



High Efficiency Motors

High efficiency motors offer a number of potential benefits over standard models. These include lower utility bills and reduced operating expenses through lower failure rates and longer service life.

What is a High Efficiency Motor?

Motor efficiency is the ratio of mechanical power output to the electrical power input. This is usually expressed as a percentage. Energy-efficient motors use less energy to perform the same amount of work as standard motors. Key design improvements and more accurate manufacturing tolerances are largely responsible for the increase in performance of energy efficient motors. Key design factors include:

- lengthening of the core and using lower-electrical-loss steel,
- thinner stator laminations and more copper in the windings to reduce electrical losses.
- Improved bearings and smaller, more aerodynamic cooling fans can also increase efficiency.
- High efficiency motors are generally 2 percent to 8 percent more efficient than standard motors.

Benefits of High Efficiency Motors

Motors systems consume approximately half of the energy used in the commercial and industrial sectors. Improving the efficiency of motors, and the systems they drive, can save substantial amounts of energy and reduce operating costs. High efficiency motors do cost more, but many models can offer a return on investment within two years. The cost of operating a motor in the first year is often several times the purchase price. Reducing operating costs through the purchase of higher efficiency motors can offer a substantial payback. In addition to energy savings, the better designs and improved construction of high efficiency motors can lead to other benefits:

- Longer insulation and bearing lives
- Lower heat output and less vibration
- Extended winding life
- Increased tolerance of overload conditions
- Higher tolerance for increased voltage rates or phase imbalance
- Lower failure rates and extended manufacturer warranties

When to Buy an Energy Efficient Motor

You should consider buying a high efficiency motor:

- For all new installations
- When purchasing equipment packages, such as compressors, HVAC systems and pumps
- When major modifications are made to facilities or processes
- Instead of rewinding older, standard efficiency units that have failed
- When replacing oversized or underloaded motor systems
- As part of a preventive maintenance or energy conservation program

What About Rewinding a Failed Motor?

Motors that have failed can usually be restored. Many companies choose this as a less expensive option than replacement. There are situations when rewinding is appropriate. Most motors that are half load (4000 hours) or less can be rewound if the iron core specifications are still



acceptable. Motors that are 50 HP or more should be rewound a maximum of three times. Still, replacement with an energy efficient model is the most cost-effective strategy in the long run. No motor should ever be rewound if the stator core is defective. In addition, no motor should be rewound if the cost of the repair exceeds 60 percent of the cost of a new energy efficient motor.

Rules of Thumb for Purchasing Energy Efficient Motors

- Purchase high efficiency motors for all new installations.
- Replace all failed standard efficiency motors that operate at 4000 hours per year or more.
- Specify energy efficient motors when purchasing equipment packages.
- Replacement of working motors is not normally justified (unless replacing oversized motors or making major modifications).
- Use energy efficient motors as part of any preventive maintenance program.
- Check with your local utility for any rebate or discount program that they may offer.
- Never rewind motors if the cost exceeds 60 percent of the purchase price of a new energy efficient model.

Beginning a Motor Efficiency Improvement Program

Start by performing a survey of your motor system. Gather information from nameplates and obtain operating measurements. These include; voltage, amperage, power factor and operating speed. Focus initially on motors that are oversized or have exceeded operating lifetime specifications.

Conduct a motor replacement analysis and categorize your motor systems into the following groups:

- *Immediate Replacement* - Typically these motors are full-load (8000 hours per year), are currently inefficient or are not reliable due to age or ill repair. Replacing these motors can offer immediate payback through energy savings or increased reliability and productivity. Order an energy efficient replacement model and install at the next convenient opportunity, such as a scheduled downtime.
- *Replace at Time of Failure* - These motors are currently in good working order and are operating at 4000 hours per year or more. Replacing these motors would offer an extended payback, but do not justify the cost of immediate replacement. Begin inquiring into cost effective replacements for these models and keep the information on hand for future needs.
- *Do Not Replace* - Motors that are reasonably efficient and operate at an average of less than 4000 hours per year. These motors can be rewound and replaced with a high efficiency model when repair is no longer a viable option.