



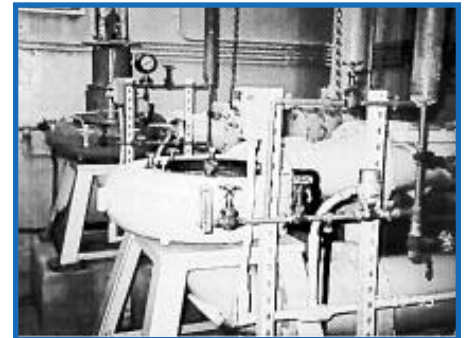
January 1997

City of Milford Develops New Approach to Pumping Process

In Milford, Connecticut, a new way of pumping raw sewage to the treatment plant is putting money in the bank. Simply by adding a smaller pump to its Welches Point pumping station, the City of Milford is capturing nearly \$3,000 in annual energy savings. Welches Point, selected as a Motor Challenge Showcase Demonstration site, handles nearly 750 million gallons of raw sewage per year for the City of Milford and consumes approximately 240,000 kilowatt hours of electrical energy annually. The knowledge and benefits achieved from this project could be duplicated not only at the City of Milford's 36 other sewage pumping stations, but at thousands of municipal pumping systems across the country.

The City of Milford selected Welches Point as a model for testing new approaches in pumping sewage because it is a typical sewage lift station. The Showcase Demonstration team, comprised of the City of Milford and ITT Flygt Corporation, added a smaller pump to the station to better match the inflow loads and

discharge piping requirements. Essentially, the smaller pump runs longer and at lower capacity than the larger pumps, but still handles the same volume of material. With the old pumping system, each pump rarely operated for more than 15 minutes at any given time. Today, there are times when the smaller pump runs for well over 1 or 2 hours and sometimes for as long as 6 or 7 hours. The benefit of operating at a reduced flow rate for longer periods is lower pump pressure. This translates into *(continued on page 4)*



Adding a smaller pump to the City of Milford's Welches Point pumping station is resulting in nearly \$3,000 annually in energy savings



A Motor Challenge
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Notice of Proposed Rulemaking for Electric Motors is Published

On November 27, 1996, DOE's Notice of Proposed Rulemaking on test procedures, labeling, and certification requirements for electric motors was published in the *Federal Register*. Motors impacted by the proposed rulemaking include most general-purpose, 1- through 200-horsepower, polyphase, squirrel-cage, induction motors. The notice covers issues such as testing requirements for manufacturers, use of mathematical methods to calculate energy efficiency, laboratory accreditation, recognition of certification programs, and motor nameplate information.

DOE will be accepting written statements, comments, data, and information

until February 17, 1997. Written comments should be labeled "Electric Motor Rulemaking (Docket No. EE-RM-96-400)" and submitted to:

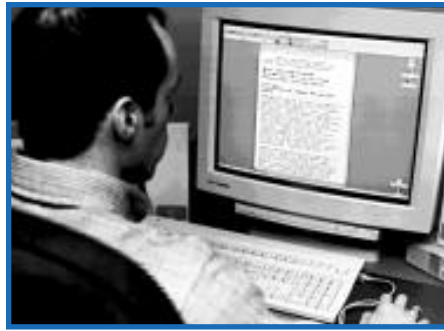
U.S. Department of Energy
Office of Codes and Standards, EE-43
1000 Independence Avenue, SW
Room 1J-018
Washington, DC 20585-0121

For further information, please contact James Raba, DOE's Office of Codes and Standards, at (202) 586-8654. A copy of the notice may be downloaded from the Motor Challenge Web site at www.motor.doe.gov.

Certification in the Electronic Classroom

Enhancing your education electronically, via the Internet, just might be the wave of the future. This past September, Motor Challenge began offering a popular 4-week course over the Internet for certification in *MotorMaster+* software. Established through an e-mail address, the course enables participants to interact with other students and instructors, and even ask questions without raising a hand.

The lecture and coursework is e-mailed to students at the beginning of each week. The students then complete the week's assignments at their convenience. Participants are amazed at the benefits of taking the course electronically. Course participant Mark Allen of Detroit Edison explains, "The method is extremely convenient and forces you to learn what's right in front of you." After completing the course, participants will be certified in the software and will be able to train other users. "The course is helping us to establish a motors database



Electronic courses offer many benefits, such as increased flexibility and convenience.

that will enable us to reduce energy consumption sitewide," said Gerald Tone of Roche Vitamins and Fine Chemicals.

The course is open to Motor Challenge Allied Partners and Partners at a first-come, first-serve basis. Registration cost is \$100. Contact the Motor Challenge Hotline at (800) 862-2086 to register.

Dates for upcoming classes:
February 10 – March 9, 1997
March 17 – April 13, 1997

Taking the Challenge Overseas

Motor Challenge is taking the challenge across its borders. In October 1996, Motor Challenge Program Manager Paul Schei-ning attended the 3-day international conference, "Energy Efficiency Improvements in Electric Motors and Drives." Sponsored by the European Commission and held in Portugal, the conference was attended by 150 representatives from about 30 countries. One of the focuses of the conference was to accelerate efforts to harmonize electric motor standards worldwide. Participants presented on a number of technical topics, which provided a valuable opportunity for attendees to learn about the efforts and challenges of different countries in promoting and implementing energy-efficient electric motor systems.

The conference was also a great opportunity to exchange information. For example, the European Commission, which is in the process of developing a motors database for Europe similar to the U.S. *MotorMaster* software database, expressed interest in sharing information with the



U.S. DOE on database development issues. In addition, the Latin American representative of the International Institute for Energy Conservation is extremely interested in working with Motor Challenge to develop an international version of *MotorMaster+* that would initially support the promotion of energy-efficient motors in Chile.

"Overall, the conference was extremely successful. Participants in the conference were really taking advantage of sharing common experiences.

Many people were very eager to learn about the variety of Motor Challenge resources and information that DOE is distributing, and many organizations will be signing up as Motor Challenge International Affiliates. We realized there are many opportunities for Motor Challenge and international organizations to learn from one another and cooperate on projects that will further improve and expand the penetration of energy-efficient electric motor systems in our individual countries, as well as worldwide," states Mr. Schei-ning.



TECH TIP

Improving Your Power Quality

Poor power quality within a facility is a common cause of energy losses. Listed below are some tips on how you can improve your power quality.

- *Maintain voltage levels—Keep voltage at the motor as close to the nameplate value as possible, with a maximum deviation of 5%. Adjusting transformer taps helps maintain voltage levels. If voltage is too low, the problem may be undersized wiring, in which case rewiring would stabilize the voltage level. If voltage varies at the service entrance, it would indicate variations in utility power supply and the utility could remedy the situation.*
- *Minimize phase unbalance—Keep voltage of each phase in a three-phase system of equal magnitude, symmetrical, and separated by 120°. Phase balance should be within 1% to avoid derating of the motor and voiding of warranties. To minimize phase unbalance, reallocate some of the single phase circuits to a different set of legs at the electrical panel. Another solution is to power down the plant and adjust the transformer taps.*
- *Maintain high power factor—Installing single capacitors or banks of capacitors at the motor or the motor control centers will maintain high power factor.*
- *Identify and eliminate distribution system losses—Regularly check for bad connections, poor grounding, and shorts to ground. Specialized firms can locate "hot spots" in your facility using infrared cameras and remedy electrical problems. Measure the harmonic distortion if motors are on the same circuit as potential harmonic sources. If significant, call the Clearinghouse for information on mitigation.*
- *Minimize distribution system resistance—During new construction or rewiring, oversize the power cables that supply motors running at full load for many hours. This will minimize line losses and voltage drops.*

For more information, contact the Motor Challenge Clearinghouse at (800) 862-2086 and ask for a copy of the fact sheet Optimizing Your Motor-Driven System.

Motor Challenge Allied Partners Getting the Message Out



The Energy Savings Network—Plug Into It

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lunge to spread the word about the benefits of energy-efficient industrial motor systems. And these Allied Partners are hitting the ground running.

Approximately 70 percent have ordered Motor Challenge training materials, publications, and software. In addition, Allied Partners have held over 20 workshops in which they displayed Motor Challenge materials or conducted training using Motor Challenge materials and software, or both. Another nine Allied Partners have signed up to take the online certification in *MotorMaster+* software. These types of activities are equipping Allied Partners with additional resources with which to support and educate their industrial customers on energy-efficient motor systems. Read on for examples of what specific Allied Partners are doing.

In December 1996, Motor Challenge Account Manager Bill Orthwein provided training on *MotorMaster+* to Darby Electric of South Carolina. Ten of Darby's sales and technical employees and two of their customers attended the training, which covered how to enter motor nameplate data and how to enter utility rate schedules. After attending the training, Darby's representatives are well equipped to apply the software in assisting their client with preventive motor maintenance efforts and train their clients.

The Energy Center of Wisconsin will begin a *MotorMaster+* training effort from

January 28 to April 23 for end users as well as member utilities throughout Wisconsin. The Energy Center has customized and distributed 350 copies of *MotorMaster* and also ordered 400 copies of the Windows-based *MotorMaster+* to distribute to participants at the upcoming training.

The Kirby Risk Electric Motor Company in Indiana recently held a motor systems workshop where they utilized Motor Challenge training modules to present the motor systems approach. They also provided fact sheets, motor selection handbooks, and other printed materials to participants. They also demonstrated and distributed copies of *MotorMaster+* software. In early 1997, Kirby plans on sponsoring several hands-on *MotorMaster+* training sessions where they will provide a customized version of *MotorMaster+*, featuring an opening screen with the Kirby Risk name, logo, and customer service contact number.

Longo Industries, a distributor, engineering, and motor rebuild-repair services firm headquartered in Morris Plains, New Jersey, has been deeply involved in energy conservation retrofits for several years, performing energy-efficient upgrades of motors from 5 horsepower to 300 horsepower (up to 1600 units), and has installed over 140 variable frequency drives. Now as a Motor Challenge Allied Partner, Longo feels that the services and products available to them from Motor Challenge will further enable them to complete even more energy-efficient upgrades and

retrofits. Having received the comprehensive set of Motor Challenge materials, Longo's field representatives are now promoting the Challenge to their customers.

Predictive Maintenance Inc., in South Carolina, hosted a training session on *MotorMaster+*, which was conducted by Account Manager Bill Orthwein and attended by 120 representatives from companies such as R. J. Reynolds, Amoco Fibers, Milliken Textile Company, Hoechst Celanese Textiles, Duke Power, and many others. Predictive Maintenance is distributing the software to its customers and plans on hosting more workshops in which they will use Motor Challenge materials.

Shoemaker Electric Company of Ohio held an open house on December 5, 1996, which was attended by more than 600 of their industrial and commercial clients. Many attendees stopped by the Motor Challenge booth to pick up materials and view the demonstration of *MotorMaster+*. A large number of organizations that saw the demonstration requested copies of the software, which were then provided by Shoemaker.

Snohomish County Public Utility District (SNOPUD) in Washington held an adjustable speed drive (ASD) seminar on December 6, 1996, attended by the Boeing Company and other industries from the utility's service territory. Special guest Roger Lawrence from the Electric Power Research Institute's ASD Demonstration Office presented on ASDs and showcased several case studies that helped clarify and explain the application of this technology. The Motor Challenge Allied Partner Account Manager Jonathan Stine met with attendees, disseminated materials, and conducted several *MotorMaster+* demonstrations.



Motor Challenge Account Manager provides training on MotorMaster+ to Allied Partners.

If your organization works with industry, you too might be interested in learning more about how Allied Partners are using Motor Challenge materials to provide increased information and support to their customers. Call the Motor Challenge Hotline at (800) 862-2086 for information on becoming an Allied Partner.

MEET THE NEW MEMBER OF THE MOTOR CHALLENGE TEAM



Chuck Procner is the newest member of the Motor Challenge Team. He will be helping Motor Challenge to further develop its Excellence Partnerships and to integrate the Excellence Partner and Allied Partner efforts. Before joining Motor Challenge, Chuck spent several years working for the General Electric Company in engineering, sales and marketing of industrial products, such as adjustable speed drives and motors. He also has held sales and marketing management positions for MAC Equipment, Arcom Control Systems, and Devine Lighting International and has operated his own Manufacturer's Representative company. Chuck is a graduate of Pennsylvania State University in Electrical Engineering and Mathematics and also has an MBA in Marketing and Organizational Behavior. Chuck is located in the Kansas City area.

Industry Partner Profile: the Compressed Air and Gas Institute

This profile is the first in a series that will highlight Motor Challenge industry partnerships. Through industry partnerships, Motor Challenge is cooperatively developing new educational products, materials, and services that focus on motor-driven equipment such as pumps, fans and blowers, and air compressors. This highly leveraged activity draws on technical strengths of trade associations representing original equipment manufacturers (OEMs), along with related service organizations. Industry partnerships seek to build and strengthen networks of relationships among OEM trade associations, industrial end users, and energy providers to create new program information and materials.

The Compressed Air and Gas Institute (CAGI), a trade association of 45 companies, manufactures compressed air system equipment. CAGI's objectives include developing and publishing standards and engineering data for air and gas compressors and related equipment, increasing the amount and improving the quality of service on air and gas compressors and related equipment, collecting and distributing valuable information to CAGI members and the general public, and engaging in cooperative educational and research activities.

CAGI works with the Motor Challenge to increase the knowledge of users, purchasers, and other interested parties concerning opportunities to maximize the efficiency of compressed air systems. CAGI formed an Energy Awareness Committee specifically to work on energy-related issues for compressed air systems and

recently became a Motor Challenge Allied Partner. The following projects are being developed to improve compressed air systems efficiency:

- Standard performance reporting forms (standard data sheets) that will allow purchasers to more easily compare products. This project will begin with air-cooled rotary screw compressors, refrigerated compressed air dryers, and regenerative desiccant compressed air dryers. Other types of compressors, dryers, and filters will also be addressed.
- A consumer fact sheet that will explain the methods of testing a compressor and the importance of the standard performance reporting forms (standard data sheets).
- A database, accessible via the Internet, that will contain information from the standard data sheets.
- An educational video or series of videos to address proper selection, installation, and maintenance of compressed air systems and components. The video will stress leak detection and repair, proper piping, and controls.
- Development of compressed air distribution guidelines.
- A future certification and training program for plant compressed air system auditors.

For more information, call Aimee McKane or Vestal Tutterow, Motor Challenge Program, Lawrence Berkeley National Laboratory, at (202) 484-0880 or send e-mail to atmckane@lbl.gov.

City of Milford's New Pumping Process

continued from page 1

energy savings in several ways. By using a smaller, more dedicated pump, less energy is consumed than by using an oversized pump. Additionally, longer operating times and reduced power inputs will increase the expected life of the operating equipment and the electrical switch gear. It is also anticipated that substantially less time will be required for maintenance due to reduced starts and stops of the equipment.

"The results have been fantastic—not only have we saved energy, we have dramatically reduced maintenance costs because the station runs much more smoothly," explains Art Berube of the City of Milford. "We are so pleased with the results, we would like to perform this pump optimization project at our other pumping stations in the city. We have also had a lot of inquiries from interested people about the project," he adds.

ITT Flygt Corporation assisted the City of Milford in this Showcase Demonstration project by providing pump hardware, collecting and assessing data, and report writing.

Widespread application of this optimization measure to sewage pumping systems would provide substantial energy cost savings. This Showcase Demonstration project shows how significant energy savings can sometimes be realized just by rethinking the operating methodology for equipment.

SHOWCASE DEMONSTRATIONS

Motor Challenge's Showcase Demonstration projects target electric motor-driven system efficiency and productivity opportunities in specific industrial applications. The teams, led by industrial end users of motor-driven systems, host and fund the design, construction, and operation of projects to improve the efficiency of electric motor systems. DOE provides technical assistance, performance validation, and communication of the results. For copies of Showcase Demonstration case studies, contact the Motor Challenge Information Clearinghouse at (800) 862-2086.



The Guest Column

The Guest Column is a new Turning Point feature that will spotlight different authors from various organizations. The articles presented provide technical news of interest to users of motor systems.

Energy Efficiency Opportunities of Plant Motor Systems

By Herman Lehman, Plant Energy Engineer, Burns Harbor Division, Bethlehem Steel Corporation

Burns Harbor is a fully integrated steel plant located in northwest Indiana, at the southern end of Lake Michigan. Approximately 6000 employees work at the plant, producing over 5 million tons of high-quality, light, flat-rolled steel product annually. Purchased energy is a major cost item for the plant, approaching \$300 million annually. Electricity is a big part of this cost with over 70% of the electrical power going to drive pumps, fans, and air compressors. Consequently, the pump and fan systems present the greatest opportunity for efficiency improvement.



Aerial view of the Burns Harbor Division, Bethlehem Steel Corporation

Although many potential opportunities exist, identifying the best candidates for improvement requires a reasonably accurate method of determining present system operating efficiency. The November 1996 issue of *Turning Point* (The Guest Column article) addresses the problem of accurately determining the efficiency of an in-service operating motor. Accurate determination of in-service motor efficiency is difficult, but essential to making the best motor repair/rewind/replace decision when that opportunity occurs. Many old inefficient motors that fail continue to be repaired or rewound that should be



This hot strip mill is the largest electrical-power consumer at Burns Harbor, with about half of the energy going to power pumps and fans.

replaced with a new energy-efficient motor. Payback periods for a new energy-efficient motor can be very short, especially when motors run most of the time and are well loaded.

Another important item required to effectively analyze the performance of an operating motor system is the load imposed on the motor (the horsepower delivered to the pump, fan, etc.). This is normally difficult to determine, but once the motor efficiency is known, then motor output horsepower is equal to $[\text{Motor Input Kilowatts} / 0.746 * \text{Motor Efficiency}]$. Motor input kilowatts is usually relatively easy to come by, either by using an ampere reading to calculate the power input, or preferably a kilowatt reading if available.

Almost all of the pumping systems at Burns Harbor are multiple pumps feeding a common header. In most cases, the only indication of pump output is pressure gauges on individual pumps and the common discharge header; there is no flow measurement. The system was designed so that one or two of the pumps on each header could be down and on standby while the remaining pumps run to adequately supply the system requirements. Over time, some operators developed the habit of running an extra pump "just in case." Of course, this action wastes energy, but there has been no easy method to determine whether or not an operator is running an extra pump. By being able to determine the horsepower delivered to the individual pumps (the load on the motor), it becomes a relatively easy matter to locate

pumping systems with underloaded motors. Underloaded motors are an indication that operators are running more pump capacity than needed. The use of this technique has resulted in operators at Burns Harbor shutting down extra pumps, which has saved considerable energy for the plant.

Sometime it is only a matter of turning off the extra pump and allowing the remaining pumps on the header to pick up the load, but it is not always that simple. For example, on a common discharge header system, a third pump may have to be run, because "we can't quite make it" with two pumps. This situation presents a tremendous opportunity to optimize the performance of this pumping system. Perhaps the pumps could be modified or even replaced with more efficient ones to increase pump output capacity. There are many possible inefficiencies and ways to correct them. Once the "candidate" has been selected, a thorough performance optimization study of the system should be conducted to determine the most economical way to proceed.

In an industrial environment such as a large steel plant, it is often difficult to locate the best candidates for performance optimization because of inadequate measurement of system parameters such as flow, equipment loading, etc. Determination of in-service motor efficiency as described above is the key that unlocks the opportunity to improve the performance and efficiency of plant pump and fans systems as well as other motor driven equipment. For more information or to comment, contact:

Herman Lehman
Bethlehem Steel Corporation
(219) 879-6145
fax (219) 879-7165
e-mail: hermfaye@netnitco.net

1997 Coming Events

February 5-6	<i>MotorMaster+</i> Training, Energy Center of Wisconsin, Milwaukee (5th) and Brookfield (6th), WI; contact Angela Prestil at (608) 238-4601 or e-mail to aprestil@ecw.org
February 11	Midwest Motor Systems Consortium Training, Madison, WI; contact Angela Prestil (608) 238-4601 or e-mail to aprestil@ecw.org
February 18-19	Carolina Plant Engineering & Maintenance Show, Greenville, SC; contact (510) 354-3131
February 24-27	Industrial Energy Efficiency Symposium & Expo, Arlington, VA, sponsored by DOE; contact Energetics Inc., by fax at (301) 621-3329 or e-mail to: oit.expo97@hq.doe.gov
February 27-28	Motor Systems Workshop, Institute of Advanced Manufacturing Sciences, Cincinnati, OH; contact Judy Gillens (513) 948-2084
March 10-13	Technical Association of the Pulp and Paper Industry's 1997 Process Control, Electrical and Information Exhibit, Birmingham, AL; contact (770) 209-7245
March 10-13	45th Annual Design Engineering Show/National Manufacturing Expo, Chicago, IL; contact (203) 840-5366
May 21-23	National Petroleum Refiners Association, New Orleans, LA; contact (202) 457-0480
June 16-20	IEEE Industry Application's Society, Pulp and Paper Committee Annual Meeting, Cincinnati, OH; contact (513) 868-5654



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INFORMATION CLEARINGHOUSE

Do you have questions about using energy-efficient electric motor systems? Call the Motor Challenge Information Clearinghouse for answers, Monday through Friday 9:00 a.m. to 8:00 p.m. (EST).

HOTLINE: (800) 862-2086

Fax: (360) 586-8303, or access our homepage at www.motor.doe.gov

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