TURNING POINT

July 1998

Bethlehem Steel Showcases Efficient Technologies

Energy Technology Showcase attendees tour Bethlehem Steel's Burns Harbor mill.

On April 30, about 300 people from industry, government, universities, and national laboratories attended a successful Energy Technology Showcase at Bethlehem Steel's Burns Harbor plant in northwest Indiana. At this event, Burns Harbor showcased an array of advanced technologies that have been developed in partnership with the steel industry and DOE's Office of Industrial Technologies (OIT). These technologies, which will help Burns Harbor improve efficiency and productivity, included:

- nickel aluminide steel rolls for use in reheating furnaces;
- blast furnace granulated coal injection;
- optimization of induced draft fans in a basic oxygen furnace (BOF); and
- Praxair oxy-fuel fired combustion system for a continuous reheat furnace.

The showcased technologies encompassed several OIT programs, including Motor Challenge. The optimization of the BOF induced draft fans was the focus of a Motor Challenge Showcase Demonstration project. (See article below.)

The Burns Harbor educational showcase featured technical presentations on many efficient technology applications. Steam utilization, motor systems management, coke oven batteries, and oscillating combustion were just a few of the topics covered in the presentations. Visitors were also given guided tours to see the featured technologies in operation at the Burns Harbor plant—the newest integrated steel mill in the country and one of the most efficient in the world.

Scott Richlen, OIT's Steel Industry Team Leader, believes the Burns Harbor event highlighted several benefits that can be achieved by industry and government partnerships. "This event raises awareness of the opportunities to save energy, reduce waste, and increase productivity," said Richlen.

Bethlehem Steel Improves System Performance and Reduces Energy Costs

To remain competitive in the global marketplace, Bethlehem Steel Corporation (BSC) was looking for opportunities to reduce energy costs while improving overall steel-making system performance at its Burns Harbor facility in northwest Indiana. By installing a variable frequency drive (VFD), and making equipment modifications to the induced draft fans that remove gases from one of the facility's three basic oxygen furnaces (BOFs), the company reduced energy consumption by 50% and saved more than $620,000 annually. With a total cost of about $1,225,000, the simple payback for this Showcase Demonstration project was about two years.

BSC is the second-largest steel producer in the United States. Its Burns Harbor facility, located on the shores of Lake Michigan, is BSC's largest and most efficient plant. Employing about 6,000 workers, Burns

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STEAM CHALLENGE

Steam Challenge Kickoff

The Steam Challenge, a voluntary partnership with DOE, the Alliance to Save Energy, and more than 50 industry leaders, was rolled out on April 30 at the Burns Harbor Showcase. The Steam Challenge will encourage energy savings and reduced costs at major industrial plants that use steam-powered systems. The program's goal is to save 20% in total efficiency by 2010—worth $3.9 billion to industry in annual energy savings.

"We invite industry to join the Steam Challenge so they too may fully realize the cost-savings opportunities offered through reviewing energy efficiency projects," said Dan Reicher, DOE's Assistant Secretary for Energy Efficiency and Renewable Energy. "The face of the future in American manufacturing is here at Bethlehem Steel, where one improvement project is saving over $3 million a year."

The Steam Challenge intends to meet its 20% efficiency goal by helping industry adopt the systems approach in designing, purchasing, installing, and managing boilers, distribution systems, and steam applications.

Partnership in Steam Challenge is open to steam system operators and managers, developers and distributors of steam systems equipment, and steam trade and membership organizations. For more information, contact the DOE Steam Challenge Program Manager, Fred Hart, at (202) 586-1496 or Ted Jones at the Alliance to Save Energy at (202) 530-2225. You can also access the new Steam Web site at www.oit.doe.gov/Access/steam.

Check out the Georgia-Pacific case study on page 6 to see how this pulp and paper company saved money by insulating steam lines.

Motor Challenge Teleconference Reaches Thousands

The Motor Challenge 1998 Teleconference team.

Thousand of viewers across the United States, Canada, Mexico, and other locations learned how to supply the missing link to new profits on May 19. The live satellite teleconference was broadcast to 290 downlink locations—over 50 more sites than the 1995 teleconference!

By all accounts, *Efficient Motor Systems II: Your Path to Profits* was a resounding success. Viewers received valuable information on improving motor system efficiency, process control, productivity, and profitability from the case studies, a role-play on selling energy-efficient projects to management, and the panel of experts.

Ernesto Wiedenbrüg of Baker Instruments in Fort Collins, Colorado, was one of many who hosted the broadcast and found it to be a clear success for his company. "By being a host, we conveyed to our present and prospective customers that we are serious about increasing operating efficiency in production," said Wiedenbrüg.

Julia Oliver, the DOE Teleconference Program Manager, was assisted by many who helped make the event a success.

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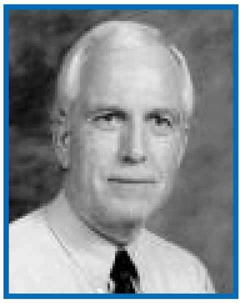
Guest Column

Evolution of Predictive Maintenance for Electric Motors

By R. Keith Mobley, President & CEO, Integrated Systems, Inc., Oak Ridge, Tennessee



R. Keith Mobley

Predictive maintenance has evolved rapidly since 1981. Prior to 1981, customers were limited to analog technologies and laboratory techniques that seriously complicated and restricted the use of technologies such as vibration, infrared, and lubricating oil analyses as effective predictive maintenance tools. Since then, advancements, driven primarily by parallel evolution of microprocessor-based technology, have resulted in tools that can be easily used by most plant personnel. With one exception—customers continue to use traditional evaluation techniques, such as meggering and Hi-Pot testing, to analyze electric motors rather than new methods that take advantage of advancements in computer technology.

The slow evolution of predictive maintenance in the motor systems area may be partly attributed to a lack of understanding of electric motors and techniques to properly evaluate their operating conditions. Examples of this lack of knowledge include the "no-load" test procedures endorsed by ASME International and the Nuclear Regulatory Commission's explicit omission of electric motors from their OM-6 testing of safety-related pumps.

Internet research of articles and discussion groups of electric motor diagnostics have revealed some interesting issues. For example, on the topic of how to test a motor on the repair shop floor, about half of the participants stated that the motor should be mounted on a rubber mat and tested in a no-load condition. Others believed that the motor should be mounted in a normal, as-installed foundation. No one questioned the validity of a no-load test.

There have been attempts to use technologies, like vibration analysis, for electric motor diagnostics. But, most have failed to provide consistent, accurate results. In most cases, it was not a failure of the technology; rather, it was misuse of the technology caused by lack of understanding of the operating dynamics of electric motors. Like other machine components, electric motors have specific, well-defined operating dynamics. If these dynamics are used to evaluate actual operating conditions, many existing predictive maintenance technologies can be used effectively. For example, the rotor in an electric motor will naturally seek the magnetic center of the stator. In a no-load situation, assuming constant incoming power supply, the rotor will always operate in a state of equilibrium. When load is applied, the motor's ability to operate in the center of the stator's magnetic field becomes totally dependent on one or more externally applied forces.

A fundamental requirement of vibration analysis is that the machine or system must be operating under normal loaded condition. No-load testing is meaningless. Without the applied forces that were used for its design, machinery will not perform normally. This is also true for electric motors. In a no-load condition, the motor will not exhibit the same characteristics it will have in actual operation. As an example, a large integrated steel mill conducted ASME-approved testing on all of its mill motors following rebuild at an outside repair shop. With few exceptions, all of these motors passed the test. When we load tested these same motors, 57% were in unacceptable operating condition.

Vibration analysis can detect many mechanical, and some electrical, problems common to electric motors. Detection of loose rotor bars, breakdown of insulation, and inconsistent incoming power are well within its capability. It can also be used to isolate most of the external forces that result in premature motor failure. Vibration analysis cannot detect all forms of insulation-related problems. Unless the failure mode results in abnormal displacement of the rotor, it cannot be detected using conventional analysis techniques. Therefore, we are forced to revert to older, proven testing methods like meggering.

One should also consider that most premature motor failures are caused by the application. For example, motors are not designed to accept the often tremendous side loads caused by belt-driven applications. Unless the motor's bearing support structure was specifically designed for this type of application, the radial forces generated by the drive-belts will change the bearing load zone and force the rotor to operate off-center. The net result will be premature failure of the bearings and other motor components. Other failures are caused by deviations of load and torsional load changes caused by excessive start-stop operation or excessive acceleration-deceleration rates. Over the past 30 years, we have found thousands of examples of premature motor damage or catastrophic failure caused by operation outside the motor's acceptable design envelope. Therefore, we question the validity of any testing method that does not fully evaluate all parameters that directly or indirectly affect motor performance.

Vibration analysis is not a perfect diagnostic tool for electric motors. Its inability to detect all forms of insulation and electrical problems limits usefulness. However, when it is coupled with other monitoring and evaluation tools, vibration analysis can help resolve most motor problems. At a minimum, the diagnostic data set must include accurate amp readings and thermal images of motor skin temperatures. The amp reading provides an indication of the load factor applied to the motor in normal operation. This reading should be within its acceptable design range. If not, there is a high probability that abnormal load is contributing to the problem. Thermal images of the motor's skin provide a temperature distribution profile of the motor. Many of the factors that contribute to motor problems will cause an abnormal temperature profile.

(continued on page 7)

Performance Optimization Tips

The following article is the first in a regular Turning Point *feature, authored by Don Casada, on motor system performance optimization.*

Control Valve Replacement Savings

By Don Casada, Motor Challenge Program, Oak Ridge National Laboratory

Don Casada

One of the most common approaches to energy reduction in pumping systems is applying variable or adjustable speed drives (ASDs). For systems with varying flow needs, and especially when most of the head required is frictional, ASDs can effectively reduce pump energy. An ASD is usually installed to control system flow rate or pressure in lieu of throttling and/or bypass valves. The energy savings resulting from the elimination of energy wasted by valve throttling can be quite large, particularly when flow rate or pressure requirements change significantly over time.

But another often overlooked opportunity to reduce waste energy—particularly during retrofit applications—is the type of throttling valve used. To understand the importance of the valve type, consider this guideline in designing valve-controlled fluid systems:

"In a pumped circuit, the pressure drop allocated to the control valve should be equal to 33% of the dynamic loss in the system at the rated flow, or 15 psi, whichever is greater." (*ISA Handbook of Control Valves, 2nd Edition*)

An inherent result of this guideline is that high-loss valves, such as globe valves, are frequently used for control purposes. These valves result in significant losses *even when they are full open.* Figure 1 illustrates the frictional head loss for three styles of full-open 12-inch valves as a function of flow rate. (The "K" value is the valve loss coefficient at full-open position.) The equation below provides a useful relationship between flow rate, pressure drop, and dissipated power because of frictional losses.

$$\textit{Fluid horsepower} = \frac{\underset{(\text{gpm})}{\text{Flow rate}} \cdot \underset{(\text{ft})}{\text{head loss}} \cdot \underset{\text{gravity}}{\text{specific}}}{3960}$$

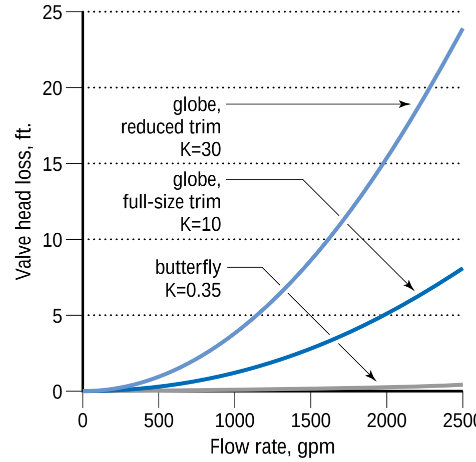


Figure 1. Typical pressure drop vs. flow rate curves for full-open 12-inch valves.

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Hydraulic Institute Committee Takes on Efficient Pumps

The Hydraulic Institute (HI), a Motor Challenge Allied Partner, recently formed an ad hoc committee to address "Energy Efficiency and Life-Cycle Cost for Pump Systems." This working group can help its members communicate to customers about the benefits and opportunities of efficient pump systems, while furthering HI's mission to enhance the effective, efficient, and economic use of pump products worldwide.

The group, led by Gunnar Hovstadius, Director of Technology at ITT Fluid Technology Corp., consists of high-level representatives from more than a dozen pump manufacturers, plus the U.S. Department of Energy. They will promote the education of pump users, engineers, and pump producers in the concept of a "life-cycle cost systems approach." To support this education process, the HI working group will also prepare appropriate educational products.

If the group is successful, future pump buyers and users will make a pump purchase based on total life-cycle cost instead of initial capital investment.

Future activities were discussed at their first committee meeting in Denver, Colorado, which coincided with HI's technical meeting in June. They will also work closely with Europump (a trade association of European pump manufacturers) and its corresponding working group ENERSAVE, which plans to use Motor Challenge Showcase Demonstrations.

Others interested in participating in the working group would be welcome.

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Hydraulic Institute Working Group:

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- *Envirotech Pump Systems*
- *Fairbanks Morse Pump*
- *Floway Pumps*
- *Flowserve Corp.*
- *Grundfos Pumps*
- *Ingersoll-Dresser Pump Company*
- *ITT Industrial Pump Group*
- *ITT Fluid Technology*
- *Patterson Pump Company*
- *Price Pump Company*
- *Sulzer Bingham Pumps, Inc.*
- *Tuthill Pump Group*
- *U.S. Department of Energy*

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Even at relatively low flow rates, the power losses can be significant in high-loss valves. For instance, at 1500 gpm (for which the fluid velocity in a 12-inch line is only about 4.3 ft/sec), about 3.3 hp is lost to valve friction in the reduced trim globe valve.

Assuming the combined pump and motor efficiency is 70%, the cost of electricity is 10¢/kWh, and continuous system operation, the annual cost of friction can be estimated. Figure 2 illustrates the annual *savings* in energy cost from replacing the two styles of globe valves with the butterfly valve.

A 250-lb pressure class butterfly valve can be purchased and installed for less than $1,000. The simple return on investment period for the two valve styles shown in Figure 2 would range from only 4 months to a year at 1500 gpm.

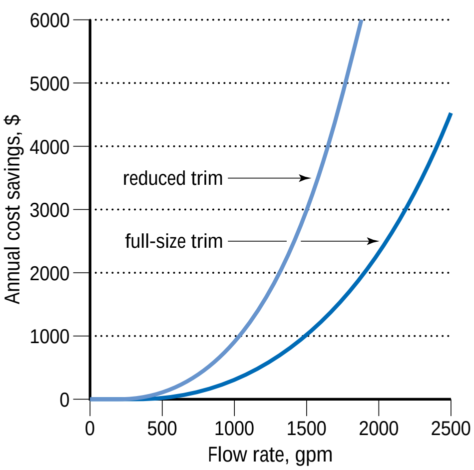

Figure 2. Annual savings from replacing globe valves with a butterfly valve.

Note that in some cases where drives are retrofitted, the control valve could simply be replaced with a spool piece instead of another valve. However, in most situations, it would be advisable to retain the flexibility (and isolation capability) offered by a replacement, low-loss valve.

Another potential benefit from valve replacement is reduced maintenance. Valve operators and positioners usually require more maintenance than the valves themselves. Air leaks that often accompany air-operated valves (and their energy costs) can be eliminated by switching to a low-loss, manually operated valve.

Introduction to Root Cause Failure Analysis on AC Induction Motors

By John M. Machelor,
Motor/Drives Systems Specialist, Motor Challenge Program,
MACRO International Inc.

This is the first in a series of articles by John Machelor on this subject. This article will address the concept of Root Cause Failure Analysis (RCFA) and the dependence of RCFA on a company's familiarity with its motors and motor systems. Future articles will cover how RCFA can be applied to any phase of a motor's life from manufacturing to application and specific motor failure root causes and their related failure modes.

U.S industry wastes millions of dollars on unnecessary repair or replacement of AC motors in their operations. In almost all cases, these motors could have performed for many more years instead of experiencing premature failures. Of course, all motors will eventually fail because of age and other factors beyond the control of a company's maintenance and operations functions. But, a typical AC motor, properly installed and maintained, should last 15 to 20 years or longer. Then why are there so many premature failures?

The answer lies in a phrase called Root Cause Failure Analysis, or RCFA for short. Although this type of analysis has been available for many years, until recently it has had little use.

So, what is RCFA? It is the detailed analysis of a system or its individual components to identify the "root cause(s)" of failure of the system or its components. RCFA can be applied with equal validity to all types of rotating equipment, such as motors, pumps, blowers, compressors, and gearboxes, as well as on non-rotating equipment like switchgear, steam systems, and compressed air systems. RCFA is most efficient when applied to systems or components that have experienced repetitive failures after relatively short life cycles. Obviously, many AC motors fit in this category.

The implementation of a successful RCFA program on a company's in-service motors relies heavily on the existence of a complete inventory and complete repair history data on the motors. Many companies do not have such organized data or, if they do, the data is incomplete and/or poorly maintained. Companies should enhance existing motor inventory/repair databases or create ones where none exist. An excellent tool to accomplish this task is the MotorMaster+ software available through Motor Challenge.

When creating new motor inventory and/or repair history databases, it is not necessary to initially include every AC motor in a company's operations. The new database(s) need only contain essential and critical motors, defined as follows:

Essential Motors—Motors whose failure will shut down an entire operation/production line until they are either repaired or replaced.

Critical Motors—Motors whose failure, while not shutting down an entire operation/production line, will cause a major disruption in it, creating the need for backup or other compromise systems to be employed in order to maintain production.

Once the necessary inventory database of essential and critical motors has been established, the next step is to review the database and further prioritize the motors. Next, a company reviews the repair history of the prioritized motors looking for repeat motor failures, especially those of the same type.

It is important to understand that root causes, which result in numerous failure modes of in-service motors, can occur at any time in a motor's existence during the manufacturing process and shipment, at the distributors, in storage, and, of course, in operation. Future articles will address the root cause problems that can occur during each of these periods and the resulting failure modes that are most likely to occur during the motor's operation.

Georgia-Pacific Saves Fuel Costs and Improves Efficiency with Insulation Upgrades

For Georgia-Pacific, insulating steam lines and installing new steam traps at its Madison, Georgia, plywood plant yielded immediate and significant savings. The Madison plant now saves about 6,000,000 Btus per hour in the manufacturing process. In addition, installing insulation has eliminated the plant's dependence on outside fuel, reduced pollution, and increased protection for employees working around the steam lines. A 6-month payback makes this project even more impressive.

Georgia-Pacific's Madison plant manufactures plywood from Loblolly pine, which grow abundantly in the area. During manufacturing, water-softened logs pass through one of four dryers set at 405°F. Before the upgrades, steam lines to the dryers were uninsulated, causing heat loss, and the result was reduced temperature.

The initial goal of the project was to eliminate the Madison plant's dependence on purchased fuel. While the plant normally used wood bark and wood byproducts to fuel its operation, it also relied on purchased fuel at certain times when the bark was too thin for adequate fuel.

Using 3E Plus, a software program created by the North American Insulation Manufacturers Association (NAIMA), Georgia-Pacific determined 2"- thick fiberglass was the right insulation for the plant's 1500 feet of saturated steam lines, which operated at 437°F. 3E Plus software calculates insulation thickness to determine economic, energy, and environmental savings for piping and equipment.

The computer program projected insulation would reduce heat loss, increase operating temperature by 15%, and maintain the process temperature along the length of the lines. These improvements would result in a faster, more efficient plywood veneer process, and required no downtime to install.

"The insulation has allowed us to cut our steam usage by approximately 6,000 lbs/hr. This is equivalent to saving 18 tons of fuel per day," explains Darryl Jackson, boiler superintendent at the plant. Insulation has also helped Georgia-Pacific eliminate its need for purchased fuel. In fact, Jackson says, "Currently, we are selling some of our excess fuel to a paper company."

Georgia-Pacific found that reducing fuel consumption cut ash generation, and the energy savings reduced CO_2 emissions by 5% to 6%. For employees, insulation makes working around the steam lines much safer by reducing surface temperature of the piping from about 400°F down to about 85°F.

Motor Challenge Teleconference

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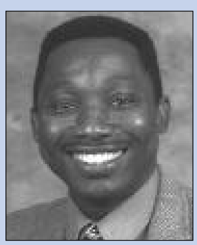
Key members of the teleconference team included:

- Panelists: Jerry Aue, Consolidated Papers; Tom Bishop, EASA; Ziba Kellum, Advanced Energy; Roger Lawrence, EPRI's Adjustable Speed Drive Demonstration Office; and Mike Muller, DOE Industrial Assessment Center, Rutgers University
- Moderator: Enrique Cerna
- Motor Challenge Program Manager: Paul Scheihing
- Craig Anderson, Larry Pribyl, and Allan Wallace, Oregon State University
- Lynn Redlin, LTR Enterprises
- Cynthia Putnam and Chad Davis, Macro International
- Erika Ericksen, National Renewable Energy Laboratory
- Mitch Olszewski, Oak Ridge National Laboratory

In addition, Motor Challenge thanks the Teleconference sponsors, the Teleconference Steering Committee, and the DOE Regional Representatives for their support.

Meet the Newest Motor Challenge Regional Representative

The Motor Challenge Program has six regional representatives throughout the United States who support the program and its Partners. These representatives often coordinate regional and local Motor Challenge workshops and spearhead local outreach efforts. Also, these representatives are aware of other federal and state energy initiatives within their area that can help private sector companies leverage their energy dollars.



Gibson Asuquo is the new regional representative in DOE's Denver Regional Support Office. This office services twelve mid- and southwestern states: Colorado, Kansas, Louisiana, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Wyoming, and Utah.

Gibson supports Motor Challenge by disseminating information and helping to implement the program throughout the region. He works to establish Allied Partnerships and uses his expertise in engineering to provide technical assistance to Partners. In addition to coordinating and attending regional workshops and events, Gibson makes technical presentations at training sessions.

Prior to joining the Denver Regional Support Office in August 1997, Gibson participated in DOE's Technical Leadership Training Program. Through this program, he worked as an engineer at the Office of Fuels Development in Washington, D.C.; The Office of Fossil Energy, U.S. Naval Petroleum Reserves in Bakersfield, California; the Yucca Mountain Site Characterization Project Office in Las Vegas, Nevada; and attended fundamentals of applied engineering courses at the Colorado School of Mines in Golden, Colorado. Gibson has been with DOE since 1995.

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Bethlehem Steel Improves Performance

continued from page 1

Harbor produces hot-rolled sheet, cold-rolled sheet, and steel plates for the automotive, machinery, and appliance markets.

For this project, BSC worked with General Conservation Corporation (GCC) to identify and implement potential energy efficiency measures on specific operations at Burns Harbor. Meade Industrial Services, Inc., a Motor Challenge Partner, performed the electrical installation, and Motor Challenge performed the energy savings validation.

An integral part of the steel-making process involves blowing gaseous oxygen into the BOF, which creates chemical reactions that generate heat and convert iron into steel. At the Burns Harbor operation, the gases are removed from BOF #3 (the focus of this case study) by an induced draft fan. After cooling and cleaning, the gases travel through the fan, which has a set of inlet dampers to regulate gas flow, and finally pass through an outlet stack into the atmosphere.

This 45-minute BOF heat cycle requires six operations of varying gas flow requirements. Idle periods of irregular length occur between cycles. Analysis of this procedure indicated that maximum flow was only needed during one-third of the cycle. The fan on BOF #3, however, operated continuously at 1,200 rpm, which was much faster than needed. Modulating the inlet dampers on the fan helped meet the widely varying ventilation requirements but caused unnecessary pressure drop in the system. Additionally, the induced fan system was oversized for the plant's current requirements. The BOF's oxygen flow rate usually operated well below the system's 40,000-SCFM capacity.

BSC installed a VFD to modulate gas flow and opened the inlet damper to the induced draft fan, increasing flow efficiency. These changes helped match fan speeds to the BOF's varying demands.

To date, BSC has been very pleased with the performance of the VFD. In addition to the electricity and cost savings, the modifications significantly decreased noise levels in the furnace area and increased the lifetime of several system components such as bearings. As a result of the reduced fan speed, the system's tolerance to slight imbalances was improved, thus reducing the need to clean and rebalance the fan wheel. This resulted in lower maintenance costs and decreased furnace downtime. Finally, with the VFD's soft-start capability, the effect of start-up of this 7,000 horsepower motor on the Burns Harbor facility's power grid has been considerably reduced.

The financing of these improvements is of interest because at the time that these energy efficiency measures were identified, BSC did not have the necessary funds to implement the project. In addition, there was reluctance on the part of some plant personnel to make any modifications because, although the original system was not energy efficient, it did run smoothly. To jump-start the project, GCC agreed to fund the program and assume all risk. In exchange, BSC agreed to share the energy savings with GCC. This agreement allowed BSC to implement the program and reap the energy savings with no capital outlay or risk.

Like BSC, other companies can apply VFDs to improve the performance of their fan or ventilation systems. VFDs can also be used to improve the performance of blowers, pumps, compressors, grinders, mills, and conveyors.

Induced draft fan on Basic Oxygen Furnace #3.

Guest Column

continued from page 3

In all cases, time- and frequency-domain vibration profiles from the entire machine-train must be used. Profiles acquired from the motor without real-time comparison to the driven components of the machine-train have little diagnostic value. Because of the signal conditioning techniques used by system vendors, frequency-domain data is static and cannot provide the dynamics of the machine-train. Continuous time-domain waveforms provide a true representation of machine dynamics. Common problems can be isolated using single-channel data acquisition techniques. More complex problems require multi-channel, real-time data.

Several microprocessor or computer-based systems currently on the market are advertised as motor diagnostic tools. Most of these are based on simplified diagnostic logic and have not been proven effective as predictive maintenance tools. We have evaluated a number of these systems and have not found one that provides the consistent, accurate diagnostic capability required for predictive maintenance.

Some new techniques, such as flux density and motor current analysis, are being introduced to the market. Most are old technologies that incorporate microprocessor technology to make them more user friendly and to improve diagnostic accuracy. The key is proper use of the technology and instrumentation.

There is still a long way to go before we have full electric motor diagnostic capability. Until there is a breakthrough in technology, we must make the best use of existing tools, such as vibration analysis, to extend the useful life of motors.

Coming Events

August 23-28	ACEEE Summer Study on Energy Efficiency in Buildings, Pacific Grove, CA; call (202) 429-8873 or access the Web at http://aceee.org
August 31-Sept. 1	Energy Efficiency Forum for managers and op. personnel of municipal and industrial water and wastewater systems, sponsored by EPRI and *Water-World Magazine,* Denver, CO; call James Laughlin at (918) 832-9320
September 10	Energy Management and Maintenance Techniques for Water and Wastewater Workshop, Long Island, NY; call Mona Cavalcoli, AWWA's New York chapter, at (315) 455-2614
September 11	Energy Management and Maintenance Techniques for Water and Wastewater Workshop, New York City, NY; call Mona Cavalcoli, AWWA's New York chapter, at (315) 455-2614
September 13-17	World Energy Congress, Houston, TX; call Barry Haest at (713) 963-6238
October 1	ASDMaster Training Workshop, cosponsored by Motor Challenge Allied Partners, Cleveland, OH; call Anna Maksimova at (360) 754-1934
November 3-5	World Energy Engineering Congress, Atlanta, GA; call Ted Kurklis at (770) 925-9648

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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

We Want Your Input

Motor Challenge is interested in your comments/suggestions on *Turning Point.* Please let us know:

- if the articles contain the right amount of technical detail;
- what issues or topics you would like to see in future issues; and
- how you like the organization and layout.

Please send your responses to:

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Thank you! Your input will help us provide you with an informative and effective newsletter.

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