



ENERGY STAR[®] Program Requirements Product Specification for Data Center Storage

Final Draft Test Method June 2013

1 OVERVIEW

The following test method shall be used for determining compliance with requirements in the ENERGY STAR Product Specification for Data Center Storage, and when acquiring test data for reporting on the ENERGY STAR Power and Performance Data Sheet.

2 APPLICABILITY

The following test method is applicable to all products eligible for qualification under the ENERGY STAR Product Specification for Data Center Storage.

3 DEFINITIONS

Unless otherwise specified, all terms used in this document are consistent with the definitions in the ENERGY STAR Eligibility Criteria for Data Center Storage.

4 TEST SETUP

A) Input Power: Input power shall be as specified in Table 1 and Table 2. The frequency for input power shall be as specified in Table 3.

B) Ambient Temperature: Ambient temperature shall be no less than 18 °C and no greater than 28 °C over the duration of the test.

C) Relative Humidity: Relative humidity shall be within 15% and 80%.

17 **Table 1: Input Power Requirements for Products with Nameplate Rated Power Less Than or Equal**
 18 **to 1500 W**

Product Type	Supply Voltage	Voltage Tolerance	Maximum Total Harmonic Distortion
Storage Products with Ac-Dc Single-Output PSUs	230 volts (V) ac or 115 V ac	+/- 1.0 %	2.0 %
Storage Products with Ac-Dc Multi-Output PSUs	230V ac or 115V ac		
Optional Testing Conditions For Ac-Dc Japanese Market	100V ac		
Three-phase Storage Products (North American Market)	208V ac		
Three-phase Storage Products (European Market)	400V ac		

19 **Table 2: Input Power Requirements for Products with Nameplate Rated Power Greater Than**
 20 **1500 W**

Product Type	Supply Voltage	Voltage Tolerance	Maximum Total Harmonic Distortion
Storage Products with Ac-Dc Single-Output PSUs	230 volts (V) ac or 115 V ac	+/- 5.0 %	5.0 %
Storage Products with Ac-Dc Multi-Output PSUs	230V ac or 115V ac		
Optional Testing Conditions For Ac-Dc Japanese Market	100V ac		
Three-phase Storage Products (North American Market)	208V ac		
Three-phase Storage Products (European Market)	400V ac		

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Table 3: Input Frequency Requirements for All Products

Supply Voltage	Frequency	Frequency Tolerance
100 V ac	50 or 60 Hz	±1.0%
115 V ac	60 Hz	
230 V ac	50 Hz or 60 Hz	
Three-phase	50 Hz or 60 Hz	

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23 **Note:** Based on stakeholder feedback to the Draft 2 Test Method, EPA has added guidance for European
 24 Three-phase input voltage and frequency requirements. Revisions have been made to Table 1, Table 2,
 25 and Table 3 to harmonize with the three phase voltage and frequency testing requirements in the Version
 26 2.0 ENERGY STAR Computer Servers Program Requirements, with the exception of the voltage tolerance
 27 for storage products with rated power greater than 1500W. Stakeholders stated that the voltage tolerance
 28 required for very high powered storage products should be within +/- 5.0 % rather than +/- 4.0 % to allow
 29 line voltage to be used and avoid the burden of high cost power conditioners. EPA has changed the range
 30 as a result welcomes feedback on the revision.

31 D) Power Meter: Power Meter(s) shall report true Root Mean Square (RMS) power and at least two
 32 of the following measurement units: voltage, current and power factor. Power Meter(s) shall
 33 possess the following attributes:

34 1) Calibration: The meter shall be calibrated within the past one year of the test date, by a
 35 standard traceable to National Institute of Science and Technology (USA) or a counterpart
 36 national metrology institute in other countries.

37 2) Crest Factor: An available current crest factor of 3 or more at its rated range value. For
 38 analyzers that do not specify the current crest factor, the analyzer must be capable of
 39 measuring an amperage spike of at least 3 times the maximum amperage measured during
 40 any 1 second sample.

41 3) Minimum Frequency Response: 3.0 kHz

42 4) Minimum Resolution:

- 43 i. 0.01 W for measurement values less than 10 W;
- 44 ii. 0.1 W for measurement values from 10 W to 100 W; and
- 45 iii. 1.0 W for measurement values greater than 100 W.

46 5) Logging: The reading rate supported by the meter shall be at least 1 set of measurements per
 47 second, where set is defined as watts. The data averaging interval of the analyzer shall equal
 48 the reading interval. Data averaging interval is defined as the time period over which all

49 samples captured by the high-speed sampling electronics of the analyzer are averaged to
50 provide the measurement set.

51 6) Measurement Accuracy: Measurement uncertainty as introduced by the instrument that
52 measures the input power to the product under test, including any external shunts.

53 i. Power measurements with a value greater than or equal to 0.5 W shall be made with an
54 uncertainty of less than or equal to 2% at the 95% confidence level.

55 ii. Power measurements with a value less than 0.5 W shall be made with an uncertainty of
56 less than or equal to 0.01 W at the 95% confidence level.

57 E) Temperature Sensor: The temperature sensor shall possess the following attributes:

58 1) Logging: The sensor shall have a minimum reading rate of 4 samples per minute.

59 2) Measurement Accuracy: Temperature must be measured no more than 50 mm in front of
60 (upwind of) the main airflow inlet of the UUT and reported by the sensor with an overall
61 accuracy of ± 0.5 °C or better.

62 5 TEST CONDUCT

63 5.1 Guidance for Implementation of SNIA Emerald™ Power Efficiency Measurement 64 Specification Version 2.0.0, Rev 1

65 A) Online 2 Data Center Storage products must include a RAID capable controller during all testing.

66 B) Storage products shipped with COMs must disable all COMs that are capable of being disabled
67 during the following tests:
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69 1) SUT Pre-fill Test (6.1)

70 2) SUT Conditioning Test (6.2)

71 3) Active State Test (6.3)

72 4) Ready State Idle Test (6.4)

73 5) Following the completion of the Ready Idle State Test, COMs shipped with the storage
74 product shall be enabled and COM Validation Testing (6.4) shall be performed for all COMs
75 present in the product.

76 C) Network Attached Storage products that ship with Block I/O capability shall be tested under the
77 following additional requirements:

78 1) All usable Storage Devices shall be allocated to Block I/O for all testing with the exception of:

79 i. Storage Devices needed to enable a minimal NAS capability in the system;

80 ii. Limitations imposed by the system for maximum allowable Block I/O capacity.

81 D) NAS functionality shall be enabled during all testing.

82 E) No external NAS storage requests shall be presented to a system during testing. (NAS
83 functionality shall be in a Ready-Idle state).

84 **6 TEST PROCEDURES FOR ALL PRODUCTS**

85 **6.1 SUT Pre-fill Test**

86 The SUT pre-fill test shall be performed according to the SNIA Emerald™ Power Efficiency Measurement
87 Specification Version 2.0.0, Rev 1: Section 7.4.1: Online SUT Pre-fill Test.

88 **6.2 SUT Conditioning Test**

89 The SUT conditioning shall be performed according to the SNIA Emerald™ Power Efficiency
90 Measurement Specification Version 2.0.0, Rev 1: *Section 7.4.2: Online SUT Conditioning Test.*

91 **6.3 Active State Test**

92 The Active state performance shall be measured according to the SNIA Emerald™ Power Efficiency
93 Measurement Specification Version 2.0.0, Rev 1: *Section 7.4.3: Online Active Test;* with the additional
94 guidance in Section 5 of this document.

95 **6.4 Ready Idle State Test**

96 The Ready Idle state performance shall be measured according to the SNIA Emerald™ Power Efficiency
97 Measurement Specification Version 2.0.0, Rev 1: *Section 7.4.4: Online Ready Idle Test;* with the additional
98 guidance in Section 5 of this document.

99 **6.5 COM Validation Test**

100 The validation of COM functionality shall be recorded according to the SNIA Emerald™ Power Efficiency
101 Measurement Specification Version 2.0.0, Rev 1: *Section 7.4.5: Online Capacity Optimization Test;* with
102 the additional guidance in Section 5 of this document.

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104 A) Verification testing of COM features specified by the storage product shall be executed at least
105 once using storage devices of the vender's choice. Once verified there is no requirement to re-
106 execute the verification testing procedure with different storage devices.