

A GUIDE TO EFFICIENCY STANDARDS FOR EXTERNAL POWER SUPPLIES



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EFFICIENCY STANDARDS FOR EXTERNAL POWER SUPPLIES

Keeping up-to-date with ever changing legislative approval standards can be a daunting task but, doing so is an essential part of your products success.

With standards varying around the world, you could find yourself conforming to many different standards depending on where you plan on distributing your product. The recent introduction of Level VI efficiency is a prime example of how new legalisation can affect the current market and in turn your production or distribution efforts.

In today's world, safety and our impact on the planet is of paramount concern, meaning staying abreast of regulation changes and movements has never been so important.

This short paper is designed to provide an up-to-date overview of the latest industry efficiency standards.

DIFFERENT CLASSES OF EFFICIENCY

ErP (Energy Related Products) Stage I - The no-load condition (when a power supply is connected to the mains power source, but the output is not connected to a device) needed for an External Power Supply (EPS) to meet the above standard is shown in the table below together with the average efficiency figures.

ErP I

NO-LOAD POWER CONSUMPTION		AVERAGE EFFICIENCY	
Output Power	Max. Standby	Output Power	Min. Efficiency Rate
0~250W:	≤0.5W	≤1W:	≥ Power x 0.50
		1~51W:	≥[0.09 x Ln(Power)] + 0.5
		51~250W:	≥85%

ErP Stage II came into effect 2 years after this regulation came into effect on 6th April 2009-, it was further defined and split into three categories; AC-AC, AC-DC and Low Voltage. The table below signifies the requirements of ErP Stage II.

ErP II

NO-LOAD POWER CONSUMPTION		AVERAGE EFFICIENCY	
AC-AC			
Output Power	Max. Standby	Output Power	Min. Efficiency Rate
≤51.0 W:	≤0.5W	≤1.0 W:	0.480 x Power + 0.140
>51.0 W:		>1.0~≤51.0 W:	[0.063 x Ln(Power)] + 0.622
		>51.0 W:	≥87%
AC-DC			
Power	Watts Used	Power	Efficiency Rate
≤51.0 W:	≤0.3W	≤1.0 W:	0.480 x Power + 0.140
>51.0 W:	≤0.5W	>1.0~≤51.0 W:	[0.063 x Ln(Power)] + 0.622
		>51.0 W:	≥87%
Low Voltage <6Vout ≥550mA			
Output Power	Max. Standby	Output Power	Min. Efficiency Rate
≤51.0 W:	≤0.3W	≤1.0 W:	0.497 x Power + 0.067
>51.0 W:	N/A	>1.0~≤51.0 W:	[0.075 x Ln(Power)] + 0.561
		>51.0 W:	≥86%

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DoE LEVEL VI (applicable to the US market) came into force on 10th February 2016 for External Power Supply (EPS) categories. It introduced a more comprehensive approach adding multiple-voltage and higher powered (>250W), to the existing AC-DC, AC-AC, basic and low voltage products, a breakdown of which is shown on the table below.



NO-LOAD POWER CONSUMPTION		AVERAGE EFFICIENCY	
Single Voltage External AC-DC Power Supply, Basic-Voltage			
Output Power	Max.	Output Power	Min. Efficiency Rate
≤1.0 W:		≤1.0 W:	$\geq 0.5 \times \text{Power} + 0.16$
>1.0~≤49.00 W:	≤0.100 W	>1.0~≤49.00 W:	$\geq 0.0071 \times \ln(\text{Power}) - 0.0014 \times \text{Power} + 0.67$
>49.0~≤250.0 W:	≤0.210 W	>49.0~≤250.0 W:	≥88%
>250.0 W:	≤0.500 W	>250.0 W:	≥87.5%
Single-Voltage AC-DC Power Supply, Low-Voltage			
Output Power	Max.	Output Power	Min. Efficiency Rate
≤1.0 W:		≤1.0 W:	$\geq 0.517 \times \text{Power} + 0.087$
>1.0~≤49.00 W:	≤0.100 W	>1.0~≤49.00 W:	$\geq 0.0834 \times \ln(\text{Power}) - 0.0014 \times \text{Power} + 0.609$
>49.0~≤250.0 W:	≤0.210 W	>49.0~≤250.0 W:	≥87%
>250.0 W:	≤0.500 W	>250.0 W:	≥87.5%
Single-Voltage External AC-AC Power Supply, Basic-Voltage			
Output Power	Max.	Output Power	Min. Efficiency Rate
≤1.0 W:		≤1.0 W:	$\geq 0.5 \times \text{Power} + 0.16$
>1.0~≤49.00 W:	≤0.100 W	>1.0~≤49.00 W:	$\geq 0.0071 \times \ln(\text{Power}) - 0.0014 \times \text{Power} + 0.67$
>49.0~≤250.0 W:	≤0.210 W	>49.0~≤250.0 W:	≥88%
>250.0 W:	≤0.500 W	>250.0 W:	≥87.5%
Single-Voltage External AC-AC Power Supply, Basic-Voltage			
Output Power	Max.	Output Power	Min. Efficiency rate
≤1.0 W:		≤1.0 W:	$\geq 0.517 \times \text{Power} + 0.087$
>1.0~≤49.00 W:	≤0.100 W	>1.0~≤49.00 W:	$\geq 0.0834 \times \ln(\text{Power}) - 0.0014 \times \text{Power} + 0.609$
>49.0~≤250.0 W:	≤0.210 W	>49.0~≤250.0 W:	≥87%
>250.0 W:	≤0.500 W	>250.0 W:	≥87.5%
Multiple-Voltage External Power Supply			
Output Power	Max.	Output Power	Min. Efficiency Rate
≤1.0 W:		≤1.0 W:	$\geq 0.497 \times \text{Power} + 0.067$
>1.0~≤49.00 W:	≤0.300 W	>1.0~≤49.00 W:	$\geq 0.0075 \times \ln(\text{Power}) + 0.561$
>49.0 W:		>49.0 W:	≥86%

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TODAYS REGULATORY ENVIRONMENT

The United States

Today the most recent energy efficiency standard is Level VI, adopted in the US by the Department of Energy (DoE) in February 2016. By doing so, the DoE identified efficiency standards for certain types of EPS's (including multiple voltages and high-power EPS's) which had never been required to meet efficiency standards in the past. This resulted in two new definitions; direct operation and indirect operation EPS units. *



The Level VI table clearly demonstrates how efficiency performance standards have developed, becoming more intricate and stringent to create a positive impact on power consumption and its environmental effects.

The United Kingdom & Europe

Meanwhile, the UK and EU must conform to the Energy-related Products (ErP) Regulations Stage II, this came into effect in April 2011 and is equivalent to a "Level V" global efficiency standard. This is based on the EU EcoDesign Directive in a pursuit to ensure that energy-related products are continuously meeting performance and efficiency standards from the point of manufacture, improving the environmental performance of electronic products.

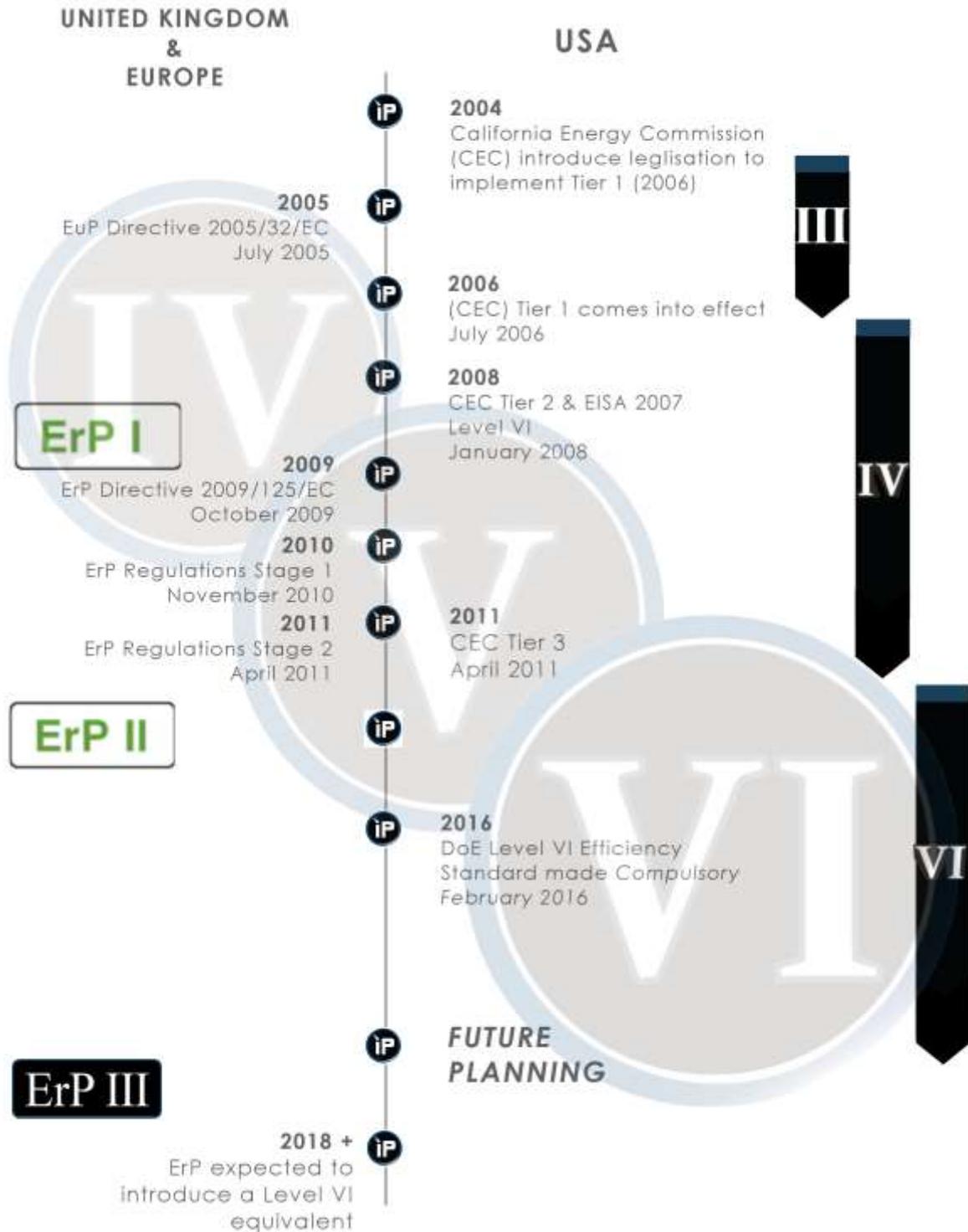


Although Level VI is only compulsory in the US, it is common for manufacturers and suppliers to modify their products to conform to the highest global standards. Thus, ensuring products are universally compliant, enabling organisations to distribute their products globally.

'ErP Stage III' or a similar directive is expected to change the dynamics of energy efficiency standards in forthcoming years.

*A "direct operation EPS" is an EPS that can operate a consumer product that is not a battery charger without the assistance of a battery, whereas an "indirect operation eps" is an EPS that cannot operate a consumer product (other than a battery charger) without the assistance of a battery. **DoE regulations at 10 CFR 430.2**

Legislation



The above diagram demonstrates the advancements in efficiency standards since 2004.

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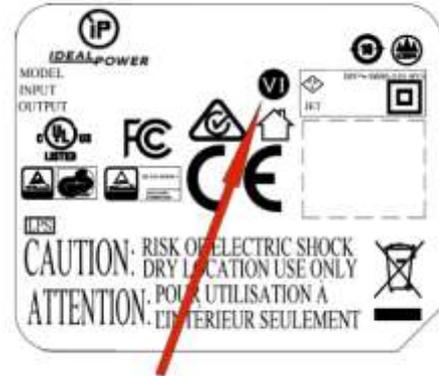
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IDENTIFYING CONFORMANT PRODUCTS

DoE LEVEL VI

Compliant units meeting Level VI can be identified by a roman numeral, which will be located on the label, a tradition specified by International Efficiency Marking Protocol, Version 3.0. This protocol was updated September 2013 and allowed flexibility of the position of the marking on the label.



ErP STAGE II

Any units meeting ErP Stage II will have either the global 'Level V' icon positioned on the label or will meet Level VI which exceeds the requirements of ErP II.

EXEMPTIONS

Although the latest mandate within a certain country may state conformity, exemptions are made under the following circumstances:

ErP STAGE II	DoE LEVEL VI
battery chargers	indirect operation power supplies
external power supplies for medical devices	power supplies used with a medical device listed with the Food and Drug Administration
voltage converters	service and spare parts (distributed up to February 2020)
uninterruptible power supplies	
halogen lighting converters	

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VOLUNTARY STANDARDS

Voluntary CoC (Code of Conduct) has been established through a working group of independent experts and despite the introduction of Tier 1 in January 2014, it is yet to be introduced as mandatory regulation.

The current CoC is Tier 2, which came into effect as a voluntary standard in January 2016 with the purpose of harmonising with DoE Level VI. However, despite many industry leaders expecting the voluntary tiers to become compulsory in the coming years, it is hard to pinpoint exactly when that might be with some speculating new regulations will be introduced via a new EU EcoDesign Directive instead.

CoC differs from Level VI, as it does not define a low-load efficiency level, nor does it distinguish between Direct and Indirect Operations. CoC Tier 1 does include the low-load measurement of 10%; however, its no-load and active mode measurements are of lower values than DoE Level VI. Tier 2 defines more stringent requirements on no-load and active mode, covering both standard and low voltage power supplies.

FUTURE PLANNING

It is predicted that within the next year or so, the UK and EU governing body will enforce Level VI equivalent as a mandatory protocol; whether through compulsory CoC enforcement or an ErP directive. However, this has not yet been announced.

It is important to ensure that from the date of manufacture or import into a country, external power supplies meet the current regulatory enforcements.



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SUMMARY

The Global regulatory environment is continuously pushing for more stringent laws on efficiency levels and power consumption. This movement is significantly reducing energy consumption and CO2 emissions, encouraging manufacturers to produce less power-hungry devices, leading to innovation in the development of highly efficient power supplies.

IDEAL POWER LTD

Ideal Power is a UK company striving to implement worldwide efficiency standards by applying innovative energy-saving technologies into their power supplies in order to harmonise with the global market and stay on top of the ever-evolving regulatory environment. The company is now able to offer a vast product portfolio of Level VI external power supplies.



Contact Ideal Power today to find out more, or why not try our [efficiency calculator](#) tool online today?

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