



## International Efficiency Marking Protocol for External Power Supplies

This fact sheet describes the international efficiency marking protocol and its implementation under the ENERGY STAR Version 2.0 External Power Supply specification. Sources for additional information are provided on page 3. This version, updated as of October 2008, replaces an earlier document released in 2005.

### What is the international efficiency marking protocol?

The international efficiency marking protocol provides a system for power supply manufacturers to designate the minimum efficiency performance of an external power supply, so that finished product manufacturers and government representatives can easily determine a unit's efficiency. This mark does not serve as a consumer information label, but rather demonstrates the performance of the external power supply when tested to the internationally supported test method (this test method titled "Test Method for Calculating the Energy Efficiency of Single-Voltage External Ac-Dc and Ac-Ac Power Supplies (August 11, 2004)" can be found at [www.energystar.gov/powersupplies](http://www.energystar.gov/powersupplies)).

### What does the international efficiency mark look like?

The international efficiency mark consists of a Roman numeral (I – VI) that corresponds to specific minimum Active and No-Load efficiency levels (as well as a power factor requirement for level V) and is printed/applied by the manufacturer on the external power supply nameplate (or an equally visible location).

- Format: Roman numeral: I, II, III, IV, V, or VI.
- Font: Times Roman preferred (or other plain serif fonts).
- Size: Legible and indelible.
- Color: Text to contrast with the nameplate background, unless incorporated in the case molding.
- Placement: Preferably on the power supply nameplate; however, exact location is at the discretion of the manufacturer. The text "Efficiency Level" shown below is optional. An example is provided below.



### How is the international efficiency marking protocol being implemented?

The nameplate (or an equally visible location) of single voltage external ac-dc and ac-ac power supplies must be clearly and permanently marked with a Roman numeral from the sequence I (least efficient) to VI (most efficient) that corresponds to specific minimum Active and No-Load efficiency levels (as well as a power factor requirement for level V). The performance requirements for each Roman numeral are shown in the table below.

To determine the appropriate Roman numeral, manufacturers: 1) compare the unit's Active, No-Load, and power factor test data (when tested in accordance with the ENERGY STAR Test Method and at each relevant test voltage and frequency value) with the performance requirements at each level of the Roman

numeral scale; and 2) choose the highest Roman numeral where the power supply meets the Active, No-Load, and power factor (where applicable) requirements.

Mark	Performance Requirements				
	Nameplate Power Output ( $P_{no}$ ) <sup>1</sup>	No- Load Power <sup>2</sup>	Nameplate Power Output ( $P_{no}$ )	Average Active Efficiency <sup>3</sup>	Power Factor
<b>I</b>	Used if none of the other criteria are met.				
<b>II</b>	0 to ≤ 10 watts	≤ 0.75	0 to < 1 watt	≥ 0.39 x $P_{no}$	Not applicable
	> 10 to 250 watts	≤ 1.0	1 to < 49 watts	≥ 0.107 x $\ln(P_{no}) + 0.39$	
			> 49 watts	≥ 0.82	
<b>III</b>	0 to < 10 watts	≤ 0.5	0 to 1 watt	≥ 0.49 x $P_{no}$	Not applicable
	10 to 250 watts	≤ 0.75	> 1 to 49 watts	≥ 0.09 x $\ln(P_{no}) + 0.49$	
			> 49 to 250 watts	≥ 0.84	
<b>IV</b>	0 to 250 watts	≤ 0.5	0 to < 1 watt	≥ 0.5 x $P_{no}$	Not applicable
			1 to 51 watts	≥ 0.09 x $\ln(P_{no}) + 0.5$	
			> 51 to 250 watts	≥ 0.85	
<b>V</b>	0 to < 50 watts	≤ 0.5 for ac-ac; ≤ 0.3 for ac-dc	0 to ≤ 1 watt	Standard: ≥ 0.480 * $P_{no} + 0.140$ Low Voltage <sup>4</sup> : ≥ 0.497 * $P_{no} + 0.067$	Power supplies with greater than or equal to 100 watts <b>input</b> power must have a true power factor of 0.9 or greater at 100% of rated load when tested at 115 volts @ 60Hz.
	≥ 50 to ≤ 250 watts	≤ 0.5	> 1 to ≤ 49 watts	Standard: ≥ [0.0626 * $\ln(P_{no})$ ] + 0.622 Low Voltage: ≥ [0.0750 * $\ln(P_{no})$ ] + 0.561	
			> 49 to 250 watts	Standard: ≥ 0.870 Low Voltage: ≥ 0.860	
<b>VI and higher</b>	Reserved for future use.				

### What is the relationship between the international efficiency marking protocol and ENERGY STAR?

The ENERGY STAR program for External Power Supplies requires that manufacturers mark their power supplies using the international efficiency marking protocol. Any external power supply meeting the performance requirements for level V and above would qualify as ENERGY STAR (Version 2.0). Power supplies with performance levels of I - IV would not qualify under the Version 2.0 ENERGY STAR specification, which takes effect on November 1, 2008.

The new federal US standard for external power supplies (effective July 1, 2008) is identical to level IV above. This standard only requires compliance at 115 V/60 Hz.

<sup>1</sup>  $P_{no}$  is the Nameplate Output Power of the unit under test.

<sup>2</sup> In Australia and New Zealand, AC-AC external power supplies are not required to meet the no load power requirements.






<sup>3</sup>  $\ln$  refers to the natural logarithm.

<sup>4</sup> A low voltage model is an EPS with a nameplate output voltage of less than 6 volts and a nameplate output current greater than or equal to 550 milliamps.

**What if my power supply meets different efficiency levels when tested at different voltage/frequency combinations?**

To qualify as ENERGY STAR, manufacturers are required to mark the nameplate (or an equally visible location) with the highest Roman numeral that the external power supply meets for Active and No-Load requirements at both voltage/frequency combinations (115 V/60 Hz and 230 V/50 Hz). EPA also has a power factor requirement under its Version 2.0 specification that only applies to power supplies with greater than or equal to 100 watts input power and when tested at 115 V/60 Hz.

Some organizations such as Australia's Department of the Environment, Heritage and Arts (DEWHA), as well as the US Energy Independence and Security Act of 2007, have adopted a modified approach to this protocol, allowing manufacturers to mark an EPS capable of operating at multiple voltages/frequencies as meeting the requirements in only one voltage/frequency combination. This modified approach is not acceptable for marking a power supply for ENERGY STAR qualification, given the requirement to test and qualify power supplies capable of operating at multiple voltages/frequencies at both 115 V/ 60Hz and 230 V/50 Hz. For illustrative purposes, the table below provides some sample marks and an explanation of each.

Sample Marks	Explanation
	Mark indicating a power supply meets the level V requirements at both 115 V/60 Hz and 230 V/50 Hz, if designed to operate at multiple input voltages. Products with a nameplate marked for only one voltage and frequency should also use this mark assuming the product meets the performance requirements; in other words, manufacturers do not have to indicate the voltage with the mark.
	Mark indicating a power supply meets the level V performance requirements only at 115 V/60 Hz (for power supplies also able to operate at 230 V/50 Hz). This mark shows compliance with the US mandatory standard, but not with the ENERGY STAR Version 2.0 specification.
	Mark indicating a power supply meets the level IV performance requirements only at 115 V/60 Hz (for power supplies also able to operate at 230 V/50 Hz). This mark shows compliance with the US mandatory standard.
	Mark indicating a power supply meets the level IV requirements at only 230 V/50 Hz (for power supplies also able to operate at 115 V/60 Hz). This would be relevant for the Australian and New Zealand markets as their MEPS and High Efficiency performance requirements and mandatory marking only require testing and compliance at 230 V ac.
	Dual marking for a power supply that meets different performance levels at different input voltages.

**For More Information**

- On ENERGY STAR: Visit the ENERGY STAR Web site at [www.energystar.gov/powersupplies](http://www.energystar.gov/powersupplies) or contact Andrew Fanara, US EPA, at [Fanara.andrew@epa.gov](mailto:Fanara.andrew@epa.gov).
- On US energy conservation standards: Visit the US Department of Energy (DOE) Web site at [http://www.eere.energy.gov/buildings/appliance\\_standards/residential/battery\\_external.html](http://www.eere.energy.gov/buildings/appliance_standards/residential/battery_external.html) or contact Victor Petrolati, US DOE, at [Victor.Petrolati@ee.doe.gov](mailto:Victor.Petrolati@ee.doe.gov).