7.2.8.2 Temperature Requirements

Ambient temperature shall be no less than 18 degrees C and no greater than 28 degrees C over the duration of the test.

7.2.8.3 Humidity Requirements

Relative humidity shall be within 15% and 80% over the duration of the test.

7.2.9 Power and Temperature Measurement Instrumentation

The solution under test shall include a recommended power meter (sometimes called an *analyzer*). If the selected power meter does not gather environmental data, the solution under test shall include an environmental meter. See Annex A for information regarding recommended meters.

The power meter shall be active throughout all tests and test phases and shall record:

- Input voltage to the product under test, to an accuracy within 2% at the 95% confidence level;
- Power consumption by the SUT, to the resolution summarized in Table 11Table 11Table 11.

The power and voltage measurements shall be recorded to durable media using a period of not more than 5 seconds and shall use a timestamp that is synchronized with the other components of the solution under test to a resolution of at least 1 second.

Table 11 – Power Meter Resolution

Power Consumption (p)	Minimum Resolution
p ≤ 10 W	± 0.01 W
10 < p ≤ 100 W	± 0.1 W
p > 100 W	± 1.0 W

The temperature, measured in degrees Celsius, to an accuracy of ± 0.5 °C, as measured no more than 50 mm in front of (upwind of) the primary air inlet port for the product under test, shall be recorded to durable media using a minimum reading rate of one reading every 10 seconds.

7.2.10 Workload Generator

7.2.10.1 Block Access Workload Generator

Vdbench (see Annex D) shall be used as the workload generator for Block Access testing. Information on access to Vdbench is provided in Annex D. Annex D identifies the version(s) of Vdbench that shall be used.

Test sponsors shall use a provided Vdbench Script (see Annex E). The script contains user adjustable parameters that the Test Sponsor may adjust within the constraints stated in the provided Vdbench Script.

This document takes precedence over any script if there is a conflict.

7.2.10.2 File Access Workload Generator

Test Sponsors shall use SPEC SFS® 2014 (see Annex F) as the workload generator for file access testing. Information on access to SPEC SFS® 2014 is provided in Annex F. Annex F identifies the version(s) of SPEC SFS® 2014 that may be used.

Test sponsors shall use a provided File Access IO Load Driver Configuration File (see Annex G). A configuration file contains user adjustable parameters.

This document takes precedence over any script if there is a conflict.

7.2.11 Instrumentation

7.2.11.1 Block Access Instrumentation

Vdbench shall be used as the workload generator and for collecting I/O rates and throughput data.

The load generator shall be active throughout all tests and test phases of the active metrics and shall record:

- IO rate and throughput in IO/sec and MiB/sec respectively, sampled reported every minute.

7.2.11.2 File Access Instrumentation

SPEC SFS® 2014 (see Annex F) shall be used as the workload generator.

An sFlow® (see Annex H) collector shall be used to collect storage performance data. sFlow® data shall be acquired by an sFlow® agent or agents located either in a network switch or the load generating host(s). The workload generator shall be active throughout all tests and test phases of the active metrics and shall record:

- The workload transition events in the log file for use during the data reduction process.

sFlow® agent(s) and an sFlow® collector shall be active and recording data throughout all tests and test phases of the active metrics and shall record:

- IO throughput in MiB/sec to/from product under test, sampled reported every 60 10 seconds.

7.2.12 IO Profiles

7.2.12.1 Block Access IO Profiles

7.2.12.1.1 Overview

The particular IO stimuli used to drive the product under test during a test or test phase are specified in terms of an IO profile (a.k.a. workload) made up of multiple attributes:

- Name: the name of the IO pattern for this stimulus. The identifier for the associated test phase is included parenthetically, when appropriate;
- IO Size: the number of bytes requested by a given read or write operation;
- Read/Write Percentage: the mixture of read/write IO requests within an IO profile;
- Transfer Alignment: Minimum granularity of IO transfer addresses. All transfer addresses within an IO stream shall be a multiple of this value;
- Access Pattern: either one or the other of the following two alternatives:
  - Random: Randomly distributed throughout the address space of the product under test;
  - Sequential, as defined in 4.2;
- Data Pattern: compression ratio of 2:1.

7.2.12.1.2 Sequential Access

The first IO within an IO Stream with a sequential access pattern shall use an offset randomly distributed throughout the address range provided to the workload generator, and rounded down to satisfy the Transfer Alignment requirement. Each subsequent IO request shall be sent to and satisfied by the product under test in sequence using an offset that satisfies Equation 7-1.

Annex B (Normative) Measurement Requirements~~(Normative) Measurement Requirements~~~~(Normative) Measurement Requirements~~

Annex B. (Normative) Measurement Requirements

B 1. Online and Near-Online Block Access Data Collection and Processing Requirements

A summary of the data collection and processing requirements for Online and Near-Online block access testing is provided in Table B-1.

Table B-1 Online and Near-Online Block Access ~~Data Collection~~ Summary

Test	Power and Temperature~~Collection Interval (seconds)~~		Workload Generator Data Collection		Minimum Test Duration (minutes)
	Power ~~Meter~~$PA_{i}(\cdot)$ (seconds)~~$_{sc}$~~	Temperature Recording Interval (seconds)~~Temp Meter~~	Metric	Collection interval (seconds)	
Conditioning	60	10	Average Response Time RTA_{sc} (milli-seconds)	60	720
Active	60	10	1) Operations Rate O_{i} (IO/s or MiB/s) 2) Average Response Time RTA_{isc} (milli-seconds)	60	40
Ready Idle	60	10	N/A	N/A	120

B 2. Removable and Virtual Media Libary Block Access Data Collection and Processing Requirements

A summary of the data collection and processing requirements for Removable Media Library and Virtual Media Library testing is provided in Table B-2.

Table B-2 Removable and Virtual Media Library ~~Data Collection~~ Summary

Test	Power and Temperature~~Collection Interval (seconds)~~		Workload Generator Data Collection		Minimum Test Duration (minutes)
	Power $PA_{i}(\cdot)$ (seconds)~~Power Meter PA_{sc}~~	Temperature Recording Interval (seconds)~~Temp Meter~~	Metric	Collection interval (seconds)	
Conditioning	60	10	1) Average throughput for each drive (MiB/s) 2) Operations Rate O_{sci} (MiB/s)	60	14
Active	60	10	1) Average throughput for each drive (MiB/s) 2) Operations Rate O_{i} (MiB/s)	60	30

Test	Power and Temperature~~Collection Interval (seconds)~~		Workload Generator Data Collection		Minimum Test Duration (minutes)
	Power PA_i (·) (seconds)~~Power Meter $PA_{...}$~~	Temperature Recording Interval (seconds)~~Temp Meter~~	Metric	Collection interval (seconds)	
Ready Idle	60	10	N/A	N/A	120

B 3. Online and Near-Online File Access Data Collection and Processing Requirements

A summary of the data collection and processing requirements for Online and Near-Online file access testing is provided in Table B-3.

Table B-3 Online and Near-Online File Access ~~Data Collection~~ Summary

Test	Power and Temperature~~Collection Interval (seconds)~~		sFlow Data Collection		Minimum Test Duration (minutes)
	Power PA_i (·) (seconds)~~Power Meter~~	Temperature Recording Interval (seconds)~~Temp Meter~~	Metric	Collection interval (seconds)	
INIT	~~60~~10	10	Operations Rate O_I (MiB/s)	10	N/A
Warm-up – per load point	~~60~~10	10	Operations Rate O_I (MiB/s)	10	5
Active – per load point	~~60~~10	10	Operations Rate O_I (MiB/s)	10	5
Ready Idle	~~60~~10	10	N/A	N/A	120