New IBM System Storage DCS3700 controller delivers high performance and efficiency

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At a glance

The IBM® DCS3700 Storage System includes the following base features:

- 4U, 19-inch rack mount enclosure
- Two intelligent array controllers with 16 GB cache (8 GB per controller)
- Four 12 GB SAS host interface ports (two per controller)
- Four 6 GB SAS ports for attachment of an DCS3700 Expansion Unit (two per controller)
- Four Ethernet ports for system management (two per controller)
- Sixty bays for SAS drives
- Two ac power supplies and two cooling units

DCS3700 also delivers the following functions at no additional cost:

- RAID levels 0, 1, 3, 5, 6, 10 and Dynamic Disk Pooling (DDP)
- 512 Storage partitions
- Host attachment support for Linux™ on x86 architecture
- IBM DS Storage Manager for administrative and management activities
- Support for 180 drives through attachment of two DCS3700 Expansion Units
- Support for up to 24 SSDs in a complete DCS3700 system configuration

As an additional premium feature option, the DCS3700 includes performance read cache which enables the utilization of SSDs for accelerating reads from the storage, helping to increase performance of the disk system for certain workloads.

Overview

The DCS3700 storage system delivers reliability and capacity in a very dense form factor, helping to address the need for streaming data and extreme capacity in a small footprint.

DCS3700 is an affordable storage platform capable of supporting up to 60 drives within a slim 4U enclosure. A complete DCS3700 system configuration consists of one DCS3700 controller and two expansion units. Since each DCS3700 Expansion unit supports 60 drives, a complete DCS3700 system (one controller unit and two expansions) can scale up to 180 drives.
With 6 TB high-capacity nearline SAS disk drives, the DCS3700 can deliver up to 1.08 PB of physical capacity within a 12U space. The controller and the expansion unit support intermixing of SSD, high-performance SAS, and nearline SAS drives. A DCS3700 storage system can support a maximum of 24 SSDs.

As standard features, the DCS3700 offers 16 GB of memory cache and four 12 Gbps SAS ports for host connectivity. The DCS3700 also offers the following options:

- Four or eight 12 Gbps SAS ports per optional host interface card
- Four or eight 16 Gbps Fibre Channel ports per optional host interface card (includes four or eight 16 Gb shortwave small form-factor pluggable transceivers)
- Four or eight 10 Gbps iSCSI ports per optional host interface card ((includes four or eight 16 Gb shortwave small form-factor pluggable transceivers)
- Performance read cache to enable the utilization of SSDs for accelerating reads from storage, helping to increase performance for analytics and high performance computing environments

In order to ensure data integrity, the DCS3700 delivers flexible levels of RAID protection (0, 1, 3, 5, 6 and 10), and includes DDP for simplified installation, greater data protection, and more consistent performance than traditional RAID options.

**Key prerequisites**

None

**Planned availability date**

June 5, 2015

**Description**

The era of big data is here, driven by the need for more data and faster data access. Low-latency performance in applications such as real-time business analytics, life sciences research, rich-media entertainment, weather forecasting, social media feeds and stock market transactions require high-performance storage architectures. In addition, today's organizations need ways to improve operational efficiency while maintaining the same data center footprint, quality of service, and high availability.

IBM System Storage (R) DCS3700 is ready to meet these challenges. Designed for applications with high-performance streaming data requirements, the DCS3700 system offers optimal space utilization, low power consumption, and high performance. By combining proven IBM storage controllers with up to 60 drives in just 4U of rack space, the DCS3700 system can reduce operational costs for capacity-intensive applications.

IBM System Storage DCS3700 highlights include:

- Fast, highly available, dense storage capabilities at an affordable price
- Simplified data protection management and automated recovery with DDP
- Improved backup and restore capabilities with enhanced IBM FlashCopy(R) technology
- Solid uptime and massive scalability
- Data integrity with support for the T10 Protection Information (T10 PI) standard
- Management expertise built into intuitive and powerful storage management software
- Optimized flow and management of large, file-based data while retaining easy access of data when combined with IBM Spectrum(TM) Scale
• Superior serviceability and easy installation with front-load, 12-drive drawers that can be extended while the drives remain active, allowing for individual drive replacement without affecting the operation of other drives.
• Multi-level data protection with IBM Enhanced FlashCopy, Volume Copy and optional disaster-recovery features across Fibre Channel or IP networks.
• Energy cost savings with a high-density enclosure, power supplies designed with multiple efficiency standards, and variable-speed fans.
• Overall operation and acquisition cost reduction with mixed host interfaces that support IBM DB2(R) Administration Server and SAN tiering.
• Support for low-power, highly reliable and high-performance solid-state drives (SSDs).

The outstanding features of the DCS3700 storage system deliver a cost-effective, fully integrated complement to IBM Power Systems(TM) servers for a wide variety of intensive computing environments.

• Increased performance: The DCS3700 system provides a simple, efficient, and flexible approach to storage that is based on eight generations of design knowledge and firmware development. Key design features include increased processor speeds and larger cache memory capacities for use in both general-purpose and high-performance computing environments.

• Intuitive storage management: IBM System Storage DS(R) Storage Manager software combines robustness with ease of use, two attributes not commonly found together in entry to midrange storage systems. With its industry-unique dynamic capabilities and intuitive graphical user interface, System Storage DS Storage Manager supports immediate reconfiguration without interrupting storage system input/output (I/O). For highly secure implementations, administrators can also use password settings to designate the users who can monitor the system, but are unauthorized to make any changes.

• Simplified data protection: With DDP technology, DS Storage Manager dramatically simplifies data protection setup and can virtually eliminate the need for unscheduled drive maintenance. DDP is a self-healing data protection technology that eliminates the need for complex RAID calculations, fully utilizing all of the disk drives in the array to deliver consistent system performance.

• Integrated DS Storage Manager: In addition to DDP, DS Storage Manager has fully integrated features that allow administrators to choose the method that best meets their data utilization and protection requirements:
  - IBM Enhanced FlashCopy: Creates near-instantaneous, capacity-efficient, point-in-time volume images that provide logical volumes for such uses as file restoration and backup.
  - Volume Copy: Creates a complete physical copy, or clone, of a volume within a storage system, and can be assigned to any host and used for application testing or development, information analysis, or data mining.
  - Thin provisioning with DDP: Helps to create the appearance of more disk space than is actually available which helps to consume less space and offers the flexibility to increase disk space as data grows.
  - Support for up to 512 partitions: Enables effective consolidation and virtualization.

• Unrelenting performance: DCS3700 delivers up to 2,100 MBps and 210,000 I/O operations per second (IOPS) in sustained drive reads. It is capable of delivering throughput to bandwidth-intensive applications providing IOPS to transactional applications such as databases and Microsoft(TM) Exchange. Using the multithreaded Redundant Disk Array Controller failover feature, the DCS3700 system can also improve performance by removing the bottlenecks common on single-threaded systems.

• Drive density: Built on a powerful hardware platform, the DCS3700 system features a 2.13 GHz dual-core processor and supports 16 GB cache/controller pairs with four 12 Gbps SAS ports, an additional four or eight 12 Gbps SAS ports, four or eight 16 Gbps Fibre Channel host ports, and four or eight 10 Gbps iSCSI. Drive density increases with up to 180 drives per system to deliver up to 1.08 PB of raw capacity in only 12U.
• **Cost-effective configuration:** The DCS3700 system can be cost-effectively configured to match drives to data requirements using target devices such as high speed SAS drives, NL-SAS drives, and SSDs. The DCS3700 system will automatically copy hot data into SSD cache in real time to improve application performance with the Performance Read Cache option.

• **Constant uptime:** The DCS3700 storage system ensures not only high-speed data access, but continuous access to the data as well. It carries on the IBM legacy of high-availability system design with redundant components, automated path failover, and extensive online administration capabilities that maximize computational efficiency and productivity, ensuring there is virtually no single point of failure. This design helps keep these environments universally productive. DDP technology is standard on the DCS3700 system and virtually eliminates maintenance worries by self-tuning, rebalancing data, and maintaining consistent performance even during drive failures.

• **High-capacity solution:** Today's storage demands not only call for performance and uptime, but also require solutions to keep up with continuous growth and meet the most demanding capacity requirements. The DCS3700 storage system can support an additional two DCS3700 expansion units for a total of 180 drives in just 12U rack space. With support for up 6 TB capacity-optimized nearline SAS drives, the DCS3700 system delivers up to 1.08 PB when storage requirements call for this additional scalability.

• **Reduction in power consumption:** As energy costs continue to rise, so does the demand to reduce power consumption. It offers power supplies designed to meet multiple efficiency standards and variable speed fans to help lower overall energy expenditures. With 60 drives housed in just 4U of rack space, the DCS3700 storage system has been optimized for maximum storage density, reducing its overall storage footprint. SSDs with low-power usage, high reliability, and high performance further help to improve system efficiency.

• **VMware and heterogeneous operating system support:** The DCS3700 storage system offers the scalability, availability, and integration necessary to power VMware implementations of all sizes. Its heterogeneous operating system support provides flexibility to manage a wide range of storage needs. It also includes support for VMware vSphere application programming interface (API) for array integration. Two application-aware plug-ins enable vCenter and Storage Replication Adapter for efficient management.

• **T10 Protection Information:** By enabling T10 PI between the storage controller and its disk drives, administrators can help ensure data integrity at the drive level. T10 PI requires the use of PI-formatted disk drives. The drives are formatted at 520 bytes per sector, with 512 bytes for user data and 8 bytes for integrity metadata. The drives can be used with or without the T10 PI function enabled, and can be intermixed within a storage enclosure or across storage systems with non-PI formatted drives. T10 PI can be used with any RAID level. To use the T10 PI function, all drives within the RAID array must be PI-formatted drives.

• **Distributed, enterprise-wide, file-based storage:** When combined with IBM Spectrum Scale, the DCS3700 system becomes a holistic, policy-driven, shared-disk file management solution that can deliver faster, more reliable access to a common set of file-based data. IBM Spectrum Scale is designed for advanced business analytics, big data, and technical computing applications that require application access to very large data files or very large numbers of data files. It is the ideal companion for the DCS3700 storage system.

Optional premium features deliver enhanced capabilities for DCS3700:

• **Disaster recovery option:** Enables 16 enhanced remote mirrors and 128 enhanced global mirrors, and offers multiple options for disaster-recovery deployment to support replication over IP or Fibre Channel.

• **Copy services option:** Enables 2,048 FlashCopy images.

• **Performance Read Cache option:** Utilizes solid-state drives (SSDs) as a level-two data cache, significantly improving read performance from spinning media.

• **Super key option:** Combines all of these features into one single key for easy deployment and management.
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<th>Product number</th>
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<tr>
<td><strong>Description</strong></td>
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<tr>
<td>Advanced Function</td>
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<tr>
<td>Performance Read Cache</td>
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<tr>
<td>Disaster Recovery Option</td>
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<td>Copy Services Option</td>
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<td>Super Key Option</td>
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**Publications**

No publications are shipped with this option. Refer to the publications that shipped with your base system for information.

Publications and product documentation are available at the IBM System Storage Support site

http://www.ibm.com/systems/support/storage/
The following publications are available for the DS3700 at the IBM System Storage Support site:

- **IBM System Storage DCS3700 Quick Start Guide**
- **IBM System Storage DCS3700 Installation, User's, and Maintenance Guide**
- **IBM System Storage DS<sup>(R)</sup> Storage Manager Version 11.2 Installation and Host Support Guide**
- **IBM System Storage DS Storage Manager Version 11.2 Command Line Interface and Script Commands Programming Guide**
- **IBM System Storage DS Storage Manager Version 11.2 Copy Services User's Guide**

The IBM Publications Center Portal is located at


The Publications Center is a worldwide central repository for IBM product publications and marketing material with a catalog of 70,000 items. Extensive search facilities are provided. A large number of publications are available online in various file formats, which can currently be downloaded.

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**Services**

**Global Technology Services**

IBM services include business consulting, outsourcing, hosting services, applications, and other technology management.

These services help you learn about, plan, install, manage, or optimize your IT infrastructure to be an on-demand business. They can help you integrate your high-speed networks, storage systems, application servers, wireless protocols, and an array of platforms, middleware, and communications software for IBM and many non-IBM offerings. IBM is your one-stop shop for IT support needs.

For details on available services, contact your IBM representative or visit


For details on available IBM Business Continuity and Recovery Services, contact your IBM representative or visit


For details on education offerings related to specific products, visit


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**Technical information**

**Specified operating environment**

**Physical specifications**

- **Width:** 48.3 cm (19.0 in)
- **Depth:** 86.6 cm (34.1 in)
- **Height:** 17.6 cm (6.93 in)

Fully configured approximate weight:

- **DCS3700 Storage System:** 103.16 Kg
To assure installability and serviceability in non-IBM industry-standard racks, review the installation planning information for any product-specific installation requirements.

**Operating environment**

**Air temperature:**
- Operating: 10°C to 35°C (50°F to 95°F) to 1000 m (3280 ft) above sea level
- Storage: -10°C to 65°C (14°F to 149°F)
- Transit: -40°C to 65°C (-40°F to 149°F)

**Relative humidity:**
- Operating: 20% to 80%
- Storage: 10% to 90%
- Transit: 5% to 95%

**Electrical power:**
- Voltage range: 200-240 V ac
- Frequency: 50-60 Hz
- Power:
  - DCS3700 Storage System: 1,108.6 watts
  - DCS3700 Expansion Unit: 802 watts

**Heat dissipation (BTU per hour):**
- DCS3700 Storage System: 3,791
- DCS3700 Expansion Unit: 2,736

**Acoustical noise emission:**
- Sound power: 7.2 bels

**Homologation**

This product is not certified for direct connection by any means whatsoever to interfaces of public telecommunications networks. Certification may be required by law prior to making any such connection. Contact an IBM representative or reseller for any questions.

**Hardware requirements**

The DCS3700 requires:
- IBM Storage Manager v11.2, or later
- Controller firmware level 8.2, or later

Refer to the DCS3700 product documentation and the IBM Systems Support site for additional information on firmware levels and other requirements

http://www.ibm.com/systems/support/storage/

**Compatibility**

Refer to the IBM System Storage Interoperation Center (SSIC) for a comprehensive list of supported environments, devices, and configurations

http://www.ibm.com/systems/support/storage/config/ssic
Planning information

Customer responsibilities

Physical configuration and installation planning are customer responsibilities. Refer to the IBM Systems Storage DCS3700 Installation, User’s, and Maintenance Guide for additional information.

You are responsible for downloading or obtaining from IBM, and installing designated Machine Code (microcode, basic input/output system code (called BIOS), utility programs, device drivers, and diagnostics delivered with an IBM machine) and other software updates in a timely manner from an IBM Internet website or from other electronic media, and following the instructions that IBM provides. You may request IBM to install Machine Code changes; however, you may be charged for that service.

Cable orders

Host attachment cables are required to connect DCS3700 host ports to server or fabric ports.

Expansion unit cables are required to connect an DCS3700 Expansion Unit to the DCS3700 Storage System or to another DCS3700 Expansion Unit.

As a convenience, a limited selection of cables can be ordered with your DCS3700. Refer to the Product number section for feature numbers.

For expansion attachment, the DCS3700 Controller units have four mSAS-HD ports while the expansion units have four mSAS ports. For this reason, four mSAS-HD to mSAS cables are required for the first DCS3700 expansion enclosure with two mSAS cables required for any additional DCS3700 expansion units.

To utilize expansion attachment, the following SAS cables can be ordered with your DCS3700 controller units:

- 1.5 m SAS cable (mSAS HD to mSAS) (Feature ACSB)
- 3 m SAS cable (mSAS HD to mSAS) (Feature ACSC)

To connect expansion units with existing controllers or to other expansion units, the following SAS cables can be ordered with your DCS3700 Expansion units:

- 1.5 m SAS cable (mSAS HD to mSAS) (Feature ACSB)
- 3 m SAS cable (mSAS HD to mSAS) (Feature ACSC)
- 1 m SAS cable (Feature 3708)
- 3 m SAS cable (Feature 3707)

Refer to Hardware Announcement ZG11-0160, dated May 24, 2011, for complete information about the DCS3700 Expansion unit.

To utilize host attachment consider the following guidelines:

- 16 Gb FC and 8 Gb FC: The DCS3700 requires a 50.0/125 micrometer fiber optic cable terminated with an LC Duplex connector. For FC host connectivity, the following cables can be ordered with the DCS3700 control enclosure model:
  - Fiber Cable, 1 m multimode LC-LC
  - Fiber Cable, 5 m multimode LC-LC
  - OM3 Fiber Optic Cable LC/LC 10 m

- 10 Gb iSCSI: DCS3700 requires a 10GBASE-SR cable terminated with an LC Duplex connector. For iSCSI connectivity, the following cables can be ordered with the DCS3700 control enclosure model:
  - OM3 Fiber Optic Cable LC/LC 10 m
• A 50.0/125 micrometer fiber optic cable can also be used, subject to distance
limitations. An OM3 cable is strongly recommended for use with 10 Gb iSCSI.
• 12 Gb SAS: DCS3700 requires a mSAS HD cable terminated with a SFF-8644
connector. For SAS connectivity, the following cables can be ordered with the
DCS3700 control enclosure model:
  – 1.5 m SAS cable (mSAS HD to mSAS)
  – 3 m SAS cable (mSAS HD to mSAS)
  – 1.5 m SAS cable (mSAS HD to mSAS HD)
  – 3 m SAS cable (mSAS HD to mSAS HD)

Management cables are required if the DCS3700 configuration will be managed
out of band using the 1 Gb Ethernet management ports. The DCS3700 requires
a Category 5 or a higher grade Ethernet cable terminated with a 8P8C modular
connector (RJ45 compatible connector). This cable must be supplied by the
customer and is not available for ordering with your DCS3700.

Security, auditability, and control

This product uses the security and auditability features of host hardware, host
software, and application software.

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

Volume orders

Contact your IBM representative.

Products - terms and conditions

Warranty period

One year

An IBM part or feature installed during the initial installation of an IBM machine is subject to a full warranty effective on the date of installation of the machine. An IBM part or feature that replaces a previously installed part or feature assumes the remainder of the warranty period for the replaced part or feature. An IBM part or feature added to a machine without replacing a previously installed part or feature is subject to a full warranty effective on its date of installation. Unless specified otherwise, the warranty period, type of warranty service, and service level of a part or feature are the same as those for the machine in which it is installed.

Warranty service

If required, IBM provides repair or exchange service depending on the types of warranty service specified for the machine. IBM will attempt to resolve your problem over the telephone, or electronically via an IBM website. 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. If applicable to your product, parts considered Customer Replaceable Units (CRUs) will be provided as part of the machine's standard warranty service.

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-specific and location-specific information.

CRU Service

IBM provides replacement CRUs to you for you to install. CRU information and replacement instructions are shipped with your machine and are available from IBM upon your request. CRUs are designated as being either a Tier 1 (mandatory) or a Tier 2 (optional) CRU.

Tier 1 (mandatory) 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.

Tier 2 (optional) CRU

You may install a Tier 2 CRU yourself or request IBM to install it, at no additional charge.

Based upon availability, CRUs 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. 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:

None

CRU and On-site Service
At IBM's discretion, you will receive specified CRU service, or IBM 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.

Service level is:

- 24 hours per day, 7 days a week, 6 hour average, same day response.

Non-IBM parts service

Warranty service

IBM is now shipping machines with selected non-IBM parts that contain an IBM field replaceable unit (FRU) part number label. These parts are to be serviced during the IBM machine warranty period. IBM is covering the service on these selected non-IBM parts as an accommodation to their customers, and normal warranty service procedures for the IBM machine apply.

Warranty service upgrades

During the warranty period, warranty service upgrades provide an enhanced level of On-site Service for an additional charge. Service levels are response-time objectives and are not guaranteed. See the Warranty services section for additional details.

IBM will attempt to resolve your problem over the telephone or electronically by access to an IBM website. 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.

Maintenance service options

CRU and On-site Service
At IBM's discretion you will receive CRU service or IBM 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. The following on-site response-time objectives are available as warranty service upgrades for your machine. Available offerings are:

- 9 hours per day, Monday through Friday, excluding public or national holidays, same business day response. Calls must be received by 12:00 local time in order to qualify for same business day response.
- 18 hours per day, Monday through Saturday, excluding public or national holidays, same business day response. Calls must be received by 18:00 local time in order to qualify for same business day response.
- 24 hours per day, 7 days a week, 6 hour average, same day response.

ESA and SSU customers: 2 hour coverage extension at no additional charge, 9 hours per day, Monday through Friday, excluding holidays, same business day response. Calls must be received by 12:00 local time in order to qualify for same business day response.

Customer Replaceable Units (CRUs) may be provided as part of the machine's standard warranty CRU Service except that you may install a CRU yourself or request IBM installation, at no additional charge, under the CRU and On-site Service
level specified above. For additional information on the CRU Service, see the warranty information.

**Maintenance services**

If required, IBM provides repair or exchange service depending on the types of maintenance service specified for the machine. IBM will attempt to resolve your problem over the telephone or electronically, via an IBM website. 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 maintenance 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-specific and location-specific information. The following service selections are available as maintenance options for your machine type.

**Non-IBM parts service**

Under certain conditions, IBM provides services for selected non-IBM parts at no additional charge for machines that are covered under warranty service upgrades or maintenance services.

This service includes hardware problem determination (PD) on the non-IBM parts (for example, adapter cards, PCMCIA cards, disk drives, memory) installed within IBM machines and provides the labor to replace the failing parts at no additional charge.

If IBM has a Technical Service Agreement with the manufacturer of the failing part, or if the failing part is an accommodations part (a part with an IBM FRU label), IBM may also source and replace the failing part at no additional charge. For all other non-IBM parts, customers are responsible for sourcing the parts. Installation labor is provided at no additional charge, if the machine is covered under a warranty service upgrade or a maintenance service.

**Usage plan machine**

No

**IBM hourly service rate classification**

Two

When a type of service involves the exchange of a machine part, the replacement may not be new, but will be in good working order.

**Maintenance service offerings**

These machines are eligible under terms and conditions of IBM ServiceElite, the IBM Enterprise Service Agreement (ESA), or the IBM Maintenance Agreement. Consult your IBM representative for details.

**General terms and conditions**

**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.

Graduated program license charges apply
No

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 at


Machine using LMC Type Model
Access to Machine Code updates is conditioned on entitlement and license validation in accordance with IBM policy and practice. IBM may verify entitlement through customer number, serial number, electronic restrictions, or any other means or methods employed by IBM in its discretion.

You may also obtain updated code by contacting your IBM representative.

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.

Prices

For all local charges, contact your IBM representative.

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