External Power Supply Efficiency Regulation Introduction

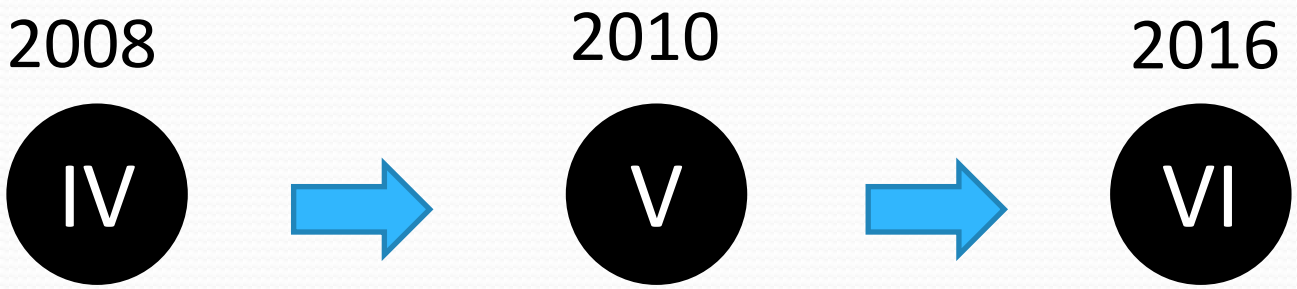
Efficiency Protocol

What is International Efficiency Marking Protocol?

→ It is a system for manufacturers to designate the efficiency performance of External Power Supply.

→ Identified using Roman Numeral: I, II, III, IV, V, VI

USA



2006/7/1
Energy Star
Voluntary

2008/7/1
CEC
Mandatory

2008/11/1
Energy Star
Voluntary

2010/12/31
Energy Star sunset
the programs for EPS

2014/6/10
Department of Energy (DoE) require manufacturer to meet VI two years after the final rule's date of publication in the Federal Register (2014/2/10)

How to define Efficiency Level

Efficiency Level

- **No Load Power Consumption**
- **Average Efficiency at 25%, 50%, 75%, 100%**

Limit of No Load at IV / V / VI

Level IV

Output Power on Label	No load power consumption
0 to < 10 Watts	0.3 Watts
≥ 10 to ≤ 250 Watts	0.5 Watts

Level V

Output Power on Label	No load power consumption
0 to < 50 Watts	0.3 Watts
≥ 50 to ≤ 250 Watts	0.5 Watts

Level VI

Output Power on Label	No load power consumption
0 to < 49 Watts	0.1 Watts
≥ 49 to ≤ 250 Watts	0.21 Watts
> 250 Watts	0.5 Watts

Average Efficiency in IV / V / VI

Minimum Average Efficiency in Active Mode

Basic Voltage

	IV	V	VI
1 to ≤ 49W	≥ [0.09 * Ln (Pno)] + 0.49	≥ [0.0626 * Ln (Pno)] + 0.622	≥ 0.071 x In(P out)- 0.0014 x Pout +0.67
> 49W to ≤ 250W	≥ 0.84	≥ 0.87	≥ 0.88
> 250W			≥ 0.875

(Average of the four values tested at 25%, 50%, 75%, 100% Load)

Average Efficiency in IV / V / VI

Minimum Average Efficiency in Active Mode

Low Voltage

	IV	V	VI
1 to ≤ 49W	Same as basic voltage	≥ [0.0750 * Ln (Pno)] + 0.561	≥ 0.0834 x In(P out)-0.0014 x Pout +0.609
> 49W to ≤ 250W	Same as basic voltage	≥ 0.86	≥ 0.87
> 250W			≥ 0.875

(Average of the four values tested at 25%, 50%, 75%, 100% Load)

(Low voltage means output voltage less than 6V and output current greater than or equal to 550mA)

EUROPE

2010/4/27
European Concil
ErP Stage 1
Mandatory

2011/4/27
European Concil
ErP Stage 2
Mandatory

Code of Conduct
(Voluntary)
Release a new
requirement of efficiency
regulation

Effective dates:

- Tier 1: 1 January 2014
- Tier 2: 1 January 2016

CE = LVD + EMC + ErP + RoHS

USA vs. Europe

No Load Power Consumption

	USA Level VI	Europe (CoC Tier 2)
1 to ≤ 49W	0.1 Watt	0.075 Watt
>49 to ≤ 250W	0.21 Watt	0.15 Watt

Average Efficiency

	USA Level VI	Europe (CoC Tier 2)	
	Average Efficiency	**Averange Efficiency**	**10% Load**
1 to ≤ 49W	≥ 0.071 x ln(P out)-0.0014 x Pout +0.67	≥ 0.071 x ln(P out)-0.00115 x Pout +0.67	≥ 0.071 x ln(P out)-0.0014 x Pout +0.57
> 49W to ≤ 250W	≥ 0.88	≥ 0.89	≥ 0.79
> 250W	≥ 0.875	N/A	NA

Product Road Map

Series	Progress
5W	Plan to use Sanken IC. IC in testing, no date determined
12W	Expected ready by end of July 2015
18W	Expected ready by end of August 2015
24W	Expected ready by end of August 2015
36W	Expected ready by end of June 2015
50W	Released
65W	Released
90W	Released
120W	Released
160W/200W	No IC available for LLC structure that can meet DoE Level VI and CoC tier 2. NXP expected to release in near future

Chronology Efficiency Standards

In the early 1990s, it was estimated that there were more than 1 billion external power supplies active in the United States alone. The efficiency of these power supplies, mainly utilizing linear technology, could be as low as 50% and still draw power when the application was turned off or not even connected to the power supply (referred to as “no-load” condition).

Experts calculated that without efforts to increase efficiencies and reduce “no-load” power consumption, external power supplies would account for around 30% of total energy consumption in less than 20 years. As early as 1992, the U.S. Environmental Protection Agency started a voluntary program to promote energy efficiency and reduce pollution that eventually became the Energy Star program. However, the first mandatory regulation dictating efficiency and no-load power draw minimums wasn’t put in place until 2004. The following section traces the path from the CEC’s 2004 regulation up to the current standards that are in place today

April 2009

Europe enacted ErP Directive 2009/125/EC (Energy Related Products) with scheduled stages of implementation for efficiency and no-load requirements equivalent to Level IV and Level V standards. The schedule defined that the EU would harmonize with Level IV efficiency standards by April 2010 and Level V efficiency standards by April 2011.

April 2011

EISA 2007, CEC Tier 3, and ErP Phase 2 took effect in full harmony of their standards leaving us with what is now simply known as the “Level V Efficiency” standard, designated by the Roman numeral V surrounded by a circle

Today, Level V will meet or exceed the requirements of any governing body around the globe. Power supply manufacturers indicate compliance by placing a Roman numeral V on the power supply label. Level V is enforced by the agencies all over the world except by UL in USA. However California requires also Level V.

Moving Forward

In what would effectively become the “Level VI” efficiency standard, the proposal on the table would mandate no-load efficiencies down to 0.1 W for external power supplies ranging from 1 W to approximately 49 W, boost mandatory average efficiency by about 1%, and set standards for models with power ratings above 250 W for the first time.

The EPA estimates that external power supply efficiency regulations implemented over the past decade have reduced energy consumption by 32 billion kW, saving $2.5 billion annually and reducing CO2 emissions by more than 24 million tons per year. Moving beyond the mandated government regulations, many OEMs are now starting to demand “greener” power supplies as a way to differentiate their end products, driving efficiencies continually higher and even pushing the implementation of control technologies that in some cases eliminate no-load power consumption altogether.

On 3 February 2014, the US Department of Energy (DOE) issued a pre-publication Federal Register final rule against the Notice of Proposed Rulemaking published in 2012. The new rule applies to all direct and indirect operation external power supplies (EPS), which are categorised into eight product classes. It not only increases the minimum energy efficiency requirement of EPS from level IV to level VI, but also extends their scope to encompass lower voltage AC- or DC-output EPS, multiple-voltage EPS and EPS with nameplate output power exceeding 250 watts. **The compliance date for the new requirements is 10 February 2016, which is two years after the rule's publication in the Federal Register.**

For More Information

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