

External Power Supply Efficiency Standards

Note: As the last EU implementation date has slipped, this is the current situation as of August 24, 2018. A draft EU amendment dated 2018 indicates that the legislation may mirror more closely the DoE Level VI limits effective April, 2020.

External power supplies (EPS) are widely used in households around the world to charge phones or operate tablets, laptops, game consoles and a variety of consumer electronic and electrical items.

Studies on European energy use of these power supplies indicate that reducing off-load power consumption and improving product efficiency will save nearly 10TWh of power a year. A Terawatt hour (TWh) is 1,000,000,000,000 Watts used in an hour. Reducing energy usage saves money, reduces the requirement to add new power generating capacity and reduces environmental pollution.

Two parameters were originally specified to regulate waste energy reduction, which when multiplied by a billion products becomes very significant:

Maximum off-load power consumption

Many power supplies are left plugged in to the AC supply and fully operational; even when the device it was charging has been removed. Although the power supply is not powering anything, it still consumes power. The maximum off load power consumption varies with the output power of the EPS and is stated in the specification.

Minimum average efficiency level

With loads less than the full rating of the EPS, the efficiency of the power supply can decrease significantly. Low load conditions occur as a battery becomes partially charged, or when a device goes into an inactive (sleep) mode. External power supplies rarely remain in a 75 to 100% load condition.

First legislation was announced in 2004, starting with the California Energy Commission's (CEC) intent to restrict the sale of non-efficient external power supplies. The USA, EU, China and a host of other countries and regions followed over the next ten years with increasingly tighter legislation.

In 2014, the EU issued a voluntary Code of Conduct (CoC) version 4, running in parallel with the mandatory Ecodesign Directive 278/2009. Also in 2014, the Department of Energy (DoE) published their Energy Efficiency Level VI standard.

In February 2016, the Level VI standard became law in the US. The EU issued the more stringent version 5 CoC Tier 2 voluntary standard that was supposed to go into effect January 2018. That has been delayed and mandatory implementation was expected early in 2018.

Table 1 shows some of the differences for a single output, basic voltage power supply between these two newest standards. Efficiency limits have been given for a power supply rated between 49 to 250W. Please consult the relevant US and EU websites for the full regulations.

Region	United States of America	European Union (EU)
Standard	DoE Level VI	CoC Tier 2 v5
Average load efficiency	49-250W: $\geq 88\%$	49-250W: $\geq 89\%$
Efficiency at 10% load	N/A	49-250W: $\geq 79\%$
Off-load power consumption	1-49W $\leq 0.1W$ 50-250W $\leq 0.21W$ >250W $\leq 0.5W$	1-49W $\leq 0.075W$ 50-250W $\leq 0.15W$ >250W N/A
Implementation date	February 2016	2018 (TBD)

Table 1: A comparison between the latest US and EU regulations

Average efficiency measurements are required at four load conditions; 25, 50, 75 and 100%. These are added together and divided by four to produce an average efficiency figure.

Note, the EU has added a minimum efficiency level at 10% load.

The USA now includes power supplies that are rated at greater than 250W.

The term external power supply is defined by the US Department of Energy as one that is used to convert household electric current into DC current or lower-voltage AC current to operate a consumer product. Currently the US also grants exemptions for supplies powering FDA approved medical devices.

Modifying a power supply to meet a decrease in off-load power consumption is not a simple component change. The control IC often has to be changed to one that draws less power and energy saving techniques like pulse skipping implemented. Changes to primary side circuitry requires resubmitting the products to have the safety certifications updated. Both the redesign and submittal process are expensive and older products are often obsoleted as a result of this. As the energy standards are directed at the ultra-high volume, short production life consumer EPSs, this gives some relief to the industrial market which prefers long production lifecycles.

TDK-Lambda has a number of external power supplies in the [DT series](#) that meet all the latest requirements, with ratings up to 300W.