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National Standard of the People's Republic of China

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Minimum allowable values of energy efficiency and evaluating values of energy conservation for single voltage external **AC-DC and AC-AC** power supplies

(Draft for approval)

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Foreword

Articles 3.1 and 3.3 of this standard are mandatory and the others are voluntary.

Annex A of this standard is normative.

Annex B of this standard is for information.

This standard has been established and drawn up by the National Development and Reform Commission and Standardisation Administration of the People's Republic of China.

This standard is proposed by the China National Standardisation Technical Committee for Energy Basis and Management.

This standard is under the jurisdiction of the China National Standardisation Technical Committee for Energy Basis and Management.

The main bodies responsible for drafting this standard are the China National Institute of Standardisation, the China Standard Certification Centre, China CEPREI (Headquarters) Lab, Delta Electronics (Shanghai) Co. Ltd., Shenzhen Huntkey Industrial Co. Ltd., Dell Computer (China) Co. Ltd., China Electronics Standardisation Institute and Tsinghua Tongfang Co. Ltd.

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Minimum allowable values of energy efficiency and evaluating values of energy conservation for single voltage external AC-DC and AC-AC power supplies

1 Scope

1.1 This standard specifies the minimum allowable energy efficiency values for external power supplies (hereinafter referred to as “power supplies”), the evaluation of values of energy conservation, the minimum allowable values of target energy efficiency, the test method and inspection gauge, which converts the voltage of the AC network into fixed single low-voltage DC (no more than 36V) or the output voltage of low-voltage AC (no more than 36V).

This standard is applicable to power supplies with rated output power of no more than 250W.

1.2 This standard is not applicable to DC-DC converters.

2 Terms and definitions

This standard utilises the following terms and definitions.

2.1

Single voltage external AC-DC power supply

1) Converts the voltage of the AC network into DC low voltage; 2) only provides one fixed DC output voltage for use each time; 3) matches the power utilisation load; 4) may separate from the power utilisation load; 5) end products are connected via wires, cables or other permanent connecting lines; 6) not equipped with a battery.

2.2

Single voltage external AC-AC power supply

1) Converts the voltage of the AC network into AC low voltage; 2) only provides one fixed AC output voltage for use each time; 3) matches the power utilisation load; 4) may separate from the power utilisation load; 5) end products are connected via wires, cables or other permanent connecting lines; 6) not equipped with a battery.

2.3

Active mode

The input terminal of the power supply is connected to the electricity network while the output terminal is connected to the load. The output current is between zero and rated current.

2.4

No load

The input terminal of the power supply is connected to the electricity network while the output terminal is not connected to the load or the load does not consume power.

2.5

Active mode efficiency

When the power supply reaches stable active mode, the actual output power and actual input power are proportionate to each other.

2.6

Average efficiency

The average value of active mode efficiency when the power supply encounters four kinds of current intensity as 100%, 75%, 50% and 25% of the rated output current in active mode.

2.7

Minimum allowable values of energy efficiency for external power supplies

Under standard test conditions, the unit of allowable minimum average efficiency of power supplies and maximum active power under no load and active power is W.

2.8

Evaluating values of energy conservation for external power supplies

Under standard test conditions, the power supply for energy conservation should reach maximum active power under minimum average efficiency and no load. The unit of active power is W.

3 Technical specifications

3.1 Minimum allowable values of energy efficiency

3.1.1 Minimum allowable values of energy efficiency at average efficiency

The minimum allowable values of energy efficiency when the power supply is operating at average efficiency should not be less than the requirements in table 1.

Table 1 Minimum allowable values of energy efficiency at average efficiency

Nominal value of output power (Po) W	Minimum average efficiency (shown as decimal fraction)
0 <Po <1	0.39 × Po
1≤Po<49	0.107 × ln Po + 0.39
49≤Po≤250	0.82
Note: Minimum average efficiency when the calculation uses the numerical value of Po.	

3.1.2 Minimum allowable values of energy efficiency under no load

The minimum allowable values of energy efficiency of power supplies under no load should be no more than the requirements in table 2.

Table 2 Minimum allowable values of energy efficiency under no load

Nominal value of output power (Po) W	Maximum active power under no load W
0 <Po≤10	0.75
10<Po≤250	1.0

3.2 Evaluating values of energy conservation

3.2.1 Evaluating values of energy conservation at average efficiency

The values of energy conservation when the power supply is operating at average efficiency should not be evaluated less than the requirements in table 3.

Table 3 Evaluating values of energy conservation at average efficiency

Nominal value of output power (Po) W	Minimum average efficiency (shown as a decimal fraction)
0 <Po<1	0.49 × Po
1≤Po<49	0.09 × ln Po + 0.49
49≤Po≤250	0.84
Note: Minimum average efficiency when the calculation uses the numerical value of Po.	

3.2.2 Evaluating values of energy conservation under no load

The values of energy conservation of the power supply under no load should not be evaluated at more than the requirements in table 4.

Evaluating values of energy conservation under no load

Nominal value of output power (Po) W	Maximum active power under no load W
0 <Po≤10	0.5
10 <Po≤250	0.75

3.3 Minimum allowable values of target energy efficiency

3.3.1 Minimum allowable values of target energy efficiency at average efficiency

Two years after the implementation date of this standard, the minimum allowable value of energy efficiency when the power supply is operating at average efficiency should not be less than the requirements in table 3.

3.3.2 Minimum allowable values of target energy efficiency under no load

Two years after the implementation date of this standard, the minimum allowable value of the energy efficiency of the power supply under no load should not be more than the requirements in table 4.

4 Test methods

Tests on average efficiency and active power under no load must be carried out in accordance with the test methods in annex A.

5 Inspection gauge

5.1 Delivery inspection

5.1.1 The minimum allowable values of energy efficiency should be one of the items inspected on delivery of the power supply. A sampling plan shall be set up by the quality inspection department of the manufacturing enterprise itself.

5.1.2 Products whose minimum allowable values of energy efficiency fail to meet the inspection requirements shall not be allowed to leave the factory.

5.2 Type checking

5.2.1 When one of the following conditions applies to the power supply products, type checking of the minimum allowable values must be carried out:

a) Trial of a new product;

b) When changes in the design, technology or materials of the product obviously affect its performance;

c) When the department of quality and technical supervision introduces new checking requirements.

5.2.2 When sampling for type checking, three samples should be taken from each batch; if they all meet the requirements of this standard then the batch is considered to meet the standard. If the minimum allowable values of one product do not meet this standard, another six samples must be taken from this group of products for rechecking; if they all meet this standard, the batch is considered to meet this standard, but if one of the six retesting samples does not meet this standard, the batch is identified as below standard.

Annex A

(Normative annex)

Test method for the average efficiency of power supplies and active power under no load

A.1 Basic requirements for testing

A.1.1 Testing environment

The temperature of the testing environment should be kept within （23±5）□. The speed of the air flow in the vicinity of the sample in testing must not exceed 0.5 m/s. An external fan, air-conditioning or a radiator must not be utilised to lower the temperature of the sample for testing. In the test, the sample must be placed on non-heat conducting materials.

A.1.2 Testing voltage and frequency

The testing voltage and frequency should be selected according to the products in question. Products with a wide-ranging nominal voltage and frequency shall be tested using two models with an alternating voltage of 115V and frequency of 60Hz, and 230V and 50Hz respectively. Products with a single type of power supply shall be tested under an alternating voltage of 220V and frequency of 50Hz. Single output products capable of adjusting their output voltage shall be tested by selecting their highest and lowest output voltage.

The test utilises AC stabilised-voltage power for supplies with fluctuating voltage and frequency all no more than ±1% and power supplies that can provide maximum power of no less than 10 times the test power. The total harmonic distortion of the regulated power supply including 13 harmonic waves should not exceed 2%. The peak value of the tested voltage should be between 1.34 and 1.49 times its practical effective value.

A.1.3 Testing equipment and measurement requirements

Measurement should use a voltmeter, current meter and power meter (or power analyzer) through calibration. The level of precision of active power measuring of the power meter should be equal to or higher than 0.01W.

Deviations of 0.5W or above active power measuring should not exceed 2%. Deviations below 0.5W should not be more than 0.01W. Measurement deviations in voltage and current measuring must not be greater than 2%.

The test loop in measurement should be as short as possible to avoid measurement errors caused by the testing line.

A.1.4 Testing load

A variable resistor or electronic load must be equipped to ensure that the test is carried out within the output power of each power supply.

A.2 Test method

A.2.1 Preparation before testing

Before testing, samples for testing should be in operation for 30 minutes for preheating according to their nominal power. Every power supply for testing may only be preheated for 30 minutes once.

All built-in switches that control the flow direction of AC input current in the power supply for testing should be open when measurement takes place. These built-in switches should all be marked in the final test report.

A.2.2 Active mode efficiency

Adjusting the load to make the output current equal X% of the rated current and reach a stable state, respectively achieving input active power (PIx) at the AC input terminal and output

power (Pox) of AC or DC at the output terminal under this stable state, you can calculate active mode efficiency ηx in this operating state according to formula (A.1).

$$\eta x = \frac{Pox}{PIx} \qquad \text{……(A.1)}$$

When measuring, it is necessary to measure output power and AC input power when output current is respectively 100%, 75%, 50% and 25% (deviation of ±1%) of rated output current and calculate the arithmetical average efficiency.

Note 1: In measurement, defining a rated output of X% equal to rated output current of X% without considering the possible voltage fluctuation on measured supply power may lead to a difference between the rated current output of X% and rated output power of X%.

Note 2: It is not necessary to carry out precision measurement on the resistance value of resistant loads. Variable resistance is only used to adjust the ammeter indication up to a percentage of rated output current, without considering changes in output voltage. For the electronic load, it is necessary to adjust output current to steady current mode rather than adjusting the necessary output power to fixed power mode.

A.2.3 Testing load change

When measuring, adjusting the test load makes the output current of the product change according to the order of 100%, 75%, 50%, 25% and 0 of the rated value.

A.2.4 Active power under no load

Set the power supply for testing under no load, measuring and keeping a record of the active power of AC input in this state.

A.3 Assessing the test result

If the technical indicators of samples measured according to the above test methods are all in accordance with the specification required by this standard, they are considered to meet the requirements of this standard.

Annex B

(Annex for information)

Expression of internationally recognised signs on external power supplies

B.1 Nature of signs

Internationally recognised signs on external power supplies (hereinafter referred to as “signs”) do not act as a kind of label containing consumer information but show the achievable performance of the energy resource when tests are carried out on the power supply according to special methods.

B.2 Composition of signs

Signs are composed of Roman numerals and printed on the nameplate of the power supply or carved on the power supply, as shown in figure B. 1. The assessment levels are I for the lowest energy efficiency and VI for the highest. At present, only grades from I to V are in production and grade VI and higher shall be produced according to need in the future. The “EFFICIENCY LEVEL” item shown in figure B.1 may be ignored.

图 B.1 标志图示

Figure B.1 Marking pattern

B.3 Technical specifications

B.3.1 Roman numerals

The technical specifications of every representative Roman numeral are all composed of two requirements for no load power and average efficiency, see table B.1.

Figure B.1 Technical specifications of signs

Roman numerals	Technical specifications			
	Output power on nameplate (P0) W	No load power W	Output power on nameplate (P0) W	Average efficiency
I	Does not meet any standard			
II	0 <Po ≤10	≤0.75	0 <Po <1	≥0.39 ×P0
	10 <Po ≤250	≤1.0	1≤Po <49	≥0.107×InP0 + 0.39
			49≤Po ≤250	≥0.82
III	0 <Po ≤10	≤ 0.5	0 <Po <1	≥0.49 ×P0
	10 <Po ≤250	≤ 0.75	1≤Po <49	≥ 0.09×InP0+0.49
			49≤Po ≤250	≥ 0.84
IV	0 <Po ≤10	≤ 0.5	0 <Po <1	≥ 0.5 ×P0
	10 <Po ≤250	≤ 0.5	1≤Po <51	≥ 0.09×InP0+0.5
			51≤Po ≤250	≥ 0.85
V	The energy star technical index at stage 2 is not determined, left for future use.			
VI and above	For future use.			

B.3.2 Dates of entry into force of signs

For the dates of entry into force for all countries implementing signs see table B.2.

Table 2 Dates of entry into force for all countries implementing signs

Roman numerals	Specification	Date of entry into force
I	Used under condition of not meeting any standard	Immediately
II	Minimum allowable values of energy efficiency at stage 1, compulsory in China.	Implementation date of this

Roman numerals	Specification	Date of entry into force
	Signs are implemented voluntarily.	standard
III	Technical specifications for the American voluntary energy star sign at stage 1. Signs have been implemented compulsorily.	1 January 2005
	Certificate technology requirement for bidding certificate centre, voluntary evaluation of the values of energy conservation at stage 1 in China. Signs have been implemented compulsorily.	1 January 2005
	Minimum allowable values of energy efficiency compulsory at stage 1 in California, the U.S. Signs are implemented at the same time.	1 July 2006
	Minimum allowable values of energy efficiency compulsory at stage 1 in Australia. Signs shall be implemented compulsorily after April 2008.	1 October 2007
	Minimum allowable values of energy efficiency at stage 2, compulsory in China. Signs are implemented voluntarily.	To be implemented 2 years after the implementation of the Standard
IV	Above IV in Australia as voluntary technical specifications. It may be implemented compulsorily after October 2010. Signs are implemented compulsorily.	1 October 2007
	Minimum allowable values of energy efficiency compulsively at stage 2 in California, the U.S. Signs are implemented compulsorily.	1 January 2008
V	Technical specifications for American voluntary energy star sign at stage 2 (undetermined). Signs are implemented compulsorily.	1 July 2006
	Certificate technology requirements for the bidding certificate centre, voluntary evaluating values of energy conservation in China at stage 2 (undetermined). Signs are implemented compulsorily.	
VI and higher grades	Left as grades for future formulating	Undetermined

B.4 Suggestions on sign implementing

B.4.1 When the power supply is tested according to the test methods in annex A and meets the

corresponding grade in table B.1, the corresponding numbers must be printed or carved on the nameplate of the power supply.

B.4.2 Signs should be clear and durable.

B.4.3 The features of the signs should meet the following specifications:

a) Format: Roman numerals: I, II, III, IV, V or VI.

b) Character style: it is better to use Times Roman (or another plain serif character style)

c) Character size: clear and not easy to erase

d) Contrast: the colour of the letters must contrast with the colour of the background of the nameplate. The laser painting and imprinting method may be used for the signs. Please refer to the proportions in figures B.2 and B.3.

e) Location: on the nameplate of the power supply; exact positions to be decided by the manufacturer.

Figure B.2 Typical drawing of laser-printed signs

B.3 Joint institution of imprinted signs

B.5 Agreement on signs

http://www.energystar.gov/index.cfm?c=prod_development.power_supplies 。

The latest version relating to the *International Agreement regarding External Power Supplies* can be downloaded from the Energy Star website:

http://www.energystar.gov/index.cfm?c=prod_development.power_supplies.