

TP-1 Whitepaper

Summary:

Traditionally designed transformers are most efficient when fully loaded. A study of installed transformers showed that a typical transformer is only loaded to 35% of maximum. The Energy Act of 2005 mandates the use of transformers designed to be more efficient at 35% loading as defined by the NEMA TP-1 standard.

Definitions:

TP-1 – Defines the NEMA standard defining the energy efficiency performance of transformers.

TP-2 – Defines the test procedures for meeting the requirements of TP-1

TP-3 – Defines the labeling of transformers tested to the efficiency levels specified in TP-1.

Energy Star[®] -- Is a US government-backed program helping businesses and individuals protect the environment through superior energy efficiency.

History:

In 1992 the US Environmental Protection Agency (EPA) introduced ENERGY STAR as a voluntary labeling program designed to identify and promote energy-efficient products to reduce greenhouse gas emissions. Computers and monitors were the first labeled products. Through 1995, EPA expanded the label to additional office equipment products and residential heating and cooling equipment. In 1996, EPA partnered with the US Department of Energy for particular product categories. The ENERGY STAR label is now on major appliances, office equipment, lighting, home electronics, and more. EPA has also extended the label to cover new homes and commercial and industrial buildings.

Over the past decade, ENERGY STAR has been a driving force behind the more widespread use of such technological innovations as LED traffic lights, efficient fluorescent lighting, power management systems for office equipment, and low standby energy use.

With the passing of the Energy Act of 1992, H.R. 776, the Department of Energy (DOE) first set guidelines for using more efficient electrical devices to reduce energy consumption.

The National Electrical Manufacturers Association (NEMA) developed a comprehensive standard for higher efficiency transformers NEMA Standard TP-1-1996.

Test procedures for the TP-1 specification were defined in NEMA TP-2-1998 and the TP-3 standard defines the labeling of distribution transformers.

Individual states including Massachusetts, Minnesota, California, New York, Oregon, and Maryland started recommending or requiring the use of TP-1 transformers over the past few years.



The Energy Policy Act of 2005 signed on August 8, 2005 requires that all “Distribution Transformer” and all “low-voltage, dry-type distribution transformer” manufacturers to produce only TP-1 units as of January 1, 2007.

Distribution transformers are defined as follows;

- Having an input voltage of 34.5 kilovolts or less
- Having an output voltage of 600 volts or less
- Are rated for operation at a frequency of 60 Hertz

Low-voltage dry-type distribution transformers are defined as follows;

- Having an input voltage of 600 volts or less
- Are air-cooled
- Do not use oil as a coolant.

These transformers must meet the Class I Efficiency levels of TP-1-2002. With a 35% load and a temperature of 75 degrees Centigrade

Class I Efficiency levels

Single Phase	
KVA	Efficiency Level (%)
15	97.7
25	98.0
37.5	98.2
50	98.3
75	98.5
100	98.6
167	98.7
250	98.8
333	98.9

Three Phase	
KVA	Efficiency Level (%)
15	97.0
30	97.5
45	97.7
75	98.0
112.5	98.2
150	98.3
225	98.5
300	98.6
500	98.7
750	98.8
1000	98.9

Transformers that do not meet the TP-1 standard cannot be manufactured for sale after January 1, 2007. Transformers manufactured before January 1, 2007 can still be sold until the stock is depleted. The manufacturing date of a transformer can be found on the nameplate of each unit.

Jefferson Electric has been an Energy Star partner since March 2002, our PowerSaver line of transformers includes both single phase and three phase units that meet all TP-1 requirements and are available now.

Payback calculations ...

The Energy Star website (<http://www.energystar.gov>) some great information about selecting energy efficient products.

The section on transformers includes a Transformer Efficiency Calculator (http://www.energystar.gov/index.cfm?c=ci_transformers.pr_ci_transformers) which can help compare different types of transformers. The calculator will graph the efficiency of each transformer and will show the payback time based on purchase price and cost of electricity.

Based on an electricity cost of \$0.974 per kW/H (US average as of November 2005) the payback time for choosing a 75KVA TP-1 transformer over a standard 75KVA transformer is 1.12 years. The payback for replacing an existing 75KVA transformer is approximately five years.