

ENERGY EFFICIENT TRANSFORMERS

A GUIDE ON HOW TO COMPARE TRANSFORMERS FOR
MAXIMUM VALUE



ISO 9001:2008

Green Star
High Efficiency Transformers



Does it pay back to buy a more efficient transformer?

Existing energy efficiency legislation has defined minimum performance standards for transformers. In the past, transformers have been considered an unavoidable contributor to the total energy losses of a system, because the added material and labour costs associated with higher efficiency levels were not justifiable by savings in electricity costs. **Today, advances in transformer core materials, improved design methodologies, and enhanced manufacturing techniques have changed all that.** With the rising costs of electricity, units that achieve *higher-than-legislated* efficiency levels can certainly reduce total ownership costs by minimizing the operating costs of electrical systems.



Understanding transformer losses

Even when the load connected to a transformer is off, the power needed to keep the transformer energized consumes electricity (core losses). When the loading is increased, the resistance of the conductors in the windings begin to contribute and becomes the primary source of loss (load losses).

How does a Green Star transformer reduce losses?

Rex Transformers utilize cutting edge materials and superior construction methods to achieve ultra-high efficiency levels. Lower flux densities, advanced modeling techniques, and manufacturing control techniques allow for cooler operation. ***As a further benefit of this approach, Rex transformers gain overload capability and short circuit withstand strength.*** The following core construction methods are instrumental for achieving the sought-after performance:

Butt-Lap Cut Core: Rectangular strips of high grade grain oriented silicon steel arranged to minimize core reluctance to flux.

Mitre or Step-Lap Mitre Cut Core: Mitre cuts at corners reduces flux crowding aiding in efficiency. Step overlapping further reduces losses at transition spots.

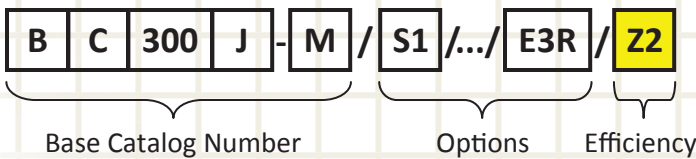
Unicore™ Distributed Gap Core: A highly specialized machine precisely bends core steel core steel to a shape that gives the flux a continuous path, maximizing the grain orientation of the steel.

Efficient encapsulated and harmonic mitigating transformers

These transformers are exempt from the existing energy efficiency legislation. ***Rex standard designs comply anyway!*** K-factor rated transformers achieve stated efficiency levels under undistorted wave shapes, and are designed to minimize losses that normally appear at higher levels of distortion.



Rex Green Star Transformers are available with a host of options. See our distribution transformer catalog for details. Three efficiency levels are available corresponding to the **Candidate Standard Levels (CSL)** set out by the U.S. Department of Energy. CSL-1 is the currently legislated standard.



Z	Complies with CSA C802.2 & NEMA TP-1 (CSL-1)
Z2	Complies with CSL-2 levels
Z3	Complies with CSL-3 levels
Z2+	Complies with NEMA Premium Efficiency level
X	Special requirement listed in order

Green Star Energy Efficient Transformer
Meets or exceeds NEMA TP-1 & CSA C802.2 (CSL-1) efficiency requirements



To meet NEMA TP-1 & CSA C802.2 transformer efficiency standards, transformer cores are made with higher grade silicon steel, constructed with special miter arrangements, and winding resistance is reduced to minimize losses. This is the currently legislated efficiency standard.

Green Star Premium Energy Efficient Transformer



Meets or exceeds CSL-2 efficiency guidelines

Green Star *Premium* transformers are one step ahead of the currently legislated NEMA TP-1 and CSA C802 levels. For many customers, these very efficient units are a smart choice which offer payback in electricity savings, while keeping one step ahead of the standard for efficiency.

Green Star Ultra Premium Energy Efficient Transformer



Meets or exceeds CSL-3 efficiency guidelines

Green Star *Ultra-Premium* transformers are the cutting edge in design and materials, which result in extremely low core and load losses.

How quickly will an ultra high efficiency unit pay for itself? How much more should you be willing to pay for such a unit? The transformer's payback is simply a function of loading on the transformer, and cost of the electricity. Increasing either will result in sooner payback. A study on Rex 3-phase copper distribution transformers across a broad range of kVAs revealed the following*:

	CSL - 2 vs. CSL - 1	CSL - 3 vs. CSL - 1
35% loading	1.97 years	3.40 years
70% loading	1.48 years	1.38 years

*Using a sample of 45, 225, and 500 kVA transformers, assumed electrical cost of \$0.10 / kWh

In nearly all cases, a CSL-2 design will pay for the difference in price in less than 2 years! Depending on loading or increased electrical cost, payback on CSL-3 transformers is also within 2 years.

Download our free efficiency comparator tool. The Rex Power Magnetics website features a free efficiency calculation tool that helps analyze the economic payback for your specific application, taking into account the cost of electricity and the percentage-loading. Also, it can help you fine tune the core (no-load) and load-losses you may want to specify to our engineering department. Enter competitors' loss and cost data to compare to Rex designs! Use the tool to arrive at your ideal tradeoff for efficiency. Available at: www.rexpowermagnetics.com



View or download all of our product catalogs and brochures from our website:
www.rexpowermagnetics.com

Contains up to date information on:

- Drawings and engineering specifications
- Selection and efficiency calculation tools
- Ordering information
- Warranty and terms & conditions

Contact and Sales info:

Tel 905.695.8844 or Fax 905.695.8855
 TOLL FREE USA/CANADA 1-800-387-2840
 E-mail: sales@rexpowermagnetics.com
 65 Basaltic Road, Concord, ON, L4K 1G4



OUR FULL PRODUCT RANGE:

- **Power Transformers (Up to 15 MVA — 35 000 V)**
 Cast Coil, VPE and VPI Construction
 Substation Type complete with primary disconnects
 Traction Power, Rectifier, Crane Duty, Special Regulation,
 Service Station Distribution
- **Specialty Type and Special Voltage Transformers**
 K-Rated, Electrostatically Shielded
 Ultra Isolating Multiple Shielded
 Harmonic Mitigating
 Electromagnetic Field Shielded
 Epoxy Potted, Hazardous Location
 Marine Duty Types (with applicable certificates)
 Mini Power Centres
 High Efficiency and Ultra High Efficiency
 On Line Tap Switching and Auto Voltage Regulating Units
 Hazardous-Location Transformers (Class 1, Div 2)
- **Control & Machine Tool Transformers (50 VA to 7500 VA)**
 Enclosed, Open Style, or Potted
 DIN Rail Mountable Units

- **General Purpose Transformers**
 Distribution/Isolation, CE Marked Transformers
 Autotransformers
 Drive Isolation
 Motor Starting
- **Reactors**
 Input and Output Reactors
 Motor Guarding Transient Filters
 DC Chokes, Saturable-Core Reactors
 Inter-Bridge Reactors
 High Voltage Iron Core or Air Core Reactors
- **Enclosures**
 NEMA -1, -2, -3R, -4, -4x, -12
 Stainless Steel and Special Paint
 Custom Switchgear and Specialty Industrial Enclosures
- **Switchgear Components**
 Low and High voltage Standoffs and Insulators
 Surge (lightning) Arresters
- **Transformer Testing, Refurbishment, and Repair**
 Replacement of windings, core, insulation, etc.



Our 145,000 sq. ft. design, manufacturing, and customer service facility in Concord, north of Toronto, Ontario

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