Why efficiency standards are important, even for industrial external power supplies

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. More often than not, many are left plugged in to the AC supply and remain fully operational; even when the device it was charging has been removed. Although the power supply is not powering anything, it still consumes power.

This white paper is intended for electronics engineers and designers specifying external power supplies for instrumentation and industrial devices. Despite the fact that these efficiency standards do not apply in the industrial setting, it is worthwhile noting the energy saving benefits compliant supplies could provide to the end customer – hence differentiating equipment from competitors.

References

www.uk.tdk-lambda.com/dt

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Rob Hutton, New Product Introduction Manager at TDK-Lambda UK

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Two parameters were originally specified to regulate waste energy reduction, the maximum off-load power consumption and the minimum average efficiency level, which when multiplied by a billion products becomes very significant. Recent studies on European EPS energy use indicate that the resulting savings will amount to 9TWh of power each year.

A Terawatt hour (TWh) is 1,000,000,000,000 Watts used in an hour - an annual savings of 9TWh is enough to power the whole of Estonia for more than three months and will reduce annual carbon emissions by more than three million tonnes, resulting in cost savings of EUR 1 billion.

Stricter legislation

First legislation began to be 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.

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 is expected shortly.

How the standards compare

The below table shows some of the differences between the newest EU and US standards for a single output, basic voltage power supply. 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 specifications.

Region	USA	European Union (EU)
Standard	**DoE Level VI**	**CoC Tier 2 v5**
Average load efficiency	49-250W: ≥ 88%	49-250W: ≥ 88%
Efficiency at 10% load	N/A	49-250W: ≥ 79%
Off-load power consumption	1-49W ≤0.1W 50-250W ≤0.21W >250W ≤0.5W	1-49W ≤0.075W 50-250W ≤0.15W >250W N/A
Implementation date	February 2016	2018 (TBD)

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

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.

Efficiency measurements are therefore 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, and the USA now includes power supplies that are rated at greater than 250W.

The maximum off-load power consumption varies with the output power of the EPS and is stated in the specification.

Little potential for modification

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 switched 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.

Voluntary conformance

EU CofC Tier 2 and US Efficiency Level VI legislation is only applicable to external power supplies for consumer products. As TDK-Lambda targets the industrial market, rather than the suppliers of mobile phones, tablets and laptops, it is exempt from this legislation. However, to ensure our customers benefit from reduced off-load power consumption and improved product efficiency, TDK-Lambda has a number of external power supplies in the DT series that meet all the latest requirements, with ratings up to 300W.

For more information about the TDK-Lambda DT series of external power supplies, please visit:
www.uk.tdk-lambda.com/dt

You may also contact the author with any questions or comments at:
powersolutions@uk.tdk-lambda.com

TDK-Lambda UK Ltd
Kingsley Avenue
Ilfracombe
Devon EX34 8ES UK
+44 (0)1271 856600
powersolutions@uk.tdk-lambda.com
www.uk.tdk-lambda.com

Ref: 07/18 8714