Suggested Actions

- Survey all critical motors in your plant. Focus on general purpose, 25 to 500 hp standard efficiency motors used more than 2,000 hours per year. Collect nameplate and application data and then measure the supply voltage and amperage for these in-service motors.
- Establish a motor repair/replace policy to achieve cost-effective and energy efficiency results, and tag motors for appropriate action. For example, replace immediately or upon failure with a NEMA Premium or Energy Efficient motor; rewind at failure with repair specifications and recommended guidelines.
- Adopt model motor repair specifications for low-voltage motors.

Resources

National Electrical Manufacturers Association (NEMA)—For additional information on the NEMA Premium standards, visit www.nema.org.

Electrical Apparatus Service Association (EASA)—Provides guidelines on motor repair/rewind practices (www.easa.org).

Motor Decisions Matter—Download a motor management planning kit (www.motorsmatter.org) that contains advice on building your in-plant motor inventory, decision rules, critical planning tips, and motor replacement.

U.S. Department of Energy—DOE's *MotorMaster+* and *MotorMaster+ International* software tools help you make motor comparisons and selection on a broad range of motors. Also, refer to *Model Repair Specifications for Low Voltage Induction Motors* for routine repair and rewind information.

Visit the BestPractices Web site at www.eere.energy.gov/industry/bestpractices to access these and many other industrial energy efficiency resources and training.

When to Purchase NEMA Premium™ Efficiency Motors

NEMA Premium™ efficiency motors should be considered for new motor procurements and when specifying motor-driven equipment. NEMA Premium motors should also be considered when repairing or rewinding failed standard-efficiency motors or as replacements for older, operable lower-efficiency motors—particularly when the existing motor has been rewound or is oversized and underloaded.

In August of 2001, the National Electrical Manufacturers Association (NEMA) implemented a new NEMA Premium Energy Efficiency Motor Standard. Under this voluntary program, a motor may be marketed as a NEMA Premium motor if it meets or exceeds a set of NEMA minimum full-load efficiency levels. These levels are higher than the minimum full-load efficiency standards for energy-efficient motors under the Energy Policy Act of 1992 (EPAct).

NEMA Premium motor standards apply to NEMA Design A and B, three-phase low- and medium-voltage induction motors rated from 1-500 horsepower (hp) and designed for service at 5,000 volts or less. Motors with speeds of 1200, 1800, and 3600 revolutions per minute (rpm) with open drip-proof (ODP), explosion-proof, and totally enclosed fan-cooled (TEFC) enclosures are included.

NEMA Premium motors are particularly cost-effective when annual operation exceeds 2,000 hours, where utility rates are high, when motor repair costs are a significant fraction of the price of a replacement motor, or where electric utility motor rebates or other conservation incentives are available.

NEMA Premium motors typically cost 10% to 15% more than their energy-efficient counterparts. Annual energy savings are dependent upon operating profile, duty cycle, and efficiency gain. Examples of annual savings due to using NEMA Premium motors instead of motors that just meet the EPAct energy-efficient motor standard are given in Table 1.

Table 1. Annual Savings from Specifying NEMA Premium Motors

Horsepower	Full-load Motor Efficiency (%)		Annual Savings from Use of a NEMA Premium Motor	
	Energy Efficient Motor	NEMA Premium Efficiency Motor	Annual Energy Savings, kWh	Dollar Savings $/year
10	89.5	91.7	1,200	$60
25	92.4	93.6	1,553	78
50	93.0	94.5	3,820	191
100	94.5	95.4	4,470	223
200	95.0	96.2	11,755	588

Note: Based on purchase of a 1,800 rpm totally enclosed fan-cooled motor with 8,000 hours per year of operation, 75% load, and an electrical rate of $0.05/kWh.

Example

An old, 75-hp standard efficiency boiler forced-draft fan motor is to be replaced with a NEMA Premium efficiency motor. The existing motor operates at a 75% load for 8,000 hours per year with an efficiency (η_{std}) of 91.0%. Determine the annual energy savings if the replacement motor has an efficiency (η_{PE}) of 95.4% and electricity is priced at $0.05/kWh.

Energy Savings = hp x load x 0.746 x hours x $(100/\eta_{std} - 100/\eta_{PE})$
= 75 x 0.75 x 0.746 x 8,000 x (100/91 – 100/95.4) = **17,014 kWh/year**

Energy Cost Savings = 17,014 x $0.05 = **$851/year**

Over a 10-year operating period for a 75-hp motor, the purchase price might represent just 2% of the total motor installation and operating costs. Energy and maintenance costs account for the remaining 98%. Even a small improvement in motor operating efficiency can produce significant energy and dollar savings and provide a rapid return on investment.

About DOE's Industrial Technologies Program

The Industrial Technologies Program, through partnerships with industry, government, and non-governmental organizations, develops and delivers advanced energy efficiency, renewable energy, and pollution prevention technologies for industrial applications. The Industrial Technologies Program is part of the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy.

The Industrial Technologies Program encourages industry-wide efforts to boost resource productivity through a strategy called Industries of the Future (IOF). IOF focuses on the following eight energy and resource intensive industries:

- Aluminum
- Chemicals
- Forest Products
- Glass
- Metal Casting
- Mining
- Petroleum
- Steel

The Industrial Technologies Program and its BestPractices activities offer a wide variety of resources to industrial partners that cover motor, steam, compressed air, and process heating systems. For example, BestPractices software can help you decide whether to replace or rewind motors (MotorMaster+), assess the efficiency of pumping systems (PSAT), compressed air systems (AirMaster+), steam systems (Steam Scoping Tool), or determine optimal insulation thickness for pipes and pressure vessels (3E Plus). Training is available to help you or your staff learn how to use these software programs and learn more about industrial systems. Workshops are held around the country on topics such as "Capturing the Value of Steam Efficiency," "Fundamentals and Advanced Management of Compressed Air Systems," and "Motor System Management." Available technical publications range from case studies and tip sheets to sourcebooks and market assessments. The Energy Matters newsletter, for example, provides timely articles and information on comprehensive energy systems for industry. You can access these resources and more by visiting the BestPractices Web site at **www.eere.energy.gov/ industry/bestpractices** or by contacting the EERE Information Center at **877-337-3463** or via email at **www.eere.energy.gov/informationcenter/.**

BestPractices is part of the Industrial Technologies Program Industries of the Future strategy, which helps the country's most energy-intensive industries improve their competitiveness. BestPractices brings together emerging technologies and best energy-management practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

BestPractices emphasizes plant systems, where significant efficiency improvements and savings can be achieved. Industry gains easy access to near-term and long-term solutions for improving the performance of motor, steam, compressed air, and process heating systems. In addition, the Industrial Assessment Centers provide comprehensive industrial energy evaluations to small- and medium-size manufacturers.

FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

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A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

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