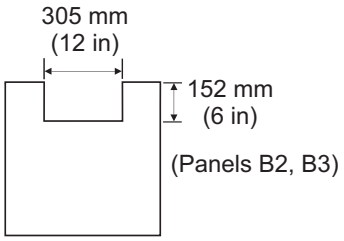
Important:

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

1. Identify the panels needed, and list the total quantity of each panel required for the installation.
2. Cut the required quantity of panels. If you have existing equipment already installed over these panels, you do not have to cut them.
3. 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.
4. For ease of installation, number each panel as it is cut as shown on the panel specification pages.
5. Use the raised floor diagram to install the panels in the proper positions.

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





Frame Entry/Exit	Cutout dimensions for raised floor	
	(mm)	(in)
Front	152 x 305	6 x 12

Chapter 5. Power requirements

zBX Model 004 **may** require as many as **16** customer power feeds. A fully configured four-rack zBX has sixteen power distribution units (PDUs). If you are ordering a smaller configuration, but intend to grow the installation, be sure to plan for the full complement of power supplies now. In addition there should be at least two service outlets near the installation position. Service outlets require standard 100V to 130V or 200V to 240V, 50/60Hz, single-phase power.

zBX operates with:

- 50/60Hz AC power
- Voltages ranging from 200V to 415V

  Note: The 32 amp wye 380V or 415V power option provides 220V or 240V line to neutral. BladeCenters operate on nominal 208 or 220V supplies.
- Both single-phase and three-phase wiring

Power installation considerations

The zBX BladeCenters and Support Elements each operate from two fully-redundant power supplies (PDUs). These redundant PDUs each have their own line cords, allowing the system to survive the loss of customer power to either line cord. If power is interrupted to one of the PDUs, the other PDU will pick up the entire load and the BladeCenters and Support Elements will continue to operate without interruption.

Table 8. Power receptacles needed per rack

Number of racks	Number of BladeCenters	Number of power receptacles needed
1	1	4 [1]
1	2	4
2	3	6
2	4	8
3	5	10
3	6	12
4	7	14
4	8	16

Note:

1. Although there is only one BladeCenter, four PDUs are required because of the Support Elements and displays/keyboards.

Therefore the line cord(s) for each PDU must be wired to support the entire power load of the BladeCenter to which that PDU supplies power.

Note: The power cord set(s) provided are for use only with this product.

For the most reliable availability, the line cords on each side of the racks should be powered from different building power distribution units. The left side line cords should be connected to one building power distribution unit. The right side line cords should be connected to a different building power distribution unit than the left side cords.

See Appendix E, “Dual power installation,” on page 65 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.

Supply type	Nominal voltage range (V)	Voltage tolerance (V)	Frequency range (Hz)
Four to sixteen redundant 3-phase line cords	200-480	180-509	50-60

Source type	Frequency	Input voltage range (V)	Rated input current (A)
Three-phase (60A plug) (U.S.)*	50/60 Hz	208V	48A
Single-phase (60A plug) (U.S.)	50/60 Hz	208V	48A
Single-phase (63A plug) (W/T)	50/60 Hz	230V	63A
Three-phase (32A plug) (W/T)	50/60 Hz	380-415V	32A
Note: The 32 amp wye 380V or 415V power option provides 220V or 240V line to neutral. BladeCenters operate on nominal 208 or 220V supplies.			

* Power cord is permanently attached to the PDU.

Power specifications

This section provides the following information:

- Power values based on the number of blades
- PDU to BladeCenter power connections
- PDU to IEDN and INMN power connections
- PDU to Support Element and display/keyboard power connections.

The following table provides power values based on the number of blades.

Table 9. Power ratings for blades.

Number of zBX blades	Maximum utility power (in KW)	Heat output (in kBTU/hour)
14	12.1	41.14
28	21.7	73.78
42	31.3	106.42
56	40.9	139.06
70	50.5	171.70
84	60.1	204.34
98	69.7	236.98
112	79.3	269.62

Note:

1. The power factor is approximately unity.
2. Input power (kVA) equals heat output (kW).
3. For heat output expressed in kBTU per hour, multiply table entries by 3.4.
4. For 3-phase installations, phase balancing is accomplished with the power cable connections between the BladeCenters and the PDUs. Refer to Table 10 on page 33 and Table 11 on page 34.
5. See Appendix E, "Dual power installation," on page 65 for recommendations on utility connections that better balance the current for installations where multiple systems are connected to the same power panel.

The following tables provides the power cabling connections from the BladeCenters to the PDUs.

Table 10. 3-phase power balancing (BladeCenter 1, BladeCenter 2, BladeCenter 3, BladeCenter 4)

BladeCenter to PDU (1-into-3 cable)	**Label on the PDU ends of the cable**
BladeCenter 1	
B10BJP2 to B06NJ01	Blower 5.5A
B10BJP2 to B06NJ04	PM 1/2 16A (PM= BladeCenter power module numbers)
B10BJP2 to B06NJ07	PM 3/4 16A
B10BJP1 to B06ZJ01	PM 1/2 16A
B10BJP1 to B06ZJ04	PM 3/4 16A
B10BJP1 to B06ZJ07	Blower 5.5A
BladeCenter 2	
B01BJP2 to B21NJ01	Blower 5.5A
B01BJP2 to B21NJ04	PM 1/2 16A
B01BJP2 to B21NJ07	PM 3/4 16A
B01BJP1 to B21ZJ01	PM 1/2 16A
B01BJP1 to B21ZJ04	PM 3/4 16A
B01BJP1 to B21ZJ07	Blower 5.5A
BladeCenter 3	
C10BJP2 to C06NJ01	Blower 5.5A
C10BJP2 to C06NJ04	PM 1/2 16A
C10BJP2 to C06NJ07	PM 3/4 16A
C10BJP1 to C06ZJ01	PM 1/2 16A
C10BJP1 to C06ZJ04	PM 3/4 16A
C10BJP1 to C06ZJ07	Blower 5.5A
BladeCenter 4	
C01BJP2 to C21NJ01	Blower 5.5A
C01BJP2 to C21NJ04	PM 1/2 16A
C01BJP2 to C21NJ07	PM 3/4 16A
C01BJP1 to C21ZJ01	PM 1/2 16A
C01BJP1 to C21ZJ04	PM 3/4 16A
C01BJP1 to C21ZJ07	Blower 5.5A

Table 11. 3-phase power balancing (BladeCenter 5, BladeCenter 6, BladeCenter 7, BladeCenter 8)

BladeCenter to PDU (1-into-3 cable)	**Label on the PDU ends of the cable**
BladeCenter 5	
D10BJP2 to D06NJ01	Blower 5.5A
D10BJP2 to D06NJ04	PM 1/2 16A
D10BJP2 to D06NJ07	PM 3/4 16A
D10BJP1 to D06ZJ01	PM 1/2 16A
D10BJP1 to D06ZJ04	PM 3/4 16A
D10BJP1 to D06ZJ07	Blower 5.5A
BladeCenter 6	
D01BJP2 to D21NJ01	Blower 5.5A
D01BJP2 to D21NJ04	PM 1/2 16A
D01BJP2 to D21NJ07	PM 3/4 16A
D01BJP1 to D21ZJ01	PM 1/2 16A
D01BJP1 to D21ZJ04	PM 3/4 16A
D01BJP1 to D21ZJ07	Blower 5.5A
BladeCenter 7	
E10BJP2 to E06NJ01	Blower 5.5A
E10BJP2 to E06NJ04	PM 1/2 16A
E10BJP2 to E06NJ07	PM 3/4 16A
E10BJP1 to E06ZJ01	PM 1/2 16A
E10BJP1 to E06ZJ04	PM 3/4 16A
E10BJP1 to E06ZJ07	Blower 5.5A
BladeCenter 8	
E01BJP2 to E21NJ01	Blower 5.5A
E01BJP2 to E21NJ04	PM 1/2 16A
E01BJP2 to E21NJ07	PM 3/4 16A
E01BJP1 to E21ZJ01	PM 1/2 16A
E01BJP1 to E21ZJ04	PM 3/4 16A
E01BJP1 to E21ZJ07	Blower 5.5A

The following table provides the power cabling connections from the IEDN top-of-rack switches and INMN top-of-rack switches to the PDUs.

Table 12. Ethernet top-of-rack switch power connections for zBX Model 004.

INMN and IEDN top-of-rack switch power connections		
From switch connector	**To PDU connector**	**Description**
B36PJP0	B21NJ08	Power cord from PDU **B** in rack **B** to INMN switch **A** at B**36**P
B35PJP0	B06NJ08	Power cord from PDU **D** in rack **B** to INMN switch **B** at B**35**P
B36PJP1	B06ZJ02	Power cord from PDU **C** in rack **B** to INMN switch **A** at B**36**P
B35PJP1	B21ZJ05	Power cord from PDU **A** in rack **B** to INMN switch **B** at B**35**P
B32PJP0	B06NJ02	Power cord from PDU **D** in rack **B** to IEDN switch **A** at B**32**P
B30PJP0	B21NJ02	Power cord from PDU **B** in rack **B** to IEDN switch **B** at B**30**P
B32PJP1	B06ZJ08	Power cord from PDU **C** in rack **B** to IEDN switch **A** at B**32**P
B30PJP1	B21ZJ08	Power cord from PDU **A** in rack **B** to IEDN switch **B** at B**30**P

The following table provides the power cabling connections from the Support Elements and displays/keyboards to the PDUs.

Table 13. Support Element and display/keyboard connections for zBX Model 004.

Support Elements and displays/keyboards power connections		
From Support Element and display/keyboard connector	**To PDU connector**	**Description**
B26BJP1	B21NJ03	Power cord from PDU **B** in rack **B** to Support Element **A** at B**26**B
B26BJP2	B21ZJ09	Power cord from PDU **A** in rack **B** to Support Element **A** at B**26**B
B25BJP1	B06NJ03	Power cord from PDU **D** in rack **B** to Support Element **B** at B**25**B
B25BJP2	B06ZJ09	Power cord from PDU **C** in rack **B** to Support Element **B** at B**25**B
B24DISP	B21NJ05	Power cord from PDU **B** in rack **B** to display/keyboard **A** at B**24**B
B23DISP	B21ZJ02	Power cord from PDU **A** in rack **B** to display/keyboard **B** at B**23**B

Customer circuit breakers (CBs)

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

Input voltage range (V)	System rated current (A)	Circuit breaker
200V	48A	60 amps
208 - 240V	63A	63 amps
380-415V	32A	32 amps

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

Note: z Systems 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 z Systems servers.** By internal design and grounding, z Systems 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.

Power plugs and receptacles

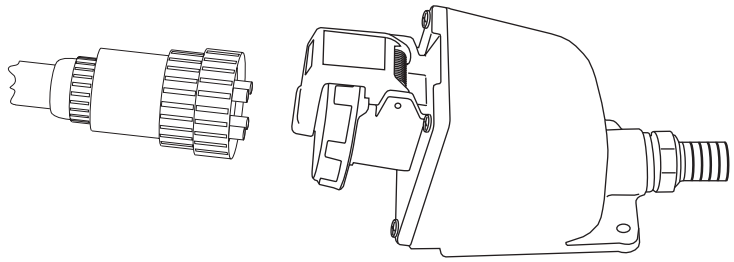
Plugs are shipped with the machine line cords in USA and Canada. The line cord lengths are 4250 mm (14 ft). Power plugs in the following table are approved for use with specified models and meet the relevant test laboratory or country/test-house standards. The power plug must be connected to a correctly 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.

Feature code	Watertight plug	Watertight receptacle
0520	60A IEC-309 460P9W	60A IEC-309 460R9W or 460C9W
0531 used with 0521	60A IEC-309 360P6W	60A IEC-309 360R6W or 360C6W
0532 used with 0521	63A IEC-309 363P6W	63A IEC-309 363R6W or 363C6W
0533 used with 0521	32A IEC-309 532P6W	32A IEC-309 532R6W or 532C6W

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 inline 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.

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 service outlets) must contain one phase conductor, a neutral conductor, and an insulated equipment-grounding conductor.

For 208 VAC through 240 VAC installations worldwide, the equipment-grounding conductor must match local electrical codes and must be green with or without one or more yellow stripes on the insulation. IBM recommends that the ground wire be the same size as the phase conductor wires.

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

There is information about additional recommendations and requirements for equipment grounding on IBM Resource Link at *http://www.ibm.com/servers/resourcelink* under **Planning** --> **Physical Planning** --> **General Information for Planning a Physical Site**.

Line cord specifications

Feature code	Description	Used in:
0520	IEC-309 208V 60A 3-phase (delta) **Note:** Line cord permanently connected to the PDU	USA, Canada, Japan, Taiwan, Philippines, Bahamas, Mexico, Trinidad, Bolivia, Brazil, Peru, Uruguay, Liberia, and other CCN and LA countries not specified
0531	IEC-309 208V 60A single-phase (P + P + G)	USA, Canada, Japan, Taiwan, Philippines, Bahamas, Mexico, Trinidad, Bolivia, Brazil, Peru, Uruguay, Liberia, and other CCN, LA, and AP countries not specified
0532	IEC-309 240V 63A single-phase (P + N+ G)	India, China, most of EMEA, Philippines, Bahamas, Curacao, Dominica, Grenada, Netherlands Antilles, St Kitts, St Lucia, St Vincent, Trinidad, Bolivia, Brazil, Argentina, Paraguay, Uruguay, Peru, Chile, and other AP countries not specified
0533	IEC-309 380-415V 32A 3-phase (wye)	India, China, Korea, most of EMEA, Philippines, Bahamas, Curacao, Dominica, Grenada, Netherlands Antilles, St Kitts, St Lucia, St Vincent, Trinidad, Bolivia, Brazil, Argentina, Paraguay, Uruguay, Peru, Chile, and other AP countries not specified

Note:

1. P=phase, N=neutral, G=ground
2. All power cords are 4.3 m (14 ft) long.
3. 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.
4. The power cord set(s) provided are for use only with this product.
5. The 32 amp wye 380V or 415V power option provides 220V or 240V line to neutral. BladeCenters operate on nominal 208 or 220V supplies.

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 Consoles

The machine type and model number of the primary HMC and alternate HMC must be identical. Both must be either FC 0091, FC 0092, or FC 0094. Verify this information by viewing the label located on the HMC:

- For FC 0091 and 0092, the label is located on the top of the HMC hardware tower. (For FC 0091, MTM is 7327-PAA. For FC 0092, MTM is 7382-PBC.)
- For FC 0094, the label is located on the front of the top cover of the HMC. (For FC 0094, MTM is 7914-PKG.)

One of these will be the primary HMC for the ensemble. The other will be the alternate HMC, so placement of the alternate HMC close to the primary HMC is important.

If you already have HMCs that you plan to use for this installation, you need not order additional consoles.

You must also know that both HMCs have to be connected on the same Ethernet subnet, so that the alternate HMC can perform the backup function should anything happen to the primary HMC.

For FC 0091 and FC 0092, two outlets are required to function properly: one outlet for the processor unit and one outlet for the monitor. For FC 0094, three outlets are required to function properly: two outlets for the 1U HMC server and one outlet for the display/monitor.

For FC 0091 and FC 0092, you need to provide a table or desk on which to place the monitor and keyboard for each console. For FC 0094, you need to provide a separate rack for the rack-mounted HMCs and rack-mounted, pull-out displays/keyboards.

If the CPC to which the zBX Model 002 or zBX Model 003 was previously attached was not covered under a warranty, you must order an additional HMC that will be assigned to the zBX Model 004 serial number. This HMC will be used for servicing the zBX Model 004.

Chapter 7. Remote Support Facility (RSF) installation planning

You can obtain a dedicated HMC by one of the following methods:

- Order a new zBX warranty HMC (FC 0092 or FC 0094) for the zBX
- Reassign an existing HMC (FC 0091 or FC 0092) at the required driver level to support the zBX
- Reassign a current HMC (FC 0091) and upgrade to support the zBX.

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 has migrated 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:

- RSF requests are always initiated from the HMC to IBM. No inbound connections are ever initiated from IBM's Service Support System.
- All transferred data is encrypted in a high-grade Secure Sockets Layer (SSL) method.
- When the HMC initiates a connection to RSF, it validates the trusted host by its digital signature issued for the IBM Service Support System.
- Data sent to IBM consists solely of hardware problem information and configuration data. No application or customer data is transmitted.

Using the internet for remote support

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

Hardware Management Console Direct Internet SSL Connection

If your Hardware Management Console can be connected to the Internet, and the external firewall can be set to allow established TCP packets to flow outbound to the 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
- 129.42.50.224
- 129.42.56.189 (enhanced)
- 129.42.58.189 (enhanced)
- 129.42.60.189 (enhanced)
- 29.42.54.189 (enhanced)

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
- 2620:0:6c4:1::1000
- 2620:0:6c0:200:129.42.56.189 (enhanced)
- 2620:0:6c1:200:129.42.58.189 (enhanced)
- 2620:0:6c2:200:129.42.60.189 (enhanced)
- 2620:0:6c4:200:129.42.54.189 (enhanced)

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. Top-of-rack switch connections

This chapter describes the connections associated with the IEDN top-of-rack switch.

SFP and SFP+ module descriptions and locations

SFP modules and SFP+ modules may be plugged into various ports in the top-of-rack switches at B10B32P and B10B30P. The ports on the switches are segmented by purpose. The illustration below shows how the ports on the IEDN switches are used. Customer ports are J31 through J37. SFP and SFP+ modules plugged into the customer ports require LC Duplex cables.

Planning worksheets for the IEDN switches are provided in Appendix A, "Top-of-rack switch ports worksheets," on page 53. You must provide the installer with your customer SFP module and SFP+ module location information.

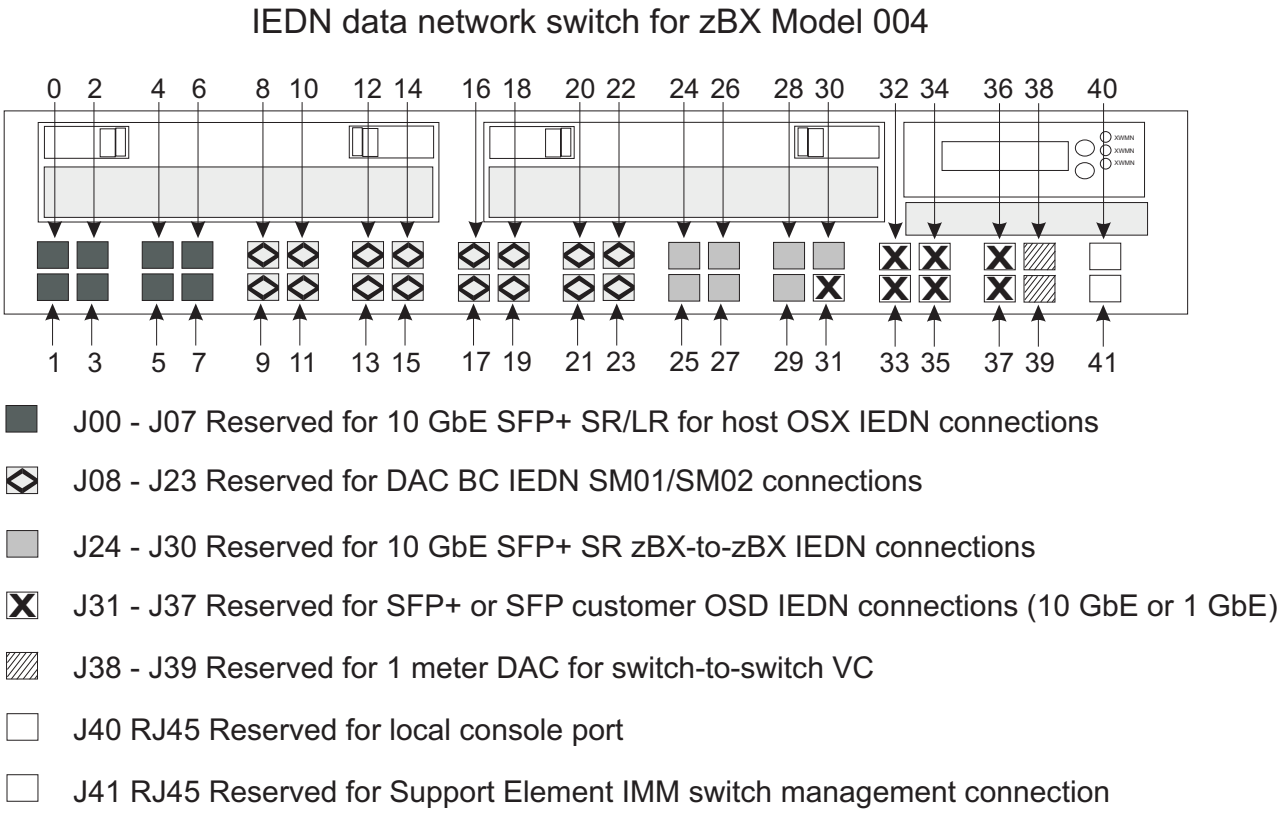


Figure 2. IEDN port connections

SFP and SFP+ module feature codes

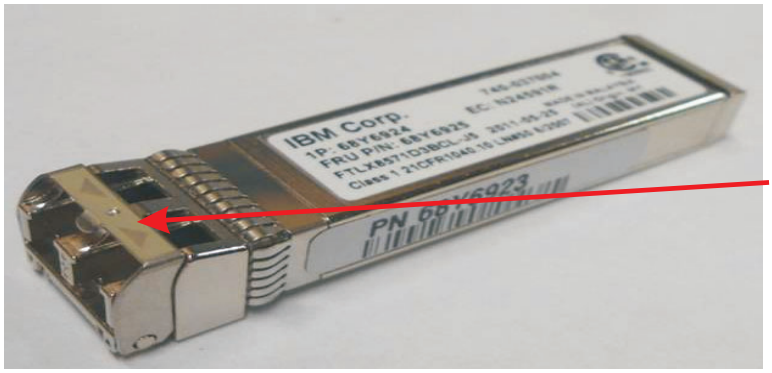
The following is a list of SFP+ and SFP module feature codes:

FC 0632

10 GbE LR SFP+ module - 1310nm

- Data rate: 10 Gbps
- Operating mode: Full duplex
- Defined as: CHPID type OSD
- Connector type: LC Duplex
- Port count: One small form/factor pluggable (SFP) optic
- Cable type: Single mode fiber optic cabling (9 micron)
- Unrepeated distance: 10 km (6.2 miles)

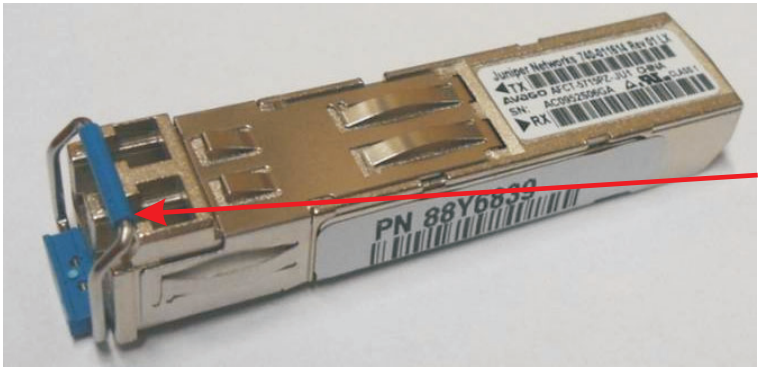
FC 0633



10 GbE SR SFP+ module - 850nm

- Data rate: 10 Gbps
- Operating mode: Full duplex
- Defined as: CHPID type OSD
- Connector type: LC Duplex
- Port count: One small form/factor pluggable (SFP) optic
- Cable type: Multimode fiber optic cabling (50 or 62.5 micron)
- Unrepeated distance: 50 micron fiber - at 2000 MHz-km (OM2) 300 meters (984 feet)
- Unrepeated distance: 50 micron fiber - at 500 MHz-km (OM2) 82 meters (269 feet)
- Unrepeated distance: 62.5 micron fiber - at 200 MHz-km: (OM1) 33 meters (108 feet)

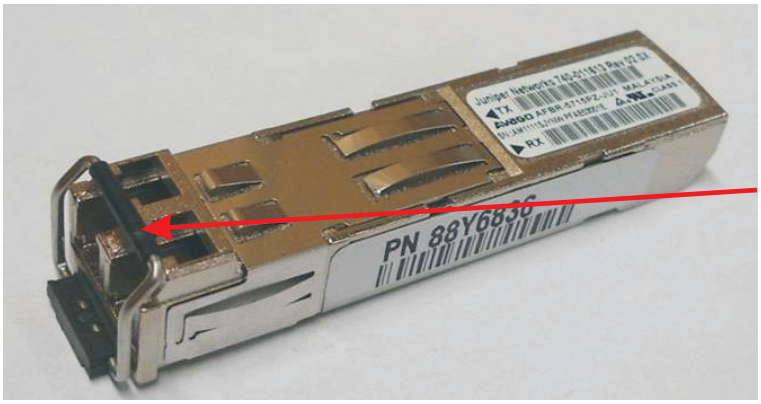
FC 0634



GbE LX SFP module - 1310nm

- Data rate: 1000 Mbps (1 Gbps)
- Operating mode: Full duplex
- Defined as: CHPID type OSD
- Connector type: LC Duplex
- Port count: One small form/factor pluggable (SFP) optic
- Cable type: Single mode fiber optic cabling (9 micron)
- Unrepeated distance: 10 km (6.2 miles)

FC 0635



GbE SX SFP module - 850nm

- Data rate: 1000 Mbps (1 Gbps)
- Operating mode: Full duplex
- Defined as: CHPID type OSD
- Connector type: LC Duplex
- Port count: One small form/factor pluggable (SFP) optic
- Cable type: Multimode fiber optic cabling (50 or 62.5 micron)
- Unrepeated distance: 50 micron fiber - at 500 MHz-km (OM2) 550 meters (1804 feet)
- Unrepeated distance: 62.5 micron fiber - at 200 MHz-km: (OM1) 275 meters (902 feet)

OSA to IEDN switch connections

Important: The customer is responsible for having the OSA cables connected between the IEDN switches and CPCs. It is necessary to plug these connections before the rest of the installation can continue.

The OSA cards and cables used to connect the IEDN switches to the CPCs may be either short range or long range OSA 10 GbE cables, type OSX.

Table 14. OSA cables to IEDN switch connections.

OSA to IEDN switch connection
First OSA **1**A to B32PJ00
First OSA **2**A to B30PJ00
Second OSA **1**A to B32PJ01
Second OSA **2**A to B30PJ01
Third OSA **1**A to B32PJ02
Third OSA **2**A to B30PJ02
Fourth OSA **1**A to B32PJ03
Fourth OSA **2**A to B30PJ03
Fifth OSA **1**A to B32PJ04
Fifth OSA **2**A to B30PJ04
Sixth OSA **1**A to B32PJ05
Sixth OSA **2**A to B30PJ05
Seventh OSA **1**A to B32PJ06
Seventh OSA **2**A to B30PJ06
Eighth OSA **1**A to B32PJ07
Eighth OSA **2**A to B30PJ07

IEDN zBX node-to-node connections

The following illustration shows node-to-node connections for the IEDN. A node is defined as a z196 or z114 with a zBX Model 002 attached, a zEC12 or zBC12 with a zBX Model 003 attached, or a stand-alone zBX Model 004. These cables connect the zBXs in each node to each other in the ensemble. Each node consists of a z196 or z114 server with its own zBX Model 002, a zEC12 or zBC12 with its own zBX Model 003, or a stand-alone zBX Model 004, running a single (local) platform management image.

IEDN node-to-node LIMITATIONS - multimode (Short Range Optics)

- 50 micron at 2000 MHz-km: 300 meters (984')
- 50 micron at 500 MHz-km: 82 meters (269')
- 62.5 micron at 200 MHz-km: 33 meters (108')

IEDN node-to-node LIMITATIONS - single mode (Long Range Optics)

- 10 km (6.2 miles)

Note: If you have to connect several zBXs, check the IEDN node-to-node connections because the system will not report missing or incorrect plugged zBX-to-zBX connections. To view the status of these ports, use the **Network Monitor** task from the Support Element or the **Network Monitors Dashboard** task from the HMC.

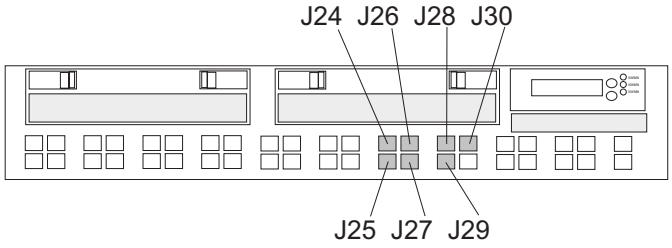
The following illustration shows the IEDN node-to-node connections between the top-of-rack switches. The box at the bottom of the illustration shows the connections graphically.

Important:

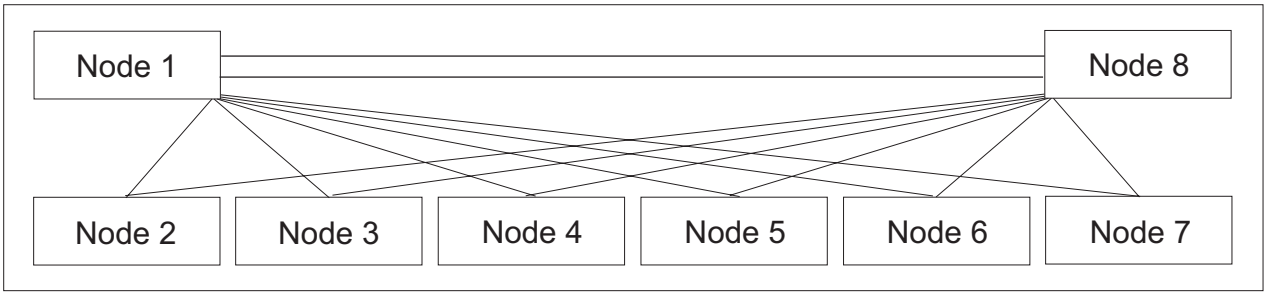
When adding the second zBX, **the node number is 8, not 2**.

The node-to-node connections are cumulative - each additional zBX must be connected in the following sequence.

Node-to-node ports on IEDN switches B32P and B30P



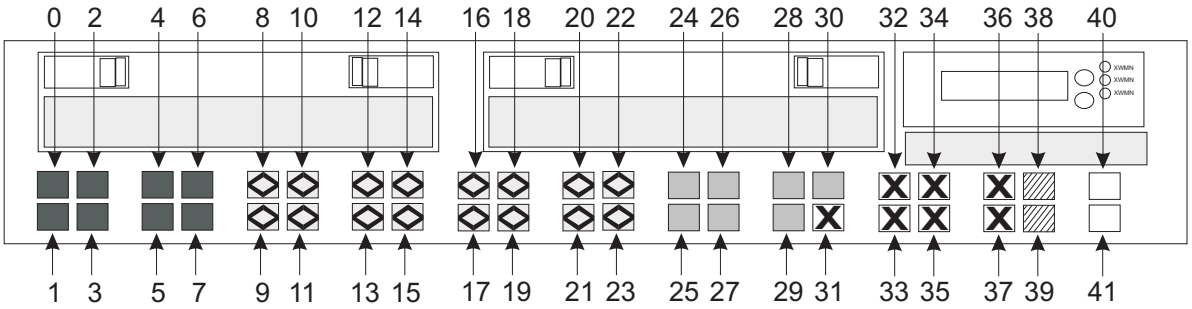
First zBX **Node 1**		
Add a second zBX **Node 8**	Node 1 - B32PJ30 to Node 8 B32PJ30	Node 8 - B30PJ24 to Node 1 B30PJ24
Add a third zBX **Node 2**	Node 1 - B32PJ30 to Node 8 B32PJ30 Node 1 - B32PJ24 to Node 2 B32PJ24	Node 8 - B30PJ24 to Node 1 B30PJ24 Node 8 - B30PJ25 to Node 2 B30PJ25
Add a fourth zBX **Node 3**	Node 1 - B32PJ30 to Node 8 B32PJ30 Node 1 - B32PJ24 to Node 2 B32PJ24 Node 1 - B32PJ25 to Node 3 B32PJ25	Node 8 - B30PJ24 to Node 1 B30PJ24 Node 8 - B30PJ25 to Node 2 B30PJ25 Node 8 - B30PJ26 to Node 3 B30PJ26
Add a fifth zBX **Node 4**	Node 1 - B32PJ30 to Node 8 B32PJ30 Node 1 - B32PJ24 to Node 2 B32PJ24 Node 1 - B32PJ25 to Node 3 B32PJ25 Node 1 - B32PJ26 to Node 4 B32PJ26	Node 8 - B30PJ24 to Node 1 B30PJ24 Node 8 - B30PJ25 to Node 2 B30PJ25 Node 8 - B30PJ26 to Node 3 B30PJ26 Node 8 - B30PJ27 to Node 4 B30PJ27
Add a sixth zBX **Node 5**	Node 1 - B32PJ30 to Node 8 B32PJ30 Node 1 - B32PJ24 to Node 2 B32PJ24 Node 1 - B32PJ25 to Node 3 B32PJ25 Node 1 - B32PJ26 to Node 4 B32PJ26 Node 1 - B32PJ27 to Node 5 B32PJ27	Node 8 - B30PJ24 to Node 1 B30PJ24 Node 8 - B30PJ25 to Node 2 B30PJ25 Node 8 - B30PJ26 to Node 3 B30PJ26 Node 8 - B30PJ27 to Node 4 B30PJ27 Node 8 - B30PJ28 to Node 5 B30PJ28
Add a seventh zBX **Node 6**	Node 1 - B32PJ30 to Node 8 B32PJ30 Node 1 - B32PJ24 to Node 2 B32PJ24 Node 1 - B32PJ25 to Node 3 B32PJ25 Node 1 - B32PJ26 to Node 4 B32PJ26 Node 1 - B32PJ27 to Node 5 B32PJ27 Node 1 - B32PJ28 to Node 6 B32PJ28	Node 8 - B30PJ24 to Node 1 B30PJ24 Node 8 - B30PJ25 to Node 2 B30PJ25 Node 8 - B30PJ26 to Node 3 B30PJ26 Node 8 - B30PJ27 to Node 4 B30PJ27 Node 8 - B30PJ28 to Node 5 B30PJ28 Node 8 - B30PJ29 to Node 6 B30PJ29
Add an eighth zBX **Node 7**	Node 1 - B32PJ30 to Node 8 B32PJ30 Node 1 - B32PJ24 to Node 2 B32PJ24 Node 1 - B32PJ25 to Node 3 B32PJ25 Node 1 - B32PJ26 to Node 4 B32PJ26 Node 1 - B32PJ27 to Node 5 B32PJ27 Node 1 - B32PJ28 to Node 6 B32PJ28 Node 1 - B32PJ29 to Node 7 B32PJ29	Node 8 - B30PJ24 to Node 1 B30PJ24 Node 8 - B30PJ25 to Node 2 B30PJ25 Node 8 - B30PJ26 to Node 3 B30PJ26 Node 8 - B30PJ27 to Node 4 B30PJ27 Node 8 - B30PJ28 to Node 5 B30PJ28 Node 8 - B30PJ29 to Node 6 B30PJ29 Node 8 - B30PJ30 to Node 7 B30PJ30



Appendix A. Top-of-rack switch ports worksheets

Use the following illustration to fill in the worksheets for the top-of-rack switches B32P and B30P.

IEDN data network switch for zBX Model 004



J00 - J07 Reserved for 10 GbE SFP+ SR/LR for host OSX IEDN connections

J08 - J23 Reserved for DAC BC IEDN SM01/SM02 connections

J24 - J30 Reserved for 10 GbE SFP+ SR zBX-to-zBX IEDN connections

J31 - J37 Reserved for SFP+ or SFP customer OSD IEDN connections (10 GbE or 1 GbE)

J38 - J39 Reserved for 1 meter DAC for switch-to-switch VC

J40 RJ45 Reserved for local console port

J41 RJ45 Reserved for Support Element IMM switch management connection

Table 15. Worksheet - TOR switch ports B32P J00-J07 for CPC to zBX connections

CPC name		10 GbE (SFP+) LR port #	10 GbE (SFP+) SR port #
CPC 1		**J00**- place checkmark here >	**J00**- place checkmark here >
CPC 2		**J01**- place checkmark here >	**J01**- place checkmark here >
CPC 3		**J02**- place checkmark here >	**J02**- place checkmark here >
CPC 4		**J03**- place checkmark here >	**J03**- place checkmark here >
CPC 5		**J04**- place checkmark here >	**J04**- place checkmark here >
CPC 6		**J05**- place checkmark here >	**J05**- place checkmark here >
CPC 7		**J06**- place checkmark here >	**J06**- place checkmark here >
CPC 8		**J07**- place checkmark here >	**J07**- place checkmark here >

Table 16. Worksheet - TOR switch ports B32P J24-J30 for zBX to zBX connections

zBX node name		10 GbE (SFP+) SR port #
zBX 2		**J24**- place checkmark here >
zBX 3		**J25**- place checkmark here >
zBX 4		**J26**- place checkmark here >
zBX 5		**J27**- place checkmark here >
zBX 6		**J28**- place checkmark here >
zBX 7		**J29**- place checkmark here >
zBX 8		**J30**- place checkmark here >

Table 17. Worksheet - TOR switch ports B32P J31-J37 to existing customer network connections

10 GbE (SFP+) LR port #	10 GbE (SFP+) SR port #	1 GbE (SFP) LX port #	1 GbE (SFP) SX port #
J31- checkmark here >	**J31**- checkmark here >	**J31**- checkmark here >	**J31**- checkmark here >
J32- checkmark here >	**J32**- checkmark here >	**J32**- checkmark here >	**J32**- checkmark here >
J33- checkmark here >	**J33**- checkmark here >	**J33**- checkmark here >	**J33**- checkmark here >
J34- checkmark here >	**J34**- checkmark here >	**J34**- checkmark here >	**J34**- checkmark here >
J35- checkmark here >	**J35**- checkmark here >	**J35**- checkmark here >	**J35**- checkmark here >
J36- checkmark here >	**J36**- checkmark here >	**J36**- checkmark here >	**J36**- checkmark here >
J37- checkmark here >	**J37**- checkmark here >	**J37**- checkmark here >	**J37**- checkmark here >

Table 18. Worksheet - TOR switch ports B30P J00-J07 for CPC to zBX connections

CPC name		10 GbE (SFP+) LR port #	10 GbE (SFP+) SR port #
CPC 1		**J00**- place checkmark here >	**J00**- place checkmark here >
CPC 2		**J01**- place checkmark here >	**J01**- place checkmark here >
CPC 3		**J02**- place checkmark here >	**J02**- place checkmark here >
CPC 4		**J03**- place checkmark here >	**J03**- place checkmark here >
CPC 5		**J04**- place checkmark here >	**J04**- place checkmark here >
CPC 6		**J05**- place checkmark here >	**J05**- place checkmark here >
CPC 7		**J06**- place checkmark here >	**J06**- place checkmark here >
CPC 8		**J07**- place checkmark here >	**J07**- place checkmark here >

Table 19. Worksheet - TOR switch ports B30P J24-J30 for zBX to zBX connections

zBX node name		10 GbE (SFP+) SR port #
zBX 2		**J24**- place checkmark here >
zBX 3		**J25**- place checkmark here >
zBX 4		**J26**- place checkmark here >
zBX 5		**J27**- place checkmark here >
zBX 6		**J28**- place checkmark here >
zBX 7		**J29**- place checkmark here >
zBX 8		**J30**- place checkmark here >

Table 20. Worksheet - TOR switch ports B30P J31-J37 to existing customer network connections

10 GbE (SFP+) LR port #	10 GbE (SFP+) SR port #	1 GbE (SFP) LX port #	1 GbE (SFP) SX port #
J31- checkmark here >	**J31**- checkmark here >	**J31**- checkmark here >	**J31**- checkmark here >
J32- checkmark here >	**J32**- checkmark here >	**J32**- checkmark here >	**J32**- checkmark here >
J33- checkmark here >	**J33**- checkmark here >	**J33**- checkmark here >	**J33**- checkmark here >
J34- checkmark here >	**J34**- checkmark here >	**J34**- checkmark here >	**J34**- checkmark here >
J35- checkmark here >	**J35**- checkmark here >	**J35**- checkmark here >	**J35**- checkmark here >
J36- checkmark here >	**J36**- checkmark here >	**J36**- checkmark here >	**J36**- checkmark here >
J37- checkmark here >	**J37**- checkmark here >	**J37**- checkmark here >	**J37**- checkmark here >

Appendix B. Fibre channel Storage Area Network information

For information about Fibre Channel specifications for Storage Area Networks (SANs), refer to located on IBM Resource Link at *http://www.ibm.com/servers/resourcelink*).

Appendix C. IBM standard symbols

In Plan Views:

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

Cable Exit Area, recommended

Power Cord exit, 50/60 Hz

Power Cord exit, 400 Hz

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

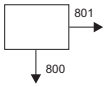
Swinging Gate

Standard equipment outline
(shows the machine with covers closed)

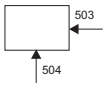
Optional equipment outline

Customer Engineer
Indicator Panel

In Cabling Schematics:



Indicates a cable group coming from a machine



Indicates a cable group going to a machine

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

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

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

Legs

Non-raised floor cable exit

Meter location

Unit Emergency Switch

Hinged Covers

Single

Bifold

Offset Bifold

Appendix D. Acoustics

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

Acoustical noise emission levels for zBX Model 004

Table 21. Acoustic information for IBM POWER7 blades, IBM System x blades, and IBM WebSphere® DataPower Integration Appliance XI50 for zEnterprise optimizers

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: MT 2458 Model 004 configured as a single-frame system with 28 blades in two BladeCenter H chassis in Acoustics Mode and two in-rack switches. All air-moving devices at nominal speeds; slimline front door with rear acoustical door.	7.5(4)	7.5(4)	57	57
Typical Configuration: MT 2458 Model 004 configured as a single-frame system with 28 blades in two BladeCenter H chassis in Acoustics Mode and two in-rack switches. All air-moving devices at nominal speeds; slimline front door with rear non-acoustical door (i.e. slimline or heat exchanger).	7.9(5)	7.9(5)	61	61
Maximum Configuration: MT 2458 Model 004 configured as a four-frame system with 112 blades in eight BladeCenter H chassis in Acoustics Mode and two in-rack switches. All air-moving devices at nominal speeds; slimline front door with rear acoustical door.	8.1(4)	8.1(4)	63	63
Maximum Configuration: MT 2458 Model 004 configured as a four-frame system with 112 blades in eight BladeCenter H chassis in Acoustics Mode and two in-rack switches. All air-moving devices at nominal speeds; slimline front door with rear non-acoustical door (i.e. slimline or heat exchanger).	8.5(5)	8.5(5)	67	67

Table 21. Acoustic information for IBM POWER7 blades, IBM System x blades, and IBM WebSphere® DataPower Integration Appliance XI50 for zEnterprise optimizers (continued)

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)**
Notes: 1. Declared level L_{WAd} is the (upper limit) A-weighted sound power level. Declared level L_{pAm} is the mean A-weighted sound pressure level measured at the 1-meter bystander positions. 2. All measurements are made in accordance with ISO 7779, and declared 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. 5. Meets IT Product Noise Limits for "Generally Unattended Data Center" per Statskontoret Technical Standard 26:6.				

Relevant international standards:

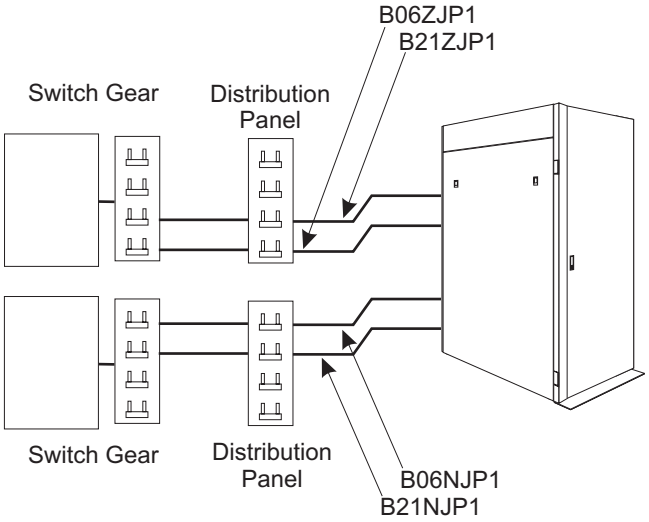
- Measurements: ISO 7779
- Declaration: ISO 9296

Appendix E. Dual power installation

The zBX BladeCenter is designed with a fully redundant power system. Each BladeCenter has two line cords attached to two power input ports which, in turn, power a pair of fully redundant power distribution systems within the BladeCenter. To take full advantage of the redundancy/reliability that is built into the system, the equipment **must** be powered from two distribution panels. Following are three examples of redundancy.

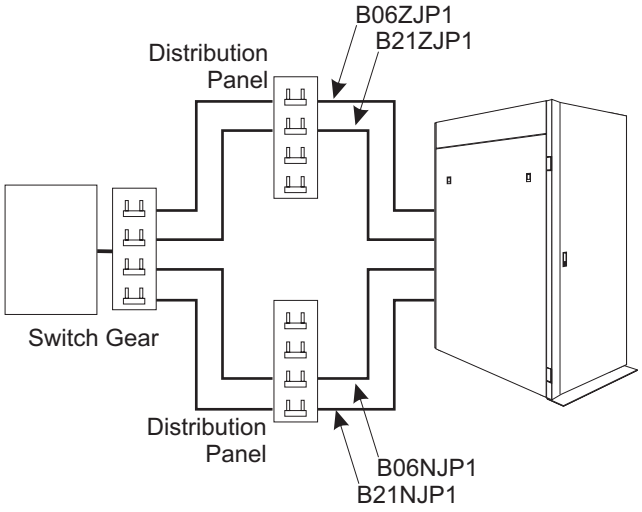
Example 1 (redundant distribution panel and switch gear)

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 level of redundancy is not available in most facilities.



Example 2 (redundant distribution panel)

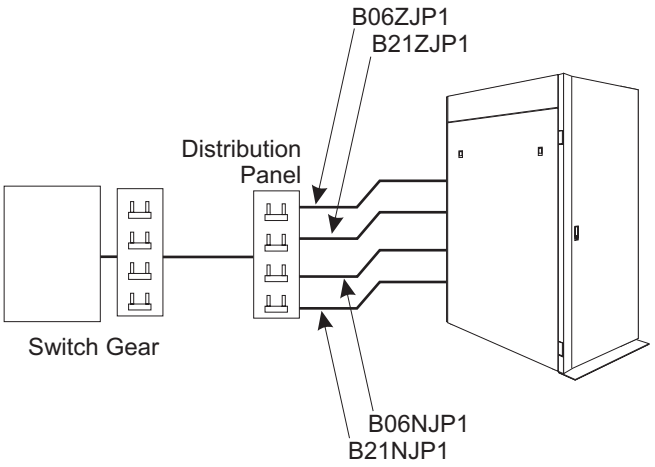
In this example, the computer receives power from two separate power distribution panels. The two distribution panels receive power from the same piece of building switch gear. Most facilities should be able to achieve this level of redundancy. In this case, loss of switch gear (building power) will 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 or four separate circuit breakers in a single power panel. This does not make use of the redundancy provided by the processor. It is, however, acceptable if a second power distribution panel is not available.

This type of power distribution will result in system outage in the event of a power failure at either the switch gear or the distribution panel.



Appendix F. Rear door heat exchanger

The heat exchanger is a water-cooled device that mounts on the rear of IBM 19-inch EIA-rail and 24-inch EIA-rail Enterprise racks to cool the air that is heated and exhausted by devices inside the rack. The heat exchanger can remove 50-60 percent of the heat load from an individual rack when water is supplied to at 18°C (64.4°F) and the door is running under optimum conditions.

The rear door heat exchanger may be installed on either a raised or non-raised floor.

For sizing purposes, consider a rack that produces a heat load of X watts. The heat exchanger can remove 0.5X watts before the heated air enters the room.

The heat exchanger feature kit consists of the components listed below:

- Door assembly (The hoses for the secondary cooling loop are not included with the heat exchanger kit.)
- Hinge kit
- Air-purge tool

A supply hose delivers chilled, conditioned water to the heat exchanger. A return hose delivers warmed water back to the water pump or chiller. This is referred to as a secondary cooling loop. The primary cooling loop supplies the building chilled water to secondary cooling loops, air conditioning units, and so on.

Each rear door heat exchanger can remove up to 50,000 Btu/hr (or approximately 15,000 watts) of heat from your data center.

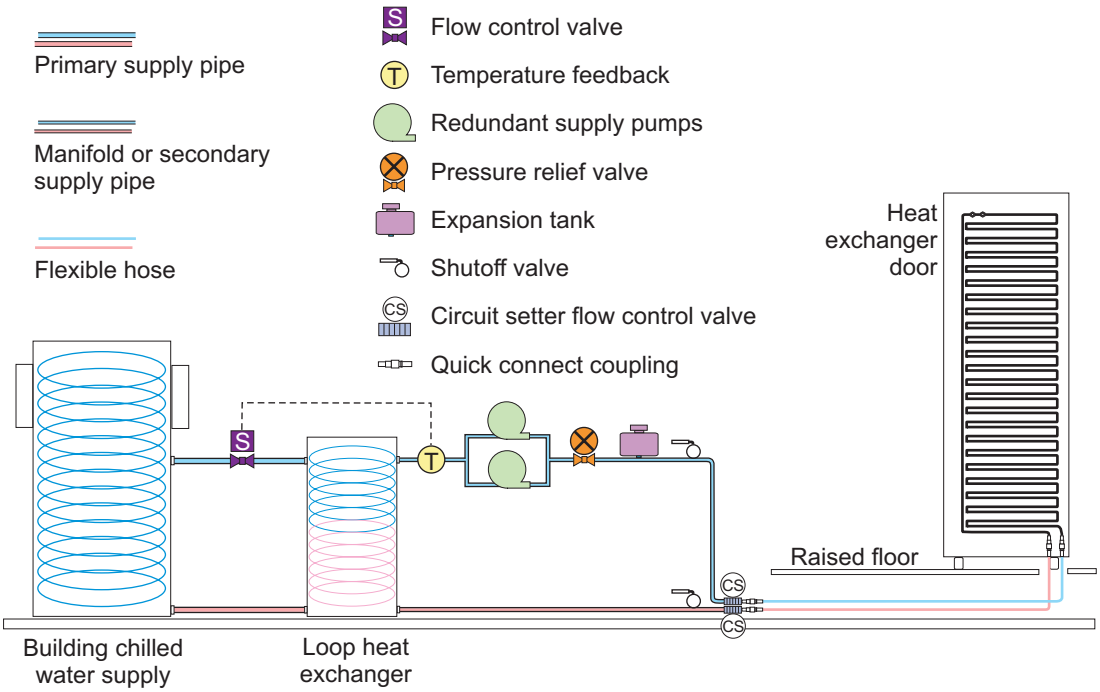


Figure 3. Components of a water supply system for a heat exchanger

If you would like to procure IBM installation planning services for supplying conditioned water and installing a heat exchanger, contact your local IBM representative or business partner for additional information.

Following are the specifications for the heat exchanger.

Table 22. Operating specifications for 19-inch EIA-rail heat exchanger

Heat exchanger door specifications		
Door size • Depth: 142.6 mm (5.6 in) • Height: 1945.4 mm (76.6 in) • Width: 639 mm (25.2 in) **Exchanger size** • Depth: 67 mm (2.7 in) • Height: 1791.3 mm (70.6 in) • Width: 438.6 mm (17.3 in) **Door assembly weight** • Empty: 29.9 kg (66 lb.) • Filled: 35.6 kg (78.5 lb.) **Door heat removal capacity** • Lab tests indicate 50 to 60 percent of total rack heat output can be removed by the door • Up to 15 kW (50 000 Btu/hr) heat removal possible	**Air movement** • Provided by servers and other devices in the rack • No additional air moving devices required. **Air source for servers** • Room air for front of rack. Air exhausts servers, moves through rear door heat exchanger and exits into the room (open loop) **Air temperature drop** • The temperature drop can be up to 25°C (45°F) between the air exiting the rack devices and the air exiting the heat exchanger on high heat load products. **Air impedance** • Air pressure drop across the heat exchanger is equivalent to the IBM® acoustic 19-inch rear door	**Water source** • User-supplied - compliant with the specifications in this document. • Couplings and inside diameter of the hoses are 19 mm (0.75 in). **Water pressure** • Normal operation: 137.93 kPa (20 psi) • Maximum: 689.66 kPa (100 psi) • Pressure drop across heat exchanger: approximately 48 kPa (7 psi) **Water volume** • Exchanger: 2.8 liters (0.74 gallons) • Exchanger plus supply and return hoses to the pump unit: Maximum of approximately 15.1 liters (4.0 gallons) excluding pump unit piping and reservoir **Water temperature** • If no dew point control is available from the secondary loop cooling distribution unit, 22°C +/- 1°C (71.6°F +/- 1.8°F) must be maintained • Lower temperature water is allowed as long as the water supply is monitored and adjusted to remain above room dew point (where heat exchanger is located) **Required water flow rate** (as measured at the supply entrance to the heat exchanger) • Minimum: 22.7 liters per minute (6 gallons per minute) • Maximum: 37.9 liters per minute (10 gallons per minute)

Secondary cooling loop specifications

It is important that the water being supplied to the heat exchanger meets the requirements described in this topic; otherwise, system failures might occur over time, as a result of:

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

The water used to fill, refill, and supply the heat exchanger must be particle-free deionized water or particle-free distilled water with appropriate controls for avoiding metal corrosion, bacterial fouling, and scaling. Because of typical water temperatures in the primary loop, water for the heat exchanger may not be able to originate from the building chilled-water system. Conditioned, warmer water for the heat exchanger should be supplied as part of a secondary, closed-loop system.

Material considerations

Recommended materials for use in supply lines, connectors, manifolds, pumps, hoses, and any other hardware that makes up the closed-loop water-supply include:

- Copper
- Brass with less than 30 percent zinc content
- Stainless steel – 303, 304, or 316
- Ethylene Propylene Diene Monomer (EPDM) rubber – peroxide cured, non-metal oxide.

Materials to avoid in secondary loops include:

- Oxidizing biocides, such as, chlorine, bromine, and chlorine dioxide
- Brass with greater than 30 percent zinc content
- Aluminum
- Irons (non-stainless steel).

Specifications for the water

The following are the specific characteristics of the system that supplies the chilled conditioned water to the heat exchanger.

Temperature

The heat exchanger, its supply hose and return hoses are not insulated and do not have features designed to address the creation and collection water from condensate. Avoid any condition that could cause condensation. The temperature of the water inside the supply hose, return hose, and the heat exchanger must be kept above the dew point of the location where the heat exchanger is being used.

Attention:

Typical primary chilled water is too cold for use in this application because building chilled water can be as cold as 4°C to 6°C (39.2°F to 42.8°F).

Important:

If the system supplying the cooling water does not have the ability to measure the room dew point and automatically adjust the water temperature accordingly, the minimum water temperature that must be maintained is 22°C +/- 1°C (71.6°F +/- 1.8°F). This is consistent with the ASHRAE Class A2 Environmental Specification that requires a maximum dew point of 17°C (62.6°F) to 21°C (69.8°F). Refer to the ASHRAE document entitled *Thermal Guidelines for Data Processing Environments*. Information on obtaining this document is found at *www.ashrae.org*. Search on "Thermal Guidelines for Data processing Environments".

Pressure

Put your short description here; used for first paragraph and abstract.

The water pressure in the secondary loop must be less than the maximum 689.66 kPa (100 pounds per square inch). Somewhere in the water circuit, a pressure relief valve, set to this maximum value, is required for safety reasons. Normal operating pressure at the rear door heat exchanger should be 137.93 kPa (20 psi) or less.

Flow rate

Put your short description here; used for first paragraph and abstract.

The flow rate of the water in the system must be in the range of 23 - 38 liters per minute (6.1 - 10.1 gallons per minute). Pressure drop versus flow rate for heat exchangers (including quick-connect couplings) is defined as approximately 48 kPa (7 psi) at 30 liters per minute (8 gallons per minute). Adjustable flow valves are recommended for installation on all supply lines of the water circuit, to enable compliance, to this flow specification.

Water volume limits

Put your short description here; used for first paragraph and abstract.

The heat exchangers hold between 2.8 liters (0.74 gallons) and 5.3 liters (1.4 gallons). Fifteen meters (50 ft) of 19 mm (0.75 in) supply and return hoses hold approximately 9.4 liters (2.5 gallons). To minimize exposure to flooding in the event of leaks, the entire product cooling system (heat exchanger, supply hose and return hose) excluding any reservoir tank should have a maximum 15.1 liters (4 gallons) of water. This is a cautionary statement not a functional requirement. Also consider using leak detection methods on the secondary loop that supplies water to the heat exchanger.

Air exposure

Put your short description here; used for first paragraph and abstract.

The secondary cooling loop is a closed loop, with no continuous exposure to room air. After you fill the loop, remove all air from the loop. Air bleed valves are provided at the top of each heat exchanger manifold for purging all air from the system.

Water delivery specifications

The secondary loop delivery system provides chilled, conditioned water to the heat exchanger. The delivery system includes pipes, hoses and the required connection hardware to attach to the heat exchanger. Hose management on raised floor environments is also described.

The primary cooling loop is considered to be the low temperature building chilled-water supply or a modular chiller unit. The primary loop must not be used as a direct source of coolant for the heat exchanger for two main reasons.

- First, below-dew-point water will cause air moisture to form on the door heat exchanger as it operates (condensation will drip and gather under the rack).

- Second, if proper leak detection is not established (for example, monitored leak tape, hose-in-trough with leak sensors and automatic shut-off valves) and a leak in the door, hoses or manifolds occurs, the constant, large supply of primary loop water could result in large amounts of water leaking into the data center.

Water provided in a controlled and monitored secondary, closed loop, would limit the amount of water available in a leak situation, and prevent condensation from forming.

Procurement and the installation of the components needed to create the secondary cooling loop system are your responsibility. The following information provides examples of typical secondary loop set-ups and operating characteristics that are needed to provide an adequate, safe supply of water to the heat exchanger. Key components recommended for the water supply and return lines are:

- Couplings to match those provided on the heat exchanger
- Flexible hoses
- Thermal feedback to a flow valve that will adjust and control supply water temperature
- Shutoff valves for each line running to a door
- Adjustable flow valves for each supply line to a door
- Pressure relief valve. The overpressure safety device must meet the following requirements:
  - Comply with ISO 4126-1
  - Be installed so that it is easily accessed for inspection, maintenance and repair
  - Be connected as close as possible to the device that it is intended to protect
  - Be adjustable only with the use of a tool
  - Have a discharge opening directed so that the discharged water will not create a secondary hazard
  - Be of adequate capacity that the maximum working pressure is not exceeded
  - Be installed with a shutoff valve between the overpressure device and the heat exchanger.

The actual number of heat exchangers connected to a secondary loop depends on the capacity of the secondary loop to transfer heat to the primary loop. For example, if the secondary loop can remove 100 kW of heat load and you have multiple 25 kW racks, you could have 12.5 kW per rack (assuming 50 percent door heat removal) going into the water loop, and attach eight doors per secondary loop.

Manifolds and piping

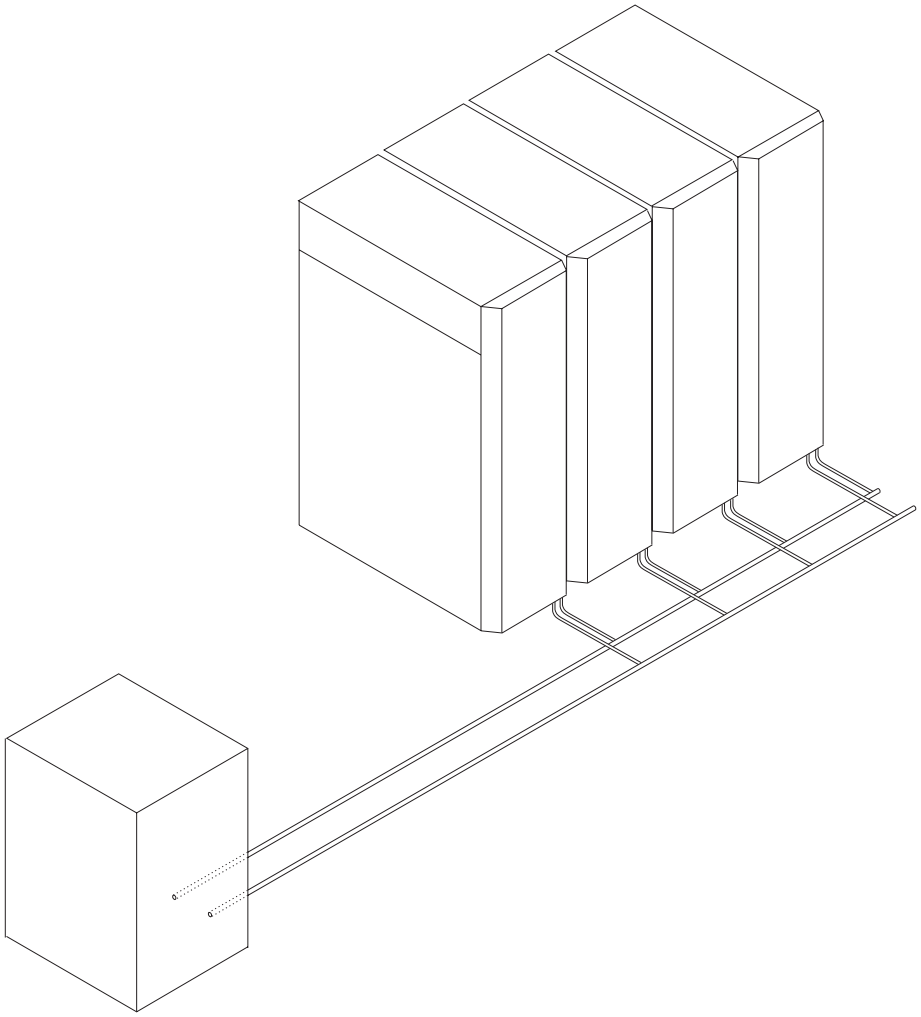


Figure 4. An example of a manifold layout

Manifolds that accept large-diameter feed pipes from a pump unit are the preferred method for splitting the flow of water to smaller diameter pipes or hoses that are routed to individual heat exchangers. Manifolds must be constructed of materials compatible with the pump unit and related piping. The manifolds must provide enough connection points to allow a matching number of supply and return lines to be attached and the manifolds must match the capacity rating of the pumps and heat exchanger (between the secondary cooling loop and building chilled-water source). Anchor or restrain all manifolds to provide the required support to avoid movement when quick-connect couplings are plugged to the manifolds and when valves are opened or closed. Example manifold supply pipe sizes include:

Note: in the following examples, CDU=Cooling Distribution Unit

- Use a 50.8 mm (2 in) supply pipe to provide the correct flow to six (100 kW CDU) 19 mm (0.75 in) supply hoses.
- Use a 63.5 mm (2.5 in) supply pipe to provide the correct flow to eight (120 kW CDU) 19 mm (0.75 in) supply hoses.
- Use an 88.9 mm (3.5 in) supply pipe to provide the correct flow to twenty (300 kW CDU) 19 mm (0.75 in) supply hoses.

Shutoff valves are suggested for each supply and return line that exits the manifold to allow stopping the flow of water in individual lines of multiple circuit loops. This provides a way of servicing or replacing an individual heat exchanger without affecting the operation of other heat exchangers in the loop.

Adjustable flow valves (called circuit setters) are also suggested for each supply line that exits a supply manifold so changes can be made to the flow to each individual rack, in the event that door heat exchangers are added or removed from the secondary loop (this method keeps water flow within specification to each door heat exchanger).

Temperature and flow metering (monitoring) are suggested in secondary loops, to provide assurance that water specifications are being met and that the optimum heat removal is taking place.

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

Flexible hoses and connections to manifolds and heat exchangers

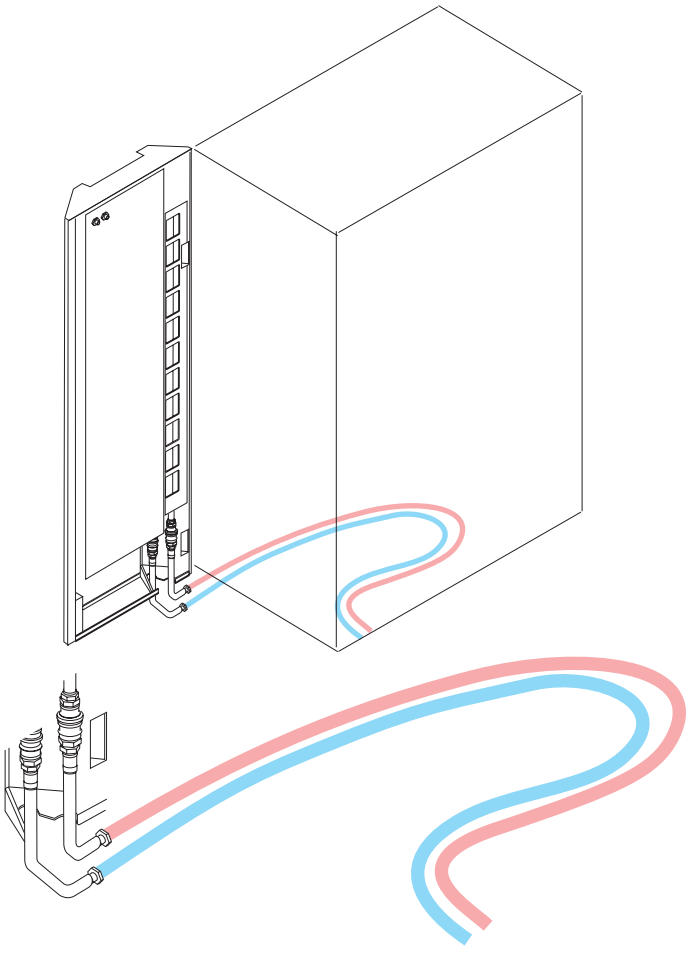


Figure 5. Flexible water supply hoses

Pipes and hose configurations can vary and are determined by analyzing the needs of your facilities, or a site preparation representative can provide this analysis.

Flexible hoses are needed to supply and return water between your hard plumbing (manifolds and cooling distribution units) and the heat exchanger, (allowing needed movement when opening and closing the rack rear door).

Hoses are available that provide water with acceptable pressure-drop characteristics and that help prevent depletion of some corrosion inhibitors. These hoses must be made of Ethylene Propylene Diene Monomer (EPDM) rubber - peroxide cured, non-metal oxide material and will have quick-connect couplings at each end. These couplings are defined below and are compatible with the heat exchanger couplings. Hose lengths from 3 to 15 m (9.9 ft to 49.3 ft), in increments of 3 m (10 ft) are available. Hoses longer than 15 m (49.3 ft) may create unacceptable pressure loss in the secondary circuit and reduce the water flow, and thus reduce the heat removal capabilities of the heat exchanger.

Use solid piping or tubing that has a minimum inner diameter of 19 mm (0.75 in) and the least number of joints possible between a manifold and a heat exchanger in each secondary loop.

Quick-connect couplings are used to attach the hoses or fixed pipes to the distribution manifolds and the rear door heat exchangers. Hose couplings that attach to the heat exchanger must have the following characteristics:

- The couplings should be constructed of passivated 300-L series stainless steel or brass couplings with less than 30 percent zinc content. The coupling size is 19 mm (0.75 in).
- The supply hose must have a (male) quick-coupling nipple part number SH6-63-W, or equivalent. The return hose must have a (female) quick-conect couplings part number SH6-62-W, or equivalent.
- At the opposite (manifold) end of the hoses, it is suggested that similar quick-connect couplings be used. However, if other types are desired, it is also suggested that positive locking mechanisms be used to prevent loss of water when the hoses are disconnected. The connections must minimize water spill and air inclusion into the system when they are disconnected.

Note: When creating supply and return loops, it is recommended to avoid placement of electrical connections directly below water connections. These would be areas prone to water drips or splash when working with the water loop. Water dripping or splashing onto electrical connections can cause electrical problems or an unsafe environment.

Layout and mechanical installation

The layout and mechanical installation of your heat exchanger is dependent upon several factors. Use the following information to plan for your specific configuration.

Heat exchanger installation overview

These are the major tasks you must complete in preparing for the installation of a heat exchanger:

1. Preparing your facility to provide water to the rack per the required specifications.
2. Routing flexible hoses, leaving enough length at the rack end to easily make connections to the heat exchanger.
3. Adjusting and inspecting the hoses to ensure there are no kinks in the hoses and that the hoses are not lying against any sharp edges.

Note: For safety reasons, trained service personnel (or qualified professionals) must perform the installation of the heat exchanger.

Planning for heat exchangers in a raised floor environment

On a raised floor, hoses are routed under the floor tiles and are brought up from beneath the rack through special tile cut outs. The hoses attach to the quick-connect couplings on the bottom of the heat exchanger.

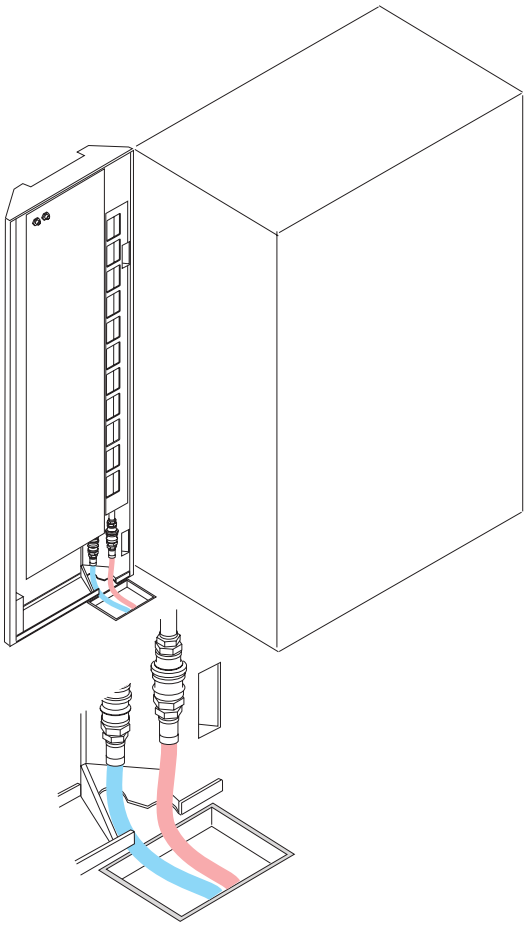


Figure 6. Flexible hose routing for a raised floor

Note: Recommendations from the floor tile manufacturers for openings in reinforced pedestal or stringer type tiles versus non-reinforced pedestal tiles should always be followed. In general, hoses should pass through floor tiles at locations that will not put high forces on the hoses, or cause rubbing that will abrade the hose surface and lead to premature hose failure (leaks).

Each heat exchanger requires a special cut floor tile below and behind the rack. A portion of the tile is cut away and the cut opening is correctly covered to protect against sharp edges. The corner opening is placed directly under the hinge side of the rack rear door. The opening size of the cut is 152.4 mm wide and 190.5 mm long +/- 12.7 mm (6.0 in wide and 7.5 in long +/- 0.5 in) in the direction parallel to the door.

Lay hoses side-by-side as they run between the heat exchanger and the supply and return manifolds, and allow the hoses to freely move. Leave enough slack in the hoses below the rear door so that minimum forces are exerted on the door when the hoses are attached and operating. When routing hoses, avoid sharp bends that can cause hose kinks, and avoid hose contact with sharp edges.

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

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

Industry Canada Compliance Statement

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

Avis de conformité à la réglementation d'Industrie Canada

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

European Community Compliance Statement

This product is in conformity with the protection requirements of EU Council Directive 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.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

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

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

VCCI Statement - Japan

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

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

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

Japanese Electronics and Information Technology Industries Association (JEITA) Confirmed Harmonics Guideline (products less than or equal to 20 A per phase)

高調波ガイドライン適合品

Japanese Electronics and Information Technology Industries Association (JEITA) Confirmed Harmonics Guideline with Modifications (products greater than 20 A per phase)

高調波ガイドライン準用品

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

声　明

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

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

Electromagnetic Interference (EMI) Statement - Taiwan

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

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

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

IBM Taiwan Contact Information:

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

Electromagnetic Interference (EMI) Statement - Korea

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

Germany Compliance Statement

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

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2004/108/EG 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 von IBM verändert bzw. wenn Erweiterungskomponenten von Fremdherstellern ohne Empfehlung von IBM gesteckt/eingebaut werden.

EN 55022 Klasse A Geräte müssen mit folgendem Warnhinweis versehen werden:

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

Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten

Dieses Produkt entspricht dem “Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)“. Dies ist die Umsetzung der EU-Richtlinie 2004/108/EG in der Bundesrepublik Deutschland.

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) (bzw. der EMC EG Richtlinie 2004/108/EG) für Geräte der Klasse A

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

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

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:
IBM Deutschland GmbH
Technical Regulations, Abteilung M372
IBM-Allee 1, 71139 Ehningen, Germany
Tel: +49 (0) 800 225 5423 or +49 (0) 180 331 3233
email: halloibm@de.ibm.com

Generelle Informationen:

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

Electromagnetic Interference (EMI) Statement - Russia

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

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