



**NEC**

**SPC BENCHMARK 2™  
FULL DISCLOSURE REPORT**

**NEC CORPORATION  
NEC STORAGE M700**

**SPC-2™ V1.5**

**Submitted for Review: August 19, 2013  
Submission Identifier: B00066**

## **First Edition – August 2013**

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# AUDIT CERTIFICATION



Kentaro Yamamoto  
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August 12, 2013

The SPC Benchmark 2™ Reported Data listed below for the **NEC Storage M700** was produced in compliance with the SPC Benchmark 2™ V1.5 Remote Audit requirements.

SPC Benchmark 2™ V1.5 Reported Data	
Tested Storage Product (TSP) Name: NEC Storage M700	
Metric	Reported Result
SPC-2 MBPS™	14,408.89
SPC-2 Price-Performance	\$25.10/SPC-2 MBPS™
ASU Capacity	53,549.652 GB
Data Protection Level	Protected 1 ( <i>Mirroring</i> )
Total Price ( <i>including three-year maintenance</i> )	\$361,612.93
Currency Used	U.S. Dollars
Target Country for availability, sales and support	USA

The following SPC Benchmark 2™ Remote Audit requirements were reviewed and found compliant with V1.5 of the SPC Benchmark 2™ specification:

- A Letter of Good Faith, signed by a senior executive.
- The following Data Repository storage items were verified by documentation supplied by NEC Corporation:
  - ✓ Physical Storage Capacity and related requirements.
  - ✓ Configured Storage Capacity and related requirements.
  - ✓ Addressable Storage Capacity and related requirements.
  - ✓ Capacity of each Logical Volume and related requirements.
  - ✓ Capacity of the Application Storage Unit (ASU) and related requirements.
- The total Application Storage Unit (ASU) Capacity was filled with random data prior to the execution of the SPC-2 Tests.

Storage Performance Council  
643 Bair Island Road, Suite 103  
Redwood City, CA 94062  
[AuditService@StoragePerformance.org](mailto:AuditService@StoragePerformance.org)  
650.556.9384



## AUDIT CERTIFICATION (CONT.)

NEC Storage M700  
SPC-2 Audit Certification

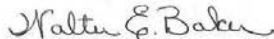
Page 2

- An appropriate diagram of the Benchmark Configuration (BC)/Tested Storage Configuration (TSC).
- Listings and commands used to create and configure the Benchmark Configuration/Tested Storage Configuration.
- Documentation that no customer tunable parameter or option was changed from its default value.
- The following Host System items were verified by documentation supplied by NEC Corporation:
  - ✓ Required Host System configuration information.
  - ✓ The TSC boundary within the Host System.
- The following SPC-2 Workload Generator information was verified by documentation supplied by NEC Corporation:
  - ✓ The presence and version number of the Workload Generator on each Host System.
  - ✓ Commands and parameters used to configure the SPC-2 Workload Generator.
- The Test Results Files and resultant Summary Results Files received from NEC Corporation for each of the following were authentic, accurate, and compliant with all of the requirements and constraints of Clauses 6 and 7 of the SPC-2 Benchmark Specification:
  - ✓ Data Persistence Test
  - ✓ Large File Processing Test
  - ✓ Large Database Query Test
  - ✓ Video on Demand Delivery Test
- There were no differences between the Tested Storage Configuration and Priced Storage Configuration..
- The submitted pricing information met all of the requirements and constraints of Clause 9 of the SPC-2 Benchmark Specification.
- The Full Disclosure Report (FDR) met all of the requirements in Clause 10 of the SPC-2 Benchmark Specification.
- This successfully audited SPC measurement is not subject to an SPC Confidential Review.

**Audit Notes:**

There were no audit notes or exceptions.

Respectfully,



Walter E. Baker  
SPC Auditor

Storage Performance Council  
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Redwood City, CA 94062  
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## LETTER OF GOOD FAITH

Empowered by Innovation

**NEC**

NEC Corporation

1-10, Nisshin-Cho, Fucyu, Tokyo 183-8501, Japan

Date: June 27, 2013

From: NEC Corporation

To: Walter E. Baker, SPC Auditor  
Storage Performance Council (SPC)  
643 Bair Island Road, Suite 103  
Redwood City, CA 94063-2755

Subject: SPC-2 Letter of Good Faith for the NEC Storage M700

NEC Corporation is the SPC-2 Test Sponsor for the above listed product. To the best of our knowledge and belief, the required SPC benchmark-2 results and materials we have submitted for that product are complete, accurate, and in full compliance with V1.5 of the SPC benchmark-2 specification.

In addition, we have reported any items in the Benchmark Configuration and execution of the benchmark that affected the reported results even if the items are not explicitly required to be disclosed by the SPC benchmark-2 specification.

Signed:

M. Kato

Mitsugu Kato  
Assistant General Manager  
IT Platform Division

Date:

June 27, 2013

## EXECUTIVE SUMMARY

### Test Sponsor and Contact Information

Test Sponsor and Contact Information	
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### Revision Information and Key Dates

Revision Information and Key Dates	
<b>SPC-2 Specification revision number</b>	V1.5
<b>SPC-2 Workload Generator revision number</b>	V1.2
<b>Date Results were first used publicly</b>	August 19, 2013
<b>Date FDR was submitted to the SPC</b>	August 19, 2013
<b>Date the TSC will be available for shipment to customers</b>	currently available
<b>Date the TSC completed audit certification</b>	August 12, 2013

### Tested Storage Product (TSP) Description

NEC's M700 SAN storage arrays are a great choice for very scalable, mission-critical, high performance, primary or tiered storage. These SAN storage arrays are easy to operate, dependable and efficient. They are also well-suited for use in virtualized environments by virtue of their great scalability, LUN lock stability, support for VMware APIs and flexibility.

NEC M700 SAN arrays feature host interfaces: 8 Gbps Fibre Channel, 10Gbps/1Gbps iSCSI. Both interfaces can be deployed concurrently. M700 offers 3.5" and 2.5" drives. 2.5" drives are attractive due to their lower power and space consumption. 3.5" drives by contract offer the best storage density per spindle. M700 simultaneously supports SAS HDD, NearLine SAS HDD, and SSD in the same enclosures, enabling flexible tiered storage architecture.

## SPC-2 Reported Data

SPC-2 Reported Data consists of three groups of information:

- The following SPC-2 Primary Metrics, which characterize the overall benchmark result:
  - SPC-2 MBPS™
  - SPC-2 Price Performance™
  - Application Storage Unit (ASU) Capacity
- Supplemental data to the SPC-2 Primary Metrics.
  - Total Price
  - Data Protection Level
  - Currency Used
  - Target Country
- Reported Data for each SPC Test: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand Delivery (VOD) Test.

**SPC-2 MBPS™** represents the aggregate data rate, in megabytes per second, of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video on Demand (VOD).

**SPC-2 Price-Performance™** is the ratio of **Total Price** to **SPC-2 MBPS™**.

**ASU (Application Storage Unit) Capacity** represents the total storage capacity available to be read and written in the course of executing the SPC-2 benchmark.

**Total Price** includes the cost of the Priced Storage Configuration plus three years of hardware maintenance and software support as detailed on page 17.

**Data Protection Level of Protected 1** using **Mirroring** configures two or more identical copies of user data.

***Protected 1:** The single point of failure of any **storage device** in the configuration will not result in permanent loss of access to or integrity of the SPC-2 Data Repository.*

**Currency Used** is formal name for the currency used in calculating the **Total Price** and **SPC-2 Price-Performance™**. That currency may be the local currency of the **Target Country** or the currency of a difference country (*non-local currency*).

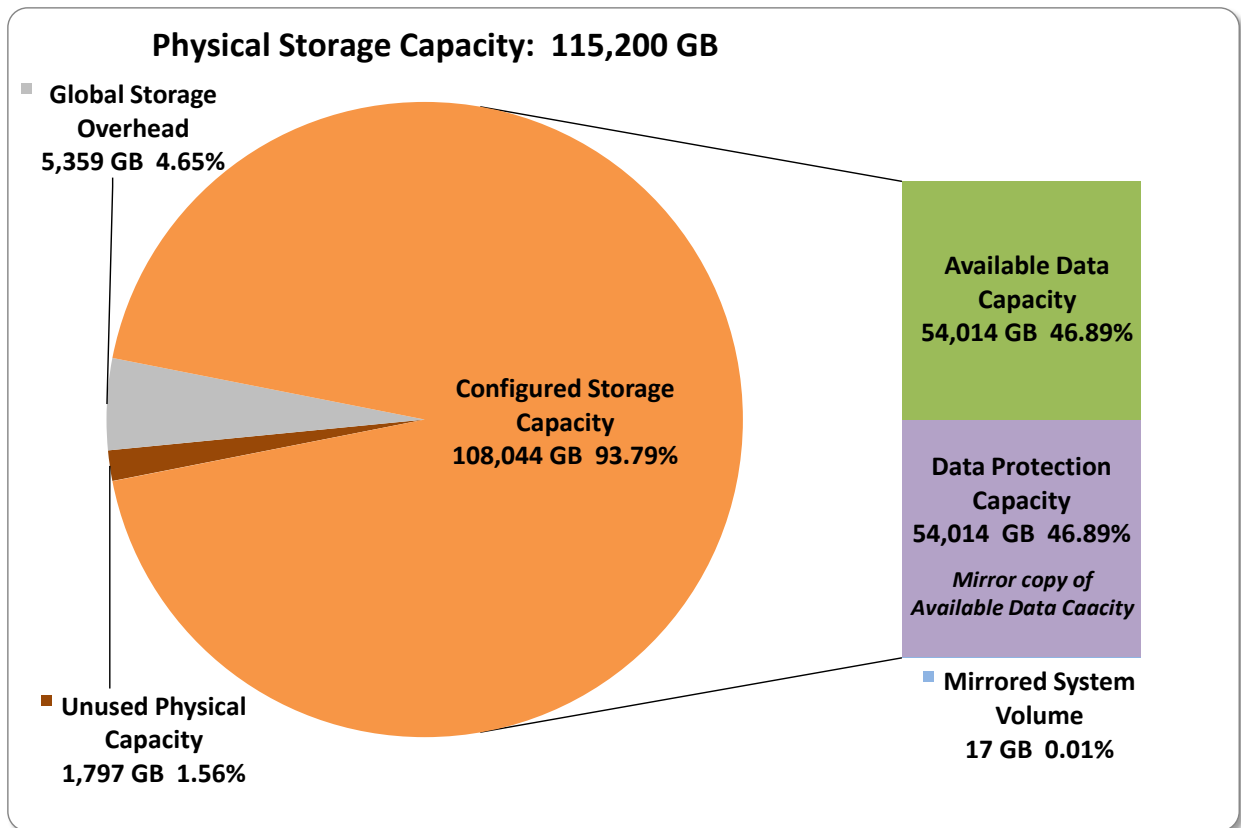
The **Target Country** is the country in which the Priced Storage Configuration is available for sale and in which the required hardware maintenance and software support is provided either directly from the Test Sponsor or indirectly via a third-party supplier.

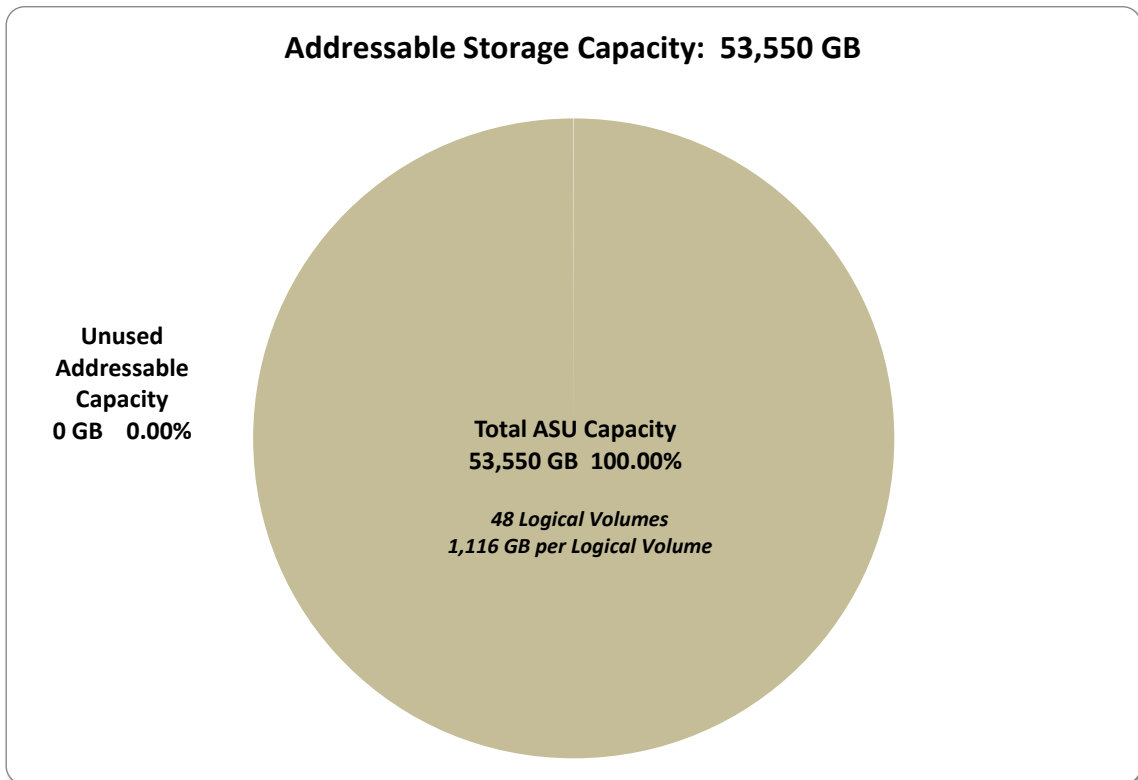
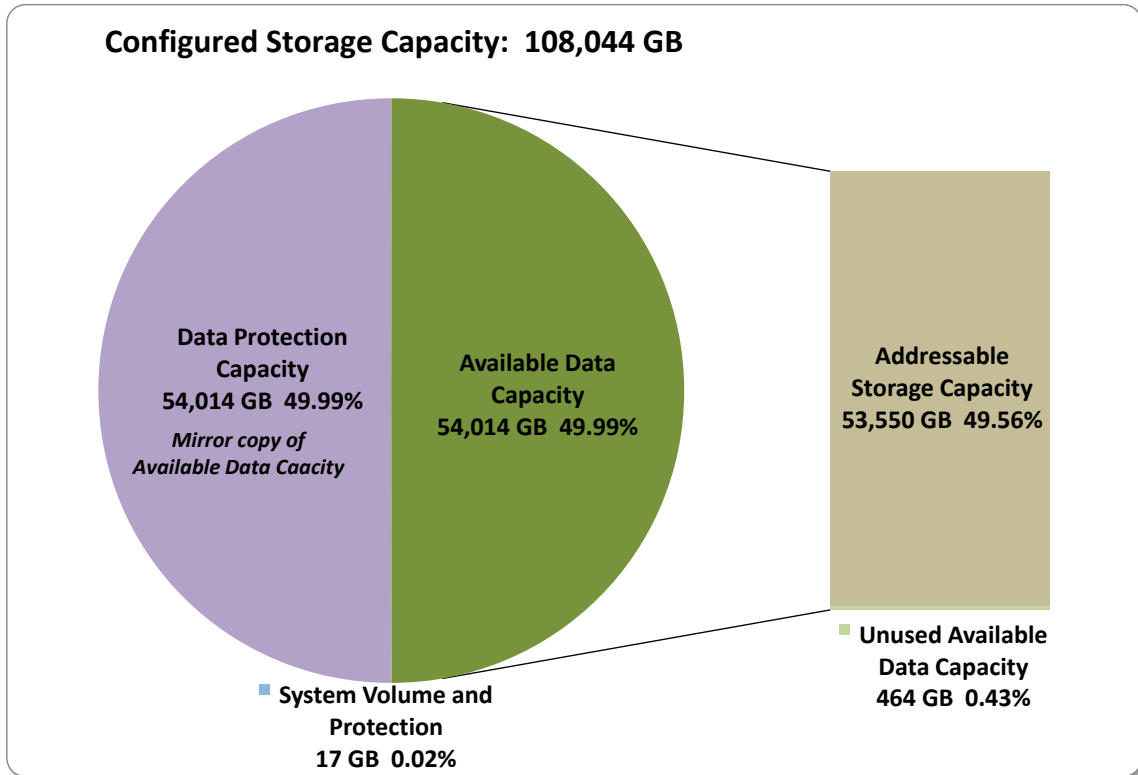
SPC-2 Reported Data				
NEC Storage M700				
SPC-2 MBPS™	SPC-2 Price-Performance	ASU Capacity (GB)	Total Price	Data Protection Level
14,408.89	\$25.10	53,549.652	\$361,612.93	Protected 1 (Mirroring)
The above SPC-2 MBPS™ value represents the aggregate data rate of all three SPC-2 workloads: Large File Processing (LFP), Large Database Query (LDQ), and Video On Demand (VOD)				
SPC-2 Large File Processing (LFP) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
LFP Composite	11,393.94			\$31.74
Write Only:				
1024 KiB Transfer	6,553.10	100	65.53	
256 KiB Transfer	6,641.97	100	66.42	
Read-Write:				
1024 KiB Transfer	10,462.85	180	58.13	
256 KiB Transfer	10,550.67	180	58.61	
Read Only:				
1024 KiB Transfer	16,246.35	700	23.21	
256 KiB Transfer	17,908.71	700	25.58	
The above SPC-2 Data Rate value for LFP Composite represents the aggregate performance of all three LFP Test Phases: (Write Only, Read-Write, and Read Only).				
SPC-2 Large Database Query (LDQ) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
LDQ Composite	16,890.48			\$21.41
1024 KiB Transfer Size				
4 I/Os Outstanding	16,856.23	700	24.08	
1 I/O Outstanding	16,571.29	700	23.67	
64 KiB Transfer Size				
4 I/Os Outstanding	17,288.51	700	24.70	
1 I/O Outstanding	16,845.90	700	24.07	
The above SPC-2 Data Rate value for LDQ Composite represents the aggregate performance of the two LDQ Test Phases: (1024 KiB and 64 KiB Transfer Sizes).				
SPC-2 Video On Demand (VOD) Reported Data				
	Data Rate (MB/second)	Number of Streams	Data Rate per Stream	Price-Performance
	14,942.25	19,000	0.79	\$24.20

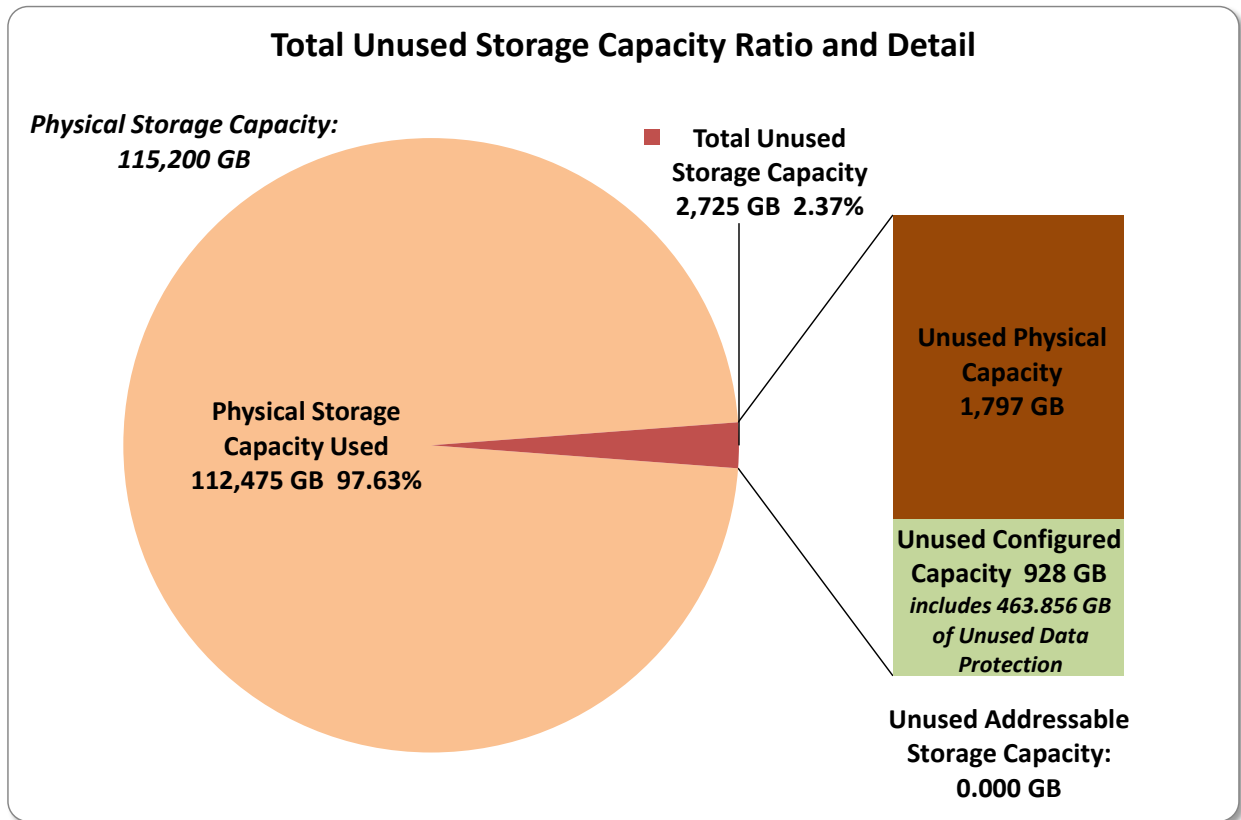
### Storage Capacities, Relationships and Utilization

The following four charts and table document the various storage capacities, used in this benchmark, and their relationships, as well as the storage utilization values required to be reported.

The capacity values in each of the following four charts are listed as integer values, for readability, rather than the decimal values listed elsewhere in this document.







SPC-2 Storage Capacity Utilization	
Application Utilization	46.48%
Protected Application Utilization	92.97%
Unused Storage Ratio	2.37%

**Application Utilization:** Total ASU Capacity (53,549.652 GB) divided by Physical Storage Capacity (115,200.000 GB).

**Protected Application Utilization:** Total ASU Capacity (53,549.652 GB) plus total Data Protection Capacity (54,013.509 GB) minus unused Data Protection Capacity (463.856 GB) divided by Physical Storage Capacity (115,200.000 GB).

**Unused Storage Ratio:** Total Unused Capacity (2,724.727 GB) divided by Physical Storage Capacity (115,200.000 GB) and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 25-26 in the Full Disclosure Report.



## Differences between the Tested Storage Configuration (TSC) and Priced Storage Configuration

There were no differences between the TSC and the Priced Storage Configuration.

### Priced Storage Configuration Pricing

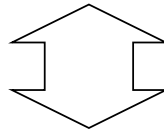
PART#	Product Name	Qty	Unit List Price	Extended LP	Discount	Discounted Price
NF5371-SB00E	M700 Disk Array Unit (includes 1 x NF5371-SD01WE (Disk Port Expansion), 8 x NF9120-SJ73 (Mini SAS Conversion cable(1m))	1	\$108,096.00	\$108,096.00	20.0%	\$86,476.80
NF5371-SF02WE	M700 Host Port Expansion(2X8Gb FC 4-Port)	6	\$4,686.00	\$28,116.00	20.0%	\$22,492.80
NF5371-SD01WE	M700 Disk Port Expansion (SAS 8Port)	1	\$3,564.00	\$3,564.00	20.0%	\$2,851.20
NF5371-SC03E	M700 Standard Cache Memory(96GB)	1	\$5,321.00	\$5,321.00	20.0%	\$4,256.80
NF5321-SM775E	SAS Disk Drive(2.5", 15krpm/300GB, 6Gbps)	384	\$395.00	\$151,680.00	20.0%	\$121,344.00
NF5321-SE71E	Disk Enclosure(2.5", 6Gbps)	16	\$3,383.00	\$54,128.00	20.0%	\$43,302.40
NF9120-SJ73	Mini SAS conversion cable(3m x 2)	4	\$636.00	\$2,544.00	20.0%	\$2,035.20
N8190-154	8Gbps Dual Port Fibre Channel HBA	12	\$1,355.00	\$16,260.00	10.0%	\$14,634.00
FC cable	FC cable	24	\$100.00	\$2,400.00	10.0%	\$2,160.00
Power Cord	Power Cord (10 ft.)	36	\$18.20	\$655.20	10.0%	\$589.68
Power Strips	Power Strips (8 outlets)	5	\$78.00	\$390.00	10.0%	\$351.00
RACK	Rack 42U	1	\$1,799.00	\$1,799.00	10.0%	\$1,619.10
UF5M01-700600AM	SW,STORAGE BASEPRODUCT M700	1	\$0.00	\$0.00	20.0%	\$0.00
UFS206-0060W0AM	SW, PATH MANAGER FOR WINDOWS, M700	1	\$1,123.00	\$1,123.00	20.0%	\$898.40
Q24-DN000000013775	3Years Upgraded Platinum Warranty for M700 Disk Array Unit	1	\$14,417.00	\$14,417.00	15.0%	\$12,254.45
Q24-DN000000013782	3Years Upgraded Platinum Warranty for M700 Host Port(8Gb FC 8Port)	6	\$1,640.00	\$9,840.00	15.0%	\$8,364.00
Q24-DN000000013803	3Years Upgraded Platinum Warranty for M700 Disk Port (SAS 8Port)	2	\$1,247.00	\$2,494.00	15.0%	\$2,119.90
Q24-DN000000013856	3Years Upgraded Platinum Warranty for M700 Standard Cache Memory(96GB)	1	\$1,862.00	\$1,862.00	15.0%	\$1,582.70
Q24-DN000000008386	3YR Upgraded to Platinum Warranty M100 HDD 2.5" 15K 300GB 6Gbps	16	\$300.00	\$4,800.00	15.0%	\$4,080.00
Q24-DN000000006695	3YR Upgraded to Platinum Warranty M100 DiskExp2.5"6Gbps	16	\$846.00	\$13,536.00	15.0%	\$11,505.60
Q24-DN0000000061141	3 Years Upgraded Platinum Warranty for Mini SAS conversion cable (1m x 2)	4	\$171.00	\$684.00	15.0%	\$581.40
Q24-DN0000000061148	3 Years Upgraded Platinum Warranty for Mini SAS conversion cable (3m x 2)	4	\$222.00	\$888.00	15.0%	\$754.80
Q24-DN000000013974	3 Years Upgraded Platinum SW Maintenance for M700 Storage Base SW	1	\$20,071.00	\$20,071.00	15.0%	\$17,060.35
Q24-DN0000000061692	3 Years Upgraded Platinum SW Maintenance for M-series PathManager_Windows	1	\$351.00	\$351.00	15.0%	\$298.35
<b>Total</b>				<b>\$445,019.20</b>		<b>\$361,612.93</b>

The above pricing includes the following:

- Acknowledgement of new and existing hardware and/or software problems within four hours.
- Onsite presence of a qualified maintenance engineer or provision of a customer replaceable part within four hours of the above acknowledgement for any hardware failure that results in an inoperative Priced Storage Configuration component.

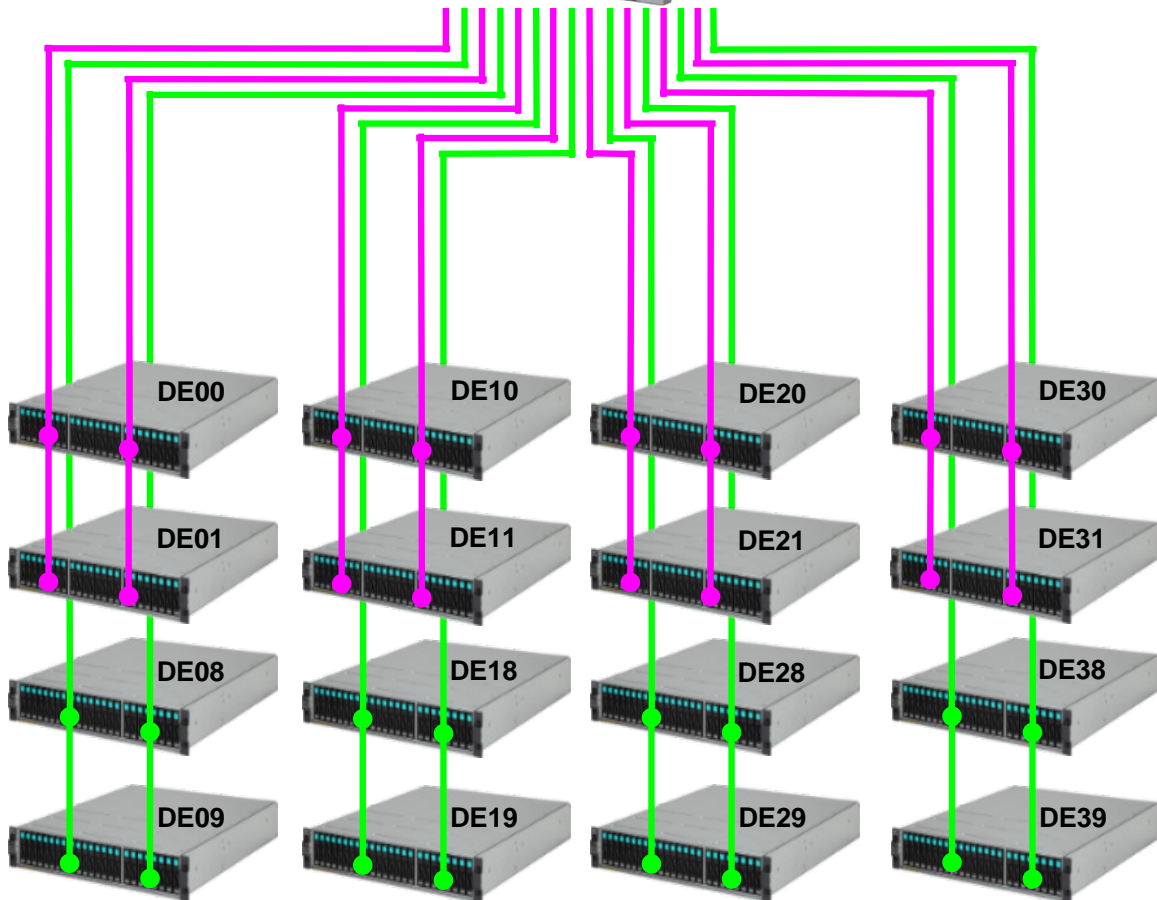
### Priced Storage Configuration Diagram

**12 – NEC N8190-154 Dual 8 Gb/s FC HBAs**  
*(2 ports per HBA, 1 HBA per server)*



**24 – 8 Gbps Fibre Channel connections**  
*(12 HBAs)*

**NEC Storage M700**  
*Dual-Active Controllers*  
*96 GB cache, 48 GB/controller*



**16 – Disk Enclosures**  
**384 – 300 GB, 15K RPM SAS disk drives**  
*(24 disk drives per disk enclosure)*

## Priced Storage Configuration Components

<b>Priced Storage Configuration:</b>
Path Manager for Windows
12 – N8190-154 dual 8 Gb/s FC HBAs
<b>NEC Storage M700</b>
<b>Dual Active Controllers</b>
48 GB cache per controller <i>(96 GB total)</i>
3 – FC 2x4-port Host Port Expansion per controller <i>(8 Gbps, 6 Host Port Expansions total)</i>
24 – 8 Gbps front-end connections per controller <i>(48 total, 24 used)</i>
1 – SAS 8 port Disk Port Expansion per controller <i>(6 Gbps, 2 Disk Port Expansions total)</i>
8 – 6 Gbps SAS backend connections per controller <i>(16 total, 16 used)</i>
16 – Disk Enclosures, 6 Gbps <i>(2.5" disk drives)</i>
384 – 15K RPM 2.5" 300 GB SAS disk drives <i>(24 disk drives per disk enclosure)</i>
1 – 42U Rack with 5 Power Strips <i>(8 outlets per strip)</i>

## **CONFIGURATION INFORMATION**

This portion of the Full Disclosure Report documents and illustrates the detailed information necessary to recreate the Benchmark Configuration (BC), including the Tested Storage Configuration (TSC), so that the SPC-2 benchmark result produced by the BC may be independently reproduced.

In each of the following sections of this document, the appropriate Full Disclosure Report requirement, from the SPC-2 benchmark specification, is stated in italics followed by the information to fulfill the stated requirement.

### **Benchmark Configuration (BC)/Tested Storage Configuration (TSC) Diagram**

#### *Clause 10.6.6*

*The FDR will contain a one page BC/TSC diagram that illustrates all major components of the BC/TSC.*

The Benchmark Configuration (BC)/Tested Storage Configuration (TSC) is illustrated on page [21 \(Benchmark Configuration \(BC\)/Tested Storage Configuration \(TSC\) Diagram\)](#).

### **Storage Network Configuration**

#### *Clause 10.6.6.1*

*If a storage network was configured as a part of the Tested Storage Configuration and the Benchmark Configuration described in Clause 10.6.6 contains a high-level illustration of the network configuration, the Executive Summary will contain a one page topology diagram of the storage network as illustrated in Figure 10.11.*

The Benchmark Configuration (BC)/Tested Storage Configuration (TSC) was configured with local storage and, as such, did not employ a storage network.

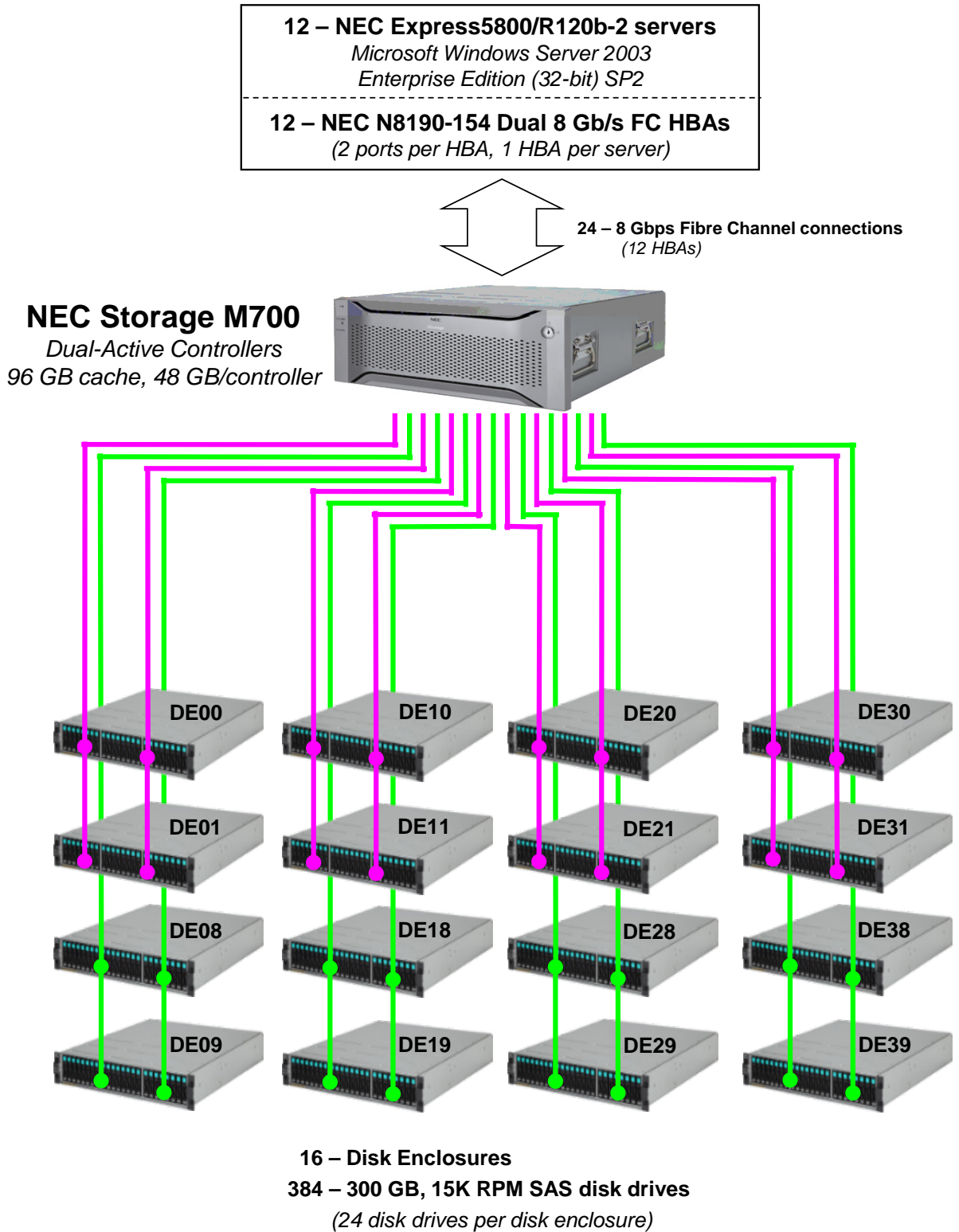
### **Host System and Tested Storage Configuration Table**

#### *Clause 10.6.6.2*

*The FDR will contain a table that lists the major components of each Host System and the Tested Storage Configuration.*

The components that comprise each Host System and the Tested Storage Configuration are listed in the table that appears on page [22 \(Host System and Tested Storage Configuration Components\)](#).

### Benchmark Configuration/Tested Storage Configuration Diagram



**Host System and Tested Storage Configuration Components**

<b>Host Systems:</b>	<b>Tested Storage Configuration (TSC):</b>
<p><b>12 – NEC Express5800/R120b-2 servers</b>                      each server with:                      1 – Intel Xeon X5650 6 core processor                      2.66 GHz, 12 MB Intel Smart Cache                      8 GB main memory                      Microsoft Windows 2003 Enterprise Edition (32-bit) with SP2                      PCIe</p>	Path Manager for Windows
	12 – N8190-154 dual 8 Gb/s FC HBAs
	<p><b>NEC Storage M700</b>  <b>Dual Active Controllers</b>                      48 GB cache per controller <i>(96 GB total)</i>                      3 – FC 2x4-port Disk Port Expansions per controller  <i>(8 Gbps, 6 Host Port Expansions total)</i>                      24 – 8Gbps front-end connections per controller  <i>(48 total, 24 used)</i>                      1 – SAS 8 port Disk Port Expansions per controller  <i>(6 Gbps, 2 Disk Port Expansions per controller)</i>                      8 –6 Gbps SAS backend connections per controller <i>(16total, 16 used)</i></p>
	16 – Disk Enclosures 6 Gbps <i>(2.5" disk drives)</i>
	384 – 15K RPM 2.5" 300 GB SAS disk drives
	1 – 42U Rack with 5 Power Strips <i>(8 outlets per strip)</i>

## Customer Tunable Parameters and Options

### Clause 10.6.7.1

All Benchmark Configuration (BC) components with customer tunable parameter and options that have been altered from their default values must be listed in the FDR. The FDR entry for each of those components must include both the name of the component and the altered value of the parameter or option. If the parameter name is not self-explanatory to a knowledgeable practitioner, a brief description of the parameter's use must also be included in the FDR entry.

[Appendix B: Customer Tunable Parameters and Options](#) on page [66](#) contains the customer tunable parameters and options that have been altered from their default values for this benchmark.

## Tested Storage Configuration (TSC) Creation and Configuration

### Clause 10.6.7.2

The Full Disclosure Report must include sufficient information to recreate the logical representation of the Tested Storage Configuration (TSC). In addition to customer tunable parameters and options (Clause 10.6.6.1), that information must include, at a minimum:

- A diagram and/or description of the following:
  - All physical components that comprise the TSC. Those components are also illustrated in the BC Configuration Diagram in Clause 10.6.5.7 and the Storage Network Configuration Diagram in Clause 10.6.5.8.
  - The logical representation of the TSC, configured from the above components that will be presented to the SPC-2 Workload Generator.
- Listings of scripts used to create the logical representation of the TSC.
- If scripts were not used, a description of the process used with sufficient detail to recreate the logical representation of the TSC.

[Appendix C: Tested Storage Configuration \(TSC\) Creation](#) on page [67](#) contains the detailed information that describes how to create and configure the logical TSC.

## SPC-2 Workload Generator Storage Configuration

### Clause 10.6.7.3

The Full Disclosure Report will include all SPC-2 Workload Generator storage configuration commands and parameters used in the SPC-2 benchmark measurement.

The SPC-2 Workload Generator storage configuration commands and parameters for this measurement appear in [Appendix D: SPC-2 Workload Generator Storage Commands and Parameter Files](#) on page [81](#).

## ASU Pre-Fill

### Clause 6.3.3

*The SPC-2 ASU is required to be completely filled with specified content prior to the execution of audited SPC-2 Tests. The content is required to consist of random data pattern such as that produced by an SPC recommended tool.*

...

### Clause 6.3.3.3

*The required ASU pre-fill must be executed as the first step in the uninterrupted benchmark execution sequence described in Clause 6.4.2. That uninterrupted sequence will consist of: ASU Pre-Fill, Large File Processing, Large Database Query, Video on Demand Delivery and Persistence Test Run 1. The only exception to this requirement is described in Clause 6.3.3.4.*

### Clause 6.3.3.4

*If approved by the Auditor, the Test Sponsor may complete the required ASU pre-fill prior to the execution of the audited SPC-2 Tests and not as part of the SPC-2 Test execution sequence.*

*The Auditor will verify the required random data pattern content in the ASU prior to the execution of the audited SPC-2 Tests. If that verification fails, the Test Sponsor is required to reload the specified content to the ASU.*

The configuration file used to complete the required ASU pre-fill appears in [Appendix D: SPC-2 Workload Generator Storage Commands and Parameter Files](#) on page [81](#).



## **SPC-2 DATA REPOSITORY**

This portion of the Full Disclosure Report presents the detailed information that fully documents the various SPC-2 storage capacities and mappings used in the Tested Storage Configuration. [SPC-2 Data Repository Definitions](#) on page [61](#) contains definitions of terms specific to the SPC-2 Data Repository.

In each of the following sections of this document, the appropriate Full Disclosure Report requirement, from the SPC-2 benchmark specification, is stated in italics followed by the information to fulfill the stated requirement.

### **SPC-2 Storage Capacities and Relationships**

#### *Clause 10.6.8.1*

*Two tables and four charts documenting the storage capacities and relationships of the SPC-2 Storage Hierarchy (Clause 2.1) shall be included in the FDR. ... The capacity value in each chart may be listed as an integer value, for readability, rather than the decimal value listed in the table below.*

#### **SPC-2 Storage Capacities**

The Physical Storage Capacity consisted of 115,200.000 GB distributed over 384 disk drives each with a formatted capacity of 300.000 GB. There was 1,797.014 GB (1.56%) of Unused Storage within the Physical Storage Capacity. Global Storage Overhead consisted of 5,358.788 GB (4.65%) of the Physical Storage Capacity. There was 463.856 GB (0.43%) of Unused Storage within the Configured Storage Capacity. The Total ASU Capacity utilized 100.00% of the Addressable Storage Capacity resulting in 0.00 GB (0.00%) of Unused Storage within the Addressable Storage Capacity. The Data Protection (*Mirroring*) capacity was 54,013.509 GB of which 53,549.652 GB was utilized. The total Unused Storage was 2,724.727 GB.

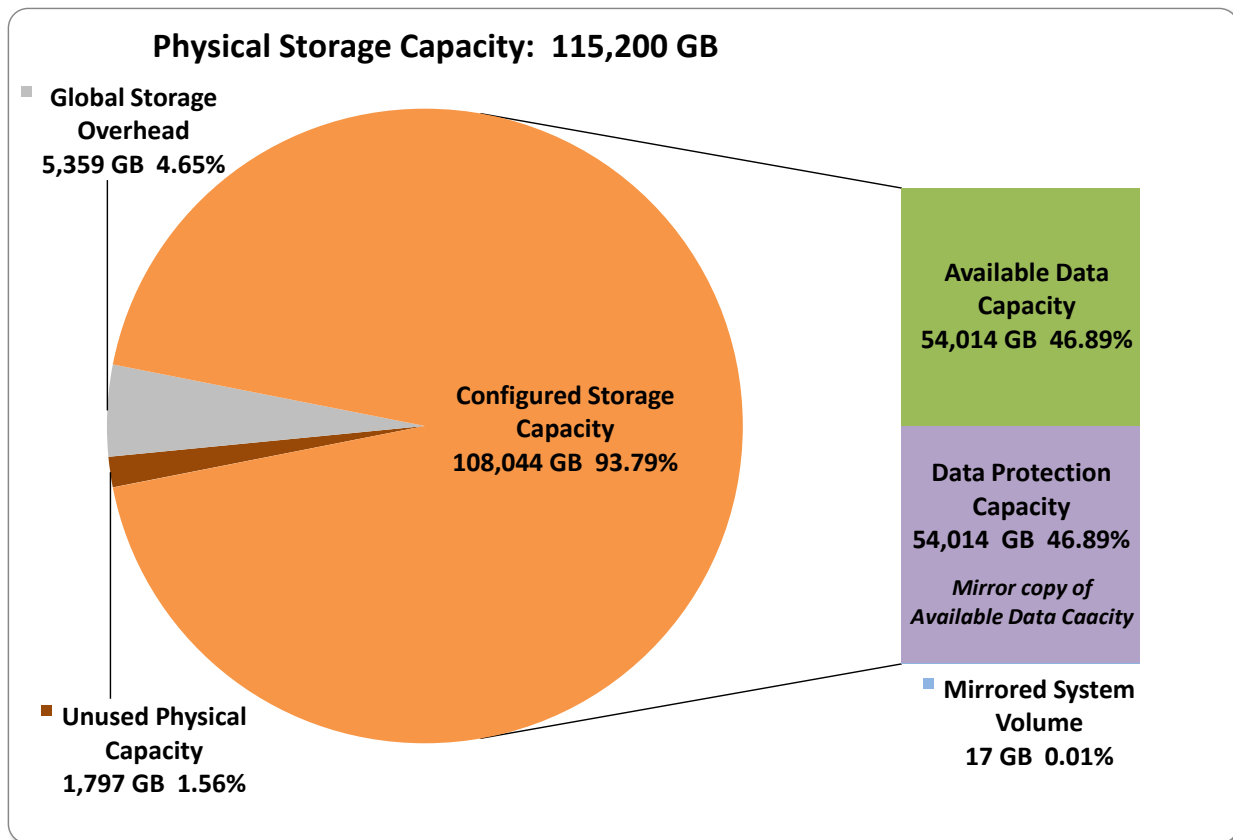
*Note: The configured Storage Devices may include additional storage capacity reserved for system overhead, which is not accessible for application use. That storage capacity may not be included in the value presented for Physical Storage Capacity.*

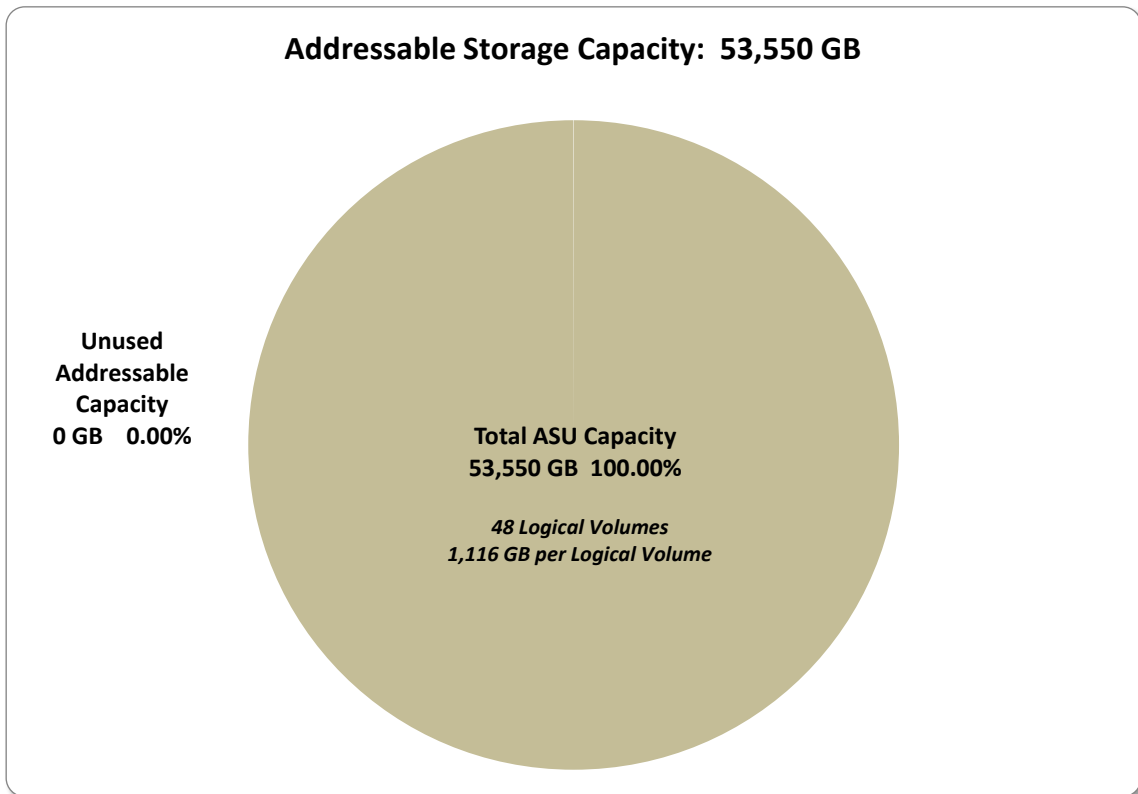
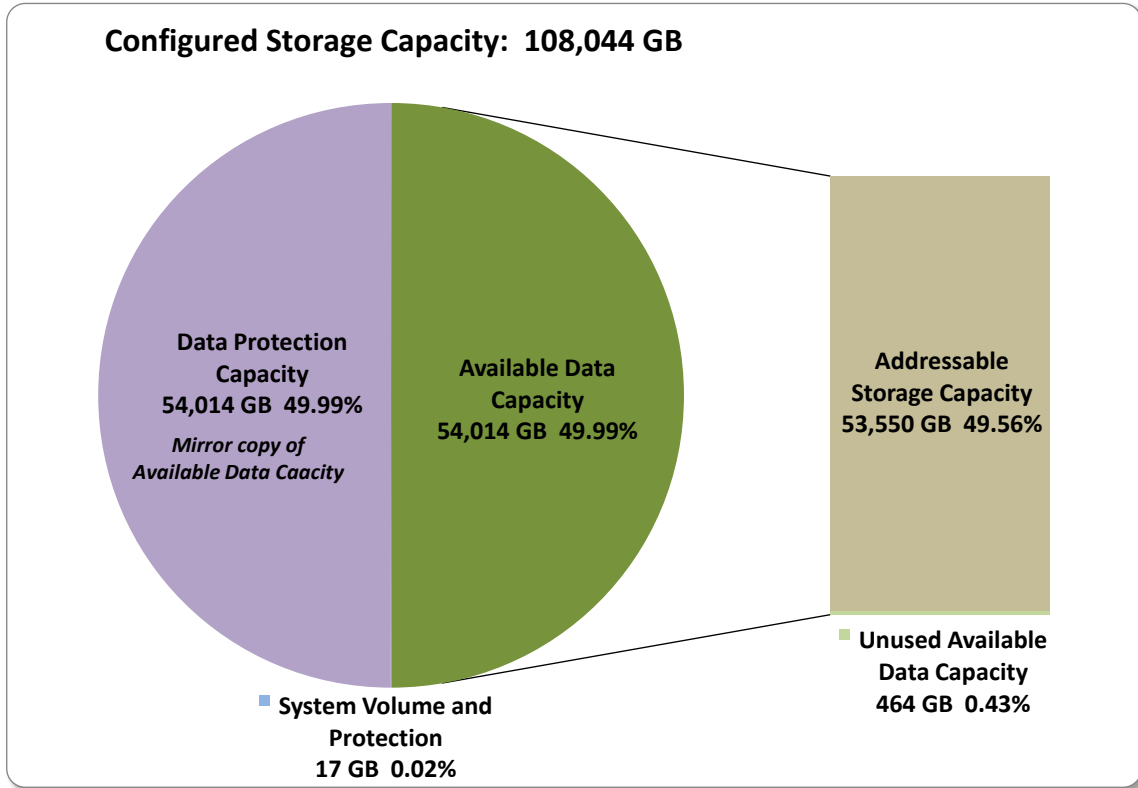
<b>SPC-2 Storage Capacities</b>		
<b>Storage Hierarchy Component</b>	<b>Units</b>	<b>Capacity</b>
Total ASU Capacity	Gigabytes (GB)	53,549.652
Addressable Storage Capacity	Gigabytes (GB)	53,549.652
Configured Storage Capacity	Gigabytes (GB)	108,044.197
Physical Storage Capacity	Gigabytes (GB)	115,200.000
Data Protection ( <i>Mirroring</i> )	Gigabytes (GB)	54,013.509
Required Storage	Gigabytes (GB)	0.000
Global Storage Overhead	Gigabytes (GB)	5,358.788
Total Unused Storage	Gigabytes (GB)	2,724.727

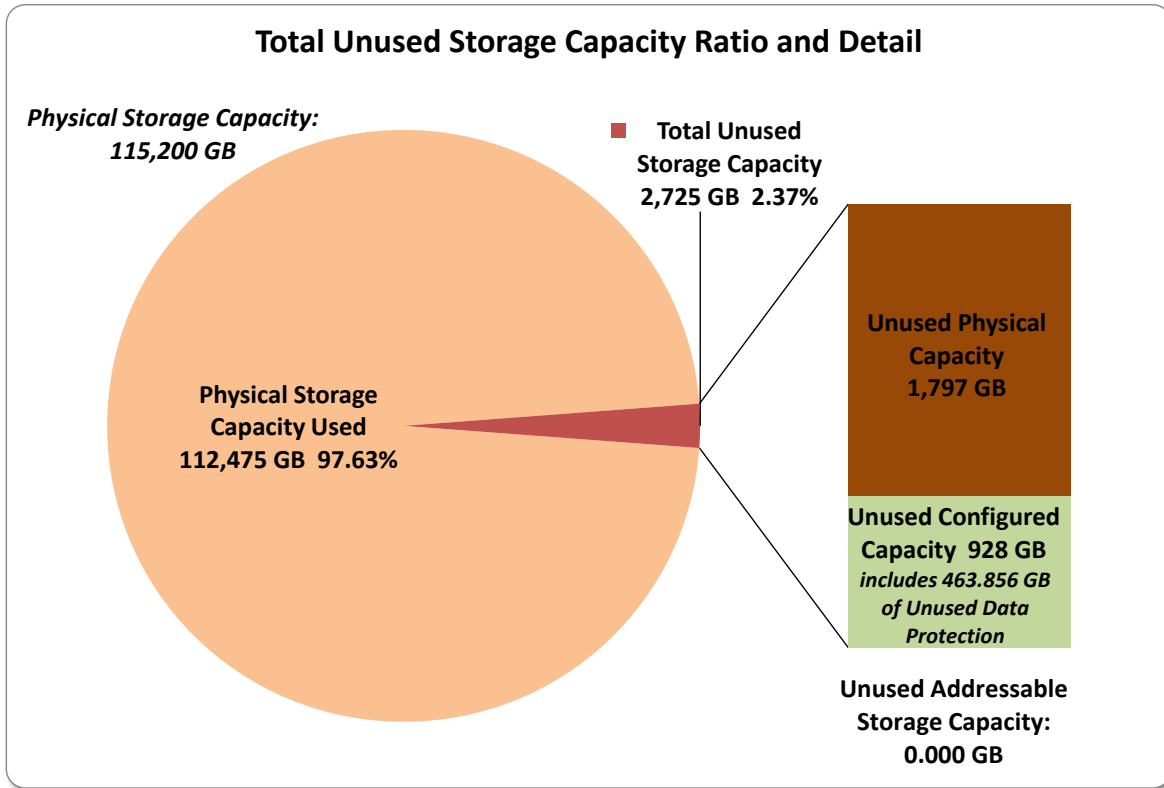
**SPC-2 Storage Hierarchy Ratios**

	Addressable Storage Capacity	Configured Storage Capacity	Physical Storage Capacity
<b>Total ASU Capacity</b>	100.00%	49.56%	46.48%
<b>Data Protection (RAID-6)</b>		49.99%	46.89%
<b>Addressable Storage Capacity</b>		49.56%	46.48%
<b>Required Storage</b>		0.00%	0.00%
<b>Configured Storage Capacity</b>			93.79%
<b>Global Storage Overhead</b>			4.65%
<b>Unused Storage:</b>			
<b>Addressable</b>	0.00%		
<b>Configured</b>		0.43%	
<b>Physical</b>			1.56%

**SPC-1 Storage Capacity Charts**







## Storage Capacity Utilization

### Clause 10.6.8.2

The FDR will include a table illustrating the storage capacity utilization values defined for Application Utilization (Clause 2.8.1), Protected Application Utilization (Clause 2.8.2), and Unused Storage Ratio (Clause 2.8.3).

### Clause 2.8.1

**Application Utilization** is defined as Total ASU Capacity divided by Physical Storage Capacity.

### Clause 2.8.2

**Protected Application Utilization** is defined as (Total ASU Capacity plus total Data Protection Capacity minus unused Data Protection Capacity) divided by Physical Storage Capacity.

### Clause 2.8.3

**Unused Storage Ratio** is defined as Total Unused Capacity divided by Physical Storage Capacity and may not exceed 45%.

SPC-2 Storage Capacity Utilization	
Application Utilization	46.48%
Protected Application Utilization	92.97%
Unused Storage Ratio	2.37%

## Logical Volume Capacity and ASU Mapping

### Clause 10.6.8.3

A table illustrating the capacity of the Application Storage Unit (ASU) and the mapping of Logical Volumes to ASU will be provided in the FDR. Capacity must be stated in gigabytes (GB) as a value with a minimum of two digits to the right of the decimal point. Each Logical Volume will be sequenced in the table from top to bottom per its position in the contiguous address space of the ASU. Each Logical Volume entry will list its total capacity, the portion of that capacity used for the ASU, and any unused capacity.

<b>Logical Volume (LV) Capacity and Mapping</b>			
<b>ASU (53,549.652 GB)</b>			
	<b>Total Capacity (GB)</b>	<b>Capacity Used (GB)</b>	<b>Capacity Unused (GB)</b>
Logical Volumes 1-48	1,115.618 per LV	1,115.618 per LV	0.000 per LV

See the Storage Definition (sd) entries in [Appendix D: SPC-2 Workload Generator Storage Commands and Parameter](#) Files on page [81](#) for more detailed configuration information.

## **SPC-2 BENCHMARK EXECUTION RESULTS**

This portion of the Full Disclosure Report documents the results of the various SPC-2 Tests, Test Phases, Test Run Sequences, and Test Runs. An [SPC-2 glossary](#) on page [61](#) contains definitions of terms specific to the SPC-2 Data Repository.

In each of the following sections of this document, the appropriate Full Disclosure Report requirement, from the SPC-2 benchmark specification, is stated in italics followed by the information to fulfill the stated requirement.

### **SPC-2 Tests, Test Phases, Test Run Sequences, and Test Runs**

The SPC-2 benchmark consists of the following Tests, Test Phases, Test Run Sequences, and Test Runs:

- **Data Persistence Test**
  - Data Persistence Test Run 1
  - Data Persistence Test Run 2
- **Large File Processing Test**
  - WRITE ONLY Test Phase
    - Test Run Sequence 1
      - ✓ Test Run 1 – 1024 KiB Transfer – maximum number of Streams
      - ✓ Test Run 2 – 1024 KiB Transfer – 50% of Test Run 1’s Streams value
      - ✓ Test Run 3 – 1024 KiB Transfer – 25% of Test Run 1’s Streams value
      - ✓ Test Run 4 – 1024 KiB Transfer – 12.5% of Test Run 1’s Streams value
      - ✓ Test Run 5 – 1024 KiB Transfer – single (1) Stream
    - Test Run Sequence 2
      - ✓ Test Run 6 – 256 KiB Transfer – maximum number of Streams
      - ✓ Test Run 7 – 256 KiB Transfer – 50% of Test Run 6’s Streams value
      - ✓ Test Run 8 – 256 KiB Transfer – 25% of Test Run 6’s Streams value
      - ✓ Test Run 9 – 256 KiB Transfer – 12.5% of Test Run 6’s Streams value
      - ✓ Test Run 10 – 256 KiB Transfer – single (1) Stream
  - READ-WRITE Test Phase
    - Test Run Sequence 3
      - ✓ Test Run 11 – 1024 KiB Transfer – maximum number of Streams
      - ✓ Test Run 12 – 1024 KiB Transfer – 50% of Test Run 11’s Streams value
      - ✓ Test Run 13 – 1024 KiB Transfer – 25% of Test Run 11’s Streams value
      - ✓ Test Run 14 – 1024 KiB Transfer – 12.5% of Test Run 11’s Streams value
      - ✓ Test Run 15 – 1024 KiB Transfer – single (1) Stream
    - Test Run Sequence 4
      - ✓ Test Run 16 – 256 KiB Transfer – maximum number of Streams
      - ✓ Test Run 17 – 256 KiB Transfer – 50% of Test Run 16’s Streams value
      - ✓ Test Run 18 – 256 KiB Transfer – 25% of Test Run 16’s Streams value
      - ✓ Test Run 19 – 256 KiB Transfer – 12.5% of Test Run 16’s Streams value
      - ✓ Test Run 20 – 256 KiB Transfer – single (1) Stream
  - READ ONLY Test Phase
    - Test Run Sequence 5
      - ✓ Test Run 21 – 1024 KiB Transfer – maximum number of Streams

- ✓ Test Run 22 – 1024 KiB Transfer – 50% of Test Run 21’s Streams value
- ✓ Test Run 23 – 1024 KiB Transfer – 25% of Test Run 21’s Streams value
- ✓ Test Run 24 – 1024 KiB Transfer – 12.5% of Test Run 21’s Streams value
- ✓ Test Run 25 – 1024 KiB Transfer – single (1) Stream
- Test Run Sequence 6
  - ✓ Test Run 26 – 256 KiB Transfer – maximum number of Streams
  - ✓ Test Run 27 – 256 KiB Transfer – 50% of Test Run 26’s Streams value
  - ✓ Test Run 28 – 256 KiB Transfer – 25% of Test Run 26’s Streams value
  - ✓ Test Run 29 – 256 KiB Transfer – 12.5% of Test Run 26’s Streams value
  - ✓ Test Run 30 – 256 KiB Transfer – single (1) Stream
- **Large Database Query Test**
  - 1024 KIB TRANSFER SIZE Test Phase
    - Test Run Sequence 1
      - ✓ Test Run 1 – 4 I/O Requests Outstanding – maximum number of Streams
      - ✓ Test Run 2 – 4 I/O Requests Outstanding – 50% of Test Run 1’s Streams value
      - ✓ Test Run 3 – 4 I/O Requests Outstanding – 25% of Test Run 1’s Streams value
      - ✓ Test Run 4 – 4 I/O Requests Outstanding – 12.5% of Test Run 1’s Streams value
      - ✓ Test Run 5 – 4 I/O Requests Outstanding – single (1) Stream
    - Test Run Sequence 2
      - ✓ Test Run 6 – 1 I/O Request Outstanding – maximum number of Streams
      - ✓ Test Run 7 – 1 I/O Request Outstanding – 50% of Test Run 6’s Streams value
      - ✓ Test Run 8 – 1 I/O Request Outstanding – 25% of Test Run 6’s Streams value
      - ✓ Test Run 9 – 1 I/O Request Outstanding – 12.5% of Test Run 6’s Streams value
      - ✓ Test Run 10 – 1 I/O Request Outstanding – single (1) Stream
  - 64 KIB TRANSFER SIZE Test Phase
    - Test Run Sequence 3
      - ✓ Test Run 11 – 4 I/O Requests Outstanding – maximum number of Streams
      - ✓ Test Run 12 – 4 I/O Requests Outstanding – 50% of Test Run 11’s Streams value
      - ✓ Test Run 13 – 4 I/O Requests Outstanding – 25% of Test Run 11’s Streams value
      - ✓ Test Run 14 – 4 I/O Requests Outstanding – 12.5% of Test Run 11’s Streams value
      - ✓ Test Run 15 – 4 I/O Requests Outstanding – single (1) Stream
    - Test Run Sequence 4
      - ✓ Test Run 16 – 1 I/O Request Outstanding – maximum number of Streams
      - ✓ Test Run 17 – 1 I/O Request Outstanding – 50% of Test Run 16’s Streams value
      - ✓ Test Run 18 – 1 I/O Request Outstanding – 25% of Test Run 16’s Streams value
      - ✓ Test Run 19 – 1 I/O Request Outstanding – 12.5% of Test Run 16’s Streams value
      - ✓ Test Run 20 – 1 I/O Request Outstanding – single (1) Stream
- **Video on Demand Delivery Test**
  - Video on Demand Delivery Test Run

Each Test is an atomic unit that must be executed from start to finish before any other Test, Test Phase, or Test Run may be executed. The Tests may be executed in any sequence.

The results from each Test, Test Phase, and Test Run are listed below along with a more detailed explanation of each component.

## Large File Processing Test

### Clause 6.4.3.1

*The Large File Processing Test consists of the I/O operations associated with the type of applications, in a wide range of fields, which require simple sequential processing of one or more large files. Specific examples of those types of applications include scientific computing and large-scale financial processing*

### Clause 6.4.3.2

*The Large File Processing Test has three Test Phases, which shall be executed in the following uninterrupted sequence:*

1. *WRITE ONLY*
2. *READ-WRITE*
3. *READ ONLY*

*The BC shall not be restarted or manually disturbed, altered, or adjusted during the execution of the Large File Processing Test. If power is lost to the BC during this Test all results shall be rendered invalid and the Test re-run in its entirety.*

### Clause 10.6.9.1

*The Full Disclosure Report will contain the following content for the Large File Processing Test:*

1. *A listing of the SPC-2 Workload Generator commands and parameters used to execute each of the Test Runs in the Large File Processing Test.*
2. *The human readable SPC-2 Test Results File for each of the Test Runs in the Large File Processing Test.*
3. *The following three tables:*
  - *Average Data Rate: The average Data Rate, in MB per second for the Measurement Interval of each Test Run in the Large File Processing Test.*
  - *Average Data Rate per Stream: The average Data Rate per Stream, in MB per second, for the Measurement Interval of each Test Run in the Large File Processing Test.*
  - *Average Response Time: The average response time, in milliseconds (ms), for the Measurement Interval of each Test Run in the Large File Processing Test.*
4. *Average Data Rate, Average Data Rate per Stream and Average Response Time graphs as defined in Clauses 10.1.1, 10.1.2 and 10.1.3.*

## SPC-2 Workload Generator Commands and Parameters

The SPC-2 Workload Generator commands and parameters for the Large File Processing Test Runs are documented in [Appendix E: SPC-2 Workload Generator Execution Commands and Parameters](#) on Page 88.



### SPC-2 Test Results File

A link to the SPC-2 Test Results file generated from the Large File Processing Test Runs is listed below.

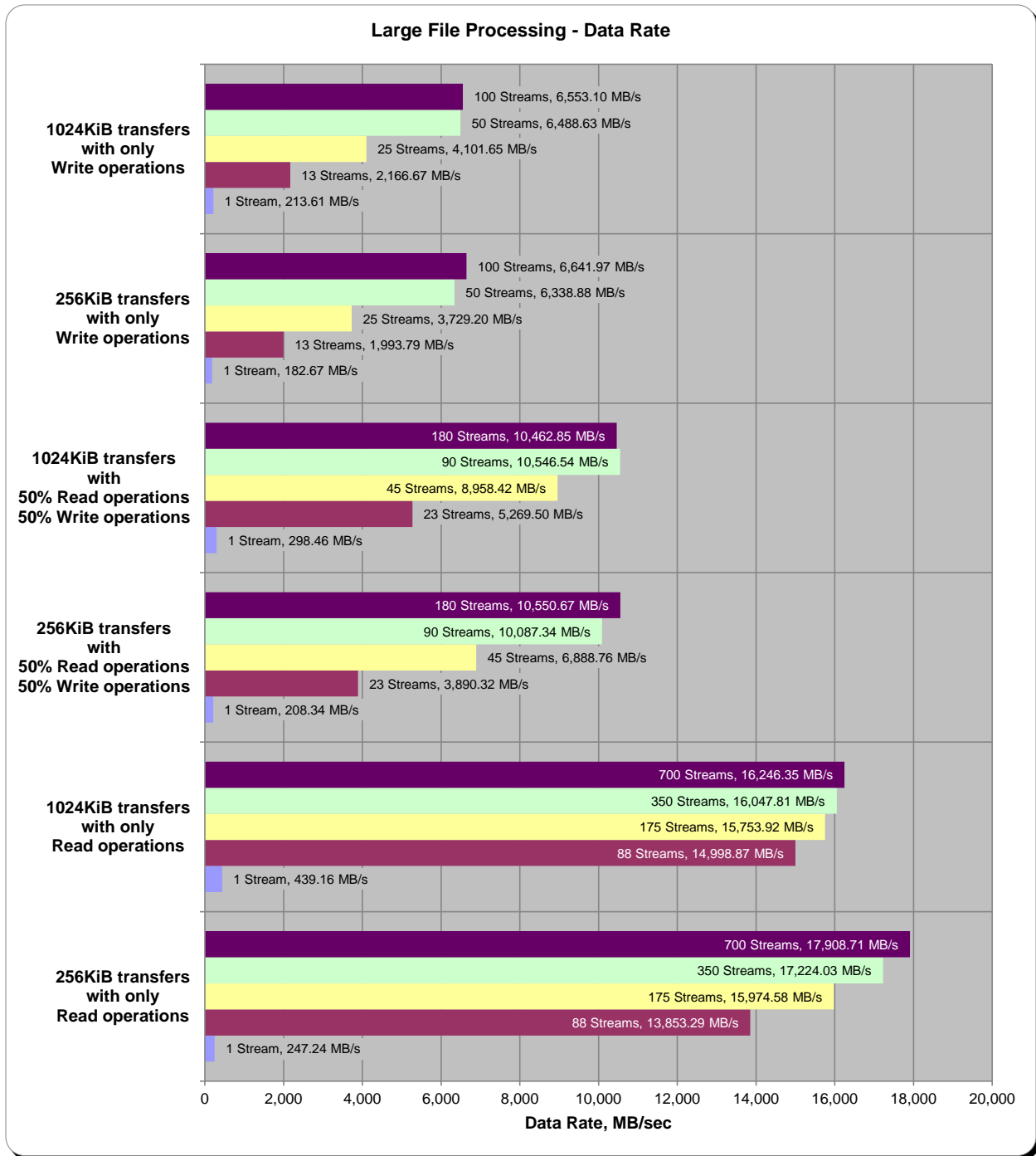
[SPC-2 Large File Processing Test Results File](#)

### SPC-2 Large File Processing Average Data Rates (MB/s)

The average Data Rate (MB/s) for each Test Run in the three Test Phases of the SPC-2 Large File Processing Test is listed in the table below as well as illustrated in the following graph.

<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>13 Streams</b>	<b>25 Streams</b>	<b>50 Streams</b>	<b>100 Streams</b>
Write 1024KiB	213.61	2,166.67	4,101.65	6,488.63	6,553.10
<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>13 Streams</b>	<b>25 Streams</b>	<b>50 Streams</b>	<b>100 Streams</b>
Write 256KiB	182.67	1,993.79	3,729.20	6,338.88	6,641.97
<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>23 Streams</b>	<b>45 Streams</b>	<b>90 Streams</b>	<b>180 Streams</b>
Read/Write 1024KiB	298.46	5,269.50	8,958.42	10,546.54	10,462.85
<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>23 Streams</b>	<b>45 Streams</b>	<b>90 Streams</b>	<b>180 Streams</b>
Read/Write 256KiB	208.34	3,890.32	6,888.76	10,087.34	10,550.67
<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>88 Streams</b>	<b>175 Streams</b>	<b>350 Streams</b>	<b>700 Streams</b>
Read 1024KiB	439.16	14,998.87	15,753.92	16,047.81	16,246.35
<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>88 Streams</b>	<b>175 Streams</b>	<b>350 Streams</b>	<b>700 Streams</b>
Read 256KiB	247.24	13,853.29	15,974.58	17,224.03	17,908.71

**SPC-2 Large File Processing Average Data Rates Graph**

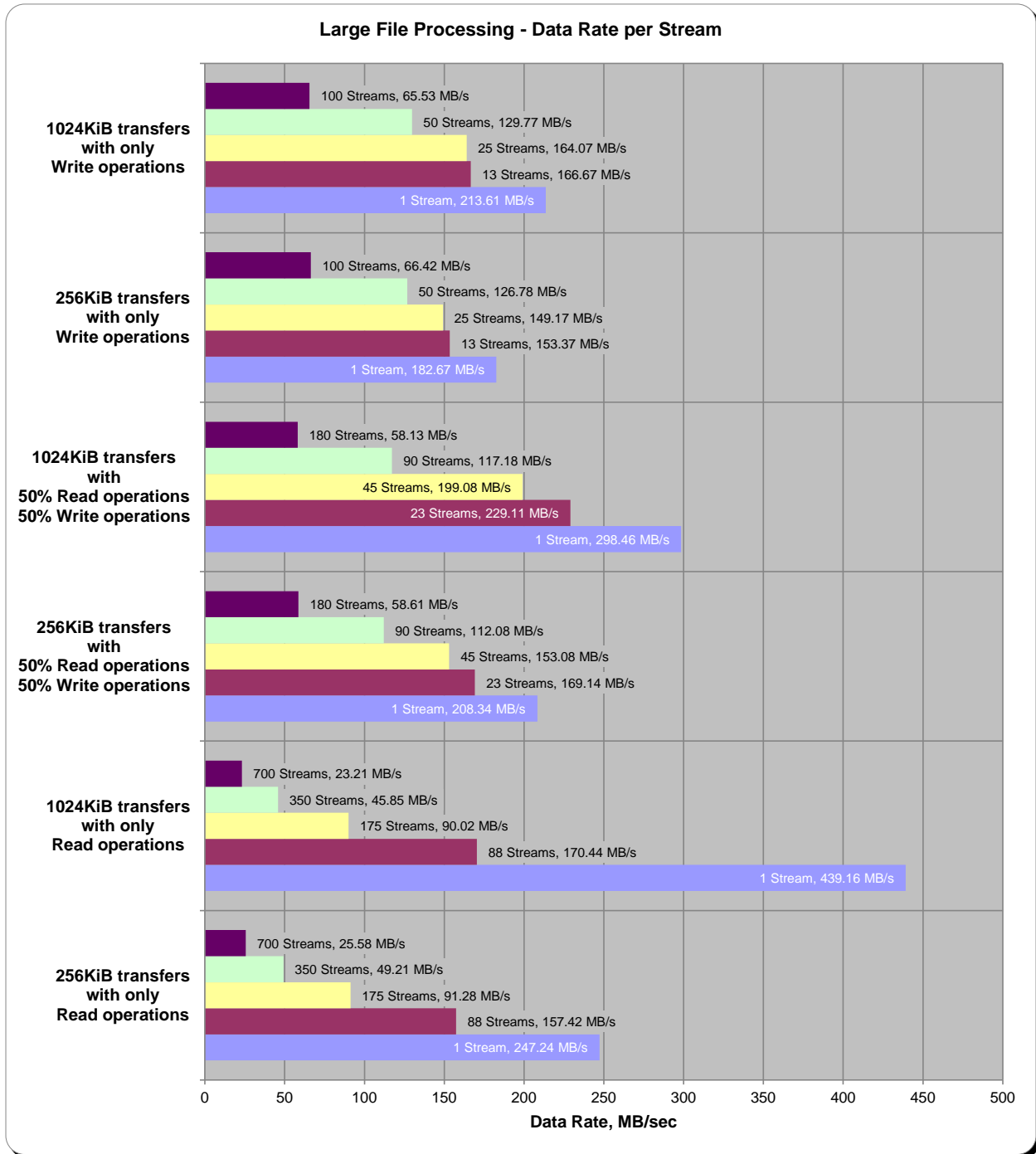


**SPC-2 Large File Processing Average Data Rate per Stream**

The average Data Rate per Stream for each Test Run in the three Test Phases of the SPC-2 Large File Processing Test is listed in the table below as well as illustrated in the following graph.

<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>13 Streams</b>	<b>25 Streams</b>	<b>50 Streams</b>	<b>100 Streams</b>
Write 1024KiB	213.61	166.67	164.07	129.77	65.53
<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>13 Streams</b>	<b>25 Streams</b>	<b>50 Streams</b>	<b>100 Streams</b>
Write 256KiB	182.67	153.37	149.17	126.78	66.42
<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>23 Streams</b>	<b>45 Streams</b>	<b>90 Streams</b>	<b>180 Streams</b>
Read/Write 1024KiB	298.46	229.11	199.08	117.18	58.13
<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>23 Streams</b>	<b>45 Streams</b>	<b>90 Streams</b>	<b>180 Streams</b>
Read/Write 256KiB	208.34	169.14	153.08	112.08	58.61
<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>88 Streams</b>	<b>175 Streams</b>	<b>350 Streams</b>	<b>700 Streams</b>
Read 1024KiB	439.16	170.44	90.02	45.85	23.21
<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>88 Streams</b>	<b>175 Streams</b>	<b>350 Streams</b>	<b>700 Streams</b>
Read 256KiB	247.24	157.42	91.28	49.21	25.58

**SPC-2 Large File Processing Average Data Rate per Stream Graph**

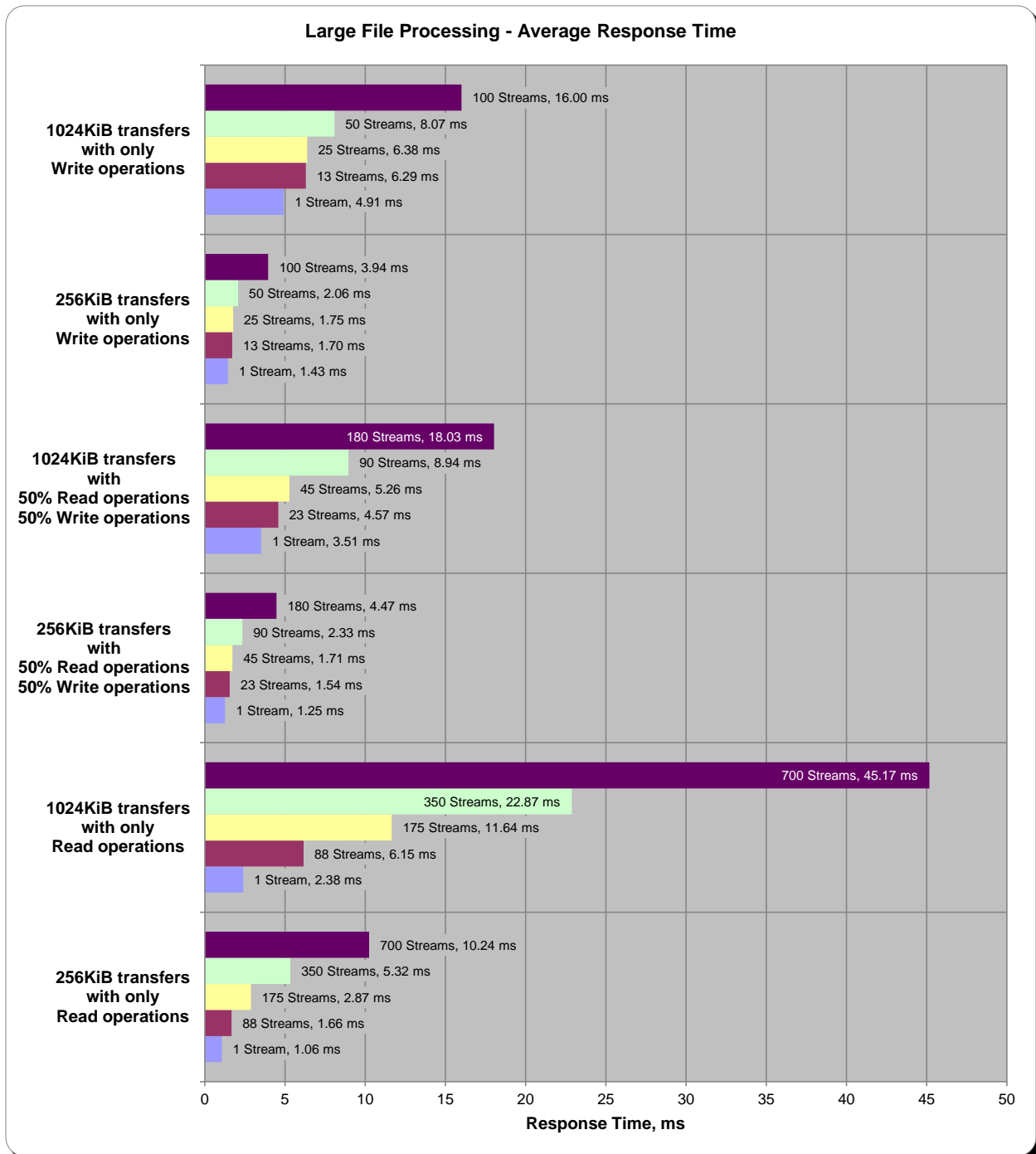


**SPC-2 Large File Processing Average Response Time**

The average Response Time, milliseconds (ms), for each Test Run in the three Test Phases of the SPC-2 Large File Processing Test is listed in the table below as well as illustrated in the following graph.

<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>13 Streams</b>	<b>25 Streams</b>	<b>50 Streams</b>	<b>100 Streams</b>
Write 1024KiB	4.91	6.29	6.38	8.07	16.00
<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>13 Streams</b>	<b>25 Streams</b>	<b>50 Streams</b>	<b>100 Streams</b>
Write 256KiB	1.43	1.70	1.75	2.06	3.94
<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>23 Streams</b>	<b>45 Streams</b>	<b>90 Streams</b>	<b>180 Streams</b>
Read/Write 1024KiB	3.51	4.57	5.26	8.94	18.03
<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>23 Streams</b>	<b>45 Streams</b>	<b>90 Streams</b>	<b>180 Streams</b>
Read/Write 256KiB	1.25	1.54	1.71	2.33	4.47
<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>88 Streams</b>	<b>175 Streams</b>	<b>350 Streams</b>	<b>700 Streams</b>
Read 1024KiB	2.38	6.15	11.64	22.87	45.17
<b>Test Run Sequence</b>	<b>1 Stream</b>	<b>88 Streams</b>	<b>175 Streams</b>	<b>350 Streams</b>	<b>700 Streams</b>
Read 256KiB	1.06	1.66	2.87	5.32	10.24

**SPC-2 Large File Processing Average Response Time Graph**



## Large File Processing Test – WRITE ONLY Test Phase

### Clause 10.6.9.1.1

1. *A table that will contain the following information for each "WRITE ONLY, 1024 KiB Transfer Size" Test Run:*
  - *The number of Streams specified.*
  - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
2. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "WRITE ONLY, 1024 KiB Transfer Size" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*
3. *A table that will contain the following information for each "WRITE ONLY, 256 KiB Transfer Size" Test Run:*
  - *The number of Streams specified.*
  - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
4. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "WRITE ONLY, 256 KiB Transfer Size" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*

*A hyperlink for each of the above tables and graphs may appear in the FDR to provide access to the table or graph.*

A hyperlink to a table with the SPC-2 "Large File Processing/WRITE ONLY/1024 KiB Transfer Size" Test Run data appears on the next page. That entry is followed by hyperlinks to graphs illustrating the average Data Rate, average Data Rate per Stream, and average Response Time produced by the same Test Runs. The table and graphs present the data at five-second intervals.

Immediately following the above SPC-2 "Large File Processing/WRITE ONLY/1024 KiB Transfer Size" entries will be hyperlinks for SPC-2 "Large File Processing/WRITE ONLY/256 KiB Transfer Size" table and graphs. The table contains the Test Run data and the graphs illustrate the average Data Rate, average Data Rate per Stream, and average Response Time produced by the Test Runs.

**SPC-2 “Large File Processing/WRITE ONLY/1024 KiB Transfer Size” Test Run Data**

[SPC-2 “Large File Processing/WRITE ONLY/1024 KiB Transfer Size” Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods](#) (3 pages)

**SPC-2 “Large File Processing/Write Only/1024 KiB Transfer Size” Graphs**

**Average Data Rate – Complete Test Run**

**Average Data Rate – Measurement Interval (MI) Only**

**Average Data Rate per Stream**

**Average Response Time**

[SPC-2 “Large File Processing/WRITE ONLY/1024 KiB Transfer Size” graphs](#)  
(four pages, 1 graph per page)

**SPC-2 “Large File Processing/WRITE ONLY/256 KiB Transfer Size” Test Run Data**

[SPC-2 “Large File Processing/WRITE ONLY/256 KiB Transfer Size” Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods](#) (3 pages)

**SPC-2 “Large File Processing/WRITE ONLY/256 KiB Transfer Size” Graphs**

**Average Data Rate – Complete Test Run**

**Average Data Rate – Measurement Interval (MI) Only**

**Average Data Rate per Stream**

**Average Response Time**

[SPC-2 “Large File Processing/WRITE ONLY/256 KiB Transfer Size” graphs](#)  
(four pages, 1 graph per page)



## Large File Processing Test – READ-WRITE Test Phase

### Clause 10.6.9.1.2

1. *A table that will contain the following information for each "READ-WRITE, 1024 KiB Transfer Size" Test Run:*
  - *The number of Streams specified.*
  - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
2. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "READ-WRITE, 1024 KiB Transfer Size" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*
3. *A table that will contain the following information for each "READ-WRITE, 256 KiB Transfer Size" Test Run:*
  - *The number of Streams specified.*
  - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
4. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "READ-WRITE, 256 KiB Transfer Size" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*

*A hyperlink for each of the above tables and graphs may appear in the FDR to provide access to the table or graph.*

A hyperlink to a table with the SPC-2 "Large File Processing/READ-WRITE/1024 KiB Transfer Size" Test Run data appears on the next page. That entry is followed by hyperlinks to graphs illustrating the average Data Rate, average Data Rate per Stream, and average Response Time produced by the same Test Runs. The table and graphs present the data at five-second intervals.

Immediately following the above SPC-2 "Large File Processing/READ-WRITE/1024 KiB Transfer Size" entries will be hyperlinks for SPC-2 "Large File Processing/READ-WRITE/256 KiB Transfer Size" table and graphs. The table contains the Test Run data and the graphs illustrate the average Data Rate, average Data Rate per Stream, and average Response Time produced by the Test Runs.

**SPC-2 “Large File Processing/READ-WRITE/1024 KiB Transfer Size” Test Run Data**

[SPC-2 “Large File Processing/READ-WRITE/1024 KiB Transfer Size” Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods](#) (3 pages)

**SPC-2 “Large File Processing/Read-Write/1024 KiB Transfer Size” Graphs**

**Average Data Rate – Complete Test Run**

**Average Data Rate – Measurement Interval (MI) Only**

**Average Data Rate per Stream**

**Average Response Time**

[SPC-2 “Large File Processing/READ-WRITE/1024 KiB Transfer Size” graphs](#)  
(four pages, 1 graph per page)

**SPC-2 “Large File Processing/READ-WRITE/256 KiB Transfer Size” Test Run Data**

[SPC-2 “Large File Processing/READ-WRITE/256 KiB Transfer Size” Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods](#) (3 pages)

**SPC-2 “Large File Processing/READ-WRITE/256 KiB Transfer Size” Graphs**

**Average Data Rate – Complete Test Run**

**Average Data Rate – Measurement Interval (MI) Only**

**Average Data Rate per Stream**

**Average Response Time**

[SPC-2 “Large File Processing/READ-WRITE/256 KiB Transfer Size” graphs](#)  
(four pages, 1 graph per page)

## Large File Processing Test – READ ONLY Test Phase

### Clause 10.6.9.1.3

1. *A table that will contain the following information for each "READ ONLY, 1024 KiB Transfer Size" Test Run:*
  - *The number of Streams specified.*
  - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
2. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "READ ONLY, 1024 KiB Transfer Size" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*
3. *A table that will contain the following information for each "READ ONLY, 256 KiB Transfer Size" Test Run:*
  - *The number of Streams specified.*
  - *The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.*
4. *Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "READ ONLY, 256 KiB Transfer Size" Test Runs as specified in Clauses 10.1.4 – 10.1.6.*

*A hyperlink for each of the above tables and graphs may appear in the FDR to provide access to the table or graph.*

A hyperlink to a table with the SPC-2 "Large File Processing/READ ONLY/1024 KiB Transfer Size" Test Run data appears on the next page. That entry is followed by hyperlinks to graphs illustrating the average Data Rate, average Data Rate per Stream, and average Response Time produced by the same Test Runs. The table and graphs present the data at five-second intervals.

Immediately following the above SPC-2 "Large File Processing/READ ONLY/1024 KiB Transfer Size" entries will be hyperlinks for SPC-2 "Large File Processing/READ ONLY/256 KiB Transfer Size" table and graphs. The table contains the Test Run data and the graphs illustrate the average Data Rate, average Data Rate per Stream, and average Response Time produced by the Test Runs.

**SPC-2 “Large File Processing/READ ONLY/1024 KiB Transfer Size” Test Run Data**

[SPC-2 “Large File Processing/READ ONLY/1024 KiB Transfer Size” Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods](#) (3 pages)

**SPC-2 “Large File Processing/Read Only/1024 KiB Transfer Size” Graphs**

**Average Data Rate – Complete Test Run**

**Average Data Rate – Measurement Interval (MI) Only**

**Average Data Rate per Stream**

**Average Response Time**

[SPC-2 “Large File Processing/READ ONLY/1024 KiB Transfer Size” graphs](#)  
(four pages, 1 graph per page)

**SPC-2 “Large File Processing/READ ONLY/256 KiB Transfer Size” Test Run Data**

[SPC-2 “Large File Processing/READ ONLY/256 KiB Transfer Size” Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods](#) (3 pages)

**SPC-2 “Large File Processing/READ ONLY/256 KiB Transfer Size” Graphs**

**Average Data Rate – Complete Test Run**

**Average Data Rate – Measurement Interval (MI) Only**

**Average Data Rate per Stream**

**Average Response Time**

[SPC-2 “Large File Processing/READ ONLY/256 KiB Transfer Size” graphs](#)  
(four pages, 1 graph per page)

## Large Database Query Test

### Clause 6.4.4.1

*The Large Database Query Test is comprised of a set of I/O operations representative of scans or joins of large relational tables such as those performed for data mining or business intelligence.*

### Clause 6.4.4.2

*The Large Database Query Test has two Test Phases, which shall be executed in the following uninterrupted sequence:*

- 1. 1024 KiB TRANSFER SIZE*
- 2. 64 KiB TRANSFER SIZE*

*The BC shall not be restarted or manually disturbed, altered, or adjusted during the execution of the Large File Processing Test. If power is lost to the BC during this Test all results shall be rendered invalid and the Test re-run in its entirety.*

### Clause 10.6.9.2

*The Full Disclosure Report will contain the following content for the Large Database Query Test:*

- 1. A listing of the SPC-2 Workload Generator commands and parameters used to execute each of the Test Runs in the Large Database Query Test.*
- 2. The human readable SPC-2 Test Results File for each of the Test Runs in the Large Database Query Test.*
- 3. A table that contains the following information for each Test Run in the two Test Phases of the Large Database Query Test:*
  - Average Data Rate: The average Data Rate, in MB per second for the Measurement Interval of each Test Run in the Large Database Query Test.*
  - Average Data Rate per Stream: The average Data Rate per Stream, in MB per second, for the Measurement Interval of each Test Run in the Large Database Query Test.*
  - Average Response Time: The average response time, in milliseconds (ms), for the Measurement Interval of each Test Run in the Large Database Query Test.*
- 4. Average Data Rate, Average Data Rate per Stream and Average Response time graphs as defined in Clauses 10.1.1, 10.1.2 and 10.1.3.*

## SPC-2 Workload Generator Commands and Parameters

The SPC-2 Workload Generator commands and parameters for the Large Database Query Test Runs are documented in [Appendix E: SPC-2 Workload Generator Execution Commands and Parameters](#) on Page [88](#).

## SPC-2 Test Results File

A link to the SPC-2 Test Results file generated from the Large Database Query Test Runs is listed below.

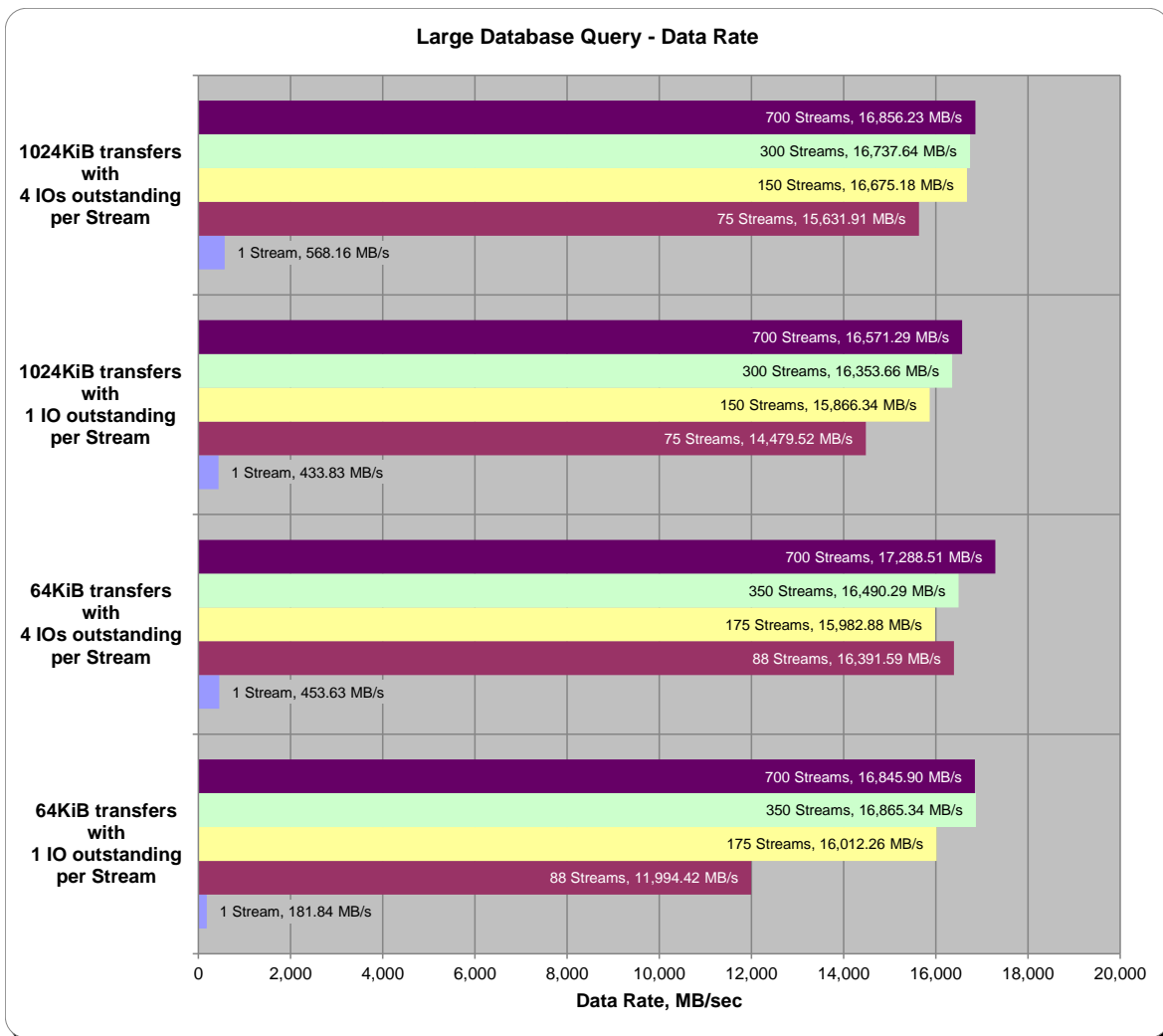
[SPC-2 Large Database Query Test Results File](#)

### SPC-2 Large Database Query Average Data Rates (MB/s)

The average Data Rate (MB/s) for each Test Run in the two Test Phases of the SPC-2 Large Database Query Test is listed in the table below as well as illustrated in the following graph.

Test Run Sequence	1 Stream	75 Streams	150 Streams	300 Streams	700 Streams
1024KiB w/ 4 IOs/Stream	568.16	15,631.91	16,675.18	16,737.64	16,856.23
Test Run Sequence	1 Stream	75 Streams	150 Streams	300 Streams	700 Streams
1024KiB w/ 1 IO/Stream	433.83	14,479.52	15,866.34	16,353.66	16,571.29
Test Run Sequence	1 Stream	88 Streams	175 Streams	350 Streams	700 Streams
64KiB w/ 4 IOs/Stream	453.63	16,391.59	15,982.88	16,490.29	17,288.51
Test Run Sequence	1 Stream	88 Streams	175 Streams	350 Streams	700 Streams
64KiB w/ 1 IO/Stream	181.84	11,994.42	16,012.26	16,865.34	16,845.90

### SPC-2 Large Database Query Average Data Rates Graph

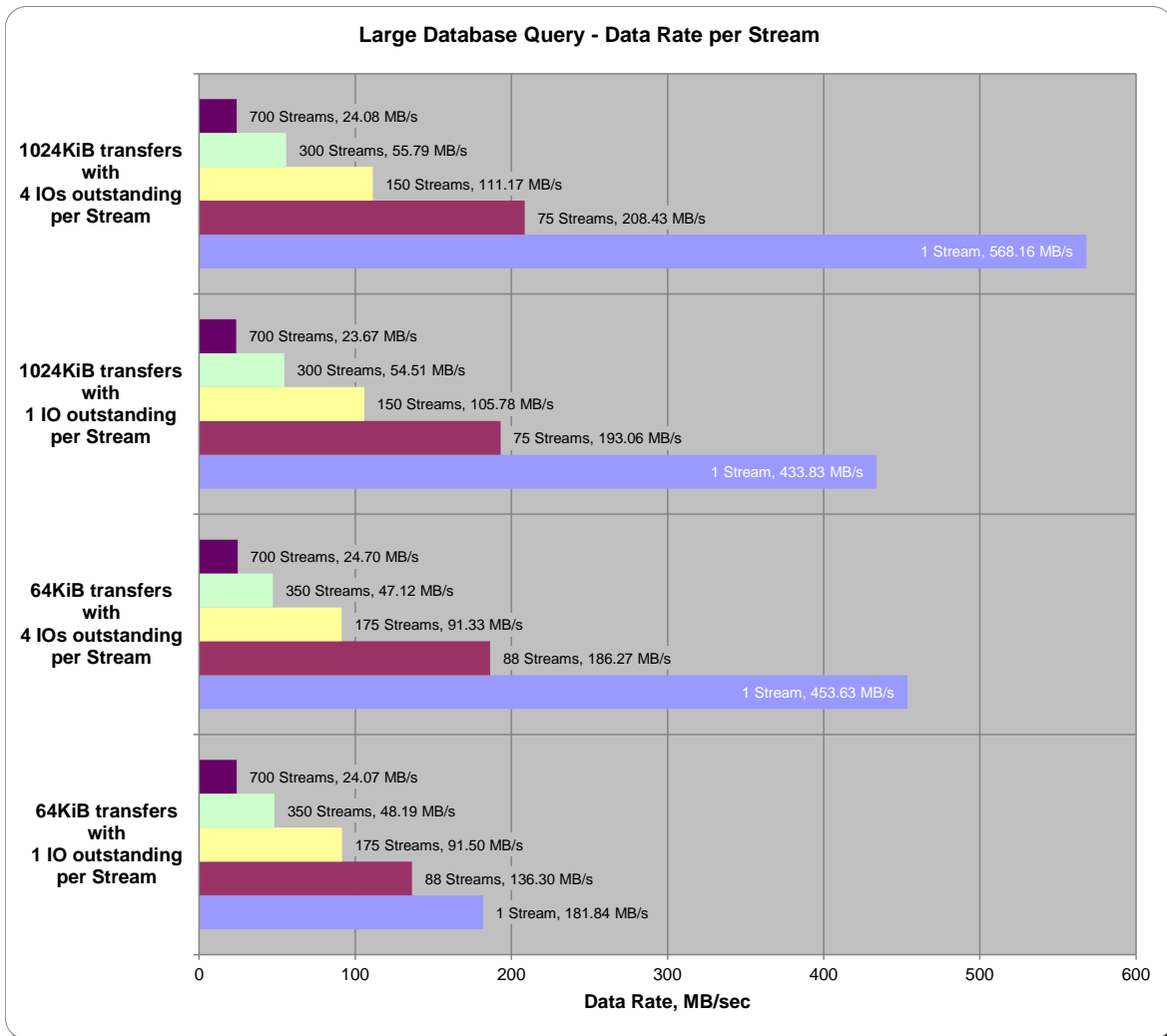


### SPC-2 Large Database Query Average Data Rate per Stream

The average Data Rate per Stream for each Test Run in the two Test Phases of the SPC-2 Large Database Query Test is listed in the table below as well as illustrated in the following graph.

Test Run Sequence	1 Stream	75 Streams	150 Streams	300 Streams	700 Streams
1024KiB w/ 4 IOs/Stream	568.16	208.43	111.17	55.79	24.08
Test Run Sequence	1 Stream	75 Streams	150 Streams	300 Streams	700 Streams
1024KiB w/ 1 IO/Stream	433.83	193.06	105.78	54.51	23.67
Test Run Sequence	1 Stream	88 Streams	175 Streams	350 Streams	700 Streams
64KiB w/ 4 IOs/Stream	453.63	186.27	91.33	47.12	24.70
Test Run Sequence	1 Stream	88 Streams	175 Streams	350 Streams	700 Streams
64KiB w/ 1 IO/Stream	181.84	136.30	91.50	48.19	24.07

### SPC-2 Large Database Query Average Data Rate per Stream Graph

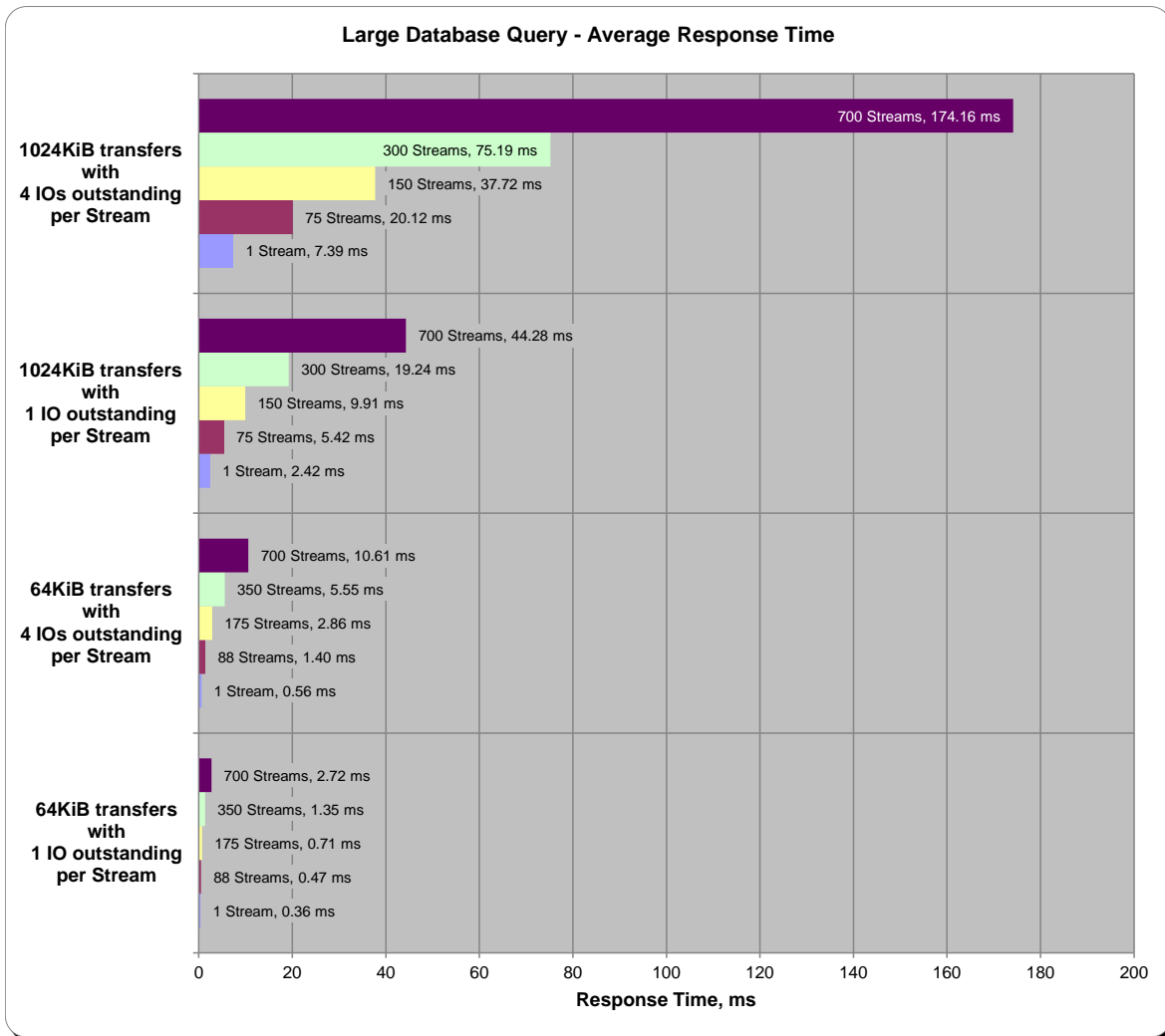


### SPC-2 Large Database Query Average Response Time

The average Response Time, in milliseconds, for each Test Run in the two Test Phases of the SPC-2 Large Database Query Test is listed in the table below as well as illustrated in the following graph.

Test Run Sequence	1 Stream	75 Streams	150 Streams	300 Streams	700 Streams
1024KiB w/ 4 IOs/Stream	7.39	20.12	37.72	75.19	174.16
Test Run Sequence	1 Stream	75 Streams	150 Streams	300 Streams	700 Streams
1024KiB w/ 1 IO/Stream	2.42	5.42	9.91	19.24	44.28
Test Run Sequence	1 Stream	88 Streams	175 Streams	350 Streams	700 Streams
64KiB w/ 4 IOs/Stream	0.56	1.40	2.86	5.55	10.61
Test Run Sequence	1 Stream	88 Streams	175 Streams	350 Streams	700 Streams
64KiB w/ 1 IO/Stream	0.36	0.47	0.71	1.35	2.72

### SPC-2 Large Database Query Average Response Time Graph





## Large Database Query Test – 1024 KiB TRANSFER SIZE Test Phase

### Clause 10.6.9.2.1

1. A table that will contain the following information for each "1024 KiB Transfer Size, 4 Outstanding I/Os" Test Run:
  - The number of Streams specified.
  - The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.
2. Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "1024 KiB Transfer Size, 4 Outstanding I/Os" Test Runs as specified in Clauses 10.1.4 – 10.1.6.
3. A table that will contain the following information for each "1024 KiB Transfer Size, 1 Outstanding I/O" Test Run:
  - The number of Streams specified.
  - The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.
4. Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "1024 KiB Transfer Size, 1 Outstanding I/O" Test Runs as specified in Clauses 10.1.4 – 10.1.6.

A hyperlink for each of the above tables and graphs may appear in the FDR to provide access to the table or graph.

A hyperlink to a table with the SPC-2 "Large Database Query/1024 KiB TRANSFER SIZE/4 Outstanding I/Os" Test Run data appears on the next page. That entry is followed by hyperlinks to graphs illustrating the average Data Rate, average Data Rate per Stream, and average Response Time produced by the same Test Runs. The table and graphs present the data at five-second intervals.

Immediately following the above SPC-2 "Large Database Query/1024 KiB TRANSFER SIZE/4 Outstanding I/Os" entries will be hyperlinks for SPC-2 "Large Database Query/1024 KiB TRANSFER SIZE/1 Outstanding I/O" table and graphs. The table contains the Test Run data and the graphs illustrate the average Data Rate, average Data Rate per Stream, and average Response Time produced by the Test Runs.

**SPC-2 “Large Database Query/1024 KIB TRANSFER SIZE/4 Outstanding I/Os” Test Run Data**

[SPC-2 “Large Database Query/1024 KIB TRANSFER SIZE/4 Outstanding I/Os” Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods](#) (3 pages)

**SPC-2 “Large Database Query/1024 KIB TRANSFER SIZE/4 Outstanding I/Os” Graphs**

**Average Data Rate – Complete Test Run**

**Average Data Rate – Measurement Interval (MI) Only**

**Average Data Rate per Stream**

**Average Response Time**

[SPC-2 “Large Database Query/1024 KIB TRANSFER SIZE/4 Outstanding I/Os” graphs](#)  
(four pages, 1 graph per page)

**SPC-2 “Large Database Query/1024 KIB TRANSFER SIZE/1 Outstanding I/O” Test Run Data**

[SPC-2 “Large Database Query/1024 KIB TRANSFER SIZE/1 Outstanding I/O” Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods](#) (3 pages)

**SPC-2 “Large Database Query/1024 KIB TRANSFER SIZE/1 Outstanding I/O” Graphs**

**Average Data Rate – Complete Test Run**

**Average Data Rate – Measurement Interval (MI) Only**

**Average Data Rate per Stream**

**Average Response Time**

[SPC-2 “Large Database Query/1024 KIB TRANSFER SIZE/1 Outstanding I/O” graphs](#)  
(four pages, 1 graph per page)

## Large Database Query Test – 64 KiB TRANSFER SIZE Test Phase

### Clause 10.6.9.2.2

1. A table that will contain the following information for each "64 KiB Transfer Size, 4 Outstanding I/Os" Test Run:
  - The number of Streams specified.
  - The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.
2. Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "64 KiB Transfer Size, 4 Outstanding I/Os" Test Runs as specified in Clauses 10.1.4 – 10.1.6.
3. A table that will contain the following information for each "64 KiB Transfer Size, 1 Outstanding I/O" Test Run:
  - The number of Streams specified.
  - The Average Data Rate, Average Data Rate per Stream, and Average Response Time reported at five second intervals.
4. Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the "64 KiB Transfer Size, 1 Outstanding I/O" Test Runs as specified in Clauses 10.1.4 – 10.1.6.

A hyperlink for each of the above tables and graphs may appear in the FDR to provide access to the table or graph.

A hyperlink to a table with the SPC-2 "Large Database Query/64 KiB TRANSFER SIZE/4 Outstanding I/Os" Test Run data appears on the next page. That entry is followed by hyperlinks to graphs illustrating the average Data Rate, average Data Rate per Stream, and average Response Time produced by the same Test Runs. The table and graphs present the data at five-second intervals.

Immediately following the above SPC-2 "Large Database Query/64 KiB TRANSFER SIZE/4 Outstanding I/Os" entries will be hyperlinks for SPC-2 "Large Database Query/64 KiB TRANSFER SIZE/1 Outstanding I/O" table and graphs. The table contains the Test Run data and the graphs illustrate the average Data Rate, average Data Rate per Stream, and average Response Time produced by the Test Runs.

**SPC-2 “Large Database Query/64 KiB TRANSFER SIZE/4 Outstanding I/Os” Test Run Data**

[SPC-2 “Large Database Query/64 KiB TRANSFER SIZE/4 Outstanding I/Os” Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods](#) (3 pages)

**SPC-2 “Large Database Query/64 KiB TRANSFER SIZE/4 Outstanding I/Os” Graphs**

**Average Data Rate – Complete Test Run**

**Average Data Rate – Measurement Interval (MI) Only**

**Average Data Rate per Stream**

**Average Response Time**

[SPC-2 “Large Database Query/64 KiB TRANSFER SIZE/4 Outstanding I/Os” graphs](#)  
(four pages, 1 graph per page)

**SPC-2 “Large Database Query/64 KiB TRANSFER SIZE/1 Outstanding I/O” Test Run Data**

[SPC-2 “Large Database Query/64 KiB TRANSFER SIZE/1 Outstanding I/O” Test Run Data Tables: Ramp-Up, Measurement Interval, Run-Out, and Ramp-Down Periods](#) (3 pages)

**SPC-2 “Large Database Query/64 KiB TRANSFER SIZE/1 Outstanding I/O” Graphs**

**Average Data Rate – Complete Test Run**

**Average Data Rate – Measurement Interval (MI) Only**

**Average Data Rate per Stream**

**Average Response Time**

[SPC-2 “Large Database Query/64 KiB TRANSFER SIZE/1 Outstanding I/O” graphs](#)  
(four pages, 1 graph per page)

## Video on Demand Delivery Test

### Clause 6.4.5.1

*The Video on Demand Delivery Test represents the I/O operations required to enable individualized video entertainment for a community of subscribers, which draw from a digital film library.*

### Clause 6.4.5.2

*The Video on Demand Delivery Test consists of one (1) Test Run.*

*The BC shall not be restarted or manually disturbed, altered, or adjusted during the execution of the Video on Demand Delivery Test. If power is lost to the BC during this Test all results shall be rendered invalid and the Test re-run in its entirety.*

### Clause 10.6.9.3

*The Full Disclosure Report will contain the following content for the Video on Demand Delivery Test:*

- 1. A listing of the SPC-2 Workload Generator commands and parameters used to execute the Test Run in the Video on Demand Delivery Test.*
- 2. The human readable SPC-2 Test Results File for the Test Run in the Video on Demand Delivery Test.*
- 3. A table that contains the following information for the Test Run in the Video on Demand Delivery Test:*
  - The number Streams specified.*
  - The Ramp-Up duration in seconds.*
  - The Measurement Interval duration in seconds.*
  - The average data rate, in MB per second, for the Measurement Interval.*
  - The average data rate, in MB per second, per Stream for the Measurement Interval.*
- 4. A table that contains the following information for the single Video on Demand Delivery Test Run:*
  - The number Streams specified.*
  - The average data rate, average data rate per stream, average Response Time, and Maximum Response Time reported at 60 second intervals.*
- 5. Average Data Rate by Intervals, Average Data Rate per Stream by Intervals, and Average Response Time by Intervals graphs for the single Video on Demand Delivery Test Run as specified in Clause 10.1.8.*
- 6. A Maximum Response Time (intervals) graph as specified in Clause 10.1.8.*

## SPC-2 Workload Generator Commands and Parameters

The SPC-2 Workload Generator commands and parameters for the Video on Demand Delivery Test Run are documented in [Appendix E: SPC-2 Workload Generator Execution Commands and Parameters](#) on Page 88..

### SPC-2 Test Results File

A link to the SPC-2 Test Results file generated from the Video on Demand Delivery Test Run is listed below.

[SPC-2 Video on Demand Delivery Test Results File](#)

### SPC-2 Video on Demand Delivery Test Run Data

The number of Streams specified, Ramp-Up duration in seconds, Measurement Interval duration in seconds, average Data Rate for the Measurement Interval, and average Data Rate per Stream for the Measurement Interval are listed in the following table.

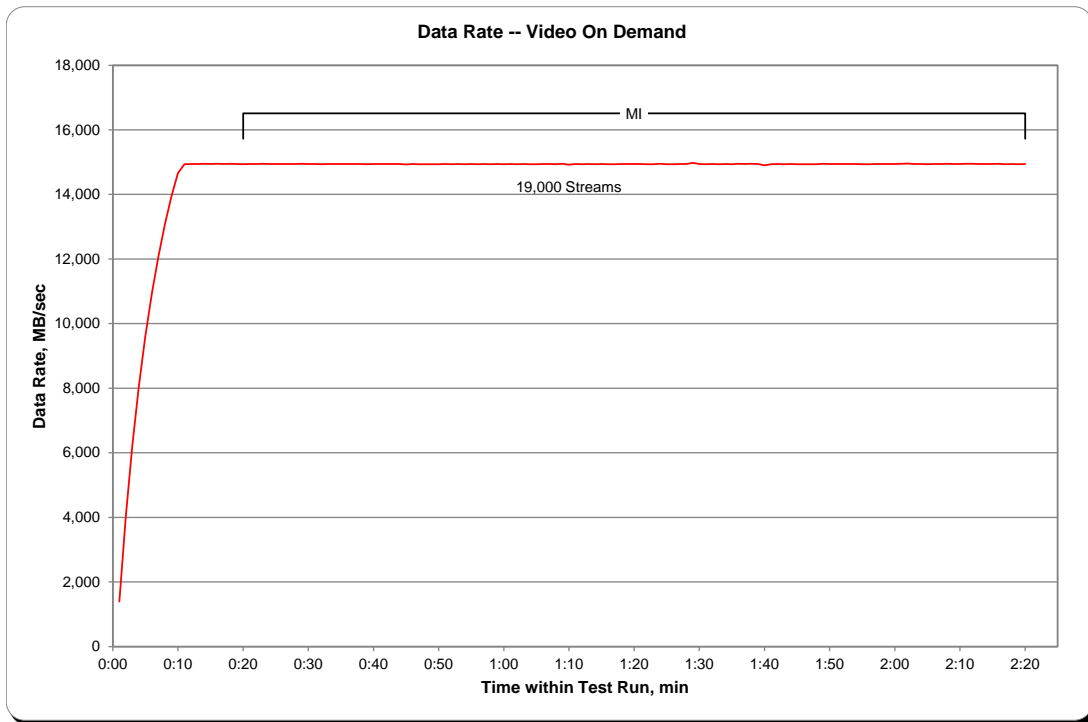
SPC-2-VOD	TR1
Number of Streams	19,000
Ramp-up Time, sec	1,200
Measurement Interval, sec	7,200
Average Data Rate, MB/sec	14,942.25
Per Stream Data Rate, MB/sec	0.79
Average Response Time, ms	17.70
Average Max Response Time, ms	396.00

### Video on Demand Delivery Test – TEST RUN DATA BY INTERVAL

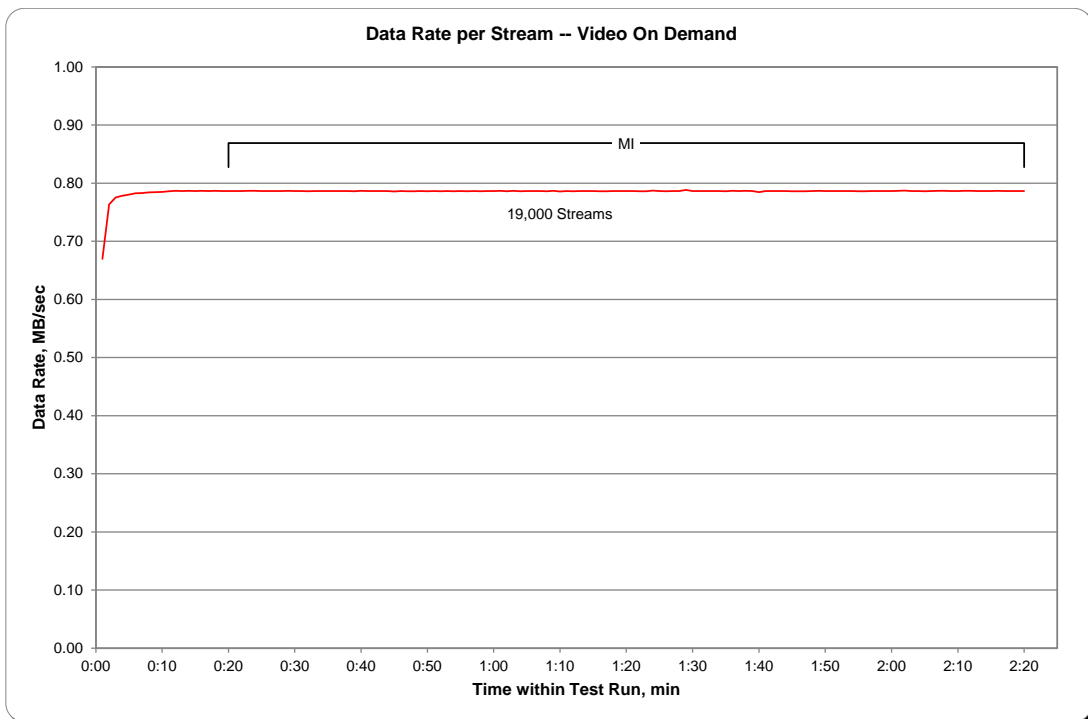
The SPC-2 Video on Demand Delivery Test Run data is contained in the table that appears below. That table is followed by graphs illustrating the average Data Rate and average Data Rate per Stream produced by the same Test Runs. The table and graphs present the data at sixty second intervals.

TR1	19,000 Streams				TR1	19,000 Streams				TR1	19,000 Streams			
Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Maximum Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Maximum Response Time, ms	Test Run Sequence Time	Data Rate, MB/sec	Data Rate / Stream, MB/sec	Response Time, ms	Maximum Response Time, ms
0:01:00	1,391.72	0.67	1.74	216.10	0:48:00	14,934.80	0.79	15.98	357.69	1:35:00	14,936.23	0.79	16.65	289.88
0:02:00	4,039.66	0.76	2.75	471.15	0:49:00	14,938.41	0.79	16.21	366.82	1:36:00	14,948.73	0.79	17.44	397.26
0:03:00	6,226.99	0.78	7.27	329.49	0:50:00	14,936.27	0.79	18.49	388.36	1:37:00	14,941.89	0.79	19.06	416.27
0:04:00	8,045.65	0.78	7.62	343.17	0:51:00	14,942.04	0.79	18.70	454.41	1:38:00	14,947.20	0.79	19.38	583.73
0:05:00	9,599.42	0.78	9.51	226.72	0:52:00	14,934.11	0.79	15.82	229.83	1:39:00	14,939.88	0.79	15.84	274.08
0:06:00	10,958.21	0.78	11.40	407.77	0:53:00	14,943.06	0.79	16.50	477.91	1:40:00	14,904.83	0.78	17.29	412.39
0:07:00	12,091.42	0.78	12.41	336.14	0:54:00	14,934.75	0.79	16.32	349.64	1:41:00	14,938.14	0.79	17.15	462.30
0:08:00	13,084.38	0.78	165.21	2,002.22	0:55:00	14,941.70	0.79	23.74	581.52	1:42:00	14,943.59	0.79	17.09	345.26
0:09:00	13,940.30	0.78	14.70	270.05	0:56:00	14,937.98	0.79	16.53	310.97	1:43:00	14,939.24	0.79	15.80	338.39
0:10:00	14,658.00	0.79	24.28	392.95	0:57:00	14,942.91	0.79	16.12	298.87	1:44:00	14,945.26	0.79	24.31	538.80
0:11:00	14,936.90	0.79	18.34	398.13	0:58:00	14,934.63	0.79	16.38	396.41	1:45:00	14,933.85	0.79	17.98	498.63
0:12:00	14,946.20	0.79	17.20	397.57	0:59:00	14,944.32	0.79	19.68	415.79	1:46:00	14,936.93	0.79	17.64	470.64
0:13:00	14,940.44	0.79	17.37	393.68	1:00:00	14,938.13	0.79	16.90	444.93	1:47:00	14,933.35	0.79	16.27	350.88
0:14:00	14,946.40	0.79	21.34	546.23	1:01:00	14,946.05	0.79	18.99	354.03	1:48:00	14,939.43	0.79	15.99	427.91
0:15:00	14,940.88	0.79	22.30	410.61	1:02:00	14,933.30	0.79	16.01	335.39	1:49:00	14,948.27	0.79	16.45	278.40
0:16:00	14,948.90	0.79	18.96	354.88	1:03:00	14,945.58	0.79	16.73	294.45	1:50:00	14,942.10	0.79	17.74	407.27
0:17:00	14,940.72	0.79	15.90	348.56	1:04:00	14,934.78	0.79	16.94	346.20	1:51:00	14,939.56	0.79	16.42	319.29
0:18:00	14,946.88	0.79	17.81	470.26	1:05:00	14,939.16	0.79	19.41	393.25	1:52:00	14,940.53	0.79	16.77	320.34
0:19:00	14,944.27	0.79	21.03	335.98	1:06:00	14,940.19	0.79	17.18	375.34	1:53:00	14,940.53	0.79	16.40	340.54
0:20:00	14,939.01	0.79	18.47	438.69	1:07:00	14,943.23	0.79	16.74	465.64	1:54:00	14,941.64	0.79	17.02	409.77
0:21:00	14,940.66	0.79	16.62	353.17	1:08:00	14,934.37	0.79	18.25	403.84	1:55:00	14,932.98	0.79	16.57	314.14
0:22:00	14,944.71	0.79	16.61	389.77	1:09:00	14,947.40	0.79	20.20	377.55	1:56:00	14,937.53	0.79	17.86	539.73
0:23:00	14,947.18	0.79	18.88	502.21	1:10:00	14,924.03	0.79	18.19	435.55	1:57:00	14,944.90	0.79	15.93	235.42
0:24:00	14,945.75	0.79	16.62	463.73	1:11:00	14,940.09	0.79	18.98	383.15	1:58:00	14,944.50	0.79	18.27	447.30
0:25:00	14,941.37	0.79	25.81	464.97	1:12:00	14,936.51	0.79	19.53	389.27	1:59:00	14,940.66	0.79	16.89	377.18
0:26:00	14,945.31	0.79	18.21	524.66	1:13:00	14,942.87	0.79	17.47	398.07	2:00:00	14,941.89	0.79	16.77	521.73
0:27:00	14,944.86	0.79	16.22	316.76	1:14:00	14,938.96	0.79	16.26	304.89	2:01:00	14,951.25	0.79	20.25	488.96
0:28:00	14,942.00	0.79	17.59	379.67	1:15:00	14,941.79	0.79	21.62	609.33	2:02:00	14,954.30	0.79	17.17	449.85
0:29:00	14,950.03	0.79	17.86	468.00	1:16:00	14,934.17	0.79	18.92	340.62	2:03:00	14,941.80	0.79	17.24	459.55
0:30:00	14,940.02	0.79	18.21	332.79	1:17:00	14,938.02	0.79	18.87	468.13	2:04:00	14,941.49	0.79	18.87	391.98
0:31:00	14,942.17	0.79	16.30	261.24	1:18:00	14,939.68	0.79	17.09	372.73	2:05:00	14,937.37	0.79	23.07	464.03
0:32:00	14,932.98	0.79	18.97	422.02	1:19:00	14,943.66	0.79	15.92	299.77	2:06:00	14,944.86	0.79	16.28	246.80
0:33:00	14,940.87	0.79	16.35	390.29	1:20:00	14,941.11	0.79	17.40	454.57	2:07:00	14,945.60	0.79	18.67	437.95
0:34:00	14,942.88	0.79	16.42	387.00	1:21:00	14,941.14	0.79	16.69	377.58	2:08:00	14,951.41	0.79	18.00	481.11
0:35:00	14,940.39	0.79	18.00	360.69	1:22:00	14,938.10	0.79	17.37	318.16	2:09:00	14,943.41	0.79	17.76	452.87
0:36:00	14,944.28	0.79	16.20	256.91	1:23:00	14,937.22	0.79	17.65	388.31	2:10:00	14,942.72	0.79	17.80	452.69
0:37:00	14,945.01	0.79	17.97	429.16	1:24:00	14,952.83	0.79	16.54	281.05	2:11:00	14,947.33	0.79	16.57	428.91
0:38:00	14,940.08	0.79	16.30	404.39	1:25:00	14,939.15	0.79	16.86	350.97	2:12:00	14,949.88	0.79	17.14	350.47
0:39:00	14,937.38	0.79	16.67	345.42	1:26:00	14,937.11	0.79	16.40	277.25	2:13:00	14,943.47	0.79	17.13	369.30
0:40:00	14,945.44	0.79	17.98	470.44	1:27:00	14,943.26	0.79	16.39	312.35	2:14:00	14,944.06	0.79	21.25	416.19
0:41:00	14,944.21	0.79	16.82	404.19	1:28:00	14,940.28	0.79	18.13	379.07	2:15:00	14,939.66	0.79	18.85	467.39
0:42:00	14,939.97	0.79	16.56	333.92	1:29:00	14,976.88	0.79	16.84	441.34	2:16:00	14,946.70	0.79	19.35	391.01
0:43:00	14,943.54	0.79	16.76	438.16	1:30:00	14,940.33	0.79	16.84	366.78	2:17:00	14,938.72	0.79	18.89	323.60
0:44:00	14,940.78	0.79	16.78	306.55	1:31:00	14,939.48	0.79	17.20	430.41	2:18:00	14,944.17	0.79	19.13	565.73
0:45:00	14,928.83	0.79	19.20	488.12	1:32:00	14,944.47	0.79	17.87	510.94	2:19:00	14,939.40	0.79	18.42	417.97
0:46:00	14,943.24	0.79	17.14	335.73	1:33:00	14,938.92	0.79	19.97	436.80	2:20:00	14,942.08	0.79	18.23	436.38
0:47:00	14,937.88	0.79	17.21	416.66	1:34:00	14,943.62	0.79	16.06	383.92	0:00:00	0.00	0.00	0.00	0.00

### SPC-2 Video on Demand Delivery Average Data Rate Graph

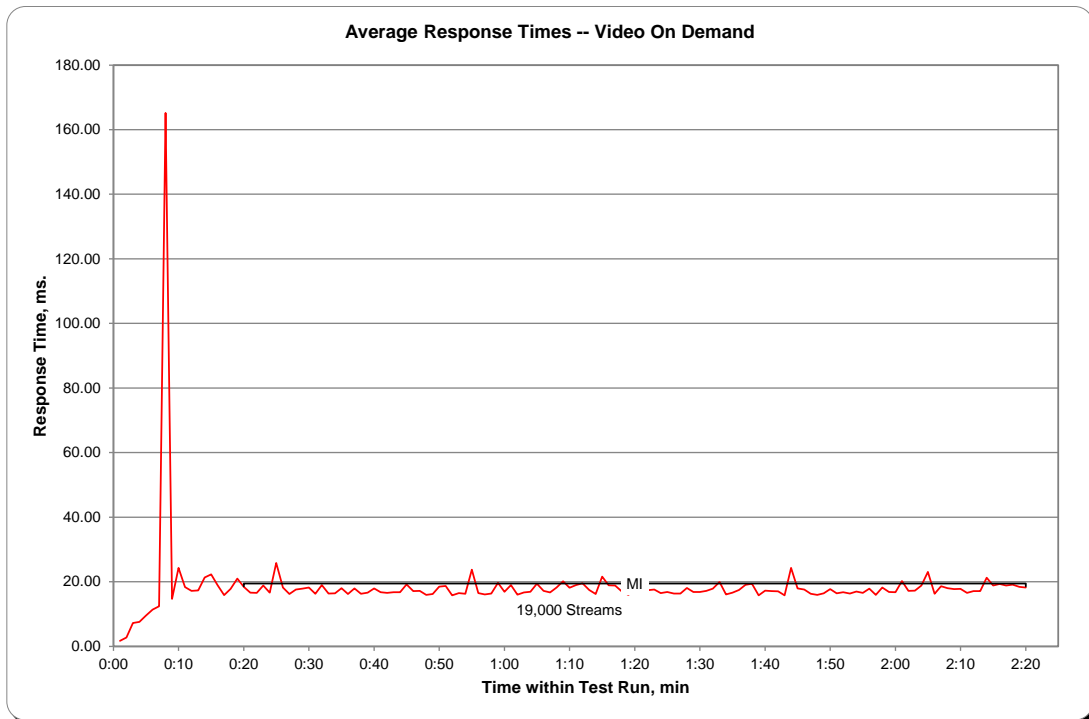


### SPC-2 Video on Demand Delivery Average Data Rate per Stream Graph

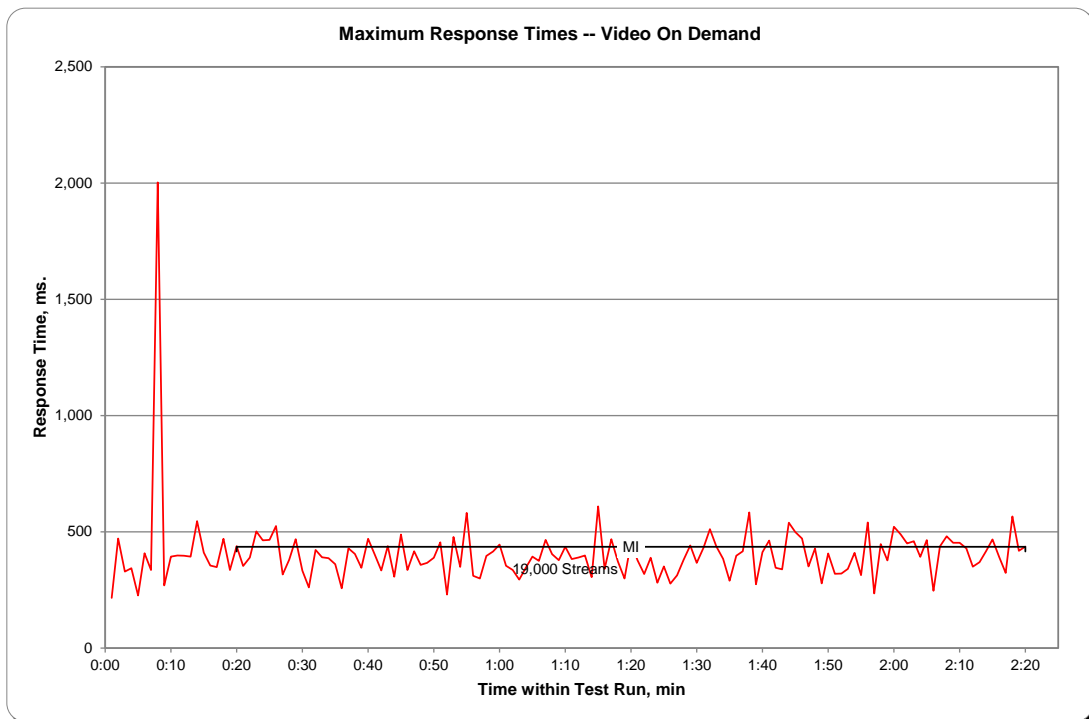




### SPC-2 Video on Demand Delivery Average Response Time Graph



### SPC-2 Video on Demand Delivery Maximum Response Time Graph



## Data Persistence Test

### Clause 7

*The Data Persistence Test demonstrates the Tested Storage Configuration (TSC):*

- *Is capable of maintain data integrity across a power cycle.*
- *Ensures the transfer of data between Logical Volumes and host systems occurs without corruption or loss.*

*The SPC-2 Workload Generator will write a specific pattern at randomly selected locations throughout the Total ASU Capacity (Persistence Test Run 1). The SPC-2 Workload Generator will retain the information necessary to later validate the pattern written at each location.*

*The Tested Storage Configuration will be shutdown and restarted using a power off/power on cycle at the end of the above sequence of write operations. In addition, any caches employing battery backup must be flushed/emptied.*

*Restart the TSC, and if the Host System(s) were shutdown and powered off, restart the Host System(s).*

*The SPC-2 Workload Generator will utilize the retained data from Persistence Test Run 1 to verify (Persistence Run 2) the bit patterns written in Persistence Test Run 1 and their corresponding location.*

### Clause 10.6.9.4

*The Full Disclosure Report will contain the following content for the Data Persistence Test:*

1. *A listing of the SPC-2 Workload Generator commands and parameters used to execute each of the Test Runs in the Persistence Test.*
2. *The human readable SPC-2 Test Results File for each of the Test Runs in the Data Persistence Test.*
3. *A table from the successful Persistence Test, which contains the results from the test.*

## SPC-2 Workload Generator Commands and Parameters

The SPC-2 Workload Generator commands and parameters for the Persistence Test Runs are documented in [Appendix E: SPC-2 Workload Generator Execution Commands and Parameters](#) on Page 88.

## Data Persistence Test Results File

A link to the test result file generated from each Data Persistence Test Run is listed below.

[Persistence 1 Test Run Results File](#)

[Persistence 2 Test Run Results File](#)

### Data Persistence Test Results

<b>Data Persistence Test Results</b>	
Data Persistence Test Number: 1	
Total Number of Logical Blocks Written	809,807
Total Number of Logical Blocks Re-referenced	11,862
Total Number of Logical Blocks Verified	797,945
Total Number of Logical Blocks that Failed Verification	0
Number of Failed I/O Requests in the process of the Test	0

## **PRICED STORAGE CONFIGURATION AVAILABILITY DATE**

### **Clause 10.6.9**

*The committed delivery date for general availability (Availability Date) of all products that comprise the Priced Storage Configuration must be reported. When the Priced Storage Configuration includes products or components with different availability dates, the reported Availability Date must be the date at which all components are committed to be available. All availability dates, whether for individual components or for the Priced Storage Configuration as a whole, must be disclosed to a precision of one day.*

*The Availability Data shall be stated in either a combination of specific alphanumeric month, numeric day and numeric year or as "Currently Available".*

The NEC Storage M700, as documented in this SPC-2 Full Disclosure Report, is currently available for customer purchase and shipment.

## **ANOMALIES OR IRREGULARITIES**

### **Clause 10.6.12**

*The FDR shall include a clear and complete description of any anomalies or irregularities encountered in the course of executing the SPC-2 benchmark that may in any way call into question the accuracy, verifiability, or authenticity of information published in this FDR.*

There were no anomalies or irregularities encountered during the SPC-2 Remote Audit of the NEC Storage M700.

## **APPENDIX A: SPC-2 GLOSSARY**

### **“Decimal” (*powers of ten*) Measurement Units**

In the storage industry, the terms “kilo”, “mega”, “giga”, “tera”, “peta”, and “exa” are commonly used prefixes for computing performance and capacity. For the purposes of the SPC workload definitions, all of the following terms are defined in “powers of ten” measurement units.

- A kilobyte (KB) is equal to 1,000 ( $10^3$ ) bytes.
- A megabyte (MB) is equal to 1,000,000 ( $10^6$ ) bytes.
- A gigabyte (GB) is equal to 1,000,000,000 ( $10^9$ ) bytes.
- A terabyte (TB) is equal to 1,000,000,000,000 ( $10^{12}$ ) bytes.
- A petabyte (PB) is equal to 1,000,000,000,000,000 ( $10^{15}$ ) bytes
- An exabyte (EB) is equal to 1,000,000,000,000,000,000 ( $10^{18}$ ) bytes

### **“Binary” (*powers of two*) Measurement Units**

The sizes reported by many operating system components use “powers of two” measurement units rather than “power of ten” units. The following standardized definitions and terms are also valid and may be used in this document.

- A kibibyte (KiB) is equal to 1,024 ( $2^{10}$ ) bytes.
- A mebibyte (MiB) is equal to 1,048,576 ( $2^{20}$ ) bytes.
- A gibibyte (GiB) is equal to 1,073,741,824 ( $2^{30}$ ) bytes.
- A tebibyte (TiB) is equal to 1,099,511,627,776 ( $2^{40}$ ) bytes.
- A pebibyte (PiB) is equal to 1,125,899,906,842,624 ( $2^{50}$ ) bytes.
- An exbibyte (EiB) is equal to 1,152,921,504,606,846,967 ( $2^{60}$ ) bytes.

## **SPC-2 Data Repository Definitions**

**Total ASU Capacity:** The total storage capacity read and written in the course of executing the SPC-2 benchmark.

**Application Storage Unit (ASU):** The logical interface between the storage and SPC-2 Workload Generator. The ASU is implemented on one or more Logical Volume.

**Logical Volume:** The division of Addressable Storage Capacity into individually addressable logical units of storage used in the SPC-2 benchmark. Each Logical Volume is implemented as a single, contiguous address space.

**Addressable Storage Capacity:** The total storage (sum of Logical Volumes) that can be read and written by application programs such as the SPC-2 Workload Generator.

**Configured Storage Capacity:** This capacity includes the Addressable Storage Capacity and any other storage (parity disks, hot spares, etc.) necessary to implement the Addressable Storage Capacity.

**Physical Storage Capacity:** The formatted capacity of all storage devices physically present in the Tested Storage Configuration (TSC).

**Data Protection Overhead:** The storage capacity required to implement the selected level of data protection.

**Required Storage:** The amount of Configured Storage Capacity required to implement the Addressable Storage Configuration, excluding the storage required for the ASU.

**Global Storage Overhead:** The amount of Physical Storage Capacity that is required for storage subsystem use and unavailable for use by application programs.

**Total Unused Storage:** The sum of unused storage capacity within the Physical Storage Capacity, Configured Storage Capacity, and Addressable Storage Capacity.

## SPC-2 Data Protection Levels

**Protected 1:** The single point of failure of any *storage device* in the configuration will not result in permanent loss of access to or integrity of the SPC-2 Data Repository.

**Protected 2:** The single point of failure of any *component* in the configuration will not result in permanent loss of access to or integrity of the SPC-2 Data Repository.

## SPC-2 Test Execution Definitions

**Completed I/O Request:** An I/O Request with a Start Time and a Completion Time (see [\*I/O Completion Types\*](#) illustrated below).

**Completion Time:** The time recorded by the Workload Generator when an I/O Request is completed by the Tested Storage Configuration (TSC) as signaled by System Software.

**Data Rate:** The data volume, in MB, transferred by all Measured I/O Requests in an SPC-2 Test Run divided by the length of the Test Run in seconds.

**Failed I/O Request:** Any I/O Request issued by the SPC-2 Workload Generator that meets one of the following conditions (see [\*I/O Completion Types\*](#) illustrated below):

- The I/O Request was signaled as failed by System Software.
- The I/O Request started within the Measurement Interval, but did not complete prior to the end of the appropriate Run-Out period..
- The I/O Request started within the Run-Out period, but did not complete prior to the end of the appropriate Ramp-Down period.

**I/O Request Throughput:** The total number of Measured I/O Requests in an SPC-2 Test Run divided by the duration of the Measurement Interval in seconds.

**Measured I/O Request:** A Completed I/O Request that begins (Start Time) within a Measurement Interval and completes (Completion Time) prior to the end of the appropriate Ramp Down (see [“I/O Completion Types”](#) illustrated below).

**Measurement Interval:** A specified, contiguous period of time, after the TSC has reached Steady State, when data is collected by the Workload Generator to produce the test results for a SPC-2 Test Run (see [“SPC-2 Test Run Components”](#) illustrated below, *Test Run 1:  $T_2-T_3$  and Test Run 2:  $T_7-T_8$* ).

**Outstanding I/O Requests:** The Outstanding I/O Requests parameter specifies the maximum number of concurrent I/O Requests, associated with a give Stream, which have been issued but not yet completed. (*Clause 3.4.4 of the SPC-2 Benchmark Specification*).

**Ramp-Down:** A specified, contiguous period of time in which the TSC is required to complete I/O Requests started but not completed during the preceding Run-Out period. Ramp-Down begins at the end of the preceding Run-Out period (see [“SPC-2 Test Run Components”](#) illustrated below, *Test Run 1:  $T_4-T_5$  and Test Run 2:  $T_9-T_{10}$* ). The Workload Generator will not submit any I/O Requests during the Ramp-Down.

**Ramp-Up:** A specified, contiguous period of time required for the Benchmark Configuration (BC) to produce Steady State throughput after the Workload Generator begins submitting I/O Requests to the TSC for execution. The Ramp-Up period ends at the beginning of the Measurement Interval (see [“SPC-2 Test Run Components”](#) illustrated below, *Test Run 1:  $T_0-T_2$  and Test Run 2:  $T_5-T_7$* ).

**Response Time:** The Response Time of a Measured I/O Request is its Completion Time minus its Start Time.

**Run-Out:** A specified, contiguous period of time in which the TSC is required to complete I/O Requests started but not completed during the preceding Measurement Interval. The Run-Out period begins at the end of the preceding Measurement Interval and is a component of the Steady State period (see [“SPC-2 Test Run Components”](#) illustrated below, *Test Run 1:  $T_3-T_4$  and Test Run 2:  $T_9-T_{10}$* ). The Workload Generator will continue to submit I/O Requests at the Test Run’s specified rate during the Run-Out period.

**Start Time:** The time recorded by the Workload Generator when an I/O Request is submitted, by the Workload Generator, to the System Software for execution on the TSC.

**Steady State:** The period during which the workload presented to the TSC by the SPC-2 Workload Generator is constant and the resulting TSC I/O Request Throughput is both consistent and sustainable. The Steady State period includes both the Measurement Interval and Run-Out periods (see [“SPC-2 Test Run Components”](#) illustrated below, *Test Run 1:  $T_1-T_4$  and Test Run 2:  $T_6-T_9$* ).

Steady State is achieved only after caches in the TSC have filled and as a result the I/O Request Throughput of the TSC has stabilized.

**Stream:** A collection of Stream Segments that started within a Test Run.

**Stream Segment:** A sequentially organized pattern of I/O requests, which transfers a contiguous range of data.

**Test:** A collection of Test Phases and or Test Runs sharing a common objective.

**Test Phase:** A collection of one or more SPC-2 Test Runs sharing a common objective and intended to be run in a specific sequence.

**Test Run:** The execution of SPC-2 that produces specific SPC-2 test results. SPC-2 Test Runs have specified, measured Ramp-Up, Measurement Interval, Run-Out and Ramp-Down periods. "[SPC-2 Test Run Components](#)" (*see below*) illustrates the Ramp-Up, Steady State, Measurement Interval, Run-Out, and Ramp-Down components contained in two uninterrupted SPC-2 Test Runs (*Test Run 1:  $T_0-T_5$  and Test Run 2:  $T_5-T_{10}$* ).

**Test Run Sequence:** A related sequence of Large File Processing (LFP) or Large Database Query (LDQ) Test Runs. Each Test Run Sequence will consist of five Test Runs, which vary the number of Streams as follows:

- Test Run 1: Maximum number of Streams, which is selected by the Test Sponsor
- Test Run 2: 50% of the maximum number of Streams used in Test Run 1.
- Test Run 3: 25% of the maximum number of Streams used in Test Run 1.
- Test Run 4: 12.5% of the maximum number of Streams used in Test Run 1.
- Test Run 5: 1 Stream.

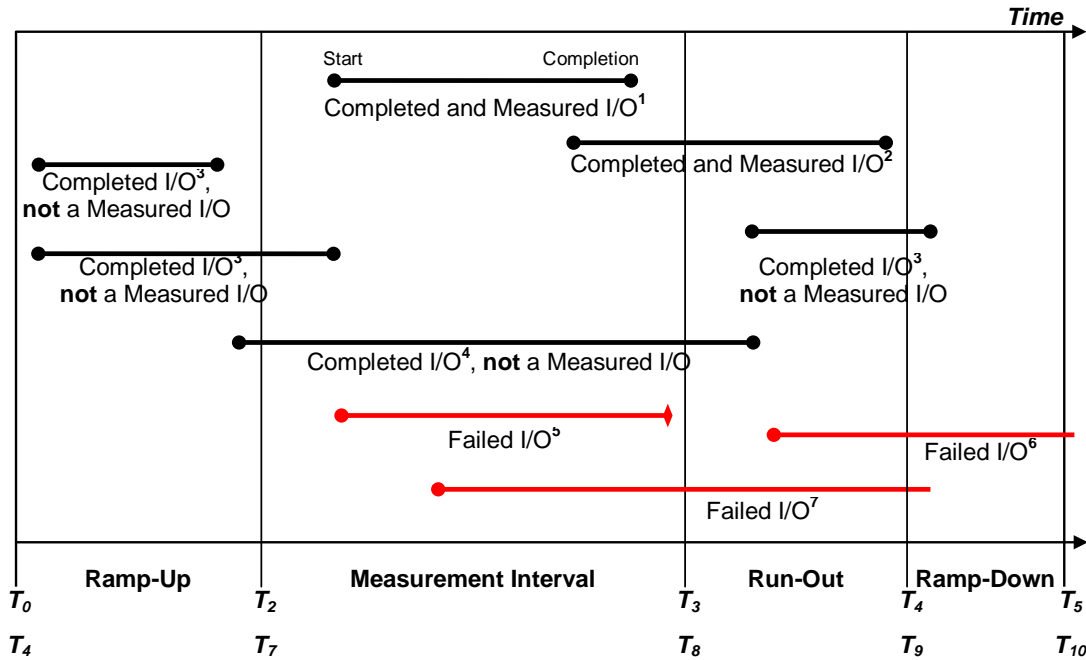
Each of the five Test Runs in a Test Run Sequence will share the same attributes with the exception of the number of Streams. For example:

- Large File Processing, Read, 1024 KiB Transfer Size: Maximum Streams
- Large File Processing, Read, 1024 KiB Transfer Size: 50% of Maximum Streams
- Large File Processing, Read, 1024 KiB Transfer Size: 25% of Maximum Streams
- Large File Processing, Read, 1024 KiB Transfer Size: 12.5% of Maximum Streams
- Large File Processing, Read, 1024 KiB Transfer Size: 1 Stream

**Transfer Size:** The Transfer Size parameter specifies the number of bytes in KiB to transfer. (*Clause 3.4.7 of the SPC-2 Benchmark Specification*)

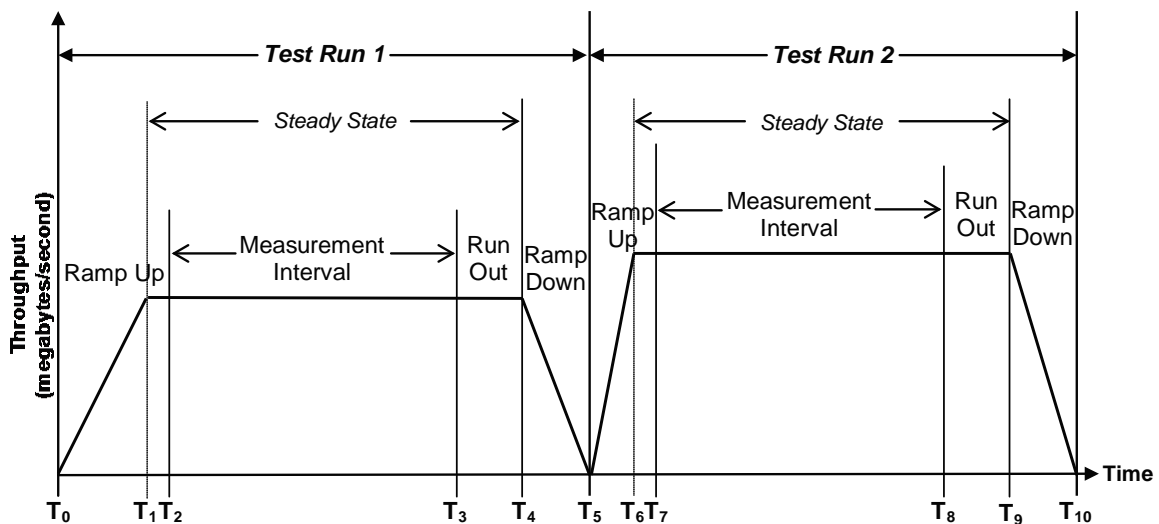


### I/O Completion Types



- Completed and Measured I/O<sup>1</sup>:** I/O started and completed within the Measurement Interval.
- Completed and Measured I/O<sup>2</sup>:** I/O started within the Measurement Interval and completed within Ramp Down.
- Completed I/O<sup>3</sup>:** I/O started before or after the Measurement Interval – not measured.
- Completed I/O<sup>4</sup>:** I/O started before and completed after the Measurement Interval – not measured.
- Failed I/O<sup>5</sup>:** Signaled as failed by System Software.
- Failed I/O<sup>6</sup>:** I/O did not complete prior to the end of Ramp-Down.
- Failed I/O<sup>7</sup>:** I/O did not complete prior to the end of Run-Out.

### SPC-2 Test Run Components



**APPENDIX B: CUSTOMER TUNABLE PARAMETERS AND OPTIONS**

There were no customer tunable parameters or options changed from their default values for any of the SPC-1 Test Runs.

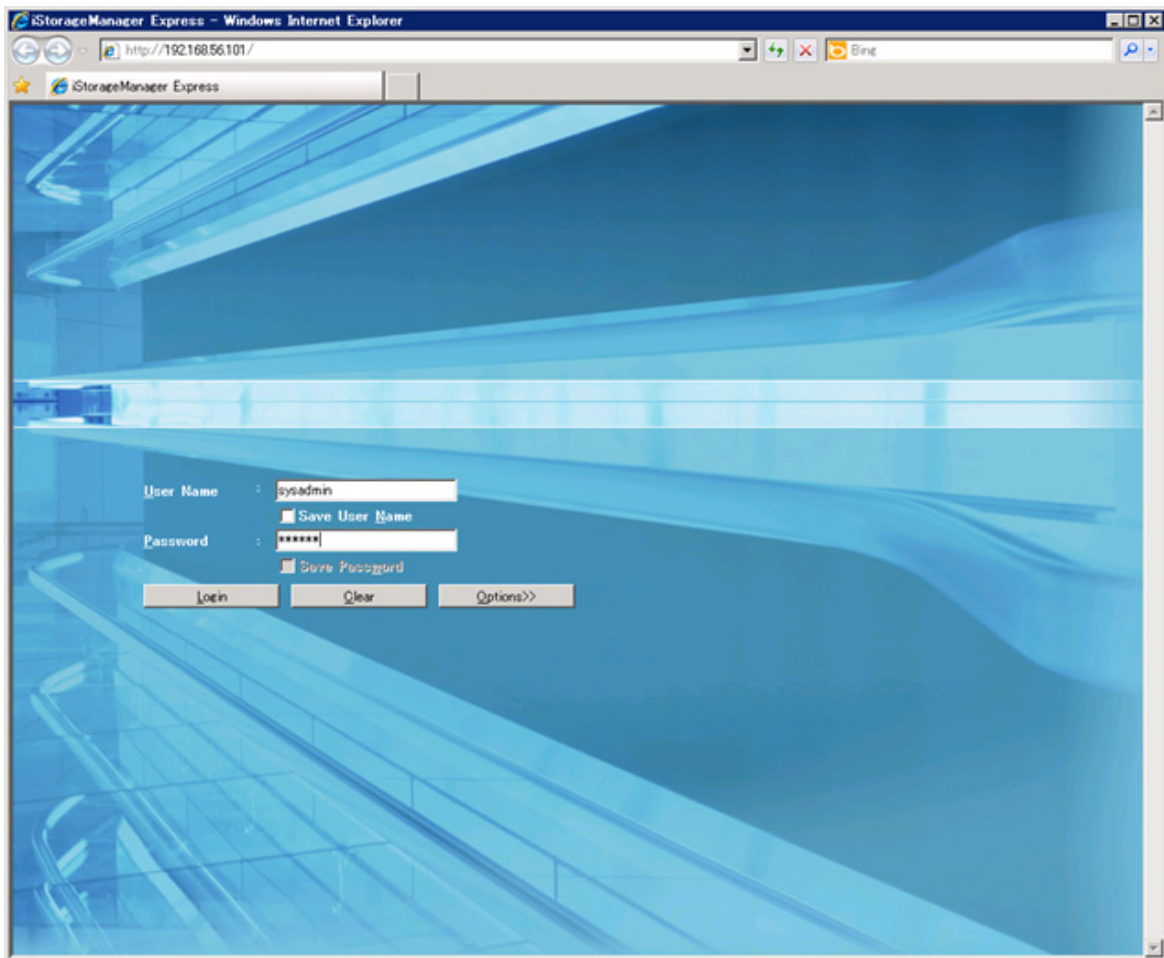
## APPENDIX C: TESTED STORAGE CONFIGURATION (TSC) CREATION

The NEC Storage Manager was used to create and configure the Tested Storage Configuration. That storage management utility was installed and used from one of the two Host Systems.

### Starting the NEC Storage Manager Client

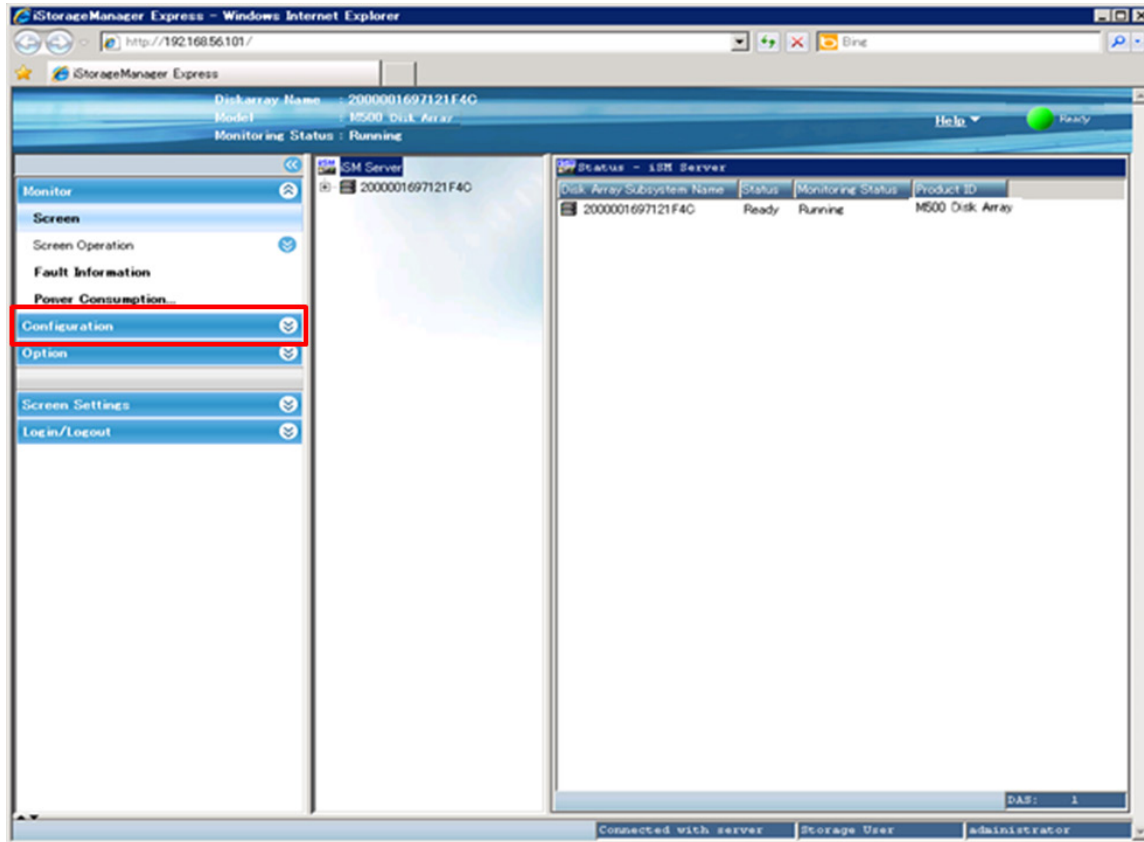
The NEC Storage Manager client is started as follows:

1. Start a web browser on the Host System where the NEC Storage Manager client is installed.
2. Start the NEC Storage Manager client by entering the IP address of the NEC Storage M500 in the address bar of the web browser.
3. Perform the following to logon to the NEC Storage Manager client:
  - a) Enter **sysadmin** in the **User Name** box
  - b) Enter **sys123** (*default value*) in the **Password** box
4. Click **Login** to open the client main menu.

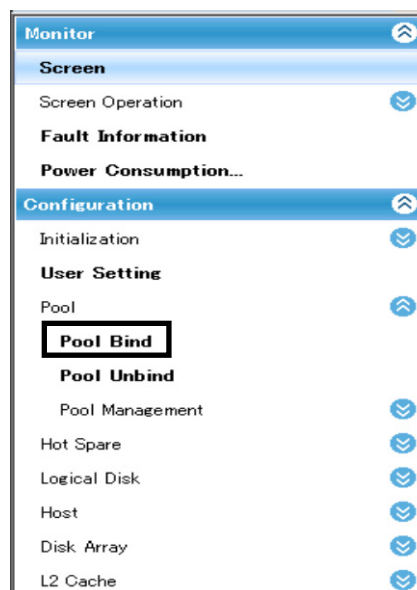


### Create Volume Groups (*Pool Bind*)

Click **Configuration** and **Pool** on the main menu to open the appropriate submenu.



Then click **Pool Bind** on that submenu.

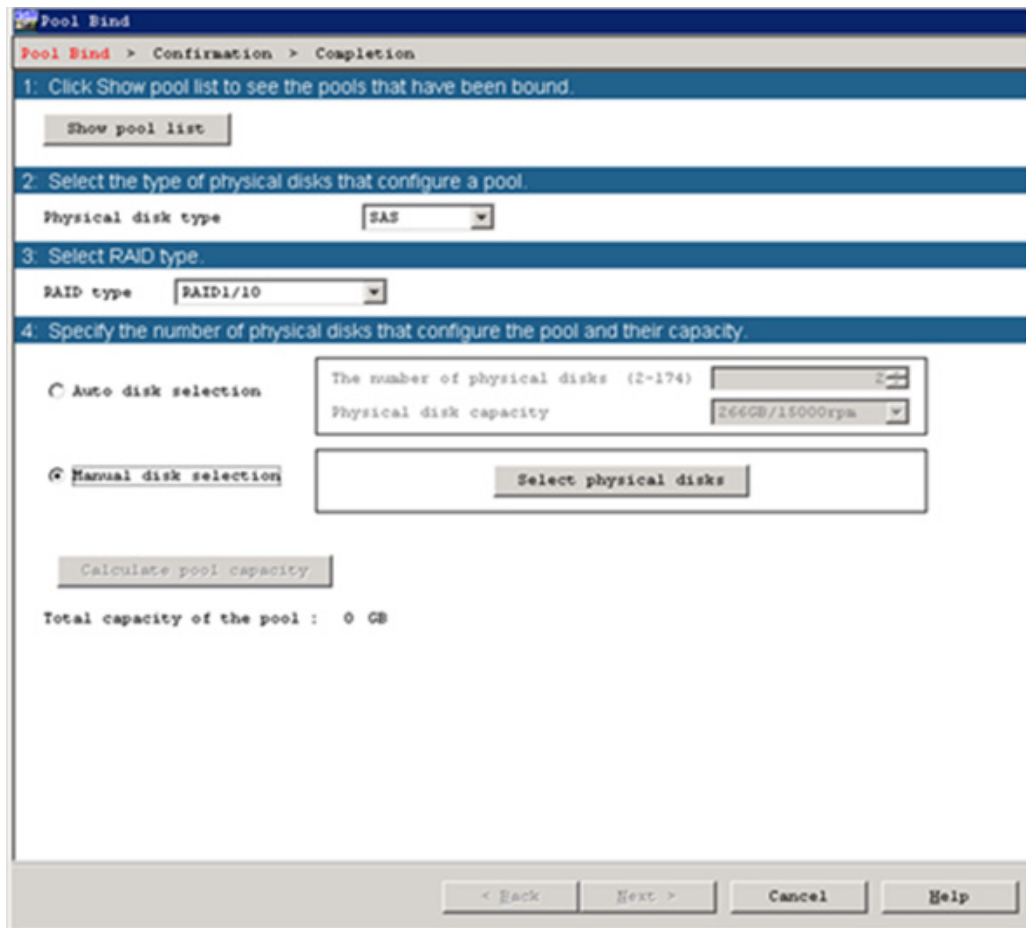


There were 48 volume groups created, each of which contained a single RAID1/10 (*mirrored*) volume.

Examples of the Pool Bind menus are listed below. The values displayed in menu were not the values used to configure the TSC. The specific parameter values for each of the 25 volume groups are listed in the [Volume Group Parameters](#) section.

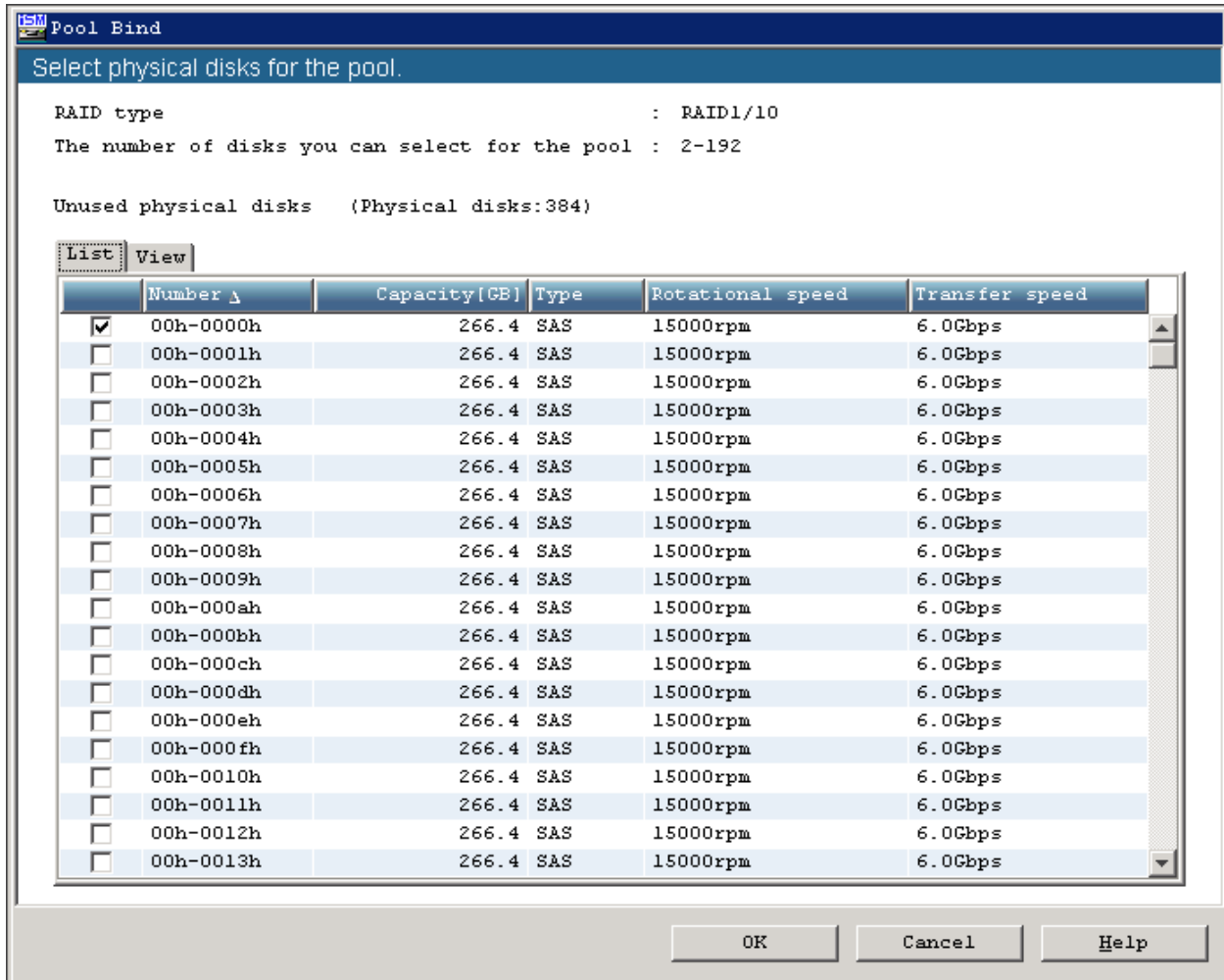
Each volume group is created, starting with the first Pool Bind menu, by selecting the following specifications:

- **Physical disk type** of **SAS**
- **RAID type** of **RAID1/10**



Specify 8 physical disks to be assigned to a pool by selecting the **Manual disk selection** option and clicking on **Select physical disks**, which will display the second Pool Bind menu.

Select the appropriate 8 physical disks and then click the **OK** button, which will return to the first Pool Bind menu.



Click on the **Next** button, which will cause a confirmation menu to be displayed.

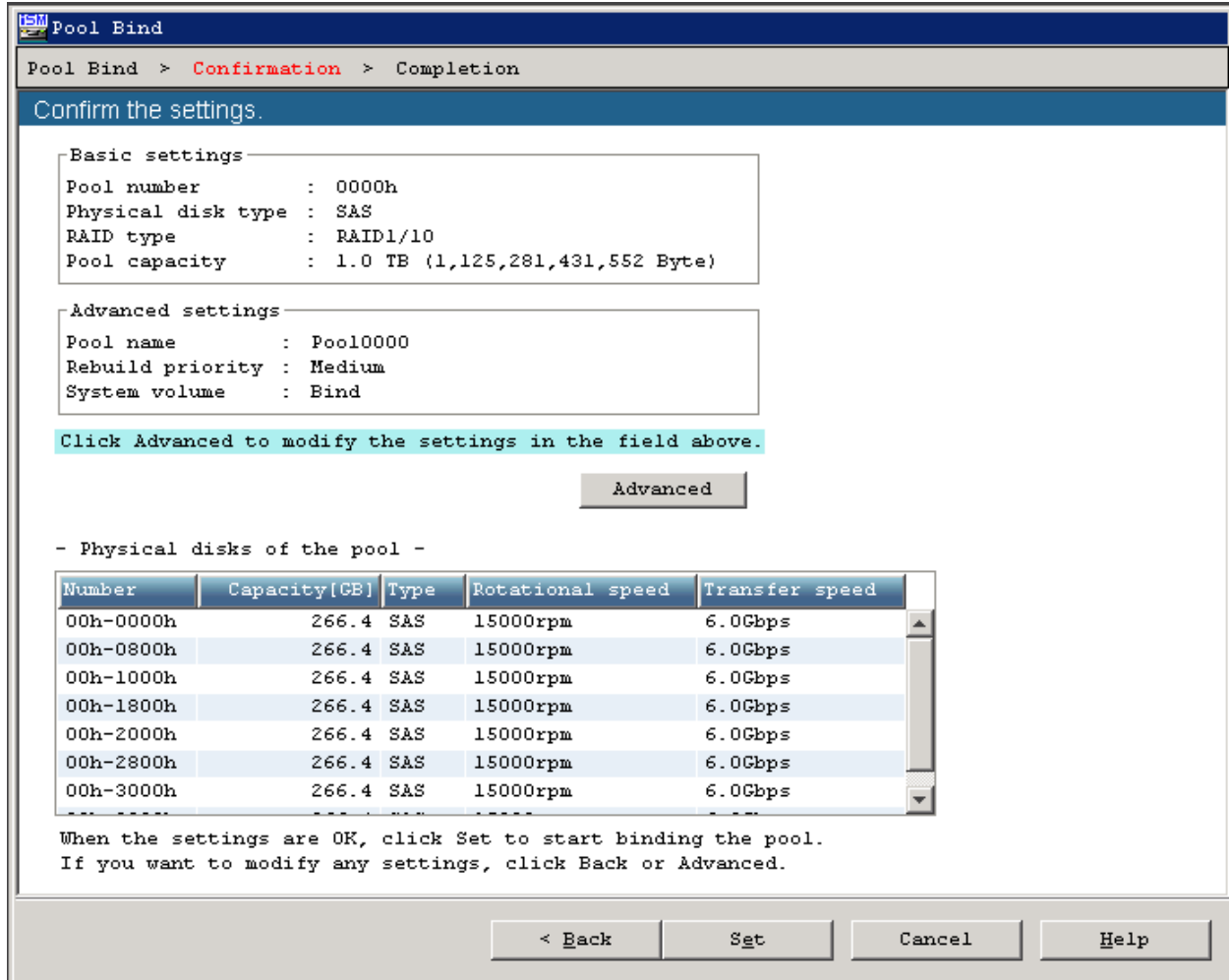
The screenshot shows a software window titled "Pool Bind" with a breadcrumb trail: "Pool Bind > Confirmation > Completion". The window contains four numbered steps:

- 1:** Click Show pool list to see the pools that have been bound. Below this is a button labeled "Show pool list".
- 2:** Select the type of physical disks that configure a pool. Below this is a dropdown menu for "Physical disk type" with "SAS" selected.
- 3:** Select RAID type. Below this is a dropdown menu for "RAID type" with "RAID1/10" selected.
- 4:** Specify the number of physical disks that configure the pool and their capacity. This section has two radio button options:
  - Auto disk selection: This option is disabled. It includes a text input for "The number of physical disks (2-174)" with the value "2" and a dropdown for "Physical disk capacity" with the value "266GB/15000rpm".
  - Manual disk selection: This option is selected. It includes a large button labeled "Select physical disks".

Below step 4, there is a button labeled "Calculate pool capacity" and a text label "Total capacity of the pool : 0 GB".

At the bottom of the window, there are four buttons: "< Back", "Next >", "Cancel", and "Help".

This menu will display the pool number, physical disk type, RAID type and physical disks selected to configure the pool. The pool number is automatically assigned.

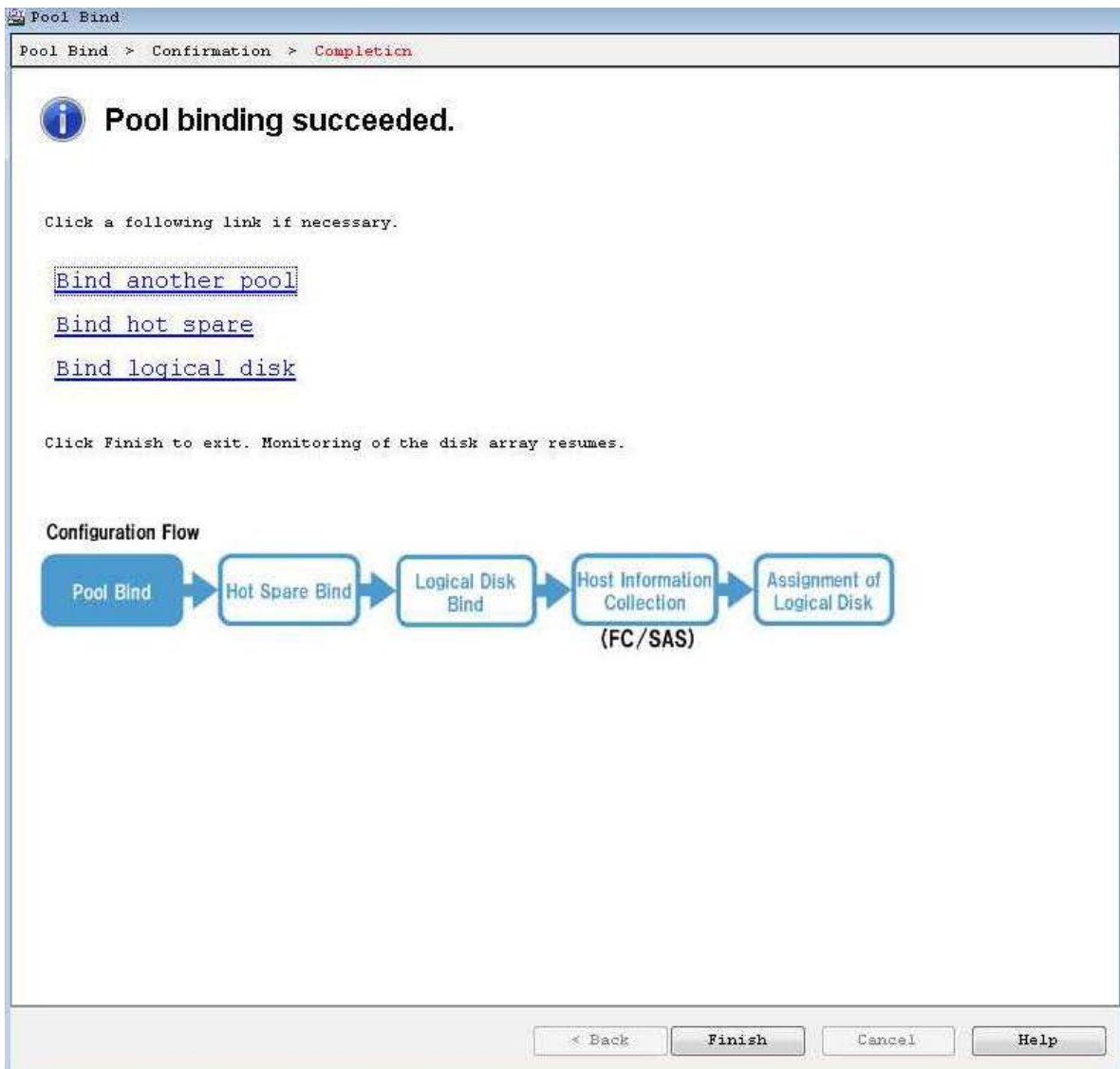


If all of the displayed information is correct, click on the **Set** button to display the following confirmation message.





Click on the **Yes** button to complete the pool bind and creation of the volume group. When the pool binding is successfully completed the following window is displayed.



Click on **Bind another pool** to create another volume group or **Bind logical disk** to create the logical disks described in the next step.

### Create Logical Disks (*Logical Disk Bind*)

The logical disks can be created by clicking the **Bind logical disk** option in the Pool Disk completion menu or by clicking **Configuration** then **Logical Disk Bind** in the main menu.



One logical disk was created from each of the 48 RAID1/10 volumes.

Examples of the Logical Disk Bind menus are listed below. The values displayed in example menus were not the values used to configure the TSC. The specific parameter values for each of the 48 logical disks are listed in the [Logical Disk Parameters](#) section.

Each logical disk was created, starting from the first Logical Disk Bind menu, with the following specifications:

- **Pool list:** Select the pool in which the logical disk will be bound.
- **Number of logical disks:** Select **1** as the number of logical disks.
- **Logical disk capacity:** Enter the capacity in GiB.
- The **logical disk name** is assigned automatically.

The screenshot shows the 'Logical Disk Bind' window with the following sections:

**1: Select the pool where a logical disk will be bound.**

Show all pools

- Pool list -

Number	Pool name	RAID	Physical disk type	Free capacity[GB]	Capacity[GB]	Num
0000h	Pool10000	RAID1/10	SAS	1039.7	1048.0	
0001h	Pool10001	RAID1/10	SAS	1048.0	1048.0	
0002h	Pool10002	RAID1/10	SAS	1048.0	1048.0	
0003h	Pool10003	RAID1/10	SAS	1048.0	1048.0	

Show logical disks of the selected pool

**2: Specify the number of logical disks and their capacity.**

Number of logical disks (1-1023)

Logical disk capacity (1-1039)

Logical disk capacity : 1,039.0 GB  
Capacity logical disks consume : 1,039.0 GB  
Unused capacity of the pool : 1,039.7 GB

**3: Set logical disk name.**

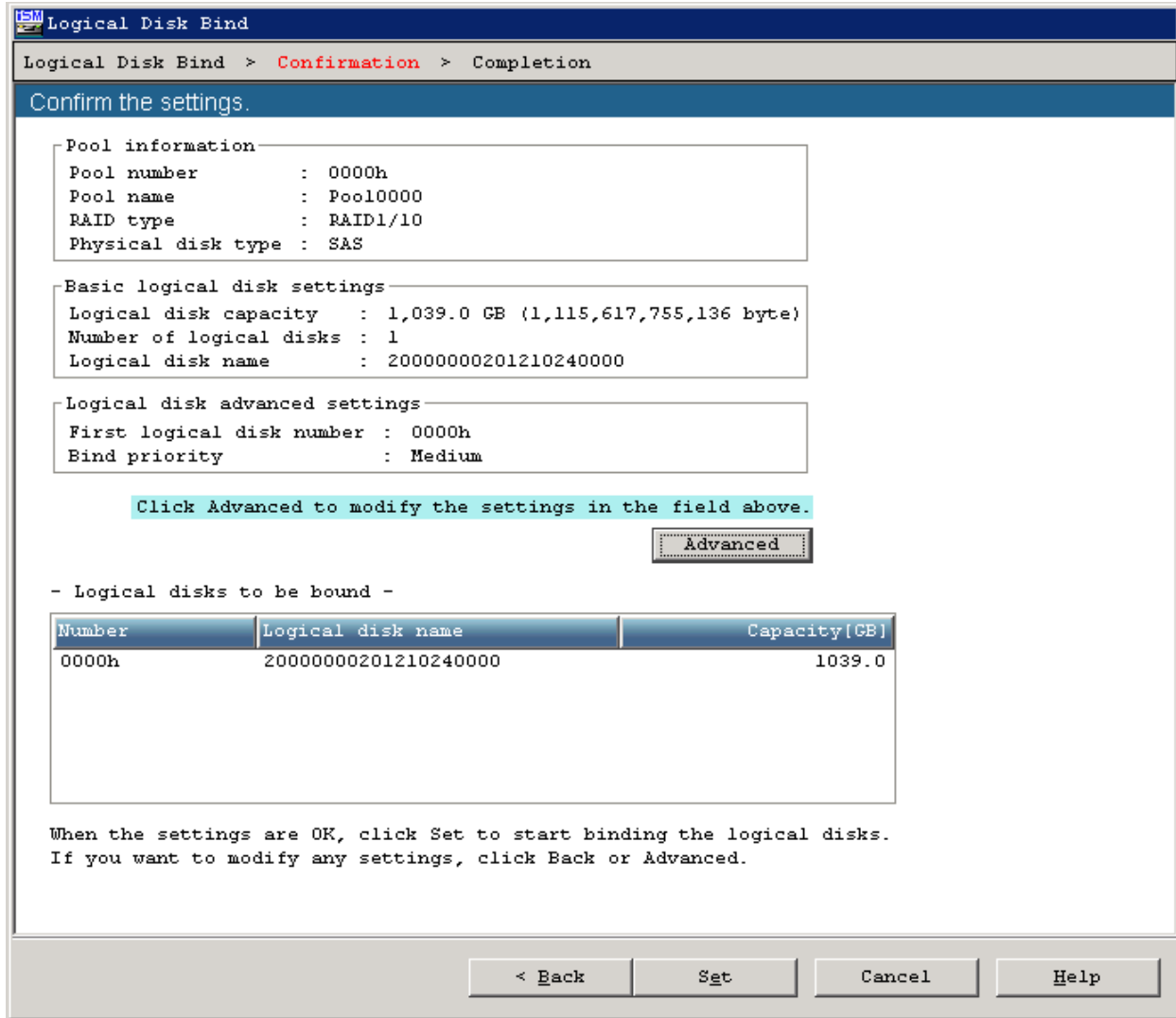
Logical disk name

Explanation  
Set the name of the logical disk to be bound.  
If two or more logical disks are bound, enter the prefix for them.

< Back    Next >    Cancel    Help

After entering the appropriate parameter values, click on the **Next** button, which will display the following confirmation menu.

This menu will list the settings of the logical disk to be bound. If all of the displayed information is correct, click on the **Set** button, which will display the following final confirmation menu.

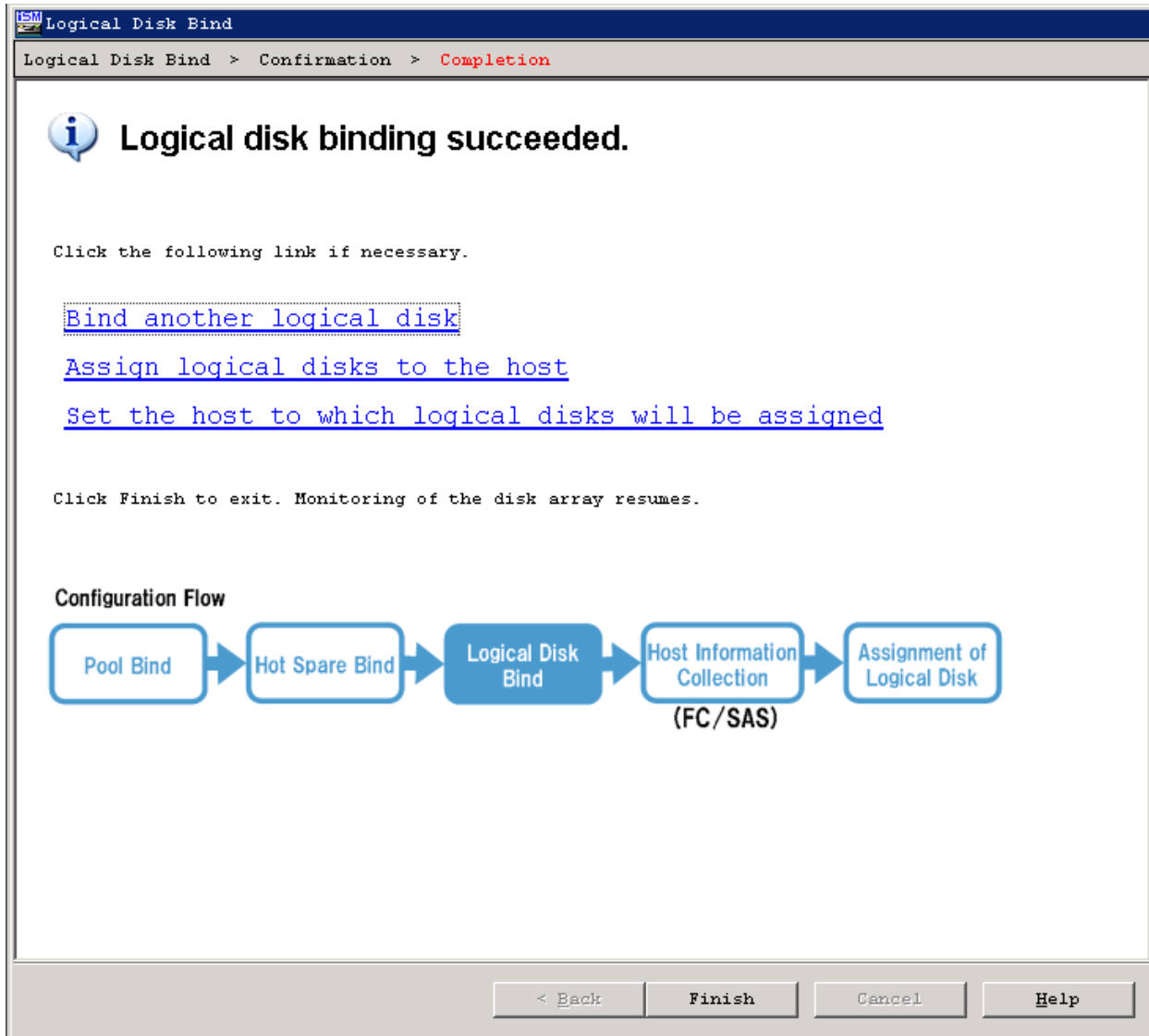


Click on the **Yes** button to create the logical disk.



After that is completed, the following window is displayed.

Select **Bind another logical disk** to create another logical disk or click the **Finish** button after creating the last logical disk.



## Referenced Parameter Details

### Volume Group Parameters

Pool Number	Physical Disk	RAID type	Select physical disks
0000	SAS	RAID1/10	00-0000,00-0800,00-1000,00-1800, 00-2000,00-2800,00-3000,00-3800
0001	SAS	RAID1/10	00-0001,00-0801,00-1001,00-1801, 00-2001,00-2801,00-3001,00-3801
0002	SAS	RAID1/10	00-0002,00-0802,00-1002,00-1802, 00-2002,00-2802,00-3002,00-3802
0003	SAS	RAID1/10	00-0003,00-0803,00-1003,00-1803, 00-2003,00-2803,00-3003,00-3803
0004	SAS	RAID1/10	00-0004,00-0804,00-1004,00-1804, 00-2004,00-2804,00-3004,00-3804
0005	SAS	RAID1/10	00-0005,00-0805,00-1005,00-1805, 00-2005,00-2805,00-3005,00-3805
0006	SAS	RAID1/10	00-0006,00-0806,00-1006,00-1806, 00-2006,00-2806,00-3006,00-3806
0007	SAS	RAID1/10	00-0007,00-0807,00-1007,00-1807, 00-2007,00-2807,00-3007,00-3807
0008	SAS	RAID1/10	00-0008,00-0808,00-1008,00-1808, 00-2008,00-2808,00-3008,00-3808
0009	SAS	RAID1/10	00-0009,00-0809,00-1009,00-1809, 00-2009,00-2809,00-3009,00-3809
000a	SAS	RAID1/10	00-000a,00-080a,00-100a,00-180a, 00-200a,00-280a,00-300a,00-380a
000b	SAS	RAID1/10	00-000b,00-080b,00-100b,00-180b, 00-200b,00-280b,00-300b,00-380b
000c	SAS	RAID1/10	00-000c,00-080c,00-100c,00-180c, 00-200c,00-280c,00-300c,00-380c
000d	SAS	RAID1/10	00-000d,00-080d,00-100d,00-180d, 00-200d,00-280d,00-300d,00-380d
000e	SAS	RAID1/10	00-000e,00-080e,00-100e,00-180e, 00-200e,00-280e,00-300e,00-380e
000f	SAS	RAID1/10	00-000f,00-080f,00-100f,00-180f, 00-200f,00-280f,00-300f,00-380f
0010	SAS	RAID1/10	00-0010,00-0810,00-1010,00-1810, 00-2010,00-2810,00-3010,00-3810
0011	SAS	RAID1/10	00-0011,00-0811,00-1011,00-1811, 00-2011,00-2811,00-3011,00-3811
0012	SAS	RAID1/10	00-0012,00-0812,00-1012,00-1812, 00-2012,00-2812,00-3012,00-3812
0013	SAS	RAID1/10	00-0013,00-0813,00-1013,00-1813, 00-2013,00-2813,00-3013,00-3813
0014	SAS	RAID1/10	00-0014,00-0814,00-1014,00-1814, 00-2014,00-2814,00-3014,00-3814
0015	SAS	RAID1/10	00-0015,00-0815,00-1015,00-1815, 00-2015,00-2815,00-3015,00-3815
0016	SAS	RAID1/10	00-0016,00-0816,00-1016,00-1816, 00-2016,00-2816,00-3016,00-3816
0017	SAS	RAID1/10	00-0017,00-0817,00-1017,00-1817, 00-2017,00-2817,00-3017,00-3817

<b>Pool Number</b>	<b>Physical Disk</b>	<b>RAID type</b>	<b>Select physical disks</b>
0018	SAS	RAID1/10	00-0100,00-0900,00-1100,00-1900, 00-2100,00-2900,00-3100,00-3900
0019	SAS	RAID1/10	00-0101,00-0901,00-1101,00-1901, 00-2101,00-2901,00-3101,00-3901
001a	SAS	RAID1/10	00-0102,00-0902,00-1102,00-1902, 00-2102,00-2902,00-3102,00-3902
001b	SAS	RAID1/10	00-0103,00-0903,00-1103,00-1903, 00-2103,00-2903,00-3103,00-3903
001c	SAS	RAID1/10	00-0104,00-0904,00-1104,00-1904, 00-2104,00-2904,00-3104,00-3904
001d	SAS	RAID1/10	00-0105,00-0905,00-1105,00-1905, 00-2105,00-2905,00-3105,00-3905
001e	SAS	RAID1/10	00-0106,00-0906,00-1106,00-1906, 00-2106,00-2906,00-3106,00-3906
001f	SAS	RAID1/10	00-0107,00-0907,00-1107,00-1907, 00-2107,00-2907,00-3107,00-3907
0020	SAS	RAID1/10	00-0108,00-0908,00-1108,00-1908, 00-2108,00-2908,00-3108,00-3908
0021	SAS	RAID1/10	00-0109,00-0909,00-1109,00-1909, 00-2109,00-2909,00-3109,00-3909
0022	SAS	RAID1/10	00-010a,00-090a,00-110a,00-190a, 00-210a,00-290a,00-310a,00-390a
0023	SAS	RAID1/10	00-010b,00-090b,00-110b,00-190b, 00-210b,00-290b,00-310b,00-390b
0024	SAS	RAID1/10	00-010c,00-090c,00-110c,00-190c, 00-210c,00-290c,00-310c,00-390c
0025	SAS	RAID1/10	00-010d,00-090d,00-110d,00-190d, 00-210d,00-290d,00-310d,00-390d
0026	SAS	RAID1/10	00-010e,00-090e,00-110e,00-190e, 00-210e,00-290e,00-310e,00-390e
0027	SAS	RAID1/10	00-010f,00-090f,00-110f,00-190f, 00-210f,00-290f,00-310f,00-390f
0028	SAS	RAID1/10	00-0110,00-0910,00-1110,00-1910, 00-2110,00-2910,00-3110,00-3910
0029	SAS	RAID1/10	00-0111,00-0911,00-1111,00-1911, 00-2111,00-2911,00-3111,00-3911
002a	SAS	RAID1/10	00-0112,00-0912,00-1112,00-1912, 00-2112,00-2912,00-3112,00-3912
002b	SAS	RAID1/10	00-0113,00-0913,00-1113,00-1913, 00-2113,00-2913,00-3113,00-3913
002c	SAS	RAID1/10	00-0114,00-0914,00-1114,00-1914, 00-2114,00-2914,00-3114,00-3914
002d	SAS	RAID1/10	00-0115,00-0915,00-1115,00-1915, 00-2115,00-2915,00-3115,00-3915
002e	SAS	RAID1/10	00-0116,00-0916,00-1116,00-1916, 00-2116,00-2916,00-3116,00-3916
002f	SAS	RAID1/10	00-0117,00-0917,00-1117,00-1917, 00-2117,00-2917,00-3117,00-3917

### Logical Disk Parameters

Pool list	Number of Logical Disks	Logical disk Capacity	Logical disk name
0000	1	1039	20000000201210240000
0001	1	1039	20000000201210240001
0002	1	1039	20000000201210240002
0003	1	1039	20000000201210240003
0004	1	1039	20000000201210240004
0005	1	1039	20000000201210240005
0006	1	1039	20000000201210240006
0007	1	1039	20000000201210240007
0008	1	1039	20000000201210240008
0009	1	1039	20000000201210240009
000a	1	1039	2000000020121024000A
000b	1	1039	2000000020121024000B
000c	1	1039	2000000020121024000C
000d	1	1039	2000000020121024000D
000e	1	1039	2000000020121024000E
000f	1	1039	2000000020121024000F
0010	1	1039	20000000201210240010
0011	1	1039	20000000201210240011
0012	1	1039	20000000201210240012
0013	1	1039	20000000201210240013
0014	1	1039	20000000201210240014
0015	1	1039	20000000201210240015
0016	1	1039	20000000201210240016
0017	1	1039	20000000201210240017
0018	1	1039	20000000201210240018
0019	1	1039	20000000201210240019
001a	1	1039	2000000020121024001A
001b	1	1039	2000000020121024001B
001c	1	1039	2000000020121024001C
001d	1	1039	2000000020121024001D
001e	1	1039	2000000020121024001E
001f	1	1039	2000000020121024001F
0020	1	1039	20000000201210240020
0021	1	1039	20000000201210240021
0022	1	1039	20000000201210240022
0023	1	1039	20000000201210240023
0024	1	1039	20000000201210240024
0025	1	1039	20000000201210240025
0026	1	1039	20000000201210240026
0027	1	1039	20000000201210240027
0028	1	1039	20000000201210240028
0029	1	1039	20000000201210240029
002a	1	1039	2000000020121024002A
002b	1	1039	2000000020121024002B
002c	1	1039	2000000020121024002C
002d	1	1039	2000000020121024002D
002e	1	1039	2000000020121024002E
002f	1	1039	2000000020121024002F



## APPENDIX D: SPC-2 WORKLOAD GENERATOR STORAGE COMMANDS AND PARAMETER FILES

### ASU Pre-Fill

```
compratio=1

sd=default,host=localhost,size=1039g
sd=sd1,lun=\\.\PhysicalDrive1
sd=sd2,lun=\\.\PhysicalDrive2
sd=sd3,lun=\\.\PhysicalDrive3
sd=sd4,lun=\\.\PhysicalDrive4
sd=sd5,lun=\\.\PhysicalDrive5
sd=sd6,lun=\\.\PhysicalDrive6
sd=sd7,lun=\\.\PhysicalDrive7
sd=sd8,lun=\\.\PhysicalDrive8
sd=sd9,lun=\\.\PhysicalDrive9
sd=sd10,lun=\\.\PhysicalDrive10
sd=sd11,lun=\\.\PhysicalDrive11
sd=sd12,lun=\\.\PhysicalDrive12
sd=sd13,lun=\\.\PhysicalDrive13
sd=sd14,lun=\\.\PhysicalDrive14
sd=sd15,lun=\\.\PhysicalDrive15
sd=sd16,lun=\\.\PhysicalDrive16
sd=sd17,lun=\\.\PhysicalDrive17
sd=sd18,lun=\\.\PhysicalDrive18
sd=sd19,lun=\\.\PhysicalDrive19
sd=sd20,lun=\\.\PhysicalDrive20
sd=sd21,lun=\\.\PhysicalDrive21
sd=sd22,lun=\\.\PhysicalDrive22
sd=sd23,lun=\\.\PhysicalDrive23
sd=sd24,lun=\\.\PhysicalDrive24
sd=sd25,lun=\\.\PhysicalDrive25
sd=sd26,lun=\\.\PhysicalDrive26
sd=sd27,lun=\\.\PhysicalDrive27
sd=sd28,lun=\\.\PhysicalDrive28
sd=sd29,lun=\\.\PhysicalDrive29
sd=sd30,lun=\\.\PhysicalDrive30
sd=sd31,lun=\\.\PhysicalDrive31
sd=sd32,lun=\\.\PhysicalDrive32
sd=sd33,lun=\\.\PhysicalDrive33
sd=sd34,lun=\\.\PhysicalDrive34
sd=sd35,lun=\\.\PhysicalDrive35
sd=sd36,lun=\\.\PhysicalDrive36
sd=sd37,lun=\\.\PhysicalDrive37
sd=sd38,lun=\\.\PhysicalDrive38
sd=sd39,lun=\\.\PhysicalDrive39
sd=sd40,lun=\\.\PhysicalDrive40
sd=sd41,lun=\\.\PhysicalDrive41
sd=sd42,lun=\\.\PhysicalDrive42
sd=sd43,lun=\\.\PhysicalDrive43
sd=sd44,lun=\\.\PhysicalDrive44
sd=sd45,lun=\\.\PhysicalDrive45
sd=sd46,lun=\\.\PhysicalDrive46
sd=sd47,lun=\\.\PhysicalDrive47
sd=sd48,lun=\\.\PhysicalDrive48

wd=default,rdpct=0,seek=-1,xfersize=256k
wd=wd1,sd=sd1
```

```
wd=wd2 ,sd=sd2
wd=wd3 ,sd=sd3
wd=wd4 ,sd=sd4
wd=wd5 ,sd=sd5
wd=wd6 ,sd=sd6
wd=wd7 ,sd=sd7
wd=wd8 ,sd=sd8
wd=wd9 ,sd=sd9
wd=wd10 ,sd=sd10
wd=wd11 ,sd=sd11
wd=wd12 ,sd=sd12
wd=wd13 ,sd=sd13
wd=wd14 ,sd=sd14
wd=wd15 ,sd=sd15
wd=wd16 ,sd=sd16
wd=wd17 ,sd=sd17
wd=wd18 ,sd=sd18
wd=wd19 ,sd=sd19
wd=wd20 ,sd=sd20
wd=wd21 ,sd=sd21
wd=wd22 ,sd=sd22
wd=wd23 ,sd=sd23
wd=wd24 ,sd=sd24
wd=wd25 ,sd=sd25
wd=wd26 ,sd=sd26
wd=wd27 ,sd=sd27
wd=wd28 ,sd=sd28
wd=wd29 ,sd=sd29
wd=wd30 ,sd=sd30
wd=wd31 ,sd=sd31
wd=wd32 ,sd=sd32
wd=wd33 ,sd=sd33
wd=wd34 ,sd=sd34
wd=wd35 ,sd=sd35
wd=wd36 ,sd=sd36
wd=wd37 ,sd=sd37
wd=wd38 ,sd=sd38
wd=wd39 ,sd=sd39
wd=wd40 ,sd=sd40
wd=wd41 ,sd=sd41
wd=wd42 ,sd=sd42
wd=wd43 ,sd=sd43
wd=wd44 ,sd=sd44
wd=wd45 ,sd=sd45
wd=wd46 ,sd=sd46
wd=wd47 ,sd=sd47
wd=wd48 ,sd=sd48
```

```
rd=PREPSSD,wd=wd* ,iorate=max,elapsed=999990,interval=10
```

## Common Commands/Parameters – LFP, LDQ, VOD and Persistence

The following command/parameter lines appear in each of the command and parameter files for the Large File Processing (LFP), Large Database Query (LDQ), Video on Demand (VOD) and SPC-2 Persistence Tests. The command lines are only listed below to eliminate redundancy.

```
host=localhost,jvms=4,maxstreams=200,java=(java,"-Xmx1536m -Xms1536m -Xss96k"),shell=spc2
```

```
host=(192.168.10.60,ns60),java=(java,"-Xmx1536m -Xms1536m -Xss96k"),shell=spc2,jvms=4,maxstreams=200
```

```
host=(192.168.10.59,ns59),java=(java,"-Xmx1536m -Xms1536m -Xss96k"),shell=spc2,jvms=4,maxstreams=200
```

```
host=(192.168.10.58,ns58),java=(java,"-Xmx1536m -Xms1536m -Xss96k"),shell=spc2,jvms=4,maxstreams=200
```

```
host=(192.168.10.56,ns56),java=(java,"-Xmx1536m -Xms1536m -Xss96k"),shell=spc2,jvms=4,maxstreams=200
```

```
host=(192.168.10.55,ns55),java=(java,"-Xmx1536m -Xms1536m -Xss96k"),shell=spc2,jvms=4,maxstreams=200
```

```
host=(192.168.10.54,ns54),java=(java,"-Xmx1536m -Xms1536m -Xss96k"),shell=spc2,jvms=4,maxstreams=200
```

```
host=(192.168.10.53,ns53),java=(java,"-Xmx1536m -Xms1536m -Xss96k"),shell=spc2,jvms=4,maxstreams=200
```

```
host=(192.168.10.50,ns50),java=(java,"-Xmx1536m -Xms1536m -Xss96k"),shell=spc2,jvms=4,maxstreams=200
```

```
host=(192.168.10.49,ns49),java=(java,"-Xmx1536m -Xms1536m -Xss96k"),shell=spc2,jvms=4,maxstreams=200
```

```
host=(192.168.10.48,ns48),java=(java,"-Xmx1536m -Xms1536m -Xss96k"),shell=spc2,jvms=4,maxstreams=200
```

```
host=(192.168.10.47,ns47),java=(java,"-Xmx1536m -Xms1536m -Xss96k"),shell=spc2,jvms=4,maxstreams=200
```

```
sd=default,host=localhost,size=1039g
sd=sd1,lun=\\.\PhysicalDrive1
sd=sd2,lun=\\.\PhysicalDrive2
sd=sd3,lun=\\.\PhysicalDrive3
sd=sd4,lun=\\.\PhysicalDrive4
sd=sd5,lun=\\.\PhysicalDrive5
sd=sd6,lun=\\.\PhysicalDrive6
sd=sd7,lun=\\.\PhysicalDrive7
sd=sd8,lun=\\.\PhysicalDrive8
sd=sd9,lun=\\.\PhysicalDrive9
sd=sd10,lun=\\.\PhysicalDrive10
sd=sd11,lun=\\.\PhysicalDrive11
sd=sd12,lun=\\.\PhysicalDrive12
sd=sd13,lun=\\.\PhysicalDrive13
sd=sd14,lun=\\.\PhysicalDrive14
sd=sd15,lun=\\.\PhysicalDrive15
sd=sd16,lun=\\.\PhysicalDrive16
```

```
sd=sd17,lun=\\.\PhysicalDrive17
sd=sd18,lun=\\.\PhysicalDrive18
sd=sd19,lun=\\.\PhysicalDrive19
sd=sd20,lun=\\.\PhysicalDrive20
sd=sd21,lun=\\.\PhysicalDrive21
sd=sd22,lun=\\.\PhysicalDrive22
sd=sd23,lun=\\.\PhysicalDrive23
sd=sd24,lun=\\.\PhysicalDrive24
sd=sd25,lun=\\.\PhysicalDrive25
sd=sd26,lun=\\.\PhysicalDrive26
sd=sd27,lun=\\.\PhysicalDrive27
sd=sd28,lun=\\.\PhysicalDrive28
sd=sd29,lun=\\.\PhysicalDrive29
sd=sd30,lun=\\.\PhysicalDrive30
sd=sd31,lun=\\.\PhysicalDrive31
sd=sd32,lun=\\.\PhysicalDrive32
sd=sd33,lun=\\.\PhysicalDrive33
sd=sd34,lun=\\.\PhysicalDrive34
sd=sd35,lun=\\.\PhysicalDrive35
sd=sd36,lun=\\.\PhysicalDrive36
sd=sd37,lun=\\.\PhysicalDrive37
sd=sd38,lun=\\.\PhysicalDrive38
sd=sd39,lun=\\.\PhysicalDrive39
sd=sd40,lun=\\.\PhysicalDrive40
sd=sd41,lun=\\.\PhysicalDrive41
sd=sd42,lun=\\.\PhysicalDrive42
sd=sd43,lun=\\.\PhysicalDrive43
sd=sd44,lun=\\.\PhysicalDrive44
sd=sd45,lun=\\.\PhysicalDrive45
sd=sd46,lun=\\.\PhysicalDrive46
sd=sd47,lun=\\.\PhysicalDrive47
sd=sd48,lun=\\.\PhysicalDrive48
```

## Large File Processing Test (LFP)

\* Large File Processing Test (LFP)

### Common Commands/Parameters – LFP, LDQ VOD and Persistence

```
maxlatestart=1
reportinginterval=5
segmentlength=512m

rd=default,rampup=180,periods=90,measurement=180,runout=45,rampdown=15,buffers=1

** LFP, Write Phase

rd=default,rdpct=0,xfersize=1024k
rd=TR1_SPC-2-FP,streams=100
rd=TR2_SPC-2-FP,streams=50
rd=TR3_SPC-2-FP,streams=25
rd=TR4_SPC-2-FP,streams=13
rd=TR5_SPC-2-FP,streams=1

rd=default,rdpct=0,xfersize=256k
rd=TR6_SPC-2-FP,streams=100
rd=TR7_SPC-2-FP,streams=50
rd=TR8_SPC-2-FP,streams=25
rd=TR9_SPC-2-FP,streams=13
rd=TR10_SPC-2-FP,streams=1

** LFP, Read/Write Phase

rd=default,rdpct=50,xfersize=1024k
rd=TR11_SPC-2-FP,streams=180
rd=TR12_SPC-2-FP,streams=90
rd=TR13_SPC-2-FP,streams=45
rd=TR14_SPC-2-FP,streams=23
rd=TR15_SPC-2-FP,streams=1

rd=default,rdpct=50,xfersize=256k
rd=TR16_SPC-2-FP,streams=180
rd=TR17_SPC-2-FP,streams=90
rd=TR18_SPC-2-FP,streams=45
rd=TR19_SPC-2-FP,streams=23
rd=TR20_SPC-2-FP,streams=1

** LFP, Read Phase

rd=default,rdpct=100,xfersize=1024k
rd=TR21_SPC-2-FP,streams=700
rd=TR22_SPC-2-FP,streams=350
rd=TR23_SPC-2-FP,streams=175
rd=TR24_SPC-2-FP,streams=88
rd=TR25_SPC-2-FP,streams=1

rd=default,rdpct=100,xfersize=256k
rd=TR26_SPC-2-FP,streams=700
rd=TR27_SPC-2-FP,streams=350
rd=TR28_SPC-2-FP,streams=175
rd=TR29_SPC-2-FP,streams=88
rd=TR30_SPC-2-FP,streams=1
```

## Large Database Query Test (LDQ)

\* Large Data Query Test (LDQ)

### Common Commands/Parameters – LFP, LDQ VOD and Persistence

```
maxlatestart=0
reportinginterval=5
segmentlength=512m

rd=default,rampup=180,periods=90,measurement=180,runout=45,rampdown=15,rdpct=99

** LDQ, 1024KiB Phase

rd=default,buffers=4,xfersize=1024k
rd=TR1_SPC-2-DQ,streams=700
rd=TR2_SPC-2-DQ,streams=300
rd=TR3_SPC-2-DQ,streams=150
rd=TR4_SPC-2-DQ,streams=75
rd=TR5_SPC-2-DQ,streams=1

rd=default,buffers=1,xfersize=1024k
rd=TR6_SPC-2-DQ,streams=700
rd=TR7_SPC-2-DQ,streams=300
rd=TR8_SPC-2-DQ,streams=150
rd=TR9_SPC-2-DQ,streams=75
rd=TR10_SPC-2-DQ,streams=1

** LDQ, 64KiB Phase

rd=default,buffers=4,xfersize=64k
rd=TR11_SPC-2-DQ,streams=700
rd=TR12_SPC-2-DQ,streams=350
rd=TR13_SPC-2-DQ,streams=175
rd=TR14_SPC-2-DQ,streams=88
rd=TR15_SPC-2-DQ,streams=1

rd=default,buffers=1,xfersize=64k
rd=TR16_SPC-2-DQ,streams=700
rd=TR17_SPC-2-DQ,streams=350
rd=TR18_SPC-2-DQ,streams=175
rd=TR19_SPC-2-DQ,streams=88
rd=TR20_SPC-2-DQ,streams=1
```

## Video on Demand Delivery (VOD)

\* Video On Demand Test (VOD)

### Common Commands/Parameters – LFP, LDQ VOD and Persistence

```
maxlatestart=10
reportinginterval=5
maxlatevod=0
videosegmentduration=7200

rd=default,rampup=1200,periods=600,measurement=7200,runout=45,rampdown=15,buffers=8

rd=TR1_SPC-2-VOD,streams=19000
```

## SPC-2 Persistence Test Run 1 (*write phase*)

### Common Commands/Parameters – LFP, LDQ VOD and Persistence

```
maxlatestart=0
reportinginterval=5
segmentlength=512m

rd=default,rampup=180,periods=90,measurement=300,runout=0,rampdown=0,buffers=1

rd=default,rdpct=0,xfersize=1024k
rd=TR1_SPC-2-persist-w,streams=700
```

## SPC-2 Persistence Test Run 2 (*read phase*)

### Common Commands/Parameters – LFP, LDQ VOD and Persistence

```
maxlatestart=0
reportinginterval=5
segmentlength=512m

maxpersistenceerrors=10

rd=default,rampup=0,periods=0,measurement=300,runout=0,rampdown=0,buffers=1

rd=default,rdpct=100,xfersize=1024k
rd=TR1_SPC-2-persist-r,streams=0
```

## **APPENDIX E: SPC-2 WORKLOAD GENERATOR EXECUTION COMMANDS AND PARAMETERS**

### **ASU Pre-Fill, Large File Processing Test, Large Database Query Test, Video on Demand Delivery Test, and SPC-2 Persistence Test Run 1**

The following script was used to execute the required ASU pre-fill, Large File Processing Test, Large Database Query Test, Video on Demand Delivery Test and SPC-2 Persistence Test Run 1 in an uninterrupted sequence.

The script also included the appropriate commands to capture the detailed TSC profile listings required for a Remote Audit.

```
call profile.bat
call prepssd.bat

sleep 30

java -Xmx1536m -Xms1536m -Xss96k -cp c:\SPC\SPC2 vdbench -w SPC2 -f
c:\ns57\M700_lfp.parm -o c:\ns57\LFP

java -Xmx1536m -Xms1536m -Xss96k -cp c:\SPC\SPC2 vdbench -w SPC2 -f
c:\ns57\M700_lfp.parm -o c:\ns57\LFP

java -Xmx1536m -Xms1536m -Xss96k -cp c:\SPC\SPC2 vdbench -w SPC2 -f
c:\ns57\M700_ldq.parm -o c:\ns57\LDQ

java -Xmx1536m -Xms1536m -Xss96k -cp c:\SPC\SPC2 vdbench -w SPC2 -f
c:\ns57\M700_vod.parm -o c:\ns57\VOD

java -Xmx1536m -Xms1536m -Xss96k -cp c:\SPC\SPC2 vdbench -w SPC2 -f
c:\ns57\M700_persist1.parm -o c:\ns57\persist1

call shutdown.bat
```

#### **profile.bat**

The script to execute the appropriate commands to capture the detailed TSC profile listings required for a Remote Audit.

```
c:\ns57\teraterm\ttermpro.exe /M=c:\ns57\M700_profile.ttl
```



## M700\_profile.ttl

The command file to capture the detailed TSC profile listings required for a Remote Audit.

```
;; connection user/password
HOSTADDR = '192.168.10.100'
USERNAME = 'sysadmin'
PASSWORD = 'sys123'
;=====
;; config
COMMAND = HOSTADDR
strconcat COMMAND ':23 /nossh /T=1'

;; connect
connect COMMAND

;; login
wait 'login: '
sendln USERNAME
wait 'Password: '
sendln PASSWORD

;; command1
wait 'sysadmin@2000000020121024-0# '
sendln 'iSMenv gettime'

;; command2
wait 'sysadmin@2000000020121024-0# '
sendln 'iSMview -all'

;; command3
wait 'sysadmin@2000000020121024-0# '
sendln 'iSMenv gettime'

;; command4
wait 'sysadmin@2000000020121024-0# '
sendln 'exit'

;; finish
end
```

## prepssd.bat

The script to execute the required ASU pre-fill.

```
c:\ns57\vdbench503rc11\vdbench -f c:\ns57\prepssd.txt -o c:\ns57\ssdprep
```

## RemoteStart.bat

This script was executed on each Slave Host System to start the SPC-2 remote connection utility, which enables a remote connection to be established between the Master and Remote Host Systems.

```
java -cp c:\SPC\SPC2 RemoteStart
```

### shutdown.bat

This script executes the required TSC power off.

```
c:\ns57\teraterm\ttermpro.exe /M=c:\ns57\M700_shutdown.ttl
```

### M700\_shutdown.ttl

The command file to execute the required TSC power off.

```
;; connection user/password
HOSTADDR = '192.168.10.100'
USERNAME = 'sysadmin'
PASSWORD = 'sys123'
;=====
;; config
COMMAND = HOSTADDR
strconcat COMMAND ':23 /nossh /T=1'

;; connect
connect COMMAND

;; login
wait 'login: '
sendln USERNAME
wait 'Password: '
sendln PASSWORD

;; command1
wait 'sysadmin@2000000020121024-0# '
sendln 'iSMenv gettime'

;; command2
wait 'sysadmin@2000000020121024-0# '
sendln 'iSMcfg shutdown -time 5'

;; finish
end
```

### SPC-2 Persistence Test Run 2

The following script was used to execute SPC-2 Persistence Test Run 2.

The script also included the appropriate commands to capture the detailed TSC profile listings required for a Remote Audit.

```
java -Xmx1536m -Xms1536m -Xss96k -cp c:\SPC\SPC2 vdbench -w SPC2 -f
c:\ns57\M700_persist2.parm -o c:\ns57\persist2

call profile.bat
```