IBM BladeCenter HS22 -- A versatile, easy-to-use blade server optimized to help provide performance, power, and cooling

Table of contents

1 Overview
2 Key prerequisites
2 Planned availability date
3 Description
10 Product positioning
10 Product number
11 Publications
12 Technical information
26 Pricing
27 Announcement countries

At a glance

BladeCenter® HS22 blade servers revolutionize the economics of application servers with versatility, ease of use, performance, and energy efficiency.

Overview

The IBM® BladeCenter HS22 offers great performance balanced with flexible configuration options and simple management in an efficient server designed to run a broad range of workloads exceptionally well.

Versatile:

- A feature-rich design enables the HS22 to run a broad range of workloads, including infrastructure, virtualization, and enterprise applications.
- An extensive choice of processors, memory, internal storage, and I/O options allows flexible configurations.
- The BladeCenter HS22 is supported in the BladeCenter H chassis (8852), the BladeCenter HT chassis (8740, 8750), the BladeCenter S chassis (8886), and the BladeCenter E chassis (8677).

Easy to use:
• Two hot-swap storage bays support SAS and SATA (which includes solid-state) drives, enabling drives to be removed easily for quick replacement.
• Optional embedded hypervisor helps enable "instant virtualization."
• Integrated Management Module provides remote supervision and cKVM functions as standard.
• Light path diagnostics and Predictive Failure Analysis® help enable quick serviceability and maintenance.

Performance optimized:
• Next-generation Intel® Xeon® processors
• High memory capacity with 12 DDR3 VLP memory DIMM slots capable of running fast memory up to 1333 MHz
• High-speed I/O on the blade that supports up to 40 GbE to each blade and up to a total of eight ports of I/O per blade
• Support for running two DIMMs per memory channel at 1333 MHz

Power and cooling features:
• Optional low-power processor, solid-state drives, and low-power memory DIMMs
• Supports energy efficient 1.35 volt memory DIMMs
• Support for the energy-efficient BladeCenter E chassis
• Support for IBM Systems Director Active Energy Manager™ to help monitor and cap power consumption
• Innovative component layout and blade design to help keep the blade up and running even under demanding conditions

Key prerequisites

• BladeCenter chassis
• Monitor, keyboard, and mouse for setup
• Network switch module
• Boot device, such as on-board HDD or network storage device
• Advanced Management Module with latest-level firmware
• Rack and appropriate PDUs and main power distribution

Planned availability date

March 31, 2010, for:
• BladeCenter HS22
  - 7870-D3x
  - 7870-A4x
  - 7870-G2x
  - 7870-G4x
  - 7870-H2x
  - 7870-H4x
  - 7870-H5x
  - 7870-GCx
  - 7870-HAx
• Intel Xeon Processor X5667 4C 3.06 GHz 12 MB Cache 1333 MHz 95w - (59Y5712)
• Intel Xeon Processor X5670 6C 2.93 GHz 12 MB Cache 1333 MHz 95w - (59Y5711)
IBM processor upgrades

- Intel Xeon Processor X5667 4C 3.06 GHz 12 MB Cache 1333 MHz 95w (59Y5712)
- Intel Xeon Processor X5670 6C 2.93 GHz 12 MB Cache 1333 MHz 95w (59Y5711)
- Intel Xeon Processor X5660 6C 2.80 GHz 12 MB Cache 1333 MHz 95w (59Y5710)
- Intel Xeon Processor X5650 6C 2.66 GHz 12 MB Cache 1333 MHz 95w (59Y5709)
- Intel Xeon Processor E5640 4C 2.66 GHz 12 MB Cache 1066 MHz 80w (59Y5708)
- Intel Xeon Processor E5630 4C 2.53 GHz 12 MB Cache 1066 MHz 80w (59Y5707)
- Intel Xeon Processor E5620 4C 2.40 GHz 12 MB Cache 1066 MHz 80w (59Y5705)
- Intel Xeon Processor E5609 4C 1.86 GHz 12 MB Cache 1066 MHz 80w (49Y5184)

IBM memory upgrades

- 1 GB (1x1 GB, 1Rx8, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM (49Y1427)
- 2 GB (1x2 GB, 2Rx8, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM (49Y1428)
- 2 GB (1x2 GB, 1Rx4, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM (49Y1429)
- 4 GB (1x4 GB, 2Rx4, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM (49Y1430)
- 8 GB (1x8 GB, 2Rx4, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM (49Y1431)

April 23, 2010, for:

- BladeCenter HS22
  - 7870-N2x
- Intel Xeon Processor L5640 6C 2.26 GHz 12 MB Cache 1333 MHz 60w (59Y5706)
- Intel Xeon Processor L5630 4C 2.13 GHz 12 MB Cache 1066 MHz 40w (59Y5704)
- Intel Xeon Processor L5609 4C 1.86 GHz 12 MB Cache 1066 MHz 40w (49Y5184)
• 4 GB (1x4 GB, 2Rx4, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM (49Y1430)
• 8 GB (1x8 GB, 2Rx4, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM (49Y1431)

**Intel 2-port 10 Gb Ethernet Expansion Card (CFFh) for IBM BladeCenter (42C1810)**

This is a 2-port 10 Gb Ethernet Adapter designed in the Combination Form Factor (CFFh) for IBM BladeCenter. This card offers full line-rate 10 Gb performance for high-I/O intensive clients. It is based on the Intel 82599 Niantic ASIC offering PCI-Gen 2 capability. This card offers several key management features:

- Support for BladeCenter Open Fabric Manager for I/O virtualization and failover
- SoL/cKVM for easy management over 10 Gb
- PXE boot

**BladeCenter HS22**

**High-performance, blade server subsystem**

The BladeCenter HS22 low-voltage blade servers are high-throughput, two-way, SMP-capable blade servers, and are highly scalable when you add memory.

The BladeCenter HS22 can have up to two Intel Xeon processors. The processor board has the following major components:

- Two Socket B (LGA 1366) sockets for two Intel Xeon processors (one or two processors may be shipped standard).
- Two Enterprise Voltage Regulator-Down (EVRD) regulators. The EVRD supplies both the processor core voltage and L2 cache voltage and must adhere to the Intel Voltage Regulator Module (VRM) and EVRD 11.0 Specification.
- One Intel I/O Hub (IOH): Host Bridge controller with PCI Express® interface.
- Twelve DDR3 VLP DIMM memory sockets.
- One Intel South Bridge (ICH10).
- One Broadcom BCM5709S Gigabit Ethernet Controller.
- One LSI 1064E SAS Controller.
- Two SAS connectors for two 2.5-inch SAS hard drives.
- 16 MB system uEFI BIOS ROM.
- One Maxim VSC452 Super Baseboard Management Controller with Integrated VGA Controller.
- Two HDM midplane connectors.
- One blade expansion connector.
- One CIOv daughter card connector.
- One TPM 1.2 chip.
- One internal USB connector for bootable Flash key.

The Intel IOH provides the interface between the processors, and PCI Express buses that interface to the ICH10, the high-speed daughter card connector, and the blade expansion connector. The HS22 server uses the following features provided by the IOH:

- Dual independent processor Intel QuickPath Interconnect (Intel QPI) links (one processor per link)
- One x4 ESI bus to interface to the ICH10
- One x4 PCI Express bus to connect to the Broadcom Ethernet 5709S Controller
- Eight x4 PCI Express buses: one to the LSI 1064E SAS Controller, four to the Blade Expansion connector, and two to the CIOv daughter card connector
The Intel I/O Controller Hub 10 (ICH10) contains the following features:

- Interface to the IOH via the x4 ESI bus
- PCI-Express 1.0 compliance
- USB host interface with support for USB 2.0
- Low Pin Count (LPC) interface

On the HS22, the ICH10 uses the x4 PCI Express bus and the LPC bus to interface with the Maxim VSC452 IMM. The USB buses are used to interface with the USB key, the MM for keyboard and mouse, and a Cypress USB hub that provides KVM USB and media tray support.

The HS22 server memory is contiguous and is shared by both processors when both processors are installed. It is Error Correction Code (ECC) protected and supports up to 96 GB using 1 GB, 2 GB, 4 GB, or 8 GB VLP DDR3 DIMMs on twelve DIMM connectors. The processors have integrated DDR3 memory controllers and interface directly to their six associated DDR3 DIMMs. For each CPU, a minimum of one DIMM must be installed. Additional DIMMs may be installed one at a time as needed.

The HS22 supports both the Intel Xeon 5500 and 5600 Series Processors. For these processors, memory speed is a specific attribute of the processor. The system memory speed (that is, the speed at which the memory is actually running) depends on several factors including:

- CPU capability
- DIMM type(s) used (memory speed, RDIMM/UDIMM, Single Rank/Dual Rank/Quad Rank)
- Number of DIMMs populated per channel

For the Intel Xeon 5600 Series Processors with Single Rank/Dual Rank DIMMs:

- Support is provided for both the 1.5V and the new 1.35V Low Voltage RDIMMs.
- When 1333 MHz RDIMMs are installed with an Intel Xeon Processor that supports 1333 MHz memory speed:
  - If there is one or two 1.5V RDIMMs installed per memory channel, the DDR3 speed is 1333 MHz.
- When 1333 MHz RDIMMs are installed with an Intel Xeon Processor that supports 1066 MHz memory speed:
  - If there are one or two RDIMMs installed per memory channel, the DDR3 speed is 1066 MHz.
- When 1333 MHz RDIMMs are installed with an Intel Xeon Processor that supports 800 MHz memory speed:
  - For all RDIMMs installed, DDR3 speed is 800 MHz.
- With 1.35V DIMMs:
  - If there is one 1.35V 1333 MHz RDIMM installed per memory channel, the DDR3 speed is 1333 MHz. If two 1333 MHz RDIMMs are installed, the DDR3 memory speed is 1066 MHz.
  - The Intel Xeon 5600 Processors support 1.35V DIMMs up to two DIMMs per channel.
  - If 1.35V and 1.5V are mixed, the DIMMs will run at 1.5V.

For systems with the Intel Xeon 5500 Series Processors, the memory speed and configuration capabilities have not changed.

- The Intel Xeon 5500 Series processors support the following DIMM options:
  - 44T1485 - 1 GB (1x1 GB) Single Rank PC3-10600 CL9 ECC DDR3-1333 VLP LP RDIMM
  - 44T1486 - 2 GB (1x2 GB) Dual Rank PC3-10600 CL9 ECC DDR3-1333 VLP RDIMM
- 44T1487 - 2 GB (1x2 GB) Single Rank PC3-10600 CL9 ECC DDR3-1333 VLP RDIMM
- 44T1488 - 4 GB (1x4 GB) Dual Rank PC3-10600 CL9 ECC DDR3-1333 VLP RDIMM
- 44T1579 - 8 GB (1X8 GB) Dual Rank PC3-8500 CL7 ECC DDR3-1066 VLP RDIMM
- 46C7451 - 8 GB (1x8 GB, Dual Rankx4) PC3-10600 CL9 ECC DDR3-1333 VLP RDIMM
- 49Y1427 - 1 GB (1x1 GB, 1Rx8, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM
- 49Y1428 - 2 GB (1x2 GB, 2Rx8, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM
- 49Y1429 - 2 GB (1x2 GB, 1Rx4, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM
- 49Y1430 - 4 GB (1x4 GB, 2Rx4, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM
- 49Y1431 - 8 GB (1x8 GB, 2Rx4, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM

- 44T1579 - 8 GB (1X8 GB) Dual Rank PC3-8500 CL7 ECC DDR3-1066 VLP RDIMM
- 46C0561 - 2 GB (1x2 GB, 1Rx4, 1.35V) PC3L-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM
- 46C0567 - 4 GB (1x4 GB, 2Rx4, 1.35V) PC3L-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM
- 46C0569 - 8 GB (1x8 GB, 2Rx4, 1.35V) PC3L-8500 CL7 ECC DDR3 1066MHz VLP RDIMM
- 49Y1427 - 1 GB (1x1 GB, 1Rx8, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM
- 49Y1428 - 2 GB (1x2 GB, 2Rx8, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM
- 49Y1429 - 2 GB (1x2 GB, 1Rx4, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM
- 49Y1430 - 4 GB (1x4 GB, 2Rx4, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM
- 49Y1431 - 8 GB (1x8 GB, 2Rx4, 1.5V) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM

The HS22 supports memory mirroring. Chipkill™ is supported in Independent mode when x4-based DIMMs are installed.

Additional features
- The BladeCenter HS22 system board contains 12 DIMM connectors (30 mm blade).
- Each DIMM connector supports 1 GB, 2 GB, 4 GB, or 8 GB DIMM options:
  - Chipkill is supported in Independent mode when x4-based DIMMs are installed.
- One or two hot-swap SATA or SAS devices (up to 300 GB each) are supported in the base blade.
- Dual Gigabit Ethernet PCI connections.

BladeCenter HS22 blade servers are designed for high throughput from processor to memory, and to bus I/O.

These features, combined with SMP capability and blade-thin density, make it an excellent choice for space- and power-constrained environments used for:
- Infrastructure applications
- Virtualization
- General enterprise applications
**High-availability and serviceability features**

- Hot-swap blades enable easy access to each blade server.
- The management module interfaces with each blade server for single systems management control.

The BladeCenter HS22 blade servers deliver reliability and serviceability.

Features include:

- High-performance ECC memory, combined with an integrated ECC memory controller, to help correct soft and hard single-bit memory errors, while reducing disruption of service to LAN clients.
- Chipkill memory correction for up to four bits per DIMM to help keep your blade server up and running.
- Memory hardware scrubbing, designed to correct many soft memory errors automatically without software intervention.
- ECC L2 cache processors to help improve data reliability and reduce downtime.
- CPU failure recovery in Symmetric Multi-Processing (SMP) configurations:
  - Forces failed processor offline
  - Automatically reboots server
  - Generates alerts
  - Continues operations with the working processor
- PFA on SAS HDD options, memory, and processors to help alert the system administrator of imminent component failures.
- Support for dual Gigabit Ethernet connections:
  - Failover, adapter fault tolerance
  - PXE 2.0 Boot Agent
  - Wake on LAN®
  - Load balancing or teaming
- Integrated management processor that supports diagnostic, reset, POST, and auto-recovery functions, and monitors temperature and voltage. Alerts are generated when certain thresholds are exceeded (refer to the Limitations section for restrictions).

**IBM Systems Director**

IBM Systems Director is available with the BladeCenter HS22 blade servers. IBM Systems Director is an easy-to-use, point-and-click, platform management solution that streamlines the way physical and virtual systems are managed across a multisystem environment. Leveraging industry standards, IBM Systems Director supports multiple operating systems and virtualization technologies across IBM and non-IBM x86 platforms. Through a single user interface, IBM Systems Director provides consistent views for visualizing managed systems and determining how these systems relate to one another while identifying their individual status, thus helping to correlate technical resources with business needs.

IBM Systems Director utilizes a modular and extensible platform services foundation, providing a way to easily add advanced platform management capabilities to the base offering. The IBM Systems Director offering provides the base function needed for platform management. Advanced platform management functions can be seamlessly added as they are required. IBM Systems Director is based on industry standards and can report results to certain other tools. IBM Systems Director is a strategic platform management tool that is designed to grow with the needs of a business.

**Optional add-ons (available for an additional charge)**

- Active Energy Manager (AEM) is positioned as a key component of IBM's energy-efficient technologies and services, which are part of IBM's Project Green
that began May 2007. AEM measures, monitors, and manages the energy
management components built into IBM servers and provides a cross-platform
management solution. AEM also retrieves temperature and power information via
wireless sensors (SynapSense) and collects alerts, events, and data from certain
facility providers related to power and cooling equipment.

- BladeCenter Open Fabric Manager is designed to help you manage growth and
complexity by making it easy to manage I/O and network interconnects for up to
100 BladeCenter chassis -- up to 1400 blade servers. BladeCenter Open Fabric
Manager helps make blade deployment easy: once installed, the utility is resident
in the Advanced Management Module (AMM) so you can pre-configure LAN and
SAN connections. Thus, I/O connections are made automatically when you plug in
a blade. And no special tools or training is required; just manage with the easy-to-
use GUI.

**IBM ToolsCenter**

The IBM System x® ToolsCenter is a collection of system management tools to help
manage your HS22 blade server and BladeServer environment. ToolsCenter helps
make managing your server environment less complicated, more productive, and
more cost-effective.

These tools include:

- **Deployment**

  IBM ServerGuide™ is a tool that simplifies the process of installing and configuring
IBM System x and BladeCenter servers. ServerGuide automates installation of
Microsoft® Windows® server operating systems, device drivers, and other system
components, with minimal user intervention.

  The ServerGuide Scripting Toolkit enables you to tailor and build custom hardware
deployment solutions. It provides hardware configuration utilities and operating
system (OS) installation examples for IBM System x and BladeCenter x86-based
hardware. The ServerGuide Scripting Toolkit, Windows Edition enables you to
create a bootable Windows Preinstallation Environment (Windows PE) 2.1 CD or
dVD.

  BladeCenter Start Now Advisor is a configuration tool that can help you quickly
configure components of the BladeCenter S chassis. It automatically updates the
firmware for selected chassis components, and provides you with the option of
saving your configuration. The Start Now Advisor guides you through the process
of connecting your computer to the chassis, either over a network or through a
direct attachment to the Ethernet port on the advanced management module.

- **Configuration**

  An Advanced Settings Utility (ASU) systems configuration utility provides a
command line interface, unattended scripting capability, and support on multiple
operating-system platforms like DOS, Linux®, Solaris, Windows, and WinPE.

  Storage Configuration Manager (SCM) is a scalable and integrated storage
management tool for both internal and external storage subsystems for
IBM System x and BladeCenter. Storage Configuration Manager is a open-
standards-based management tool that provides a uniform and rich user interface
that is easy to use.

- **Updates**

  The UpdateXpress System Packs (UXSPs) contain a bundle of online firmware
and device driver updates for your server. UXSPs facilitate the downloading and
installation of drivers and firmware for a given system and verify that you are
working with a complete set of updates which have been tested together.

  Bootable Media Creator pulls current updates for firmware and drivers from an
IBM Web site and creates custom bootable media to CD, DVD, or USB key.

- **Diagnostics**
Dynamic System Analysis (DSA) collects and analyzes system information to aid in diagnosing system problems. DSA creates a merged log that helps provide easy identification of cause-and-effect relationships from different log sources in the system.

**BladeCenter Advanced Management Module**

BladeCenter HS22 is supported on the Advanced Management Module.

Use the Advanced Management Module in the BladeCenter to manage the BladeCenter and obtain vital system information about your installed BladeCenter HS22 servers. The management module communicates with the blade servers within the BladeCenter via an RS-485 intermanagement network. This network relays vital information about individual blade servers, such as:

- Voltages
- Power supply status
- Memory status
- Fan status
- HDD status
- Error and status log

You receive status and control of all blade servers within the BladeCenter. You can shut down and restart any blade server from anywhere on the network to help save time and costs associated with travel to the actual installation.

These manageability functions are provided through a self-contained Web page, creating an easy and familiar way to help administrators monitor, control, and maintain high availability.

**BladeCenter HS22 model configurations**

<table>
<thead>
<tr>
<th>System SEO number</th>
<th>Processor</th>
<th>L2 cache</th>
<th>Memory</th>
<th>iface HDD</th>
<th>RAID</th>
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** Power supplied through BladeCenter chassis

**Accessibility by people with disabilities**

A U.S. Section 508 Voluntary Product Accessibility Template (VPAT) containing details on accessibility compliance can be requested at
**Product positioning**

The BladeCenter HS22 offerings are positioned as high-density, compute-oriented blade servers offering lower-power-usage Intel Xeon processors.

The BladeCenter and BladeCenter HS22 blades can require less space and power resources than traditional rack offerings because of their high-density design, reduced power requirements, and single environment systems management. This is an extremely important consideration for:

- Large enterprises
- Application service providers
- Scientific and technical computing businesses

They are an excellent fit for applications such as:

- Lotus Notes®
- Microsoft Exchange
- Linux clusters

**Product number**

<table>
<thead>
<tr>
<th>Description</th>
<th>MT</th>
<th>Model</th>
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**MTM Starting Point models**

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<tr>
<th>Description</th>
<th>Machine</th>
<th>Model</th>
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<tr>
<td>BladeCenter HS22</td>
<td>7870</td>
<td>FT2</td>
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<td>Intel Xeon Processor X5670 6C 2.93 GHZ 12 MB Cache</td>
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<td>Intel Xeon Processor X5660 6C 2.80 GHZ 12 MB Cache</td>
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<td>Intel Xeon Processor X5650 6C 2.66 GHZ 12 MB Cache</td>
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<tr>
<td>Intel Xeon Processor E5640 4C 2.66 GHZ 12 MB Cache</td>
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<td>Intel Xeon Processor E5630 4C 2.53 GHZ 12 MB Cache</td>
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<tr>
<td>Intel Xeon Processor E5620 4C 2.40 GHZ 12 MB Cache</td>
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<tr>
<td>Intel Xeon Processor L5640 6C 2.26 GHZ 12 MB Cache</td>
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<tr>
<td>Intel Xeon Processor L5630 4C 2.13 GHZ 12 MB Cache</td>
<td>59Y5704</td>
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<tr>
<td>Intel Xeon Processor L5609 4C 1.86 GHZ 12 MB Cache</td>
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Intel Xeon Processor E5507 4C 2.26 GHz 4 MB Cache 800 MHz 80w 59Y5695
Intel Xeon Processor E5503 2C 2.00 GHz 4 MB Cache 800 MHz 80w 59Y5692
Intel 10Gb 2-port Ethernet Expansion Card (CFFh) for IBM BladeCenter 42C1810
1GB (1x1GB, 1Rx8, 1.5V) PC3-10600 CL9 ECC DDR3 1333MHz VLP RDIMM 49Y1427
2GB (1x2GB, 2Rx8, 1.5V) PC3-10600 CL9 ECC DDR3 1333MHz VLP RDIMM 49Y1428
2GB (1x2GB, 1Rx4, 1.5V) PC3-10600 CL9 ECC DDR3 1333MHz VLP RDIMM 49Y1429
4GB (1x4GB, 2Rx8, 1.5V) PC3-10600 CL9 ECC DDR3 1333MHz VLP RDIMM 49Y1430
8GB (1x8GB, 2Rx4, 1.5V) PC3-10600 CL9 ECC DDR3 1333MHz VLP RDIMM 49Y1431

Publications

An installation and user's guide, and safety and warranty publications are shipped with each BladeCenter HS22 blade. The following publications are available immediately:

<table>
<thead>
<tr>
<th>Title</th>
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<tr>
<td>BladeCenter Solutions</td>
<td>GM13-0127</td>
</tr>
<tr>
<td>System x Family Brochure</td>
<td>GM13-0128</td>
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http://www.ibm.com/services/continuity

For details on education offerings related to specific products, visit


Select your country, and then select the product as the category.

Technical information

Specified operating environment

Physical specifications

BladeCenter HS22

7870-H5G

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<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<td>Interconnect speed</td>
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<tr>
<td>L2 cache (full speed)</td>
<td>12 MB</td>
</tr>
<tr>
<td>Memory (VLP ECC DDR3)</td>
<td>6 GB</td>
</tr>
<tr>
<td>DIMMS (Standard)</td>
<td>3 x 2 GB</td>
</tr>
<tr>
<td>DIMM sockets</td>
<td>12</td>
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<tr>
<td>Capacity</td>
<td>96 GB(1)</td>
</tr>
<tr>
<td>Video</td>
<td>SVGA</td>
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<tr>
<td>Memory</td>
<td>16 MB</td>
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<tr>
<td>Disk controller</td>
<td>SAS</td>
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<td>Channels</td>
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<td>Connector int.</td>
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Connector ext.          0
ServeRAID-MR10ie (CIOv) Controller w/battery Optional(2)
HDD                    0
Connectors             2
Internal capacity      600 GB(3)
Total HDD bays         2
PCI Slots              0
Management proc.       Standard
Ethernet controller    Dual GB
FC card                Optional
DVD-ROM (IDE)          0
Diskette drive         0
Power supply           0

7870-H4G

Processor               Intel Xeon X5670
  6 core 95w
  Int. speed             2.93 GHz
  Max. mem. speed        1333 MHz
  Interconnect speed     6.4 GT/s
  Number standard        1
  Maximum                2
  L2 cache (full speed)  12 MB
Memory (VLP ECC DDR3)   6 GB
  DIMMS (Standard) 3 x 2 GB
  DIMM sockets          12
  Capacity               96 GB(1)
Video                   SVGA
  Memory                 16 MB
Disk controller         SAS
  Channels               1
  Connector int.         2
  Connector ext.         0
ServeRAID-MR10ie (CIOv) Controller w/battery Optional(2)
HDD                    0
Connectors             2
Internal capacity      600 GB(3)
Total HDD bays         2
PCI Slots              0
Management proc.       Standard
Ethernet controller    Dual GB
FC card                Optional
DVD-ROM (IDE)          0
Diskette drive         0
Power supply           0

7870-H2G

Processor               Intel Xeon X5650
  6 core 95w
  Int. speed             2.66 GHz
  Max. mem. speed        1333 MHz
  Interconnect speed     6.4 GT/s
  Number standard        1
  Maximum                2
  L2 cache (full speed)  12 MB
Memory (VLP ECC DDR3)   6 GB
  DIMMS (Standard) 3 x 2 GB
  DIMM sockets          12
  Capacity               96 GB(1)
Video                   SVGA
  Memory                 16 MB
Disk controller         SAS
  Channels               1
  Connector int.         2
  Connector ext.         0
ServeRAID-MR10ie (CIOv) Controller w/battery Optional(2)
HDD                    0
Connectors             2
Internal capacity      600 GB(3)
<table>
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<td>Total HDD bays</td>
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<td>Management proc.</td>
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<td>Ethernet controller</td>
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<td>DVD-ROM (IDE)</td>
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<td>Power supply</td>
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**7870-G4G**

- **Processor:** Intel Xeon E5640
- **Int. speed:** 2.66 GHz
- **Max. mem. speed:** 1066 MHz
- **Interconnect speed:** 5.86 GT/s
- **L2 cache (full speed):** 12 MB
- **Memory (VLP ECC DDR3):** 6 GB
- **DIMMs (Standard):** 3 x 2 GB
- **DIMM sockets:** 12
- **Capacity:** 96 GB (1)
- **Video:** SVGA
- **Memory:** 16 MB
- **Disk controller:** SAS
- **Channels:** 1
- **Connector int.:** 2
- **Connector ext.:** 0
- **ServeRAID-MR10ie (CIOv):**
  - **Controller w/battery:** Optional (2)
  - **HDD:** 0
  - **Internal capacity:** 600 GB (3)
- **Total HDD bays:** 2
- **PCI Slots:** 0
- **Management proc.:** Standard
- **Ethernet controller:** Dual GB
- **FC card:** Optional
- **DVD-ROM (IDE):** 0
- **Diskette drive:** 0
- **Power supply:** 0

**7870-G2G**

- **Processor:** Intel Xeon E5620
- **Int. speed:** 2.40 GHz
- **Max. mem. speed:** 1066 MHz
- **Interconnect speed:** 5.86 GT/s
- **L2 cache (full speed):** 12 MB
- **Memory (VLP ECC DDR3):** 6 GB
- **DIMMs (Standard):** 3 x 2 GB
- **DIMM sockets:** 12
- **Capacity:** 96 GB (1)
- **Video:** SVGA
- **Memory:** 16 MB
- **Disk controller:** SAS
- **Channels:** 1
- **Connector int.:** 2
- **Connector ext.:** 0
- **ServeRAID-MR10ie (CIOv):**
  - **Controller w/battery:** Optional (2)
  - **HDD:** 0
  - **Internal capacity:** 600 GB (3)
- **Total HDD bays:** 2
- **PCI Slots:** 0
- **Management proc.:** Standard
- **Ethernet controller:** Dual GB
- **FC card:** Optional
- **DVD-ROM (IDE):** 0
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<td>Intel Xeon E5503</td>
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<td>Power supply</td>
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**7870-GCG**

<p>| Processor                     | Intel Xeon E5640 |
| Int. speed                    | 4 core 80w      |
| Max. mem. speed               | 2.66 GHz        |
| Interconnect speed            | 1066 MHz        |
| Number standard               | 5.86 GT/s       |
| Number standard               | 1              |</p>
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<thead>
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<tr>
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<tr>
<td>Power supply</td>
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</table>

1 Total system memory capacity is based on using 8 GB memory DIMMs.

2 Installation of optional battery-backed RAID adapter is for connection to external storage, not for internal HDD drives.

3 Capacities are based on installation of two 300 GB HDDs.

For latest information on supported HDD options, visit http://www.ibm.com/servers/eserver/serverproven/compat/us/

**Video subsystem**

- Matrox video core
- Integrated on the blade

**Supported BladeCenter HS22 video resolutions**

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Maximum refresh rate supported</th>
<th>CRT ISO 9241.3 compliance</th>
<th>Flat panel support</th>
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</thead>
<tbody>
<tr>
<td>640 x 480</td>
<td>85 Hz</td>
<td>Yes</td>
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<tr>
<td>800 x 600</td>
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<tr>
<td>1024 x 768</td>
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</tbody>
</table>

**Note:** For resolutions supported by different operating systems, refer to the operating system documentation.

**Dimensions - BladeCenter HS22**

- Height: 24.5 cm (9.7 in)
- Depth: 44.6 cm (17.6 in)
- Width: 2.9 cm (1.14 in)
- Maximum weight: 5.4 kg (12 lb) (depending on the configuration when options are added)

**Electrical**

- BladeCenter chassis: 200 to 240 (nominal) V ac; 50 Hz or 60 Hz
• BladeCenter HS22: 12.2 (nominal) V dc

**Standards**
This system supports or complies with the following standards:

- Multiprocessor Specification (MPS) 1.4
- Hardware-enabled to meet the International Organization for Standardization (ISO) 9241, Part 3

**Equipment approvals and safety**
- CE Mark (EN55022:1998 Class A, EN60950, EN55024:1998, EN61000-3-2 and EN61000-3-3)
- CISPR 22, Class A
- FCC - Verified to comply with Part 15 of the FCC Rules (Class A) prior to product delivery
- IEC 60950-1 CB Certificate and CB Test Report indicating compliance to Group Differences

**Operating environment**
Temperature

- 10.0 to 35.0 degrees C (50 to 95 degrees F) at 0 to 914 m (0 to 3,000 ft)
- 10.0 to 32.0 degrees C (50 to 90 degrees F) at 914 to 2,133 m (3,000 to 7,000 ft)

Relative humidity: 8% to 80%

Maximum altitude: 2,133 m (7,000 ft)

**Hardware requirements**
For attended installation of an operating system, this server requires a compatible:

- Keyboard
- Mouse
- Display

Unattended or remote installation may be performed without requiring some or all of these components. Review your unattended software installation program information for specific hardware configuration requirements.

For service, the server requires a compatible:

- Keyboard
- Mouse
- Display

When having the unit serviced, plan to have these components attached to your server either directly or indirectly via a console switch.

**Programming requirements**
The following network operating systems have been tested for compatibility with the BladeCenter HS22:

- Microsoft:
  - Windows Server 2008 Datacenter (32-bit)
  - Windows Server 2008 Datacenter (64-bit)
  - Windows Server 2008 Enterprise (32-bit)
  - Windows Server 2008 Enterprise (64-bit)
- Windows Server 2008 Standard (32-bit)
- Windows Server 2008 Standard (64-bit)
- Windows Server 2008 Web (32-bit)
- Windows Server 2008 Web (64-bit)
- Windows Small Business Server 2008 Premium (64-bit)
- Windows Small Business Server 2008 Standard (64-bit)
- Windows Essential Business Server 2008 Premium (64-bit)
- Windows Essential Business Server 2008 Standard (64-bit)
- Windows Server 2008 HPC Edition (64-bit)
- Windows HPC Server 2008 (64-bit)
- Windows Datacenter 2003 R2 UV (32-bit)
- Windows Datacenter 2003 R2 UV (64-bit)
- Windows Server 2003 R2 Enterprise (32-bit)
- Windows Server 2003 R2 Enterprise (64-bit)
- Windows Server 2003 R2 Standard (32-bit)
- Windows Server 2003 R2 Standard (64-bit)
- Windows Server 2003 R2 Web (32-bit)
- Windows Compute Cluster Server (64-bit)
- Windows Compute Cluster Edition (64-bit)
- Windows Small Business Server 2003 R2 Premium
- Windows Small Business Server 2003 R2 Standard

- Linux:
  - Red Hat EL 4 AS 32-bit
  - Red Hat EL 4 ES 32-bit
  - Red Hat EL 4 WS/HPC 32-bit
  - Red Hat EL 5 (Server) 32-bit
  - Red Hat EL 5 (Server) 64-bit
  - Red Hat EL 5 (Server) 64-bit w/ Xen
  - SUSE Linux ES 10 32-bit
  - SUSE Linux ES 10 32-bit w/ Xen
  - SUSE Linux ES 10 64-bit
  - SUSE Linux ES 10 64-bit w/ Xen
  - SUSE Linux Enterprise Server Edition 11 for x86 (32bit)
  - SUSE Linux Enterprise Server Edition 11 for x86_64 (64bit)
  - SUSE Linux Enterprise Server Edition 11 with Xen for x86_64 (64bit)

- Solaris 10

- VMware:
  - ESX 3.5 Update 4
  - ESXi 3.5 Update 4
  - ESX Server 4.0
  - ESXi 4.0

Models that include the Intel Xeon 5600 Series Processors require the Update 5 level or above of VMware ESX 3.5.

For additional information, support, certification, and versions of network operating systems, access

Compatibility
The BladeCenter HS22 contains licensed system programs that include set configuration, set features, and test programs. IBM system BIOS is loaded from a "flash" EEPROM into system memory. This BIOS provides instructions and interfaces designed to support the standard features of the BladeCenter HS22 and to maintain compatibility with many current software programs.

For detailed information about IBM and non-IBM devices, adapters, software, and network operating systems supported with System x servers, visit


Contact your IBM representative or IBM Business Partner, or refer to the IBM Sales Manual for information on the compatibility of hardware and software for System x servers. The Sales Manual is updated periodically as new features and options are announced that support these servers.

Limitations

- The BladeCenter HS22 blades contain 12 DIMM sockets. A maximum of 96 GB of system memory is supported by using an 8 GB DIMM of ECC DDR memory in each of the DIMM sockets. A minimum of one DIMM per CPU must be installed; DIMMs may be added singly after that. DIMMs must be installed in matched pairs for Mirror Mode.

Refer to the Planning information section or the System x server Web page for memory options.

- Microprocessors must be of the same type, power level, and clock speed on each BladeCenter HS22. Mixing microprocessors of different speeds, power levels, or cache sizes or upgrading the base processors is not supported. The latest BladeCenter hardware and software compatibility is available via the Web


- The BladeCenter HS22 is supported in the BladeCenter H chassis (8852), the BladeCenter HT chassis (8740, 8750), the BladeCenter S chassis (8886), and the BladeCenter E chassis (8677). For supported configurations, refer to the latest BladeCenter hardware configuration tools via the Web

http://www-03.ibm.com/systems/x/hardware/configtools.html

- The ServeRAID-MR10ie (CIOv) Controller for IBM BladeCenter (46C7167) does not support the use of SATA or SSD drives on the blade.

- Support for VMware 3.5 Update 4 is limited to 5500 series processors.

Refer to the Programming requirements section for operating system limitations.

Planning information

Customer responsibilities
This product is designated as customer setup. Customer setup instructions are shipped with the product.

Configuration information
BladeCenter HS22 blades must be installed in a BladeCenter chassis.

BladeCenter configuration
The BladeCenter contains 14 blade server bays supporting up to 14 hot-swap BladeCenter HS22 blades. A control panel, located at the top left of the unit, contains the following LEDs:

- Power good
- Blade location
• Over temperature
• Information
• General fault

Processor upgrades

The system comes standard with one Intel Xeon processor. An additional processor may be added by purchasing a supported processor option. The optional processor must match the initial processor in each system.

The following processor options are supported with BladeCenter HS22:

• Intel Xeon Processor X5667 4C 3.06 GHz 12 MB Cache 1333 MHz 95w (59Y5712)
• Intel Xeon Processor X5670 6C 2.93 GHz 12 MB Cache 1333 MHz 95w (59Y5711)
• Intel Xeon Processor X5660 6C 2.80 GHz 12 MB Cache 1333 MHz 95w (59Y5710)
• Intel Xeon Processor X5650 6C 2.66 GHz 12 MB Cache 1333 MHz 95w (59Y5709)
• Intel Xeon Processor E5640 4C 2.66 GHz 12 MB Cache 1066 MHz 80w (59Y5708)
• Intel Xeon Processor E5630 4C 2.53 GHz 12 MB Cache 1066 MHz 80w (59Y5707)
• Intel Xeon Processor E5620 4C 2.40 GHz 12 MB Cache 1066 MHz 80w (59Y5705)
• Intel Xeon Processor L5640 6C 2.26 GHz 12 MB Cache 1333 MHz 60w (59Y5706)
• Intel Xeon Processor L5630 4C 2.13 GHz 12 MB Cache 1066 MHz 40w (59Y5704)
• Intel Xeon Processor L5609 4C 1.86 GHz 12 MB Cache 1066 MHz 40w (49Y5184)
• Intel Xeon Processor E5507 4C 2.26 GHz 4 MB Cache 800 MHz 80w (59Y5695)
• Intel Xeon Processor E5503 2C 2.00 GHz 4 MB Cache 800 MHz 80w (59Y5692)

Memory support

The following memory options are supported with BladeCenter HS22:

• 1 GB (1X1GB) Single Rank PC3-10600 CL9 ECC DDR3-1333 VLP Low Power RDIMM (44T1485)
• 2 GB (1X2GB) Single Rank PC3-10600 CL9 ECC DDR3-1333 VLP RDIMM (44T1487)
• 2 GB (1x2GB) Dual Rank PC3-10600 CL9 ECC DDR3-1333 VLP LP RDIMM (44T1486)
• 4 GB (1X4GB) Dual Rank PC3-10600 CL9 ECC DDR3-1333 VLP RDIMM (44T1488)
• 8 GB (1X8GB) Dual Rank PC3-8500 CL7 ECC DDR3-1066 VLP RDIMM (44T1579)
• 8 GB (1x8GB, Dual Rankx4) PC3-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM (46C7451)
• 2 GB (1x2 GB, 1Rx4, 1.35V) PC3L-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM (46C0561)
• 4 GB (1x4 GB, 2Rx4, 1.35V) PC3L-10600 CL9 ECC DDR3 1333 MHz VLP RDIMM (46C0567)
• 8 GB (1x8 GB, 2Rx4, 1.35V) PC3L-8500 CL7 ECC DDR3 1066 MHz VLP RDIMM (46C0569)

Power considerations

BladeCenter HS22 is supported in the BladeCenter chassis.

Note: Consult specific chassis announcements for more information on setup and redundancy.

Cable orders

Each BladeCenter HS22 blade contains two Gigabit Ethernet connections. An optional BladeCenter Gigabit Ethernet Switch Module must be installed in the BladeCenter to support external Ethernet connections.
Cabling is not included with the server. Consult the Ethernet Switch module documentation for external cabling requirements.

Installations using the BladeCenter Fibre Channel Switch Module require short- or long-wave small form factor pluggable (SFP) options and appropriate Fibre Channel cabling.

**Installability**

Each BladeCenter HS22 requires approximately 10 minutes for installation. Installation includes unpacking, setting up, and powering on the system. Additional time is required to install an operating system, additional options, or features.

**Packaging**

### BladeCenter HS22

<table>
<thead>
<tr>
<th>Product</th>
<th>Package description</th>
<th>Boxes</th>
</tr>
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<tbody>
<tr>
<td>BladeCenter HS22</td>
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<td></td>
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<tr>
<td></td>
<td>Safety flyer</td>
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</tr>
<tr>
<td></td>
<td>Standard form factor I/O Expansion card tray kit</td>
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</tbody>
</table>

The BladeCenter HS22 blades are shipped in a single package. The approximate shipping dimensions and weight are:

- Single pack dimensions: 60.32 x 33.4 x 15.57 cm (23.75 x 13.13 x 6.13 in)
- Single pack weight: 4.2 kg (9.2 lb)
- Intel Xeon processor
- Heat sink
- Installation publications and warranty

**Security, auditability, and control**

Security and auditability features include:

- A power-on password function helps provide control of who has access to the data and server setup program on the server.
- A set unattended boot mode allows the system keyboard to be locked to all entries except the password and at the same time allows other computers on the network to access the system disk drive.
- A selectable boot sequence can be used to help prevent unauthorized installation of software or removal of data from the diskette drive.

The BladeCenter HS22 blades have no security intrusion detection. Therefore, they should be installed in a rack environment that provides security through lockable doors or other security measures. It is the client’s responsibility to ensure that the server is secure to protect sensitive data.

The customer is responsible for evaluation, selection, and implementation of security features, administrative procedures, and appropriate controls in application systems and communications facilities.
Global Technology Services

Contact your IBM representative for the list of selected services available in your country, either as standard or customized offerings, for the efficient installation, implementation, and/or integration of this product.

IBM Electronic Services

IBM has transformed its delivery of hardware and software support services to help you achieve higher system availability. Electronic Services is a Web-enabled solution that offers an exclusive, no-additional-charge enhancement to the service and support available for IBM servers. These services are designed to provide the opportunity for greater system availability with faster problem resolution and preemptive monitoring. Electronic Services comprises two separate, but complementary, elements: Electronic Services news page and Electronic Services Agent.

The Electronic Services news page is a single Internet entry point that replaces the multiple entry points traditionally used to access IBM Internet services and support. The news page enables you to gain easier access to IBM resources for assistance in resolving technical problems.

The Electronic Service Agent™ is no-additional-charge software that resides on your server. It monitors events and transmits system inventory information to IBM on a periodic, client-defined timetable. The Electronic Service Agent automatically reports hardware problems to IBM. Early knowledge about potential problems enables IBM to deliver proactive service that may result in higher system availability and performance. In addition, information collected through the Service Agent is made available to IBM service support representatives when they help answer your questions or diagnose problems. Installation and use of IBM Electronic Service Agent for problem reporting enables IBM to provide better support and service for your IBM server.

To learn how Electronic Services can work for you, visit

http://www.ibm.com/support/electronic

Terms and conditions

Warranty period

- Three years
- Optional features - One year

Optional IBM features initially installed in an IBM machine carry the same warranty period as the machine. If installed after the initial machine installation, they carry the balance of the machine warranty or the optional feature warranty, whichever is greater.

The following have been designated as consumables or supply items and are, therefore, not covered by this warranty:

- Battery

Warranty service

If required, IBM provides repair or exchange service, depending on the type of warranty service specified below for the machine. IBM will attempt to resolve your problem over the telephone or electronically by access to an IBM Web site. Certain machines contain remote support capabilities for direct problem reporting, remote problem determination, and resolution with IBM. You must follow the problem determination and resolution procedures that IBM specifies. Following problem
determination, if IBM determines On-site Service is required, scheduling of service will depend upon the time of your call, machine technology and redundancy, and availability of parts. Service levels are response-time objectives and are not guaranteed. The specified level of warranty service may not be available in all worldwide locations. Additional charges may apply outside IBM's normal service area. Contact your local IBM representative or your reseller for country- and location-specific information.

The type of service is Customer Replaceable Unit (for example, keyboard, mouse, speaker, memory, or hard disk drive) Service and On-site Service.

**Customer Replaceable Unit (CRU) Service**

IBM provides a replacement CRU to you for you to install. CRU information and replacement instructions are shipped with your machine and are available from IBM at any time on your request. A CRU is designated as being either a Tier 1 (mandatory) or a Tier 2 (optional) CRU. Installation of Tier 1 CRUs, as specified in this announcement, is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation. You may install a Tier 2 CRU yourself or request IBM to install it, at no additional charge, under the type of warranty service specified below, On-site Service.

Based upon availability, a CRU will be shipped for next business day (NBD) delivery. IBM specifies in the materials shipped with a replacement CRU whether a defective CRU must be returned to IBM. When return is required, return instructions and a container are shipped with the replacement CRU, and you may be charged for the replacement CRU if IBM does not receive the defective CRU within 15 days of your receipt of the replacement.

The following parts have been designated as Tier 1 CRUs:

- Blank filler
- Cable-management arm
- Hard disk drive
- Lift handle kit
- Memory DIMM
- Memory expansion card
- PCI adapter
- PCI divider
- Service label
- Service processor
- System label
- Top cover
- Voltage regulator module

**On-site Service**

This provides On-site Repair, 9 hours per day, Monday through Friday excluding holidays, NBD response. IBM or your reseller will repair the failing machine at your location and verify its operation. You must provide a suitable working area to allow disassembly and reassembly of the IBM machine. The area must be clean, well lit, and suitable for the purpose. On-site Service is not available in all countries, and some countries have kilometer or mileage limitations from an IBM service center. In those locations where On-site Service is not available, the normal in-country service delivery is used.

**International Warranty Service**

International Warranty Service (IWS) is available in selected countries or regions.
The warranty service type and the service level provided in the servicing country may be different from that provided in the country in which the machine was purchased.

Under IWS, warranty service will be provided with the prevailing warranty service type and service level available for the IWS-eligible machine type in the servicing country, and the warranty period observed will be that of the country in which the machine was purchased.

To determine the eligibility of your machine and to view a list of countries where service is available, visit


For more information on IWS, refer to Services Announcement ZS01-0168, dated September 25, 2001.

**Licensing**

Programs included with this product are licensed under the terms and conditions of the License Agreements that are shipped with the system.

**IBM hourly service rate classification**

Two

**Field-installable features**

Yes

**Model conversions**

No

**Machine installation**

Customer setup. Customers are responsible for installation according to the instructions IBM provides with the machine.

**Licensed machine code**

IBM Machine Code is licensed for use by a customer on the IBM machine for which it was provided by IBM under the terms and conditions of the IBM License Agreement for Machine Code, to enable the machine to function in accordance with its specifications, and only for the capacity authorized by IBM and acquired by the customer. You can obtain the agreement by contacting your IBM representative or visiting


IBM may release changes to the Machine Code. IBM plans to make the Machine Code changes available for download from the IBM System x technical support Web site

http://www-304.ibm.com/systems/support/

If the machine does not function as warranted and your problem can be resolved through your application of downloadable Machine Code, you are responsible for downloading and installing these designated Machine Code changes as IBM specifies. If you would prefer, you may request IBM to install downloadable Machine Code changes; however, you may be charged for that service.
For all local charges, contact your IBM representative.

**ServicePac service upgrades**

The announced products are also eligible for ServicePac® warranty upgrades. ServicePacs provide a higher level of service than that provided under the base IBM Machine Warranty.

ServicePacs can be purchased from your IBM Business Partner and are specific to the machines/products listed.

<table>
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<tr>
<th>ServicePac Offering</th>
<th>PC No</th>
<th>Ordering Part Number</th>
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<tr>
<td>3yr On-site Repair 9hr x 5 days 4hr Resp Target</td>
<td>PC1080 e-ServicePac</td>
<td>65Y5227 (2)</td>
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<tr>
<td>3yr On-site Repair 24hr x 7 days 4hr Resp Target</td>
<td>PC1081 e-ServicePac</td>
<td>65Y5228 (2)</td>
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<td>3yr On-site Repair 24hr x 7 days 6hr Committed Service</td>
<td>PC502 e-ServicePac</td>
<td>41W9356 (4)</td>
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<td>3yr On-site Repair 24hr x 7 days 6hr Committed Service</td>
<td>PC935 e-ServicePac</td>
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<td>3yr On-site Repair 9hr x 5 days NBD Comm Parts</td>
<td>PC1013 e-ServicePac</td>
<td>65Y0980 (Russia only)</td>
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**Announcement Countries for ServicePacs**

Announcement is restricted to the following countries:

- Austria
- Belgium
- Bulgaria
- Croatia
- Czech Rep
- Denmark
- Egypt
- Finland
- France (1)
- Germany
- Greece
- Hungary
- Ireland
- Israel
- Italy
- Luxembourg
- Netherlands
- Norway
- Pakistan
- Poland
- Portugal
- Romania
- Russia (2)
- S. Africa
- Serbia
- Slovakia
- Slovenia
- Spain
- Sweden
- Switzerland
- Turkey
- UK (3)
- Ukraine

(1) Except overseas Territories
Maintenance

The products in this document are also covered by Maintenance Agreements and ServiceSuite™ contracts.

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