



## IBM Storwize V5000 for Lenovo Product Guide

IBM Storwize V5000 for Lenovo (Machine Type 6194) is a highly flexible, easy to use virtualized storage system that enables midsize organizations to meet the challenges of rapid data growth and limited IT budgets. As an intermediate Storwize family offering, Storwize V5000 enables organizations to consolidate and provide new capabilities to their infrastructures.

Storwize V5000 control enclosure models include two node canisters, each with 8 GB cache for a system total of 16 GB cache. Standard is 6 Gb SAS and 1 Gb iSCSI connectivity, with an option for 8 Gb Fibre Channel (FC) or 10 iSCSI or Fibre Channel over Ethernet (FCoE) connectivity.

The LFF enclosure models support up to 12 3.5-inch drives, while the small form factor (SFF) enclosure models support up to 24 2.5-inch drives. High-performance disk drives, high-capacity nearline disk drives, and flash (solid-state drives [SSDs]) are supported. Drives of the same form factor can be intermixed within an enclosure, which provides the flexibility to address performance and capacity needs within a single enclosure. You can also intermix large form factor (LFF) and SFF expansion enclosures behind an LFF or SFF control enclosure.

A Storwize V5000 system scales up to 480 drives with the attachment of up to 19 Storwize V5000 expansion enclosures. All Storwize V5000 functional capabilities are provided through IBM Storwize Family Software for Storwize V5000. The Storwize V5000 SFF enclosure is shown in the following figure.



Figure 1. Storwize V5000 SFF enclosure

### Did you know?

A single Storwize V5000 system can be scaled up to 1.92 PB of raw storage capacity. With external virtualization, the system can manage up to 32 PB in total.

Storwize V5000 offers hybrid block storage connectivity with support for 6 Gb SAS, 1 Gb iSCSI, and 10 Gb iSCSI or FCoE or 8 Gb FC at the same time.

Storwize V5000 systems can be clustered to help deliver greater performance, bandwidth, and scalability. A Storwize V5000 clustered system can contain two Storwize V5000 systems and up to 960 drives.

Storwize V5000 for Lenovo includes three years of Software Subscription and Support.

## Key features

**Note:** Storwize V5000 functional capabilities that are described in this product guide are based on the IBM Spectrum Virtualize Software for Storwize V5000 version 7.6.

The Storwize V5000 storage system provides the following features:

- Scalable enterprise storage with a dual active/active intelligent array node canisters with 8 GB cache each for high availability and performance.
- Flexible host connectivity to match diverse client needs with support for a mix of 6 Gb SAS, 1 Gb iSCSI, and 10 Gb iSCSI or FCoE or 8 Gb FC connectivity at the same time.
- A 6 Gb SAS drive-side connectivity with support for 12x 3.5-inch LFF or 24x 2.5-inch SFF drives in the control enclosure, which are scalable up to 240 LFF drives per system with the attachment of Storwize V5000 LFF Expansion Enclosure (12x LFF drives each) or up to 480 SFF drives per system with the attachment of Storwize V5000 SFF Expansion Enclosure (24x SFF drives each) to satisfy growing needs for storage capacity and performance.
- With two-way system clustering, the size of the system can be doubled to a maximum of 960 drives.
- Further scalability can be achieved with virtualization of external storage. When Storwize V5000 virtualizes an external disk system, capacity in the external system inherits the functional richness and ease of use of Storwize V5000.
- Flexibility in storing data on high-performance SAS SSDs, performance-optimized enterprise SAS hard disk drives (HDDs), or capacity-optimized enterprise NL SAS HDDs; mixing and matching drive types and form factors within a single system to perfectly meet performance and capacity requirements for various workloads.
- Storwize V5000 combines various IBM technologies, including thin provisioning, automated tiering, external and internal storage virtualization, clustering, replication and multiprotocol support.
- VMware vSphere Virtual Volumes (VVol) integration brings advanced storage management functions to the virtual machine level for finer VM storage service level control and policy-driven automation.

**Note:** VVol integration feature requires IBM Spectrum Control Base Edition for Lenovo that can be downloaded from <http://www.ibm.com/support/fixcentral>.

- Intuitive, web-based next-generation GUI for easy system set up and management.
- Extensive interoperability with support for most major server platforms and operating systems.

The Storwize V5000 LFF enclosure is shown in the following figure.



Figure 2. Storwize V5000 LFF enclosure

The Storwize V5000 supports the complete range of data storage requirements, from highly used applications to high-capacity, low usage applications.

The following 2.5-inch drives are supported:

- High-performance SSDs: 200 GB, 400 GB, 800 GB, and 1.6 TB SAS
- Performance-optimized, enterprise class disk drives:
  - 300 GB and 600 GB 15K rpm SAS
  - 600 GB, 900 GB, 1.2 TB, and 1.8 TB 10K rpm SAS
- High-capacity, archival-class nearline disk drives: 1 TB and 2 TB 7.2K rpm NL SAS

The following 3.5-inch drives are supported:

- Performance-optimized, enterprise class disk drives:
  - 300 GB and 600 GB 15K rpm SAS
  - 900 GB, 1.2 TB, and 1.8 TB 10K rpm SAS
- High-capacity, archival-class nearline disk drives: 3 TB, 4 TB, 6 TB, and 8 TB 7.2K rpm NL SAS

All drives are dual-port and hot-swappable. Drives of the same form factor can be intermixed within the appropriate enclosure, which provides the flexibility to address performance and capacity needs within a single enclosure.

Up to 19 Storwize V5000 expansion enclosures are supported by a single Storwize V5000 control enclosure. You can intermix 3.5-inch and 2.5-inch expansion enclosures behind a 3.5-inch or 2.5-inch control enclosure. This configuration delivers the added flexibility to mix 3.5-inch and 2.5-inch drives within a single system.

More drives and expansion units are designed to be dynamically added with virtually no downtime, which helps to quickly and seamlessly respond to ever-growing capacity demands.

The V5000 storage system offers high levels of system and data availability with the following technologies:

- Dual-active, intelligent node canisters with mirrored cache
- Dual port drives with automatic drive failure detection and RAID rebuild with global hot spares
- Redundant hardware, including power supplies and fans
- Hot-swappable and customer replaceable components
- Automated path failover support for the data path between the server and the drives

The following functions are included with every Storwize V5000:

- RAID levels 0, 1, 5, 6, and 10  
Provides the flexibility to choose the level of data protection that is required.
- Distributed RAID 5 and 6 for internal storage  
Helps improve performance and availability with significantly faster rebuild time by allowing data to be distributed across more physical drives that are used simultaneously.
- Dual-system clustering  
Storwize V5000 systems can be clustered to help deliver greater performance, bandwidth, and scalability. A Storwize V5000 clustered system can contain two Storwize V5000 systems and up to 960 drives.
- HyperSwap for Spectrum Virtualize  
Provides dual-site, active-active access to a volume for high availability and disaster recovery configurations. With active-active relationships between the volume copies at each site, HyperSwap configurations can be used to maintain access to data on the system when site-wide failures or outages occur, using a flexible choice of host multipathing drivers.

**Note:** HyperSwap feature requires a Remote Mirroring license and a third site to host an FC- or IP-based quorum device for an automatic tie-break in the event of a potential link failure between the two main sites.

- Virtualization of internal storage  
Enables rapid, flexible provisioning and simple configuration changes.
- Thin provisioning  
Optimizes efficiency by allocating drive storage space in a flexible manner among multiple applications that is based on the minimum space that is required by each application at any time. With thin provisioning, applications use only the space they are actually using (not the total space that was allocated to them) which allows clients to purchase storage they need today and add storage as application requirements grow.
- One-way data migration  
Enables easy and nondisruptive moves of volumes from another storage system onto the Storwize V5000 Storage System by using FC or SAS connectivity.
- Embedded GUI  
Intuitive, web-based next-generation GUI for easy system set up and management.

The Storwize V5000 storage capabilities can be expanded with optional licensed functions. Each optional Storwize V5000 software license is required for each control enclosure, expansion enclosure, and externally virtualized enclosures.

The following optional licensed functions are available:

- Easy Tier  
Easy Tier provides a mechanism to seamlessly migrate frequently accessed data between three tiers of storage (Flash drives, SAS, NL SAS). This migration can be to different tiers of internal drives or to external storage systems that are virtualized by Storwize V5000.
- FlashCopy  
Enables creation of copies of data for backup, parallel processing, testing, and development and have the copies available almost immediately. Storwize V5000 supports up to 2,048 FlashCopy targets per system and up to 4,096 FlashCopy targets per cluster.
- Remote mirroring  
This feature provides storage system-based data replication by using synchronous or asynchronous data transfers over IP, FC, or FCoE communication links:

For ultimate flexibility, Storwize V5000 remote mirroring interoperates with any other Storwize family system, including Storwize V7000, Storwize V3700, and SAN Volume Controller.

- Metro Mirror maintains a fully synchronized copy at metropolitan distances (up to 300 km)
- Global Mirror operates asynchronously and helps maintain a copy at greater distances (up to 8000 km)

The remote mirroring licenses must be acquired for the primary (local) and secondary (remote) systems. If Storwize V5000 is mirrored to a system other than Storwize V5000, the other system must have the appropriate and applicable licenses for remote mirroring.

- External Virtualization  
This feature helps consolidate storage systems from various vendors that are connected into single FC networking. Storage administrator can manage and provision storage to applications from a single user interface and use a common set of advanced functions across all the storage systems under the control of Storwize V5000.

The Storwize V5000 supports the following management interfaces:

- Web-based graphical user interface (GUI) via HTTPS that requires only a supported browser (Microsoft Internet Explorer, Google Chrome, or Mozilla Firefox), so there is no need for a separate console or plug-in
- Command line interface (CLI) via SSH
- Storage Management Initiative Specification (SMI-S)
- SNMP and email notifications

### Components and connectors

The following figure shows the front of the Storwize V5000 SFF enclosure.

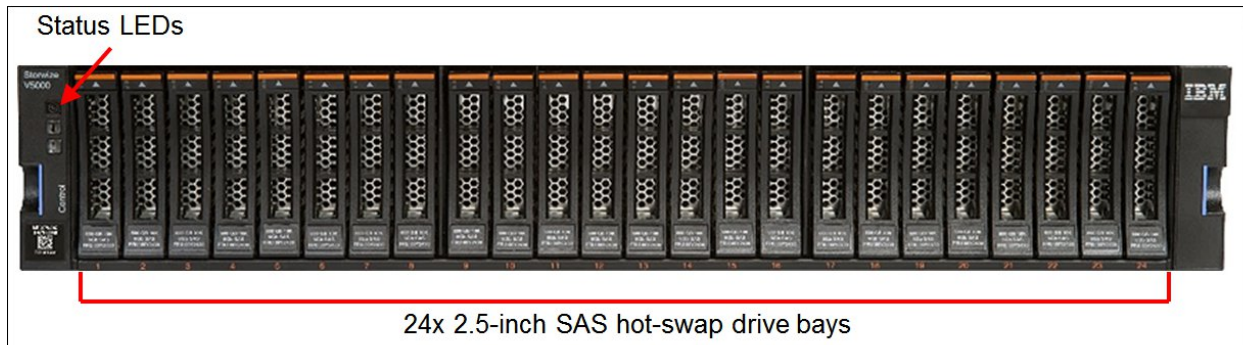


Figure 3. Front view of the Storwize V5000 SFF enclosure

The following figure shows the front of the Storwize V5000 LFF enclosure.



Figure 4. Front view of the Storwize V5000 LFF enclosure

The following figure shows the rear of the Storwize V5000 Control Enclosure.

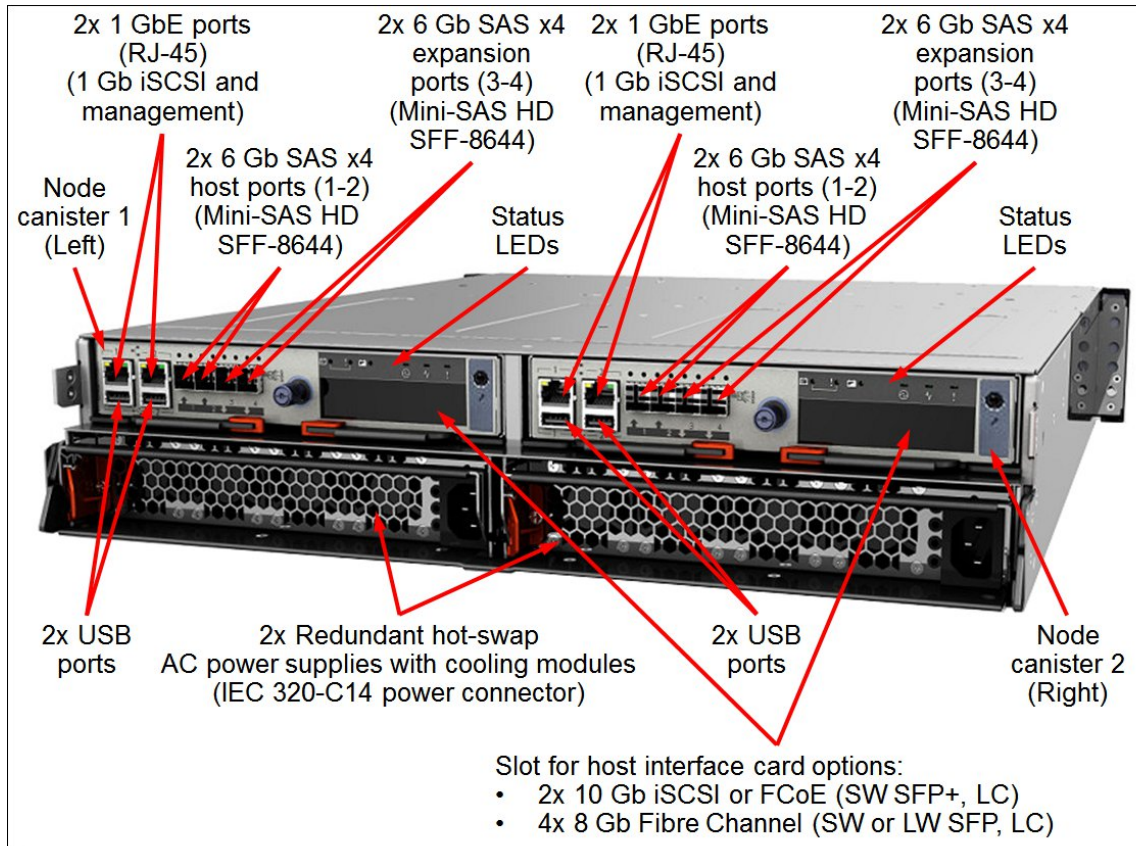


Figure 5. Rear view of the Storwize V5000 Control Enclosure

The following figure shows the rear of the Storwize V5000 Expansion Enclosure.

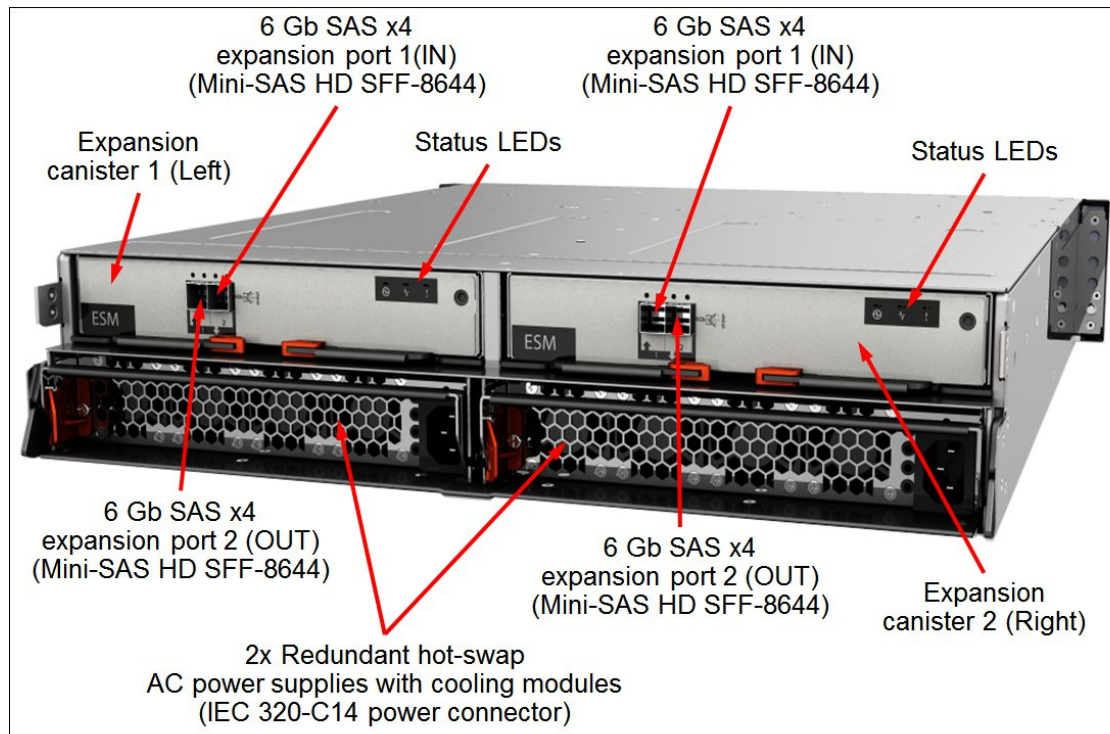


Figure 6. Rear view of the Storwize V5000 Expansion Enclosure

## System specifications

The following table lists the Storwize V5000 storage system specifications.

Table 1. System specifications

Components	Specification
Form factor	Storwize V5000 control enclosure: 2U rack mount Storwize V5000 expansion enclosure: 2U rack mount
Controller configuration	Dual controller (known as <i>node canister</i> ) configuration per control enclosure. Two control enclosures can be combined into a single Storwize V5000 clustered system (or cluster).
RAID levels	RAID 0, 1, 5, 6, and 10; Distributed RAID 5 and 6 (internal storage only)
Controller cache	16 GB per single system (8 GB per node canister); 32 GB per cluster. Battery-backed cache protection.
Drive bays	Up to 480 SFF drive bays per single system (up to 960 SFF drive bays per cluster): <ul style="list-style-type: none"> <li>• 24 SFF drive bays in the control enclosure</li> <li>• 24 SFF drive bays in the expansion enclosure; up to 19x expansion enclosures</li> </ul> Up to 240 LFF drive bays per single system (up to 480 LFF drive bays per cluster): <ul style="list-style-type: none"> <li>• 12 LFF drive bays in the control enclosure</li> <li>• 12 LFF drive bays in the expansion enclosure; up to 19x expansion enclosures</li> </ul> Intermix of SFF and LFF enclosures is supported.
Drive technology	SAS and NL SAS HDDs and SAS SSDs. Intermix of HDDs and SSDs is supported.

Components	Specification
Drive connectivity	<p>Dual-ported 6 Gb SAS drive attachment infrastructure.</p> <p>Control enclosure with two node canisters (ports per one node canister):</p> <ul style="list-style-type: none"> <li>• 24x 6 Gb SAS internal drive ports (SFF chassis)</li> <li>• 12x 6 Gb SAS internal drive ports (LFF chassis)</li> <li>• 2x 6 Gb SAS x4 (Mini-SAS SFF-8644) expansion port for the attachment of the external enclosures</li> </ul> <p>Expansion enclosure with two expansion canisters (ports per one expansion canister):</p> <ul style="list-style-type: none"> <li>• 24x 6 Gb SAS internal drive ports (SFF chassis)</li> <li>• 12x 6 Gb SAS internal drive ports (LFF chassis)</li> <li>• 2x 6 Gb SAS x4 (Mini-SAS SFF-8644) expansion ports (IN and OUT) for the daisy chained attachment of the external enclosures</li> </ul>
Drives	<p>SFF drives:</p> <ul style="list-style-type: none"> <li>• 200 GB, 400 GB, 800 GB, and 1.6 TB SAS SSDs</li> <li>• 300 GB and 600 GB 15K rpm SAS HDDs</li> <li>• 600 GB, 900 GB, 1.2 TB, and 1.8 TB 10K rpm SAS HDDs</li> <li>• 1 TB and 2 TB 7.2K rpm NL SAS HDDs</li> </ul> <p>LFF drives:</p> <ul style="list-style-type: none"> <li>• 300 GB and 600 GB 15K rpm SAS HDDs</li> <li>• 900 GB, 1.2 TB, and 1.8 TB 10K rpm SAS HDDs</li> <li>• 3 TB, 4 TB, 6 TB, and 8 TB 7.2K rpm NL SAS HDDs</li> </ul>
Storage capacity	<ul style="list-style-type: none"> <li>• Up to 1.92 PB (240x 8 TB NL SAS HDDs) per single system</li> <li>• Up to 3.84 PB (480x 8 TB NL SAS HDDs) per cluster</li> </ul>
Host connectivity	<p>Standard ports (per control enclosure with two node canisters):</p> <ul style="list-style-type: none"> <li>• 4x 6 Gb SAS host ports (Mini-SAS HD, SFF-8644) (2 ports per node canister)</li> <li>• 4x 1 Gb iSCSI host ports (UTP, RJ-45) (2 ports per node canister)</li> </ul> <p>Extra ports must be configured by selecting one of the following host port options (per control enclosure with two node canisters):</p> <ul style="list-style-type: none"> <li>• 4x 10 Gb iSCSI or FCoE SFP+ host ports (SW fiber optics, LC) (2 ports per node canister)</li> <li>• 8x 8 Gb FC SFP host ports (SW or LW fiber optics, LC) (4 ports per node canister)</li> </ul>
Host operating systems	<p>Microsoft Windows Server 2008 R2, 2012 and 2012 R2; Red Hat Enterprise Linux (RHEL) 5, 6, and 7; SUSE Linux Enterprise Server (SLES) 10, 11, and 12; VMware vSphere 5.0, 5.1, 5.5, and 6.0.</p>
Standard software features	<p>Virtualization of internal storage, Thin provisioning, One-way data migration, Dual-system clustering, HyperSwap (requires a Remote Mirroring license)</p>
Optional features	<p>Easy Tier, FlashCopy, Remote Mirroring, External Virtualization.</p>
Performance (single system)*	<ul style="list-style-type: none"> <li>• Up to 500,000 cache read IOPS</li> <li>• Up to 85,500 disk read IOPS</li> <li>• Up to 18,200 disk write IOPS</li> <li>• Up to 40,500 disk mixed (70% read/30% write) IOPS</li> <li>• Up to 5.7 GBps sequential cache read throughput</li> <li>• Up to 5.5 GBps sequential disk read throughput</li> <li>• Up to 2.4 GBps sequential disk write throughput</li> </ul>



Components	Specification
Configuration maximums**	Per one control enclosure / cluster (if different): <ul style="list-style-type: none"> <li>• Maximum storage capacity (including virtualized external storage): 32 PB</li> <li>• Maximum number of storage pools: 1,024</li> <li>• Maximum number of logical volumes: 2,048 / 4,096</li> <li>• Maximum logical volume size: 256 TB</li> <li>• Maximum number of drives in a RAID array: 16</li> <li>• Maximum number of drives in a distributed RAID array: 128 (including up to 4 spares)</li> <li>• Maximum number of RAID arrays: 128</li> <li>• Maximum number of distributed RAID arrays: 10 / 20</li> <li>• Maximum hot spare drives: No limit</li> <li>• Maximum number of host ports: 2,048 / 4,096</li> <li>• Maximum number of hosts: 256 / 512</li> <li>• Maximum number of host ports per one host: 32</li> <li>• Maximum number of snapshots: 2,048 / 4,096 (requires an optional license)</li> <li>• Maximum number of remote mirroring relationships: 2,048 / 4,096 (requires an optional license)</li> </ul>
Cooling	Redundant cooling with the fan modules that are built into power supplies.
Power supply	Two redundant hot-swap 800 W AC power supplies.
Hot-swap parts	Node canisters, expansion canisters, SFP/SFP+ transceivers, drives, power supplies with fans.
Management interfaces	2x 1 GbE ports (UTP, RJ-45) in a primary/redundant configuration. Web-based GUI; SSH CLI; SMI-S; SNMP and email notifications
Security features	Secure Socket Layer (SSL), Secure Shell (SSH), user level security, LDAP authentication
Warranty	Three-year customer-replaceable unit and onsite warranty with 9x5 next business day terms.
Service and support	Optional warranty service upgrades are available through Lenovo: 24x7 coverage, 2-hour or 4-hour response time, 1-year or 2-year warranty extensions, Hard Drive Retention.
Dimensions	Height: 87 mm (3.4 in); width: 483 mm (19.0 in); depth: 556 mm (21.9 in)
Weight	<ul style="list-style-type: none"> <li>• LFF control enclosure: Empty: 18.0 kg (39.6 lb); Fully configured: 28.3 kg (62.2 lb)</li> <li>• SFF control enclosure : Empty: 19.0 kg (41.8 lb); Fully configured: 27.3 kg (60.0 lb)</li> <li>• LFF expansion enclosure: Empty: 16.4 kg (36.1 lb); Fully configured: 26.7 kg (58.8 lb)</li> <li>• SFF expansion enclosure: Empty: 16.7 kg (36.7 lb); Fully configured: 25.0 kg (55.2 lb)</li> </ul>

\* Performance measurements with the maximum number of 15K rpm HDDs supported by the system.

\*\* For a detailed list of configuration limits and restrictions for a specific version of the Storwize V5000 software, see the following online document: <http://www.ibm.com/support/docview.wss?uid=ssg1S1004971>

## Control enclosures

The following table lists the models of the Storwize V5000 control enclosures.

Table 2. Part numbers and feature codes for ordering the Storwize V5000 control enclosures

Description	Part number	Feature code (MTM* 6194-12C)	Feature code (MTM 6194-24C)
IBM Storwize V5000 LFF Control Enclosure	6194L2C	ADL4	None
IBM Storwize V5000 SFF Control Enclosure	6194S2C	None	ADL6

\* MTM = Machine Type (first four digits); Model (last three digits and letters)

The part number for the Storwize V5000 controller unit includes the following items:

- One Storwize V5000 LFF or SFF control enclosure with two power supplies with cooling modules and with two node canisters
- Rack mount hardware kit
- Publications package

**Note:** Power cables are not included and must be ordered separately (for more information, see Table 12).

The Storwize V5000 control enclosures ship with two node canisters. A *node canister* provides interfaces for host connectivity, management, and internal drives, and it runs storage management and virtualization software.

The Storwize V5000 control enclosures ship with the following host connectivity interfaces:

- 4x 4 Gb Ethernet (RJ-45) ports (2 ports per node canister) for 1 Gb iSCSI host connectivity and management
- 4x 6 Gb SAS x4 (Mini-SAS HD SFF-8644) ports (2 ports per node canister) for 6 Gb SAS direct host attachments

The Storwize V5000 must be configured with eight 8 Gb FC ports or four 10 Gb Ethernet (iSCSI or FCoE) ports by ordering a pair of the host interface cards (HICs) that supply the following interfaces:

- 4x 10 GbE SFP+ ports (2 ports per HIC) with four SW SFP+ optical transceivers (LC connectors) included for 10 Gb iSCSI or FCoE connectivity
- 8x 8 Gb FC SFP ports (4 ports per HIC) with eight SW SFP optical transceivers (LC connectors) included for FC connectivity (a pair of optional 8 Gb FC LW SFP transceivers is available for ordering as an option; it replaces a pair of the SW SFP transceivers that are included with the FC HIC)

**Note:** Both node canisters must have the same type of the host interface card installed, and both cards must have SFP/SFP+ modules of the same type.

The following table lists the available host port configurations for the Storwize V5000 control enclosures.

Table 3. Storwize V5000 control enclosure host port configurations

Port type	6 Gb SAS	1 Gb iSCSI	10 Gb iSCSI or FCoE	8 Gb FC
Number of ports	Standard ports		Extra ports on a pair of HICs (required)	
	4 (2 per node canister)	4 (2 per node canister)	4 (2 per node canister)	-
	4 (2 per node canister)	4 (2 per node canister)	-	8 (4 per node canister)

The following table lists ordering information for the host connectivity options for the Storwize V5000 control enclosures.

Table 4. Storwize V5000 host connectivity options

Description	Part number	Feature code (Models 12C, 24C)	Maximum qty per one control enclosure
<b>Host interface cards</b>			
8 Gb FC 4 Port Adapter Cards (Pair)	00NC625	AC00	1
10 Gb Ethernet 2 Port Adapter Cards (Pair)	00NC627	AC01	1
<b>SFP transceiver options for 8 Gb FC host interface card (ships with four 8 Gb FC SW SFP transceivers)</b>			
8Gb FC LW SFP Transceivers (Pair)	00MJ105	ACHT	4*

Description	Part number	Feature code (Models 12C, 24C)	Maximum qty per one control enclosure
<b>Cable options for 8 Gb FC host connectivity</b>			
1m Fiber Cable (LC)	00MJ168	ACSJ	8
5m Fiber Cable (LC)	00MJ170	ACSK	8
25m Fiber Cable (LC)	00MJ172	ACSL	8
<b>Cable options for 10 Gb iSCSI or FCoE host connectivity</b>			
10m OM3 Fiber Cable (LC)	00MJ174	ACSS	4
<b>SAS host connectivity cables: Mini-SAS HD (controller) to Mini-SAS (host)</b>			
0.6m SAS Cable (mSAS HD to mSAS)	00MJ162	ACSA	4
1.5m SAS Cable (mSAS HD to mSAS)	00MJ163	ACSB	4
3m SAS Cable (mSAS HD to mSAS)	00MJ166	ACSC	4
<b>SAS host connectivity cables: Mini-SAS HD (controller) to Mini-SAS HD (host)</b>			
0.6m SAS Cable (mSAS HD to mSAS HD)	00MJ176	ACTA	4
1.5m SAS Cable (mSAS HD to mSAS HD)	00MJ178	ACTB	4
3m SAS Cable (mSAS HD to mSAS HD)	00MJ180	ACTC	4

\* A pair of LW SFP modules replaces a pair of SW SFP modules that ship standard with the 8 Gb FC HIC. Up to two LW SFP module pairs per 8 Gb FC host interface card in the node canister; both node canisters must have the same connectivity type.

The Storwize V5000 control enclosures provide 6 Gb SAS internal dual-port drive connectivity, and each control enclosure also has four 6 Gb SAS x4 (Mini-SAS HD SFF-8644) ports (2 port per node canister) for 6 Gb SAS expansion enclosure connectivity.

## Expansion enclosures

The Storwize V5000 Control Enclosure supports attachment of up to 19 Storwize V5000 LFF or SFF expansion enclosures. Intermix of LFF and SFF enclosures is supported. The expansion enclosures can be added to the system non-disruptively.

The following table lists the models of the Storwize V5000 LFF and SFF expansion enclosures.

Table 5. Part numbers and feature codes for ordering Storwize V5000 expansion enclosures

Description	Part number	Feature code (MTM 6194-12E)	Feature code (MTM 6194-24E)
IBM Storwize V5000 LFF Expansion Enclosure	6194LEU	ADL5	None
IBM Storwize V5000 SFF Expansion Enclosure	6194SEU	None	ADL7

The part number for the Storwize V5000 expansion enclosures includes the following items:

- One Storwize V5000 LFF or SFF expansion enclosure with two power supplies with cooling modules and with two expansion canisters
- Rack mount hardware kit
- Publications package

**Note:** Power cables are not included and must be ordered separately (for more information, see Table 12).

Each Storwize V5000 expansion unit ships with two expansion canisters. Each expansion canister provides 6 Gb SAS connectivity to the internal drives and two external 6 Gb SAS x4 ports (Mini-SAS HD SFF-8644 connectors labelled Port 1 and Port 2) that are used for connections to the Storwize V5000 node canisters and for connecting the expansion units between each other. One of the expansion ports (Port 3 or Port 4) on the Storwize V5000 node canister is connected to the Port 1 on the expansion canister. The Port 2 on the expansion canister is connected to the Port 1 on the expansion canister in the adjacent enclosure, and so on.

**Note:** Up to 10 expansion enclosures can be connected to Port 3 in a daisy-chained manner, and up to nine expansion enclosures can be connected to Port 4 in a daisy-chained manner, for a total of 19 expansion enclosures per one control enclosure.

The expansion enclosure connectivity topology is shown in the following figure.

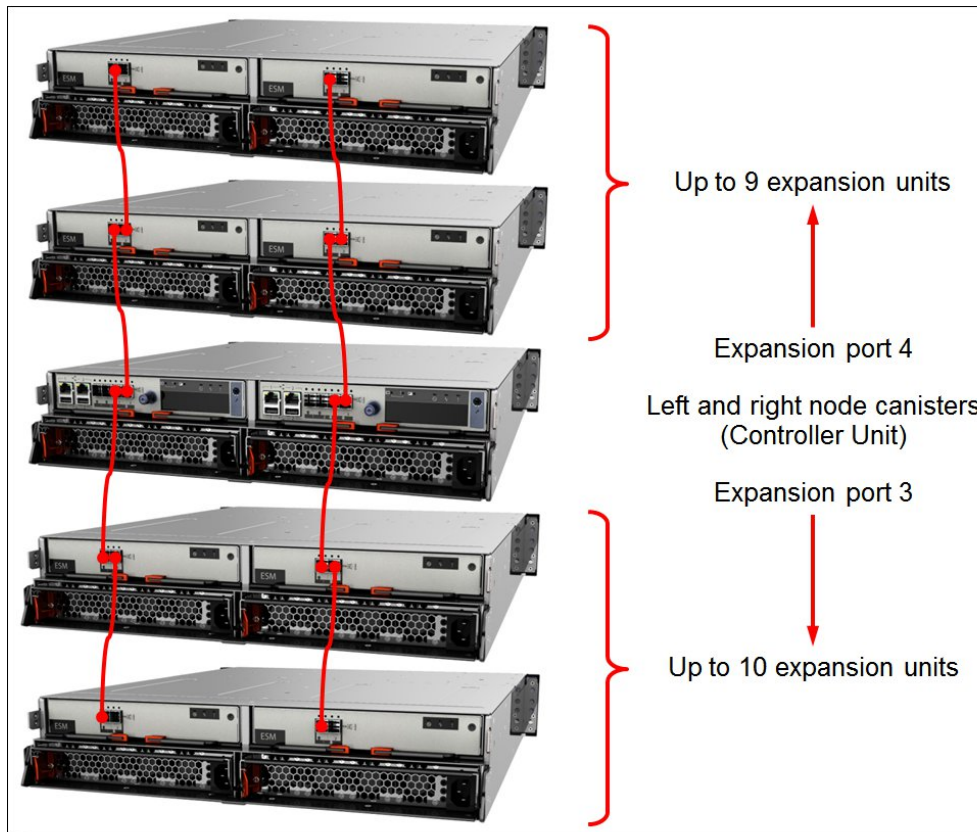


Figure 7. Expansion unit connectivity topology

The following table lists ordering information for the expansion enclosure connectivity options.

Table 6. Expansion enclosure connectivity options

Description	Part number	Feature code (Models 12E, 24E)	Maximum qty per one expansion enclosure
0.6m SAS Cable (mSAS HD to mSAS HD)	00MJ176	ACTA	2
1.5m SAS Cable (mSAS HD to mSAS HD)	00MJ178	ACTB	2
3m SAS Cable (mSAS HD to mSAS HD)	00MJ180	ACTC	2

## Drive options

The Storwize V5000 LFF control and expansion enclosures support up to 12 LFF hot-swap drives. The Storwize V5000 SFF enclosures support up to 24 SFF hot-swap drives.

The following table lists drive options for the Storwize V5000 LFF enclosures.

Table 7. LFF drive options

Description	Part number	Feature code (Models 12C, 12E)	Max qty per one LFF enclosure
<b>3.5-inch SAS hot-swap HDDs</b>			
300 GB 15,000 rpm 6 Gb SAS 3.5 Inch HDD	00NC629	AC10	12
600 GB 15,000 rpm 12 Gb SAS 3.5 Inch HDD	00NC631	AC11	12
900 GB 10,000 rpm 6 Gb SAS 3.5 Inch HDD	00NC633	AC20	12
1.2 TB 10,000 rpm 6 Gb SAS 3.5 Inch HDD	00NC635	AC21	12
1.8 TB 10,000 rpm 12 Gb SAS 3.5 Inch HDD	00MN538	ASTS	12
<b>3.5-inch NL SAS hot-swap HDDs</b>			
3 TB 7,200 rpm 6 Gb NL SAS 3.5 Inch HDD	00NC639	AC31	12
4 TB 7,200 rpm 6 Gb NL SAS 3.5 Inch HDD	00NC641	AC32	12
6 TB 7,200 rpm 12 Gb NL SAS 3.5 Inch HDD	00MN536	ASTR	12
8 TB 7,200 rpm 12 Gb NL SAS 3.5 Inch HDD	00WC009	AT0U	12

The following table lists drive options for the Storwize V5000 SFF enclosures.

Table 8. SFF drive options

Description	Part number	Feature code (Models 24C, 24E)	Max qty per one SFF enclosure
<b>2.5-inch SAS hot-swap SSDs</b>			
200 GB 12 Gb SAS 2.5 Inch Flash Drive	00NC656	AC93	24
400 GB 12 Gb SAS 2.5 Inch Flash Drive	00NC658	AC94	24
800 GB 12 Gb SAS 2.5 Inch Flash Drive	00NC660	AC95	24
1.6 TB 12 Gb SAS 2.5 Inch Flash Drive	00WC015	AT10	24
<b>2.5-inch SAS hot-swap HDDs</b>			
300 GB 15,000 rpm 6 Gb SAS 2.5 Inch HDD	00NC645	AC51	24
600 GB 10,000 rpm 6 Gb SAS 2.5 Inch HDD	00NC649	AC60	24
600 GB 15,000 rpm 12 Gb SAS 2.5 Inch HDD	00NC647	AC52	24
900 GB 10,000 rpm 6 Gb SAS 2.5 Inch HDD	00NC651	AC61	24
1.2 TB 10,000 rpm 6 Gb SAS 2.5 Inch HDD	00NC653	AC62	24
1.8 TB 10,000 rpm 12 Gb SAS 2.5 Inch HDD	00MN540	ASTT	24
<b>2.5-inch NL SAS hot-swap HDDs</b>			
1 TB 7,200 rpm 6 Gb NL SAS 2.5 Inch HDD	00AK399	AC70	24
2 TB 7,200 rpm 12 Gb NL SAS 2.5 Inch HDD	00WC012	AT0X	24

## Software options

The Storwize V5000 comes standard with the following software features:

- Virtualization of internal storage
- Thin provisioning
- One-way data migration
- Dual-system clustering
- HyperSwap (requires an optional Remote Mirroring license)

The functionality of the Storwize V5000 can be expanded with the following optional software features:

- Easy Tier
- Flash Copy
- Remote Mirroring
- External Virtualization

The following table lists ordering information for optional software features for Storwize V5000 control enclosures.

Table 9. Software licenses for Storwize V5000 control enclosures (Part 1: North America, Asia Pacific)

Description	Part number	Max qty per one control enclosure
IBM Storwize Family for Strwz V5000 Cntrl V7 - Bundle Per Storage Dev, w/3 Yr S&S*	00KE103	1
IBM Storwize Family for Strwz V5000 Cntrl V7 - Easy Tier Per Storage Dev, w/3 Yr S&S	00KE104	1
IBM Storwize Family for Strwz V5000 Cntrl V7 - FlashCopy Per Storage Dev, w/3 Yr S&S	00KE106	1
IBM Storwize Family for Strwz V5000 Cntrl V7 - Rmt Mir Per Storage Dev, w/3 Yr S&S	00KE105	1

\* The bundle option includes Easy Tier, FlashCopy, and Remote Mirroring licenses.

Table 9. Software licenses for Storwize V5000 control enclosures (Part 2: Latin America, EMEA)

Description	Part number	Max qty per one control enclosure
IBM Storwize Family for Strwz V5000 Cntrl V7 - Bundle Per Storage Dev, w/3 Yr S&S*	00KE258	1
IBM Storwize Family for Strwz V5000 Cntrl V7 - Easy Tier Per Storage Dev, w/3 Yr S&S	00KE259	1
IBM Storwize Family for Strwz V5000 Cntrl V7 - FlashCopy Per Storage Dev, w/3 Yr S&S	00KE261	1
IBM Storwize Family for Strwz V5000 Cntrl V7 - Rmt Mir Per Storage Dev, w/3 Yr S&S	00KE260	1

\* The bundle option includes Easy Tier, FlashCopy, and Remote Mirroring licenses.

The following table lists ordering information for optional software features for Storwize V5000 expansion enclosures.

Table 10. Software licenses for Storwize V5000 exp. enclosures (Part 1: North America, Asia Pacific)

Description	Part number	Max qty per one expansion enclosure
IBM Storwize Family for Strwz V5000 Expan V7 - Bundle Per Storage Dev, w/3 Yr S&S*	00KE123	1
IBM Storwize Family for Strwz V5000 Expan V7 - Easy Tier Per Storage Dev, w/3 Yr S&S	00KE124	1
IBM Storwize Family for Strwz V5000 Expan V7 - FlashCopy Per Storage Dev, w/3 Yr S&S	00KE126	1
IBM Storwize Family for Strwz V5000 Expan V7 - Rmt Mir Per Storage Dev, w/3 Yr S&S	00KE125	1

\* The bundle option includes Easy Tier, FlashCopy, and Remote Mirroring licenses.

Table 10. Software licenses for Storwize V5000 exp. enclosures (Part 2: Latin America, EMEA)

Description	Part number	Max qty per one expansion enclosure
IBM Storwize Family for Strwz V5000 Expan V7 - Bundle Per Storage Dev, w/3 Yr S&S*	00KE278	1
IBM Storwize Family for Strwz V5000 Expan V7 - Easy Tier Per Storage Dev, w/3 Yr S&S	00KE279	1
IBM Storwize Family for Strwz V5000 Expan V7 - FlashCopy Per Storage Dev, w/3 Yr S&S	00KE281	1
IBM Storwize Family for Strwz V5000 Expan V7 - Rmt Mir Per Storage Dev, w/3 Yr S&S	00KE280	1

\* The bundle option includes Easy Tier, FlashCopy, and Remote Mirroring licenses.

The following table lists ordering information for optional external virtualization software features for Storwize V5000.

Table 11. External virtualization licenses for Storwize V5000 (Part 1: North America, Asia Pacific)

Description	Part number	Max qty per one external storage enclosure
IBM Storwize Family for Strwz V5000 ExtVirt V7 - Base Per Storage Dev, w/3 Yr S&S	00KH164	1**
IBM Storwize Family for Strwz V5000 ExtVirt V7 - Bundle Per Storage Dev, w/3 Yr S&S*	00KE143	1**
IBM Storwize Family for Strwz V5000 ExtVirt V7 - Easy Tier Per Storage Dev, w/3 Yr S&S	00KE144	1**
IBM Storwize Family for Strwz V5000 ExtVirt V7 - FlashCopy Per Storage Dev, w/3 Yr S&S	00KE146	1**
IBM Storwize Family for Strwz V5000 ExtVirt V7 - Rmt Mir Per Storage Dev, w/3 Yr S&S	00KE145	1**

\* The bundle option includes Easy Tier, FlashCopy, and Remote Mirroring licenses.

\*\* One license for each storage enclosure that is attached to, and externally managed by, the Storwize V5000.

Table 11. External virtualization licenses for Storwize V5000 (Part 2: Latin America, EMEA)

Description	Part number	Max qty per one external storage enclosure
IBM Storwize Family for Strwz V5000 ExtVirt V7 - Base Per Storage Dev, w/3 Yr S&S	00KH166	1**
IBM Storwize Family for Strwz V5000 ExtVirt V7 - Bundle Per Storage Dev, w/3 Yr S&S*	00KE298	1**
IBM Storwize Family for Strwz V5000 ExtVirt V7 - Easy Tier Per Storage Dev, w/3 Yr S&S	00KE299	1**
IBM Storwize Family for Strwz V5000 ExtVirt V7 - FlashCopy Per Storage Dev, w/3 Yr S&S	00KE301	1**
IBM Storwize Family for Strwz V5000 ExtVirt V7 - Rmt Mir Per Storage Dev, w/3 Yr S&S	00KE300	1**

\* The bundle option includes Easy Tier, FlashCopy, and Remote Mirroring licenses.

\*\* One license for each storage enclosure that is attached to, and externally managed by, the Storwize V5000.

**Note:** A storage enclosure that is externally managed by the Storwize V5000 is defined as an independently powered, channel-attached device that stores data on magnetic disks or SSDs, such as disk controllers and their respective expansion units, each of which constitutes separate enclosures. Therefore, an enclosure can be the main controller housing disk or SSDs, or the expansion chassis that houses extra disk or SSDs for the purpose of expanding the total capacity of the storage system.

## Power cables

The Storwize V5000 LFF and SFF control and expansion enclosures ship standard without power cables. The part numbers and feature codes to order the power cables (one part number includes two power cords) are listed in the following table.

Table 12. Part numbers and feature codes for ordering power cables

Description	Part number	Feature code (Models 12C, 12E, 24C, 24E)
<b>Country-specific power cords</b>		
1.8m, 10A/120V, C13 to NEMA 5-15P (US/Chicago) Line Cord	00MJ248	AS25
2.8m, 10A/230V, C13 to BS 1363/A (UK) Line Cord	00MJ232	ARZT
2.8m, 10A/230V, C13 to AS/NZS 3112 (Aus/NZ) Line Cord	00MJ233	ARZU
2.8m, 10A/230V, C13 to CEE7-VII (Europe) Line Cord	00MJ234	ARZV
2.8m, 10A/230V, C13 to DK2-5a (Denmark) Line Cord	00MJ235	ARZW
2.8m, 10A/230V, C13 to SABS 164 (South Africa) Line Cord	00MJ236	ARZX
2.8m, 10A/230V, C13 to SEV 1011-S24507 (Sws) Line Cord	00MJ237	ARZY
2.8m, 10A/230V, C13 to CEI 23-16 (Italy) Line Cord	00MJ238	ARZZ
2.8m, 10A/230V, C13 to SI 32 (Israel) Line Cord	00MJ239	AS00
2.8m, 10A/220V, C13 to IRAM 2073 (Argentina) Line Cord	00MJ240	AS01
2.8m, 10A/220V, C13 to GB 2099.1 (China) Line Cord	00MJ241	AS02
2.8m, 10A/120V, C13 to NEMA 5-15P (US) Line Cord	00MJ242	AS03
2.8m, 10A/110V, C13 to CNS 10917-3 (Taiwan) Line Cord	00MJ243	AS04
2.8m, 10A/220V, C13 to NBR 6147 (Brazil) Line Cord	00MJ244	AS05
2.8m, 10A/240V, C13 to IS 6538 (India) Line Cord	00MJ245	AS06
2.8m, 12A/100V, C13 to JIS C-8303 (Japan) Line Cord	00MJ246	AS07



2.8m, 12A/220V, C13 to KSC 8305 (S. Korea) Line Cord	00MJ247	AS08
<b>Rack power cord</b>		
2.8m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable	00NC547	AS26

## Physical specifications

The Storwize V5000 enclosures have the following dimensions and weight (approximate):

- Height: 87 mm (3.4 in)
- Width: 483 mm (19.0 in)
- Depth: 556 mm (21.9 in)
- Weight:
  - LFF control enclosure:
    - Empty: 18.0 kg (39.6 lb)
    - Fully configured: 28.3 kg (62.2 lb)
  - SFF control enclosure:
    - Empty: 19.0 kg (41.8 lb)
    - Fully configured: 27.3 kg (60.0 lb)
  - LFF expansion enclosure:
    - Empty: 16.4 kg (36.1 lb)
    - Fully configured: 26.7 kg (58.8 lb)
  - SFF expansion enclosure:
    - Empty: 16.7 kg (36.7 lb)
    - Fully configured: 25.0 kg (55.2 lb)

## Operating environment

The Storwize V5000 enclosures are supported in the following environment:

- Air temperature:
  - Operating: 10 °C - 35 °C (50 °F - 95 °F) at 30.5 m (100 ft) below to 3,000 m (9,840 ft) above sea level
  - Non-operating: -10 °C - 50 °C (14 °F - 125 °F)
  - Maximum altitude: 3,000 m (9,840 ft)
- Humidity:
  - Operating: 20% - 80%
  - Non-operating: 10% - 90%
- Electrical power:
  - Voltage range: 100 V AC - 240 V AC
  - Frequency: 50 Hz - 60 Hz
  - Power:
    - LFF control enclosure: 378 watts
    - SFF control enclosure: 425 watts
    - LFF expansion enclosure: 300 watts
    - SFF expansion enclosure: 338 watts
- Heat dissipation (BTU per hour):
  - LFF control enclosure: 1,290
  - SFF control enclosure: 1,451
  - LFF expansion enclosure: 1,024
  - SFF expansion enclosure: 1,154
- Acoustical noise emission:
  - LFF control enclosure:
    - 5.8 bels (idling)
    - 5.8 bels (operating)

- SFF control enclosure:
  - 5.9 bels (idling)
  - 5.9 bels (operating)
- LFF expansion enclosure:
  - 6.0 bels (idling)
  - 6.0 bels (operating)
- SFF expansion enclosure:
  - 6.1 bels (idling)
  - 6.1 bels (operating)

## Warranty options

The Storwize V5000 has a three-year Customer Replaceable Unit (CRU) and onsite warranty with 9x5/next business day (NBD) terms. Lenovo offers the service upgrades through warranty maintenance upgrades and post-warranty maintenance agreements with a well-defined scope of services, including service hours, response time, term of service, and service agreement terms and conditions.

Lenovo warranty service upgrade offerings are country-specific; that is, each country might have its own service types, service levels, response times, and terms and conditions. Not all covered types of warranty service upgrades might be available in a particular country or area. For more information about Lenovo warranty service upgrade offerings that are available in your country, see the Lenovo Services Product Selector that is available at this website:

<https://www-304.ibm.com/sales/gss/download/spst/servicepac>

The warranty service definitions for the Storwize V5000 system are listed in the following table.

Table 13. Warranty service definitions

Term	Description
On-site service	A service technician arrives at the client's location for equipment service.
24x7x2 hour	A service technician is scheduled to arrive at the client's location within two hours after remote problem determination is completed. Lenovo provides service around the clock, every day, including Lenovo holidays.
24x7x4 hour	A service technician is scheduled to arrive at the client's location within four hours after remote problem determination is completed. Lenovo provides service around the clock, every day, including Lenovo holidays.
9x5x4 hour	A service technician is scheduled to arrive at the client's location within four business hours after remote problem determination is completed. Lenovo provides service 8:00 am - 5:00 pm in the client's local time zone, Monday-Friday, excluding Lenovo holidays. For example, if a customer reports an incident at 3:00 pm on Friday, the technician will arrive by 10:00 am the following Monday.
9x5 next business day	A service technician is scheduled to arrive at the client's location on the business day after remote problem determination is completed. Lenovo provides service 8:00 am - 5:00 pm in the client's local time zone, Monday - Friday, excluding Lenovo holidays. Calls received after 4:00 pm local time require an extra business day for service dispatch. Next business day service is not guaranteed.

In general, the following types of Lenovo warranty service upgrades for the Storwize V5000 are available:

- Warranty and maintenance service upgrades:
  - Three or five years of 9x5 or 24x7 service coverage
  - Onsite response from next business day to 2 or 4 hours
  - Up to five years of warranty extension for all service levels in one or two year increments

- **Hard Drive Retention**  
Lenovo's Hard Drive Retention service is a multi-drive hard drive retention offering that ensures your data is always under your control, regardless of the number of hard drives that are installed in your Lenovo system. In the unlikely event of a hard drive failure, you retain possession of your hard drive while Lenovo replaces the failed drive part. Your data stays safely on your premises, in your hands. The Hard Drive Retention service can be purchased in convenient bundles with our warranty upgrades and extensions.
- **Remote Technical Support Services (RTS) - 1 or 3 years**  
RTS provides comprehensive technical call center support. RTS can reduce problem resolution time, decreasing the cost to address technical problems and increasing uptime.

## Regulatory compliance

The Storwize V5000 conforms to the following regulations:

- FCC - Verified to comply with Part 15 of the FCC Rules, Class A
- Canada ICES-003, Class A
- Australia and New Zealand Class A statement
- European Union Council Directive 2004/108/EC
- EN 55022, Class A
- Japan VCCI Class A statement
- People's Republic of China Class A statement
- Taiwan Class A compliance statement
- Korea KCC Class A statement
- Russia EMI Class A statement

## Interoperability

Lenovo provides end-to-end storage compatibility testing to deliver interoperability throughout the network. The Storwize V5000 supports attachment to Lenovo System x®, ThinkServer®, BladeCenter®, and Flex System™ hosts by using SAS, iSCSI, FC, or FCoE storage connectivity protocols. Hybrid storage connectivity also is supported.

**Note:** Tables that are provided in this section are for ordering reference purposes only. End-to-end storage configuration support *must* be verified through the System Storage Interoperation Center (SSIC): <http://ibm.com/systems/support/storage/ssic>

### SAS connectivity

The following table lists currently available System x and ThinkServer SAS adapters that are compatible with the Storwize V5000 SAS storage (direct attach).

Table 14. SAS adapters

Description	Part number
<b>System x SAS HBAs</b>	
6Gb SAS HBA	46M0907
N2125 SAS/SATA HBA (6Gb)	46C9010
N2225 SAS/SATA HBA (12Gb)	00AE912
N2226 SAS/SATA HBA (12Gb)	00AE916
<b>ThinkServer SAS HBAs</b>	
Lenovo ThinkServer 9300-8e PCIe 12Gb 8 Port External SAS Adapter by LSI	4XB0F28703

## FCoE or iSCSI connectivity

The Storwize V5000 supports end-to-end 10 Gb FCoE connectivity with native FCoE ports or FCoE connectivity via FCoE/FC gateways with native Fibre Channel ports. Lenovo RackSwitch™, Brocade, and Cisco converged switches can be used to provide FCoE connectivity with the Storwize V5000 FC storage.

The Storwize V5000 also supports iSCSI attachments via standard 1 Gb or 10 Gb Ethernet network. Any compatible Ethernet switch, including Lenovo RackSwitch top of rack (TOR) switches and integrated BladeCenter or Flex System Ethernet I/O modules, can be used to provide iSCSI connectivity with the Storwize V5000 iSCSI storage.

With software iSCSI initiators, any supported 1 Gb Ethernet or 10 Gb Ethernet adapter for System x, ThinkServer, BladeCenter, or Flex System is compatible with the Storwize V5000 iSCSI storage.

Currently available converged FCoE/iSCSI adapters for Lenovo servers that are compatible with Storwize V5000 are listed in the following table. Other HBAs also might be supported (see the SSIC for details).

Table 15. Converged FCoE/iSCSI adapters

Description	Part number
<b>System x converged adapters</b>	
Emulex VFA5 ML2 Dual Port 10GbE SFP+ Adapter (Requires 00D8544)	00D1996
Emulex Dual Port 10GbE SFP+ Embedded VFA IIIr (Requires 90Y5178)	00Y7730
Emulex Dual Port 10GbE SFP+ VFA IIIr (Requires 95Y3760)	00D8540
Emulex VFA5 2x10 GbE SFP+ Adapter and FCoE/iSCSI SW	00JY830
Emulex VFA5 2x10 GbE SFP+ PCIe Adapter (Requires 00JY824)	00JY820
Qlogic Dual Port 10GbE SFP+ Embedded VFA (Requires 90Y5179)	90Y6454
Qlogic 8200 Dual Port 10GbE SFP+ VFA (Requires 00Y5624)	90Y4600
<b>System x FoD upgrades required for FCoE/iSCSI support</b>	
Emulex VFA5 ML2 FCoE/iSCSI License (FoD) (Required for 00D1996)	00D8544
Emulex Mezz VFA III/IIIr FCoE/iSCSI License (FoD) (Required for 00Y7730)	90Y5178
Emulex VFA III/IIIr FCoE/iSCSI License (FoD) (Required for 00D8540)	95Y3760
Emulex VFA5 FCoE/iSCSI SW for PCIe Adapter (FoD) (Required for 00JY820)	00JY824
Qlogic Embedded VFA FCoE/iSCSI License (FoD) (Required for 90Y6454)	90Y5179
Qlogic 8200 VFA FCoE/iSCSI License (FoD) (Required for 90Y4600)	00Y5624
<b>BladeCenter converged adapters</b>	
10Gb Interposer Card for BladeCenter HS23 (LOM) (Requires 90Y9310)	94Y8550
Emulex 10GbE VFA II for BladeCenter HS23 (Requires 90Y9350)	81Y3120
Emulex 10GbE VFA Advanced II for BladeCenter HS23	90Y9332
<b>BladeCenter FoD upgrades required for FCoE/iSCSI support</b>	
Virtual Fabric Advanced Software Upgrade (LOM) (Required for 94Y8550)	90Y9310
Virtual Fabric Advanced FOD Upgrade for BladeCenter HS23 (Required for 81Y3120)	90Y9350
<b>Flex System converged adapters</b>	
Flex System CN4022 2-port 10Gb Converged Adapter	88Y5920
Flex System CN4052 2-port 10Gb Virtual Fabric Adapter (Requires 00JY804)	00JY800
Flex System CN4054 10Gb Virtual Fabric Adapter (Requires 90Y3558)	90Y3554
Flex System CN4054R 10Gb Virtual Fabric Adapter (Requires 90Y3558)	00Y3306
Flex System CN4058S 8-port 10Gb Virtual Fabric Adapter (Requires 94Y5164)	94Y5160

Description	Part number
<b>Flex System FoD upgrades required for FCoE/iSCSI support</b>	
Flex System CN4052 Virtual Fabric Adapter SW Upgrade (FoD) (Required for 00JY800)	00JY804
Flex System CN4054 Virtual Fabric Adapter Upgrade (FoD) (Required for 90Y3554, 00Y3306)	90Y3558
Flex System CN4058S Virtual Fabric Adapter SW Upgrade (FoD) (Required for 94Y5160)	94Y5164

### Fibre Channel connectivity

The Storwize V5000 supports direct FC attachments and FC switch-based attachments. Brocade and QLogic SAN switches can be used to provide FC connectivity with the Storwize V5000 FC storage.

Currently available FC adapters for Lenovo servers that are compatible with the Storwize V5000 FC storage are listed in the following table. Other HBAs also might be supported (see the SSIC for details).

Table 16. FC adapters

Description	Part number
<b>System x HBAs: 16 Gb FC</b>	
Emulex 16Gb FC Dual-port HBA	81Y1662
Emulex 16Gb FC Single-port HBA	81Y1655
QLogic 16Gb FC Single-port HBA	00Y3337
QLogic 16Gb FC Dual-port HBA	00Y3341
<b>System x HBAs: 8 Gb FC</b>	
Emulex 8Gb FC Dual-port HBA	42D0494
Emulex 8Gb FC Single-port HBA	42D0485
QLogic 8Gb FC Dual-port HBA	42D0510
QLogic 8Gb FC Single-port HBA	42D0501
<b>ThinkServer HBAs: 16 Gb FC</b>	
ThinkServer QLE2672 PCIe 16Gb 2 Port FC Adapter by Qlogic	4XC0F28745
ThinkServer LPe16000B Single Port 16Gb FC HBA by Emulex	4XB0F28653
ThinkServer LPe16002B Dual Port 16Gb Fiber Channel HBA by Emulex	4XB0F28650
ThinkServer LPe16002B-M6-L PCIe 16Gb 2 Port FC HBA by Emulex	4XB0F28705
ThinkServer LPe16004B-M6-L PCIe 16Gb 4 Port FC HBA by Emulex	4XB0F28681
ThinkServer LPm16002-M6-L AnyFabric 16Gb 2 Port FC HBA by Emulex	4XB0F28706
<b>ThinkServer HBAs: 8 Gb FC</b>	
ThinkServer QLE2562 Dual Port 8Gb Fibre Channel HBA by Qlogic	0C19482
ThinkServer LPe16002B-M8-L PCIe 8Gb 2 Port FC HBA by Emulex	4XB0F28704
<b>Flex System HBAs: 8 Gb FC</b>	
Flex System FC3052 2-port 8Gb FC Adapter	95Y2375
Flex System FC3172 2-port 8Gb FC Adapter	69Y1938
<b>Flex System HBAs: 16 Gb FC</b>	
Flex System FC5052 2-port 16Gb FC Adapter	95Y2386
Flex System FC5054 4-port 16Gb FC Adapter	95Y2391
Flex System FC5172 2-port 16Gb FC Adapter	69Y1942
<b>BladeCenter HBAs: 8 Gb FC</b>	
Qlogic 8Gb Fibre Channel Expansion Card (CIOv) for BladeCenter	44X1945

Description	Part number
Emulex 8Gb Fibre Channel Expansion Card (CIOv) for BladeCenter	46M6140
QLogic Ethernet and 8Gb FC Expansion Card (CFFh) for BladeCenter	00Y3270

## Networking switches

The following table lists currently available Ethernet and FC rack-mount switches that are offered by Lenovo that can be used in Storwize V5000 storage solutions.

Table 17. Ethernet and FC rack-mount switches

Description	Part number
<b>1 Gb Ethernet (iSCSI connectivity)</b>	
Lenovo RackSwitch G7028 (Rear to Front)	7159BAX
Lenovo RackSwitch G7052 (Rear to Front)	7159CAX
Lenovo RackSwitch G8052 (Rear to Front)	7159G52
<b>10 Gb Ethernet (iSCSI connectivity, FCoE transit switch)</b>	
Lenovo RackSwitch G8124E (Rear to Front)	7159BR6
Lenovo RackSwitch G8264 (Rear to Front)	7159G64
Lenovo RackSwitch G8272 (Rear to Front)	7159CRW
Lenovo RackSwitch G8296 (Rear to Front)	7159GR6
<b>Converged 10 GbE and 8 Gb FC (iSCSI connectivity, FCoE/FC gateway, end-to-end FCoE)</b>	
Lenovo RackSwitch G8264CS (Rear to Front)	7159DRX
<b>8 Gb FC</b>	
Brocade 300 FC SAN Switch	3873AR1
Lenovo B300, 8 ports activated w/ 8Gb SWL SFPs, 1 PS, Rail Kit	3873AR3
Lenovo B6505, 12 ports activated w/ 8Gb SWL SFPs, 1 PS, Rail Kit	3873AR4
Lenovo B6510, 24 ports activated w/ 8Gb SWL SFPs, 2 PS, Rail Kit	3873BR2
<b>16 Gb FC</b>	
Brocade 6505 FC SAN Switch	3873AR2
Brocade 6510 FC SAN Switch	3873BR1
Lenovo B6505, 12 ports activated w/ 16Gb SWL SFPs, 1 PS, Rail Kit	3873AR5
Lenovo B6510, 24 ports activated w/ 16Gb SWL SFPs, 2 PS, Rail Kit	3873BR3

For more information, see the list of Product Guides in the following categories:

- Top-of-rack Switches: <http://lenovopress.com/servers/options/switches?rt=product-guide>
- Rack SAN Switches: <http://lenovopress.com/storage/switches/rack?rt=product-guide>

The following table lists currently available Ethernet and FC embedded switches and pass-thru modules for Flex System that can be used in Storwize V5000 storage solutions.

Table 18. Ethernet and FC embedded switches for Flex System

Description	Part number
<b>1 Gb Ethernet (iSCSI connectivity)</b>	
Lenovo Flex System EN2092 1Gb Ethernet Scalable Switch	49Y4294

Description	Part number
<b>10 Gb Ethernet (iSCSI connectivity, FCoE transit switch)</b>	
Lenovo Flex System Fabric EN4093R 10Gb Scalable Switch	00FM514
Lenovo Flex System SI4091 10Gb System Interconnect Module	00FE327
Lenovo Flex System Fabric SI4093 System Interconnect Module	00FM518
Cisco Nexus B22 Fabric Extender for Flex System*	94Y5350
Cisco Nexus B22 Fabric Extender with FET bundle for Flex System*	94Y5355
<b>Converged 10 GbE and 8 Gb FC (iSCSI connectivity, FCoE/FC gateway, end-to-end FCoE)</b>	
Lenovo Flex System Fabric CN4093 10Gb Converged Scalable Switch	00FM510
<b>Converged 10 GbE and 16 Gb FC (iSCSI connectivity, FCoE/FC gateway)</b>	
Lenovo Flex System EN4023 10Gb Scalable Switch	94Y5212
<b>8 Gb FC</b>	
Lenovo Flex System FC3171 8Gb SAN Switch	69Y1930
<b>16 Gb FC</b>	
Lenovo Flex System FC5022 16Gb SAN Scalable Switch	88Y6374
Lenovo Flex System FC5022 24-port 16Gb SAN Scalable Switch (includes two 16 Gb SFPs)	00Y3324
Lenovo Flex System FC5022 24-port 16Gb ESB SAN Scalable Switch	90Y9356
<b>Pass-thru modules (require a compatible external switch)</b>	
Lenovo Flex System EN4091 10Gb Ethernet Pass-thru	88Y6043
Lenovo Flex System FC3171 8Gb SAN Pass-thru	69Y1934

\* Requires a supported Cisco Nexus top of rack switch.

The following table lists currently available Ethernet and FC embedded switches and pass-thru modules for BladeCenter that can be used in Storwize V5000 storage solutions.

Table 19. Ethernet and FC switches and pass-thru modules for BladeCenter

Description	Part number
<b>1 Gb Ethernet (iSCSI connectivity)</b>	
BladeCenter 1/10Gb Uplink Ethernet Switch Module for BladeCenter	44W4404
BladeCenter Layer 2/3 Fiber Gb Ethernet Switch Module	32R1861
BladeCenter Layer 2/3 Copper Gb Ethernet Switch Module	32R1860
BladeCenter Server Connectivity Module	39Y9324
<b>10 Gb Ethernet (iSCSI connectivity, FCoE transit switch)</b>	
BladeCenter Virtual Fabric 10Gb Switch Module	46C7191
<b>8 Gb FC</b>	
Brocade 10-port 8Gb SAN Switch Module for BladeCenter	44X1921
Brocade 20-port 8Gb SAN Switch Module for BladeCenter	44X1920
Brocade Enterprise 20-port 8Gb SAN Switch Module for BladeCenter	42C1828
QLogic 20-port 8Gb SAN Switch Module for BladeCenter	44X1905
<b>Pass-thru modules (require a compatible external switch)</b>	
10Gb Ethernet Pass-Thru Module for BladeCenter	46M6181
QLogic 8Gb Intelligent Pass-thru Module for BladeCenter	44X1907

For more information, see the list of Product Guides in the following categories:

- Blade Network Modules: <http://lenovopress.com/servers/blades/networkmodule?rt=product-guide>
- Blade Storage Modules: <http://lenovopress.com/servers/blades/storagemodule?rt=product-guide>

## Operating systems

The Storwize V5000 supports host attachments to the System x, ThinkServer, and BladeCenter servers and Flex System compute nodes with the following operating systems:

- Microsoft:
  - Microsoft Windows Server 2012 R2
  - Microsoft Windows Server 2012 R2 (Hyper-V)
  - Microsoft Windows Server 2012
  - Microsoft Windows Server 2012 (Hyper-V)
  - Microsoft Windows Server 2008 R2
  - Microsoft Windows Server 2008 R2 (Hyper-V)
  - Microsoft Windows Server 2008
- Red Hat:
  - Red Hat Enterprise Linux 7
  - Red Hat Enterprise Linux 6
  - Red Hat Enterprise Linux 5
- SUSE:
  - SUSE Linux Enterprise Server 12
  - SUSE Linux Enterprise Server 11
  - SUSE Linux Enterprise Server 10
- VMware:
  - VMware vSphere 6.0
  - VMware vSphere 5.5
  - VMware vSphere 5.1
  - VMware vSphere 5.0



## Rack cabinets

The following table lists the rack cabinets that are offered by Lenovo that can be used in Storwize V5000 storage solutions.

**Note:** If a Storwize V5000 enclosure is shipped and installed in a rack, the Rack Shipment Bracket option (part number 00MJ107, feature code 3690) must be installed.

Table 20. Rack cabinets

Description	Part number
11U Rack Office Enablement Kit	201886X
25U S2 Standard Rack	93072RX
25U Static S2 Standard Rack	93072PX
42U S2 Standard Rack	93074RX
42U 1100mm Enterprise V2 Dynamic Rack	93634PX
42U 1100mm Enterprise V2 Dynamic Expansion Rack	93634EX
42U 1200mm Deep Dynamic Rack	93604PX
42U 1200mm Deep Static Rack	93614PX
42U Enterprise Rack	93084PX
42U Enterprise Expansion Rack	93084EX

For more information, see the list of Product Guides in the Rack cabinets category:  
<http://lenovopress.com/servers/options/racks>

## Power distribution units

The following table lists the the power distribution units (PDUs) that are offered by Lenovo that can be used in Storwize V5000 storage solutions.

Table 21. Power distribution units

Description	Part number
<b>0U Basic PDUs</b>	
0U 24 C13 16A 3 Phase PDU with IEC 309 P+N+Gnd line cord	46M4122
0U 24 C13 30A 3 Phase PDU with NEMA L21-30P line cord	46M4125
0U 24 C13 30A PDU with NEMA L6-30P line cord	46M4128
0U 24 C13 32A PDU with IEC 309 P+N+Gnd line cord	46M4131
0U 12 C19/12 C13 32A 3 Phase PDU with IEC 309 3P+N+Gnd line cord	46M4143
0U 12 C19/12 C13 60A 3 Phase PDU with CS8365L 3P+Gnd line cord	46M4140
<b>Switched and Monitored PDUs</b>	
1U 9 C19/3 C13 Switched and Monitored DPI PDU (without line cord)	46M4002
1U 9 C19/3 C13 Switched and Monitored 60A 3 Phase PDU with IEC 309 3P+Gnd line cord	46M4003
1U 12 C13 Switched and Monitored DPI PDU (without line cord)	46M4004
1U 12 C13 Switched and Monitored 60A 3 Phase PDU with IEC 309 3P+Gnd line cord	46M4005
0U 24 C13 Switched and Monitored 30A PDU with NEMA L6-30P line cord	46M4116
0U 24 C13 Switched and Monitored 32A PDU with IEC 309 P+N+Gnd line cord	46M4119
0U 12 C19/12 C13 Switched and Monitored 32A 3 Phase PDU with IEC 309 3P+N+Gnd cord	46M4137

Description	Part number
0U 12 C19/12 C13 Switched and Monitored 50A 3 Phase PDU with CS8365L 3P+Gnd cord	46M4134
Ultra Density Enterprise PDUs (9x IEC 320 C13 + 3x IEC 320 C19 outlets)	
Ultra Density Enterprise C19/C13 PDU Module (without line cord)	71762NX
Ultra Density Enterprise C19/C13 PDU 60A/208V/3ph with IEC 309 3P+Gnd line cord	71763NU
C13 Enterprise PDUs (12x IEC 320 C13 outlets)	
DPI C13 Enterprise PDU+ (without line cord)	39M2816
DPI Single Phase C13 Enterprise PDU (without line cord)	39Y8941
C19 Enterprise PDUs (6x IEC 320 C19 outlets)	
DPI Single Phase C19 Enterprise PDU (without line cord)	39Y8948
DPI 60A 3 Phase C19 Enterprise PDU with IEC 309 3P+G (208 V) fixed line cord	39Y8923
Front-end PDUs (3x IEC 320 C19 outlets)	
DPI 30amp/125V Front-end PDU with NEMA L5-30P line cord	39Y8938
DPI 30amp/250V Front-end PDU with NEMA L6-30P line cord	39Y8939
DPI 32amp/250V Front-end PDU with IEC 309 2P+Gnd line cord	39Y8934
DPI 60amp/250V Front-end PDU with IEC 309 2P+Gnd line cord	39Y8940
DPI 63amp/250V Front-end PDU with IEC 309 2P+Gnd line cord	39Y8935
Universal PDUs (7x IEC 320 C13 outlets)	
DPI Universal Rack PDU with US LV and HV line cords	39Y8951
DPI Universal Rack PDU with CEE7-VII Europe line cord	39Y8952
DPI Universal Rack PDU with Denmark line cord	39Y8953
DPI Universal Rack PDU with Israel line cord	39Y8954
DPI Universal Rack PDU with Italy line cord	39Y8955
DPI Universal Rack PDU with South Africa line cord	39Y8956
DPI Universal Rack PDU with UK line cord	39Y8957
DPI Universal Rack PDU with AS/NZ line cord	39Y8958
DPI Universal Rack PDU with China line cord	39Y8959
DPI Universal Rack PDU (Argentina)	39Y8962
DPI Universal Rack PDU (Brazil)	39Y8960
DPI Universal Rack PDU (India)	39Y8961
NEMA PDUs (6x NEMA 5-15R outlets)	
DPI 100-127V PDU with Fixed NEMA L5-15P line cord	39Y8905
Line cords for PDUs that ship without a line cord	
DPI 32a Line Cord (IEC 309 3P+N+G)	40K9611
DPI 32a Line Cord (IEC 309 P+N+G)	40K9612
DPI 63a Cord (IEC 309 P+N+G)	40K9613
DPI 30a Line Cord (NEMA L6-30P)	40K9614
DPI 60a Cord (IEC 309 2P+G)	40K9615
DPI Australian/NZ 3112 Line Cord	40K9617

For more information, see the list of Product Guides in the Power Distribution Units category:  
<http://lenovopress.com/servers/options/pdu>

## Uninterruptible power supply units

The following table list the uninterruptible power supply (UPS) units that are offered by Lenovo that can be used in Storwize V5000 storage solutions.

Table 22. Uninterruptible power supply units

Description	Part number
RT1.5kVA 2U Rack or Tower UPS (100-125VAC)	55941AX
RT1.5kVA 2U Rack or Tower UPS (200-240VAC)	55941KX
RT2.2kVA 2U Rack or Tower UPS (100-125VAC)	55942AX
RT2.2kVA 2U Rack or Tower UPS (200-240VAC)	55942KX
RT3kVA 2U Rack or Tower UPS (100-125VAC)	55943AX
RT3kVA 2U Rack or Tower UPS (200-240VAC)	55943KX
RT5kVA 3U Rack or Tower UPS (200-240VAC)	55945KX
RT6kVA 3U Rack or Tower UPS (200-240VAC)	55946KX
RT8kVA 6U Rack or Tower UPS (200-240VAC)	55948KX
RT11kVA 6U Rack or Tower UPS (200-240VAC)	55949KX
RT8kVA 6U 3:1 Phase Rack or Tower UPS (380-415VAC)	55948PX
RT11kVA 6U 3:1 Phase Rack or Tower UPS (380-415VAC)	55949PX

For more information, see the list of Product Guides in the Uninterruptible Power Supply Units category: <http://lenovopress.com/servers/options/ups>

## Lenovo Financial Services

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For more information about your region-specific offers, contact your Lenovo sales representative or your technology provider about the use of Lenovo Financial Services. For more information, see the following Lenovo website:

<http://www.lenovofs.com>

## Related publications and links

For more information, see the following resources:

- Lenovo Storage product page:  
<http://www.lenovo.com/systems/storage>
- US Announcement Letter - IBM Storwize V5000 for Lenovo:  
<http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS115-015>
- US Announcement Letter - IBM Storwize Family Software for Storwize V5000 for Lenovo:  
<http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS215-042>
- IBM Spectrum Virtualize Software for Storwize V5000 for Lenovo (Machine Type 6194):  
<http://www.ibm.com/support/fixcentral>
- Standalone Solutions Configuration Tool:  
<http://ibm.com/support/entry/portal/docdisplay?Indocid=MIGR-62168>
- System Storage Interoperation Center (SSIC):  
<http://ibm.com/systems/support/storage/ssic>

## Related product families

Product families related to this document are the following:

- [IBM Alliance](#)
- [IBM Storage](#)
- [External Storage](#)

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This document, TIPS1301, was created or updated on February 23, 2016.

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