

## IBM Storwize V5000 for Lenovo

### Product Guide (withdrawn product)

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 or five years of Software Subscription and Support (model dependent).

## Key features

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, 1.6 TB, and 3.2 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: 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: 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 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 figures show the front of the Storwize V5000 SFF and LFF enclosures.

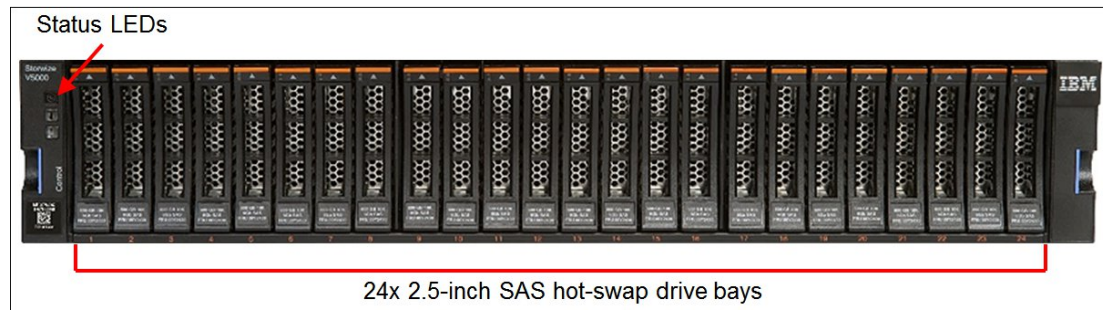


Figure 3. Front view of the Storwize V5000 SFF enclosure

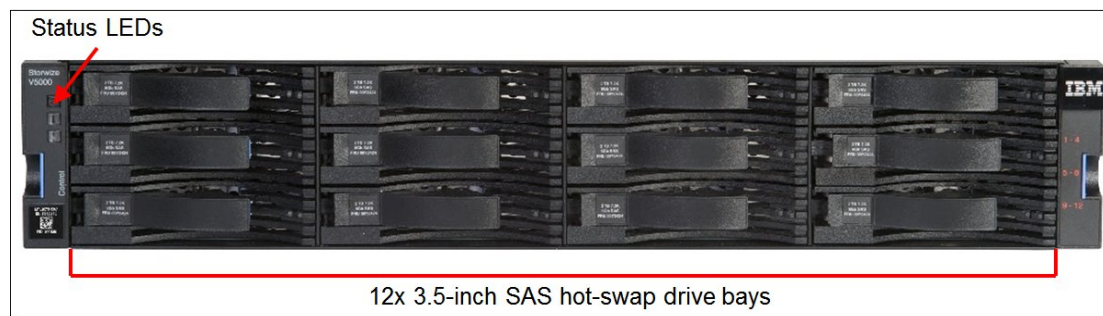


Figure 4. Front view of the Storwize V5000 LFF enclosure

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

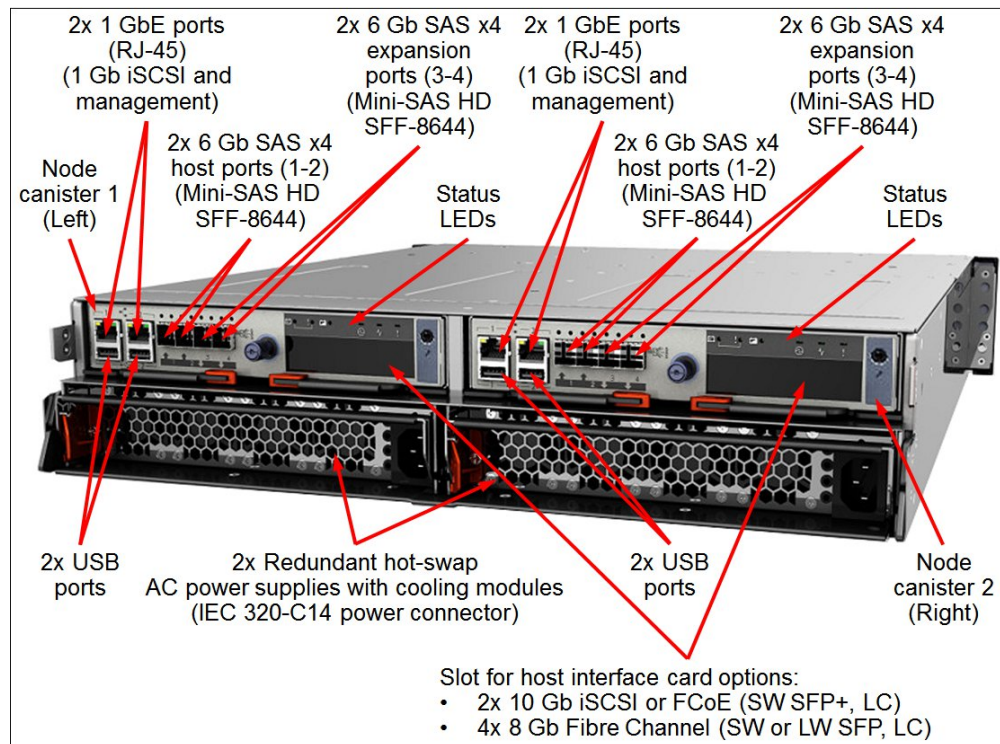


Figure 5. Rear view of the Storwize V5000 Control Enclosure

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

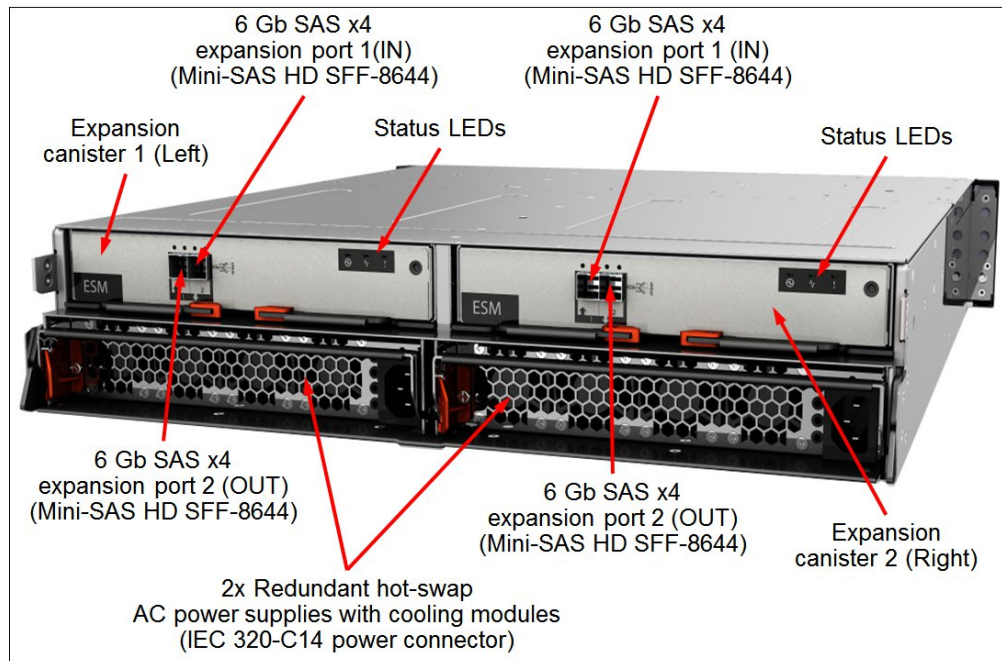


Figure 6. Rear view of the Storwize V5000 Expansion Enclosure

## 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, 1.6 TB, and 3.2 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>• 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 GB 10K rpm SAS HDDs</li> <li>• 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	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.
Standard software features	Virtualization of internal storage, Thin provisioning, One-way data migration, Dual-system clustering, HyperSwap (requires a Remote Mirroring license)
Optional features	Easy Tier, FlashCopy, Remote Mirroring, External Virtualization.
Performance (single system)*	<ul style="list-style-type: none"> <li>• Up to 500,000 cache read IOPS</li> <li>• Up to 100,000 disk read IOPS</li> <li>• Up to 20,000 disk write IOPS</li> <li>• Up to 45,000 disk mixed (70% read/30% write) IOPS</li> <li>• Up to 5.7 GBps sequential cache read throughput</li> <li>• Up to 5.6 GBps sequential disk read throughput</li> <li>• Up to 1.8 GBps sequential disk write throughput</li> </ul>

Components	Specification
Configuration maximums**	<p>Per one control enclosure (I/O group) / cluster (if different):</p> <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
Hardware warranty	Three-year customer-replaceable unit and onsite warranty with 9x5 next business day terms. 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.
Software maintenance	Three-year or five-year (model dependent) base software maintenance is included.
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.

**Product availability:** Storwize V5000 Control Enclosures are withdrawn and no longer available for ordering.

Table 2. Ordering information for the Storwize V5000 control enclosures

Description	Part number	Machine Type-Model	Feature codes*
Worldwide models (except Latin America)			
IBM Storwize V5000 LFF Control Enclosure, w/3 Yr S&S	6194L2C	6194-12C	ADL4 / ASHN / ASHM
IBM Storwize V5000 LFF Control Enclosure, w/5 Yr S&S	61941A1	6194-12C	ADL4 / ASHN / AU0T
IBM Storwize V5000 SFF Control Enclosure, w/3 Yr S&S	6194S2C	6194-24C	ADL6 / ASHN / ASHM
IBM Storwize V5000 SFF Control Enclosure, w/5 Yr S&S	61941C1	6194-24C	ADL6 / ASHN / AU0T
Latin America models			
IBM Storwize V5000 LFF Control Enclosure, w/3 Yr S&S	6194L2L	6194-12C	ADL4 / ASHN / ASHM
IBM Storwize V5000 LFF Control Enclosure, w/5 Yr S&S	61941AL	6194-12C	ADL4 / ASHN / AU0T
IBM Storwize V5000 SFF Control Enclosure, w/3 Yr S&S	6194S2L	6194-24C	ADL6 / ASHN / ASHM
IBM Storwize V5000 SFF Control Enclosure, w/5 Yr S&S	61941CL	6194-24C	ADL6 / ASHN / AU0T

\* Feature codes for System unit base hardware / Base software / Software support and subscription.

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

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	Maximum quantity per one control enclosure
Host interface cards			
8 Gb FC 4 Port Adapter Cards (Pair)	00NC625	AC00	1
10 Gb Ethernet 2 Port Adapter Cards (Pair)	00NC627	AC01	1
SFP transceiver options for 8 Gb FC host interface card (ships with four 8 Gb FC SW SFP transceivers)			
8Gb FC LW SFP Transceivers (Pair)	00MJ105	ACHT	4*
Cable options for 8 Gb FC host connectivity			
1m Fiber Cable (LC)	00MJ168	ACSJ	8
5m Fiber Cable (LC)	00MJ170	ACSK	8
25m Fiber Cable (LC)	00MJ172	ACSL	8
Cable options for 10 Gb iSCSI or FCoE host connectivity			
10m OM3 Fiber Cable (LC)	00MJ174	ACSS	4
SAS host connectivity cables: Mini-SAS HD (controller) to Mini-SAS (host)			
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
SAS host connectivity cables: Mini-SAS HD (controller) to Mini-SAS HD (host)			
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	Machine Type-Model	Feature codes*
Worldwide models (except Latin America)			
IBM Storwize V5000 LFF Expansion Enclosure, w/3 Yr S&S	6194LEU	6194-12E	ADL5 / ASHQ / ASHP
IBM Storwize V5000 LFF Expansion Enclosure, w/5 Yr S&S	61941B1	6194-12E	ADL5 / ASHQ / AU0U
IBM Storwize V5000 SFF Expansion Enclosure, w/3 Yr S&S	6194SEU	6194-24E	ADL7 / ASHQ / ASHP
IBM Storwize V5000 SFF Expansion Enclosure, w/5 Yr S&S	61941D1	6194-24E	ADL7 / ASHQ / AU0U
Latin America models			
IBM Storwize V5000 LFF Expansion Enclosure, w/3 Yr S&S	6194LEL	6194-12E	ADL5 / ASHQ / ASHP
IBM Storwize V5000 LFF Expansion Enclosure, w/5 Yr S&S	61941BL	6194-12E	ADL5 / ASHQ / AU0U
IBM Storwize V5000 SFF Expansion Enclosure, w/3 Yr S&S	6194SEL	6194-24E	ADL7 / ASHQ / ASHP
IBM Storwize V5000 SFF Expansion Enclosure, w/5 Yr S&S	61941DL	6194-24E	ADL7 / ASHQ / AU0U

\* Feature codes for System unit base hardware / Base software / Software support and subscription.

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.

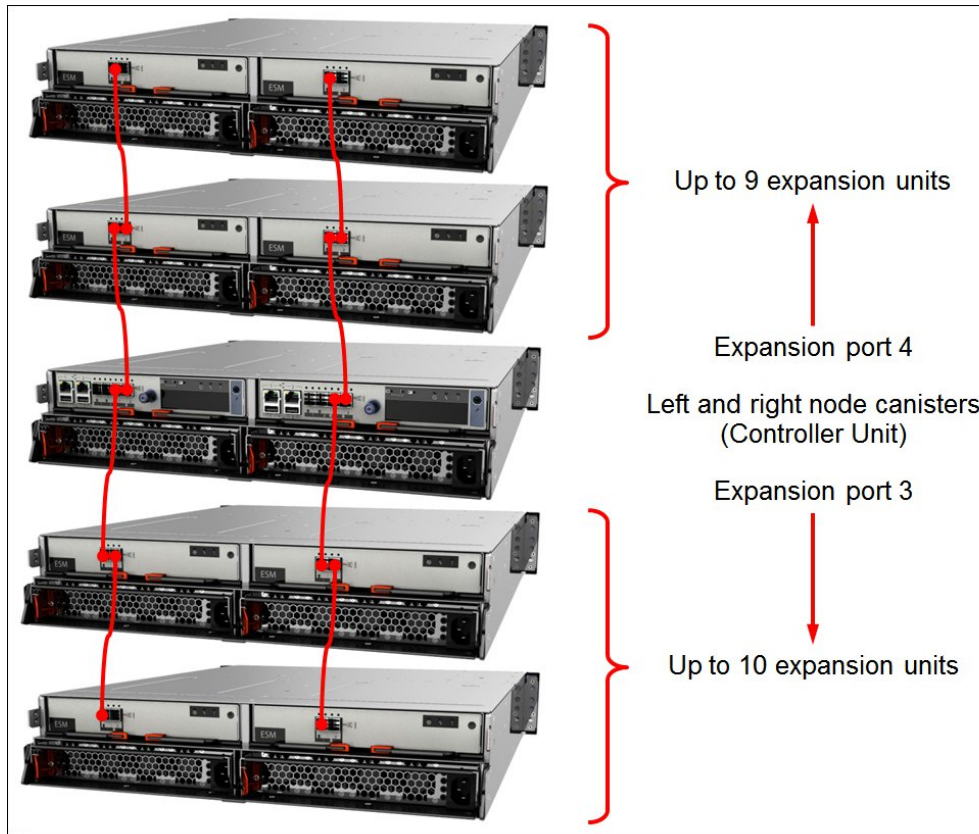


Figure 7. Expansion unit connectivity topology

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

Table 6. Expansion enclosure connectivity options

Description	Part number	Feature code	Maximum quantity 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

## Drives

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 tables lists drive options for the Storwize V5000 LFF and SFF enclosures, respectively.

Table 7. LFF drive options

Description	Part number	Feature code	Maximum quantity 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>			
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

Table 8. SFF drive options

Description	Part number	Feature code	Maximum quantity 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
3.2 TB 12 Gb SAS 2.5 Inch Flash Drive	00MM833	ATQT	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>			
2 TB 7,200 rpm 12 Gb NL SAS 2.5 Inch HDD	00WC012	AT0X	24

## Software

**Note:** Storwize V5000 functional capabilities that are described in this product guide are based on the Spectrum Virtualize Software for Storwize V5000 version 7.8.

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 following tables list ordering information for optional software features for Storwize V5000 control enclosures.

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

Description	Part number	Maximum quantity per one control enclosure
Software licenses for models with 3-year software maintenance		
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
Software licenses for models with 5-year software maintenance		
IBM Storwize Family for Strwz V5000 Cntrl V7 - Bundle, Per Storage Dev, w/5 Yr S&S*	01DA183	1
IBM Storwize Family for Strwz V5000 Cntrl V7 - Easy Tier, Per Storage Dev, w/5 Yr S&S	01DA184	1
IBM Storwize Family for Strwz V5000 Cntrl V7 - FlashCopy, Per Storage Dev, w/5 Yr S&S	01DA186	1
IBM Storwize Family for Strwz V5000 Cntrl V7 - Rmt Mir, Per Storage Dev, w/5 Yr S&S	01DA185	1

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

Table 10. Software licenses for Storwize V5000 control enclosures: Latin America, EMEA

Description	Part number	Maximum quantity per one control enclosure
Software licenses for models with 3-year base software maintenance included		
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
Software licenses for models with 5-year base software maintenance included		
IBM Storwize Family for Strwz V5000 Cntrl V7 - Bundle, Per Storage Dev, w/5 Yr S&S*	01DA212	1
IBM Storwize Family for Strwz V5000 Cntrl V7 - Easy Tier, Per Storage Dev, w/5 Yr S&S	01DA213	1
IBM Storwize Family for Strwz V5000 Cntrl V7 - FlashCopy, Per Storage Dev, w/5 Yr S&S	01DA215	1
IBM Storwize Family for Strwz V5000 Cntrl V7 - Rmt Mir, Per Storage Dev, w/5 Yr S&S	01DA214	1

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

The following tables list ordering information for optional software features for Storwize V5000 expansion enclosures.

Table 11. Software licenses for Storwize V5000 expansion enclosures: North America, Asia Pacific

Description	Part number	Maximum quantity per one expansion enclosure
Software licenses for models with 3-year base software maintenance included		
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
Software licenses for models with 5-year base software maintenance included		
IBM Storwize Family for Strwz V5000 Expan V7 - Bundle, Per Storage Dev, w/5 Yr S&S*	01DA187	1
IBM Storwize Family for Strwz V5000 Expan V7 - Easy Tier, Per Storage Dev, w/5 Yr S&S	01DA188	1
IBM Storwize Family for Strwz V5000 Expan V7 - FlashCopy, Per Storage Dev, w/5 Yr S&S	01DA190	1
IBM Storwize Family for Strwz V5000 Expan V7 - Rmt Mir, Per Storage Dev, w/5 Yr S&S	01DA189	1

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

Table 12. Software licenses for Storwize V5000 expansion enclosures: Latin America, EMEA

Description	Part number	Maximum quantity per one expansion enclosure
Software licenses for models with 3-year base software maintenance included		
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
Software licenses for models with 5-year base software maintenance included		
IBM Storwize Family for Strwz V5000 Expan V7 - Bundle, Per Storage Dev, w/5 Yr S&S*	01DA216	1
IBM Storwize Family for Strwz V5000 Expan V7 - Easy Tier, Per Storage Dev, w/5 Yr S&S	01DA217	1
IBM Storwize Family for Strwz V5000 Expan V7 - FlashCopy, Per Storage Dev, w/5 Yr S&S	01DA219	1
IBM Storwize Family for Strwz V5000 Expan V7 - Rmt Mir, Per Storage Dev, w/5 Yr S&S	01DA218	1

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

The following tables list ordering information for optional external virtualization software features for Storwize V5000.

Table 13. External virtualization licenses for Storwize V5000: North America, Asia Pacific

Description	Part number	Maximum quantity per one external storage enclosure
Software licenses for models with 3-year base software maintenance included		
Storage V5000/V5030 External Virtualization V7-Base w/3 Yr S&S	00KH164	1**
Storage V5000/V5030 External Virtualization V7-Bundle w/3 Yr S&S*	00KE143	1**
Storage V5000/V5030 External Virtualization V7-Easy Tier w/3 Yr S&S	00KE144	1**
Storage V5000/V5030 External Virtualization V7-FlashCopy w/3 Yr S&S	00KE146	1**
Storage V5000/V5030 External Virtualization V7-Rmt Mirror w/3 Yr S&S	00KE145	1**
Software licenses for models with 5-year base software maintenance included		
Storage V5000/V5030 External Virtualization V7-Base w/5 Yr S&S	01DA191	1**
Storage V5000/V5030 External Virtualization V7-Bundle w/5 Yr S&S*	01DA192	1**
Storage V5000/V5030 External Virtualization V7-Easy Tier w/5 Yr S&S	01DA193	1**
Storage V5000/V5030 External Virtualization V7-FlashCopy w/5 Yr S&S	01DA195	1**
Storage V5000/V5030 External Virtualization V7-Rmt Mirror w/5 Yr S&S	01DA194	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 14. External virtualization licenses for Storwize V5000: Latin America, EMEA

Description	Part number	Maximum quantity per one external storage enclosure
Software licenses for models with 3-year base software maintenance included		
Storage V5000/V5030 External Virtualization V7-Base w/3 Yr S&S	00KH166	1**
Storage V5000/V5030 External Virtualization V7-Bundle w/3 Yr S&S*	00KE298	1**
Storage V5000/V5030 External Virtualization V7-Easy Tier w/3 Yr S&S	00KE299	1**
Storage V5000/V5030 External Virtualization V7-FlashCopy w/3 Yr S&S	00KE301	1**
Storage V5000/V5030 External Virtualization V7-Rmt Mirror w/3 Yr S&S	00KE300	1**
Software licenses for models with 5-year base software maintenance included		
Storage V5000/V5030 External Virtualization V7-Base w/5 Yr S&S	01DA220	1**
Storage V5000/V5030 External Virtualization V7-Bundle w/5 Yr S&S*	01DA221	1**
Storage V5000/V5030 External Virtualization V7-Easy Tier w/5 Yr S&S	01DA222	1**
Storage V5000/V5030 External Virtualization V7-FlashCopy w/5 Yr S&S	01DA224	1**
Storage V5000/V5030 External Virtualization V7-Rmt Mirror w/5 Yr S&S	01DA223	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 15. Part numbers and feature codes for ordering power cables

Description	Part number	Feature code
Line cords		
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

Description	Part number	Feature code
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
Rack power cord		
2.8m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable	00NC547	AS26

## Physical specifications

The Storize 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 Storize 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 services and upgrades

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.

**Note:** When purchasing the system that includes 5-year software maintenance, additional two years of hardware support are required.

Lenovo warranty service upgrade offerings are country-specific. Not all warranty service upgrades are available in every country. For more information about Lenovo warranty service upgrade offerings that are available in your country, refer to the Data Center Advisor and Configurator (DCACT; formerly known as LESC):

<http://lesc.lenovo.com>

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

Table 16. 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.

Term	Description
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.
Committed Repair	Problems receive priority handling so that repairs are completed within the committed time of 6 or 24 hours. Lenovo provides service 24 hours/day, every day, including Lenovo holidays.

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

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

Committed Repair Services enhances the level of Warranty Service Upgrade or Post Warranty/Maintenance Service offering associated with the selected systems. Offerings vary and are available in select countries.

  - Priority handling to meet defined time frames to restore the failing machine to good working condition
  - Committed repair service levels are measured within the following coverage hours:
    - 24x7x6: Service performed 24 hours per day, 7 days per week, within 6 hours
    - 24x7x24: Service performed 24 hours per day, 7 days per week, within 24 hours
- 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.
- Hardware Installation Services

Lenovo experts can seamlessly manage the physical installation of your server, storage, or networking hardware. Working at a time convenient for you (business hours or off shift), the technician will unpack and inspect the systems on your site, install options, mount in a rack cabinet, connect to power and network, check and update firmware to the latest levels, verify operation, and dispose of the packaging, allowing your team to focus on other priorities. Your new systems will be configured and ready for your software installation.

## 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®, 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 17. SAS adapters

Description	Part number
System x SAS HBAs	
6Gb SAS HBA	46M0907
N2125 SAS/SATA HBA (6Gb)	46C9010
N2225 SAS/SATA HBA (12Gb)	00AE912
N2226 SAS/SATA HBA (12Gb)	00AE916
ThinkServer SAS HBAs	
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, 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 18. 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>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
<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 19. 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

Description	Part number
QLogic 16Gb FC Dual-port HBA	00Y3341
System x HBAs: 8 Gb FC	
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
ThinkServer HBAs: 16 Gb FC	
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
ThinkServer HBAs: 8 Gb FC	
ThinkServer QLE2562 Dual Port 8Gb Fibre Channel HBA by Qlogic	0C19482
ThinkServer LPe16002B-M8-L PCIe 8Gb 2 Port FC HBA by Emulex	4XB0F28704
Flex System HBAs: 8 Gb FC	
Flex System FC3052 2-port 8Gb FC Adapter	95Y2375
Flex System FC3172 2-port 8Gb FC Adapter	69Y1938
Flex System HBAs: 16 Gb FC	
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

## 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 20. Ethernet and FC rack-mount switches

Description	Part number
1 Gb Ethernet (iSCSI connectivity)	
Lenovo RackSwitch G7028 (Rear to Front)	7159BAX
Lenovo RackSwitch G7052 (Rear to Front)	7159CAX
Lenovo RackSwitch G8052 (Rear to Front)	7159G52
10 Gb Ethernet (iSCSI connectivity, FCoE transit switch)	
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
Converged 10 GbE and 8 Gb FC (iSCSI connectivity, FCoE/FC gateway, end-to-end FCoE)	
Lenovo RackSwitch G8264CS (Rear to Front)	7159DRX

Description	Part number
<b>8 Gb FC</b>	
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>	
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 21. 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
<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.

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 and ThinkServer servers and Flex System compute nodes with the following operating systems:

- Microsoft:
  - Microsoft Windows Server 2016
  - Microsoft Windows Server 2016 (Hyper-V)
  - 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 6.5
  - 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 22. Rack cabinets

Description	Part number
25U S2 Standard Rack (1000 mm deep; 2 sidewall compartments)	93072RX
25U Static S2 Standard Rack (1000 mm deep; 2 sidewall compartments)	93072PX
42U S2 Standard Rack (1000 mm deep; 6 sidewall compartments)	93074RX
42U 1100mm Enterprise V2 Dynamic Rack (6 sidewall compartments)	93634PX
42U 1100mm Enterprise V2 Dynamic Expansion Rack (6 sidewall compartments)	93634EX
42U 1200mm Deep Dynamic Rack (6 sidewall compartments)	93604PX
42U 1200mm Deep Static Rack (6 sidewall compartments)	93614PX
42U Enterprise Rack (1105 mm deep; 4 sidewall compartments)	93084PX
42U Enterprise Expansion Rack (1105 mm deep; 4 sidewall compartments)	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 power distribution units (PDUs) that are offered by Lenovo that can be used in Storwize V5000 storage solutions.

Table 23. Power distribution units

Description	Part number
<b>0U Basic PDUs</b>	
0U 36 C13/6 C19 24A/200-240V 1 Phase PDU with NEMA L6-30P line cord	00YJ776
0U 36 C13/6 C19 32A/200-240V 1 Phase PDU with IEC60309 332P6 line cord	00YJ777
0U 21 C13/12 C19 32A/200-240V/346-415V 3 Phase PDU with IEC60309 532P6 line cord	00YJ778
0U 21 C13/12 C19 48A/200-240V 3 Phase PDU with IEC60309 460P9 line cord	00YJ779
<b>Switched and Monitored PDUs</b>	
0U 20 C13/4 C19 Switched and Monitored 24A/200-240V/1Ph PDU w/ NEMA L6-30P line cord	00YJ781
0U 20 C13/4 C19 Switched and Monitored 32A/200-240V/1Ph PDU w/ IEC60309 332P6 line cord	00YJ780
0U 18 C13/6 C19 Switched / Monitored 32A/200-240V/346-415V/3Ph PDU w/ IEC60309 532P6 cord	00YJ782
0U 12 C13/12 C19 Switched and Monitored 48A/200-240V/3Ph PDU w/ IEC60309 460P9 line cord	00YJ783
1U 9 C19/3 C13 Switched and Monitored DPI PDU (without line cord)	46M4002
1U 9 C19/3 C13 Switched and Monitored 60A 3Ph PDU with IEC 309 3P+Gnd 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
<b>Ultra Density Enterprise PDUs (9x IEC 320 C13 + 3x IEC 320 C19 outlets)</b>	
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
<b>C13 Enterprise PDUs (12x IEC 320 C13 outlets)</b>	
DPI C13 Enterprise PDU+ (without line cord)	39M2816
DPI Single Phase C13 Enterprise PDU (without line cord)	39Y8941
<b>C19 Enterprise PDUs (6x IEC 320 C19 outlets)</b>	
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
<b>Front-end PDUs (3x IEC 320 C19 outlets)</b>	
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
<b>Universal PDUs (7x IEC 320 C13 outlets)</b>	
DPI Universal 7 C13 PDU (with 2 m IEC 320-C19 to C20 rack power cord)	00YE443
<b>NEMA PDUs (6x NEMA 5-15R outlets)</b>	
DPI 100-127V PDU with fixed NEMA L5-15P line cord	39Y8905
<b>Line cords for PDUs that ship without a line cord</b>	
DPI 30a Line Cord (NEMA L6-30P)	40K9614
DPI 32a Line Cord (IEC 309 P+N+G)	40K9612

Description	Part number
DPI 32a Line Cord (IEC 309 3P+N+G)	40K9611
DPI 60a Cord (IEC 309 2P+G)	40K9615
DPI 63a Cord (IEC 309 P+N+G)	40K9613
DPI Australian/NZ 3112 Line Cord (32A)	40K9617
DPI Korean 8305 Line Cord (30A)	40K9618

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 24. 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>

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## 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>
- Lenovo Hardware Configurator:  
<http://lesc.lenovo.com>
- System Storage Interoperation Center (SSIC):  
<http://ibm.com/systems/support/storage/ssic>

## Related product families

Product families related to this document are the following:

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

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This document, TIPS1301, was created or updated on April 4, 2017.

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