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- Why Motor Decisions Matter
- Motor System Reliability
- When to Replace or Repair



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VOL. 2, NO. 3

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product news



With Voith's WinDrive technology, the maximum operating loads in the drivetrain are reduced by up to 20 percent for the tower and foundation.

Old Tricks for New Dogs

THE LATEST DEVELOPMENTS FOR WIND TURBINES RELY ON PROVEN TECHNOLOGIES

In the fast-paced and high-tech world of wind turbine development and manufacturing, it's all about incorporating the latest technology, right? Not so fast, say the experts at Voith Wind, established in 2007 as a new division of the German company Voith Turbo.

Voith, now more than 100 years old, manufactures components of industrial turbines and compressors, including hydrodynamic and mechanical drive systems for energy generation, petrochemical plants, metallurgical processing and other industries. In addition, more than a million units

of Voith turbo couplings have been installed in quarrying, mining and other applications.

Some of those well-established products and technologies are suited to applications in megawatt-sized wind turbines, says marketing manager Thomas Genz.

In fact, Voith Wind has developed the WinDrive unit, a complete power transmission package for wind turbines. Production began in March on the first 18 units, which are scheduled to be included in DeWind model 8.2 wind turbines being installed at wind farms in Argentina and Texas this year.

One of the challenges facing wind turbine manufacturers is being able to supply steady voltage to the power grid when the input—windpower—is variable. Most current-generation wind turbines use a mechanical gear drive coupled with a frequency converter to ensure that steady stream of power. The problem with that, Genz says, is that

frequency converters are failure-prone. In fact, the mean time between failures (MTBF) for frequency converters is about two years, Genz says.

The WinDrive system replaces the mechanical gearbox found in most modern wind turbines with a hydrodynamic gearbox. This type of variable-ratio gear drive automatically converts variable input speed to a constant output speed.

Because of that constant output speed, the WinDrive system doesn't need complicated power electronics. It can be hooked up directly to a synchronous generator, the same type of generator used for many years to provide reliable power to the grid at conventional, fossil fuel-powered plants. By eliminating the power electronics, you increase the system's overall reliability, especially considering the track record of similar equipment operating in other industries.

"The MTBF of traditional Voith

hydrodynamic speed converters is 39 years,” Genz says. That figure is based on variable-speed drives used on pumps and compressors in the oil and gas industry as well as at traditional power plants generating electricity from 1 to 30 megawatts.

But reduced down time isn't the only way the WinDrive can save turbine operators money. Because the WinDrive is designed for variable-speed operation, the wind rotor can be operated at the aerodynamic optimum speed for the rotor, even at different wind speeds. As a result, the overall efficiency of a wind farm improves by more than 1 percent, Genz says.

The WinDrive also provides initial cost savings on the equipment itself. Due to the elimination of the transformer and frequency converter, along with the reduction of size and weight of the generator and gearbox required, the drive system from the rotor to the power grid costs about 10 percent less than drive systems currently being used, Genz says.

Because the WinDrive uses fewer components, and because it's smaller and more compact, it weighs less—75 tons compared with 100–180 tons for competitive drive systems. In large systems, this translates into steel and cement material savings of up to 20 percent for the tower and foundation. Per wind turbine, this means hundreds of tons in weight that can be saved.

In January Voith Wind was selected as one of five finalists from among 269 entrants for the “Innovation Prize in German Industry,” which is awarded annually to a company for its outstanding innovation. Only companies whose developments and products have demonstrated significant advances over current technology are considered for the award.

Although no WinDrive units are yet operating in the field, Voith is confident the new product will be well received. “The product is a highly innovative product meeting the requirements of the market and providing exceptional



The highly mechatronic system is a single component with a size of approximately 2 m long x 1.5 m diameter.



By eliminating the frequency converter and step-up transformers, the complexity of the wind turbines is reduced significantly.

value to the customers,” Genz says.

Even better, the company has already received contracts for 100 more WinDrive units in 2008.

For more information:

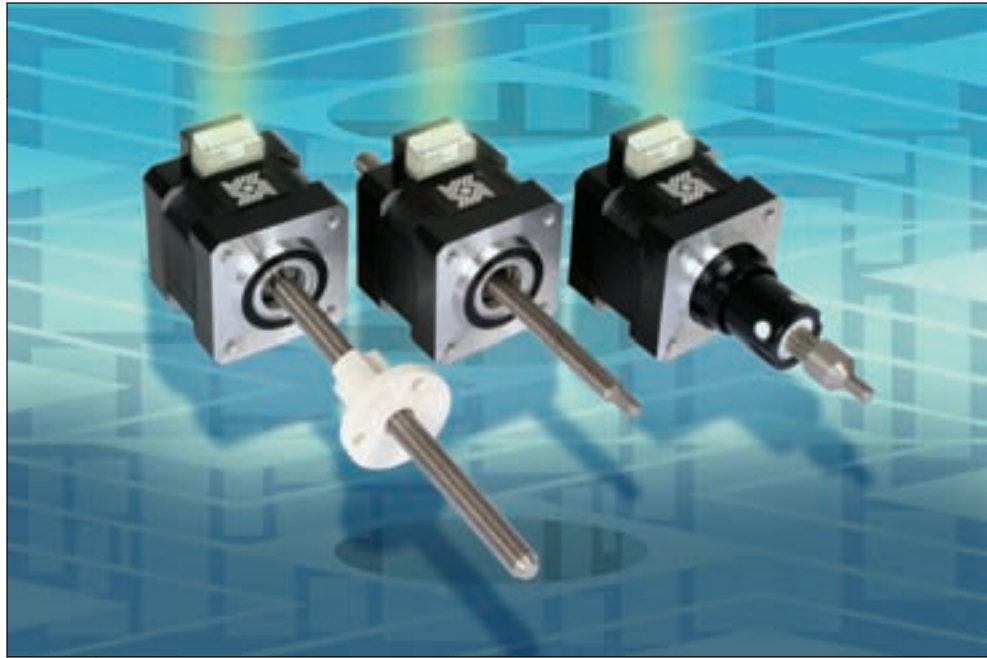
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Fax: + (49) 7321-37-13-81-49
www.voithturbo.com

Linear Actuators

IMPROVE
PERFORMANCE AND LIFE

Haydon Switch & Instrument, Inc. recently announced that its size 14 hybrid linear actuators are now available with an integrated connector. Offered alone or with a harness assembly, the connector is RoHS-compliant and features a positive latch for high connection integrity, according to the company's press release. The connector is rated up to three amps and the mating connector can handle a range of wire gages from 22 to 28. The motor is an option for those that want to plug directly into a preexisting harness.

Available in three designs—captive, non-captive and external linear—these actuators come in resolutions ranging from 0.00012" per step to 0.00192" per step and deliver thrusts of up to 50 lbs. The size 14 actuators can be micro stepped for finer resolutions. Applications requiring precise positioning and rapid motion are best suited for this



motor. Priced competitively, the product can be utilized for drop-in replacements to improve performance and life or for incorporation into your next project. Haydon can custom design the motor to meet specific application requirements.

For more information:

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Waterbury, CT 06705
Phone: (203) 756-7441
Fax: (203) 756-8724
info@hsi-inc.com
www.hsi-inc.com



R+W America

EXPANDS COUPLING AND
TORQUE LIMITER LINES

BK8 Coupling Series Allows High Level of Torsional Stiffness—R+W America has developed a series of couplings for mounting to flange output servo

gearheads. According to the company's press release, the BK8 coupling series allows for an equally compact, flexible interface between gearheads and driven components that protects bearings and simplifies alignment. The BK8 utilizes stainless steel bellows, allowing for torsional stiffness while compensating for small misalignments between components. The series is available in a variety of sizes covering torque ratings from 15 Nm to 1,500 Nm and for special applications up to 10,000 Nm. In addition to the traditional clamping hub, they can be made into a variety of coupling output hubs including tapered conical clamping hubs and expanding shafts.

EK7 Couplings Offer Backlash-Free Connection—The EK7 coupling

series allows installers to slide the male portion of the coupling into the driven bore. With tightening of a single screw, the shaft will expand for a backlash-free connection. A cone, internal to the expanding shaft, forces the outer part of the shaft to spread and create the frictional connection to the bore. These couplings are available in eight sizes. Shore hardness allows designers to select the correct amount of flexibility, vibration damping or stiffness depending on their performance requirements. Torques range from 9–2,150 Nm, though some custom versions can transmit up to 4,000 Nm.

Torque Limiter Provides Inexpensive Insurance for Machine Performance— Torque limiters by R+W America are backlash-free and highly responsive with the ability to completely disconnect the drive and driven components in under three milliseconds, according to the company's press release. Disengagement torque can be field-adjusted with several disengagement behaviors available. The design uses a single screw radial clamping hub that's available in English or metric bores, with or without keyways. They are available in bore diameters from 3–80 mm and disengagement torques from 0.1–1,800 Nm.

For more information:

R+W America
1120 Tower Lane
Bensenville, IL 60106
Phone: (630) 521-9911
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www.rw-america.com

Allegro Hall-Effect Sensors

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MARKETS

Allegro Microsystems, Inc. has introduced a programmable, linear Hall-effect sensor with a 125 Hz pulse width modulated output. According to the company's press release, the thin package and PWM output of the sensor would benefit current and position sensing applications. The A1351 device

converts an analog signal to a digitally-encoded PWM output signal. A simple RC network can be used to convert the digital PWM back to an analog signal.

The BiCMOS, monolithic circuit inside integrates a Hall element and precision temperature-compensating circuitry to reduce the intrinsic sensitivity

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product news

and offset drift of the Hall element. A high-frequency offset cancellation clock allows for a greater sampling rate, which increases the accuracy of the output signal and results in faster signaling capability, according to the company's press release. The A1351 is supplied in a thin 4-lead SIP (K) package and is priced at \$1.38 each in quantities of 1,000. It has a 12–14 week lead-time to market.

Allegro has also introduced the ACS756 family of low-noise, open-loop current sensors with bandwidth capability of 125 KHz. The Hall-effect sensor is appropriate for various 50 S to 100 A applications due to the high speed and increased accuracy, which result from the proximity of the magnetic signal to the Hall transducer, according to the company's press release. Standard uses include motor control, load detection and management, power supplies, overcurrent fault protection and other applications involving high-

side current sensing.

The sensor's internal electrostatic shield forces the effects of voltage-transient spikes around the silicon to reduce the voltage ripple on the device output. The linear Hall sensor circuit has a copper conduction path near the die, so an applied current moves through the conduction path to generate a magnetic field, which the integrated Hall IC senses and converts into proportional voltage. The copper conductor is thick enough for the device to survive at five times overcurrent conditions. The conductive path terminals are isolated electrically from the sensor leads, so the ACS756 sensors are suitable for uses that require electrical isolation without using expensive isolation techniques, such as opto-isolators. Geared towards the industrial and consumer markets, the ACS756 is priced at \$3.16 per unit in quantities of 1,000 with a 12–14 week lead-time to market.

For more information:

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115 Northeast Cutoff
Worcester, MA 01606
Phone: (508) 853-5000
Fax: (508) 853-3353
sales@allegromicro.com
www.allegromicro.com



Powerstation

DESIGNED FOR HUMAN-MACHINE INTERFACE PROJECTS

Parker's Electromechanical Automation Division has developed a new Level 1 HMI platform for *Interact* software. The P13 Powerstation is designed to fit into existing cutouts of many common 6" HMI products. Every P13 Powerstation comes with *Interact* preinstalled. It can be tailored to meet the specific needs of the user and is compatible with all existing P1 family applications. Each Powerstation includes a new AMD LX700 CPU, 128 MB of DRAM and a 256 MB



CompactFlash card standard.

The hardware also includes two serial ports, a 100 BaseT Ethernet port and 24 VDC power. All P13 units are passively cooled, allowing the units to be deployed in harsh environments as there are no rotating media storage devices or fans of any kind. The P13 family comes with a 1/4 VGA TFT display and offers a VGA resolution TFT display.

The *Interact* software package offers basic panel tools, graphics, alarming and networking capabilities included in the base configuration. It also offers options such as recipes, reporting, historical trending, machine configuration and custom user programs. Parker's CTC HMI hardware and software are designed and tested under the same roof. The Powerstations include a 24-month warranty.

For more information:

Parker Electromechanical Automation
5500 Business Park Drive
Rohnert Park, CA 94928
Phone: (707) 584-7558
thiserodt@parker.com
www.parkermotion.com

Rolled Steel Motors

OFFER ALTERNATIVE TO CAST IRON

WEG Electric Motors Corp. has recently announced the addition of a

family of 3-phase motors with rolled steel bodies and cast iron endbells. These motors are available in 12 standard sizes with ratings from 1 to 20 hp for operation at 230 or 460 VAC mains. The 3-phase motors were developed using Finite Element Analysis software on their motor parts to detect irregularities and thermal simulations of mechanical components. Fans ensure low motor temperature rise, minimizing winding losses. The 3-phase motors use SAE/AISI 1040/45 steel as standard and are designed to withstand torques caused during motor acceleration and deceleration.

“Our customers have been asking us to develop an alternative to our popular cast iron motors for use in applications where a light-weight motor is required, without sacrificing WEG quality or reliability,” says Gerardo Elias, motors marketing manager at WEG. “Our new rolled steel family of motors meets these requirements, while establishing a new value proposition, with list prices typically nine percent less than equivalent cast iron motors.”



For more information:

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 1327 Northbrook Parkway, Ste. 490
 Suwanee, GA 30024
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Power Up!



If you have a background in gears, bearings, motors, belts, couplings, sensors or actuators, we'd like to talk to you. Powerplay, the new back page feature in *PTE*, is all about your industry. If you've got a funny anecdote, an interesting observation or perhaps a limerick on motion control, feel free to send it our way. This column is dedicated to the stories too radical to make the cut in industry or product news. We need story ideas, and we're confident you can provide them.

The rules are quite simple: submit a story idea about the power transmission industry, make it entertaining as well as informative, and become a *PTE* magazine editor-at-large today (salary not included). Submit your award-winning material to publisher@powertransmission.com.



LoadMate Chain Hoist

DELIVERS
IN SMALL WORK PLACES

With load capacities from 1/8 to 1 ton, a lifting height of 262 feet and a wide range of lifting speeds and power supplies, the LoadMate Electric Chain Hoist from R&M Materials Handling is a viable option for wind turbine applications. The LoadMate can be installed inside the wind turbine nacelle to assist with standard maintenance activities such as change-outs and repairs of generators, high-speed gears and yaw and pitch motors.

According to the company's press release, the LoadMate is an ergonomic low-headroom hoist that allows for close trolley approaches. It's equipped with detachable parts and electromagnetic disc brakes to increase service life. A torque limiter protects against overloads and the hoist comes

standard with upper and lower limit switches. The lifting motor has 40 percent ED, IP55 protection and Class F insulation with thermal protection. It comes standard with a wide range of lifting speeds including 64 and 16 fpm, 96 and 24 fpm and 128 and 32 fpm. The LoadMate is also available in a variety of power supplies including 208, 230, 460, 575/3/60, or 380/3/50.

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www.rmhoist.com

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Available in travel lengths to six meters, the Slipstream series linear stages from LM76, Inc. feature 0.2 mm/300 mm accuracy and 0.1 mm repeatability. T-slots on three sides allow for installation and/or accessories, making the stages ideal for robotics, pick-and-place, assembly, packaging, sampling and testing, according to the company's press release.

Motor options for the Slipstream series include a NEMA 23 Stepper with a 100 W or 200 W servo motor with encoder. These motors can be mounted on the left or right side, and a fail-safe brake is also available. Mounting configurations include X, Y, and Z axes and gantries. The precision profile rails handle dynamic loads to 22.3 kN, and the 50 mm wide timing belt features maximum belt strength at 3,000 rpm of 1,300 N in high-duty applications. Stock linear stages can be shipped in less than two weeks.



For more information:

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Phone: (413) 525-4166
Fax: (413) 525-3735
mquinn@lm76.com
www.lm76.com

Efficient Motor Drive

MAINTAINS
CONSTANT VELOCITY

Trust Automation has introduced a compact, programmable TA2230 motor drive designed to run a brushless motor at a constant velocity. Using Hall sensors for velocity feedback, the motor drive can be programmed at start-up to ramp up at a present rate and maintain velocity regardless of changes in load, according to the company's press release. The motor drive, with optional cooling fans, measures 9.3 in. x 3.5 in. x 5.7 in. The TA2230 includes three speed setting options, soft start control, AC line filtering, and a self-contained, enclosed and optically-isolated user interface for safety. Software parameters include enable input level, fault output level, coast input level, target velocity, Hall active level and current limit. Applications include factory automation, machine tools, conveyors, injection molding

machines, air compressors, pumps and existing applications where improved performance and lower operating costs are desired.



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Fax: (805) 544-4621
info@trustautomation.com
www.trustautomation.com

Hinged Shaft Collars

AVAILABLE IN 25 SIZES

Stafford Manufacturing has expanded its line of hinged shaft collars by offering various bore styles to match different types of shafts. The hinged shaft collars feature a triple-link hinge and a captive clamping screw to simplify assembly and provide the same holding power as conventional two-piece collars, according to the company's press release. They are offered with round-, threaded-, hex- and square bores and suitable for use as stops or spacers and for mounting devices with different shaft configurations. Available in 25 sizes from 3/8" to 4" I.D. and 16 metric



sizes from 6 mm to 50 mm, the shaft collars come in steel, stainless steel with stainless steel clamping screws and aluminum. These collars are viable for applications requiring frequent repositioning and maintenance.

For more information:

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Fax: (978) 657-4731
jswiezynski@staffordmfg.com
www.staffordmfg.com

World's Smallest Cable-Extension Transducer

SUPPORTS
DURABILITY, RELIABILITY

Celesco Transducer Products' M150 cable-extension transducer is about the size of a thumbprint, measuring .74 x .74 x .38" with a range of 1.5", making it the smallest transducer in the world, according to the company's press release. The M150 comes with a .014-

inch diameter nylon-coated stainless steel measuring cable offering durable construction and high reliability.

Celesco's M150 is suitable for various applications, especially those in robotics, biomedical firms and automotive-related companies. The transducer provides constant tensions, and the fully-retractable measuring cable attaches to the object in motion. Since cable alignment is unnecessary, installation is easier. The M150 has an internal spring-loaded spool that turns the potentiometer, which supplies a voltage directly proportional to the measuring cable's position when it is connected to a voltage source.



"What really sets the M150 apart from other solutions is the small size and the fact that it doesn't require precise manual alignment," says Jim Bishop, general manager for Celesco Transducer Products, Inc. "There is no need for customers to sacrifice any stroke range to properly position the sensor."

Each M150 package includes extra leader cable and an eyelit kit, so users can end the measuring cable precisely at the required stroke position. The transducer has an expected life of at least five million cycles, according to Celesco's press release.

For more information:

Celesco Transducer Products, Inc.
20630 Plummer St.
Chatsworth, CA 91311
Phone: (800) 423-5483
Fax: (818) 701-2799
www.celesco.com

Stand-Alone Output Hub

PROCESSES
VISMART VISCOSITY DATA



The VisConnect transmitter, launched by SenGenuity, the sensors and advanced packaging division of Vectron International, is a stand-alone, analog/digital output hub that accesses data from the company's ViSmart solid-state viscosity sensor. The devices are connected by a standard 4-20 mA output signal, so users can receive several channels of continuous viscosity and temperature data. Users can integrate the data into a host control platform without additional instrumentation. The ViSmart sensor provides immediate sample and/or continuous, real-time, in-process viscosity measurements for embedded real-time, in-line environments needing high resolution and accuracy in low- to mid-range viscosity liquids, according to the company's press release.

"The VisConnect provides a simple and self-contained path for acquiring ViSmart viscosity and temperature data that can be integrating to host control systems, as needed," says Shrvan Jumani, product manager for SenGenuity. "It is a highly portable solution that allows our customers to gather viscosity and temperature data

and start characterizing application opportunities, whether in the lab or in the field."

The VisConnect attaches to any legacy DAQ or host control system with an optional two-channel analog voltage output, which is standard communications protocol for industrial applications. The transmitter has two loop-powered, galvanically isolated channels of the 4-20 mA output, so users can arrange the minimum and maximum analog outputs that correlate to 4 mA and 20 mA or optional .5V to 4.5V, respectively. In the future, an optional CAN interface will be available, according to the company's press release.

Kerem Durdag, director of business development for SenGenuity says, "The introduction of the VisConnect transmitter will greatly facilitate the process of configuring, installing and managing viscosity data from the ViSmart, providing our customers with an easier, more cost-effective way to identify and define solutions that serve their monitoring and control needs."

For more information:

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Unibrake AC Motor Brakes

REDUCE DOWNTIME FOR
STOP/HOLD APPLICATIONS

Warner Electric, an Altra Industrial Motion company, released the Unibrake AC Motor Brakes, which are spring-applied with a straightforward design that features fewer moving parts. The simpler design results in less

downtime for stop/hold applications typically found in material handling, food processing and baggage handling equipment, according to the company's press release.

The Unibrake has an external manual release lever, so the driven load can move without energizing the motor, and the lever automatically returns to its starting position once the brake is re-energized. The AC motor brakes' construction prevents dust and other grit from coming into contact with internal components. Torque transmission occurs efficiently by splined hubs and friction discs. The torque rating can be adjusted from full to 50 percent. Unibrake features single-phase AC coils, which provide quick engagement and release times as well as simple wiring.

Available in two versions, the Single C-Face Unibrakes, made from 3 ft.-lb. to 15 ft.-lb., mount to a motor's non-driven end and are designed for motors adapted to accept a brake. The Double C-Face Unibrake style achieves a dual function between C-Face motors and C-Face gear reducers, and they are offered from 3 ft.-lb. to 10 ft.-lb. Each style is interchangeable with standard motor brakes.



For more information:

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449 Gardner St.
South Beloit, IL 61080
Phone: (800) 234-3369
www.warnerelectric.com

Electric Motors

WHEN IS IT

Best to Repair,

AND WHEN IS IT

Best to Replace?

Dave Hawley of Deritend Industries

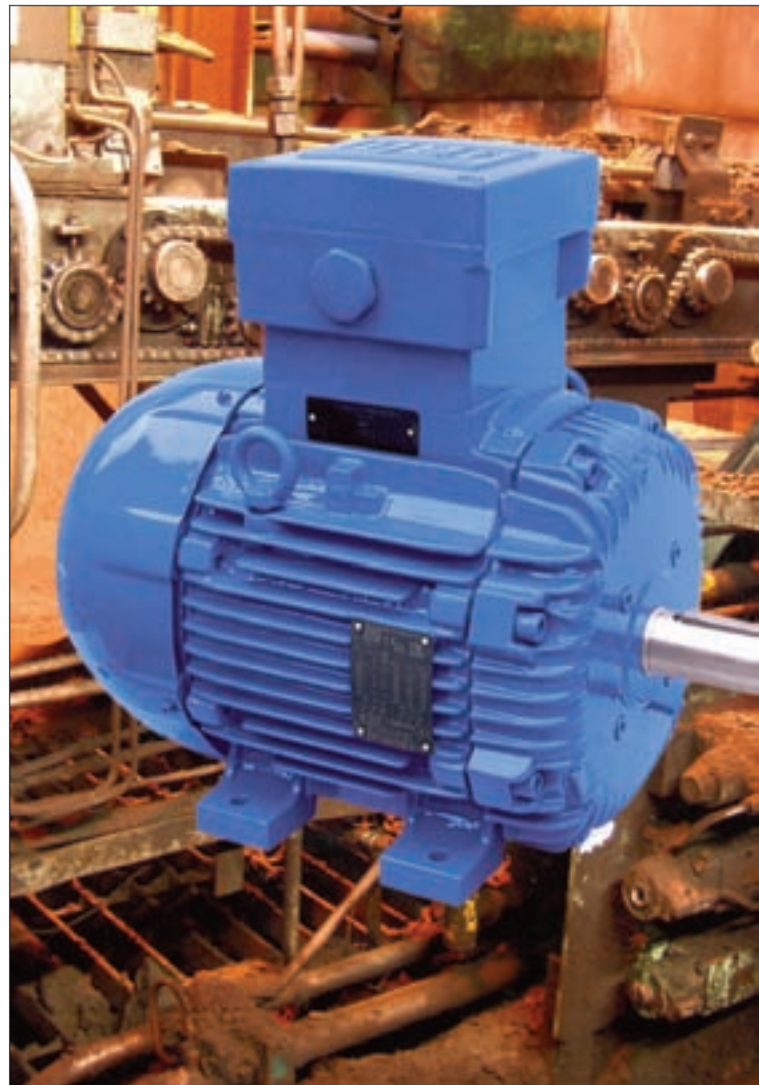
The high cost of plant downtime due to the failure of an electric motor means that the decision to repair or replace should be a simple one; especially in view of the competitive price and availability of new motors. However, while this may be true for motors of 11 kW or less, the situation for larger motors is much less clear cut. In fact, in the higher kW ranges, the repair-versus-replace decision is quite complicated, depending upon variables such as rewind cost, severity of the failure, replacement motor purchase price, motor size, the availability of government grants and simple payback criteria.

Even before the relative benefits of repair versus replacement are considered, what must be appreciated by the motor user is that a motor failure should also be viewed as a systematic failure in itself. In today's highly pressurized environment for manufacturing and processing, the primary focus should not be on how to get a plant up and running quickly after a motor failure, but how to prevent the failure in the first place. Prevention is always better than cure, and regular condition monitoring surveys are already conducted in many plants to predict when and how a motor might fail. Not only does this help plant managers allow for repairs to be carried out on a planned basis, but it can also help avoid being forced into taking the quickest and usually most costly option when an impending problem is identified.

As all plant/maintenance engineers are acutely aware, if an unexpected motor failure does occur, the losses in production, delivery problems and lost revenues can soon spiral out of control.

The most effective way to deal with such situations is to have as much information about the plant and various options available beforehand, so that the quickest and most economic

continued



solution is immediately apparent.

By conducting an audit of all the motors used in a plant, noting their nameplate information, details of the application requirements and how important they are to production, spare units can be purchased, quickest/cheapest suppliers can be noted and all the information needed to ensure a reliable repair is immediately at hand.

Why Do Motors Fail?

Both the condition monitoring and plant audit should give clues to why a unit has failed, or is failing. Condition monitoring surveys can include electrical, thermal, noise, vibration and oil analysis, which can identify contaminated windings, failing insulation, bearings and lubrication to give engineers vital information as to the efficiency of the unit, as well as the cost and timescale of repairs. The equipment survey, on the other hand, provides information that allows engineers to assess the suitability of the motor for its application. For example, a motor may be burning out because of an insufficient power rating, or due to changes in the driven load or gearing as more power or torque output is required.

Environmental factors should also be taken into account, such as increased moisture levels or ambient operating temperatures, and the repair history of the motors can be used for working out the life expectancy of the unit after repair. Bearings are responsible for over half of all motor failures, and it is usually the result of poor maintenance practices such as

overloading, using incorrect or excessive amounts of grease for the application, or lack of cleaning.

Replacement Options

To keep downtime to a minimum, standard motors should ideally be kept in stock on site, but it is becoming more common for larger companies to have consignment stocks left on site by a contracted supplier to avoid the investment costs involved. If holding stock is not economical to the provider, or motor tasks are more specialized at a site, making an assessment of the potential suppliers with cost comparisons will also save time and money when the need arises.

When repairing a motor, having a good idea of what repair services are offered by a company and the respective costs of each level of repair can also be beneficial to avoid unexpected costs, i.e., the difference between basic reconditioning, re-insulating, stator rewinding, stator repair, major lamination repair or a new shaft.

Repair or Replace?

It is a general rule that standard motors of 11 kW or less should be replaced, as they are generally stock items available at short notice and are not cost-effective to repair; however, testing/dismantling to find the cause of failure is recommended. Depending on the severity of the failure mode, motors of 11 kW and above can be worth repairing. If the unit proves economic to repair, that repair can be completed quickly to take advantage of a shutdown period or returned to site as replacement stock.



In an emergency breakdown situation, though, the opportunity cost of waiting for an analysis nearly always outweighs the money saved through repair. Standard replacement units in the 11–250 kW range are usually available in less than 48 hours, so these can be a viable option. Exceptions to the 11–250 kW range include servomotors used for high-precision automation positioning systems, and motors designed for specialist power transmission applications. EFF1 high-efficiency and ATEX explosive atmosphere motors can also prove to be exceptions, as their complex designs make for expensive replacement, but also for more costly repairs. Additionally, standard motors that only require an electrical or mechanical overhaul can also be quicker and more cost effective to repair than purchasing a replacement.

Standard motors of 250 kW and above are more likely to be repaired, due to the longer lead times for larger motors. Exceptions to this rule are when failure is catastrophic; i.e., where bearing mounts, frames, stator cores or shafts need replacing. But even if this is the case, over the long term it is often worth repairing the unit and keeping it as a backup. Some companies can repair motors more quickly depending on the urgency of the job and nature of the failure; however, extra costs may be incurred, putting further emphasis on the need to plan ahead.

A survey should take into account previous repairs, enabling engineers to find out if the damage is isolated to the same area and whether the repair was to the correct standard or if the unit is again unsuitable for the application. If the damage is limited to these areas, and the previous job proved cost-effective, it is usually worth repairing the unit for a second time, but repairing additional damage may result in diminishing returns.

What Are the Benefits of a Repair?


If a motor has failed due to having the wrong specifications for its job (i.e., more output is required, it is subjected to dust, moisture or explosive gases), an upgrade repair can match the old motor to these changed conditions. For example, replacing the insulation can allow the motor to operate at higher temperatures. Moreover, high-speed bearings, lubricants and balancing can also improve rpm performance. It is also worth noting that during the repair process, the cause of motor failure can be ascertained and that information fed back to the customer, helping to prevent a recurrence of the problem.

When considering whether to repair or replace a motor, it is also worth noting that specialist companies can also increase the efficiency of motors during winding replacement, etc., allowing the “whole life costs” of larger motors to be significantly reduced. By logging this data and keeping it up-to-date as cheaper/more efficient replacements come on the market, plant managers can also make sure that the most realistic payback period is always available.

How to Choose a Supplier

Unless a plant already has an established survey of all the motors and a sound working relationship with both motor suppliers and repairers, choosing the right company to work

with can be a demanding task. Smaller sites may have all the knowledge required in the hands of a few experienced employees, while larger plants may use consignment stocks and a complex repair schedule with all roles applied to a few key suppliers.

The majority of sites fall in between, with engineers always juggling a number of suppliers who offer the best option for one service, but not for others. For example, an inexpensive motor supplier may not offer the required support in terms of problem solving for applications, or manufacturers may offer custom units but not conduct repairs and large suppliers that leave consignment stocks may not repair units. 

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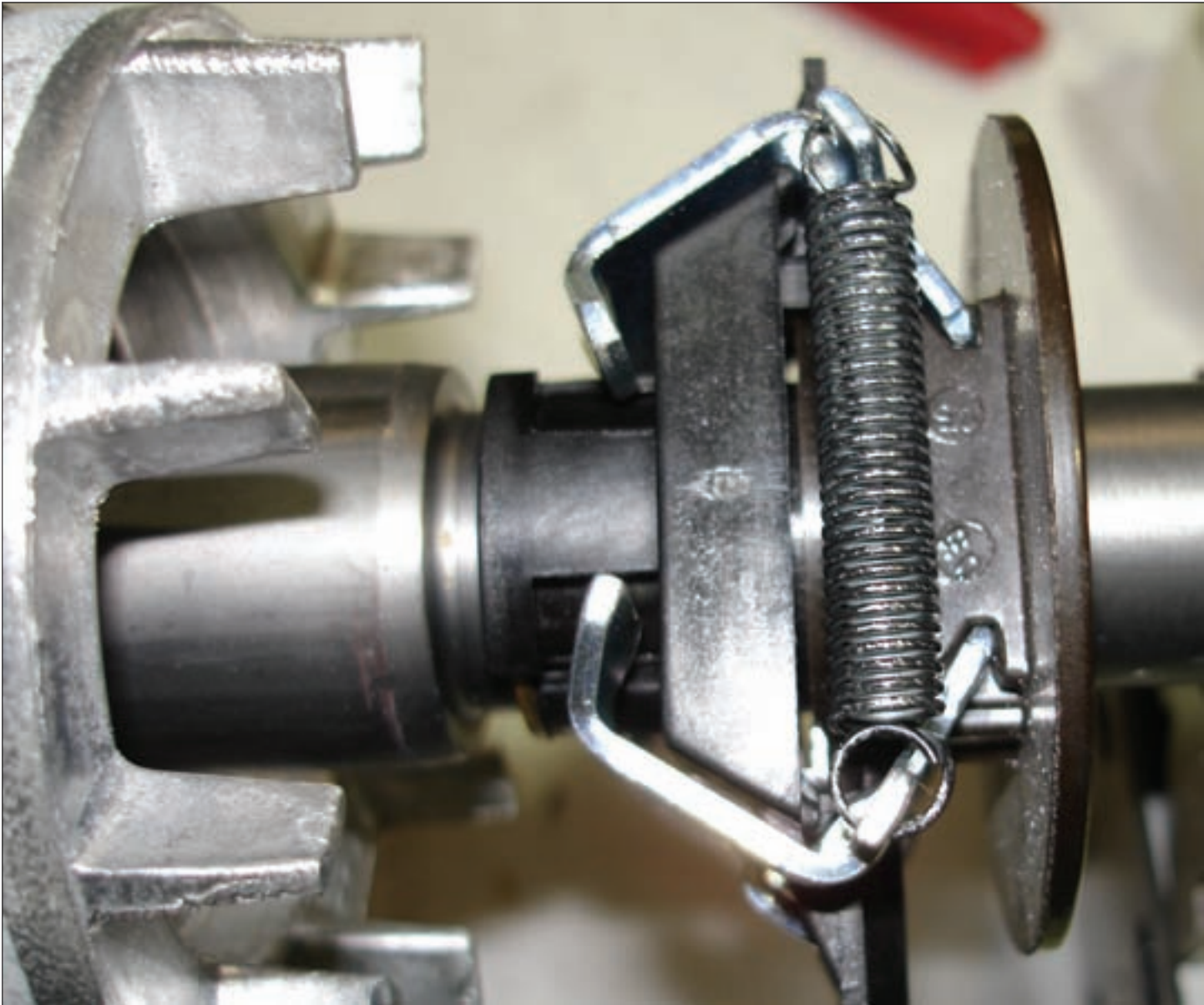
Dave Hawley is the general manager of Deritend Wolverhampton. Deritend repairs or replaces thousands of motors each year, and specializes in all aspects of motor replacement; from condition monitoring to conducting motor usage surveys, supplying motors off the shelf to repairing motors of any type or size to installing/maintaining the units and providing impartial advice in all these areas.

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Motor System



Typical centrifugal switch for capacitor start induction run motor.

Reliability Considerations

FOR COST-EFFECTIVE PURCHASING DECISIONS

Kitt Butler, Advanced Energy



In specifying a motor for an industrial application, reliability should be the first consideration above even price. Compromised productivity and downtime on an assembly line can cost far more in the long run than a motor's initial purchase price. The initial outlay for a motor is almost inconsequential in relation to its total cost of ownership. Motor reliability is crucial to equipment operation and smooth-running processes, which affect the bottom line much more significantly than buying equipment. Original equipment manufacturers (OEMs) can minimize the cost of ownership by using highly efficient motors and recognizing when unreliable motors are driving up the operating costs of their applications.

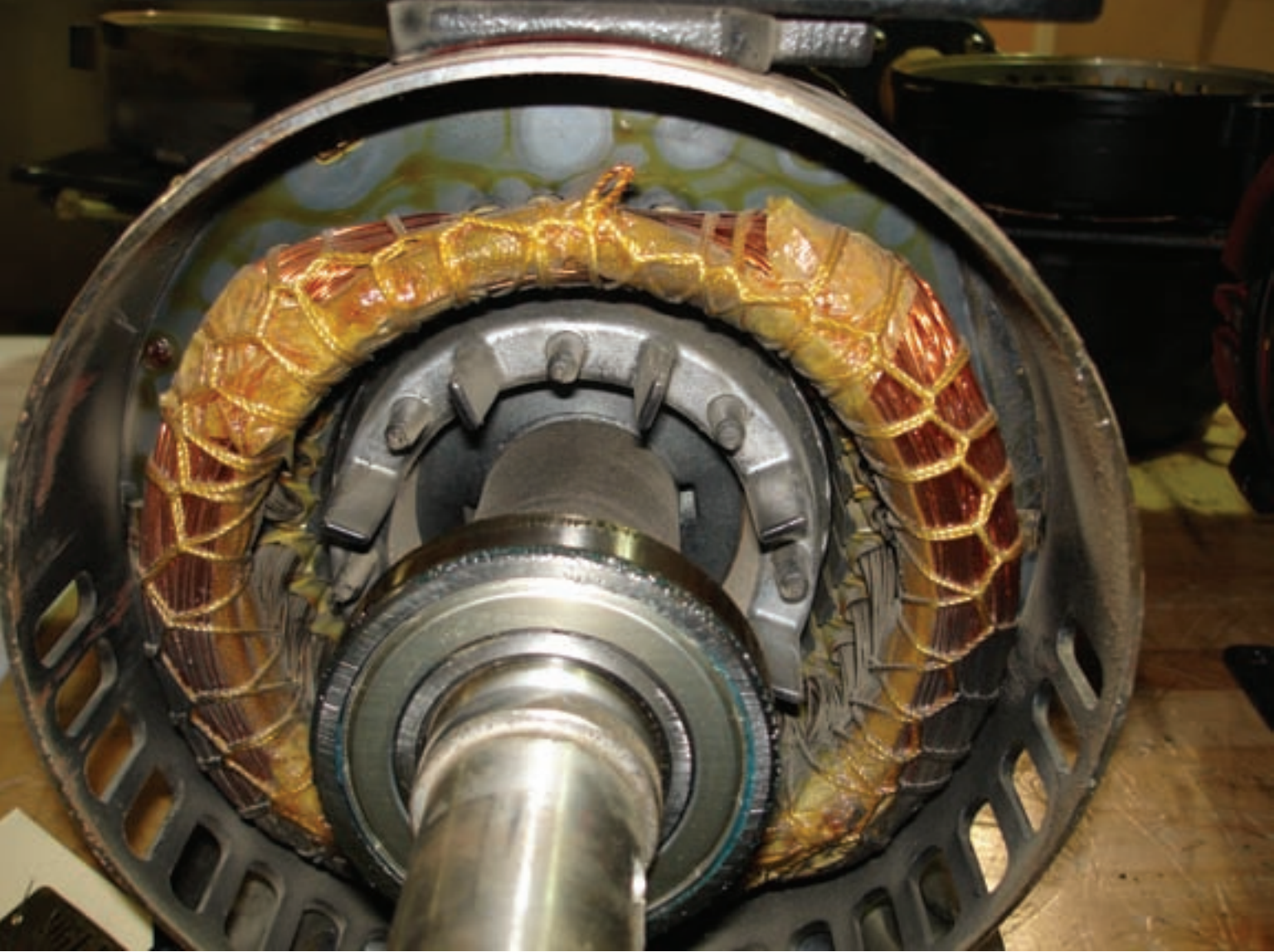
How long should a motor last before failure? This is an open discussion. Some experts suggest a design life of 15 to 20 years. Many motors are known to last much longer than that, while others fail in the first few years of operation, which is consistent with a bathtub curve where the front end relates to manufacturing variations, poor maintenance processes, or misapplication, and the back end relates to aging of the motors. A motor failure, for the purposes of this article, is a condition requiring the removal of the motor from service to repair a fault that results in an inability to provide one or more fundamental functions.

Bearing failure is the most common cause of failure in induction motors (the primary motor type in an industrial setting) followed by winding failures, which together account for 60 percent of all motor failures, with half of those occurring during normal operation. No OEM can afford to equip each and every motor in a plant with detection systems that would warn in advance of failures, so some equipment failure on the plant floor should be expected. The rate of failure, however, must be contained in order to keep an operation running smoothly and profitably.

Many industrial processes are driven by motors, and huge costs can be associated with lost production and downtime. Product downtime costs vary greatly, but the low end of downtime cost is estimated at about \$4,000 per hour for building materials to \$10,000 per hour for cement plants and up to \$2 million per hour for the refining industry. The cost of downtime due to equipment failure is not always measured in monetary terms. In evaluating cost of downtime (COD), failures that result in environmental or human safety issues are of the highest priority.

In ensuring motor reliability, there is clearly more at stake than profits and expenses; motor and equipment failure can also put an equipment manufacturer's reputation in the marketplace at

Continued



7.5 hp single-phase motor (drive end).

risk. OEMs often purchase motors by the thousands or even millions. Since these motors go into products branded with the OEM's name, the motor's quality and reliability become synonymous with the OEM, regardless of the motor manufacturer. OEMs are continually challenged to take cost out of their product, and the motor is often one of the most expensive components in the system. With rising iron, steel and copper prices, it is becoming more and more challenging to find low-cost, high-quality motors.

Whether the issue is large motors operating in plants or smaller motors operating in an OEM's primary product line, both manufacturers and end users are under exceptional pressure to reduce the cost of production, the cost of products and the cost of warranty claims just to stay competitive. If a motor is not

performing well over time, an OEM may consider replacing it with a new model. The decision to replace a motor must be given a bit of thought, as it is not a simple switch-out maneuver.

So what is "reliability"? Reliability is the probability that a system will perform satisfactorily for at least a given time period when used under stated conditions. This probability, expressed as a function of time, is called the reliability function or $R(t)$. Reliability engineers measure reliability for non-repairable equipment in mean-time-to-failure (MTTF) while mean-time-between-failures (MTBF) measures reliability in repairable equipment. Assuming a constant failure rate and an exponential distribution, the mean time between failures and the reliability function are expressed as $MTBF = \text{total operating time} / \text{number of failures}$.

When motors are used as recommended by their manufacturers, they are usually highly reliable and, just as important, repairable. But while a motor may be repairable, in some cases (such as with small motors) it is more cost effective to simply replace them.

To quantify a motor's reliability, accurate and dependable data is required. This can be difficult to track and calculate, even if plant personnel can collect historical failure data during operation, because it may not be possible to ascertain the reasons for the failure. In addition, this method often does not allow for accurately recording the operating environment in which the failure occurred, and this is often a key issue in failure because different motors in different environments experience different conditions.

It is also possible to utilize model

predictions to analyze equipment and system components to determine failure rates, but this requires complex mathematical formulations. The most pragmatic way to obtain failure data is through physical testing, an approach that is more suitable for smaller motors.

What type of information is beneficial for motor evaluation? There are several ways to evaluate and compare incumbent and potential replacement motors:

- **Inspection build analysis.**
Early in the process of selecting a motor, product samples should be disassembled and compared to each other as well as to a known motor that the OEM may have used for many years already (incumbent). Manufacturing defects or design differences can be easily pointed out, documented, and even changed by the vendor before proceeding further.
- **Performance characterization.**
OEMs must be confident

that the new motor will work in the given application. It's best to test a set of sample motors to fully define torque over a given speed range (speed/torque curves). This testing will also demonstrate how well the motor performs under load and temperature, a key issue, as heat kills motors.

- **Endurance testing.** After the first sets of tests mentioned above, most OEMs have identified a motor that is a good candidate for further testing. Next comes endurance testing, which should be designed based on the OEM's equipment's operating characteristics and the duty cycle the motor will experience under the equipment's full warranty period. This can also include worst-case scenarios that the equipment might experience during operation. Once the test parameters are defined, several potential replacement motors can be placed in test with

several of the incumbent motors for comparative purposes.

- **Post-endurance testing.** After the motors have been put through the paces, OEMs should consider testing speed-torque curves and heat runs again to make certain performance has not degraded as a result of the endurance testing beyond an acceptable level.
- **Post-endurance build analysis.**
During the endurance testing, all motors tested will experience wear but may never fail. No endurance test can account for all of the potential faults a motor might see during operation. Knowing which components in the motors experience the most wear can lead to design improvements in the motor before an OEM takes shipment on the first order from a new supplier.

During endurance tests, the OEM at times requires a number expressing motor reliability for a critical process. To obtain this number, carefully de-

Continued



Motor reliability test bed.

signed testing of a number of identical motors will be necessary. There are two main ways this can be achieved. One is to measure the time to failure for sample motors, fitting the data to an appropriate distribution and analyzing the results, which will reveal the probability of a certain lifetime for the motors. Unfortunately, the sample motors must be tested until each fails, and that may take an extended period of time and not be cost-effective.

The second method specifies the desired motor reliability in a given time period and tests a statistically significant sample to demonstrate that the product meets the reliability goal. A few motors can be tested over a long period of time or a high number of sample motors can be tested in a short time, but both options can be expensive. A compromise can be found through speeding up the testing cycle with a reasonable number of samples that are analyzed with statistical tools to determine reliability. These methods are really only efficient for single-phase motors and three-phase motors smaller than 5 hp, which constitute much of the industrial OEM motor population.

Single-phase induction motors often develop problems with the starting circuit components (which are more susceptible to failure than other motor components). An endurance test in this case might involve rapidly cycling the motor on and off under load, causing severe stress, inrush current and severe electromechanical forces. The rapid cycling can also overheat the motor windings and bearings, accelerating motor failure. This is an example of how endurance tests are designed so that failure mechanisms of interest are accelerated.

This testing practice, however, is not practical for multiple large motors. A better method for larger motors would

be examining historical data on motors operating in a given plant. Unfortunately, few plants keep sufficiently detailed records of their motors and failures. But even if they could, the number and types of motors vary so much in a single plant, comprised of different manufacturers, with each motor operating under such different conditions, different maintenance practices and different operating schedules, that it is doubtful any statistics gleaned from such research would be dependable.

Vendor qualification testing can provide some assurance regarding reliability and the lifetime cost of a new motor. This involves a battery of performance tests as mentioned above, including temperature rise, locked rotor and breakdown tests as well as motor build and inspection analyses (MBIA). In the MBIA, sample motors are torn down to examine and compare component quality to that of the incumbent motor.

Case Study


Recently an OEM that manufactures a wide array of products and control systems needed to evaluate motor performance to select the best motor for its application. The OEM has a world-class testing lab with strong capabilities but was not equipped to test motors, so it began consulting with Advanced Energy for guidance.

A global RFP was sent out with several motor manufacturers responding. Through performance testing (speed-torque curves) matched against the OEM's set objectives, the candidates were quickly whittled down to two brands. The next task was to determine, through testing, which motor would hold up best to the operating parameters it would face. Testing the motors over their life spans in the field was not feasible or practical. Devising a test in the lab that could simulate the operating life could be done but might take years—again, not practical.

The OEM's engineering team was determined to make the best choice and do it within the project timeframe (about three months). Through discussions with Advanced Energy's motor systems engineers, it was determined

the capacitor start motors being considered for this application were most vulnerable at the start windings and the switch that automatically engages the run winding once the motor comes up to speed. Also, it was determined by the OEM that during a normal operating life its product systems would be operated (turned on and off) 300,000 times. The last thing to determine was how many motors had to be tested to get a fair representation of each supplier.

With five motors from each supplier (10 total) in hand, the Advanced Energy team went to work building a test rig and devising a control mechanism to test for motor reliability. There were many issues to be addressed to get 300,000 start/stop cycles within an acceptable time frame: the motors needed to be loaded; they needed to come up to speed to engage the capacitor switch and stop again so they could be restarted quickly; a system for control and remote monitoring needed to be established, as testing was continuous, seven days a week; and temperature rise from rapid starting and stopping needed to be monitored and minimized as a variable due to the accelerated life cycle testing each motor was being subjected to.

After 10 weeks of testing, the OEM now has the information needed to make an informed decision. Its team members have specified to the winning supplier the exact design they will need. And to be on the safe side, they are bringing back more of these motors for further reliability testing in the lab. 

Kitt Butler is director of motors and drives for Advanced Energy in Raleigh, NC. Advanced Energy houses the only independent NVLAP-accredited motor testing facility in North America.



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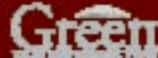
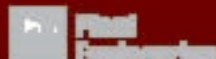
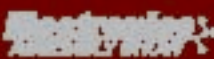
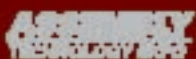
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MOTOR DECISIONS DO INDEED MATTER— BIG TIME!

CEE/NEMA Repair-or-Replace Campaign Saves Energy, Dollars and Downtime

Jack McGuinn, Senior Editor

“Based on U.S. Department of Energy data, it is estimated that the NEMA Premium motor program would save 5,800 gigawatts of electricity and prevent the release of nearly 80 million metric tons of carbon into the atmosphere over the next 10 years. This is the equivalent to keeping 16 million cars off the road.”

— *National Electrical Manufacturers Assn. (NEMA)*

Not since this nation’s oil crisis of the mid-1970s has awareness of that ever-precious resource been so prevalent in the news media and among citizens, industry and government—both federal and state. (Remember when oil was a commodity? And \$60 for a barrel of crude was just four years ago the record high?)

Anyone old enough to remember those days of block-long lines at the gas pumps and rationing for gas stations will tell you that it was not only the height of inconvenience but more than a little unnerving as well. Despite that wake-up call 30 years ago, we as a country have done—or sacrificed—little in an attempt to become oil independent. Shortly after the crisis passed—after resolution of the Iranian-U.S. embassy hostage drama and Ronald Reagan’s 1980 election—two things happened: gasoline was once again flowing at reasonable prices and the whole episode was, for all practical purposes, forgotten, at least at the consumer level.

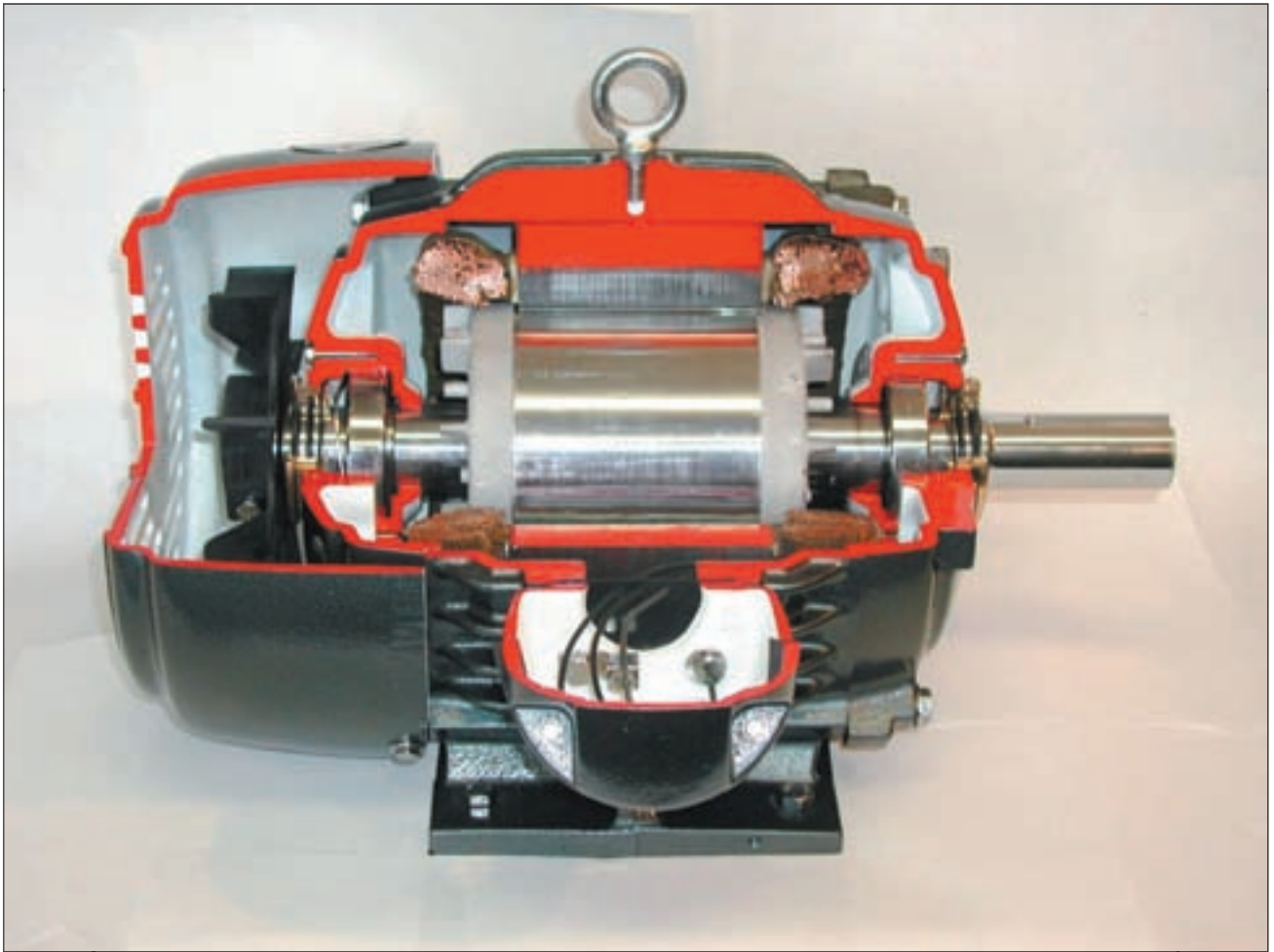
Today, it is encouraging to know that although we as citizens have yet to be asked by our leaders in Washington to do anything even remotely approaching sacrifice, American businesses and industries have in some important ways (with some prodding and incentives from government—especially at the state level) taken the lead in energy conservation. Terms like “global warming,” “fossil fuel,” “carbon footprint” and “green-

house gases” are now on the lips of CEOs everywhere across the land. Cynics would say it doesn’t require a charter member of the Sierra Club to know that being “green” has become an essential if not unavoidable marketing platform for industries of all kinds—pressured, some would say, by customers and environmental groups of all stripes.

But there’s much more to it than that. A variety of manufacturers are making honest efforts to establish or maintain their reputations for being responsible corporate citizens, and believe that being environmentally proactive is in their view a commonplace “best practice” endeavor in running their business, making a profit and supplying their customers.

That has never been truer than is the case with both U.S. motor makers and the industries that they supply. Motor manufacturers have for the last decade been working at reengineering motors of all sizes with the goal of making them as dependable and energy-efficient as reasonably possible, without any compromise in power. And their end-users—whether they use motors in, for example, their distribution facilities or in their automated packaging plants—are jumping on the environmental bandwagon in significant numbers. Why is this happening now?

One reason is the passage into law last December of the Energy Independence Security Act (*EISA*—<http://energy.gov>).



As more robust motor efficiency standards are mandated, NEMA Premium-grade motors such as this one from Emerson Motor Co. will require an increase in copper packing.

senate.gov/public/_files/RL342941.pdf), which, among other things, sets forth new, more robust efficiency standards for general purpose and many other industrial motors used in a multitude of automated applications. The legislation, although stripped just prior to passage of most of its tax and production incentives for alternative sources of energy, is a step—however uncertain—forward on the long road to energy independence.

The other reason—and a more compelling one—is the work done over the years by two organizations, readily known in the motor world: the Consortium for Energy Efficiency (CEE) and the National Electrical Manufacturers Association (NEMA).

Founded in 1991, the Boston-based CEE is a not-for-profit, North American organization with approximately 100 members—primarily electric utilities and various non-profit regional entities—dedicated to promoting energy-efficient products, technologies and services that impact in a positive way upon residential and commercial energy usage. A small sampling of CEE members includes Idaho Power, New England Gas and the Ontario Power Authority.

NEMA, located in Rosslyn, Virginia, was founded in the 1920s; it is an American trade organization of about 450 members critical to the “generation, transmission, distribu-

tion, control and end-use of electricity,” in the United States. Members include such familiar names as Baldor, Bodine, SEW-Eurodrive and many more.

Awareness key to decision making. A very important part of what both organizations do is the Motor Decisions Matter (MDM) campaign, conceived in part and sponsored by the two groups—along with their collective hundreds of member company co-sponsors—and in conjunction with the U.S. Department of Energy (DOE). As the CEE’s website puts it, the campaign co-sponsors represent “300 years of combined motor experience” relative to motor manufacture, sales and repair centers, utilities and government agencies.

In brief, the national public awareness campaign exists to help answer a central question manufacturing facility managers and personnel have long struggled with regarding motors in their daily operation—replace or repair? And by virtue of the data, guidelines, standards and recommendations developed over the years by both the CEE, NEMA and their member companies, motor end-users (i.e., factories, most any other physical plants and numerous other applications) now have the proper tools and information to answer that question in a clear and reasoned manner.

NEMA and especially the CEE are very much involved in

Continued

other related arenas having to do with energy conversion, as well as its use and conservation. But the focus here is on the Motor Decisions Matter effort—what it is, how it works, why it is important—and how that applies to the newly imposed EISA standards for motor efficiency. It's news you can use, and it may enable you to gain a step on your competition, although for now it appears to be a fairly well-kept secret.

"It's curious in that we haven't seen much in the trade press yet about the (new) standards," says Ted Jones, senior industrial program manager for CEE. "They're out there, but no one seems to be really aware or talking about it much. One of the first things we're going to do is raise awareness that the standards are out there. The focus of MDM has been on motor management, and a lot of that is focused on the repair/replace decision-making regarding a failed motor."

Why motor decisions matter. Beyond "awareness," what in essence matters most in the campaign is this: manufacturers and facility managers can offset skyrocketing energy costs, conserve energy consumption and reduce greenhouse gases by implementing sound motor management and planning. Becoming familiar with MDM's goals has led companies to see the campaign as an opportunity, and not solely to make money. Rob Boteler, director of marketing for Emerson

Motor Company and chairman of the NEMA Motor and Generator Marketing Committee, explains.

"We as a company saw that our products had the potential to make a difference. We all have our own personal feelings about climate change, but I think from a motor manufacturer's point of perspective. We like to say that our motors are large converters of electricity; we convert electricity into rotating torque and we saw a way to produce higher performance products that would ultimately reduce greenhouse gases."

Valone A. Gomes, national OEM sales and product manager, low-voltage motors, for WEG Electric Motors Corp., also welcomes the new EISA standards as well as the MDM campaign. He looks at both as opportunities for WEG to show the market how far they've advanced in the production of efficient motors.

"MDM is good for WEG because we have the product that a lot of competitors don't. It's going to prove to the market who actually has the (most efficient) product, who has invested in technology and who is actually on the cutting edge of technology to have motors with high efficiency. It will differentiate us from most of the market."

We've thus far discussed why the MDM campaign is a good thing, but what, exactly, is it? How does it work? What are its specific goals?

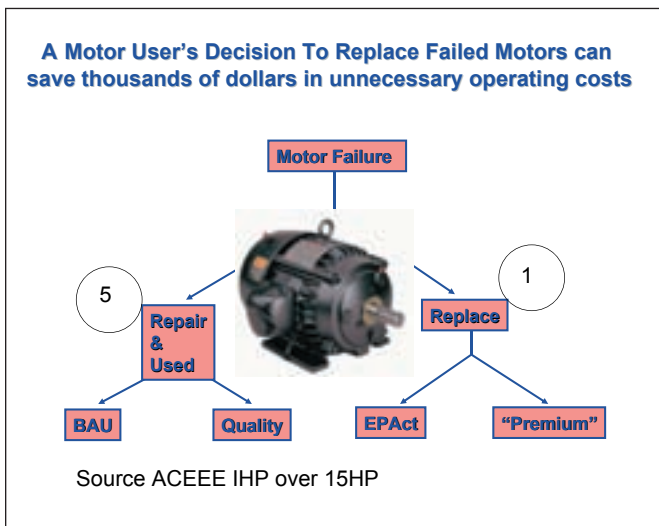
In one sense, it's all about repair-or-replace and the NEMA Premium motor. But other factors also apply, like penny-wise, pound-foolish thinking.

"The key thing with MDM is when you're looking to make that repair-or-replace decision, are you focused solely on that 3-5 percent first cost," says Jones. "And trying to translate that from technical-speak to business-speak is a large part of what MDM is all about. And having that message and that lifecycle costing approach endorsed by multiple, credible resources, e.g., CEE, NEMA, EASA (Electrical Apparatus Service Association—www.easa.com, the DOE and many more). So MDM provides a platform for that.

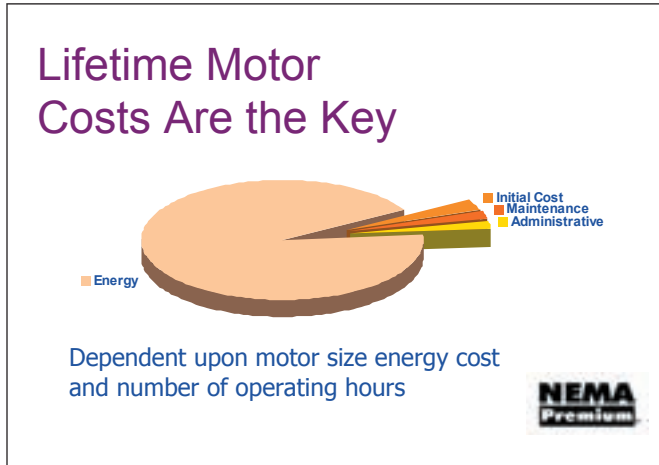
"And when you talk about when your motor fails and you know what you're going to do, that is a matter of panic and planning. If you planned and if you tagged that motor, you know what you're going to do because you've run the numbers. That makes a big difference. If you're going to replace it, are you going to replace it with an EPAct motor or a NEMA Premium motor? If you're going to repair it, are you getting a "best practice" repair as defined by EISA or EASA? That assures that you're going to maintain the efficiency rather than degrade it during the process."

The EPAct motor referred to above derives from the Energy Policy Act of 1992, the last time motor efficiency standards were established prior to the 2007 EISA. At the time, manufacturers and end-users were allowed five years to reengineer their products or upgrade their facility with the then higher-efficiency EPAct motor or to upgrade their existing motor population with best-practice repair.

Placing a premium on high-efficiency motors. But now, as mandated by last year's EISA legislation, it is the NEMA



Charts courtesy of Emerson Motor Co.



Premium motor that sets the gold standard for motor efficiency. William Hoyt, industry director for NEMA, explains how that came to be.

“NEMA was very much involved back in 1992 when they put in the EPAAct regulations that were based on our MG1 standard for motor efficiency tables. We have continued throughout the years to cooperate with the DOE and some other interested environmental groups such as ACEEE (Washington, DC-based American Council for an Energy-Efficient Economy—www.aceee.org) to raise the level of motor efficiency as it comes into play.”

But after some back-and-forth with the ACEEE over implementing individual, state-by-state standards that proved unworkable, says Hoyt, the question arose, “Should we attempt to raise the efficiency levels on a broader scale nationally in the Energy Security Act? And they pretty much agreed that was a better way to go. It just so happened that (in 2003) we (NEMA) already had the NEMA Premium tables in place for premium-efficiency motors that were over and above what EPAAct required. So we just translated the efficiency tables from the NEMA Premium on the 1 to 200 hp and a couple of different types and designs of motors and said, ‘Let’s make that the new national minimum efficiency level standard for that class of motor.’ And we also took an additional class of motor—the 201 to 500 hp motor and proposed that to be the minimum efficiency level for that type of motor.” As with the last-iteration EPAAct motor and standards, the new benchmarks also have a grace period, ending in 2010.

The tables Hoyt refers to are important to understanding the benefits of higher-efficiency motors. “There is a direct correlation between the efficiency of industrial motors to reducing the carbon footprint, taking cars off the road, reducing gigawatts off the grid. Whatever analogy you want to use for being able to understand why this is a value to the society as a whole.

“Our technical committees have come up with realistic tables for what can be achieved from an engineering standpoint, from a cost-effective standpoint and from a practical standpoint, as well as for being able to produce and sell something on a reasonably profitable basis.” Hoyt also points out that a correct motor and correct sizing for a given application is of equal importance if best-practice methods are to be adhered to. “Choosing the correct motor and size for the application is critical to the efficiency aspect of it. You can manufacture the most efficient motor in the world, but if you don’t size it right for the application, you’re not going to get the efficiency you should.”

If this sounds at all confusing, relax. There are plenty of motor manufacturers out there ready to give you a hand in auditing your facility’s motor inventory. Siemens Energy and Automation Inc. is one of them.

“Yes, we work with customers,” says Tony Giamba, product marketing consultant/NEMA motors for Siemens. “In fact, we have an energy efficiency calculator that’s available to our customers online (siemens.com/energysaving). It allows them to

compare a NEMA Premium efficiency motor with whatever they may have in their factory. You can put in quantities, hours of operation, whatever their energy costs are, and it will actually give you a payback time; it will tell you your power saved in a year’s time.”

And is the MDM campaign good for a company like Siemens?

“Absolutely,” says Giamba. “Because what their campaign is about is exactly what we’re doing. We’ve made a more efficient motor, so we want our customers to understand why having an energy-efficient motor is better. And that’s exactly what the MDM campaign is doing.”

Motor makers in high-gear mode. As a result, Siemens, like many other motor makers, is gearing up for when the EISA standards go into effect in 2010. Giamba says the company is developing a “new product road map” that will highlight the new efficiency levels. That’s because some of Siemens’ product line is not yet up to the impending new standards, although they do in fact meet the 1992 energy act standards. Giamba says the company is now redesigning all its products to meet the 2010 standards.

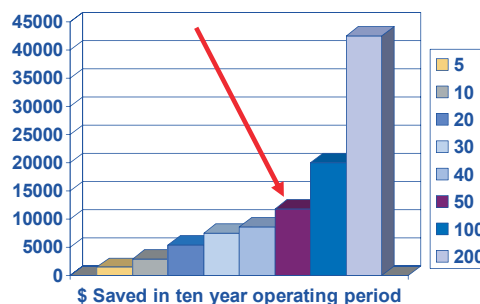
Boteler says the same holds true at Emerson. “One of the things it (the new standards) does of course is it forces redesigns, and in some cases, major changes at the factory level because we’re switching from maybe 20 percent of our products being NEMA Premium today, and tomorrow it’s going to be 80–85 percent. That’s why we needed the three years (prior to 2010), so that we could get all of our laborers and our machinery and everything aligned as we move into a different mix.”

Another reason Boteler is a big fan of MDM is that it provides sales representatives an opportunity to change the collective mindset of facility maintenance managers; that MDM, the new standards and NEMA Premium are indeed a good thing.

“You know, you can go in and talk to the maintenance people all day long, and they’re like, ‘Yeah, I know we should

Continued

Premium Savings Over Ten Years



A 50hp motor can save the equivalent of a significant labor cost reduction over ten years

Courtesy Emerson Motor Co.

All the Tools You Need for Motor Management

Following is a listing of MDM tools and resources available online (www.cee.org) to interested parties. They serve to further explain the MDM campaign and how adhering to it can help you realize significant savings in energy usage, energy cost and downtime:

Motor Planning Kit

A booklet providing a comprehensive overview of motor management, including available opportunities and how best to implement a number of plans ranging from generic purchasing policies to total motor inventory. Available online and in print.

The 1-2-3 Approach to Motor Management—Users' Manual

Developed by Emerson's Boteler, this step-by-step guide explains how to use the 1-2-3 spreadsheet. It also suggests a process for applying the results to convey the financial benefits of sound motor management to your customers.

The 1-2-3 Approach to Motor Management Spreadsheet

A simple how-to guide for getting started in motor management for your facility. It is intended to benefit motor service centers, vendors, utilities, energy-efficient organizations and others in relating the financial benefits of sound motor management to their customers.

Simple Savings Chart

Just log in the number of hours of operation and electricity cost in this spreadsheet and it will provide a side-by-side comparison of annual energy costs and annual energy savings for pre-EPA 1992, EPA 1992 and NEMA Premium motors. Includes calculations for TEFC and ODP motors.

MotorSlide Calculator

This slide rule calculates annual energy costs and annual energy savings based on electricity costs, motor size, motor efficiency and hours of operation.

CEE Motor & Drive Program Summary

Explains the value of energy efficiency programs in bringing financial, technical and educational resources to commercial and industrial markets. It supplies an overview of programs that support the use of NEMA Premium motors, ASDs (adjustable speed drives), motor management services, system optimization and other energy management strategies.

Trifold Brochure

Provides a thumbnail sketch of motor management. It is intended for C-level managers to learn more about motor management. Available online and in print.

How-To Guide to Bringing Motor Management to Your Customers

Online guide offers tips on helping your customers implement motor management plans.

be using more efficient motors, but we just have an expense budget and if I repair an old motor for \$100 instead of replacing it with a brand new premium efficiency motor for \$150, I get good marks.’

“So what we have to do is to try and explain at the financial level the benefits of the \$150 motor versus the \$100 repair. And of course when we do that we have to switch from upfront cost to lifecycle cost, and that’s really where the whole initiative for MDM applies in trying to explain lifecycle cost and why that’s important at the end-user level.”

So what is a NEMA Premium motor? The CEE’s Jones defines it as a “branded product that meets a predefined specification level. NEMA Premium is two things—it’s a spec and it’s a brand, endorsed by CEE and NEMA. So when utility programs talk to a customer and when motor marketing people talk to a customer, they’re talking about the exact same motor in terms of efficiency. It’s not Baldor or GE; it’s a performance level.”

To repair or replace looms large in 2010. NEMA’s Hoyt points out that the MDM campaign will soon be updated regarding the new regulations slated to come online in 2010. He says by that time marketing of NEMA Premium will wind down because they’re going to be required in any event. He adds that repair versus replace will be the next marketing platform. And while motor repair shops will always have a place in the market, Hoyt says that there are factors to be considered.

“The repair shops will tell you that they can repair (a motor) to the efficiency level that’s on the nameplate of the motor, but if it’s 15 or 20 years old, what’s the efficiency of that 20-year-old motor?”

Siemens’ Giamba sheds further light on the repair versus replace dilemma.

“EPAAct only went into effect in 1997, so there’s probably a lot of motors out there that don’t even meet the EPAAct efficiency level.”

And believe it, those new efficiency levels matter. Just ask Boteler.

“We can argue that, depending upon the load of the motor and a lot of other variables, you may or may not get that (savings) benefit, depending on your individual application. But overall, if we can take a motor in an existing application and make it two or three points more efficient, we are reducing the overall energy usage and the overall greenhouse gases that we’re producing as a country.

“I think to us at Emerson, that’s something we’re aware of.”

(Editor’s Note—For further proof that good motor management can save you significant savings and improved downtime, simply go to the CEE’s website (www.cee.org) and review the many real-world case studies there documenting how various companies in a variety of industries made it happen. See also a story on motor replacement on page 15.)

For more information:

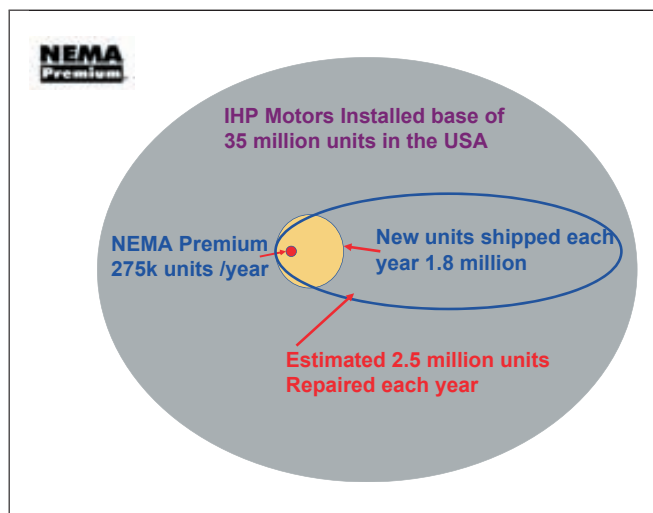
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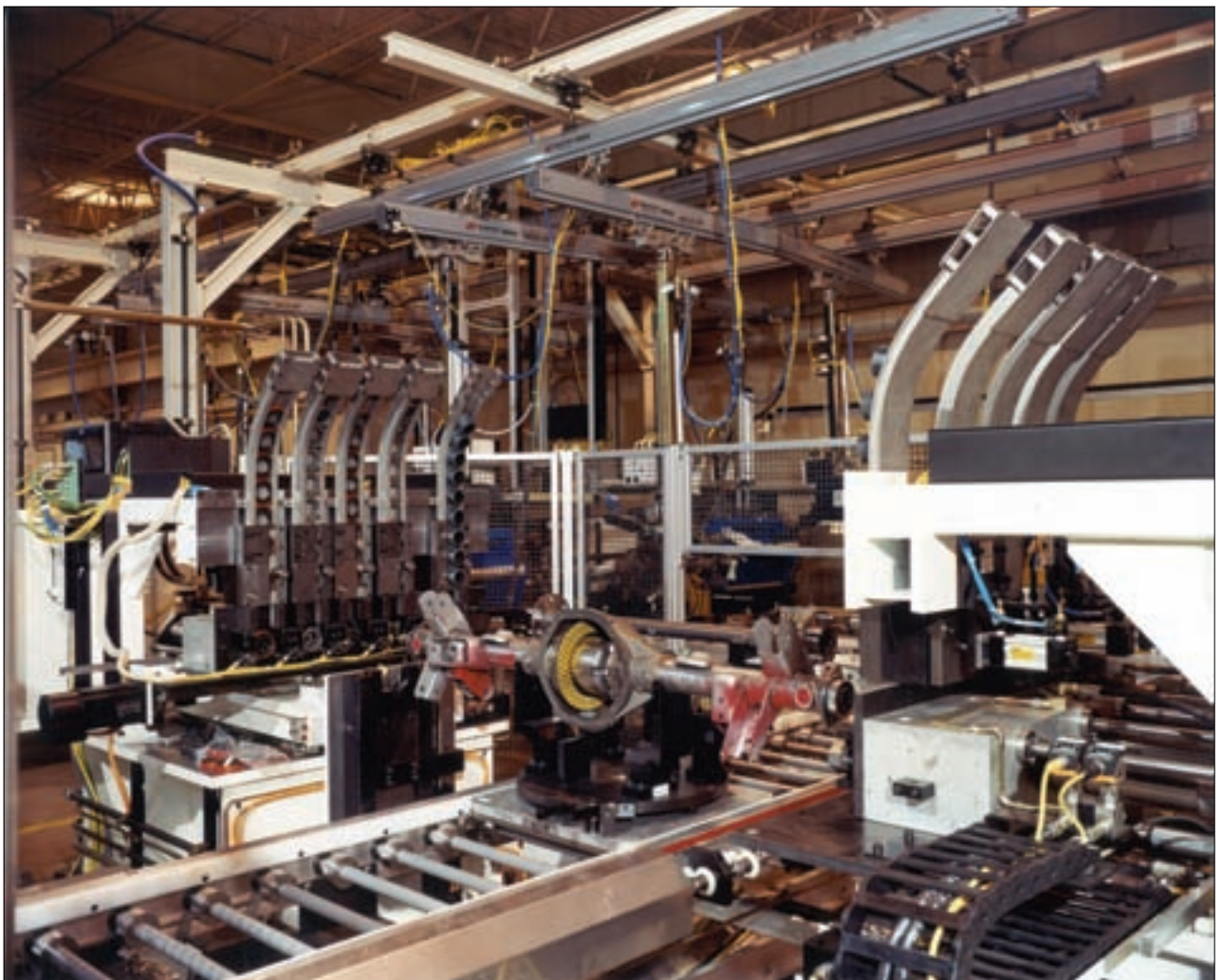


Courtesy Emerson Motor Co.

Custom-Made Manufacturing

Sound Business Model Increases Opportunities for Misumi USA, Inc.

Matthew Jaster, Associate Editor



This axle press station by Cincinnati Automation uses a variety of components provided by Misumi USA, Inc.

Cincinnati Automation & Test, a provider of automated assembly and quality testing equipment located in Machesney Park, IL, knows all too well the pressures of meeting the needs of its customers. With a demanding factory floor schedule, the company cannot expect “off-the-shelf” supplies to meet the diverse specifications needs of its various products. Due to customization, this puts many conventional suppliers at a disadvantage.

“If the standard part no longer meets the specification, we need to be adaptable and diligent with costing while reinventing or reworking our previous designs. Compounding this is the need to maintain minimal inventory, faster turnaround on projects and overall cost containment. It all adds up to quite a challenge,” says Noel Nichols, director of standards and development at Cincinnati Automation & Test.

Though Cincinnati Automation has an assortment of standard equipment modules such as conveyors and material handling devices, the core of its business comes from special automation systems for the assembly of light- and heavy-duty finished products. These systems typically have components that must be configured and adjusted for each application.

“We rely heavily on our supplier base for the production of components, allowing us to focus on our core strengths of engineering and system integration. Once our design solution is established, we have a regimented system of part supply and procurement,” Nichols says. “Engineering identifies the part, such as a shaft, collar, roller switch assembly, structural section, motor or bracket, and then procurement places the orders. We emphasize the functionality of the part, the price and the delivery schedule.”

According to Nichols, cost is minimal during the initial design stage. As the design takes shape on the factory floor, however, the cost rises dramatically. Should a part be out of spec, late for delivery, or the quantity not exactly what was ordered, the impact becomes more severe, says Nichols. “In the final stages of assembly and system testing, failures become critical.”

Cincinnati Automation finds success in identifying and establishing relationships with unique suppliers for its component needs, and Misumi USA, Inc. fits right into that description. Headquartered in Schaumburg, IL, Misumi has provided various components for Cincinnati Automation for more than six years.

“Since the first products were sold in 2003, the relationship has developed quite nicely,”

says Mike Ricketts, account manager for Misumi. “From an initial six components, Cincinnati Automation & Test now buys over 70 families of products from Misumi. These range from simple washers and linear shafts to locating bushings, circular posts and oil-free bearings.”

This relationship works because Misumi boasts a business model that dovetails effectively with Cincinnati Automation. Ricketts calls the configurable component “a toolbox for the imagination” of a machine designer, and customers have repeatedly stated they can receive finished products from Misumi at less cost than bringing the raw materials into their shops for in-house machining.

“We chose Misumi as a supply partner because they have good quality, prompt delivery and excellent cost advantage for us—these factors contribute significantly to our customers’ satisfaction. Often we buy parts in small quantities, and with most suppliers there are cost issues, right from the start. In working closely with Misumi, we quickly realized there were cost and quality advantages to their standard components,” Nichols says.

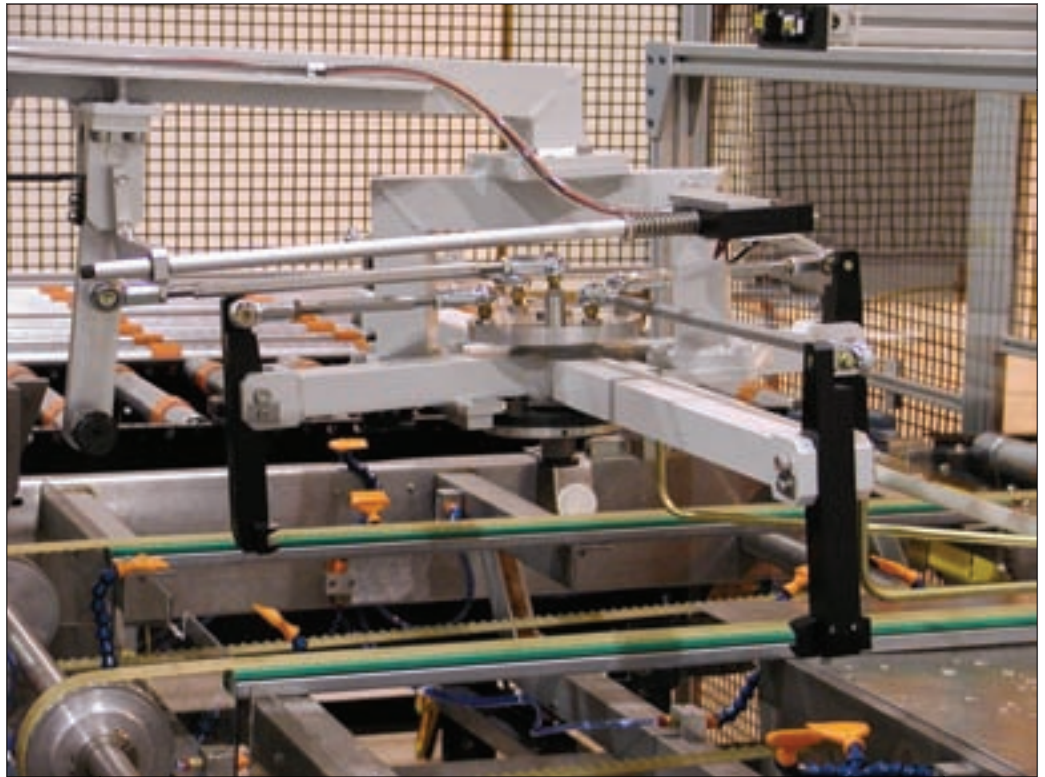
According to Ricketts, Misumi’s customer base is oftentimes building one-off machines for dedicated operations. In numerous cases, a custom machine is being built with 100 percent Misumi content. Subsequently, when the customer gets reorders or chooses to take the machine to general production, considerable carrying and inventory costs are saved through its unique shipment policy where all the components arrive before the machine enters the assembly phase.

Misumi’s delivery system allowed small and large lots of parts at Cincinnati Automation, whether standard or configured, to arrive on the assembly floor at the optimum time for the machine build schedule. In the overall cost picture described by Nichols, this was a dealmaker, as it complements Cincinnati Automation & Test’s VMI (Vendor Managed Inventory) strategy.

Cincinnati Automation originally sourced a local machine shop for an anti-backup latch for their conveyor systems, but soon realized they could configure and purchase the part directly from Misumi and save time and money.

“Another differentiator is that Misumi has a CAD configurator that allows our engineers to configure a part, download the native CAD file, modify the file and then insert the file into our CAD assembly, thereby saving substantial time

Continued



Misumi supplied this gripper mechanism with custom-configured parts for Cincinnati Automation, helping the company enhance their status as a key component supplier.

and cost in the design phase," Nichols says.


Solidworks and *AutoCAD* programs are primarily used in designing Cincinnati Automation products and these programs are resident in the Misumi CAD Configurator, thus allowing Cincinnati Automation to easily import the native files into their assemblies.

"Oftentimes, a customer requires a unique product solution for a particular job and we find that it also provides a solution for many other customers with similar applications. After working through any proprietary design issues, we offer such products through our catalog to achieve cost advantages by producing in higher volumes," says Chris Blaszczyk, manager of product development for the automation components division at Misumi. "Working in synergy with our customers yields superior results for everyone. We're quite pleased about the relationship we have with Cincinnati Automation & Test and believe that is has helped to create a new industry standard."

Another strong selling point is Misumi's aggressive ad and public relations campaign. The company markets specifically to machine designers and automation builders in hundreds of relevant media sources, both print and online. The company also participates in numerous trade shows and conducts its own Configuration

Technical Seminar series across the country in an effort to court new business opportunities.

At the end of the day, however, it's project management at Misumi and Cincinnati Automation that has benefitted both companies moving forward.

"Overall project management is founded on the triangle of quality, price and delivery," Nichols says. "The old business maxim that you can only have two of those things simply doesn't work in today's business environment. We can and we must have all three, working in concert to support our unique machine build requirements, or the supplier is simply off our team." 

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What Can Handle a Crowd of 80,000 and is Still Asking for More?



The screenshot shows the homepage of powertransmission.com. At the top, there are navigation links: Home, Advertise, Subscribe, About Us, Buyers Guide, Search, Login, and geartechnology.com. The main content area is divided into several sections:

- POWER TRANSMISSION ENGINEERING**: A section for the April 2008 issue of PTE magazine, featuring a technical drawing of a gear assembly. Below it are links for "Read Complete Issue (PDF)", "Table of Contents", "Subscribe", and "Submit an Article".
- BUYERS GUIDE**: A central section titled "What are you looking for?" with a search box and "Look I Search" button. It contains two columns of product categories:
 - A-Z Company List**: Actuators, Adjustable Variable Speed Drives, Brakes, Chain & Chain Drives, Rolling & Ball Drives, Brakes, Clutches, Controls, Couplings & Joints.
 - Complete Product List**: Seals, Gear Drives, Gear Box Services, Hydraulic Pumps, Linear Motion, Motors, PE Accessories, Sensors, Other Components.
- FEATURED ARTICLE**: A section with a graph showing data trends.
- CALENDAR**: A section titled "See All Calendar Events" featuring the "10th Annual European Supply Chain & Logistics Summit (May 13-15)".
- Right Sidebar**: Contains logos for Fairfield, GTO, and Precipart, along with a "Custom Motion Control" advertisement.

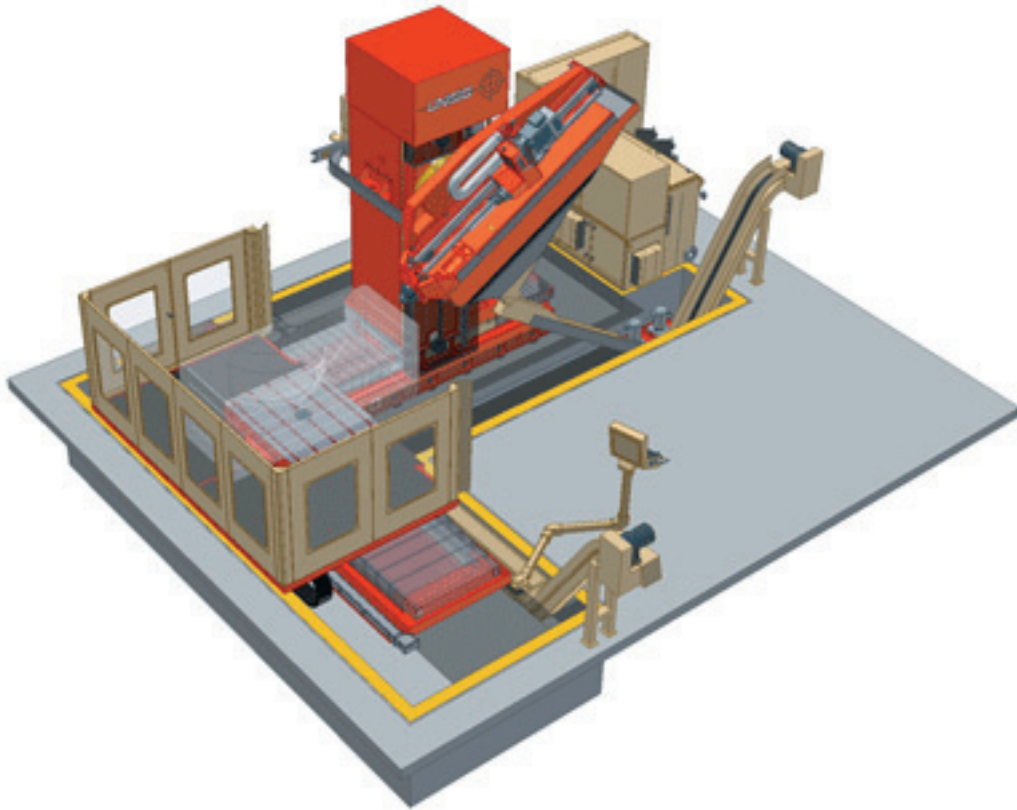
■ Find suppliers for the products you need

■ Latest news, Updated as it happens

■ Improved Buyers Guide format (free listings now available)

powertransmission.com averages more than 80,000 unique visits per month

www.powertransmission.com



Mold Machining Center Maintains Accuracy

ENTRUST ENLISTS ADVANCED MACHINE & ENGINEERING FOR 7-AXIS, 2-SPINDLE PERFORMANCE

Matthew Jaster, Associate Editor

Entrust Tool & Design, a manufacturer of machine tools, transfer machines and deep drilling equipment based in Menomonee Falls, Wisconsin, needed specific components for the cutting mechanism on its new Unisig USC50, a 7-axis, 2-spindle milling and deep-hole machining center.

Since the machine tool was designed

for four-sided machining and deep-hole drilling on workpieces up to 40" x 120" on a 25-ton CNC rotary table, a high degree of accuracy and rigidity would be needed, especially at full extension of the tool tip.

With an emphasis on high productivity, precision was also necessary even at the maximum speeds of 10 meters

per minute. An ANSI 85.50 CAT 50 spindle was designed into the machine to handle the substantial torque, so a power drawbar became an essential element as well as a nearly backlash-free worm gear assembly to satisfy the accuracy spec.

In order to meet these demands, Entrust turned to Advanced Machine

& Engineering, a longtime associate based in Rockford, Illinois, to assist with the necessary components required to accommodate the load and to provide stability and repositioning. The relationship between both companies has been steady for more than five years, especially in the area of new spindle components and worm gear assemblies.

For the power drawbar, Entrust sought a high-quality, precision model that featured bolt-on reliability, 80 bar max (1,160 psi) coolant pressure, steep taper air-blast and standard integral position sensors for feedback. The company also needed the features to be configurable.

Based on previous automotive experience, Entrust selected an OTT-Jakob power drawbar with rotary union and steep taper gripper. OTT-Jakob, a German company distributed in North America by Advanced Machine & Engineering, recommended the modular ES series drawbar with a high pull force of 23 kN (5,169 lbs.).

It helped that the ES series had a reputation as a quality product in the world machine tool market, according to the company's press release, based largely on the strength of the tools being used by both Mercedes and BMW.

For the worm gear assembly, Entrust once again turned to Advanced Machine & Engineering for a solution. After looking at the available products, the suggestion was to utilize the Zahnradfertigung OTT patented worm gear design with a gear and a worm shaft that are adjusted to minimize backlash.


After investigating other worm gear designs, Entrust selected this particular design because it had the best backlash scenario for the application, namely large-area, deep-pocket mold-making. Due to the nature of the application, a DIN standard Class 3 set of worm gears was required. Advanced Machine supplied Class 2 worm gears at no additional charge to the customer.

"A conventional solution would not work here for this precision application and the OTT worm gear set was more appropriate," says Dan Lapp, vice president of sales at Advanced Machine &

Engineering. Lapp went on to explain how the typical machine tool worm gear on the market often has a split worm, spring-loaded to compensate for backlash errors. With the OTT split worm design, the left side of the worm gear features a worm shaft while a hollow worm engages the shaft from the right. By the accurate positioning of one worm half relative to the other, the backlash can be changed.

"The Unisig engineers worked with Advanced Machine & Engineering as a provider of these critical, precision mechanical components on our USC50 mold machining center," says Anthony Fettig, COO at Entrust Tool & Design. "The OTT worm gear set, OTT-Jakob power drawbar and Speith components (locknuts, sleeves, bushings) have performed very well in the application, and the technical support from Advanced Machine was thorough and usually immediate."

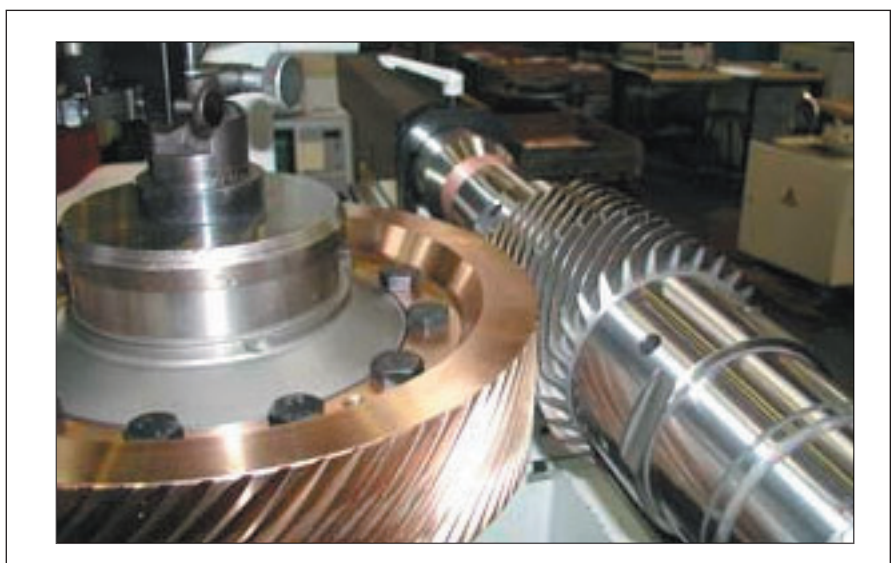
Fettig notes that the USC50 is entirely designed and built in the United States, but incorporates key components from suppliers in the U.S., Italy, Germany and Japan. Initial customer reports

on the performance of the USC50 have been positive, according to Fettig. 

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Motor fair attendees view product demonstrations conducted by the Oriental staff.

Oriental Motor Fair

COVERS MUCH MORE
THAN THE BASICS

The question is whether or not a customer can save time and money using a step motor. It's followed by another on the differences between a brush and brushless motor. The discussion continues with topics on tachogenerators, permanent magnets, inertia calculations and torque motors. What resembles a high school science fair at first glance is actually an informative and productive way to spend a day discussing the motor industry.

The 2008 Oriental Motor Fair and Seminar recently took place in the Chicago area in an effort to underline Oriental products and put them to the test using real world applications. The seminar allows engineers, maintenance personnel and purchasing managers to get together to talk shop and learn some additional concepts specifically for these applications.

With 125 years of experience, Oriental Motor knows firsthand how important quality, delivery, service and support are to its customers. Instead of boasting this experience in an advertising campaign, Oriental takes its mechanical and sales engineers on the road to show how its products work and why they're beneficial.

"Customers can come and see all of our products and participate in our seminars to better understand the product line and gain an understanding of the global support Oriental Motor brings to motion control," says Rob Cheatham, senior sales engineer at Oriental Motor USA.

The motor fair kicks off with an introduction highlighting the 30 years the international company has served customers in the United States and Canada. Oriental Motor was originally founded in 1885 in Japan, but made its U.S. debut in 1978 with a variety of fractional HP products for position control, velocity control and temperature control.

The eight-hour, technical presentation lets attendees see how specific motors are chosen for certain applications and why these choices are made. At the Chicago seminar, guests

were treated to a PowerPoint presentation on motors in a bottling application. Engineers took attendees step-by-step through the various motors used in bottle removal, cooling, inspection, filling, capping, label placement and packaging. These steps were supplemented with DVD demonstrations and motor-sizing options. A soundtrack provided songs with themes that complemented the product demonstrations.

Each section began with the engineers analyzing the various criteria needed for the application. In the bottle diverter section, for example, a list of needs was presented for the diverter, and these needs were addressed with motor sizing options.

If attendees wanted to see these specific applications, the product room next door provided motion control demonstrations and hands-on examples. Engineers were available at each station to answer questions and discuss the various applications on display.

“Having all of our products available for the attendees to see, brings us one step closer to finding a solution to their applications,” Cheatham says. “Everyone likes to touch and feel products versus just looking at it in a catalog or on a website.”

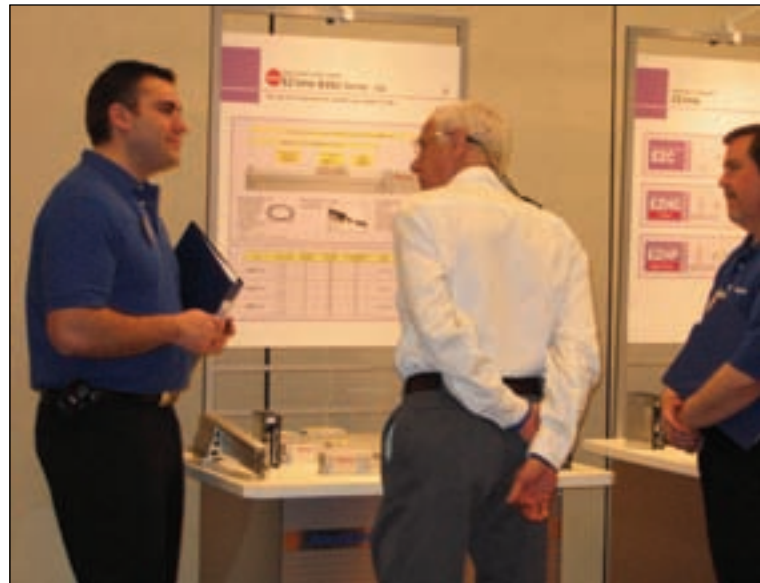
The bulk of the one-day event, however, took place in the meeting room where Oriental engineers breezed through eight sections of motor options for the bottling application. Attendees were given a printed copy of the PowerPoint presentation and could jot down notes during the event. If an engineer did not have an answer for a particular question, there was always a colleague in the back of the room ready to provide additional information.

Oriental did an excellent job of distributing information to a wide audience. Some attendees had an extensive background in motor applications while others had minimal exposure. The company was able to bring a diverse group together and provide information that everyone could benefit from.

In an effort to continually push the seminar forward, Oriental always takes feedback into consideration for future presentations. The company recently reformatted the seminar based on information provided by previous attendees. At the end of the program, guests were asked to fill out a brief questionnaire and turn it in with comments and suggestions.

The seminar was educational and far more informative than just a sales pitch. Attendees received an extensive demonstration of the product line via industry examples. Engineers explained why some motors worked better in certain conditions. They also discussed the longevity and accuracy of the motors in question.

For more information on the Oriental Motor Fair and Seminar, visit www.orientalmotor.com or call (800) 418-7903.





Rewind Seminar

JUMP STARTS MOTOR, GENERATOR KNOW-HOW

Calling on engineers and maintenance power plant personnel, industrial users of low- and medium-voltage motors and generators and motor repair shop staff. The TECO-Westinghouse Motor Company (TWMC) hosts the EPRI Motor/Generator Rewind Seminar. The three-and-a-half day tutorial is intended for specialists and non-specialists alike who specify, contract and accept motor generator repairs and rewinds. Attendees come from a range of companies such as light electric utility, nuclear and motor repair plants and, “We get quite a mixture of people,” says Jim Oliver, the seminar founder.

The Electric Power Research Institute (EPRI) of Palo Alto, California, came up with the idea for the course, which Oliver first wrote as a motor rewind book for the association. Oliver coordinates the whole seminar, which he began 10 or so years ago when the EPRI decided they wanted a course based on his book. The seminar has been held at different repair shops over the years, but 2008 is the fourth year the course is located at TWMC, just 20 miles north of Austin, Texas. EPRI licenses the course to Oliver because “They were restricted just to inviting EPRI members whereas I can invite anybody,” he says.

The program covers material on increasing capacity of nuclear power plant motors, turbine generator rewinding practices, motor testing, buying new motors, VPI resins and tiered motor maintenance. IEEE, NEMA and API industry standards are covered along with insulation materials, processes, coil design and manufacturing, stator cores, core testing, rotors and bearings. Attendees learn the intricacies of rewinding medium-voltage electric motors and generators based on design and function essentials, and how to develop rewind specifications for motors and generators from 480 V through 13.2 kV. One highlight of the course is a tour of TWMC’s 500,000-square-foot motor and generator repair and manufacturing facility, which is equipped with complete test and engineering services. Groups of four or five people each gather for the approximately three-hour tour. The length depends on how many questions are posed by attendees. Another highlight for many participants is the coil-making exhibits TWMC sets up as part of the tour.

The seminar is taught by four instructors, including Oliver, Jim Michalec, Elton Floyd and Mike Howell. They have decades of experience in significant electric industrial areas, and TWMC engineers are available for consultation on



specific technical issues. The instructors often swap topics with each other, demonstrating their versatility on the subjects, but they each have a group of segments they tend to teach.

Every year Oliver tries to improve the program by making minor changes or additions. “We give a critique sheet and carefully go over responses. We get good ideas from them,” he says. “We take all comments very seriously.”

A comment made one year was to exclude testing qualifications because the topic interrupted the flow of the seminar, which Oliver came to agree with. Two years ago, he brought in the subject of steam turbine generators.

Last year’s seminar attracted 53 attendees. In recent years, international participants have come from Thailand, Spain, France and Korea. In addition to the presentations and TWMC tour, the seminar includes lunches and an annually upgraded, four-volume seminar book. Oliver says they always have extra books on hand to anticipate any last-minute registrants.

The EPRI Motor/Generator Rewind Seminar takes place July 15–18 at the TECO-Westinghouse Motor Company in Round Rock, Texas. TWMC supplies AC and DC motors and generators in a range of HP ratings used to drive pumps, fans, compressors, rolling mills, grinders, crushers and other rugged applications. The company’s products are found worldwide in

petroleum, chemical, pulp, paper, mining, marine propulsion, steel, electric utility and other industries. The test facilities include full-voltage, full-speed run-up, heat run, locked rotor, sound level, vibration analysis and insulation testing. For more information including registration, contact Jim Oliver at joliver003@aol.com.



June 24–25—European PLM Summit. Diagona Espace De Congrès et d'Exposition, Toulouse, France. The fourth installment of this conference and networking event attracts leading practitioners of product lifecycle management (PLM). The two days are scheduled with keynote conference sessions and workshops that address the business and technology forces affecting PLM implementation. There are opportunities to connect with other attendees in pre-arranged, interactive one-on-one meetings where the business strategies of PLM are discussed and how they can improve the design, delivery and development of new products. The event intends to demonstrate how product lifecycle management is important to manufacturing, supply chain and IT operations. Some technical sessions will address linking design with sourcing and procurement decisions—extended supply chain, product maintenance and support and integrating PLM with existing manufacturing execution systems. For more information, visit www.plmsummit.com.

June 24–27—EXPO PACK Mexico. Centro Banamex, Mexico City, Mexico. Gain access to the packaging industry in Mexico and Central America at this comprehensive packaging machinery and materials tradeshow in Mexico. More than 860 exhibitors appear at Expo Pack Mexico, showcasing packaging and processing machinery, materials, components and containers, to provide solutions for processing, packaging, sorting and distributing products. The 2007 show drew 32,000 attendees from 34 countries representing a wide range of industries including automotive, tools, electric, electronics, medical and chemical. Expo Pack Mexico 2008 is co-located with Procesa, the food and beverage processing machinery and equipment show for Mexican end-users. The events are produced by the Packaging Machinery Manufacturers Institute (PMMI). For more information, visit www.expopack.com.mx.

July 9–11—ProPak China. Shanghai New International Expo Center (SNIIEC), Shanghai, China. ProPak China features the 14th International Processing, Packaging and End-Line Printing Exhibition. As the only integrated processing and packaging trade event in China, ProPak caters to buyers, sellers, manufacturers, distributors and suppliers worldwide involved in food, beverage, pharmaceutical, cosmetic, toiletries and light industries. The exhibition highlights processing and packaging machinery, materials and related technology. The 2007 event attracted 517 companies from 24 countries, and the exhibition was visited by over 13,000 attendees from more than 80 countries. The 2008 event has expanded to fill a third hall in response to growth and demand. For more information, visit www.propakchina.net.

July 15–17—SEMICON West. Moscone Center, San Francisco. “Infinite Innovations, Infinite Ideas” is the slogan

for Semicon West, where companies, technologies and people meet that advance micro- and nano-electronics design and manufacturing. Information is presented by industry technologists about the latest developments in areas like semiconductors, MEMS, renewable energy applications, semiconductor test, advanced packaging and wafer processing. Some major themes that will be addressed this year include semiconductors in transition, the mobile electronics revolution and the integration of design, production and test. Registered visitors receive an online “personal assistant” to search and find the products, exhibitors, people and events that match their specific interests. For more information, visit www.semiconwest.org.

August 4–8—Rotordynamics/Magnetic Bearings Short Course. University of Virginia Mechanical Engineering Building, Charlottesville, VA. This short course, organized by the Rotating Machinery and Controls (ROMAC) Industrial Program at the University of Virginia, covers many topics relating to rotordynamics, bearing dynamics, applied dynamics and topics on magnetic bearings for industrial rotors. Last year's short course covered unbalance response and rotor balancing, stability of industrial compressor rotors, advanced fluid film bearing analysis, compressible flow seals, advanced pump analysis, motors, turbines and aircraft engines. Also covered in last year's course was magnetic bearing design and control theory for magnetic bearings along with specifications for industrial rotors. University of Virginia faculty and students are among presenters, and case histories are given by ROMAC industrial members.

September 8–11—SAMPE Fall Technical Conference and Exhibition. Memphis Marriott Downtown, Cook Convention Center, Memphis. Representing many sides of material and process engineering industries, around 800 engineers, R&D engineers and educators attend the Society for the Advancement of Material and Process Engineering's (SAMPE) annual technical conference. Related topics include chemical engineering, design, operation and maintenance of chemical and material manufacturing processes. Technical sessions and panels discuss advanced materials and applications while the two-day exhibition consists of distributors and manufacturers of advanced materials showcasing new products and services. This year's SAMPE conference is co-located with the American Society for Composites and ASTM International, a voluntary standards developing organization. Significant contributions were made by the Air Force Office of Scientific Research. Some of the panels and featured talks include industrial applications of multifunctional materials, ionic polymer-metal composite: soft actuator and sensor and polymer nanocomposites research in Canada.

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Bosch Rexroth

EXPRESSES FUTURE OPTIMISM
WITH 2007 RESULTS



The unsure economic situation was far from avoided by Bosch Rexroth President and CEO, Berend Bracht, in his news and strategy update for the company, which he delivered via webcast in April. Despite the U.S. economic factor, Bracht expressed a positive outlook for 2008 based on the company's 2007 year-end results. The sales and expansion numbers for the company demonstrated healthy gains, and Bosch Rexroth is responding with expanded business and production initiatives.

Total sales have grown by 50 percent since 2002, without contributions from major acquisitions. Asia served as a key to growth in 2007, increasing sales by 13 percent, which is twice the region's business volume since 2002. China was the largest contributor to sales in Asia, experiencing an approximate 30 percent increase. Sales also increased in other regions such as Western, Central and Eastern Europe.

Bosch Rexroth sales declined by 5.5 percent in North America, mostly due to the state of the dollar and weakness

in the Canadian manufacturing sector. "The good news came from South America, where we achieved a phenomenal 18.5-percent increase in sales, making it one of the company's fastest growing regions," Bracht says.

While acknowledging the lack of U.S. economic improvement and the expectation that the situation will remain negative, Bracht expressed confidence that Bosch Rexroth would benefit by growth-oriented industries like renewable energy, semiconductor and medical areas. Renewable energy in particular has only begun to expand, but the Global Wind Energy Council projects a 20 percent growth Bracht expects to materialize. Bosch Rexroth has increased sales in machine tool, woodworking, packaging and heavy industries. Mobile hydraulics is another area that expanded in 2007.

The Bosch Rexroth global workforce may have seen the most significant area of growth, increasing by 3,150 employees with new jobs in Germany, the Americas, Central and Eastern Europe and Asia. This is a 10 percent growth, with the company now employing almost 33,000 people worldwide.

In recognition of the global demand for young and upcoming engineers and technical workers, Bosch Rexroth has been involved with various educational institutions including Texas A&M, Illinois State University, Tri-County Technical College in South Carolina and Lake Superior State University in Michigan. "Young people are very much aware of these activities. Through survey results—as in previous years—Bosch Rexroth has again been placed high on the list of the most attractive employers," Bracht says.

Investments were made in 2007 that went towards new buildings, plants and machinery representing \$517 million. The majority of this 7-percent sales reinvestment went towards global networks and promising up-and-coming markets. Bracht mentioned a new \$247 million plant in Germany that will be developed over the next few years, which will manufacture large gear systems for wind farms. American investments in 2007 included the "addition of a 50,000-square-foot logistics center at our industrial hydraulics manufacturing plant in Bethlehem, Pennsylvania," Bracht says. "Another 25,000 square feet is planned for 2008, to add production capacity for mobile controls."

Research and Development is another area Bosch Rexroth invested significantly in last year. The \$343 million spent in R&D helped result in several energy-conservation developments in standard production with projects that limit fuel consumption in mobile machinery, increase factory automation efficiency and plant upgrades for renewable energy generation. In a news and strategy update broadcasted by webcast, Bracht drew special notice to future prospects for solar energy. "Rexroth is deeply involved in this emerging technology, from grains of sand to the manufacture of solar

panels, to the positioning of finished assemblies," he says.

Many of the business initiatives Bosch Rexroth employed in 2007 will be pursued next year as well. The company expects to increase investments in worldwide production, adding production capacities and expanding its position in the global hydraulics industry. While heeding the potentially negative effect a weak U.S. economy will have on worldwide growth, Bracht predicts a sales increase in the double-digit percentage for 2008. "We are optimistic about our growth in North America because of our major new initiatives in alternative energy and factory automation."

Two Timken Manufacturing Facilities

OPEN IN INDIA, CHINA

With the addition of two new plants in Asia, the Timken Company now manages seven manufacturing facilities spanning six Asian countries. An industrial bearing manufacturing plant in Chennai, India and an aerospace and precision products facility in Chengdu, China increase Timken's presence in aerospace and industrial markets. The new sites will feature a surge in production for the upcoming quarters. Both enterprises began plans and construction in the fall of 2006, according to the company's website.

The Chennai industrial bearing plant will manufacture medium-sized tapered roller bearings for industrial consumers. Timken's other Indian locations include a bearing manufacturing plant in Jamshedpur and a Global Technology Center in Bangalore, which designs, develops and tests new friction management and power transmission technologies.

China's growing commercial aviation industry and international customers are targeted by Timken's expansion in Chengdu. Timken first appeared in China and India in 1992, with plants in Wuxi and Yantai. A joint-venture facility in Xiangtan is in the works for ultra-large-bore bearing manufacture directed towards the wind energy industry. Ground has yet to be broken at this location.

"The opening of our plants in Chennai and Chengdu is not only important to our ability to serve customers in Asia, it represents a major step forward in our strategy of driving growth in global industrial markets," says James W. Griffith, Timken president and chief executive officer. "We will continue to make investments, both organic and inorganic, to take advantage of strong global demand in our targeted industrial growth markets."

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Fenner

GAINS
WINFIELD INDUSTRIES



Fenner Precision acquired Winfield Industries, Inc. on March 3, 2008. Winfield Industries will help expand Fenner's technology base, production capabilities, product lines and the industries both companies serve, according to a Fenner Precision press release.

Winfield Industries has been in business for 40 years at a Buffalo, New York facility, where it will continue under the Fenner Precision name to manufacture polyurethane and silicone rollers for digital imaging, medical and diagnostic imaging applications. Fenner Precision should bolster its ongoing research and development of high-performance polymer based rollers, supplementing this R&D with the manufacture of polyurethane mini-pitch timing belts, rubber flat belts and polyurethane and silicone tires for office automation and propulsion applications. With the acquisition, Fenner intends to focus on more inclusive product lines.

"Bringing together the Winfield and Fenner Precision businesses and products will enable us to offer a comprehensive, problem solving range of products to the paper propulsion industry and to our customers in the U.S., Asia and Europe," says Mike Thompson, Fenner Precision president.

Jeffrey Oak, president of Winfield, says, "The combination of Winfield's custom molded and Fenner Precision's polymer-reinforced fabric technology will enable us to offer a broader range of solutions to our customers through a jointly formed global sales and marketing organization."

Ruland Representative Office

OPENS IN SHANGHAI

As part of Ruland Manufacturing Company, Inc.'s attempts to serve its global customers, the shaft collar and coupling manufacturer opened a representative office in Shanghai, China to handle sales and marketing activities in China and Southeast Asia, including Singapore and Malaysia. The immediate focus of the new Shanghai office is on supplying existing customers that have moved their production to Asia, establishing the Ruland brand in the Asian markets domestically and providing sales and marketing services to other manufacturers as well. The Ruland office is managed by Zhao Xian (Jennifer) Ye, a Shanghai native with a background in import, export and domestic sales of industrial products, according to the company's press release.



Tecumseh Headquarters

RELOCATE IN PURSUIT OF GLOBAL AMBITIONS

Tecumseh Products Company is moving its corporate, sales and engineering functions from the location in Tecumseh, Michigan where the global headquarters have existed for over 75 years to the Valley Ranch Business Park in Pittsfield Township, Michigan, near Ann Arbor. The majority of the relocation is scheduled to be completed by July 2008 and the rest completed by the end of the year.

The new location was chosen primarily for its immediacy to a major hub airport, so visiting customers, suppliers and employees will benefit. An estimated 200 people will be impacted, but the cost is not expected to be significant.

"Much of the logic for remaining in Tecumseh has been predicated on the emphasis in local manufacturing and on regional markets," comments Ed Buker, chairman, president and CEO of Tecumseh. "With the previously announced mid-year closure of its manufacturing operation and with the current focus on global sales, engineering and corporate activities, the Tecumseh location becomes less compelling for us in the future."

IMI Sensors

WELCOMES INTERNATIONAL BUSINESS DEVELOPMENT MANAGER

IMI Sensors, a division of PCB Piezotronics, has appointed Doug Eberhart as international business development manager to oversee the growth and development of new and existing sales channels.

Eberhart brings 25 years of experience in the industrial vibration monitoring market to IMI Sensors. His background



Doug Eberhart

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also includes a global sales and business development in industrial machinery condition monitoring, working for sensor and instrumentation manufacturers and establishing large multi-million dollar OEM and factory-direct accounts. Before joining PCB, he served several leadership roles at Accutech Instrumentation Solutions, FCx Performance and IRD Mechanalysis. Eberhart spent much of his career creating, training and maintaining a results-oriented international sales and service network for various instrumentation companies, supporting over 40 independent representative companies, according to the company's press release.

Kaydon

EXPERIENCES SEVERAL KEY MANAGEMENT CHANGES

Kaydon Corporation of Ann Arbor, Michigan made several new management appointments including Debra K. Crane as vice president, general counsel and secretary, Anthony T. Behrman as vice president of human resources, and Dale E. Ulman's promotion to vice president of taxes.

Crane previously served as senior counsel for Parker-Hannifin Corporation. She held several positions in private practice and also served as vice president of general counsel and secretary of Scott Technologies, Inc. She has a J.D. degree from Cleveland-Marshall College of Law and a B.A. from Hiram College.

Behrman was formerly vice president of human resources with BorgWarner Inc.'s TorqTransfer Systems Division among other human resources positions at BorgWarner, Thomson Consumer Electronics and GTE Data Services. He earned an M.A. in labor relations from the University of Cincinnati and a B.A. from Indiana University.

Ulman has worked for Kaydon as the director of taxes since 2002. Preceding his position at Kaydon, Ulman was a senior tax analyst at Federal-Mogul Corporation after working for Grant Thornton LLP. He holds an M.S. in taxation from Walsh College and a B.S. from Wayne State University.

Regarding the new appointments, James O'Leary, chairman, CEO and president of Kaydon says, "The additions of Deb Crane and Tony Behrman to Kaydon's executive team provide expertise critical to Kaydon's continued growth. In addition, the promotion of Dale Ulman recognizes his contribution to Kaydon, as well as the internal strength of our management team."



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180 Heads Are Better Than One

A classic case of collaboration behind the scenes at Cirque du Soleil

Since 2005, the performers of Cirque du Soleil's *KÀ* show in Las Vegas have been engaging audiences with acrobatic feats, martial arts, puppetry and multimedia entertainment. What makes the production different from previous Cirque du Soleil extravaganzas is the pivotal role hydraulics and motion control play in the overall experience.

With a \$190 million budget, the *KÀ* production features a 140-ton, cantilevered stage where airborne artists flip and twirl their way through fight scenes, all in the name of epic storytelling.

Known as the Sand Cliff Deck, the main staging unit is supported by long, hydraulic cylinders, allowing the stage the flexibility to rise, rotate and spin. On its surface, electronic sensors coordinate computer-generated effects in step with each artist as though the stage itself is a supporting character in the production.

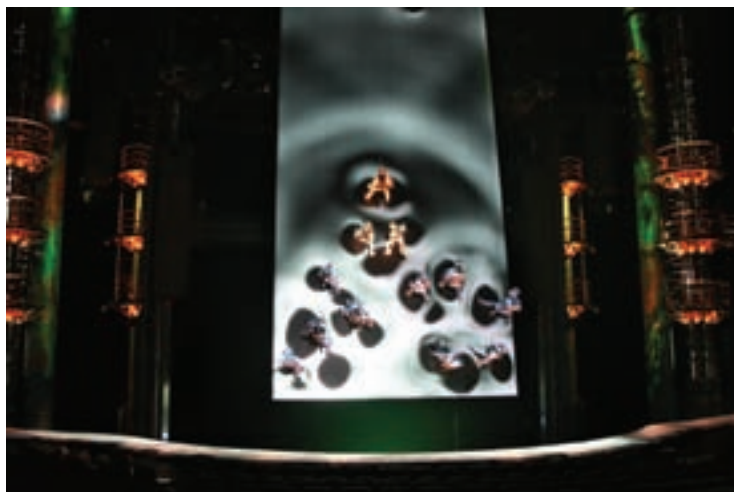
On any given performance night, there are more than 80 artists and 100 technicians working in unison on the show. With an automation department on hand to maintain pneumatic, hydraulic, electrical and computerized controls for lifts, winches, gears and motor drives, things tend to get hectic behind the scenes.

James Tomlinson, senior project manager of Cirque du Soleil, likens the communication system during certain portions of the show to "calling a horse race on the home stretch."

Communication is the No. 1 priority as the stage manager directs the timing of each event on and off the stage, according to Tomlinson. With more than 200 computer-controlled axes of motion, it's imperative that the machinery is predictable at all times, and the technicians are attentive if adjustments need to be made.

"Many of our scenes involve artist and machine in intimate proximity, and many of the artists use the machinery to expand their performance," Tomlinson says.

Thankfully, the men and women responsible on the



control boards are experienced when it comes to entertainment engineering.

"We have a great deal of experience conceiving and executing show machinery, and we take full advantage of our historical experiences in planning new designs," Tomlinson says.

Safety, above all else, is the top priority. Preventive maintenance is done regularly and the show utilizes a database that tracks system failures and schedules periodic inspections and maintenance routines.

That's not to say the show is void of the occasional hiccup.

At a presentation at the IFPE 2008 conference, Tomlinson spoke of a performance where an understudy was struck in the thigh by an automated 18-inch steel peg because she was out of position. Although she

walked away with only a bruise, it was a reminder to the entire production staff that no amount of preparation can dictate every possible scenario once the curtain goes up.

"We want to present new things to our audiences, and we are regularly exploring the physical limits of what we can do safely and reliably on stage," Tomlinson says.

With more than 470 performances per year, *KÀ* has successfully taken the Cirque du Soleil franchise in an entirely different and exciting direction.

Tomlinson says the company has several new shows in production that incorporate even more advanced technologies and the desire to "one-up" the previous version will never fade.

"The initial challenge for the creative team on a show like this is to assemble their ideas into a cohesive timeline that utilizes the capabilities of the artists and utilizes the equipment to support the artistic intent," Tomlinson says.

"There is no point in having fantastic machinery if it does not contribute to the idea, theme or story we are trying to convey."

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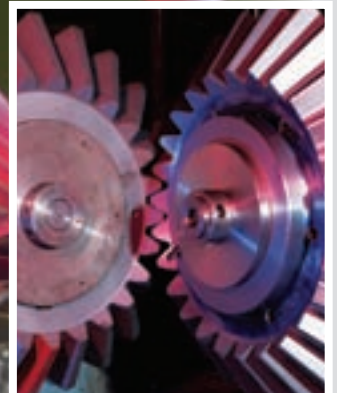
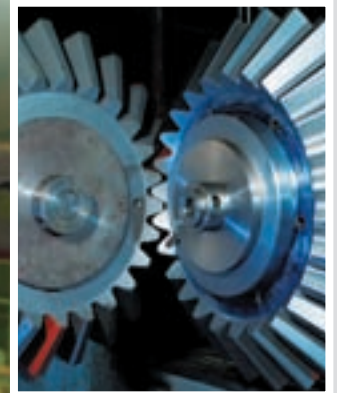
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