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International Efficiency Marking Protocol for External Power Supplies Version 3.0, September 2013

This fact sheet describes the international efficiency marking protocol for external power supplies (EPSs) developed by the U.S. Environmental Protection Agency and now maintained by the U.S. Department of Energy (DOE). Sources for additional information are listed at the end of this document. This version, updated as of September 2013, replaces an earlier document released in October 2008.

What is the international efficiency marking protocol?

The international efficiency marking protocol provides a system for EPS manufacturers to designate the minimum efficiency performance of an EPS, 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 EPS when tested to the internationally supported test methods. (See **For More Information** on page 3 for references to these test procedures.)

What does the international efficiency mark look like?

The international efficiency mark consists of a Roman numeral 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 EPS nameplate, product packaging, or accompanying documentation.

- Format: Roman numeral: I, II, III, IV, V, VI, etc.
 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 EPS nameplate; however, placement on the product packaging or accompanying documentation is also acceptable. The exact location is at the discretion of the manufacturer. The text "Efficiency Level" shown in the example below is optional.



How is the international efficiency marking protocol being implemented?

The nameplate, product packaging, or accompanying documentation of ac-dc and ac-ac EPSs must be marked with a Roman numeral 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 appropriate single-voltage or multiple-voltage test method¹) 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.

¹ Note that some jurisdictions have additional sampling requirements that must be met when testing products.

Mark	<u>Performance Requirements</u>				
	Nameplate Output Power (P_{no}) ²	No-Load Mode Power ³	Nameplate Output Power (P_{no})	Average Efficiency in Active Mode ⁴	Power Factor
I	Used if none of the other criteria are met.				
II	0 to ≤ 10 W	≤ 0.75	0 to < 1 W	≥ 0.39 * P_{no}	Not Applicable
	> 10 to 250 W	≤ 1.0	1 to < 49 W > 49 W	≥ 0.107 * $\ln(P_{no}) + 0.39$ ≥ 0.82	
III	0 to < 10 W	≤ 0.5	0 to 1 W	≥ 0.49 * P_{no}	Not Applicable
	10 to 250 W	≤ 0.75	> 1 to 49 W > 49 to 250 W	≥ 0.09 * $\ln(P_{no}) + 0.49$ ≥ 0.84	
IV	0 to 250 W	≤ 0.5	0 to < 1 W	≥ 0.5 * P_{no}	Not Applicable
			1 to 51 W > 51 to 250 W	≥ 0.09 * $\ln(P_{no}) + 0.5$ ≥ 0.85	
V	0 to < 50 W	AC-DC: ≤ 0.3 AC-AC: ≤ 0.5	0 to ≤ 1 W > 1 to ≤ 49 W	Basic Voltage: ≥ 0.480 * $P_{no} + 0.140$ Low Voltage ⁵ : ≥ 0.497 * $P_{no} + 0.067$ Basic Voltage: ≥ 0.0626 * $\ln(P_{no}) + 0.622$ Low Voltage: ≥ 0.0750 * $\ln(P_{no}) + 0.561$	EPSs with ≥ 100 watts input power must have a true power factor ≥ 0.9 at 100% of rated load when tested at 115 volts/60Hz.
	≥ 50 to ≤ 250 W	≤ 0.5	> 49 to 250 W	Basic Voltage: ≥ 0.870 Low Voltage: ≥ 0.860	
VI	Single-Voltage				
	0 to ≤ 49 W	AC-DC: ≤ 0.100 AC-AC: ≤ 0.210	0 to ≤ 1 W	Basic Voltage: ≥ 0.5 * $P_{no} + 0.16$ Low Voltage: ≥ 0.517 * $P_{no} + 0.087$	Not Applicable
			> 1 to ≤ 49 W	Basic Voltage: ≥ 0.071 * $\ln(P_{no}) - 0.0014 * P_{no} + 0.67$ Low Voltage: ≥ 0.0834 * $\ln(P_{no}) - 0.0014 * P_{no} + 0.609$	
	> 49 to ≤ 250 W	≤ 0.210	> 49 to ≤ 250 W	Basic Voltage: ≥ 0.880 Low Voltage: ≥ 0.870	
	> 250 W	≤ 0.500	> 250 W	≥ 0.875	
	Multiple-Voltage				
Any	≤ 0.300	0 to ≤ 1 W	≥ 0.497 * $P_{no} + 0.067$		
		> 1 to ≤ 49 W	≥ 0.075 * $\ln(P_{no}) + 0.561$		
		> 49 W	≥ 0.860		
VII	Reserved for future use.				

² P_{no} is the Nameplate Output Power of the unit under test.

³ In Australia and New Zealand, AC-AC external power supplies are not required to meet the no-load mode power requirements.

⁴ "ln" refers to the natural logarithm.

⁵ A low-voltage model is an EPS with nameplate output voltage of less than 6 volts and nameplate output current greater than or equal to 550 milliamperes. A basic-voltage model is an EPS that is not a low-voltage model.

What if my EPS meets different efficiency levels when tested at different voltage/frequency combinations?

Some organizations allow manufacturers to mark an EPS capable of operating at multiple voltages/frequencies as meeting the performance requirements in only one voltage/frequency combination. For illustrative purposes, the table below provides some sample marks and an explanation of each.

Sample Mark	Explanation
	Mark indicating EPS 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 EPS meets the level IV performance requirements only at 115 V/60 Hz (for EPSs also able to operate at 230 V/50 Hz).
	Mark indicating EPS meets the level IV requirements at only 230 V/50 Hz (for EPSs also able to operate at 115 V/60 Hz).
	Dual marking for EPS that meets different performance levels at different input voltages.

For More Information

- Test methods for single-voltage and multiple-voltage EPSs: Title 10 of the U.S. Code of Federal Regulations, Appendix Z to Subpart B of Part 430. Available from the U.S. Government Printing Office at www.ecfr.gov.
- U.S. energy conservation standards for External Power Supplies: Visit the DOE website at http://www1.eere.energy.gov/buildings/appliance_standards/index.html or e-mail the U.S. DOE at battery_chargers_and_external_power_supplies@ee.doe.gov.
- ENERGY STAR: Visit the ENERGY STAR website at www.energystar.gov/powersupplies