

eServer Cluster 1350



Preinstallation Planning

eServer Cluster 1350



Preinstallation Planning

Note!

Before using this information and the product it supports, review the safety information in "Safety and environmental notices" on page ix.

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International Business Machines Corporation
Department 55JA, Mail Station P384
2455 South Road
Poughkeepsie, NY 12601-5400
United States of America

FAX (United States and Canada): 1+845+432-9405
FAX (Other Countries):
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Safety and environmental notices

For general information concerning safety, refer to *Electrical Safety for IBM Customer Engineers*, S229-8124. For a copy of the publication, contact your IBM account representative or the IBM branch office serving your locality.

Enterprise Rack Safety Information: Read the safety notices in the manual provided with the Enterprise Rack before beginning work. Keep the Enterprise Rack Manual near the rack for fast reference.

Safety notices

The procedures described in this document must be performed by qualified service personnel. Safety warnings are contained within these procedures. If you cannot read the language of this document, do not perform any procedures until you receive a translated copy. IBM does not accept responsibility or liability for failure to follow these procedures correctly.

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The following is a list of safety notices (in English only) pertaining to hardware maintenance tasks:

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 emphasizes certain explanatory information and calls attention to statements in text, figures, and tables. Attention notices also highlight situations that could potentially cause damage to the equipment or loss of data.

Danger notices

In English:

DANGER

To avoid a shock hazard

Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.

Connect all power cords to a properly wired and grounded electrical outlet.

When touching two surfaces with different electrical grounds, use one hand, when possible, to connect or disconnect signal cables.

This product has high leakage current. Earth connection is essential before connection to supply.

Laser safety information

Cluster 1350 hardware components might contain certain communication adaptors which are fiber optic based and use lasers.

Laser Compliance

All lasers are certified in the U.S. to conform to the requirements of DHHS 21 CFR Subchapter J for class 1 laser products. Outside the U.S., they are certified to be in compliance with the IEC 825 (first edition 1984) as a class 1 laser product. Consult the label on each part for laser certification numbers and approval information.

Environmental notices

Product recycling and disposal

This product contains materials such as circuit boards, cables, electromagnetic compatibility gaskets, and connectors which might contain lead and copper/beryllium alloys that require special handling and disposal at end of life. Before this unit is disposed of, these materials must be removed and recycled or discarded according to applicable regulations. IBM offers product return programs in several countries. You can find country-specific instructions at www.ibm.com/ibm/environment/products/prp.phtml.

This product might contain nickel-cadmium or lithium batteries in communication adapters. The batteries must be recycled or disposed of properly. Recycling facilities might not be available in your area. In the United States, IBM has established a collection process for reuse, recycling, or proper disposal of used sealed lead-acid, nickel-cadmium and nickel metal hydride batteries and battery packs from IBM equipment. For information on proper disposal of batteries in this product, please contact IBM at 1-800-426-4333. For information on disposal of batteries outside the United States, contact your local waste disposal or recycling facility.

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Chapter 1. System overview

Contents

The IBM® Cluster 1350 provides an array of computational and storage devices connected through high-speed networks. The Cluster 1350 is an engineered system, not just a collection of components, and therefore provides the following advantages:

Interoperability

A clustered system contains many diverse parts, not all of which are designed to work together. If a system is assembled without anticipating mismatches, there is great risk of system failures, performance degradation, technical incompatibilities, lengthy installation times, and frequent service calls. The Cluster 1350 system has been designed and tested to prevent operational mismatches.

Increased reliability

Guaranteed interoperability provides greater reliability. For example, a common mismatch in non-engineered systems is thermal stability. Each module in a cluster provides airflow for cooling of internal parts. But if the outflow from one module happens to be placed next to the intake for another module, the second module will always be at risk of overheating and eventual failure. In the most severe case, a thermal loop might cause total system failure. As another example, power connections may not be distributed equitably, overloading power distribution units and causing repeated failures within the system. System-wide testing ensures that Cluster 1350 system reliability will not be undermined.

Ease of installation and service

The Cluster 1350 establishes rules for system configurations, placement of modules, and lengths of cables. For these reasons, installation and service can be accomplished more smoothly. Standardized placement of modules allows for use of manufactured cable harnesses, reducing installation time and minimizing the chance of incorrect cable placement. Systems arrive well-packaged with minimal waste material. Service can be accomplished from the front or rear of the cabinet without having to move cabinets.

Electromagnetic interference (EMI) compliance

EMI radiation is an important consideration. The Cluster 1350 system is engineered to provide the shielding and cable routing necessary to comply with national and international certifications for radiated energy. Non-engineered systems have not been tested against these requirements.

Safety Weight distribution within a cabinet is important. The standardized placement of modules in a Cluster 1350 minimizes the danger of tipping.

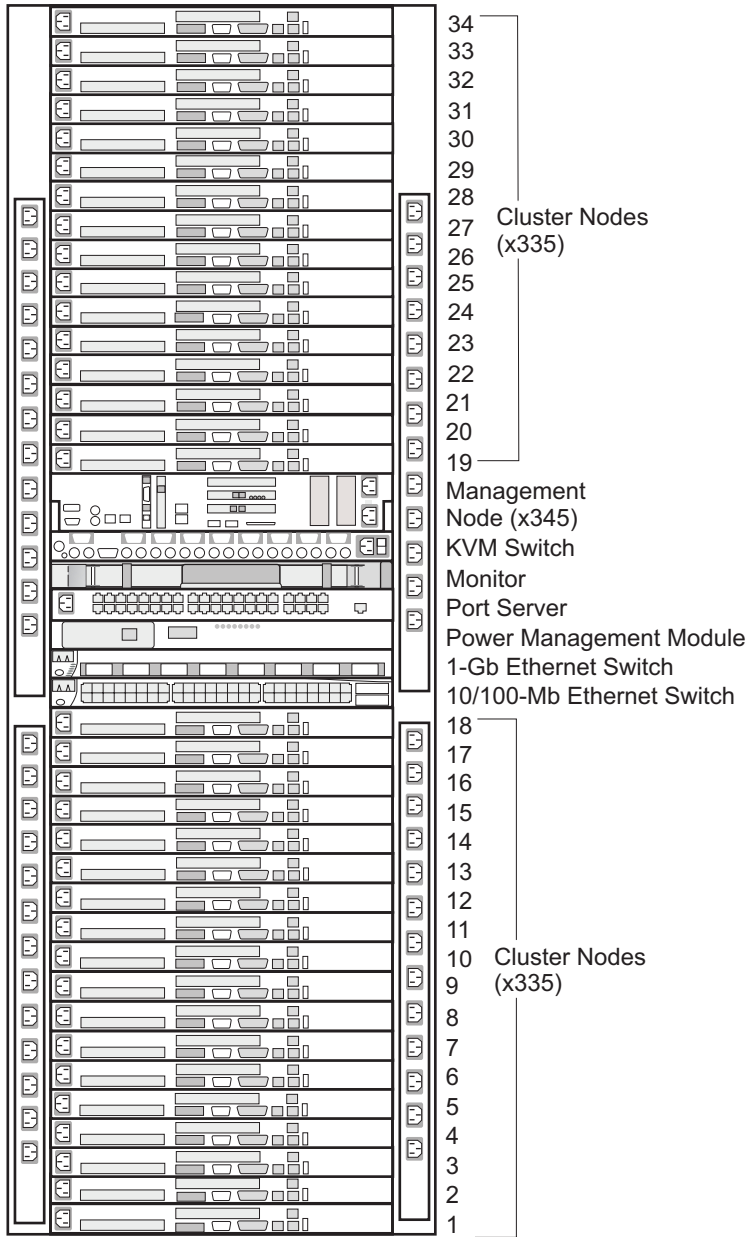
Ease of expansion

Because the Cluster 1350 is built upon standardized increments of modules, you can start with a minimal system and easily expand the system over time, knowing that interoperational considerations have been accounted for.

The Cluster 1350 can have a maximum of 512 nodes in addition to the one required Management Node. All nodes run one of the supported Linux distributions.

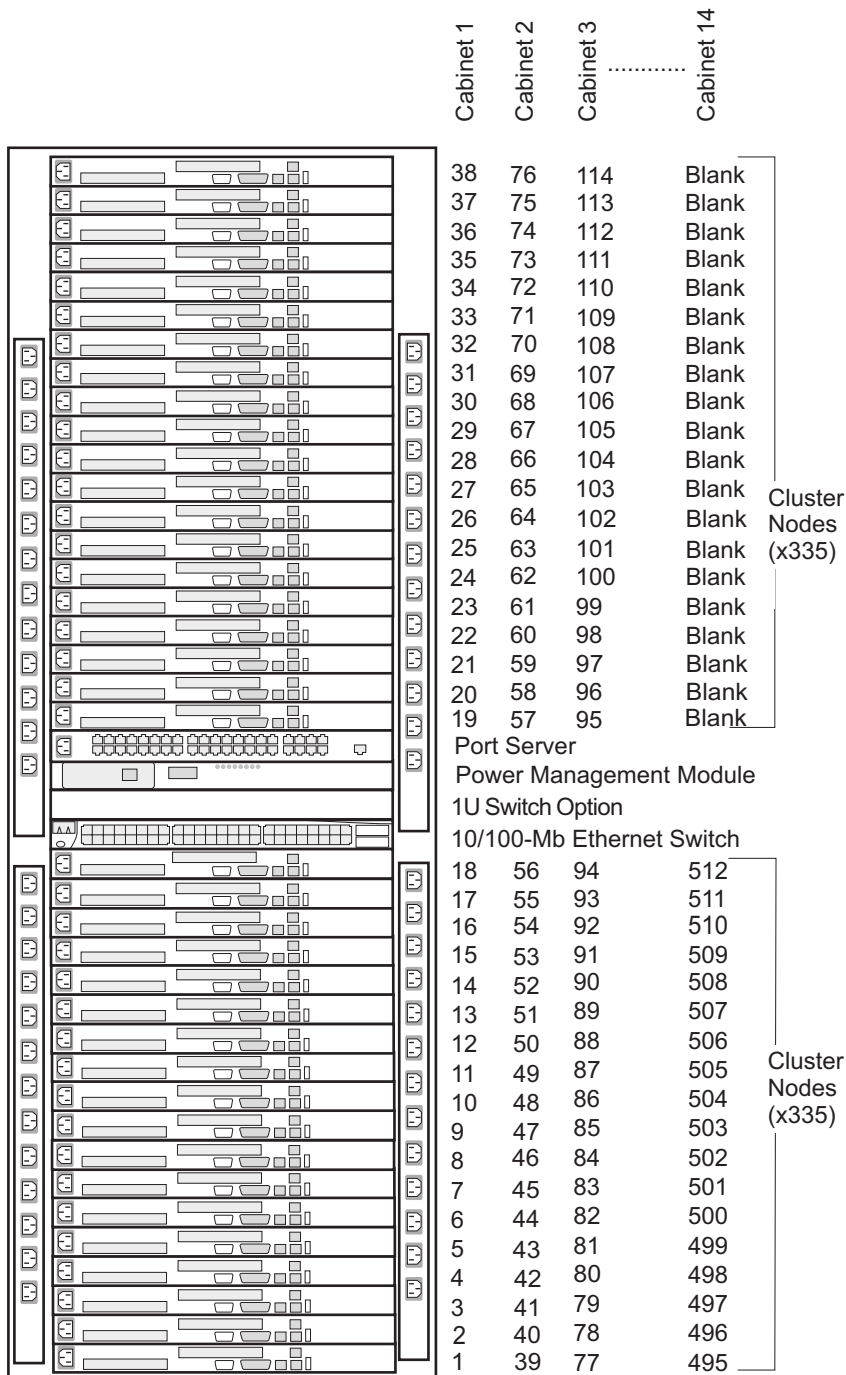
The Cluster 1350 identifies two types of cabinet: Primary and Expansion. A cabinet is called Primary if it contains the Management Node and console monitor. Expansion cabinets may contain Storage Nodes or mass-storage devices as well as computing nodes (called "Cluster Nodes"); they do not contain a Management Node or console. Figure 1 on page 5 shows an example of a Primary cabinet. Figure 2 on page 6 shows an example of an Expansion cabinet containing Cluster Nodes.

Figure 3 on page 7 shows an example of an Expansion cabinet containing storage controllers and mass storage.



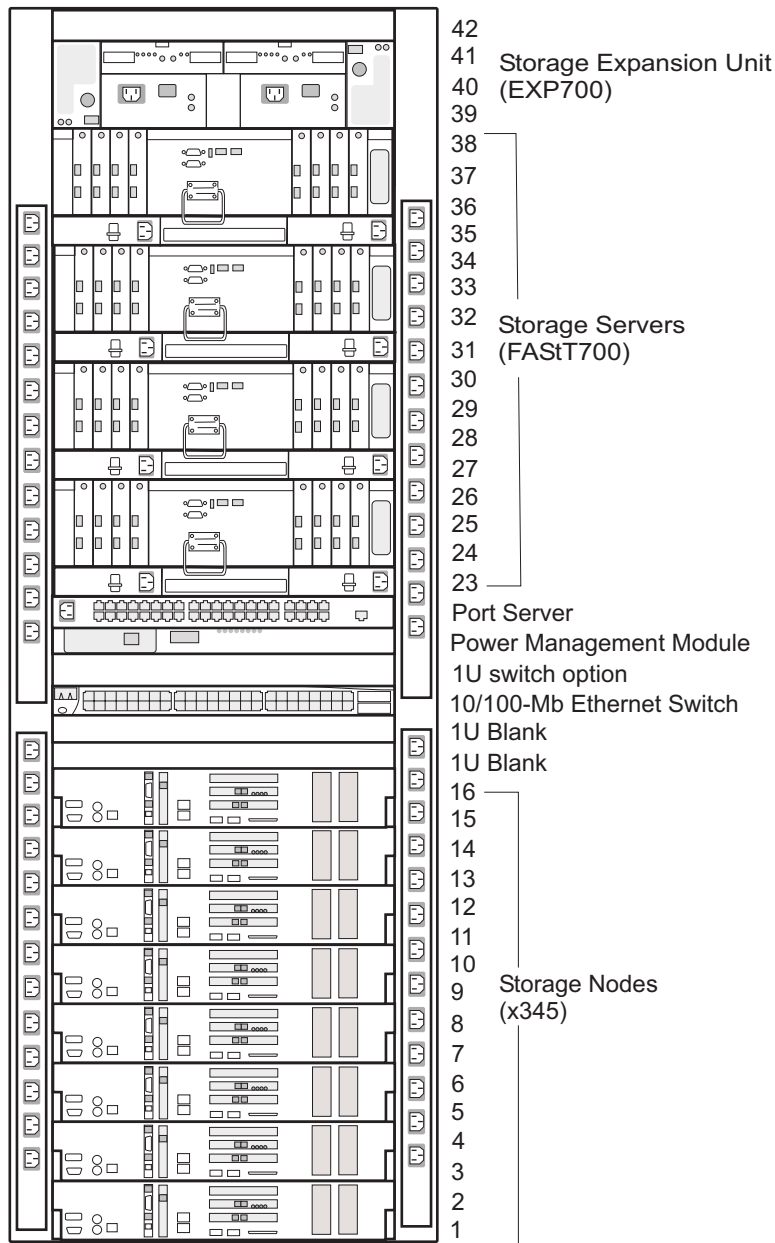
C11350pi_1

Figure 1. Example of an @server Cluster 1350 Primary Cabinet



CI1350pi-2

Figure 2. Example of an @server Cluster 1350 Expansion Cabinet with Cluster Nodes. This figure also shows how the node numbering scheme maps to other Expansion Cabinets.



Cl1350pi3

Figure 3. Example of an @server Cluster 1350 Expansion cabinet containing storage controllers and mass storage

The IBM @server Cluster 1350 uses the following modules:

Cluster Node

The Cluster Nodes carry out the computational tasks in the cluster. The Cluster 1350 Cluster Node is either an IBM eServer xSeries™ 335 (x335) or IBM eServer BladeCenter running a supported distribution of Linux. A cluster must contain at least four Cluster Nodes.

Management Node

Each cluster contains one Management Node, which provides system management for all modules in the cluster. The Cluster 1350 Management Node is an IBM eServer xSeries 345 (x345) running a supported distribution of Linux.

Storage Node

The optional Storage Nodes manage the mass storage.

For tasks that do not require large amounts of mass storage, the Storage Node's onboard disk storage may be sufficient. The Cluster 1350 Storage Node is either an IBM eServer xSeries 345 (x345) or an IBM eServer xSeries 360 (x360) running a supported distribution of Linux.

More frequently, however, mass storage is desired for today's computing tasks. Each Storage Node can communicate with a FAStT200 Storage Server or FAStT700 Storage Server over a Fibre Channel connection.

Storage Server

For this option the Cluster 1350 system uses the RAID-capable FAStT200 Storage Server or FAStT700 Storage Server. Each FAStT200 Storage Server adds up to ten internal 18 GB 15,000 RPM drives or ten 36 or 73 GB 10,000 RPM drives to the storage capacity of the cluster. The FAStT700 Storage Server can support up to 224 18 GB 15,000 RPM drives or 224 36 or 73 GB 10,000 RPM drives contained in external expansion cabinets.. Both enable the Storage Node to communicate with large RAID-protected arrays of storage.

Storage Expansion Unit

Each FAStT200 Storage Server in the cluster controls up to two IBM EXP500 Disk Storage Expansion Units, each of which expands the capacity of the Storage Server by ten disk drives. Each FAStT700 Storage Server in the cluster controls up to sixteen IBM EXP700 Disk Storage Expansion Units, each of which expands the capacity of the Storage Server by fourteen disk drives.

Console

The console provides the monitor, keyboard, and mouse for the Management Node. The monitor is a fold-down flat-panel display that retracts into the rack.

KVM Switch

The KVM switch lets the console connect to all the different nodes in the cluster. Storage and Management Nodes connect directly to the KVM switch. For Cluster Nodes in the same rack, you can daisy-chain multiple nodes on one KVM switch port.

The Cluster 1350 can use the IBM NetBAY 2x8 Console Switch or the NetBAY Remote Console Manager.

10/100-MB Ethernet Switch

The 10/100-MB Ethernet switch provides 10/100-MB Ethernet connections for the cluster. The Cluster 1350 uses the Cisco Ethernet switch Models 3550 XL (24-port) and 3550 XL (48-port). You can partition the switch to set up multiple independent LANs within the same switch.

Each model also provides two 1-GB Ethernet ports for communication with the Management Node.

1-GB Ethernet Switch

The 1-GB Ethernet switch provides a 1-GB Ethernet trunk line between the Management Node and the Cluster and Storage Nodes. The Cluster 1350 uses the Cisco Ethernet switch Models 3508G (8-port). The 1-GB Ethernet switch uses an optical cable.

Port Server

The port server provides serial connections for cluster modules. The Cluster 1350 can use the MRV In-Reach IR-8020-101 (20-port), or the MRV In-Reach IR-8040-101 (40-port).

The main purpose of the port server is to assign Ethernet addresses to cluster components. The port server can also act as a backup for Ethernet connections to download firmware and to check information stored in logs in cluster components.

High-Speed Myrinet Switch (optical)

This is an optional 2-GB switch for interconnecting Cluster Nodes and Storage Nodes. The Cluster 1350 uses the Myrinet Models M3-E32 (5-slot), M3-E64 (9-slot), and M3-E128 (17). The high-speed switch can replace the optional secondary Ethernet. It requires a Myrinet PCI adapter in each Cluster Node and Storage Node. The Myrinet Switch uses an optical cable.

High-Speed Cisco Switch (copper)

The Cluster 1350 can also use the Cisco Catalyst 4003 (3-slot) and Cisco Catalyst 4006 (6-slot) switches for a lower cost solution.

Power Management Module

The Power Management Module provides power to the service processors (RSA boards) and to the port servers. The Cluster 1350 uses the APC MasterSwitch Model AP9212. The Power Management Module can supply up to eight connections. It provides the ability to power-cycle a component remotely.

Power Distribution Unit (PDU)

Each rack contains one or more IBM NetBAY Rack Power Distribution Units (PDUs). The PDUs are mounted sideways beside the regular rack space. Two types of PDUs are used:

- Rack PDU
- Front end PDU

Rack PDUs provide power to components within a cabinet, while front end PDUs provide the connection to the external power source and distribute the power among the rack PDUs. A rack PDU can also be directly connected to the external power source to eliminate the need for the front end PDU. Up to four front end PDUs can be placed in each cabinet and up to twelve rack PDUs.

DANGER

The breaker switch on the PDU is not accessible. To turn off power to the cabinet, you must pull all the PDU power cords from the wall outlets or from the individual PDU inlets.

Related Topics

You can also refer to the following information:

- **IBM:**

x335

xSeries 335 Installation Guide:

ftp://ftp.pc.ibm.com/pub/pccbbs/pc_servers_pdf/33p2612.pdf

BladeCenter

eServer BladeCenter Planning and Installation Guide:
ftp://ftp.pc.ibm.com/pub/pccbbs/pc_servers_pdf/ga27-4327-00.pdf

x345

xSeries 345 Installation Guide:
ftp://ftp.pc.ibm.com/pub/pccbbs/pc_servers_pdf/48p9726.pdf
xSeries 345 User's Guide:
ftp://ftp.pc.ibm.com/pub/pccbbs/pc_servers_pdf/48p9717.pdf

x360

xSeries 360 Installation Guide:
ftp://ftp.pc.ibm.com/pub/pccbbs/pc_servers_pdf/48p9794.pdf
xSeries 360 User's Reference:
ftp://ftp.pc.ibm.com/pub/pccbbs/pc_servers_pdf/48p9793.pdf

Storage Server

FAST Host Adapter Installation and User's Guide:
ftp://ftp.pc.ibm.com/pub/pccbbs/pc_servers/25p1663.pdf
Fibre Array Storage Technology, a FAST Introduction (Redbook):
<http://www.redbooks.ibm.com/>
Installation and User's Guide for IBM FAST200 and FAST200 HA Storage Servers
ftp://ftp.pc.ibm.com/pub/pccbbs/pc_servers_pdf/59p6243.pdf
FAST 700 Installation Guide:
ftp://ftp.pc.ibm.com/pub/pccbbs/pc_servers_pdf/32p0171.pdf
FAST 700EXP Installation and User's Guide:
ftp://ftp.pc.ibm.com/pub/pccbbs/pc_servers_pdf/32p0178.pdf

Monitor

IBM NetBAY 1U Flat Panel Monitor Installation Guide:
ftp://ftp.pc.ibm.com/pub/pccbbs/pc_servers_pdf/33p2442.pdf

- **MRV:**

In-Reach IR 8000 Series Port server

Product technical information:
<http://service.mrv.com/support/index.cfm>

- **APC:**

Power Management Module

Product information:
http://www.apcc.com/resource/include/techspec_index.cfm?base_sku=AP9212
MasterSwitch Power Distribution Unit User's Guide:
<http://sturgeon.apcc.com/techref.nsf/partnum/990-6018e>
Troubleshooting information:
<http://www.apcc.com/support/kbase.cfm>

- **Cisco:**

10/100-MB and 1-GB Ethernet switches

Product information:
<http://www.cisco.com/univercd/cc/td/doc/product/lan/>
Catalyst 3550 Series XL Hardware Installation Guide:
<http://www.cisco.com/univercd/cc/td/doc/product/lan/c3550/1219ea1/3550hig/index.htm>

Quick Start Guide Catalyst 3550 Series XL Switches:

http://www.cisco.com/univercd/cc/td/doc/product/lan/c2900xl/29_35xu/3500.htm

- **Myrinet:**

- High-speed switches**

- Myrinet software and documentation:

- <http://www.myri.com/scs/index.html>

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Chapter 2. Preinstallation customer checklist

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These installation steps are used by a customer prior to the initial set-up of a Cluster 1350.

ATTENTION!

The Cluster 1350 should be maintained only by system administrators experienced with Linux, DHCP, NFS, and Linux networking and administration.

To prepare for the delivery and installation of the Cluster 1350 the customer must complete the following actions before IBM arrives on site to setup the Cluster 1350 hardware.

Completing these steps early in the process of planning for your Cluster 1350 will help the installation proceed smoothly:

- ___ 1. Review the safety information.
- ___ 2. Review the physical, environmental, and electrical requirements for the Cluster 1350.
Ensure the installation site meets all the requirements outlined in these sections. If there is a problem with the installation site, work with your IBM Sales Support Representative to define an acceptable alternate approach.
- ___ 3. Review the proposed configuration from the IBM Sales Support Representative.
The IBM Sales Support Representative will provide you with a suggested configuration for your cluster. The configuration will show the optimal racking scenario for your Cluster 1350.
- ___ 4. Complete the Cluster 1350 Site Readiness Worksheet and submit the results to your IBM Sales Support Representative.
Take into account the physical, environmental, and electrical requirements, along with the proposed configuration of the cluster, when gauging the readiness of your installation site.
- ___ 5. Plan the rack layout/floorplan.
Use the information in Chapters 3 and 4, along with proposed configuration to sketch the rack layout. Take into account the number of racks, rack dimensions, required clearances, floor loading restrictions, and heating and cooling concerns.
- ___ 6. Assess the quality of the AC mains power supply.
Arrange for a qualified electrician to assess your current power supply and to verify your power and electrical plans.
- ___ 7. Determine the grounding requirements and power consumption of your Cluster 1350.
The proposed configuration provided by the IBM Sales Support Representative will show the number and type of Power Distribution Units (PDUs) included in each rack.
- ___ 8. Determine the AC power sources required to support your configuration.

Each PDU has its own AC power cord that requires an external power connection outside of the cabinet.

- 9. Unpack the cabinet(s) only (but not the other boxes.)

The other boxes include instructions for the installer as well as miscellaneous components that may have been removed to satisfy shipping requirements.

ATTENTION!

Ensure that all rack-mounted units are fastened in the rack frame. Do not extend or exchange any rack-mounted units when the stabilizer is not installed. .

The power supply cords provide the main disconnect for this product. If the rear door is locked thus preventing access to the PDU disconnect, the power socket outlet must be installed near the product and must be readily accessible.

This product has more than one power supply cord. Disconnect all power supply cords before servicing.

This product may contain a lithium battery. To avoid possible explosion, do not burn, exchange, or charge the battery. Discard the battery as instructed by local regulations for lithium batteries.

This product may contain a Class 1 laser device.

- 10. Dispose of packing material.

- 11. Refer to Chapter 6, “Cabinet placement and intercabinet cabling”, on page 45 to ensure proper placement of the cabinets by following the parameters listed.

- 12. Arrange for a phone line near the cabinet.

- 13. Schedule installation with your IBM installer.

Make sure the physical, environmental, and electrical requirements for the Cluster 1350 have been satisfied. The IBM installer will perform the final cabling and hardware installation steps. If the installation site is not ready when the installer arrives they will not be able to complete the installation. A return visit may result in an additional charge.

After the system hardware is completely installed, you can install your software and connect your network cables.

Chapter 3. Physical requirements

Contents

Table 1. Physical characteristics for @server Cluster 1350

System Components	Physical Characteristics
Cluster Node	
IBM eServer xSeries 335 (rack model 1U)	Width: 17.32 in. (439.93 mm) Depth: 25.98 in. (660 mm) Height: 1.69 in. (43 mm) Weight: approximately 28 lb. (12.7 kg) fully configured
IBM eServer xSeries BladeCenter (rack model 7U)	Width: 17.50 in. (444.5 mm) Depth: 28 in. (711.2 mm) Height: 12.25 in. (311.15 mm) Weight: approximately 270 lb. (122.47 kg) fully configured
Management Node	
IBM eServer xSeries 345 (rack model 2U)	Width: 17.5 in. (444.5 mm) Depth: 27.5 in. (698 mm) Height: 3.36 in. (85.4 mm) Weight: 62 lb. (28.1 kg)
Storage Node	
IBM eServer xSeries 345 (rack model 2U)	Width: 17.5 in. (443.6 mm) Depth: 27.5 in. (698 mm) Height: 3.36 in. (85.4 mm) Weight: 62 lb. (28.1 kg)
IBM eServer xSeries 360 (rack model 3U)	Width: 17.4 in. (441.9 mm) Depth: 27.6 in. (701 mm) Height: 5.25 in. (133.35 mm) Weight: 70 lb. (31.7 kg)
Storage Server	

Table 1. Physical characteristics for @server Cluster 1350 (continued)

System Components	Physical Characteristics
IBM FAStT200 Storage Server	<p>Width: Front ears: 19 in. (483 mm), chassis: 17.6 in. (447 mm)</p> <p>Depth: 22.6 in. (575 mm)</p> <p>Height: Front ears: 5.2 in. (132 mm), chassis: 5.1 in. (12.9 cm)</p> <p>Weight: 83 lb. (37.65 kg), fully configured</p>
IBM FAStT700 Storage Server (rack model 4U)	<p>Width: 18.9 in. (482 mm)</p> <p>Depth: 25 in. (635 mm)</p> <p>Height: 6.87 in. (174.5 mm)</p> <p>Weight: 83 lb. (37.65 kg), fully configured</p>
Storage Expansion Unit	
IBM EXP500 Disk Expansion Unit	<p>Width: Front ears: 19 in. (48.3 cm), chassis: 17.6 in. (44.7 cm)</p> <p>Depth: 22.6 in. (57.5 cm)</p> <p>Height: Front ears: 5.2 in. (13.2 cm), chassis: 5.1 in. (12.9 cm)</p> <p>Weight: 83 lb. (37.65 kg), fully configured</p>
IBM EXP700 Disk Expansion Unit	<p>Width: 17.52 in. (445 mm)</p> <p>Depth: 22.17 in. (563 mm)</p> <p>Height: 5.03 in. (128 mm)</p> <p>Weight: 66.4 lb. (30.1 kg), fully configured</p>
Console	
IBM 1U Flat Panel Monitor (32P1031)	<p>Width: 19 in (482.6 mm)</p> <p>Depth: 29.6 in (751.84 mm)</p> <p>Height: 1.75 in (44.4 mm)</p> <p>Weight: 37 lb. (17.0 kg)</p>
KVM Switch	
IBM NetBAY Remote Console Manager	<p>Width: 17.0 in. (432 mm)</p> <p>Depth: 11.0 in. (279.4 mm)</p> <p>Height: 1.75 in. (45 mm)</p> <p>Weight: 8 lb. (3.6 kg)</p>

Table 1. Physical characteristics for @server Cluster 1350 (continued)

System Components	Physical Characteristics
IBM NetBAY 2x8 Console Switch	Width: 17.0 in. (432 mm) Depth: 8.0 in. (203 mm) Height: 1.75 in. (45 mm) Weight: 5.3 lb. (2.38 kg)
10/100-MB Ethernet Switch/1-GB Ethernet Switch	
Cisco Catalyst 3550–24 XL (24-port)	Width: 17.5 in. (44.45 cm) Depth: 11.82 in. (30.02 cm) Height: 1.75 in. (4.45 cm) Weight: 8.5 lb. (3.86 kg)
Cisco Catalyst 3550–48 XL (48-port)	Width: 17.5 in. (44.45 cm) Depth: 15.34 in. (39.0 cm) Height: 1.73 in. (4.39 cm) Weight: 12 lb. (5.45 kg)
1-GB Ethernet Switch	
Cisco Catalyst 3508G (8-port)	Width: 16.0 in. (40.46 cm) Depth: 17.5 in. (44.4 cm) Height: 1.75 in. (4.45 cm) Weight: 12 lb. (5.45 kg)
Port Server	
MRV In-Reach IR-8020–101 (20-port)	Width: 19 in. (482.6 mm) Depth: 11.7 in. (297.1 mm) Height: 1.75 in. (44.5 mm) Weight: 11 lb. (5 kg)
MRV In-Reach IR-8040–101 (40-port)	Width: 19 in. (482.6 mm) Depth: 11.7 in. (297.1 mm) Height: 1.75 in. (44.5 mm) Weight: 12 lb. (5.4 kg)
High-Speed Myrinet Switch (optical)	

Table 1. Physical characteristics for @server Cluster 1350 (continued)

System Components	Physical Characteristics
Myrinet Model M3-E32 (5-slot)	<p>Width: enclosure 17.18 in. (43.64 cm), to rack-mount ears 19.0 in. (48.26 cm)</p> <p>Depth: 17.5 in. (44.45 cm)</p> <p>Height: 3U, 5.25 in. (13.3 cm)</p> <p>Weight: without line cards - 12.1 lb. (5.5 kg), with line cards in all slots - 18.3 lb. (8.3 kg)</p>
Myrinet Model M3-E64 (9-slot)	<p>Width: enclosure 17.18 in. (43.64 cm), to rack-mount ears 19.0 in. (48.26 cm)</p> <p>Depth: 17.5 in. (44.45 cm)</p> <p>Height: 5U, 8.75 in. (22.2 cm)</p> <p>Weight: without line cards - 22 lb. (10 kg), with line cards in all slots - 33 lb. (15 kg)</p>
Myrinet Model M3-E128 (17-slot)	<p>Width: enclosure 17.18 in. (43.64 cm), to rack-mount ears 19.0 in. (48.26 cm)</p> <p>Depth: 17.5 in. (44.45 cm)</p> <p>Height: 9U, 15.75 in. (40.0 cm)</p> <p>Weight: without line cards - 46.2 lb. (21 kg), with line cards in all slots - 68.2 lb. (31 kg)</p>
High-Speed Cisco Switch (copper)	
Cisco Catalyst 4003 switch	<p>Width: 17.25 in. (437 mm)</p> <p>Depth: 11.81 in. (300 mm)</p> <p>Height: 10.5 in. (266 mm)</p> <p>Weight: 40 lb. (18 kg)</p>
Cisco Catalyst 4006 switch	<p>Width: 17.25 in. (437 mm)</p> <p>Depth: 11.81 in. (300 mm)</p> <p>Height: 15.75 in. (400 mm)</p> <p>Weight: 61 lb. (27.7 kg)</p>
Power Management Module	
APC MasterSwitch Model AP9212	<p>Width: 17.00 in. (431.8 mm)</p> <p>Depth: 6.50 in. (165.1 mm)</p> <p>Height: 1.88 in. (47.6 mm)</p> <p>Weight: 6.50 lb. (2.95 kg)</p>
Power Distribution Unit (PDU)	

Table 1. Physical characteristics for @server Cluster 1350 (continued)

System Components	Physical Characteristics
IBM NetBAY Rack Power Distribution Unit	Width: 7.5 in. (192 mm) Depth: 8.7 in (221 mm) Height: 1.7 in (43 mm) Weight: 3.5 lb. (1.6 kg)
IBM NetBAY front end Power Distribution Unit	Width: 7.5 in. (192 mm) Depth: 8.7 in (221 mm) Height: 1.7 in (43 mm) Weight: 3.5 lb. (1.6 kg)
System Cabinet^{1,2}	
IBM 1410-42L	Width: • 25.5 in. (647.7 mm) with side panels Depth: • 43.3 in. (1099.8 mm) with front and rear doors Height: • 79.5 in. (2019.2 mm) Empty Weight: • 736 lb. (333.8 kg) Maximum Weight: • 2,211 lb. (1003 kg)
Total Square Footage with Minimum Serviceability Space	
6.50 m ² (70 ft. ²)	
(65032.13 cm ²)	
Notes: 1. The front and back doors have latches but do not lock. 2. IBM does not support installation of Cluster 1350 components in OEM racks. Service and Warranty for each Cluster 1350 is by rack serial number.	

Stability kit

A stability kit (IBM part number 31L8305), containing one tilt foot, is included with the 1410 rack. Installation of the tilt foot is recommended once the rack is at the final installation location. Figure 4 on page 22 shows the attachment of the tilt foot.

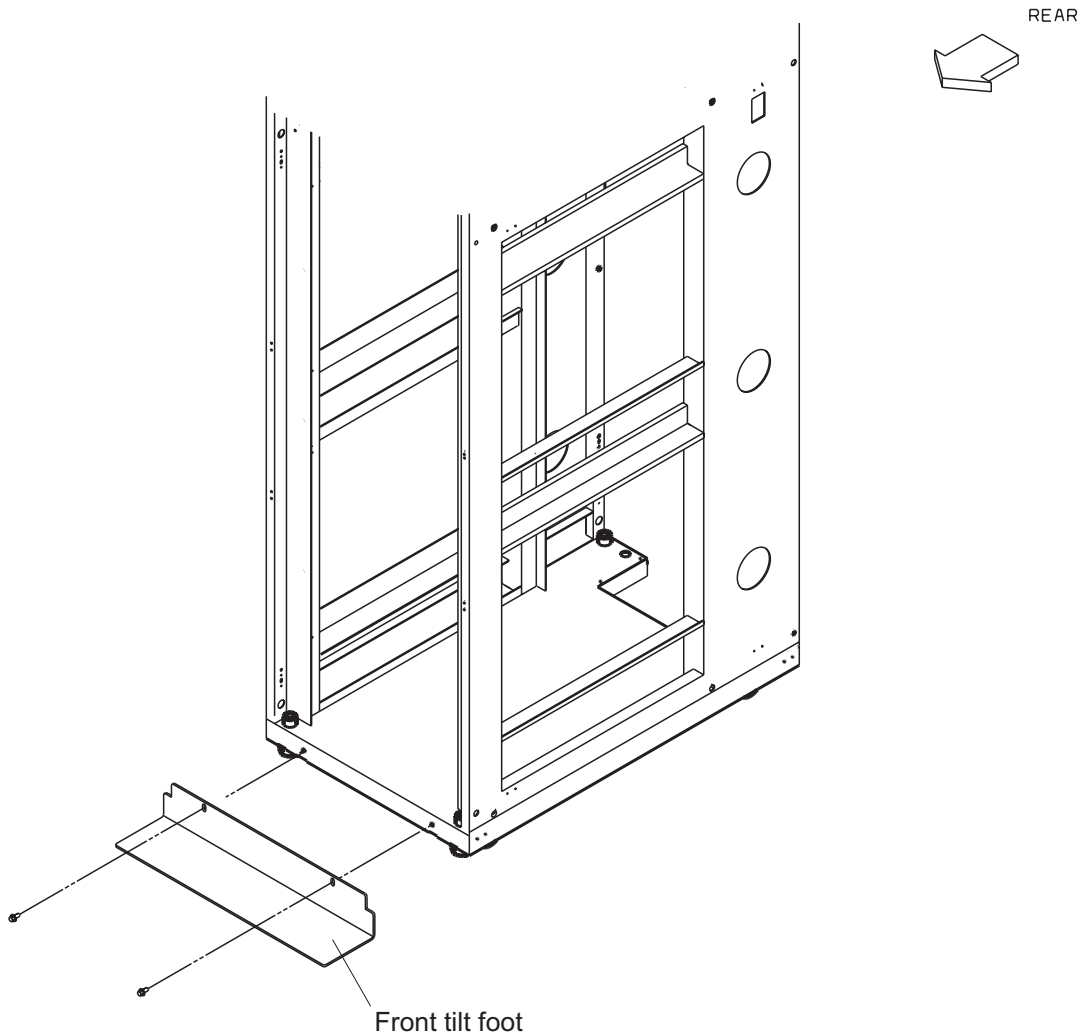


Figure 4. Cluster 1350 stability kit

Floor loading

To determine the clearances required for each rack you must know the maximum floor load rating in pounds per square foot or kilograms per square meter at your installation site. The following table shows the necessary clearances or weight distribution distances for a fully configured rack. The weight distribution distance in all four directions is the area around the rack (minus covers) necessary to distribute the weight beyond the perimeter of the rack. Weight distribution areas cannot overlap with adjacent computer equipment weight distribution areas.

For example, if the raised floor at your site could safely support 72.0 lb./ft.² (351.5 kg/m²) then the correct distance between the sides of each cabinet would be 40 inches (1524 mm). You would also maintain front and back clearances of 30 inches (762 mm), making sure that no other equipment was placed within the area.

The Cluster 1350 cabinet footprint without covers is 24.5 inches (622 mm) by 40.2 inches (1021 mm). The values shown in the table assume a maximum rack weight

of 2211 pounds (1003 kilograms). Floor loading will vary by configuration. Contact your IBM representative if you need to know floor loading for a specific configuration.

If you need to know the approximate point load each caster exerts on a raised floor panel, divide the weight of the rack by three.

Table 2. Floor loading

lb/ft²	kg/m²	Side clearances	Front and back clearances
72.0	351.5	20 in. (508 mm)	30 in (762 mm)
78.4	382.8	20 in. (508 mm)	24 in (610 mm)
86.8	423.8	20 in. (508 mm)	18 in (457 mm)
93.1	454.6	10 in. (254 mm)	30 in (762 mm)
102.4	500.0	10 in. (254 mm)	24 in (610 mm)
114.5	559.1	10 in. (254 mm)	18 in (457 mm)
112.8	550.8	5 in. (127 mm)	30 in (762 mm)
124.8	609.3	5 in. (127 mm)	24 in (610 mm)
140.5	686.0	5 in. (127 mm)	18 in (457 mm)
139.3	680.1	1 in. (25 mm)	30 in (762 mm)
154.9	756.3	1 in. (25 mm)	24 in (610 mm)
175.4	856.4	1 in. (25 mm)	18 in (457 mm)

Chapter 4. Environmental requirements

Contents

The temperature and humidity data shown in Table 3 are from the individual specifications of the IBM and OEM equipment contained in the rack. The table shows the range of temperature and humidity that are acceptable to the products when operating, when not operating, and when being shipped or stored.

Generally, the air conditioning system should be designed for 22 C (72 F) and 45% relative humidity for maximum availability and reliability.

Table 3. Environmental characteristics for @server Cluster 1350

System Components	Environmental Characteristics
Cluster Node	
IBM eServer xSeries 335	<p>Temperature</p> <ul style="list-style-type: none"> server on at altitude of 0 to 914 m (3000 ft.): 10° to 35° C (50.0° to 95.0° F) server on at altitude of 914 m (3000 ft.) to 2133 m (7000.0 ft.): 10° to 35° C (50.0° to 95.0° F) server off: 10° to 43° C (50° to 109.4° F) <p>Maximum Altitude: 2133 m (7000.0 ft.)</p> <p>Humidity</p> <ul style="list-style-type: none"> server on: 8%–80% server off: 8%–80% <p>Heat Output (approximate British Thermal Units (BTU) per hour):</p> <ul style="list-style-type: none"> Maximum configuration: 1092 BTU (320 watts)
IBM eServer xSeries BladeCenter	<p>Temperature</p> <ul style="list-style-type: none"> BladeCenter unit on at altitude of 0 to 914 m (3000 ft.): 10° to 35° C (50.0° to 95.0° F) BladeCenter unit on at altitude of 914 m (3000 ft.) to 2134 m (7000.0 ft.): 10° to 32° C (50.0° to 89.6° F) BladeCenter unit off: -40° to 60° C (-40° to 140° F) <p>Maximum Altitude: 2134 m (7000.0 ft.)</p> <p>Humidity</p> <ul style="list-style-type: none"> server on: 8%–80% server off: 8%–80% <p>Heat Output (approximate British Thermal Units (BTU) per hour):</p> <ul style="list-style-type: none"> Minimum configuration: 1365 BTU (400 watts) Maximum configuration: 9622 BTU (2820 watts)
Management Node	

Table 3. Environmental characteristics for @server Cluster 1350 (continued)

System Components	Environmental Characteristics
IBM eServer xSeries 345	<p>Temperature</p> <ul style="list-style-type: none"> • server on at altitude of 0 to 914 m (3000 ft.): 10° to 35° C (50° to 95° F) • server on at altitude of 914 m (3000 ft.) to 2133 m (7000 ft.): 10° to 35° C (50° to 95° F) • server off: 10° to 43° C (50° to 109.4° F) <p>Maximum Altitude: 2133 m (7000 ft.)</p> <p>Humidity</p> <ul style="list-style-type: none"> • server on: 8%–80% • server off: 8%–80% <p>Heat Output (approximate British Thermal Units (BTU) per hour):</p> <ul style="list-style-type: none"> • Maximum configuration: 1195BTU (350 watts)
Storage Node	
IBM eServer xSeries 345	<p>Temperature</p> <ul style="list-style-type: none"> • server on at altitude of 0 to 914 m (3000 ft.): 10° to 35° C (50° to 95° F) • server on at altitude of 914 m (3000 ft.) to 2133 m (7000 ft.): 10° to 35° C (50° to 89.6° F) • server off: 10° to 43° C (50° to 109.4° F) <p>Maximum Altitude: 2133 m (7000 ft.)</p> <p>Humidity</p> <ul style="list-style-type: none"> • server on: 8%–80% • server off: 8%–80% <p>Heat Output (approximate British Thermal Units (BTU) per hour):</p> <ul style="list-style-type: none"> • Maximum configuration: 1195 BTU (350 watts)
IBM eServer xSeries 360	<p>Temperature</p> <ul style="list-style-type: none"> • server on at altitude of 0 to 914 m (3000 ft.): 10° to 35° C (50° to 95° F) • server on at altitude of 914 m (3000 ft.) to 2133 m (7000 ft.): 10° to 32° C (50° to 89.6° F) • server off: 10° to 43° C (50° to 109.4° F) <p>Maximum Altitude: 2133 m (7000 ft.)</p> <p>Humidity</p> <ul style="list-style-type: none"> • server on: 8%–80% • server off: 8%–80% <p>Heat Output (approximate British Thermal Units (BTU) per hour):</p> <ul style="list-style-type: none"> • Minimum configuration: 1232 BTU (360 watts) • Maximum configuration: 3566 BTU (1045 watts)
Storage Server	

Table 3. Environmental characteristics for @server Cluster 1350 (continued)

System Components	Environmental Characteristics
IBM FAStT200 Storage Server	<p>Temperature</p> <p>Operating Range: 10° to 35° C (50° to 95° F)</p> <p>Storage Range: -10° to 50° C (14° to 122° degrees F)</p> <p>Transit Range: -40° to 60° C (-40° to 140° F)</p> <p>If the FAStT200 is operated at altitudes between 1000m (3280 feet) and 3000m (9850 feet), apply a temperature derating of 3.3 degrees C per 1000m (1.7 degrees F per 1000 feet)</p> <p>Humidity</p> <p>8–80%</p>
IBM FAStT700 Storage Server	<p>Temperature</p> <p>Operating Range: 10° to 35° C (50° to 95° F)</p> <p>Storage Range: 10° to 43° C (50° to 109.4° degrees F)</p> <p>Humidity</p> <p>8–80%</p>
Storage Expansion Unit	
IBM EXP500 Disk Expansion Unit	<p>Temperature</p> <p>Operating Range: 10° to 35° C (50° to 95° F)</p> <p>Storage Range: -10° to 50° C (14° to 122° F)</p> <p>Transit Range: -40° to 60° C (-40° to 140° F)</p> <p>If the FAStT200 is operated at altitudes between 1000m (3280 feet) and 3000m (9850 feet), apply a temperature derating of 3.3 degrees C per 1000m (1.7 degrees F per 1000 feet)</p> <p>Humidity</p> <p>8–80%</p>
IBM EXP700 Disk Expansion Unit	<p>Temperature</p> <p>Operating Range: 10° to 35° C (50° to 95° F)</p> <p>Storage Range: 10° to 43° C (50° to 109° F)</p> <p>Humidity</p> <p>8–80%</p>
Console	

Table 3. Environmental characteristics for @server Cluster 1350 (continued)

System Components	Environmental Characteristics
1-U monitor	<p>Temperature</p> <p>Operating: 50° F to 104° F (10° C to 40° C)</p> <p>Storage: 13° F to 113° F (-25° C to 45° C)</p> <p>Humidity</p> <p>Operating: 10% to 80%</p> <p>Storage: 5% to 95%</p>
KVM Switch	
IBM NetBAY Remote Console Manager	<p>Temperature</p> <p>Operating Temperature: 50° to 122° F (10° to 50° C)</p> <p>Storage Temperature: -4° to 140° F (-20° to 60° C)</p> <p>Humidity</p> <p>20–80% noncondensing operating</p> <p>5–95% noncondensing nonoperating</p>
IBM NetBAY 2x8 Console Switch	<p>Temperature</p> <p>Operating Temperature: 32° to 104° F (0° to 40° C)</p> <p>Storage Temperature: -4° to 158° F (-20° to 70° C)</p> <p>Humidity</p> <p>10–95%</p>
10/100-MB Ethernet Switch/1-GB Ethernet Switch	
Cisco Catalyst 3550–24 XL (24-port)	<p>Temperature</p> <p>Operating Temperature: 32° to 113° F (0° to 45° C)</p> <p>Storage Temperature: -13° to 158° F (-25° to 70° C)</p> <p>Humidity</p> <p>10–85% (noncondensing)</p> <p>Operating Altitude: Up to 10,000 ft. (3000 m)</p> <p>Storage Altitude: 15,000 ft. (4570 m)</p> <p>Heat Output (approximate British Thermal Units (BTU) per hour): 222</p>

Table 3. Environmental characteristics for @server Cluster 1350 (continued)

System Components	Environmental Characteristics
Cisco Catalyst 3550-48 XL (48-port)	<p>Temperature</p> <p>Operating Temperature: 32° to 113° F (0 to 45° C)</p> <p>Storage Temperature: -13° to 158° F (-25 to 70° C)</p> <p>Humidity</p> <p>10–85% (noncondensing)</p> <p>Operating Altitude: Up to 10,000 ft. (3000 m)</p> <p>Storage Altitude: 15,000 ft. (4570 m)</p> <p>Heat Output (approximate British Thermal Units (BTU) per hour): 375</p>
1-GB Ethernet Switch	
Cisco Catalyst 3508G (8-port)	<p>Temperature</p> <p>Operating Temperature: 32° to 113° F (0 to 45° C)</p> <p>Storage Temperature: -4° to 149° F (-10° to 65° C)</p> <p>Humidity</p> <p>10–85% (noncondensing)</p> <p>Operating Altitude: Up to 10,000 ft. (3000 m)</p> <p>Storage Altitude: Up to 15,000 ft. (4570 m)</p> <p>Heat Output (approximate British Thermal Units (BTU) per hour): 280</p>
Port Server	
MRV In-Reach 8000 Series	<p>Temperature</p> <p>Operating Temperature: 32° to 113° F (0° to 45° C)</p> <p>Storage Temperature: -4° to 140° F (-20° to 60° C)</p> <p>Humidity</p> <p>10–90% noncondensing operating</p>
High-Speed Switch	

Table 3. Environmental characteristics for @server Cluster 1350 (continued)

System Components	Environmental Characteristics
Myrinet Model M3-E32 (5-slot)	<p>Temperature</p> <p>Operating Temperature: 5° to 40° C, Relative Humidity 15–80% & 40° C (noncondensing)</p> <p>Storage Temperature: -40° to 70° C, Relative Humidity 90% & 65° C</p> <p>Shock & Vibration: conforms to EN 60068 (IEC 68)</p> <p>Fans on fan tray: 3 92mm</p> <p>Total air flow: 60 cfm</p> <p>Maximum BTU/hour with line cards in all slots: 840</p>
Myrinet Model M3-E64 (9-slot)	<p>Temperature</p> <p>Operating Temperature: 5° to 40° C, Relative Humidity 15–80% & 40° C (noncondensing)</p> <p>Storage Temperature: -40° to 70° C, Relative Humidity 90% @ 65° C</p> <p>Shock & Vibration: conforms to EN 60068 (IEC 68)</p> <p>Fans on fan tray: 4 92 mm</p> <p>Total air flow: 120 cfm</p> <p>Maximum BTU/hour with line cards in all slots: 1680</p>
Myrinet Model M3-E128 (17-slot)	<p>Temperature</p> <p>Operating Temperature: 5° to 40° C, Relative Humidity 15–80% & 40° C (noncondensing)</p> <p>Storage Temperature: -40° to 70° C, Relative Humidity 90% @ 65° C</p> <p>Shock & Vibration: conforms to EN 60068 (IEC 68)</p> <p>Fans on fan tray: 8 92 mm</p> <p>Total air flow: 240 cfm</p> <p>Maximum BTU/hour with line cards in all slots: 3360</p>
Cisco 4003 Gbit	<p>Temperature</p> <p>Operating Temperature: 0° to 40° C, Relative Humidity 5–95% & 40° C (noncondensing)</p> <p>Storage Temperature: -40° to 75° C, Relative Humidity 90% @ 65° C</p> <p>Maximum BTU/hour with line cards in all slots: 1800</p>

Table 3. Environmental characteristics for @server Cluster 1350 (continued)

System Components	Environmental Characteristics
Cisco 4006 Gbit	<p>Temperature</p> <p>Operating Temperature: 0° to 40° C, Relative Humidity 5–95% & 40° C (noncondensing) Storage Temperature: -40° to 75° C, Relative Humidity 90% @ 65° C Maximum BTU/hour with line cards in all slots: 3090</p>
Remote Power Unit	
APC MasterSwitch Model AP9212	<p>Temperature</p> <p>Operating Temperature: 0° to - 45 ° C (32° to 113° F)</p> <p>Humidity</p> <p>0–95 %</p> <p>Operating Elevation: 0-10000 ft. (0-3000 m) Storage Temperature: -15° to 65° C (5° to 149° F) Storage Elevation: 0-50000 ft. (0-15000 m)</p>
Power Distribution Unit (PDU)	
IBM NetBAY Rack Power Distribution Unit	<p>Temperature</p> <p>Operating temperature: 10°to 32° C(50° to 90° F)</p> <p>Humidity</p> <p>0–95 %</p>
IBM NetBAY front endPower Distribution Unit	<p>Temperature</p> <p>Operating temperature: 10°to 32° C(50° to 90° F)</p> <p>Humidity</p> <p>0–95 %</p>

Chapter 5. Electrical requirements

Contents

Before delivery, you must arrange for an electrician to verify or install the necessary AC power sources and grounding system.

To provide for future expansion, IBM recommends that you size your AC power sources to support the maximum configuration for each rack. Additionally, to provide a level of redundancy it is suggested that each plug coming out of a rack have its own branch circuit.

If you are planning on using existing AC power sources, refer to Table 4 on page 36 and add up the total power requirements of your racks to ensure that existing AC power sources are able to support your planned installation.

This checklist can help you prepare your site electrically for your IBM Cluster 1350.

- ___ 1. Assess existing AC mains supply quality.
- ___ 2. Determine earthing/grounding requirements for your system.
- ___ 3. Determine AC power requirements of your system configuration.
- ___ 4. Determine AC power sources needed to meet these power requirements.

AC mains supply quality

The amount of power your system requires cannot be your sole consideration; power quality is also a concern. If AC power is not consistent and of sufficient quality, the performance and life expectancy of your system will suffer. If the installation site has a history of AC power-line disturbances, you must consider whether corrective measures, such as power-line conditioning or an uninterruptible power supply (UPS), may be necessary.

Low nominal line voltages

Each system is designed to operate within the voltage ranges specified. A main supply that is consistently close to the bottom of the voltage range makes the system more susceptible to momentary line disturbances, which can result from problems with the power utility company, wiring deficiencies (in the building), or an overloaded local transformer.

If consistently low line voltages are a problem at your site, make sure that a qualified electrician investigates and corrects the problem. If a nominal voltage cannot be maintained, a regulated and shielded power conditioner or UPS should be used.

Brownouts and line sags

Brownouts and line sags often result from power company load switching or load switching within buildings. In addition, power companies may deliberately reduce the line voltage during general overload or high demand, producing short-term brownout.

Power-line impulses

Power-line transients can result when other equipment shares the system's power source. Electromagnetic interference (EMI) can pass from the power line to the system chassis ground. These transient impulses can then flow into connecting cables, causing errors or the loss or corruption of data.

Proper grounding and bonding procedures protect against most power-line impulses. A shielded isolation transformer with single-point grounding at the secondary provides added protection.

Frequency stability

Generally, large power distribution networks maintain a stable frequency, but smaller and isolated power distribution systems (motor or diesel generators) may not. The system's power-line frequency must be stable within the limits specified.

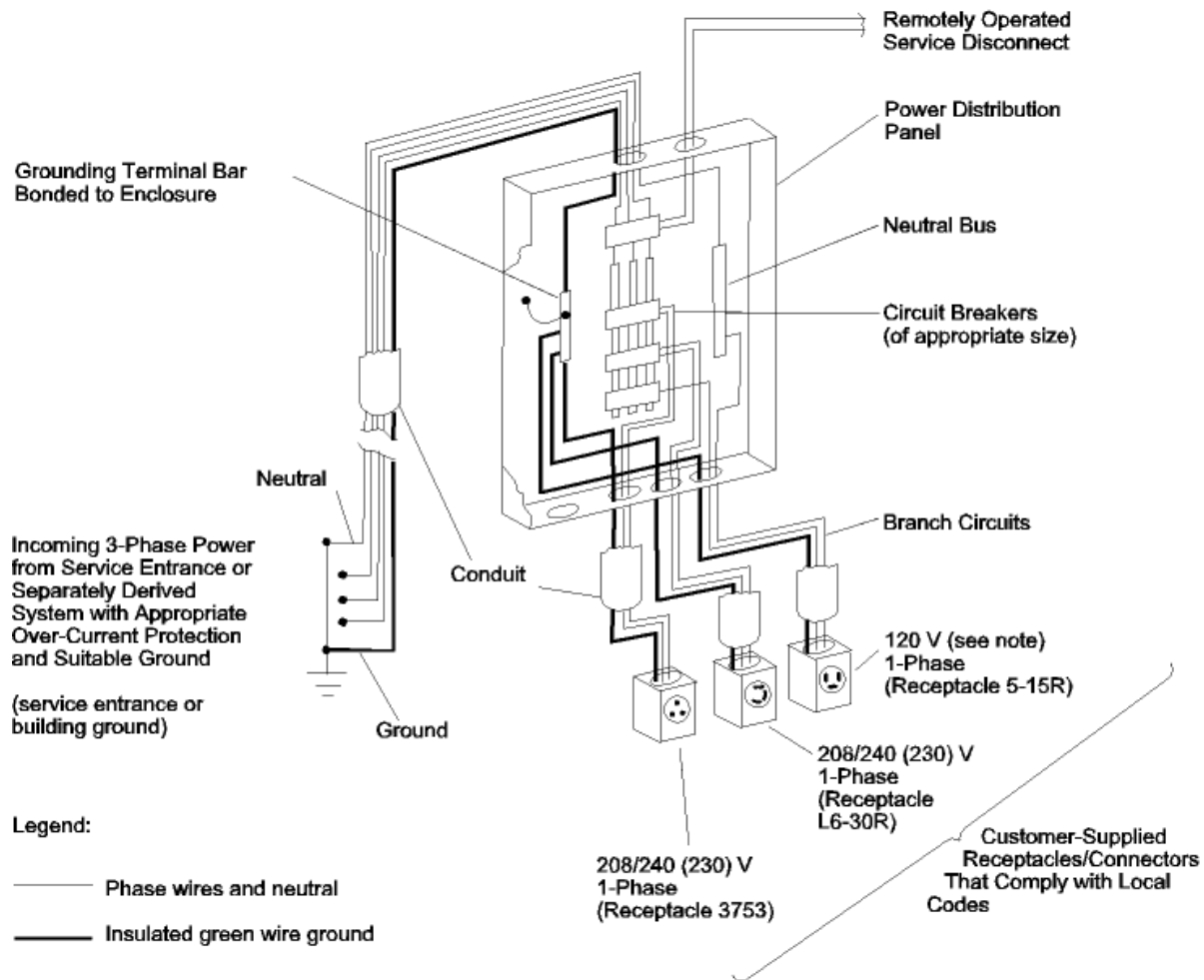
Earthing/Grounding requirements

Earthing/Grounding requirements for safe operation of equipment are documented in International standards, National standards, and local electrical codes. The local authority having jurisdiction over enforcement of electrical requirements at your location or local electrician qualified to do commercial electrical work can tell you which standards and codes apply to your installation location. These recommendations are industry proven practices that help to minimize the affects of external electrical disturbances by providing a common ground potential for interconnected equipment, even when equipment is separated by long distances.

The intent of the standards and codes are to provide a safe environment for personnel and property in the event of a power fault, equipment wiring fault, or lightning event. However, there are earthing/grounding recommendations or requirements that are important for proper operation, reliability, and performance of sensitive electronic equipment. These recommendations or requirements exceed what is documented in the standards and codes, but do not compromise the baseline provisions that are considered necessary for safety.

To ensure proper operation of your Cluster 1350 you must provide a common ground potential for interconnected equipment, even when equipment is separated by long distances. The Cluster 1350 line cords contain an insulated equipment grounding wire that connects the rack frame to the ground terminal on the receptacle. The receptacle for IBM equipment should be connected by an insulated equipment grounding conductor to the grounding bus bar in the branch-circuit distribution panel. The grounding bus bar should be connected by an insulated equipment grounding wire back to the service entrance or suitable building ground.

The earthing/grounding conductor must be continuous from the receptacle where the Cluster 1350 is installed to the service entrance or suitable building earth/ground. The earthing/grounding conductor must be in the same conduit as the associated feed wires. For example, in the United States, the grounding conductor from the circuit-breaker panel to the receptacle where the Cluster 1350 is installed must be in the same conduit as the two line conductors that supply 200–240 VAC to the Cluster 1350. The earthing/grounding conductor must have sufficiently low impedance to facilitate the operation of over-current protective devices. Figure 5 on page 35 shows one way to properly ground sensitive electrical equipment.



Note: 1. The receptacles must match the plug types ordered on your data processing equipment.
 2. For loads requiring a neutral, attach computer/data processing equipment only.

RV2C031-1

Figure 5. Properly grounding sensitive electrical equipment

AC power requirements

Each rack contains one or more IBM NetBAY Rack Power Distribution Units (PDUs). The PDUs are mounted sideways beside the regular rack space. Two types of PDUs are used:

- Rack PDU
- Front end PDU

Rack PDUs provide power to components within a cabinet, while front end PDUs provide the connection to the external power source and distribute the power among the rack PDUs. A rack PDU can also be directly connected to the external power source to eliminate the need for the front end PDU. Up to four front end PDUs can be placed in each cabinet and up to twelve rack PDUs.

Regardless of the PDU configuration used in the rack, each plug coming out of the rack must attach to an AC mains power source that provides 30 amps of single phase 200–240 VAC, 50/60 Hz power.

Table 4 lists the power requirements for each individual IBM Cluster 1350 system component. The power usages are summarized to aid in sizing total power requirements and backup power systems.

Table 4. Electrical specifications of individual components

System Components	Electrical Rating (Nominal)
Cluster Node	
IBM eServer xSeries 335	Power supply: One 320 watt (115–230 VAC) Electrical input: <ul style="list-style-type: none"> • Sine-wave input (50-60 Hz) required • Input voltage low range: <ul style="list-style-type: none"> – Minimum: 100 VAC – Maximum: 127 VAC • Input voltage high range: <ul style="list-style-type: none"> – Minimum: 200 VAC – Maximum: 240 VAC • Input kilovolt-amperes (kVA) approximately: <ul style="list-style-type: none"> – Maximum: 0.323 kVA
IBM eServer xSeries BladeCenter	Power supply: Two 1200– watt (200–240 VAC) Electrical input: <ul style="list-style-type: none"> • Sine-wave input (50-60 Hz single-phase) required • Input voltage low range: <ul style="list-style-type: none"> – 200 VAC • Input voltage high range: <ul style="list-style-type: none"> – 240 VAC
Management Node	
IBM eServer xSeries 345	Hot-swap power supplies: 350 Watt (115–230 VAC) <ul style="list-style-type: none"> • Minimum: One • Maximum: Two - the second power supply provides redundant power Electrical input: <ul style="list-style-type: none"> • Sine-wave input (50-60 Hz) required • Input voltage low range: <ul style="list-style-type: none"> – Minimum: 100 VAC – Maximum: 127 VAC • Input voltage high range: <ul style="list-style-type: none"> – Minimum: 200 VAC – Maximum: 240 VAC • Input kilovolt-amperes (kVA) approximately: 0.354 kVA
Storage Node	

Table 4. Electrical specifications of individual components (continued)

System Components	Electrical Rating (Nominal)
IBM eServer xSeries 345	<p>Hot-swap power supplies: 350 Watt (115–230 VAC)</p> <ul style="list-style-type: none"> • Minimum: One • Maximum: Two - the second power supply provides redundant power <p>Electrical input:</p> <ul style="list-style-type: none"> • Sine-wave input (50-60 Hz) required • Input voltage low range: <ul style="list-style-type: none"> – Minimum: 100 VAC – Maximum: 127 VAC • Input voltage high range: <ul style="list-style-type: none"> – Minimum: 200 VAC – Maximum: 240 VAC • Input kilovolt-amperes (kVA) approximately: 0.354kVA
IBM eServer xSeries 360	<p>Hot-swap power supplies: 370 Watt (115–230 VAC)</p> <ul style="list-style-type: none"> • Minimum: One or two power supplies are shipped with the server, depending on model • Maximum: Three - the third power supply provides redundant power <p>Electrical input:</p> <ul style="list-style-type: none"> • Sine-wave input (50-60 Hz) required • Input voltage low range: <ul style="list-style-type: none"> – Minimum: 100 VAC – Maximum: 127 VAC • Input voltage high range: <ul style="list-style-type: none"> – Minimum: 200 VAC – Maximum: 240 VAC • Input kilovolt-amperes (kVA) approximately: <ul style="list-style-type: none"> – Minimum: 0.08 kVA (AC power connected, server off) – Minimum: 0.38 kVA (DC power on, server idle) – Maximum: 1.1 kVA
Storage Server	
IBM FAStT200 Storage Server	<ul style="list-style-type: none"> • Sine-wave input (50-60 Hz) required • Input voltage low range: <ul style="list-style-type: none"> – Minimum: 90 VAC – Maximum: 136 VAC • Input voltage high range: <ul style="list-style-type: none"> – Minimum: 198 VAC – Maximum: 264 VAC • Input kilovolt-amperes (kVA) approximately: <ul style="list-style-type: none"> – Minimum configuration: 0.06 kVA – Maximum configuration: 0.37 kVA
IBM FAStT700 Storage Server	<ul style="list-style-type: none"> • Sine-wave input (50-60 Hz) required • Input voltage low range: <ul style="list-style-type: none"> – Minimum: 100 VAC – Maximum: 127 VAC • Input voltage high range: <ul style="list-style-type: none"> – Minimum: 200 VAC – Maximum: 240 VAC • Input kilovolt-amperes (kVA) approximately: <ul style="list-style-type: none"> – Maximum configuration: 0.155 kVA

Table 4. Electrical specifications of individual components (continued)

System Components	Electrical Rating (Nominal)
Storage Expansion Unit	
IBM EXP500 Disk Expansion Unit	<ul style="list-style-type: none"> • Sine-wave input (50-60 Hz) required • Input voltage low range: <ul style="list-style-type: none"> – Minimum: 90 VAC – Maximum: 127 VAC • Input voltage high range: <ul style="list-style-type: none"> – Minimum: 198 VAC – Maximum: 257 VAC • Input kilovolt-amperes (kVA) approximately: <ul style="list-style-type: none"> – Minimum configuration: 0.06 kVA – Maximum configuration: 0.36 kVA
IBM EXP700 Disk Expansion Unit	<ul style="list-style-type: none"> • Sine-wave input (50-60 Hz) required • Input voltage low range: <ul style="list-style-type: none"> – Minimum: 100 VAC – Maximum: 127 VAC • Input voltage high range: <ul style="list-style-type: none"> – Minimum: 200 VAC – Maximum: 240VAC • Input kilovolt-amperes (kVA) approximately: <ul style="list-style-type: none"> – Maximum configuration: 0.390 kVA
Console	
1-U Monitor	<p>Power Input:</p> <p>Supply Voltage: 90–264 VAC, 50/60</p> <p>Power Consumption:</p> <p>Normal Operation: 26 W</p> <p>Stand-by: 3 W</p>
KVM Switch	
IBM NetBAY 2x8 Console Switch	<p>In/out Voltage - Low Range</p> <p>Minimum: 90 VAC</p> <p>Maximum: 136 VAC</p> <p>In/out Voltage - High Range</p> <p>Minimum: 198 VAC</p> <p>Maximum: 264 VAC</p>
IBM NetBAY Remote Console Manager	<p>AC input power: 40 W maximum</p> <p>AC input voltage: 100–240 VAC (Autosensing)</p> <p>AC current rating: 1A</p> <p>AC frequency: 50/60 Hz</p> <p>Power consumption: 25 W</p>
10/100-MB Ethernet Switch/1-GB Ethernet Switch	

Table 4. Electrical specifications of individual components (continued)

System Components	Electrical Rating (Nominal)
Cisco Catalyst 3550-24 XL (24-port)	AC input voltage: 100-127/200-240 VAC (autoranging) 50-60 Hz Power consumption: 65 W
Cisco Catalyst 3550-48 XL (48-port)	AC input voltage: 100-127/200-240 VAC (autoranging) 50-60 Hz Power consumption: 110 W
1-GB Ethernet Switch	
Cisco Catalyst 3508G (8-port)	AC input voltage: 100-127/200-240 VAC (autoranging) 50-60 Hz DC input voltages: +3.3V @ 14A, +12V @ 3A Power consumption: 82.2 W
Port Server	
MRV In-Reach IR-8020-101 (20-port)	Power External supply: 100-240 VAC Power consumption: 32 W
MRV In-Reach IR-8040-101 (40-port)	Power External supply: 100-240 VAC Power consumption: 32 W
High-Speed Myrinet Switch (optical)	
Myrinet Model M3-E32 (5-slot)	Power input: 100-127/200-240 VAC, 50 Hz / 60 Hz Maximum total power with line cards in all slots: 240 W Maximum input current @ 100-127 VAC: 2.4A Maximum input current @ 200-240 VAC: 1.2A
Myrinet Model M3-E64 (9-slot)	Power input: 100-127/200-240 VAC, 50 Hz / 60 Hz Maximum total power with line cards in all slots: 480 W Maximum input current @ 100-127 VAC: 4.8A Maximum input current @ 200-240 VAC: 2.4A
Myrinet Model M3-E128 (17-slot)	Power input: 100-127/200-240 VAC, 50 Hz / 60 Hz Maximum total power with line cards in all slots: 960 W Maximum input current @ 100-127 VAC: 9.6A Maximum input current @ 200-240 VAC: 4.8A
High-Speed Cisco Switch (copper)	
Catalyst 4003 switch	Power input: 100-240 VAC, 50 Hz / 60 Hz Maximum total power: 530 W

Table 4. Electrical specifications of individual components (continued)

System Components	Electrical Rating (Nominal)
Catalyst 4006 switch	Power input: 100–240 VAC, 50 Hz / 60 Hz Maximum total power: 725 W
Power Management Module	
APC MasterSwitch Model AP9212	Nominal input voltage: 208, 230 Input frequency (Hz): 50/60 Hz +/- 5 Hz (manual switch) Input Connection Type: IEC-320 C14 Acceptable Input Voltage: 253 VAC Maximum Line Current: 10 A Maximum Input Current: 10 A
Power Distribution Unit (PDU)	
IBM NetBAY Rack Power Distribution Unit	Output Power: 16 A, 180–240 VAC, 50–60 Hz Receptacles: Input - IEC 60320 C20 outlet Output - (7) IEC 60320 C13 outlets Maximum current draw for each outlet is 10 A Maximum for all 7 outlets is 13 A
IBM NetBAY front end Power Distribution Unit	Output Power: 16 A, 100–240 VAC, 50–60 Hz Receptacles: Input - IEC 60320 C20 outlet Output - (3) IEC 60320 C13 outlets

Receptacle styles and pin-outs

Power is supplied to the Cluster 1350 system through power distribution units (PDUs) and plugable power cords. Table 5 on page 41 describes the possible power cords and shows the pin patterns and nominal voltages for the various receptacles.

Table 5. AC receptacle patterns with voltage pin-outs

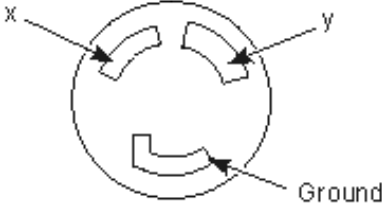
International or Country Type (IBM Type Number)	Receptacle Pattern	Cluster 1350 Part Number	Supported Countries
<p>NEMA L6-30 (IBM plug type 12)</p>		<p>37L6884</p>	<p>Afghanistan, Anguilla, Antigua, Argentina, Aruba, Bahamas, Bangladesh, Barbados, Belize, Bermuda, Bolivia, Bonaire, Brunei, Caicos Islands, Canada, Cape Verde Islands, Cayman Islands, Chile, China (Hong Kong S.A.R.) Colombia, Costa Rica, Curacao, Dominican Republic, Ecuador, El Salvador, Guam, Guatemala, Haiti, Honduras, Indonesia, Jamaica, Japan, Malaysia, Mexico, Montserrat, Myanmar, Netherlands Antilles, Nicaragua, Panama, Paraguay, People's Republic of China, Peru, Philippines, Puerto Rico, Sri Lanka, St. Kitts, St. Martin, Suriname, Taiwan, Thailand, Tobago, Tortola (BVI), Trinidad, Turks Island, United States, Uruguay, Venezuela, Virgin Islands</p>

Table 5. AC receptacle patterns with voltage pin-outs (continued)

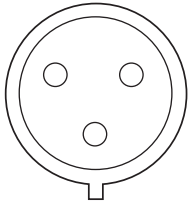
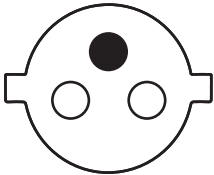
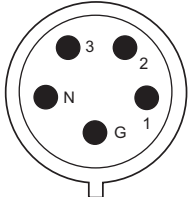
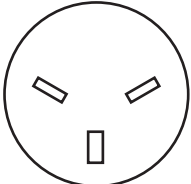
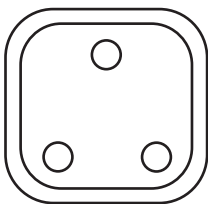
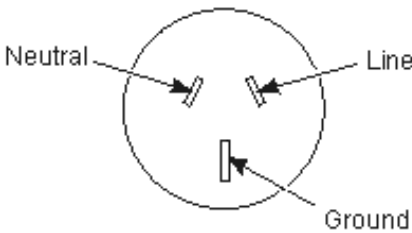
International or Country Type (IBM Type Number)	Receptacle Pattern	Cluster 1350 Part Number	Supported Countries
IEC 309, 32A, P+N+G (IBM plug type 46)		37L6885	Albania, Algeria, Andorra, Angola, Armenia, Azores, Belarus, Belgium, Benin, Bosnia, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Chad, China (Macau S.A.R), Congo, Croatia, Dahomey, Djibouti, Egypt, Equatorial Guinea, Faero Islands, France, French Guiana, French Polynesia, Gabon, Georgia, Germany, Greece, Greenland, Guadeloupe, Guinea, Guinea-Bissau, Hungary, Iceland, Iran, Ivory Coast, Kazakhstan, Kirghizia, Laos, Lebanon, Liberia, Luxembourg, Macedonia, Malagasy Republic, Mali, Martinique, Mauritania, Moldavia, Monaco, Mongolia, Morocco, Mozambique, Netherlands, New Caledonia, Niger, Norway, Poland, Principe, Reunion, Romania, Rwanda, Sao Tome Island, Saudi Arabia, Senegal, Serbia, Slovakia, Slovenia, Spain, Sudan, Swaziland, Syria, Tahiti, Togo, Tunisia, Ukraine, Uzbekistan, Vietnam, Zaire, Zimbabwe
CEE 7 VII (IBM plug type 18)		37L6868	Czech Republic, Estonia, Finland, Latvia, Lithuania, Russia, Sweden, Turkey, Korea
IEC 309, 16A, 3P+N+G (IBM plug type 46)		37L6870	Denmark, Liechtenstein, Switzerland
SII 32-1971 (IBM plug type 32)		37L6872	Israel

Table 5. AC receptacle patterns with voltage pin-outs (continued)

International or Country Type (IBM Type Number)	Receptacle Pattern	Cluster 1350 Part Number	Supported Countries
SABS 164 BS 546 (IBM plug type 22)		37L6876	South Africa
SAA-AS 3112 (IBM plug type 54)		24P7884	Australia, Fiji, New Zealand, Papua New Guinea, Western Samoa

Communication port protection

IBM Cluster 1350 products are designed to meet all industry-standard requirements for data communication interfaces, but the necessary external cables make the interfaces vulnerable to damage from sources such as electrical-storm lightning or power-line surges.

IBM Cluster 1350 recommends that you protect your system's data communications interfaces by implementing procedures described in one or more of the standards from the following list:

- ANSI T1.313, *Electrical Protection For Telecommunications Central Offices and Similar Type Facilities*
- CCITT K.15, *Protection of Remote-Feeding Systems and Line Repeaters Against Lightning and Interference From Neighboring Electricity Lines*
- ECMA 200, *Immunity of Information Technology Equipment to Lightning Surges*
- MIL-HDBK-1004/6, *Lightning Protection*
- NFPA 70, *National Electrical Code*
- TR-NWT-001089, *Electromagnetic Compatibility and Electrical Safety Generic Criteria For Network Telecommunication Equipment (Bellcore)*
- VDE 0845 (PTI), *Protection of Telecommunication Systems Against Lightning, Electrostatic Discharges, and Overvoltages From Electric Power Installations*

PDU requirements

The power-distribution units (PDUs) that are installed in an IBM Clusters 1350 cabinet are not powered through a cabinet AC breaker. Each front end PDU has its own AC power cord that requires an external power connection outside of the cabinet. Rack PDUs can either attach to the front end PDUs or directly to an external power connection outside of the cabinet. Safe power-down of a cabinet with PDUs installed requires that each PDU power cord must be disconnected from its AC power source or the PDU. Prepare the IBM Clusters site so that PDU

power cords are visible and identifiable. Their external AC-power source receptacles should be readily accessible for fast disconnection.

DANGER

The breaker switch on the PDU is not accessible. To turn off power to the cabinet, you must pull all the power plugs out of the wall outlet or all the plugs from individual PDUs.

Chapter 6. Cabinet placement and intercabinet cabling

Contents

DANGER

Ensure that all rack-mounted units are fastened in the rack frame. Do not extend or exchange any rack-mounted units when the stabilizer is not installed.

Minimum service clearances

There are several factors that influence final cabinet placement. In addition to adequate cable length and staying within safe floor loading limits for your installation site, you should keep in mind the minimum clearances required for service of the racks in the Cluster 1350. You may want to plan for extra space around the cluster to allow movement of racks for service.

Figure 6 shows the clearances needed for servicing a rack in the Cluster 1350. Keep in mind that the service clearances for the sides of the rack are not required when operating, but only when servicing the PDUs.

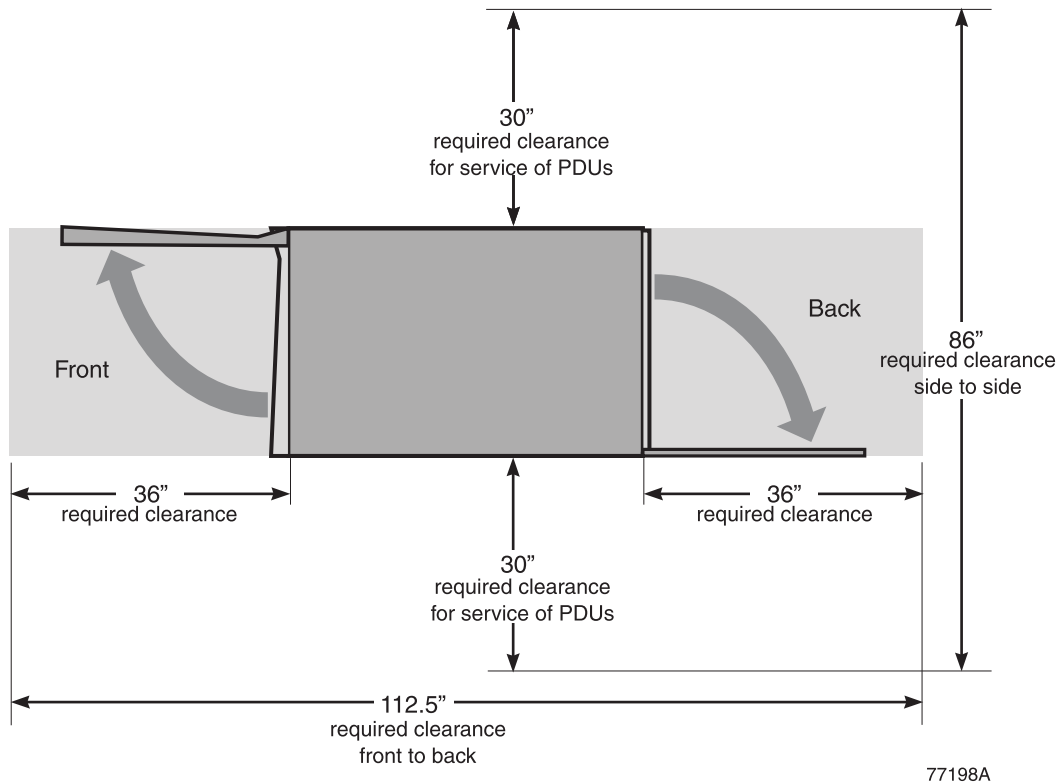
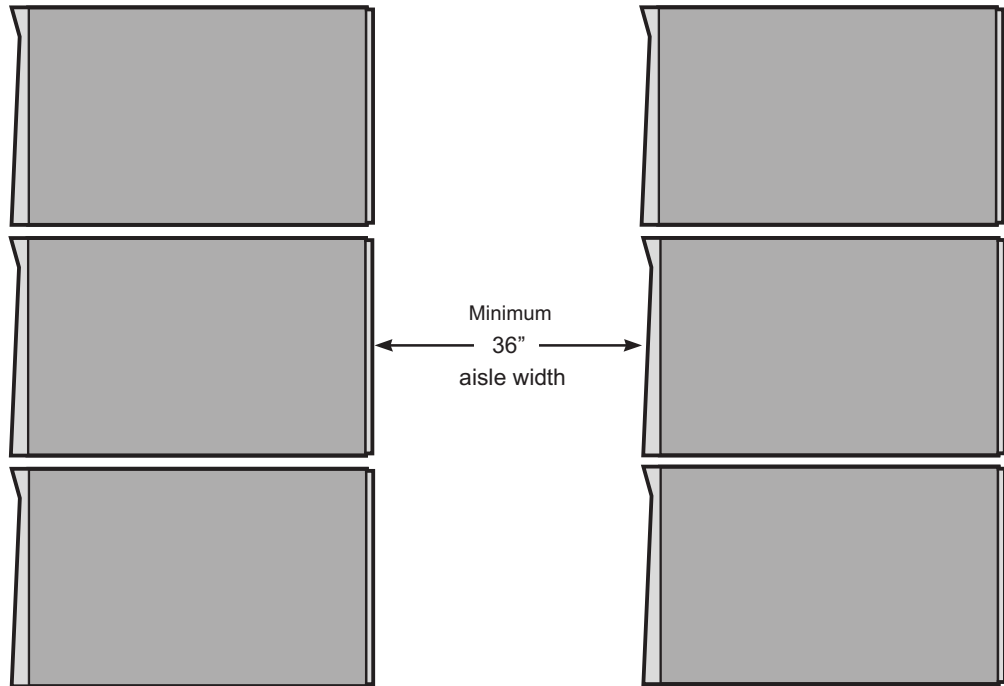


Figure 6. Cabinet clearances required for service

If you are planning the installation of a large cluster and you want to arrange the racks in several rows you must maintain a minimum aisle width of 36 inches as shown in Figure 7 on page 46. This will allow enough space for the front and back

covers of the racks to open. An aisle width of 48 inches may be more appropriate if you want to ensure you have enough room to move the rack to gain access to the sides for servicing the PDUs.

Figure 7. Minimum aisle width for Cluster 1350 installations



Final cabinet placement will determine what will qualify as adequate cable lengths. This chapter gives guidelines for intercabinet (rack-to-rack) cabling. Use these guidelines to determine the best cable lengths for your installation.

Remember to install the stability kit once the cabinets are placed in their final location. Refer to “Stability kit” on page 21 for information on installing the stability kit that comes with each cabinet.

Types of intercabinet cabling

Cabinet placement is partly determined by the cables that run between cabinets. Both optical and copper cables are involved.

All intercabinet (rack-to-rack) cables and cable harnesses come in varying lengths up to 25 meters. There are no layout restrictions.

Table 6 on page 47 shows the available lengths for the different cables and cable harnesses.

Table 6. Available Lengths for Intercabinet Cables and Cable Harnesses

Lengths	Part Number	Notes
Copper based Ethernet cables:		
0.25 m	24P7860	Individual CAT5E Ethernet cable.
0.50 m	24P7858	Individual CAT5E Ethernet cable.
1 m	24P7856	Individual CAT5E Ethernet cable.
2 m	24P7854	Individual CAT5E Ethernet cable.
3 m	24P7852	Individual CAT5E Ethernet cable.
10 m	24P7835	Individual CAT5E Ethernet cable.
25 m	24P7833	Individual CAT5E Ethernet cable.
1.7–2.1 m	24P7831	CAT5E Ethernet harness. Contains eight cables.
2 m	24P7829	CAT5E Ethernet harness. Contains eight cables.
25 m	24P7827	CAT5E Ethernet harness. Contains eight cables.
Fibre based Ethernet and Fibre Channel cables:		
1 m	36L9973	Fibre cable, SC to SC
5 m	03K9306	Fibre cable, SC to SC
25 m	03K9305	Fibre cable, SC to SC
1 m	19K1247	Fibre cable, LC to LC
3 m	31P6327	Fibre cable, LC to LC
5 m	19K1248	Fibre cable, LC to LC
10 m	31P6326	Fibre cable, LC to LC
25 m	19K1249	Fibre cable, LC to LC
0.208 m	19K1250	Fibre cable, SC to LC

Appendix. Declaration of IBM Product Noise Emission Values

Contents

General noise emission values for the Cluster 1350 are shown in Table 7

Table 7. General noise emission values for the Cluster 1350

Declaration of IBM Product Noise Emission Values				
Product configuration	Declared A-weighted Sound Power Levels L_{wAd} (B)		Declared A-weighted Sound Pressure Level L_{pAm} (db) at 1 meter Bystander Position	
	Cluster 1350 (fully configured racks)	8.0 (bels) operating	8.0 (bels) idling	62 (db) operating
Note: L_{wAd} is the declared (upper limit) sound power level for a random sample of machines. L_{pAm} is the mean value of the A-weighted sound pressure levels at the bystander (1-meter) positions for a random sample of machines. All measurements are made in accordance with ISO 7779, and declared in conformance with ISO 9296.				

Noise emission values are different for racks that contain BladeCenters. Each BladeCenter unit has two blowers for cooling. An optional Acoustics Module is available that dampens the noise generated by the blowers. Table 8 shows the maximum sound levels emitted by BladeCenter units without the Acoustics Module and with the Acoustics Module. This represents the minimum and maximum number of BladeCenter units that can be installed in a 42U rack.

Table 8. Noise emission values for racks containig BladeCenters

	Number of BladeCenter units per rack	Maximum sound power idle	Maximum sound power operating
Without Acoustics Module	1	7.4 bels	7.4 bels
With Acoustics Module	1	6.9 bels	6.9 bels
Without Acoustics Module	4	8 bels	8 bels
With Acoustics Module	4	7.5 bels	7.5 bels
Without Acoustics Module	6	8.2 bels	8.2 bels
With Acoustics Module	6	7.7 bels	7.7 bels

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

Australia and New Zealand Class A statement

Attention: 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.

United Kingdom telecommunications safety requirement

Notice to Customers

This apparatus is approved under approval number NS/G/1234/J/100003 for indirect connection to public telecommunication systems in the United Kingdom.

European Union EMC Directive conformance statement

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC 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 nonrecommended 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 CISPR 22/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.

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

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Regulatory and Compliance Requirements

The IBM eServer Cluster 1350 systems meet the following regulatory and compliance requirements. Unless otherwise stated, the information applies to all systems.

Telecom

Three communication interfaces exist in the IBM eServer Cluster 1350. Each interface is an alternative configuration of the PCI-360 High Speed Serial Interface.

Only the SCC-P X.21 interface is used to support X.25 communication. This interface is certified to European X.25 requirements. The board is labeled appropriately for connection to Telecom networks throughout Europe. The shipping container is labeled with the CE label.

The interface is also certified for X.25 communication in Australia.

Safety Compliance

USA

IBM eServer Cluster 1350 systems have third-party certification to UL 1950, Safety of Information Technology Equipment.

These systems can include components such as an FC Host Adapter PCI card, the FC Switch, the FC-AL Hub, and the FC Bridge that contain laser component-assemblies called GLM (Gigabaud Link Module), GBIC (Gigabit Interface Converter), and GOT (Gigabit Optical Transceiver).

All models of laser component-assemblies comply with the requirements for Class-1 laser products set by the Department of Health and Human Services (DHHS) regulation 21 CFR Subchapter J. This compliance is indicated by markings on the laser component-assembly. Note that the Class 1 conformity label may not be visible when the laser component-assembly is installed in the system.

Canada

IBM eServer Cluster 1350 systems have third-party certification to CSA 22.2 #950, Safety of Information Technology Equipment.

International

IBM eServer Cluster 1350 systems have third party certification, and the SQuad, MQuad, and Bootbay are self-certified to EN60950 and comply with IEC 950, Safety of Information Technology Equipment.

These systems also comply with EN60825, Class 1; and with IEC 825, Class 1: Radiation Safety of Laser Products. Systems can include components such as an FC Host Adapter PCI card, the FC Switch, the FC-AL Hub, and the FC Bridge that contain laser component-assemblies called GLM (Gigabaud Link Module), GBIC (Gigabit Interface Converter), and GOT (Gigabit Optical Transceiver).

All models of laser component-assemblies are certified as Class-1 laser products that conform to the requirements contained in the International Electrotechnical Commission (IEC) standard 825 and CENELEC (European Committee for Electrotechnical Standardization) European Normalization standard EN 60825. All these assemblies are certified by the German testing institute VDE or an equivalent agency approved by the European Union.

Note that the Class 1 conformity mark may not be visible when the laser component-assembly is installed in the system.

Batteries

IBM eServer Cluster 1350 systems and products provided by IBM for connection to IBM products may contain sealed lead acid batteries or nickel-cadmium batteries. These batteries must be recycled or disposed of properly. Recycling facilities may not be available in your area. In the United States, IBM has established a collection process for reuse, recycling, or proper disposal of used sealed lead acid, nickel cadmium and nickel metal hydride batteries and battery packs from IBM equipment. For information on proper disposal of the batteries in this product, please contact IBM at 1-800-426-4333. For information on disposal of sealed lead acid or nickel cadmium batteries outside the United States, contact your local waste disposal or recycling facility.

Environmental Statement

IBM eServer Cluster 1350 systems were designed with customers' concerns about the environment in mind. The environmental impacts of product shipping, usage and recycling were considered throughout. Some of these features are noted below. IBM is continuously working with its partners to improve the environmental quality of OEM products; but at this time environmental achievements cannot be assumed for all OEM devices.

Energy Savings

Four-processor boards do the work of several of the fastest dual-processor boards in previous multiprocessor systems. With each new processor generation, IBM offers computing power increases while achieving power consumption decreases on a per-unit basis. An extra benefit of this performance is energy savings for the user. These systems also continue to provide the Energy Star option on all video display terminals.

Hazardous Materials

IBM has eliminated the following environmentally hazardous materials from IBM eServer Cluster 1350:

- CFCs and HCFCs
- PCB and PCT
- Mercury
- Cadmium in packaging and ink
- Lead in plastic parts that weigh more than 25 grams
- PBB, PBBO, PBBE and PBDE in plastic parts that weigh more than 25 grams

Printed Circuit Boards

IBM continually reviews printed circuit board processes for opportunities for improvement. Boards used in the IBM eServer Cluster 1350 systems use the following environmentally conscious processes:

- No solvent cleaners are used.
- Aqueous solutions are used for solder mask and photo imaging processes.
- No lead is used in the surface finish.
- Materials returned to IBM are reused and recycled such that only 5% of the base board volume, as nontoxic ash, goes to a landfill.

Documentation

On-line documentation is now available to all system users, thus minimizing the need for printed manuals. Manuals that are printed use at least 20% recycled, alkaline bleached paper and water based ink. The manuals are 95% recyclable.

Packaging

Shipping containers for IBM eServer Cluster 1350 systems and their components have been designed to meet the German Packaging Ordinance and the (US) Institute of Packaging Professionals Environmentally Responsible Packaging Handbook, R3P2. This compliance includes the following features:

- Wood is minimized, untreated and not permanently secured to unlike material.
- Cardboard and paper are free from foreign materials that impede recycling.
- Foams are CFC-free and are not permanently secured to unlike material.
- Plastics are free from foreign materials that impede recycling, with the exception of static bags.
- Commingled or copolymer plastics are not used, with the exception of static bags.
- The sum concentration of incidental levels of lead, cadmium, mercury and hexavalent chromium is less than 0.01% by weight.
- Inks are water based with no heavy metal additives.
- The total package is 100% recyclable with the exception of static bags and polyurethane foam, both of which are reusable.
- The total package is made of 10-20% recycled materials.

Upgradability

The modular design of the IBM eServer Cluster 1350 systems and their adherence to industry standards allow the systems to be both scalable and easily upgradable. Features include scalable memory, PCI I/O cards, standard 19 inch rack-mount capability, and clustering for processing units.

Recycling

IBM eServer Cluster 1350 systems cabinets and peripherals all have steel enclosures. The only significant plastic parts are the decorative cabinet doors and top panel. Waste material from their molding process is recycled into production parts. In addition, for ease of recycling, the ISO 11469 recycling mark designating the plastic composition is displayed on the doors and panels.

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