

PTE

powertransmissionengineering®

Features

- Ohio Company's Brakes are Clutch
- These Controllers are Poetry in Motion
- Parcel Handling Gear Drive Selection

Technical Articles

- New VSD Motor Efficiencies
- Radial Play in Ball Bearings



Power Play

- It's Paro!

AC Servo Systems

start under \$1,000

The **SureServo** family of brushless servo systems from AutomationDirect is fully digital and offers a rich set of features at dynamite prices. Beginners to experienced users can take advantage of this easy-to-use family for as little as \$978* (100W system). * All components sold separately.



Agency Approvals for Drives:



Agency Approvals for Systems:



Agency Approvals for Motors:



- Eight standard systems from 100 W to 3 kW
- Use with **DirectLOGIC** PLCs or any other host control
- Drives feature on-board indexer and adaptive tuning modes
- Free set-up software
- 2 year warranty

SureServo drives accept a wide range of command sources:

- Built-in motion controller with preset position, velocity or torque select presets with switch inputs and/or the multi-drop Modbus serial interface
- Position commands with "pulse/direction" or "count up/down" format
- Encoder follower
- Analog voltage Velocity or Torque command

For configuration, tuning and diagnostics, use the drive's integrated keypad/display or take advantage of the free **SureServo Pro™** PC-based software.

www.automationdirect.com/servos or www.sureservo.com

CHECK OUT OUR PRICES

Servo Systems	AutomationDirect Price/Part Number	US	Allen-Bradley Price/Part Number
Digital Servo Drive	\$484.00 SVA-2040		\$1,009.00 2098-DSD-005
100W Servo Motor with connectorized Leads	\$322.00 SVL-201		\$531.00 TLY-A130F-HW62AA
Breakout Board Kit for CN1 Control Interface	\$93.00 ASD-BM-50A		\$209.00 2090-U3BK-D4401
10' Motor Feedback Cable	\$49.50 SVC-EFL-010		\$80.00 2090-CFBM6DF-CBAAD3
10' Motor Power Cable	\$29.50 SVC-PFL-010		\$90.00 2090-CPBM6DF-16AAD3
Configuration Software	FREE SV-PRO*		\$75.00 2098-UWCPRG
Complete 1-axis 100W System	\$978.00		\$1994.00

*SureServo Pro software is FREE when downloaded and is also available for \$9 on a CD
All prices are U.S. list prices. AutomationDirect prices are from March 2011 Price List. The Allen-Bradley 100W system consists of part numbers shown in table above with prices from www.rockwellautomation.com/en/e-tools/2/22/11.

www.automationdirect.com

Go online or call to get complete information, request your free catalog, or place an order.

1-800-633-0405



Order Today,
Ships Today!*

* See our website for details and restrictions.
© Copyright 2011 AutomationDirect, Cumming, GA, USA. All rights reserved.



AUTOMATIONDIRECT.COM
the #1 value in automation

FEATURE ARTICLES

Blocks (Around the Clock)

Force Control maximizes uptime for concrete manufacturer.

16

Product Spotlight: Motion Control

If it moves, latest controllers and software can help.

20

Gear Drive Selection Process

For the parcel handling industry.

32



TECHNICAL ARTICLES

Motoring Ahead

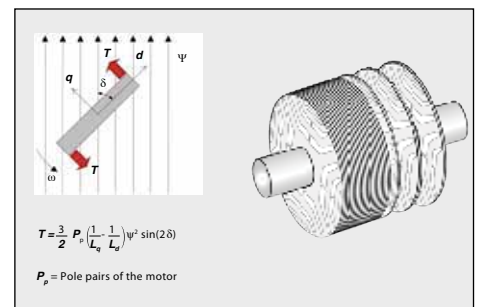
Synchronous motors controlled by variable-speed drives are bringing higher efficiencies to industrial applications.

26

Radial Play (Internal Clearance) in Ball Bearings

A discussion of contact angle, deflection, end play and preload in ball bearings.

36



PTE

powertransmissionengineering®

August
2011

DEPARTMENTS

Products

Silence Plus for noisy pumps; other new products of note

6

Events/Calendar

Pack Expo 2011

40

Industry News

Announcements, updates, etc.

42

Subscriptions

Free subscriptions for you and your friends!

45

Advertiser Index

Advertiser contact information

46

Classifieds

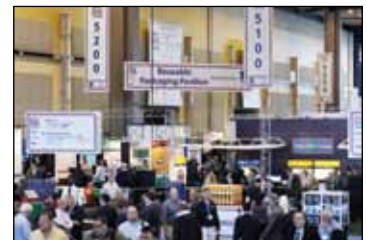
Our products and services marketplace

47

Power Play

Meet Paro, the Robotic Baby Seal

48



ONLINE



Monthly e-mail newsletter at
www.powertransmission.com/newsletter

- Power Transmission Engineering
Sign up for a free subscription or read back issues online.
- powertransmission.com
Our new look and feel includes online videos and more.
- BUYERS GUIDE
Search for power transmission products and services and communicate with the industry's leading suppliers.



Monthly e-mail newsletter at
www.geartechology.com/newsletter

- BUYERS GUIDE
Search for gear industry products and services and communicate with the industry's leading suppliers.
- SUBSCRIPTIONS
Sign up for subscriptions to *Gear Technology*.
- E-GT
Subscribers get access to back issues of *Gear Technology*.

Randall Publications LLC makes every effort to ensure that the processes described in POWER TRANSMISSION ENGINEERING conform to sound engineering practice. Neither the authors nor the publisher can be held responsible for injuries sustained while following the procedures described. Postmaster: Send address changes to POWER TRANSMISSION ENGINEERING, 1840 Jarvis Avenue, Elk Grove Village, IL, 60007. ©Contents copyrighted by RANDALL PUBLICATIONS, LLC 2011. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without permission in writing from the publisher. Contents of ads are subject to Publisher's approval.

THE WIZARDS OF FOREST CITY



“Actually, it’s not magic at all...these guys just like to dress up!”

“At Forest City Gear, you see, we produce the highest quality, engineered solutions to our customers’ requirements and we do it using the best gearmaking machines and test equipment we can afford. If there’s any magic in us at all, it’s found in the people who make those gears, splines and assemblies at our company, every day, then deliver them to you on time and at the best price possible.”

*“Our company motto is **Excellence Without Exception** and we try to live by that code, on every part on every job. To do less would make us bad wizards and, worse, it would disappoint our worldwide customer base, some of whom are you folks reading this ad, right now. That’s a witch’s brew and you’ll never find such a concoction at our company... ever.” “That’s one spell you can count on!”*

-Fred Young, CEO and Chief Wizard, Forest City Gear



11715 Main Street, Roscoe, IL 61073 815-623-2168



Scan this code on your smart phone and see Fred walking through the plant. (He’s really the guy who likes to dress up!) www.bit.ly/ForestCityWizard Or visit www.forestcitygear.com for the rest of our story!

PTE

powertransmissionengineering®

VOL. 5, NO. 4

Randall Publications LLC
1840 Jarvis Avenue
Elk Grove Village, IL 60007

Phone: (847) 437-6604
Fax: (847) 437-6618

EDITORIAL

Publisher & Editor-in-Chief Michael Goldstein
publisher@powertransmission.com

Managing Editor William R. Stott
wrs@powertransmission.com

Senior Editor Jack McGuinn
jmcguinn@powertransmission.com

Associate Editor Matthew Jaster
mjaster@powertransmission.com

Editorial Consultant Paul R. Goldstein

ART

Art Director Kathleen O'Hara
kathyohara@powertransmission.com

ADVERTISING

Advertising Sales Manager Dave Friedman
dave@powertransmission.com

Materials Coordinator Dorothy Fiandaca
dee@randallpublications.com

CIRCULATION

Circulation Manager Carol Tratar
subscribe@powertransmission.com

RANDALL PUBLICATIONS STAFF

President Michael Goldstein

Accounting Luann Harrold

Photo courtesy
Bison Gear &
Engineering
Corporation.



Cincinnati Gearing Systems Inc

www.cincinnati-gearingsystems.com

GEAR DESIGN
&
MANUFACTURING

OVER
100
YEARS

OF EXPERIENCE



ISO 9001
TS 16949

(513) 527-8600

5757 Mariemont Avenue

Cincinnati, OH 45227

gearsales@csi-c.com



Full Range of Motion



Baldor's full range of motion control products provide unmatched quality, high performance, ease of use and superior reliability. From controls, drives and motors, to our Mint® programming language and Ethernet capability, Baldor products install and operate seamlessly with each other.

Simple applications or the most complex, available from stock or custom made, Baldor is your one source for a full range of motion products.

baldor.com 479-646-4711

- Easy to Use
- Unmatched Quality
- Superior Reliability
- Quickest Delivery Available

BALDOR
A MEMBER OF THE ABB GROUP

Silent Innovations

SPECIAL TOOTH GEOMETRY
REDUCES NOISE IN EXTERNAL
GEAR PUMPS

External gear pumps are rugged, economical, efficient and competitively priced. Additionally, they tend to create a great deal of noise while running. This noise has led to secondary measures for acoustic decoupling, insulation and encapsulation creating more work and costing more money for manufacturers. Bosch Rexroth has released a new generation of external gear pumps with a low-wear design that ensures efficiency and long service life called the Silence Plus.

The Silence Plus reduces the noise levels by an average of 15 decibels compared to conventional gear pumps. This constitutes a huge reduction in noise and pulsation which can lead to lower noise levels throughout the entire hydraulic system. The new pump is characterized by a subjectively much more pleasant, deeper sound.

“We’ve created a gear pump that doesn’t lose efficiency or sacrifice any speed or pressure,” says Bill Novak, product manager for Bosch Rexroth.



The Silence Plus from Bosch Rexroth reduces noise levels by an average of 15 decibels (courtesy of Bosch Rexroth).

“Rexroth has been developing quiet gear products since 1998 (silence pump, dual flank concept) and 2008 (Silence Plus pump, helical gear concept) and continues to be a market leader in low-noise gear technology. The noise levels are lower for the operators as well as anyone else in the vicinity, and the gear pumps adhere to the noise limitations set by the Occupational Safety and Health Administration (OSHA).”

The key to the Silence Plus design is the non-involute helical gearing, which uses its innovative tooth profile for continuous fluid delivery. This ensures virtually noiseless running of the pump while generating far fewer noise-exciting vibrations in the connected hydraulic system. The internal axial forces generated in the helical gearing are cancelled out in a wear-free manner using hydrostatic bearings. Use of the Silence Plus can, for example, reduce the total noise emission of a standard hydraulic power unit by 11 dB(A). The new pump combines increased comfort for the operator along with the expected high reliability of Rexroth external gear pumps.

“Rexroth went from a spur gear, zero backlash design to the helical gear concept which is very different and extremely effective in reducing the noise typically found in gear pumps,” Novak says.

The surfaces of the two gears are in contact not only at the flanks of the teeth but also at the top and bottom. There is no abrupt transfer of contact pressure from one flank to the next. Instead, there is a single contact line that moves continuously along a closed-loop



Christian Böhmecker and Lucas Wintjes, accept an innovation award for the Silence Plus at Hannover Messe 2011.

engagement pattern in the form of a figure eight. "The noise reduction results from the non-involute gear profile and continuous tooth contact that eliminates drive play in the gear set," Novak says.

The benefits of gear pump noise reduction can be found in industrial machine tools and mobile conveyor technology as well as mobile power packs, such as tail lifts on supply trucks. "The Silence Plus has been in series production since February 2011 and is being considered for European applications in material handling, paper cutting machines, electrical trucks, garbage trucks and trash compactors to name a few," Novak adds.

It is available successively in sizes from 12 to 28 cm³/rev. With dimensions identical to other series of Rexroth external gear pumps, the Silence Plus is

simple to integrate into existing systems.

In order to achieve high manufacturing standards, Rexroth requires that tolerances for all components are in the micrometer range. To develop external gear units, not only 3-D CAD and FEM strength analyses are used, but also modern optimization methods such as complex gearing calculations and vibration simulations. The latest measuring methodologies for high efficiency and low noise emission take place in a soundproof chamber per DIN and ISO standards.

At this year's Hannover Messe, the Silence Plus was declared the overall winner of the "Industriepreis 2011" industrial award. More than 500 product applications with innovative industrial solutions were received. The jury was made up of professors, scientists,

technical journalists, sector and industrial experts that acknowledged the significant engineering developments of the Silence Plus.

"Not everyone is going to jump onboard this concept at first, but we've tested the machine in real manufacturing settings and people are quite amazed how quiet the gear pump is during operation," Novak says. "We're now at a point where we'd like to examine different sizes and configurations and try to match the product to specific customers that have a need for low-noise applications."

For more information:

Bosch Rexroth Corporation
5150 Prairie Stone Parkway
Hoffman Estates, IL 60192
Phone: (847) 645-3600
www.boschrexroth.com/SILENCE-PLUS

Mico and Haldex

COLLABORATE ON ACCUMULATOR CHARGE VALVE WITH GEAR PUMP

Mico Inc. recently announced a collaboration with Haldex Hydraulics Corporation to offer an integrated accumulator charge valve and gear pump package. The integrated package reduces the amount of plumbing and mounting hardware needed, resulting in a less complex, more durable and efficient design. This product is designed for vehicles that use a full power hydraulic brake system and requires power-off braking by storing energy in accumulators.

Contributing to the package's long-lasting design is the Haldex gear pump that is known for its reliability

and durability. The gear pump's simple design also makes it a more cost-effective solution than alternative pump designs. The package greatly reduces the potential for leak paths by decreasing plumbing, which also makes the system easier and less time-intensive to incorporate into an overall design. Additional efficiency comes from the package's design feature that provides excess flow from the charge valve to operate steering, cooling or implement functions.

The integrated accumulator charge valve and gear pump package comes with the option of single or dual accumulator ports with four charging rate options

between 0.5 gallons per minute (gpm) and five gpm. The unit displaces up to 1.4 cubic inches with system pressures up to 3,000 psi maximum continuous.

For more information:

Haldex
10930 N. Pomona Avenue,
Kansas City, MO 64153
Phone: (800) 643-2374
www.haldex.com

Mico Incorporated
1911 Lee Boulevard
North Mankato, MN 56003
Phone: (507) 625-6426
www.mico.com

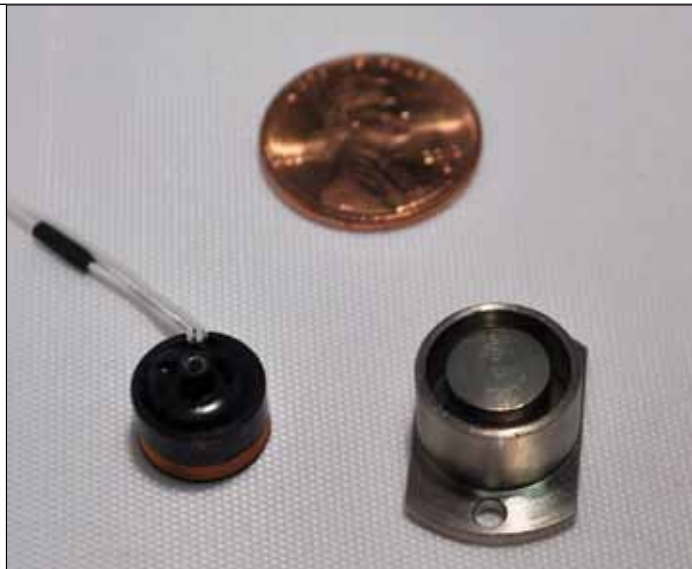


product news

BEI Kimco

OFFERS VOICE COIL ACTUATORS

BEI Kimco Magnetics, a company of Custom Sensors & Technologies (CST) Inc., has announced an exciting breakthrough in miniaturization for cylindrical shaped voice coil actuators (VCAs) with the introduction of the Model LA05-05-000A. The new actuator measures only 0.5" in diameter by 0.5" in length at mid-stroke, approximately 0.5" smaller than typical models on the market. This size reduction offers engineers a new solution in meeting tight packaging constraints for military, medical and industrial applications. "To our knowledge, the new actuator is unique—there is no other cylindrical VCA this small on the market," says Miguel Hermsillo, BEI Kimco's applications engineer for VCAs. "With its tiny size, customers can now use a VCA in spaces they previously



couldn't, opening a whole new realm of design options. Previously an application may have required a BLDC motor with other components to accomplish what the LA05-05-000A can now do with a single component."

The miniature actuator characteristics include a force of 2.5 ozf, a total stroke of 1.02 mm and an actuator constant of 1.04 N/sqrt (watt). The new actuator features direct drive, hysteresis-free and cog-free operation while delivering

high-acceleration and infinite position resolution, particularly important in mission-critical applications where precision is paramount.

For more information:

BEI Kimco Magnetics
1499 Poinsettia Ave. Ste 160
Vista, CA 92081
Phone: (760) 597-7042
www.beikimco.com

AutomationDirect

EXPANDS PROSENSE LINE

AutomationDirect has expanded the ProSense line of pressure sensors and temperature transmitters. IP68/IP69K-rated 5,000-psi pressure transmitters are available in zero to 10V and 4 to 20mA output models. Offering higher operating and burst pressures, the transmitters are suitable for use in applications such as hydraulic systems, paintball changing systems, biotechnology and more. ProSense PTD25 series pressure transmitter prices start at \$97. New TTD temperature transmitters, for use

with RTD probes, are available in three temperature ranges. Equipped with M12 quick-disconnects for fast wiring, the transmitters provide a high accuracy two-wire or three-wire 4–20mA signal output. The IP67 rated transmitters convert low-level RTD temperature probe output signals to high-level analog signals, making them more appropriate for long-distance transmission. Backed by a three-year warranty, ProSense temperature transmitter prices start at \$65.



For more information:

AutomationDirect
3505 Hutchison Road
Cumming, GA 30040
Phone: (770) 889-2858
www.automationdirect.com

Sevcon Motor Controllers

MEET HIGH PERFORMANCE DEMANDS



Sevcon has expanded its range of advanced technology Gen4 motor controllers for electric vehicles with the introduction of a new high power unit. The new Gen4 Size 8 AC motor controller is designed to meet the high performance and safety requirements of on-road and off-road electric vehicles and hybrid electric vehicles. The hardware platform of the new controller supports both AC induction and permanent magnet AC motor control technologies. The new controller has a continuous power output of up to 60 kW, with a peak output of up to 100 kW, and is capable of running from a peak DC supply voltage up to 400 V.

The size 8 model is the latest addition to the Sevcon Gen4 range that combines the latest in electronic motor control technology with a compact, rugged and IP66-rated design to meet the needs of electric vehicle (EV) OEMs, EV conversions and EV drivetrain system integrators. Advanced flux vector control improves traction control efficiency and motor responsiveness—channeling drive power and energy from the battery smoothly and efficiently. In addition, the controller is designed to support a wide range of vehicle functional safety requirements including ISO26262. Multiple motor sensor feedback options are provided through a range of hardware inputs and software control. Fully integrated sets of input and outputs are designed to handle a wide range of

vehicle functions, eliminating the need for additional external input/output modules or vehicle controllers and connectors.

Alternatively, for a lower level of vehicle integration, the controller can operate as a motor “slave,” directly receiving a required motor torque/speed command via CANbus. The CANopen

bus also allows the easy interconnection of multiple controllers and motors as well as devices such as displays and driver controls. Sevcon’s new Gen4 range of motor controllers forms part of a comprehensive range of AC and DC motor controllers, power converters and battery chargers for

continued



www.circlegear.com

Circle Gear and Machine

1501 South 55th Ct. • Cicero, IL 60804
Ph: 708-652-1000 • Fax: 708-652-1100



- **Quality Custom Gearing**
- **All Gear Types and Sizes**
- **ISO 9001:2008 Certified**
- **Reverse Engineering**
- **Design Analysis**
- **Nationwide Service Since 1951**





GEARBOX REPAIR SPECIALISTS

- **Prompt, accurate quotations**
- **Competitive pricing**
- **Quality repairs/rebuilds**



Quality Reducer Service

620 East Avenue ■ LaGrange, IL 60525
708-354-8080

WE SERVICE ALL TYPES OF INDUSTRIAL GEARBOXES

www.qualityreducer.com

electric powered vehicles.

For more information:

Sevcon USA, Inc.
155 Northboro Rd.
Southborough, MA 01772
Phone: (508) 281-5510
www.sevcon.com

Tiny Rotary Position Sensor

FITS IN TIGHT SPACES



Piher International Corporation recently announced the availability of the non-contacting MTS 360 SMD Rotary Position Sensor. The MTS combines a through-shaft design with 360-degree absolute position feedback in an ultra miniature size with reliability up to 25 million cycles. With its size of only 6 mm x 17 mm x 18 mm, engineers can now integrate a fully featured rotary sensor directly on their PCB without the packaging issues that typically accompany encoders or other absolute position devices. The low profile fits easily in places that were previously too small for pre-packaged rotary sensors.

The MTS 360 relies on patented Hall effect technology to enable true non-contacting through-hole shaft sensing using standard SMD features. The offset

through-hole accommodates the vacuum pick-up tool, allowing use in automated SMD assembly systems. The standard model features a 4 mm double D-flat shaft and an 8-pad SMD footprint that is compatible in most reflow soldering systems.

The new device offers electrical angles up to 360 degrees with no dead band and linearity as low as ± 0.5 percent. Rated for use at -40 C to $+150$ C, the sensor can operate up to 300 RPM and can be programmed with full scale output with angles shorter than 360 degrees. Output is selectable between analog, PWM 12 bits or serial protocol (SPI) at 14 bits and includes a second output channel to provide a programmable switch signal. A redundant version with a dual core sensor in the same package is also available.

For more information:

Piher International Corporation
316 Washington Blvd. Ste A-103
Mundelein, IL 60060
Phone: (224) 475-0582
www.piher.net

Zero-Max Hubs

PROVIDE ACCURATE MECHANICAL ADJUSTMENTS

Zero-Max Phas-Lok adjusting hubs provide a fast and easy method for changing the phase relationship of components in a power transmission system. Phas-Lok compensates for required timing changes in a system. They provide an accurate, mechanical adjustment within a 24 degrees range (± 12 degrees). They eliminate the need to disconnect or remove drive components in order to reposition or re-synchronize drive components. Mounted in a system, Phas-Loks provide a reliable position control that does not loosen or slip during



equipment start up and shut down. Without any system disassembly, the phase adjustment can be made quickly on the machine with accuracy using ordinary hand tools.

"Phas-Loks are a time-proven device for fine tuning timing adjustment in a power transmission system," reports Robert Mainz, Zero-Max sales manager. Available in 3 sizes with bores ranging from 1/2 inch to 2-1/2 inches. Also available in metric bore sizes and with a variety of split taper bushings.

For more information:

Zero-Max, Inc.
13200 6th Avenue North
Plymouth, Minnesota 55441
Phone: (800) 533-1731
www.zero-max.com

Bison's ServoNOW

DESIGNED FOR SINGLE-AXIS APPLICATIONS

Bison's integrated brushless ServoNOW servo system for single-axis applications was designed to meet basic motion needs by limiting programmability and using simple positioning and speed

control applications. This state-of-the-art design reduces the amount of time and money spent on overall set-up and installation. All input and output functions of the ServoNOW are programmed into the set-up feature through a simplified indexing type command structure making it able to interface to nearly any logic input and output. Analog inputs can be selected and set up to control the position or velocity of the system. All set-up and installation can be accomplished with any standard PC with a built-in USB port. Free, downloadable host software called *QuickLaunch* is available with the package and loads on any Windows PC. The ServoNOW incorporates an inclusive closed-loop brushless servo motor with built-in driver, controller, magnetic encoder and 110/230VAC universal power supply all in one complete, compact package. Four programmable digital inputs and outputs, analog I/O (0 to 10 VDC or 4 to 20 MA, 12 bit) and position resolution of 4,096 counts per revolution are included.



For more information:

Bison Gear & Engineering Corporation
3850 Ohio Avenue
St. Charles, IL 60174
Phone: (800) 28-24766
www.bisongear.com

Technosoft

RELEASES SMALL
SERVO DRIVE SOLUTION

Technosoft recently announced a new family of intelligent servo drives known as

the iPOS Line based on a design concept offering higher power density on very compact boards. Modularly designed to cover both low- and high-volume applications, the first member of this family—iPOS3602 (36 V, 2 A, 75 W)—is a complete motion control and drive

solution packed on only 21 x 54 mm of PCB space. It integrates all the basic motor control functions, motion control and PLC features on a remarkably small-sized plug-in module.

Equipped with CAN/CANopen interfaces (optionally, additional

continued

WORLDWIDE ELECTRIC

A COMPLETE FAMILY OF PRODUCTS

- Premium Efficiency T & TC-Frame
- EISA-Compliant T & TC-Frame
- Premium Efficiency Explosion-Proof T & TC-Frame
- Explosion-Proof T & TC-Frame
- Permanent Magnet DC
- Close Coupled Pump
- 56 & 56C Frame
- Stainless Steel Washdown Duty
- Advanced Design Rock Crusher
- Oil Well Pump
- Vertical Hollow Shaft
- HYUNDAI Medium Voltage

MOTORS

Shaft Mount Speed Reducer

Cast Iron Right Angle Speed Reducers

Aluminum Right Angle Speed Reducer

- Across-Line Starters
- Soft Start Starters
- Contactors
- Overload Relays
- Variable Frequency Drives
- Safety Switches
- Transfer Switches
- Pressure Switches
- Alternator Relays
- Drum Controllers
- Pilot Devices

MOTOR CONTROLS

ALL PRODUCTS IN STOCK!

WorldWide Electric Corporation
1-800-808-2131 ♦ www.worldwideelectric.net

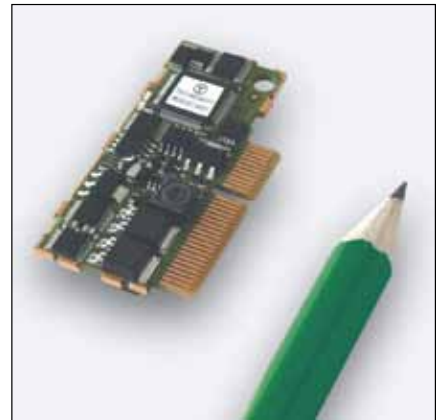
product news

EtherCAT interface also available), the iPOS drive controls any rotary or linear brushless, DC brush or step motor. The iPOS3602 is able to execute complex motion programs directly at drive level, using its built-in motion programmer and the high-level Technosoft Motion Language (TML), or it can operate as an intelligent EtherCAT and CANopen slave.

In simple applications iPOS3602 works as a single-axis motion controller and drive in stand-alone mode, autonomously running the program residing in its non-volatile memory. In systems that request a host, the iPOS drive operates as an intelligent slave executing motion sequences triggered by input lines, or commands received via RS-232 or CAN bus. The motion

capabilities of the iPOS card include position or speed profiles (trapezoidal, S-curve), 3rd order PVT and 1st order PT interpolation, electronic gearing and camming, analog or digital external reference, complemented with the cyclic synchronous position, speed and torque modes specific to EtherCAT. This enables you to reduce both the development time of complex applications, and the master's task, by calling complex motion functions, pre-stored in the drive memory, or by triggering their execution via I/O signals.

This drive can operate with a wide choice of feedback devices. Incremental and Sin/Cos encoders, digital or linear Halls are supported by default. SSI, BiSS, EnDAT absolute encoders and resolver interfaces are available through an additional extension.



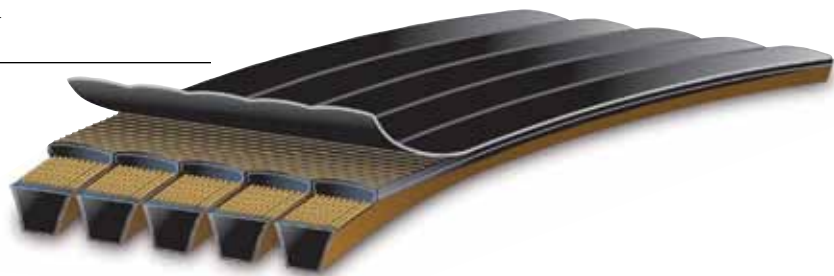
For more information:

Technosoft U.S. Inc.
48595 Wildrose Drive
Canton, MI 48187
Phone: (734) 667-5275
www.technosoftmotion.com

TB Wood's Belt Drives

PROVIDE HIGH-IMPACT STRENGTH

Premium belts from TB Wood's stretch less than standard cross sections, which makes them suitable for use on problem drives requiring high-impact strength and load-carrying power. Premium banded belts can replace several belts with the strength of a single belt. Banded belts feature a multiple-layer tie band that provides lateral rigidity to prevent belts from turning over or from coming off of the drive. Premium singles are available for applications when banded belts are not an option. Single belts can be used with deep groove sheaves and drives with limited room for "take up." They can also be an "A" section solution for multi-groove A/B sheaves. TB Wood's Premium V-belts can handle 1.4 to 2.2 times more horsepower than equivalent sized standard V-belts, so you can design a more compact drive that weighs less, puts less strain on costlier components, and



uses fewer belts.

A "clutching" non-rubber surfaced cover allows momentary slippage due to excessive overloads without burning belts up. Kevlar or Aramid tensile cords yield extraordinary strength, durability and virtually zero stretch. Chloroprene rubber compounds provide superb oil and heat resistance, and a treated cover withstands slip and shear forces at peak loads without generating excessive heat and fends off penetration by foreign materials. Curve design compensates for effects such as sidewall bulge, which occur when belts bend around a sheave. A double fabric cover creates maximum abrasion resistance that protects against wear caused by fine airborne dust, which can cause rapid belt sidewall wear, resulting in early failures.

The strength of premium belts, combined with tough application environments, may require extra heavy-

duty TB Wood's sheaves that can meet the challenge. TB Wood's sheaves are carefully engineered to assure maximum performance over a long life span. They're constructed of fine-grain, high tensile cast iron. A full array of sheaves is available to meet specific application requirements with capacities up to 600 hp from stock and bore sizes from 1/2 to 8-1/2 inches. These belts are designed for use in a variety of industries including agriculture, pulp and paper, forestry, mining, construction, lumber, manufacturing and oilfields.

For more information:

TB Wood's Inc.
440 North Fifth Avenue
Chambersburg, PA 17201
Phone: (815) 847-7532
www.altramotion.com

Applimotion

OFFERS CUSTOM DIRECT-DRIVE MOTOR SYSTEM

Applimotion recently introduced a custom direct-drive motor system with precision encoders and bearings in unique packages. For years OEMs have routinely designed Applimotion ULT, UTH, UTS, and UTO frameless motor kits into direct-drive systems unique to an application. Applimotion is now offering custom design engineering to incorporate its widely popular frameless motor kits into application-specific direct-drive motors as a service to customers. Whether your requirements include special mechanical requirements, high accuracy for precision positioning or a harsh environment, Applimotion can create a solution. An Applimotion motor kit is selected based on performance needs. Then Applimotion engineers guide you through the selection of feedback and precision mechanical attributes. Finally, a complete custom direct-drive motor solution is fabricated and delivered, including unique testing if required.

Direct-drive motors are finding their way into many new applications as the advantages in reliability, precision and performance are realized. Applimotion has supplied their motors to a wide range of industries including energy, medical, unmanned-vehicles, inspection, metrology and military/defense. Unfortunately, standard off-the-shelf solutions currently available often don't have the right features and can be too expensive.



Applimotion can create an affordable direct-drive solution that fits your application.

For more information:

Applimotion, Inc.
5915 Jetton Lane
Loomis, CA 95650
Phone: (916) 652-3118
www.applimotion.com



AVOID EQUIPMENT BREAKDOWNS.
Torque Limiters up to 118,000 ft-lbs.
FAST REACTING. EASY TO RESET. COST SAVING.



R+W
COUPLING TECHNOLOGY
THE PERFECT COUPLING
WORLDWIDE.

R+W America | Phone: (888) 479-8728 | E-Mail: info@rw-america.com | Internet: www.rw-america.com

McINNES
ROLLED RINGS



Fast Quotes
Fast Deliveries

4" -72" Diameters

Carbon,
Alloy &
Stainless

1-2 Week
Deliveries*

*with material in stock



1-800-569-1420
www.mcinnestrolledrings.com
sales@mcrings.com

product news

Ogura Brake

CONTROLS SHUTTER DOORS

Anyone who has ever lifted a manual rolling shutter door knows that sometimes doors in a free fall condition can have significant force behind them. Left unchecked, this force can cause either personnel injury or property damage. For this application, Ogura developed the new CFB Centrifugal Brake. In a normal speed condition, springs hold back the brake shoes the brake does not engage and the door can be raised or lowered normally. However, in an over-speed condition the brake shoes are applied by centrifugal force slowing the door down, the faster the speed, the higher the torque applied by the centrifugal brake. Since the brakes do not require any external controls and/or power sources they are very easy to set up and maintain. There are many other types of overhauling load applications that could also utilize this brake. Conveyor applications, hose reels, wire unwinding and over-speed protection



in windmills could all benefit from this type of brake. Ogura has been producing clutches and brakes since 1938. Over that time, the company has developed more than 5,000 different models of clutches and brakes. Although Ogura primarily produces electromagnetic clutches and brakes, it also produce magnet particle, mechanical, pneumatic, hydraulic and a variety of specialty products.

For more information:

Ogura Industrial Corp.
100 Randolph Road
Somerset, NJ 08873
Phone: (732) 271-7361
www.ogura-clutch.com



R+W

OFFERS COMPACT, FLEXIBLE
SAFETY COUPLING

Making use of the existing EKL line of compact elastomer couplings, the all new SLE safety coupling offers a compact, flexible and vibration damping option with integral torque overload release. Designed for aggressive servo driven applications, the SLE

is completely backlash free, relying on preloads and frictional connections, along with a precision molded, wear resistant, polyurethane insert to damp vibration and relieve bearing loads resulting from misalignment. In the event of a machine crash, power surge,

product news

or any other cause of unanticipated overload, the SLE will disengage the motor or gearbox shaft from the load in less than three milliseconds. Re-engagement takes place automatically with slow speed rotation of the shaft subsequent to the overload occurrence. Available in four sizes, the SLE handles a range of disengagement torque values from five to 700 Nm, and English or metric shaft diameters from 12 to 60

mm. Technical details can be viewed and downloaded at: http://www.rw-america.com/torque-limiters/torque-limiter-sle_t.php.

For more information:

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



Physik

ADDS TWO MODELS TO MICROSCOPE STAGE SERIES

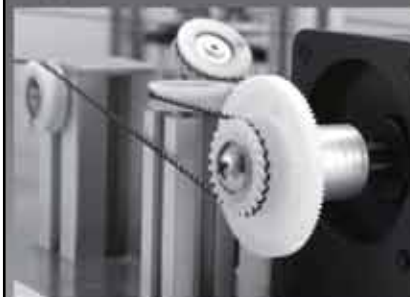
PI (Physik Instrumente) LP has added two higher-performance models to its successful PInano superresolution (SR) microscope stage series. The new models are equipped with direct-measuring capacitive sensors. This type of sensor can provide higher linearity and long term stability than the lower cost piezoresistive sensor-equipped stages which are still available. Capacitive sensors are also less sensitive to noise due to a high-frequency measurement principle as opposed to the DC-based sensing technique used in piezoresistive sensors. The net effect is similar to the higher quality and lower noise on FM radio channels compared to AM radio. The large aperture accommodates microscopy accessories such as slide holders, Petri dish holders, etc. The recessed bottom slide mount allows full rotation of the turret without in and out Z-motion, protecting valuable

objectives from crashing into the stage on turret rotation. Both XY and XYZ stages are available. The low profile design of 20 mm (0.8") facilitates the integration into inverted microscopes from the four major manufacturers Leica, Nikon, Olympus and Zeiss. An optional 25 x 25 mm positioning stage with self-clamping ultrasonic ceramic motors serves as a stable basis for the piezo scanning stage and allows imaging of large samples. The microscope stages are compatible with all major image acquisition software packages such as Micromanager, Metamorph, etc.

For more information:

PI Physik Instrumente
16 Albert Street
Auburn, MA 01501
Phone: (508) 832-3456
www.pi-usa.us

Synchromesh Wire Rope



"Revolutionary"
Wire Rope Timing Belt

Reliable 3D Application
Low Tension Drive
Meshing Engagement with the Drive
Variable Belt Lengths



Your dreams. Woven together.
ASAHI INTECC USA, INC.

Asahi Intecc USA, Inc.
2500 Red Hill Ave., Ste 210
Santa Ana, CA 92705
Tel: 866-678-2281
Fax: 949-756-8165

www.asahi-intecc.com

Blocks (Around the Clock)

Force Control Maximizes Uptime for Concrete Manufacturer

Force Control Industries



A single production line at Reading Rock means any problems could bring the entire production line to a halt (all photos courtesy of Force Control).

Reading Rock manufactures concrete blocks—the kind that were probably used to build the schools that you attended. With employees working three shifts six to seven days a week, they make plenty of them. In fact, production manager Phil Thacker figures that they’ve manufactured about 22 million of the industry-standard 8-inch blocks in the past four years (when they replaced an aging Besser block machine with their newest version). That’s enough blocks, if placed end-to-end, to reach from their suburban Cincinnati factory all the way to the Golden Gate

Bridge and back and still build a few large schools with the leftovers.

One reason for this productivity is that Thacker and the Reading Rock team go to great lengths to maximize their “uptime.” Brakes and clutch-brakes utilizing oil shear technology have played a major role in eliminating Reading’s downtime. “Pretty much everything that has a motor on it is equipped with a Force Control clutch-brake or brake” says Thacker. “I never worry about them going down.”

A Single Production Line Equals No Room for Error

Reading Rock, like many of the

cement block plants across the country, has a single production line. That means that from the time that dry materials enter the mixer until pallets of formed and dried concrete blocks exit the facility, everything follows a single pathway. That also means that a problem with any component used along the way will bring the entire production floor to a halt.

If you follow the manufacturing path, you’ll quickly see where and how oil shear technology is making a difference—and keeping the plant operational. At the beginning, dry, raw materials are weighed and fed into a mixer and blended for several minutes (along with admixtures

like coloring agents and water repellants) before water is added. When optimal consistency of the mixture is attained, the material is discharged into a block machine and fed into a mold. Once in the mold, the concrete is compacted with a combination of pressure and vibration to ensure strength and uniformity.

The main drive is equipped with a Posidyne clutch-brake, which controls the indexing of the machine bringing pallets in, bringing molds in and dropping the concrete into the molds. After the mix is poured, vibrators run to shake the forms, ensuring the proper density of the blocks. Once this is complete, the main drive indexes again, and the cycle repeats.

Oil-shear technology plays a major role in ensuring that the cycle repeats flawlessly. Force Control clutch-brakes and brakes employ oil shear technology, which transmits torque between lubricated surfaces. The circulating fluid provides both cooling and lubrication of the friction surfaces, eliminating wear and dissipating heat. Because there is no direct contact between the friction surfaces during acceleration or deceleration, there is no wear and thus no need for adjustment or replacement of discs.

Normal dry clutch-brakes and brakes, on the other hand, employ a sacrificial surface—the brake disc or pad—to engage the load. Having no good way to remove the heat caused from engagement between the disk and plate, this material must absorb the heat. These extremely high temperatures will eventually degrade the friction material. As the friction surface wears away and begins to glaze, the ensuing torque fade causes positioning errors, which require adjustment or replacement of the friction surface.

The Posidyne clutch-brakes in service at Reading Rock utilize oil shear technology. Here a fluid film flows between the friction surfaces. As the brake is engaged, the fluid is compressed, and the automatic transmission fluid particles shear, thus transmitting torque to the other side. This torque transmission causes the stationary surface to turn, bringing it up to the same relative speed as the moving surface. Since most of the work is done by the fluid particles in shear, by the time the surfaces



Reading Rock has manufactured about 22 million 8-inch blocks in the past four years.



If there's a motor in the plant, there's a Force Control clutch-brake or brake on it.

actually meet or “lock up,” wear is virtually eliminated.

In addition to transmitting torque, the automatic transmission fluid also helps to dissipate heat, due to a patented fluid recirculation system. Along with torque transmission and heat removal, the fluid also serves to continually lubricate all components, thus extending their service life. Additionally, this provides a “cushioned” stop that reduces shock to the drive system. Unlike dry clutch-brakes, the totally enclosed oil shear system is impervious to external elements such as wet, dusty or dirty environments, as are found in a large percentage of concrete block plants.

Since the layer of oil eliminates wear, the Posidyne clutch-brake provides a long service life with virtually no need for adjustments. That is in marked contrast to dry braking systems which have a sacrificial surface that abrades away during contact and requires eventual replacement and frequent adjustment to maintain proper parameters. With elimination of wear comes elimination of adjustment—and increased “uptime” for Reading Rock. In addition, the clutch-brake cycles faster than most prime movers, which means that the block machine speeds can be increased. And that means that more blocks are produced per shift.

continued

Lower inrush currents are seen using a Posidyne clutch-brake, which reduces power factor imbalance and can reduce energy costs. Torque on the Posidyne clutch-brakes can be adjusted by the actuation system to provide the proper



The motor on a clutch-brake assembly runs constantly, eliminating the starting and stopping to allow larger motor life.



Posidyne clutch-brakes, MagnaShear brakes and SmartPac vibrator systems have increased uptime at Reading Rock.

acceleration and deceleration, as opposed to some dry clutch-brake systems where adjustment is not available.

A Whole Lotta Shakin' Goin' On

Posidyne oil shear clutch-brakes are also employed on the vibrator drive to quickly "settle" the contents in the concrete block mold. Vibrator shafts can be fixed or variable and are driven by the clutch-brake or motor with a motor-brake. The motor on a clutch-brake driven assembly runs constantly, thus eliminating the starting and stopping of the motor. The constant operation is smoother, allowing the motor to last longer than one that is subject to constant starts/stops.

This also decreases the cycle time and speeds the production of blocks. A built-in neutral position is another benefit of the Posidyne clutch-brake driven assembly. At the completion of the vibration cycle, the brake is released and the weights can drop into the bottom position. This allows both weights to remain in sync during start-up, imparting vibration of predetermined amplitude into the shaft as opposed to starting the cycle with weights in varying positions and imparting more (or less) severe amplitude that would cause shock to the system and shorten life of components, not to mention the effect it would have on the density of the blocks being formed.

Motor brakes, on the other hand, are used to stop the motor at the end of each cycle. PosiStop air actuated brakes feature a multi-disk stack, which provides a high torque capacity in a small package. The increased torque capacity is achieved with a minimum increase in inertia. Dry brake designs, in contrast, feature a single surface with lower torque and higher inertia.

The formed and uncured or "green" concrete blocks are ejected from the mold onto a metal pallet. The pallet is conveyed horizontally across a span to a loading system with an elevator. The elevator carries the blocks vertically and then feeds a finger car which loads stacks of block into drying racks. Each motor on the horizontal conveyor, the vertical elevator and the finger cars is equipped with MagnaShear oil shear brakes, on motors from ¾ to five HP. The totally enclosed oil shear

design dissipates heat and is impervious to dust and dirt. MagnaShear brakes, which combine oil shear durability with electric actuation, simple control logic and spring-set load holding, are used on virtually all areas of green and cured block handling.

Once a curing rack is filled with steel pallets of "green" blocks, the entire rack is transported to the curing kiln. Here the blocks are cured at 120 to 180 degrees F (as opposed to the 500-plus degrees for traditional kilns) for 24 hours. Cured concrete blocks are removed from the kiln and moved via similar equipment to a processing area for "cubing" or palletizing before they are placed in storage.

Conveyors transport the now empty steel pallets back along a similar pathway to an area opposite the loading conveyor, called an unloading conveyor. Again, all conveyor motors are equipped with MagnaShear oil shear brakes for optimal performance with virtually no downtime.

Half-Blocks Garner Full Attention

Perhaps the most impressive recent improvement is in filling half-block forms. Reading Rock was using SmartPac vibrator shafts to introduce vibration to achieve the half-block height molds. This technology was actuated directly from the motor which meant that the vibrator was either "on" or "off" with no variability. For several years, however, Reading has been using a variation that allows Reading personnel to change the amplitude and frequency. In addition to flexibility never before seen in this application, the technology offers a service life that is fully twice the number of cycles of prior designs. Additionally, the rapid compaction and quicker finish times allow these special block designs to be completed quickly and economically. Maintenance is simple too—just grease a bearing every 8 hours and tighten mounting bolts periodically.

Reading Rock has benefited substantially from the increased uptime that three primary Force Control Oil Shear products provide, namely Posidyne clutch-brakes, MagnaShear brakes and SmartPac vibrator systems. These are also branded under the Besser Company trade names BescoDyne, BescoShear and SmartPac.


Each of these products was selected due to the particular requirements and parameters of the applications they serve.

Service Programs

to Support Critical Production

In addition to robust designs which eliminate adjustment and wear, Force Control also provides a 24-hour service line which is important to Thacker. "I never worry about the Force Control products going down," says Thacker, "but if there ever is a problem, I know that I can call them anytime—night or day—for an immediate resolution to the problem."

Being located in the same city as Force Control is an advantage that every block plant would like, but few enjoy. So Force Control developed their Emergency Response Service program to give companies with critical production lines like this some peace of mind. With this program, Force Control has popular models of its Posidyne clutch-brakes and Posistop brakes staged around the country for immediate shipment. Currently, factory rebuilt models (in "just like new" condition) are strategically located in Ohio, Florida and California. This allows fast response and may mean that same-day or next day delivery is possible. A return-goods-authorization number is also issued to simplify the return of the replaced unit.

The reliability and durability of oil shear technology, coupled with the Emergency Response Service, helps plants with a single production line to maintain high production. It has made a huge difference for concrete block plants in general and for Reading in particular. In short, oil shear technology keeps Reading rockin'! 

For more information:

Force Control Industries, Inc.
3660 Dixie Hwy
Fairfield, OH 45014
Phone: (513) 868-0900
www.forcecontrol.com

Reading Rock
4600 Devitt Drive
Cincinnati, OH 45246
Phone: (513) 874-2345
www.readingrock.com

Keep the Drive in Your Train™

High strength Plastalloy™ magnets capture metal filings *before* they can derail your drive train or downstream components. They are an excellent, inexpensive form of insurance.

- Enhance the performance & life of filter elements
- Available as Chip Collector Magnets or embedded in Magnetic Drain Plugs
- Oil resistant & suitable for the extremes of automotive "under hood" applications
- Ideal for high-temperatures (up to 150°C)



The Electrodyne Company, Inc

4188 Taylor Road, Batavia, OH, 45103
513.732.2882

www.edyne.com
info@edyne.com



Clifford-Jacobs custom high-strength forgings work everywhere and for some of the biggest names in mining, aerospace, and energy.

So whether you need a 5-pound gear blank or an 800-pound finish machined component, depend on Clifford-Jacobs' uncompromising quality. It comes with fast estimates, ready resources, part warehousing, and zero tolerance for failure.



CLIFFORD-JACOBS
FORGING
AN IMT COMPANY

sales@Clifford-Jacobs.com | Clifford-Jacobs.com | 888.352.5172 | ISO 9001:2000

Motion Control

New Controller Family

FROM ROCKWELL AUTOMATION SUITED FOR SMALL-SIZE APPLICATIONS



The new family of Allen-Bradley Micro800 component-class micro programmable controllers and *Connected Components Workbench* software from Rockwell Automation are designed to give machine builders fully customizable solutions for nano- and micro-level controller applications.

Designed to be used with other Allen-Bradley component class products, such as drives, motion control and operator interface products, the controllers are part of a solution bundle that offers machine builders easy selection, installation and commissioning of their low-cost, stand-alone machines.

“Machine builders need economical, convenient control solutions they can customize to suit their customers’ specific application needs,” said Paul Gieschen, market development director,

Rockwell Automation. “With this new line, Rockwell Automation is delivering the functionality and flexibility of a micro programmable logic controller for the price of a smart relay. Yet, the greatest value of the new Micro800 family is the simplicity and convenience it offers users—namely, that it provides just enough control, so they’re only paying for what they need.”

Suited for standalone machine applications with fewer than 48 I/O, the initial launch consists of two controllers—the Allen-Bradley Micro810 and Micro830 controllers—and *Connected Components Workbench* software. Leveraging the controller’s embedded USB and serial ports, machine builders can quickly program the controllers and link them to human-machine interfaces (HMI) and other serial devices—ultimately helping minimize selection and installation time for themselves, and the total cost of ownership for end users.

The Micro800 controllers offer a wide range of plug-in modules for analog or digital I/O, communications and expanded memory. The plug-in modules enable machine builders to personalize the controllers to increase functionality without expanding the product footprint. The new controller family also offers removable terminal blocks (most models) and simplified communication via point-to-point data exchange.

Complementing the new line of controllers, the new *Connected Components Workbench* software follows established IEC-61131 standards. The software allows machine builders and end users to leverage one platform for their programming and configuration needs. It allows machine builders to program Micro800 controllers and configure other devices in the system, including PowerFlex drives and PanelView Component HMI products.

Based on proven Rockwell Automation and Microsoft Visual Studio technology, the new software provides controller programming, device configuration and data sharing with the HMI editor for PanelView Component operator products. In addition, the software supports three standard IEC program-



ming languages: ladder diagram, function block diagram and structured text. In addition, the programming software features run-time download, which enables live program adjustments.

As the smallest of the Micro800 family, the Micro810 controller features embedded smart relay function blocks that can be configured from a 1.5-inch LCD and keypad. The function blocks include Delay Off/On Timer, Time of Day, Time of Week and Time of Year for applications requiring a programmable timer and lighting control.

The Micro830 controller provides flexible communications and up to six

high-speed counter inputs. It also provides easy incorporation of as many as five plug-in modules on the 48pt models. These off-the-shelf, fully customizable controllers carry global certifications and support.

“Machine builders seek the best of all worlds: They want solutions that are priced to provide not only the essential capabilities that they require, but also feature convenient, easy-to-use programming and configuration tools that minimize set-up and start-up times to maximize their profitability,” said Craig Resnick, research director, ARC Advisory Group. “The Allen-Bradley Micro800 PLCs and

Connected Components Workbench software from Rockwell Automation appear to meet this machine builder demand for a customizable, cost-effective solution suited to standalone applications that require simple, time-efficient installation, configuration, programming and updating tools.”

The Micro810 and Micro830 controllers are available immediately. Additional plug-in capabilities for the controllers will be available later this year.

For more information:

<http://ab.rockwellautomation.com/>

Aerotech's Ensemble Epaq MR Series Controllers

BUILT FOR FLEXIBILITY

The Ensemble Epaq MR is Aerotech's next-generation, stand-alone motion controller for applications from basic laboratory experimentation and general purpose positioning to advanced OEM systems. It is offered in a 4- or 8-axis 3U rack-mount version that contains integrated power supplies and pluggable motor and IO connectors. The integrated PWM or linear amplifiers control DC brush servo, rotary brushless and micro-stepping motors. Higher power external amplifiers may be daisy-chained to the Epaq MR using the high-speed AeroNet serial interface for a total of ten axes of coordinated motion.

The flexibility of the Epaq MR allows users to seamlessly mix and match drive types (linear versus PWM, brush or brushless, stepper, etc.) within the same positioning system using a common programming and control platform. Multiple Epaq MRs can be controlled from one Windows PC through Ethernet or USB. Optional on-board encoder interpolation offers the user programmable axis resolution including the ability to change inter-

polation (multiplication) values through software.

Unlike most controllers on the market today, there is no need to understand a cryptic command set to generate motion—the interface is designed to make programming intuitive and easy. Online help further simplifies writing motion programs and includes many functional examples that can be modified for customer applications. Ease of use is enhanced via built-in libraries for LabVIEW, AeroBASIC, .NET tools for C#, VB.NET, managed C++, as well as a full C library.

The *Ensemble with Integrated Development Environment* software offers a graphical user interface in Windows featuring program editor, variable output window, compiler output window, and task state monitor. This interface enables users to monitor all aspects of their positioning system, no matter how complex. The axis control and diagnostic screens are further supplemented by a fully functional autotuning utility that minimizes startup time and allows easy optimiza-

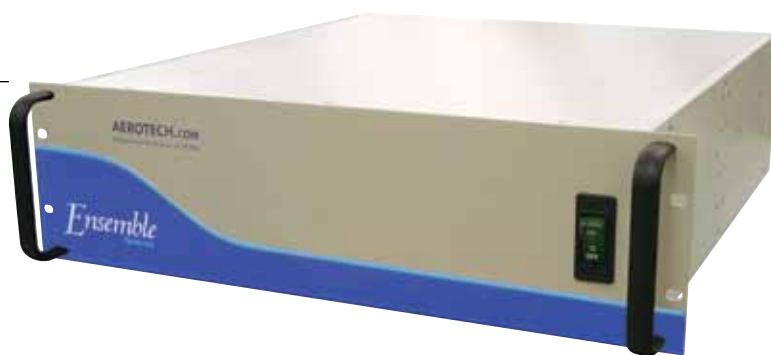
tion of motion axes. The *Windows*-based remote software package is included with each unit, which allows the user to upload/download programs, modify parameter files and analyze motion with Aerotech's advanced graphical tuning package, all from the convenience of a remote PC.

The EtherNet/IP interface enables AB PLCs (MicroLogix, CompactLogix, or ControlLogix) to be integrated directly with the Ensemble. Motion can be programmed in the RSLogix 5000 environment or separate programs can be written on the controller and triggered from the AB PLC.

Aerotech manufactures a wide range of positioning stages, drives and controls to provide a fully integrated and optimized motion solution.

For more information:

Aerotech Inc.
101 Zeta Dr.
Pittsburgh, PA 15238-2897
Phone: (412) 963-7470
Fax: (412) 963-7459
www.aerotech.com



Lenze

OFFERS ETHERCAT INTERFACE FOR SERVO CONTROL



Lenze's ECS servo system can now be ordered with a clock-synchronized EtherCAT interface. Combined with the new L-force Controller 3200 C for central control architectures, even the most demanding motion tasks in terms of

number of axes and precision required can be solved effectively and economically.

The ECS servo system provides the compact servo drives with high dynamic performance that is necessary for motion tasks with the highest requirements regarding precision and speed. It has been designed specifically for multi-axis applications in central control architectures. The versatile system includes a large selection of axis and power supply modules that can be connected to form an integrated unit. The ECS drives are designed to be matched to the motors in the Lenze MCS range, but can also be combined effectively with other synchronous and asynchronous motors.

The L-force Controller 3200 C has been designed for use in the control cabinet and is based on the energy-efficient Intel Atom processor. The integrated 48 MBit/s backplane bus allows I/O modules from the I/O system 1000 to be

directly side-mounted to the controller. A short cycle time and minimum jitter in combination with a time stamp guarantee that the motion system also complies with the strictest speed and synchronization requirements.

"With our combination of Controller 3200 C and ECS servo system, we offer the optimum solution for tasks with a large proportion of motion," explains Sören Mirbach from Control Technology Product Management at Lenze. "And integration of the ECS in the EtherCAT-based control environment rounds off our uniform, end-to-end portfolio for setting up central control architectures."

For more information:

Lenze Americas Corporation
630 Douglas Street
Uxbridge, MA 01569
Phone: (508) 278-9100
Fax: (508) 278-7873
info@lenze-actech.com
www.lenze-actech.com

Haydon Kerk

INTRODUCES SIZE-17 PROGRAMMABLE LINEAR ACTUATOR

Haydon Kerk Motion Solutions has broadened its Idea line of programmable linear actuators with a RoHS-compliant, easy-to-use electronic drive and fully programmable control unit integrated with a linear actuator. The compact, versatile unit is suited for equipment or systems that require a small footprint. The Idea platform also has added the capability of communication using an RS-485 data protocol, overcoming the limitations of other drive communication methods and making the RS-485 Idea programmable linear actuator well suited for industrial applications.

The main advantage for using the RS-485 protocol—especially for industrial equipment such as stepper drives, industrial motor drives and servo systems—is the ability for long data transmissions that exhibit excellent immunity to electrical noise. The RS-485 protocol



utilizes "differential" signal lines for limiting common mode noise coupling and twisted pair cabling for canceling out induced noise current. These allow Idea devices to communicate over a 1,000-foot network without the need for termination resistors and to reach up to 256 addressable device nodes. An industrial controller can send commands to all the drives at once or control each drive separately when assigned a unique identifier, a number between 0 and 255. To download the entire *Idea Drive Communications Guide*, visit www.idea-drive.com.

Among the hardware features of the

Idea Drive platform are programmable current control, a single supply voltage of 12 to 48 VDC, 2.6 Arms (3.68 A peak) maximum rated current per phase, and 8 opto-isolated general purpose I/O. The inputs are rated for 5–24 VDC, 4 mA maximum per input. The outputs are open collector, 5–24 VDC, 200 mA maximum per output.

For more information:

Haydon Kerk Motion Solutions
1500 Meriden Road
Waterbury, CT 06705
Phone: (203) 756-7441
www.haydonkerk.com

WHEN DOWNTIME IS A **DIRTY WORD**

Clean up your language with *Martin*



Your equipment is your businesses' lifeblood. Don't let unexpected downtime destroy your bottom-line. Routine inspections and scheduled maintenance reduce the likelihood of production failure. But when the unpredictable happens and you're down, call *Martin* for unbelievable response to your specific needs.

Martin has been manufacturing quality Power Transmission & Bulk Material Handling products in the USA for nearly 60 years. Our dedication to quality and service allows us to offer the most reliable line of replacement products in the industry.

- Sprockets • Gears • Sheaves • Bushings • Couplings • Synchronous Drives
- Bucket Elevators • Screw Conveyors • Drag Conveyors • Screw Feeders
- Heavy Duty Conveyor Pulleys • Sintered Metal • Plastics
- Industrial Hand Tools • Custom Commercial Forgings

For More Information Contact Your Nearest *Martin* Distributor

Martin SPROCKET & GEAR, INC.

www.martinsprocket.com • 817-258-3000



"The ONE You Rely On"



ONE STOP

Machining and Complete Assemblies

Premier manufacturing capabilities and on-time delivery make Delta Research the supplier of choice for:

- Prototype Powertrains And Transmissions
- Precision Gears
- Shafts And Assemblies
- Precision Machining
- CNC 3,4 and 5-Axis Machining
- And Short Run Production

For The:

- Automotive
- Electric Vehicle
- Aerospace
- And Defense Industries

Our highly skilled employees, a continuous reinvestment into new capital equipment, advanced machining solutions and quick delivery make Delta Research your #1 source for short-run and prototype machined components and assemblies. To learn more about Delta Research capabilities, visit deltaresearch.com



*Old-World Craftsman
On The Leading Edge Of Technology*

www.deltaresearch.com | 1-734-261-6400 | 1-734-261-0909 Fax
ISO9001 & AS9100 Registered

PRECISION

World-Class Precision Prototype and Short-Run Production Gears

The premier gear manufacturer for Aerospace, Defense, Industrial and Automotive industries.

Delta Gear products are recognized around the world for precision-quality and on-time delivery. Now we have the privilege of taking the TIFCO Gage & Gear legacy of products forward with us into the future.

Together, our superior manufacturing capabilities, highly trained workforce and ability to manufacture highly engineered and customized products set us apart from all the other aerospace gear manufacturers.

Our continuous capital investment in precision CNC machinery, trained personnel, ISO9001 and AS9100 registrations, non-destructive testing and engineering solutions deliver aerospace quality at automotive prices.



We Make The World's Finest Gears

www.delta-gear.com | 1-734-525-8000 | 1-734-525-8400 Fax
ISO9001 & AS9100 Registered

 DELTA
GEAR
Formerly TIFCO Gage & Gear

Motoring Ahead

SYNCHRONOUS MOTORS CONTROLLED BY VARIABLE-SPEED DRIVES ARE BRINGING HIGHER EFFICIENCIES TO INDUSTRIAL APPLICATIONS

Heinz Lendenman, Reza R. Moghadam, Ari Tami and Lars-Erik Thand

Management Summary

Electric motors in industrial applications account for approximately 60–65 percent of consumed industrial electricity. Using energy effectively by increasing motor efficiency is at the center of continued motor optimization. Major energy savings are also gained through the use of variable speed drive systems, and today this technology is adopted in as many as 30–40 percent of all newly installed motors. Sustainable use and investment also demand increased reliability and lifetime of a motor. The streamlined rotor structure of ABB's synchronous reluctance motors eliminates rotor cage losses, thus increasing efficiency and compactness. The possibility of achieving standard power and torque levels at merely a low class-A temperature rise (60 K) improves the lifetime of the motor insulation and lengthens the bearing lifetime or greasing intervals.

Electric motors are used in a wide range of industrial applications. What most applications have in common is the need for their motor to be as efficient as possible and to have the longest possible lifetime without increasing maintenance demands or failures. ABB's synchronous reluctance motors are physically smaller in size, helping machine builders to design smaller, lighter and more efficient equipment. Additionally, the possibility of high-speed operation helps to eliminate mechanical power transmission elements such as gearboxes. This eventually enables the integration of the motor and the load equipment—now an increasingly common request.

To answer the need for a motor that is more efficient, smaller and with a long lifetime and low maintenance needs, and that could also be perfectly adapted to variable speed drive (VSD) operation, ABB radically re-thought all technology options. Starting a VSD motor is very different compared to a direct line connection start. This and other changes in boundary conditions highlighted potential opportunities to simplify the motor design and improve efficiency. One well known approach is the utilization of synchronous motors

(SM). SMs with a 4-pole rotor operated at 50 Hz rotate in synchronism with the supply at exactly 1,500 rpm. The corresponding induction motor (IM), however, has slip losses and rotates only at 1,475 rpm for a chosen 30 kW example. In modern IMs with a short circuit rotor cage, the losses associated with the rotor amount to 20–35 percent of the total motor losses. Synchronous rotation eliminates most of these associated losses.

The elimination of these slip losses leads to an efficiency increase of about ~0.6 percent (220 kW motor) to 8 percent (3 kW), as well as a 20–40 percent increase in power and torque density for the same insulation temperature class.

Synchronous motors come in different variants—field-wound with brushless exciters; permanent-magnet (PM) motors; or as motors based on the principle of magnetic reluctance (often called a synchronous reluctance motor or SynRM). A SynRM rotor has neither a conducting short circuit cage—as does the IM—nor permanent magnets or field excitation winding. Rather, the magnetic principle of reluctance is utilized.



Figure 1—A motor-and-drive system undergoing highly accelerated stress testing (HAST). (The above and all other pictures/images courtesy ABB).

The synchronous reluctance motor. Magnetic reluctance is the magnetic equivalent of the resistance in electrical circuits. The rotor consists of one direction of least-possible magnetic resistance (d) and a perpendicular direction (q) with a high magnetic reluctance or good magnetic “insulation” (Fig. 3). Torque is produced as the rotor attempts to align the magnetically conducting direction to the stator field. The strength of the produced torque is directly related to the saliency ratio—i.e., the inductance ratio between the two magnetic directions of the rotor.

The invention of the SynRM concept dates back to 1923. However, at that time the motor type was not adapted for industrial use, due primarily to the lack of a direct online starting capability. But now—with the use of variable speed controllers—this obstacle has been removed (Fig. 4).

In 1982, NdFeB-based, permanent-magnet materials were discovered. The resulting new permanent-magnet (PM) motor technology was adapted for servomotors and is now emerging in many industrial specialty applications such as gearless, low-speed torque motors (Ref. 1). But once again, less attention was paid to the unpretentious SynRM.

In addition, not all earlier published work on the SynRM succeeded in demonstrating superior torque performance or reaching higher efficiency than the IM, as was expected from the calculations—a fact cited by experts and academics as to why the SynRM is not used more often today. Presumably, these early results were due to less-optimized converter control. Indeed, some publications show very promising results

continued



Figure 2—The possibility of high-speed operation helps to eliminate mechanical power transmission elements, such as gearboxes.

and have addressed the electromagnetic design aspects in great depth (Refs. 2–3). It is important to note the contrast of the SynRM to the switched reluctance—or stepper motor—with an entirely different stator, winding concept and non-sinusoidal current waves; a motor often considered unsuitable for industrial use due to high noise. A cited disadvantage of the SynRM is a higher current need for the same torque compared to the PM motor, since the rotor must be magnetized through the stator. However, the power factor as seen from the network is determined by the power converter and is in unity with all operating modes—even for the SynRM.

The industrial motor for VSD systems. In ABB’s SynRM rotor designs and drive control, the motor current, propor-

tional to the inverse of power factor and efficiency— $\propto 1/(\eta \cdot \cos[\rho])$ —is actually lower than that of a small-size induction machine at the same torque and speed. This is primarily due to the significant gain in efficiency. Only for large motors

For small motors at 3 or 4 kW level, as much as 60 percent more power can be obtained for the same temperature rise.

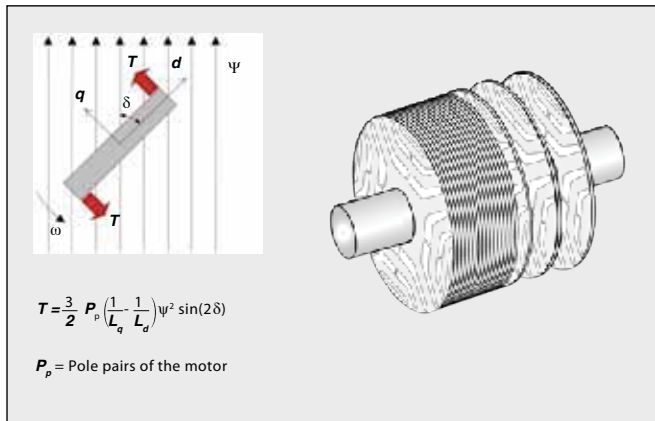


Figure 3—Synchronous reluctance rotor and torque principle.

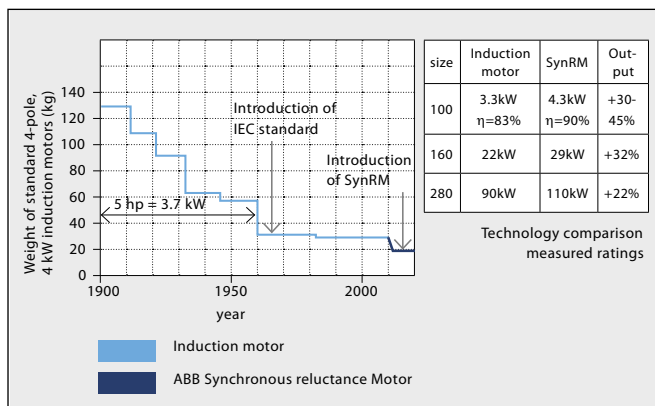


Figure 4—Innovation timeline in LV motors.

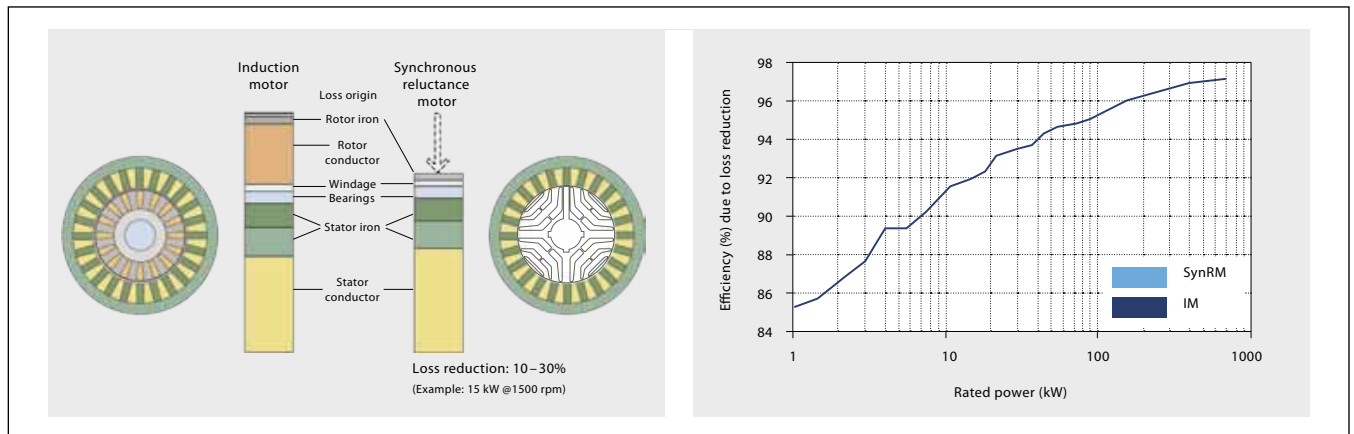


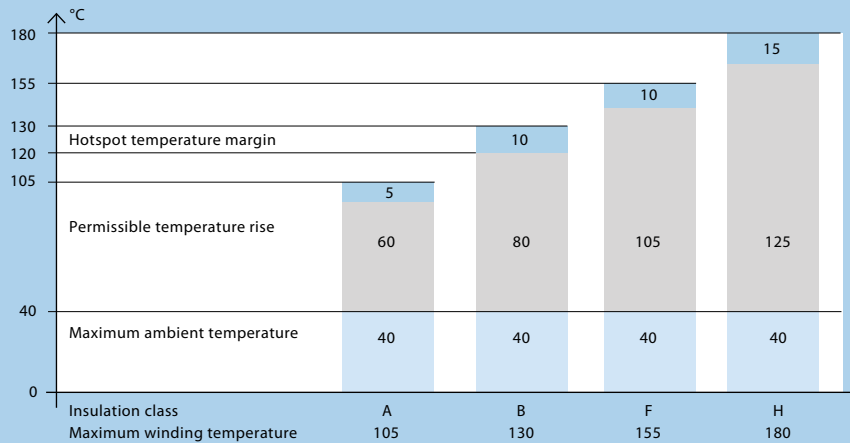
Figure 5—Loss distribution and efficiency.

is the converter current higher than with an IM at the same torque. In general, the ABB SynRM operates with the same frame size for the drive (e.g., ACS850) as the IM at the same power and torque level, albeit at the increased power density and higher efficiency than the IM. The motor efficiency increase translates to a nearly identical energy savings at the drive system level.

One other key advantage of ABB’s SynRM is the plain rotor structure. Without magnets or cage, the rotor construction is more robust than either IM or PM machines. In addition, no risk of permanent loss of performance exists due to potential de-magnetization in case of failure or overheating situations. The motor is inherently safe in operation since, without magnets, no back-EMF voltage is induced and the need for over-voltage protection of the converter becomes superfluous. Finally, rare earth materials for permanent magnets are relatively expensive and have currently been in limited supply for some markets due to the geographic concentration of the common raw materials suppliers, among other reasons.

Elimination of most of the rotor losses and the streamlined rotor structure result in a number of benefits for this motor and its connected load equipment (Fig. 5). A motor with this technology can be operated at the IEC standardized power level for the given frame size. In this case, the VSD efficiency gain ranges from more than 5 percent units for single kW machines to about 0.5 percent for the largest motors (frame 315). Consequently, where an IM would have run at class-F temperature rise (105 K), the ABB SynRM operates merely at class-A temperature rise (60 K) (Fig. 6).

Temperature Classes



Ambient temperature is the temperature of the air surrounding the motor. This is the threshold point or temperature the motor assumes when shut off and completely cool.

Temperature rise is the change within a motor when operating at full load. The difference between the motor's starting temperature and its final elevated temperature is the motor's temperature rise.

The standard method of measuring temperature rise involves taking the difference between the cold and hot ohmic resistance of the winding. This averages the temperature change of the whole winding—including the motor leads, end turns, and wire deep inside the stator slots. Since some of these spots are hotter than others, an allowance factor uses the average temperature to indicate what the temperature probably is

at the hottest spot. This is known as the "hot spot" allowance.

Insulation classes group insulations by their resistance to thermal aging and failure. The four common insulation classes are designated as A, B, F or H. The temperature capability of each class is the maximum temperature at which the insulation can operate to give an average life of 20,000 hr.

Operating a motor at a lower temperature rise than allowed by the insulation class can change the motor's thermal capacity, allowing it to handle higher than normal ambient temperatures. In doing so, the motor's life is extended.

The above graph shows the temperature ratings, temperature rise allowances and hot spot allowances for various enclosures of standard motors.

Figure 6.

In comparison, for a specific compressor at 4,500 rpm, the associated ABB SynRM features still lower bearing temperatures when run at true class-H rise (125 K) than the larger IM run at class-F rise (105 K). The motor was thus also called a "CoolMotor" (Fig. 7). This low-temperature operation improves the lifetime of the motor insulation and lengthens the bearing lifetime or greasing intervals. Motor bearings in particular require regular servicing and, according

The low-temperature operation improves the lifetime of the motor insulation and extends the bearing lifetime or greasing intervals.

to some studies, bearing failure is the root cause of approximately 70 percent of all unplanned motor outages. The lower bearing temperature directly translates into longer greasing intervals, reduced maintenance and higher reliability. Even if a bearing eventually needs replacing, having no magnetic forces—unlike a PM motor—the bearing change is as easy as for an IM.

The technology enables good torque utilization at higher speeds. In another utilization of this technology, the operation is maintained at the conventional temperature—often B- or F-class. Since losses on the rotor are difficult to cool—

compared to stator losses—their near elimination has a particularly high impact on the torque performance. For small motors at 3 or 4 kW level, as much as 60 percent more power can be obtained for the same temperature rise. For a 60 kW motor the gain is in the 40 percent range and for a 220 kW motor in the 20 percent range, compared to an IM. In most cases, the same power can be obtained from a motor by one or sometimes two frame sizes smaller than an IM. The reduction of the footprint is appreciable for all applications that can utilize lower frame heights and smaller motors. An additional gain is the reduced heat load on nearby parts, particularly in closed cabinets. Even at this vastly increased power density, a further important advantage results from the removal of the losses on the rotor side; since much of the heat conduction through the shaft is eliminated, the bearing temperature, particularly on the drive-end, is reduced. Comparing an ABB SynRM with an IM at 6 kW, this can be as much as a 30 K reduction, with an approximately 15 to 20 K reduction typical over the entire range. This effect is particularly pronounced at higher speeds, as well as for operation at higher temperature classes. The generally high efficiency is maintained even at this high output. Furthermore, the ABB SynRM retains the excellent partial load efficiency curve typical of synchronous machines in that the efficiency remains high—even at partial load; a feature particularly appreciated in VSD drives for fans and pumps.

Finally, these rotors feature about 30–50 percent reduced

continued

higher-speed ramp rates.

Rotor construction and reliability. Most technical aspects of drive systems with ABB's SynRMs are directly based on existing technology. The housing, connection box, stator, winding design and technology and bearing options are identical to IMs. As the 3-phase currents are sinusoidal, the same drive products can control this motor type, provided the firmware is optimized and includes this motor type. Only the rotor is different.

The rotor is less complex than in both IM and PM, as laminated electrical steel sheets are fitted to the shaft. The complexity is in the design. Extensive finite element simulations (FEM) were used to design the cross-section carefully in terms of electrical and mechanical properties. Important design choices made include the number of magnetic segments and the exact shape of the air barriers. This determines the torque production and the magnetization current of the motor. Minimizing this reactive current was crucial in maintaining a favorable drive rating. The exact placement of the segments along the periphery is essential to create smooth

torque during rotation, thus keeping the motor noise as low as with conventional motors. One result of this complex optimization using FEM, along with analytical and genetic algorithms, was that a 4-pole configuration is most suitable for the entire speed range up to 6,000 rpm.

Drive conditions of pumps, fans, compressors, and mining and crane applications were emulated using methods for highly accelerated stress testing (HAST).

To verify the reliability of this new rotor, extensive motor and drive system testing was conducted throughout development. Drive conditions of pumps, fans, compressors and mining and crane applications were emulated using methods

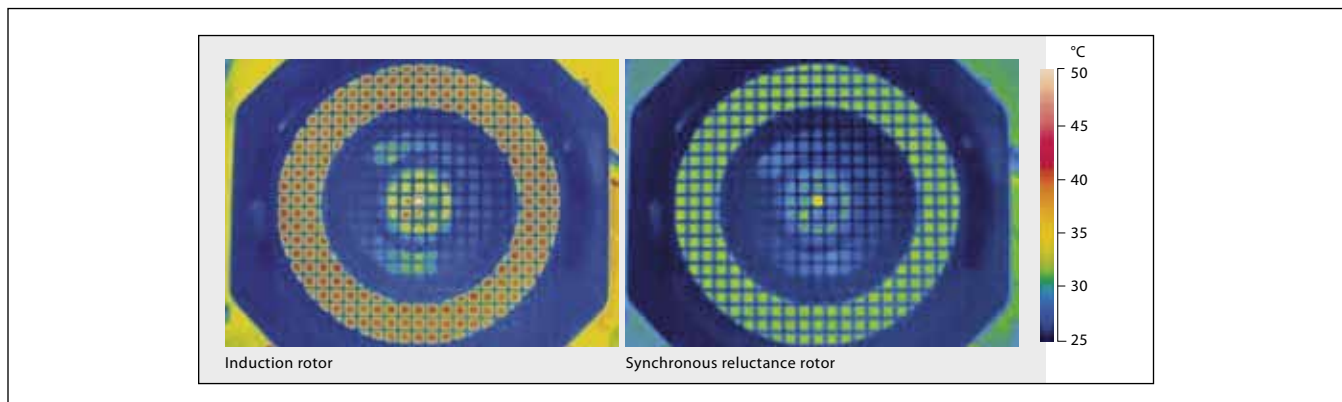


Figure 7—Temperature scans from a thermal-imaging camera.

The performances of the new motor drive system are given for three IEC motor frame sizes.

Motor, temperature rise class F								Drive, 400 V				
Size mm	PN kW	nN r/min	PN kW	nmax r/min	Eff % (1/1)	TN Nm	MM kg	Type code ACS-850-04	IN A	Noise dBA	Frame size	MD kg
100	4	1,500	4	2,250	84.3	25	22	010A-5	10.5	39	B	5
100	7.5	3,000	7.5	4,500	88.7	23	22	018A-5	18	39	B	5
100	13	4,500	13	6,000	90.5	27	22	030A-5	30	63	C	16
100	17.5	6,000	17.5	6,000	91.3	27	22	044A-5	44	71	C	16
160	26	1,500	26	2,250	91.7	165	180	061A-5	61	70	D	23
160	50	3,000	50	4,500	94.0	159	180	144A-5	144	65	E0	35
160	70	4,500	70	5,300	94.6	148	180	166A-5	166	65	E	67
280	110	1,500	110	1,800	96.0	700	640	260A-5	260	65	E	67
280	130	1,800	130	2,200	95.9	689	640	290A-5	290	65	E	67

For full specifications check ABB web pages at www.abb.com/motors&generators

Figure 8—Performance of motor drive system for piloting.

for highly accelerated stress testing (HAST). HAST cycles were developed specifically for this motor to ensure robust lifetime performance, such as successfully conducting high-repetition-rate motor starts and stops at speeds above catalog-permitted values. The cycle count and overload conditions were dimensioned to correspond to a more than 20-year lifetime of rated operation.

Drive converter and control. Conventional ABB drive technology used for IM and PM motors, with standard direct torque control (DTC), was adapted to include the SynRM as a new motor type. Despite sharing many similarities with the PM motor, except for zero rotor flux, strong development focus was given to optimizing the torque production through maximum-torque-per-Ampere (MTPA) control. This ensures that the drive current is kept minimal in each operating point. The control also includes capabilities for the field-weakening range; i.e., the speed range above the nominal rated speed. A maximal rated speed of as much as 1.5 times nominal can be reached for much of the motor range. This drive control is a particularly important ABB result that enables this SynRM to reach appreciably higher torque densities than IMs.

The installation and operation of the power electronic drive for this motor is indistinguishable from driving VSDs with IM or PM motors. Standard features include automatic parameter identification based on nameplate values and sensorless operation. The motor does not need any speed sensors but nevertheless can maintain perfect speed accuracy as well as a high torque dynamic. The drive can even be dimensioned for specially requested overload and cycle load capability.

Performance preview. Since this motor, like the PM motor, always requires a VSD drive, matched pairs of motor and ACS drives are given as the standard recommendation

Heinz Lendenmann, Reza Rajabi Moghaddam

ABB Corporate Research

Västerås, Sweden

heinz.lendenmann@se.abb.com

reza.r.moghaddam@se.abb.com

Ari Tammi

ABB Discrete Automation and Motion

Motors & Generators

Vaasa, Finland

ari.tammi@fi.abb.com

Lars-Erik Thand

ABB Discrete Automation and Motion

Motors & Generators

Västerås, Sweden


lars-erik.thand@se.abb.com

References

1. Haikola, M. "No Gears Required: ABB's Direct Drive Solution Meets the Challenges of the World's Most Demanding Processes." *ABB Review*, April, 2009, pp. 12–15.
2. Boglietti, A., A. Cavagnino, M. Pastorelli and A. Vagati. "Experimental Comparison of Induction and Synchronous Reluctance Motors Performance," *IEEE/IAS Annual Meeting*, Oct., 2005, Vol. 1, pp. 474–479.
3. Germishuizen, J. J., F.S. Van der Merwe, K. Van der Westhuizen and M.J. Kamper. "Performance Comparison of Reluctance Synchronous and Induction Traction Drives for Electrical Multiple Units," *IEEE/IAS Annual Meeting*, Oct. 8–12, 2000, Vol. 1, pp. 316–323.

An additional gain is the reduced heat load on nearby parts—particularly in closed cabinets.

for a range of power and speed levels (Fig. 8).

As a response to the key market trends of higher output, higher efficiency, longer service intervals and footprint reduction, a radical new motor uniquely suited for VSD systems is now available. The result is that increased power density of 20–40 percent when compared to an IM; a rotor construction without short circuit cage or permanent magnets; smaller motors; less heat generation and the highest possible efficiency for VSD systems is now a reality. A standard IM fitted with a new rotor—combined with a standard drive with new software—results in a high-output, high-efficiency VSD system. The output and efficiency performance is comparable to a PM motor drive, while technologies associated with the robust induction motor deliver the best of both worlds to users—all with value-added benefits as a bonus. 

Gear Drive Selection Process

FOR THE PARCEL HANDLING INDUSTRY

Adam Soder, applications engineer, Sumitomo Drive Technologies

(Courtesy Sumitomo Machinery Corporation of America)

Introduction

This article is designed to help describe the selection process of a reducer to be used in the parcel handling industry. It will go over the different applications for which gearboxes are used throughout parcel handling facilities such as UPS, FedEx and DHL. This article will also discuss what factors are used to decide which gearbox is required to meet the demands of the industry, yet still be durable, long lasting, easy to maintain, and easy to replace when or if a failure does occur.

Consider: When we receive a package in the mail, we never really stop to think about how it made it to our mailbox. We are just glad that it arrived without any damage. But for a package to get from point 'A' to point 'B' there are many factors that make the process work—from making sure the mailing addresses are correct, to meeting the required delivery date—everything needs to operate seamlessly to keep the end-user satisfied.

In most, if not all, sorting facilities, there are miles and miles of conveyor systems, and all play an important role in making sure all orders are processed accurately. The conveyor systems are broken up into different sections based on their function. Some examples are mainline and box line conveyors, but there are also systems used to sort the packages from one conveyor to the other depending on their destination. In all of the systems, a reliable gearbox is required to keep the operation running smoothly.

The gearboxes must also be able to withstand the demands of the facility. The most important requirement

of the gearboxes is that they must be reliable. In the sorting areas, many of the gearboxes are used intermittently and need to be able to stand up to frequent starting and stopping. If one gearbox cannot take the abuse, and fails, the downtime required for the repair could disrupt the entire flow of the distribution center. For when the inevitable happens, and a box does fail, the new replacement box needs to be available as soon as possible. The shipping companies cannot afford to be down for an extended period of time.

An example of a high demand for shipping facilities is during the holiday season. With the growth and popularity of online shopping, the amount of packages being shipped gets greater and greater every passing year. With this growth, the need for more and more gearboxes grows just as much. The Christmas holiday season starts right after Thanksgiving and goes all the way to the end of December. Most online retailers offer many discounted prices, and consumers take advantage of them, and make the purchases as soon as they can. The retailers also may offer guaranteed delivery by Christmas day, and for the late shoppers, this is a must. The shipping companies must be able to meet the demands of the extra packages that must be delivered.

Selecting the Correct Gearbox for Your Application

When selecting the appropriate gearbox, there are a few points that must be taken into consideration. Firstly there are the environmental factors that must be taken into account, namely the ambient temperature. Temperature data should be collected to get an idea of what temperatures the unit will be encountering during its everyday usage. Next is to

determine the operation that the gearbox will be performing. Sorters, feed belts and diverters are just a few of the operations required in the facility. Each operation has its own set of requirements.

For example, sorters and diverters (see Figure 2) will see a lot of start and stop operation. The sorters and diverters are mounted underneath the mainline of the conveyor, and when triggered, small rollers or plates are moved to change the direction of the packages so they go to the correct area. That constant on/off scenario, with many load variations can wreak havoc on a gearbox. On the opposite end of the spectrum, the feed belts are running for long amounts of time under varying loading conditions. The feed belts normally run constantly, with little or no downtime. They serve as the main drive belt that all the sorters and diverters run off of. Depending on the size of the packages, the belt can see a wide range of loads from very light to moderately loaded all in a matter of minutes. So they need to be able to keep up the speed and efficiency required, allowing all systems to run smoothly.

Once the working environment is determined, the next step would be to determine what motor horsepower is required, and also what speed the conveyors will need to be running. This is determined based on what loads the conveyor belts will be carrying. If the packages being conveyed were heavier, a higher horsepower motor would be required, which in turn nets a higher torque output of the reducers. The higher torque output is what is needed for the heavier loads. With the higher torque units, the output speed of the reducer will be reduced. This must be kept in mind if a high speed is needed for the conveyor system.

After the speed and horsepower are determined, it is time to pick the correct gearbox. Figure 4 shows examples of some of the products Sumitomo offers to handle the variety of ratios and speeds typically used in a parcel handling facility.

Maintenance

No matter what gearbox manufacturer is selected for a project, there is one item that cannot be avoided, and that is maintenance. All the boxes must be regularly monitored. Any increase in the temperature of the box can lead to premature failure due to the lubrication fluid inside the box breaking down, and becoming unable to lubricate the gearbox properly. In some cases, there is no visible or audible sign of a pending failure. The box will fail without warning and cause unwanted down time. If the box were properly maintained, the inspector would be able to spot an issue, and resolve it before incurring a timely delay in productivity.

A simple way to check on a gearbox is via the “hand test.” A touch of the gearbox can determine if it is operating at the optimal temperature. This isn’t the proper way to test the box temperature, but it can be a quick way to determine if further investigation of the gearbox is needed. Figure 8 is an example of how hot a gearbox can be in operation. The shown temperature is an extreme case and it shows a temperature rise that is more than the AGMA standard of 100°F above ambient temperature. This is not an acceptable temperature rise, and this unit would be due for an inspection and/or maintenance.

Another way to prevent premature failure is to ensure the box is installed correctly. Each gearbox is designed based on proper installation. Everything inside the box, including the

bearings, shafts, gears and seals all are sized to be able to withstand certain load amounts and temperature ranges. If these parameters are exceeded, failure of the box is unavoidable.

continued



Figure 1—Typical sorting facility layout.



Figure 2—Diverter operation.



Figure 3—Main feed belts.



Hyponic

The Hyponic gearbox uses Hypoid gear technology along with grease lubrication. This allows the box to be mounted with any orientation without the risk of leaking. The grease lubrication is maintenance free and doesn't require frequent fluid changes. Hyponics are the perfect gear drive for conveyors that are not easily accessible for routine maintenance.



Cyclo 6000

The Cyclo unit is very efficient unit and is best suited for conveyors that will see any sort of shock loading. The Cyclo units are also very quiet during operation without sacrificing any reliability or quality.



Cyclo Bevel Buddybox (BBB)

The Cyclo Bevel Buddy Box (BBB) is one of the smaller, more compact units, but it maintains the advantages of the Cyclo unit. With the patented Taper-Grip Bushing, the Cyclo BBB is perfect for retrofit applications onto existing conveyors with shaft-mounted reducers.



Cyclo Helical Buddybox (HBB)

The Cyclo Helical Buddy Box (HBB) is another alternative for a shaft-mounted reducer. It also replaces the need for belt drives, sheaves, or keys by using the Taper-Grip Bushing to mount on the conveyors driven shaft.

Figure 4—The proper gearbox for the proper application.

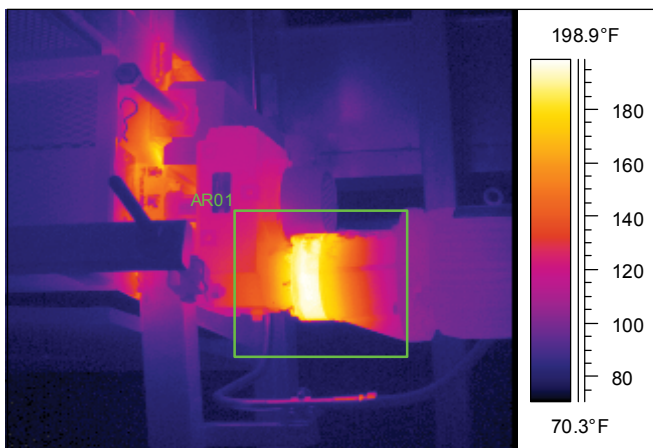



Figure 5—Thermal image of gearbox in operation.

In Figure 9, you can see that the unit is mounted a long distance away from the bearing of the conveyor. That gap causes the bearing on the low-speed shaft to support more of the weight than it was designed for, which can cause a bearing failure. Another issue with the installation shown in Figure 10, is that it is completely rigid mounted. The bolt through the mounting plate on the bottom does not allow for any run-out of the driven shaft. With this installation, all the run-out of the shaft will be transferred into the unit, causing seal failure and/or bearing failure.

Conclusion

For the employees in the parcel handling industry, there will always be pressure to make sure the job is done smoothly and efficiently. From the phone operators that answer the calls of the angry customer whose package arrived three days late, to the driver of the delivery trucks who still have to make their deliveries on time no matter how bad the weather gets, the pressure to perform will always be there. The pressure from the consumer is something that comes with the territory, but keeping the distribution facilities running smoothly

is one of the easiest ways to keep the demands of the industry at a manageable level. By using the correct reducer for the job, the possibility of downtime due to a gearbox failure is much less. With less downtime of the facility comes better efficiency and in the long run, happy customers.

The efficiency doesn't come without some work, though. The maintenance of the gearboxes is key to keep them up and running optimally. Regular visual checks of the gearboxes, and temperature monitoring will be required on a regular basis. Also, when the gearboxes are installed, they must be installed correctly to perform their desired functions. If all these factors are taken into consideration, the end user can expect a long life for the gearboxes being used, which means a much more successful package handling facility in the long run. 

References

1. Polich, Frank. "UPS Sorting Facility" Photo, *blogs.sacbee.com* Dec. 18, 2009, Nov. 26, 2010 <<http://blogs.sacbee.com/photos/2009/12/holiday-package-delivery.html>>.
2. Kersey, Brian. "UPS Package Sort" Photo, *UPI.com*, Nov. 2, 2010, <http://www.upi.com/Top_News/US/2010/11/02/Screening-Every-Parcel-Slows-Air-Express/UPI-11391288697628/>.
3. "The FedEx Hub in Action," Photo, *news.van.fedex.com*, Nov. 2, 2010, Nov. 10, 2010, <<http://news.van.fedex.com/node/404>>.
4. "Box Sorting" Photo, *incasgroup.com*, Nov. 23, 2010, <<http://www.incasgroup.com/solutions-andproducts/warehouse/management-of-put-pick-to-light-and-packaging-lines>>.
5. Sumitomo Drive Technologies. "Products, in Sumitomo Speed Reducers and Gear Motors," 2007, Retrieved November 26, 2010, from <http://www.smcyclo.com/modules.php?name=Product&pmenu_id=3>.
6. "UPS Hyponic Transverse Drive Install Guide," Sumitomo Drive Technologies, 2007.
7. Robinson, R. "Hands-On Workshop," w/install pictures (PowerPoint Slides), 2006, Retrieved from *www.smcyclo.com/ups*.

For more information:

Sumitomo Machinery Corporation of America
 4200 Holland Boulevard
 Chesapeake, VA 23323
 Phone: (757) 485-3355
 Fax: (757) 487-3193
www.smcyclo.com



Adam Soder is an applications engineer with Sumitomo Drive Technologies. He has a 2009 bachelors degree in mechanical engineering technology from Old Dominion University.

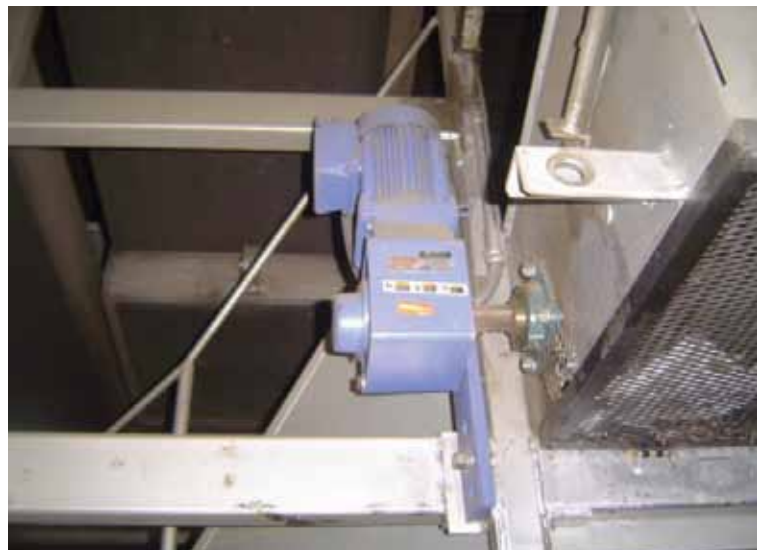


Figure 6—Example of improper installation.



Figure 7—Example of a rigid-mounted installation; the bolt through the mounting plate prevents run-out of the driven shaft, resulting in all of the run-out of the shaft transferring into the unit—causing seal and/or bearing failure.



Figure 8—Example of seal failure.

Radial Play

(INTERNAL CLEARANCE) IN BALL BEARINGS

John Wallace, Vice President of Operations, AST Bearings LLC

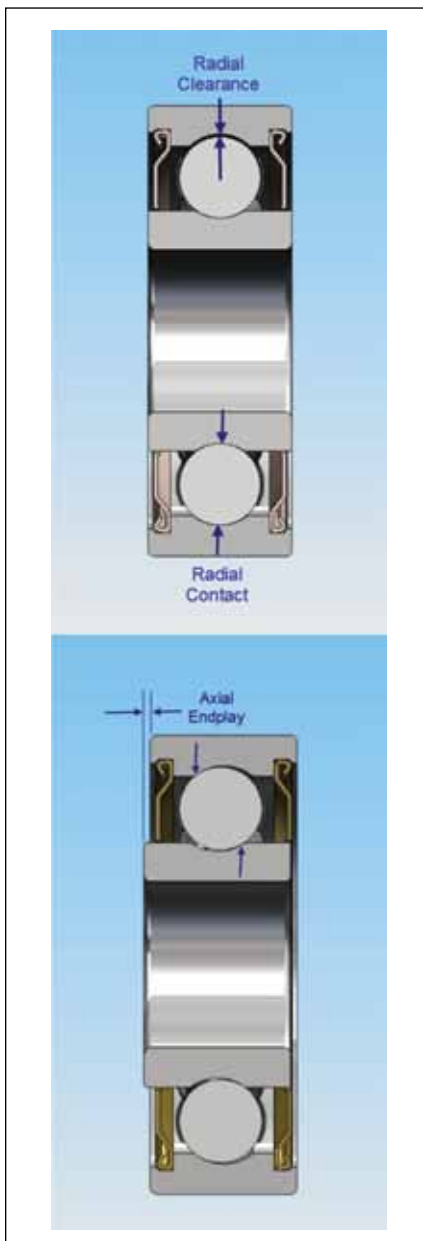


Figure 1—(Top) Depiction of internal looseness—or “radial play”—and (above) “axial endplay” in a bearings set.

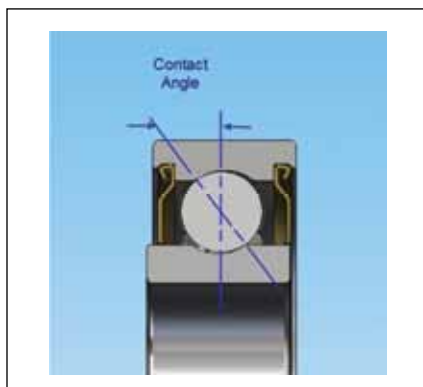


Figure 2—Axially pre-loaded bearings establish a “contact angle.”

At first glance, ball bearings are relatively simple mechanisms. However, an analysis of their internal geometries reveals that they are quite complex. For example, the ball to raceway conformity, the radial play, and the number of balls all impact the ability of a ball bearing to support loads under a variety of conditions. Typically, ball and other rolling element bearings are designed and assembled with a slight amount of internal looseness between the rolling elements (balls) and the raceways. This looseness results in both radial play and axial play in the bearing.

It should be noted that due to the nature of their design and construction, the internal geometry of needle, roller and tapered roller bearings is quite different than that found in ball bearings. For example, tapered roller bearings are somewhat unique in that the clearance within the bearing is adjusted at the time of assembly. Radial play and running clearance are of primary importance in all rolling element bearings. In this article, the discussion of contact angle, deflection, end play and preload applies primarily to ball bearings.

Definition of Radial Play in a Ball Bearing

Radial play, or internal clearance, is the internal radial looseness in a bearing and is the measured value of the total radial movement of the outer ring with respect to the inner ring in a

plane perpendicular to the bearing axis. Ball bearings are assembled to radial play values depending upon a desired range. The radial play is determined by the actual raceway diameters and ball diameter.

Radial play can be verified on assembled bearings using specially designed gages. When measuring the radial play, the bearing is subjected to a standard gage load to ensure full contact between all the bearing components. With regard to miniature and thin section bearings under such a load, the measured value is larger than the stated value for radial play. This is due to elastic deformation. Compensation factors are used in these cases.

Definition of Axial Play in a Ball Bearing

Axial, or end play, is the maximum relative axial movement of the inner ring with respect to the outer ring. The end play is directly related to the radial play of the ball bearing. In most part numbering systems, axial play is not normally specified.

There is often confusion with “looseness” and precision level. Radial play is specified independently of ABEC tolerance classes for rings. With ball bearings, in most cases, the internal looseness should be removed in the assembly process by applying an axial preload across the pair of bearings. This can be accomplished with shims,

springs, take up nuts, and/or other assembly techniques. Axial preload is also an important design parameter that affects both performance and life.

Contact Angle in a Ball Bearing

When ball bearings are axially preloaded, a contact angle is established. The contact angle is the angle between a plane perpendicular to the bearing axis and a line joining the two contact points between the ball and the inner and outer raceways. The initial contact angle is the contact angle when the bearing is subjected to the minimal axial force or load necessary to remove the looseness resulting from the radial play. Additional applied axial loads will increase the contact angle further. The greater the value of radial play in the bearing, the greater the resulting contact angle.

In most bearing applications, radial play—from a functional point of view—is more critical than axial play. As a result, it has become the standard purchasing specification.

General Design Considerations

The selection of the radial play value in a specific bearing application is an important design consideration. As described previously, radial play directly affects the contact angle and axial, or end play, of the bearing. In addition, in operation it is an important factor that has a significant influence on other factors such as noise, vibration, heat, stress, deflection, load distribution and fatigue life.

Fitting: A looser or greater value of radial play should be selected when the bearing is mounted using interference fits. The radial clearance in the bearing is reduced after mounting due to deformation of the inner or outer rings. With miniature bearings having very thin cross section rings, the radial play is reduced by approximately 80% of the actual amount of interference. The radial play after mounting is the primary design consideration. Therefore, a tolerance study of the mating components should be completed and compensation for the interference at maximum material condition must be made. For maximum life, a positive clearance after mounting is desired.

Loading: When a ball bearing is subjected to thrust loading, a higher contact angle will result in reduced

Clearance Symbol		MC1 (Extra Tight)	MC2 (Tight)	MC3 (Normal)	MC4 (Normal +)	MC5 (Loose)	MC6 (Extra Loose)
Actual Clearance in um	min	0	3	5	8	13	20
	max	5	8	10	13	20	28
Actual Clearance in inches	min	0	0.0001	0.0002	0.0003	0.0005	0.0008
	max	0.0002	0.0003	0.0004	0.0005	0.0008	0.0011

AST CODE	Actual Radial Play	Classification
K13 or P13	.0001 to .0003	Tight
K25 or P25	.0002 to .0005	Normal
K58 or P25	.0005 to .0008	Loose
K811 or P811	.0008 to .0011	Extra Loose

ball-to-raceway stresses. Greater values of radial play result in higher values of contact angle. Under these conditions, this will provide longer bearing life, lower torque and less axial deflection. In a pure thrust situation, a 15° increase in contact angle can result in over a 70% reduction in contact stress (ball-to-raceway).

When a ball bearing is subjected to pure radial loads—or radial load with low axial load—lower radial play is normally recommended. This distributes the load over a greater number of balls. However—particularly with miniature bearings—bearings with low radial play should not be subjected to interference fits. This can result in negative clearance and drastically reduce life.

Misalignment and positioning: Higher values of radial play allow for greater misalignment and should be selected in cases where there is a high degree of shaft deflection. It should be noted that although a ball bearing has the ability to compensate—around 1° or less— misalignment greatly reduces bearing life. Yet in cases with light loads, the impact of minor misalignment may be tolerable.

Tighter values of radial play will of course control and restrict radial movement.

When axial positioning must be controlled or end play of “zero” is desired, it is recommended that the end play be removed by applying axial pre-

load via shims, washers or other assembly methods; duplex bearings should be considered as well. It is not advisable to use low values of radial play to control end play.

Temperature: When a high-temperature gradient exists between the inner and outer rings, a looser radial play is recommended.

Speed: As mentioned previously, high values of radial play result in high values of contact angle. When a bearing is rotating, the set of balls—or ball complement—is rotating about the pitch circle of the bearing; each ball is rotating about its own axis; and gyratory moments are acting upon the balls. The magnitude of the gyratory moment is related to the contact angle. As rotational speed increases, the gyratory forces acting on the balls increase and there is sliding action between the balls and the raceways. This slippage results in lubricant film failure, increased heat and potential premature failure. The balance between the benefits of contact angle reducing stress must be weighed against the potential for lubricant failure due to ball slippage.

Specifying Radial Play

It is not practical—or perhaps even possible—to produce a group of bearings that all have the exact same amount of radial play. This is because all of the features of the bearing components—inner ring raceway, outer ring

continued

John Wallace is an industry expert with over 20 years of manufacturing and engineering experience in the defense, aerospace and commercial sector industries. In addition, he has a strong background in quality assurance and expertise in statistical process control (SPC).



raceway and balls—that affect radial play have manufacturing tolerances associated with them. Manufacturers measure and sort the bearing rings and balls so that they can be “matched” during the assembly process to achieve a specific range of radial play for a group (or manufacturing lot) of bearings.

There are several ways to specify radial play. Radial play specifications are usually manufacturer-dependent. How AST specifies radial play is shown in Tables 1–4.

(Copyright 2010 AST Bearings LLC – All rights reserved.) 

For more information:

AST Bearings LLC
 115 Main Road
 Montville, NJ 07045-9299
 Phone: U.S. Toll Free (800) 526-1250
 Headquarters (973) 335-2230
 Fax (973) 335-6987
www.astbearings.com

Table 3—Clearance for Radial Deep-Groove Ball Bearings in Micrometers

Bore Diameter (d) in mm		Bore Diameter (d) in inches		C2 (less than standard clearance)		C0 (standard clearance)		C3 (greater than standard clearance)		C4 (greater than C3 clearance)		C5 (greater than C4 clearance)	
OVER	INCL.	OVER	INCL.	min	max	min	max	min	max	min	max	min	max
2.5	6	0.0984	0.2362	0	7	2	13	8	23	-	-	-	-
6	10	0.2362	0.3937	0	7	2	13	8	23	14	29	20	37
10	18	0.3937	0.7087	0	9	3	18	11	25	18	33	25	45
18	24	0.7087	0.9449	0	10	5	20	13	28	20	36	28	48
24	30	0.9449	1.1811	1	11	5	20	13	28	23	41	30	53
30	40	1.1811	1.5748	1	11	6	20	15	33	28	46	40	64
40	50	1.5748	1.9685	1	11	6	23	18	36	51	30	45	73
50	65	1.9685	2.5591	1	15	8	28	23	43	38	61	55	90
65	80	2.5591	3.1496	1	15	10	30	25	51	46	71	65	105
80	100	3.1496	3.9370	1	18	12	36	30	58	53	84	75	120
100	120	3.9370	4.7244	2	20	15	41	36	66	61	97	90	140
120	140	4.7244	5.5118	2	23	18	48	41	81	71	114	105	160

Values are in micrometers

Table 4—Clearance for Radial Deep-Groove Ball Bearings in Inches (.00001").

Bore Diameter (d) in mm		Bore Diameter (d) in inches		C2 (less than standard clearance)		C0 (standard clearance)		C3 (greater than standard clearance)		C4 (greater than C3 clearance)		C5 (greater than C4 clearance)	
OVER	INCL.	OVER	INCL.	min	max	min	max	min	max	min	max	min	max
2.5	6	0.0984	0.2362	0	3	1	5	3	9	-	-	-	-
6	10	0.2362	0.3937	0	3	1	5	3	9	6	11	8	15
10	18	0.3937	0.7087	0	3.5	1	7	4.5	10	7	13	10	18
18	24	0.7087	0.9449	0	4	2	8	5	11	8	14	11	19
24	30	0.9449	1.1811	0.5	4.5	2	8	5	11	9	16	12	21
30	40	1.1811	1.5748	0.5	4.5	2.5	8	6	13	11	18	16	25
40	50	1.5748	1.9685	0.5	4.5	2.5	9	7	14	12	20	18	29
50	65	1.9685	2.5591	0.5	6	3	11	9	17	15	24	22	35
65	80	2.5591	3.1496	0.5	6	4	12	10	20	18	28	26	41
80	100	3.1496	3.9370	0.5	7	4.5	14	12	23	21	33	30	47
100	120	3.9370	4.7244	1	8	6	16	14	26	24	38	35	55
120	140	4.7244	5.5118	1	9	7	19	16	32	28	45	41	63

Values are in .00001 inches

transform

POWER INTO PROFITS

NOVEMBER 1-3, 2011 DUKE ENERGY CONVENTION CENTER CINCINNATI, OHIO



REGISTRATION IS OPEN FOR GEAR EXPO 2011!

VALUE, CONVENIENCE, AND INNOVATION—
All reasons to attend Gear Expo 2011

SEE

machinery in action *and*

DISCOVER

innovative products

from the world's leading manufacturers.

BRING YOUR SHOPPING LIST!

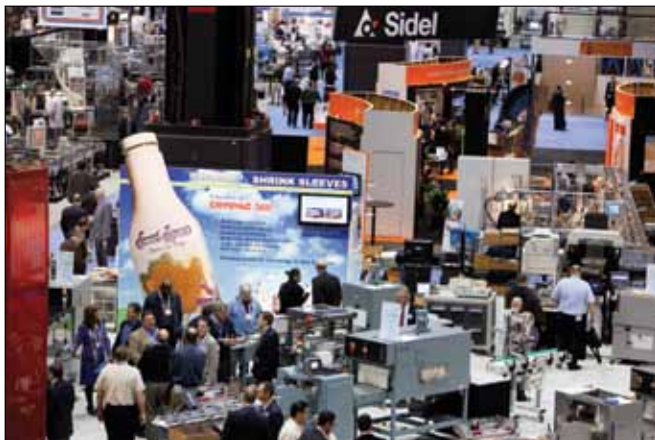
REGISTER TODAY AT

www.gearexpo.com/PTE



Pack Expo 2011

EXAMINES SUSTAINABILITY, PLANT EFFICIENCY AND TOTAL SYSTEM SOLUTIONS



Pack Expo 2010.

Pack Expo Las Vegas 2011, taking place September 26–28 at the Las Vegas Convention Center, is North America's largest trade show for processing and packaging innovation, with more than 1,600 exhibitors in vertical industries including bakery and snack, candy and confection, chemical/household product, electronics/parts, produce and pharmaceutical/medical device. Attendees at this year's show will find the latest innovations in motor technology, motion control, control components and machine control software to address efficiency, speed and sustainability challenges. This year's show has a particular focus on total systems solutions, a direct reflection of the increasing number of brand owners taking a unified approach for streamlined production, increased output and greater automation. The enhanced communication between processing and packaging operations allows maintenance professionals to better understand which product or packaging changes can feasibly run on a line and ensures that any new machinery added is adaptable to future changes. Having machinery that can be adjusted or replaced all at the same time helps to minimize downtime and keep the pace of production.

A few new additions to this year's Pack Expo will be of particular benefit to maintenance professionals:

- **The Processing Zone**

This special pavilion will feature technologies to enhance food safety, reduce waste, ensure product freshness and improve sustainability. In addition to the exhibits in The Processing Zone, packaging engineers and maintenance professionals will find processing technologies throughout the halls of the Las Vegas Convention Center.

- **Industry Specific Lounges**

The Baking-Snack Break and The Candy Bar will offer specialized opportunities for professionals in the baking, snack and confectionary industries to connect with suppliers and partners for even faster access to the solutions they need.

- **Food Safety Summit Resource Center**


Featuring leading industry and subject matter experts, the Food Safety Summit Resource Center will help manufacturers and processors respond to the many challenges they face on the job. Attendees will have the opportunity to learn about the latest breakthroughs in food safety and gain valuable insight into potential solutions.

Additionally, a wide variety of materials, containers and packaging and processing equipment innovations will be featured at this year's show. Some highlights include:

New Metal Detection Technology That Increases Plant Efficiency. Bunting Magnetics Co. (Booth #5327) has strengthened its lineup of metal-detection equipment with the addition of the Meatline 05 0 Metal Detector. The Meatline 05 0 provides the highest possible sensitivity to detect contaminants for any food product in paste form. The new technology features an innovative reject mechanism, keeping all components linked together for easy detachment and re-assembly. The system helps reduce clean-up, minimizing downtime and enhancing plant efficiency.

Motoman MPP3 Delta Robot That Improves High-Speed Packaging. Motoman Robotics (Booth #3438) will showcase the new Motoman MPP3 Delta Robot. Designed specifically for high-speed packaging and handling applications, its high payload, large work area and exceptional speed make it ideal for demanding picking and packaging tasks. The new Motoman increases efficiency for packaging lines and optimized production for increased output.

The Conference at Pack Expo will include sessions focused on operations; from insight into developing positive results on costs and profits to "Best Practices" sessions that focus on good automated manufacturing practices. Sustainability will also be a major topic.

In addition, former U.S. Secretary of State and Chairman of the Joint Chiefs of Staff General Colin L. Powell will be the speaker at the first Pack Expo Leadership Lecture, presenting "Diplomacy: Persuasion, Trust and Values." The event, with title sponsors DuPont and Morrison Container Handling Solutions, will take place Tuesday, Sept. 27, 2011. Tickets can be purchased at www.packexpo.com. Single tickets are available for \$125 and packages of 10 tickets are available for \$1,000. 

calendar

September 15–17—AWEA Small and Community Wind Conference.

Des Moines, Iowa. More than 100 exhibitors will have the latest wind technology to show consumers, renewable energy professionals and installers how to best capitalize on wind technology for homes, farms and ranches, businesses and rural electric cooperatives. Community wind development has proven itself to municipalities, schools, universities and other groups willing to band together to produce their own energy. Designed with direct input from AWEA members who are shaping these important wind markets, this conference offers two tracks focusing on all the facets of the small and community wind industries. Hear from wind experts, investors, and stakeholders from across the nation on how wind can create a cleaner energy future, strengthen regional and national economies and lead to a sound, profitable energy market. For more information, visit www.awea.org.

September 20–22—Design and Manufacturing Midwest.

McCormick Place, Chicago. This UBM Canon event provides attendees with the newest technologies, equipment, products and services for the design and manufacturing industry. Products and services include computer-aided design and manufacturing, rapid prototyping, engineering, components, production and automation machinery, lasers, motors and drives, packaging, materials handling, electronics, quality systems, networking, enterprise IT, contract services and more. One badge gives attendees unlimited access to seven other trade shows including MidPack, Quality Expo, Medical Design and Manufacturing Chicago, AeroCon, Plastec Midwest, Assembly and Automation Expo and the Green Manufacturing Expo. For more information, visit www.canontradeshows.com.

October 3–8—Detroit International Advanced Manufacturing Technology Show.

Cobo Center, Detroit. The Detroit International Advanced Manufacturing Technology Show (DIAMTS) will focus on OEM auto

parts and components, systems and modules, green energy and electric vehicles and advanced CNC machinery and automation. Organized by the Detroit International Auto Salon and Detroit International Exhibition LLC., DIAMTS aims to bring the most advanced products and technologies to the region including machine tools, manufacturing systems and control equipment, electric vehicles, hybrid vehicles and auto parts and accessories. For more information, visit www.diamts.com.

October 10–12—Sensors Tech Forum.

Sheraton Boston Hotel, Boston. Tech Briefs Media Group, publisher of *NASA Tech Briefs* magazine, is teaming up with EventEvolution Management Inc. to launch the Sensors Tech Forum. The format for the Sensors Tech Forum allows exhibitor personnel to attend conference sessions, providing another opportunity for exhibitor networking and learning. The Tech Forum will produce a four-track education conference program that features all-day tutorials, panel discussions, in-depth “power” sessions and peer-to-peer roundtables focused on helping product and system design engineers specify and design products and applications that utilize sensors and related technology. Attendees can choose to follow a specific track or create their own program by choosing from more than 30 individual sessions. In addition to the above, the forum will also feature a variety of networking events such as opening and closing day keynote luncheons and an opening night reception that supports its mission of creating an intimate environment that is conducive to learning, networking and making long-term business relationships. For more information, visit www.sensortechforum.com.

October 11–13—South-Tec 2011.

Charlotte Convention Center, Charlotte, North Carolina. Sponsored by SME, South-Tec offers the latest technologies in precision machine tools, advanced materials and fabricating equipment for the manufacturing industry in the Southeastern United States. The trade show looks for ways to manufacture better, faster and smarter. Attendees of South-Tec come to evaluate these technologies, make purchases, get applications advice

and find industry expertise. Technologies at the event include cutting tools, composites, electronic manufacturing, lean manufacturing, machining centers, material handling, robotics and much more. For more information, visit www.southteconline.com.

November 1–3—Gear Expo.

Duke Energy Convention Center, Cincinnati, Ohio. The only trade show dedicated to the complete gear manufacturing process, AGMA's Gear Expo 2011 offers efficient solutions to streamline your workflow, reduce errors and increase productivity. Browse the exhibits, compare product features side-by-side and capitalize on show-only pricing from the world's leading gear manufacturers. Registering for educational programs including the Fall Technical Meeting, Training School for Gear Manufacturing, Why Bearings Fail and How to Organize and Manage a Failure Investigation gets you free admission to the Expo. Attendees include corporate executives, design and manufacturing engineers, plant and operations managers, manufacturing personnel, purchasing managers and inspection and quality control personnel. Gear Expo offers an affordable, respected, gear-specific curriculum developed by AGMA, SME, ABMA, ASM and others to be announced. It is once again co-located with the ASM Heat Treating Society Conference and Exposition. For more information, visit www.gearexpo.com.

Timken

APPOINTS DIRECTOR OF SALES
FOR THE AMERICAS



James W. Skelly

The Timken Company recently named James W. Skelly to the position of director of sales for the Americas. In this role, Skelly will be responsible for leading the sales team in North and South America, focusing on sales to original-equipment manufacturers in the off-highway, heavy truck, process industries and health and positioning control markets. During his 26 years with Timken, Skelly has held positions of increasing

responsibility including product manager, operations manager, regional manager for original equipment sales and general manager of business development for the company's distribution network. He earned a Bachelor of Science degree in business administration from Ohio Northern University and a Master of Business Administration degree from Robert Morris University. A native of Lima, Ohio, Skelly is a member of the Power Transmission Distributors Association (PTDA) and European Power Transmission Distributors Association (EPTDA).

Minera Panama S.A. has revised the original 2008 purchase of Metso grinding mills for the Cobre Panama project and has confirmed the resizing of mills. The original grinding mill supply has been revised to two SAG mills of 40 ft (12.2 m) in diameter and four ball mills of 26 ft (7.9 m) in diameter. This change is a consequence of a more detailed throughput modeling conducted as part of the basic engineering phase and will provide a reasonable design margin over the nominal throughput. Delivery will be completed by the end of 2013.

The Cobre Panama project is located approximately 100 kilometers west of the Panama Canal. It is estimated that start-up will commence by the end of 2015. Once the new Cobre Panama mine is in full operation, the concentrator will be capable of processing ore at a rate of 150,000 dmtpd over the first 10 years of operation. According to figures included in the FEED Report (March 2010) the average annual metal production rate over the first 16-years has been estimated at 289,000 tons of copper, 108,000 ounces of gold, 1.544 million ounces of silver and 3,600 tons of molybdenum.

The original order was included in Metso's order backlog in Q2/2008 and now the upgraded value of EUR 54 million is included in order backlog in Q2/2011.

Minera Panama S.A. is developing its world-class deposit in the Republic of Panama. The company is owned by Inmet Mining Corporation, a Canadian-based global mining company that produces copper and zinc. They are active in production, development and exploration.

PTDA Business Index

HINTS AT RAPID EXPANSION

Minera

RE-SIZES METSO'S EQUIPMENT FOR MINING



Firms seeking a glimmer of hope that economic conditions are improving, despite recent media reports to the contrary, need look no further than the Power Transmission Distributors Association (PTDA) Business Index. The PTDA Business Index indicated the first quarter of 2011 was the fourth consecutive quarter for business growth among PTDA members. With a reading of 85.5, the recently released first quarter results indicate the power transmission/motion control industry expanded at a faster pace compared with fourth quarter 2010 when the index was at 73.4.

The full report is available through PTDA's website at www.ptda.org/Index. It includes United States and Canadian breakout data in addition to historical data. Conducted jointly by PTDA and Cleveland Research Company, the Index was modeled after the widely respected Purchasing Managers Index and tracks change in business activity, new orders, employment, supplier deliveries, inventories, prices and

industry news

backlog in the PT/MC market to arrive at an overall index.

Founded in 1960, the PTDA is the leading association for the industrial power transmission/motion control (PT/MC) distribution channel. A U.S.-based trade association, PTDA represents 188 power transmission/motion control distribution firms that generate more than \$10 billion in sales and span 3,500 locations in North America and 11 other countries. Members also include 187 manufacturers that supply the PT/MC industry. PTDA is dedicated to providing exceptional networking, targeted education, relevant information and leading-edge business tools to help distributors and manufacturers meet marketplace demands competitively and profitably.

Serapid Group

WELCOMES FOUR NEW MEMBERS

Serapid Group recently announced the hiring of four new employees for positions in engineering, manufacturing and marketing: Devin Badaczewski, Emanuel Chirila and Anthony Lelej. Badaczewski is a designer in the engineering department. He will complete his mechanical engineering degree at Kettering University in Flint, Michigan in December. Prior to joining Serapid, he held several internships, including one at MHart Corporation.



Bonnie Taube

Chirila has been appointed to the position of project engineer. He has over 17 years of mechanical engineering experience designing small mechanics and assembly automation machines. Lelej has been hired as a builder in the manufacturing department. Prior to joining Serapid, Lelej worked as a job setter for American Axle in Detroit.

Kevin Dombrowski, engineering and operations manager, says, "We are excited to bring Devin, Emanuel and Anthony on-board. Even in this tough economy, our company has continued to grow. They will be a great addition to our team."

Additionally, the company recently announced the appointment of Bonnie Taube to the position of marketing manager for North America and Europe. Taube will have the key responsibilities of creating marketing strategy to grow and expand the Serapid business worldwide. "We are thrilled

continued

METRIC WORMS & WORMGEARS

Exclusive North American Distributor of **KHK GEAR**
www.khkgears.co.jp/

With our selection of standardized metric worm gear sets, QTC will meet all of your worm gear requirements.

Available from stock are modules 0.5 thru 6 in ratios of 100:1 to 20:1.

Materials such as Alloy Steel, Stainless Steel, Carbon Steel, Aluminum Bronze, Bronze, Cast Iron & Nylon.

QTC Quality Transmission Components
Phone: 516.437.6700
Fax: 516.328.3343
www.qtcgears.com

Available with GLOBALSPEC®

WORMS & WORMGEARS • WORMS & WORMGEARS

PRECISION GAGE COMPANY

"Quality Since 1948"

+ GearMaster - Backed by 50 years Experience

Large Gear Inspection (up to 15" center distance)

Nick and Burr Detection

Spur, Helical, Worm and Bevel Gears

For greater accuracy and efficiency, as well as historical record tracking, use GearMaster with the Vari-PC Gear Analyzer to achieve all your composite gear inspection and analysis needs.



100 Shore Drive
Burr Ridge, IL 60527
Phone: 630-655-2121
Fax: 630-655-3073
www.precisiongageco.com



VARI-ROLL
GEAR TESTERS MASTER GEARS
VARI-PC

ISO 9001 CERTIFIED

to bring Bonnie on-board to coordinate global marketing, develop our corporate brand identity and generate new project opportunities,” remarked Said Lounis, president of Serapid Group.

Prior to joining Serapid, Taube worked in publishing as the founder and president of a commercial real estate magazine. After selling her publication to 21st Century Newspapers, which is now owned by the Journal Register Company, she worked as an advertising executive for The Oakland Press. Taube was a captain in the U.S. Army, stationed in Germany, and has an English degree from Syracuse University. As the new marketing manager, Taube brings more than 15 years of advertising and marketing experience to Serapid and will have a major role in growing and expanding Serapid Group worldwide.

Emerson

JOINS WATER FOOTPRINT NETWORK

Emerson Industrial Automation has joined the Water Footprint Network (WFN) as a partner in the organization. The Water Footprint Network is a non-profit organization based in the Netherlands. The organization’s mission is to promote the transition towards sustainable, fair, efficient use of fresh water resources through increased awareness of how the consumption of goods and services and production chains relate to water use and its impact on fresh water systems. The WFN has partners from around the globe. They include Coca Cola, U.S.; C & A, Germany; Am Bev, Brazil; Barilla, Italy; and Unilever, U.K.

Today there is a shortage of fresh water in many parts of the globe. In developing countries about 80 percent of illnesses are linked to poor water and sanitation conditions. Clean, safe water is a cornerstone of socio-economic growth. Lack of fresh water can impact the ability for a region or country to provide food. Some examples of water footprints include; beef—15,500 liters of water per KG of beef; corn—900 liters of water per KG of corn; rice—3,400 liters of water per KG of rice and 2,400 liters of water for one hamburger. “As a company that sells globally, we need to understand how we can impact sustainability in both our operations and the operations and supply chain of our customers,” says Jeff Himes, senior product manager, System Plast.

Mike Suter, vice president of marketing, Power Transmission Solutions, noted; “Our customers have asked for help in reducing water usage. By joining the WFN we provide support to their global effort while gaining the ability to access new technical information and participate in the development of water research and policy agendas.”

Temporiti **BRAKES**

SPRING APPLIED • FAIL SAFE

- 4 ~ 2065 lb.ft
- AC or DC supply
- Single or multi-disc
- Electromagnetic or permanent magnet
- Spring applied for fail safe operation
- Many accessories and options
- Quick deliveries
- OEM pricing



Temporiti 

Visit us on the web!
www.temporiti.it

For North American Inquiries, please contact:
VL Motion Systems Inc.
precision in movement
vlmotion.com | 1.866.267.8077 | Fax 1.888.217.7926



**Find Suppliers of
Gears, Bearings,
Motors,
Gear Drives
...and more at
powertransmission.com**



The screenshot shows the website for Power Transmission Engineering. The header includes the PTE logo and a navigation menu with categories like GEARS, BEARINGS, MOTORS, GEAR DRIVES, CHAIN DRIVERS, BELT DRIVERS, CLUTCHES, BRAKES, HYDRAULIC POWER, LINEAR MOTION, SERVOS, COUPLERS, and more. A featured article titled "Development of an Educational Engineering Workshop on Electric Vehicle and Motor Technology" is highlighted. The page also features a search bar and a sidebar with "Products" and "Links" sections.



Sign Up for YOUR Free Subscription

If you want the printed version, but your mailing address is outside the USA, Canada or Mexico, please visit our subscription page online at www.powertransmission.com/subscribe.htm

Power Transmission Engineering offers free electronic subscriptions anywhere in the world, and free printed subscriptions in the USA, Canada and Mexico.

- 1) YES I want to receive/continue to receive **Power Transmission Engineering FREE.**
 No thank you.
- 2) I want to receive the PRINT version (USA, Canada or Mexico) *DIGITAL version (Anywhere) *BOTH print and digital (USA, Canada or Mexico)
- (*Please include your e-mail address for DIGITAL or BOTH versions.) _____ (Please print e-mail address)
- 3) Name: _____ Job Title/Position: _____
(print)
- 4) Signature _____ Date: _____

5) Please tell us about your company:

Company Name: _____
 Company Address: _____

 City: _____
 State/Province: _____
 ZIP/Postal Code: _____
 Telephone: _____ Fax: _____
 E-mail: _____
 Co. Internet Address: _____

6) How is THIS LOCATION involved with power transmission products?

- (Check all that apply)
- WE MAKE power transmission products (10)
 - WE BUY power transmission products (12)
 - WE SELL power transmission products (Distributors, sales reps. etc.) (14)
 - WE DESIGN products with power transmission components in them. (16)
 - Other (please describe) (15) _____

7) Which of the following products and services do you personally specify, recommend or purchase? (Check all that apply)

- | | | |
|--|--|---|
| <input type="checkbox"/> Actuators (30) | <input type="checkbox"/> Controls (36) | <input type="checkbox"/> Hydraulic Power (42) |
| <input type="checkbox"/> Adjustable-Variable Speed Drives (31) | <input type="checkbox"/> Chain & Chain Drives (37) | <input type="checkbox"/> Linear Motion (43) |
| <input type="checkbox"/> Bearings (32) | <input type="checkbox"/> Couplings & U-Joints (38) | <input type="checkbox"/> Motors (44) |
| <input type="checkbox"/> Belting and Belt Drives (33) | <input type="checkbox"/> Gears (39) | <input type="checkbox"/> PT Accessories (45) |
| <input type="checkbox"/> Brakes (34) | <input type="checkbox"/> Gear Drives (40) | <input type="checkbox"/> Sensors (46) |
| <input type="checkbox"/> Clutches (35) | <input type="checkbox"/> Gear Mfg. Services (41) | |

8) What is your primary job function responsibility? (Check one)

- | | |
|--|---|
| <input type="checkbox"/> Corporate Management (1) | <input type="checkbox"/> Purchasing (6) |
| <input type="checkbox"/> Plant Engineering (2) | <input type="checkbox"/> Quality Control (7) |
| <input type="checkbox"/> Design Engineering (3) | <input type="checkbox"/> Factory Automation (8) |
| <input type="checkbox"/> Marketing & Sales (4) | <input type="checkbox"/> Maintenance (9) |
| <input type="checkbox"/> Manufacturing Engineering (5) | <input type="checkbox"/> Other (10) _____ |

9) What is the principal product manufactured or service performed at THIS LOCATION?

10) How many employees are at THIS LOCATION (Check one)

- 1-19 20-49 50-99 100-499 500+

YES, I would like to receive *Power Transmission Engineering's* monthly e-mail newsletter

YES, I would like to receive 3rd-party e-mails from *Power Transmission Engineering's* advertisers and partners

YES, I would like to receive subscription renewal notices by e-mail

NO, I do not wish to be contacted by e-mail.

FAX TO 1-847-437-6618 OR
 VISIT US ONLINE AT
WWW.POWERTRANSMISSION.COM

AGMA/Gear Expo

Page 39
Phone: (800) 687-7469
www.gearexpo.com

Asahi Intecc

Page 15
Phone: (866) 678-2281
Fax: (949) 756-8165
www.asahi-intecc.com

Automation Direct

Inside Front Cover
Phone: (800) 633-0405
www.automationdirect.com

B&R Machine and Gear

Inside Back Cover
Phone: (731) 456-2636 or
(800) 238-0651
Fax: (731) 456-3073
inquiry@brgear.com
www.brgear.com

Baldor

Page 5
www.baldor.com

Cincinnati Gearing Systems

Page 4
Phone: (513) 527-8600
www.cincinnati-gearing-systems.com

Circle Gear Co.

Page 9
Phone: (708) 652-1000
Fax: (708) 652-1100
sales@circlegear.com
www.circlegear.com

Clifford-Jacobs Forging Co.

Page 19
Phone: (217) 352-5172
sales@clifford-jacobs.com
www.clifford-jacobs.com

Delta Gear

Pages 24-25
Phone: (734) 525-8000
Fax: (734) 525-8400
sales@delta-gear.com
www.delta-gear.com

Electrodyne Co. Inc.

Page 19
Phone: (513) 732-2882
info@edyne.com
www.edyne.com

Excel Gear

Page 47
Phone: (815) 623-3414
Fax: (815) 623-3314
Chinn@excelfgear.com
www.excelfgear.com

Forest City Gear

Page 3
Phone: (815) 623-2168
Fax: (815) 623-6620
fyoung@fcgear.com
www.fcgear.com

Gear Motions Inc.

Page 47
Phone: (315) 488-0100
ron.wright@gearmotions.com
www.gearmotions.com

The Gear Works—Seattle, Inc.

Page 47
Phone: (206) 762-3333
sales@thegearworks.com
www.thegearworks.com

Martin Sprocket & Gear

Page 23
Phone: (817) 258-3000
www.martinsprocket.com

McInnes Rolled Rings

Page 14
Phone: (800) 569-1420
sales@mcrings.com
www.mcinnesorledrings.com

Precision Gage Co. Inc.

Page 43
Phone: (630) 655-2121
Fax: (630) 655-3073
sales@precisiongageco.com
www.precisiongageco.com

Quality Transmission Components

Page 43
Phone: (516) 437-6700
www.qtcgears.com

R+W America

Page 13
Phone: (630) 521-9911
www.rw-america.com

Stock Drive Products/Sterling Instrument

Back Cover
Phone: (516) 328-3300
Fax: (516) 326-8827
SDP-SIsupport@sdp-si.com
www.sdp-si.com


VL Motion

Page 44
Phone: (866) 267-8077
Fax: (888) 217-7926
www.vlmotion.com

Worldwide Electric

Page 11
Phone: (800) 808-2131
www.worldwideelectric.net

Gear Manufacturing



THE Gear Works
Ingenuity in Motion

- Gearbox Repair
- Gear Metrology
- Gear Grinding to 2600 mm
- Industrial Gears
- Custom Gearboxes
- Turbo Compressor Gears
- Machining
- Emergency Service
- ISO 9001 Certified

Seattle, Washington | 206.762.3333
www.thegearworks.com

Gear Manufacturing

Excel Gears.. Important! And Much More!

Precision gears, high-speed spindles, CNC gimbal heads, wind turbines, even gearbox assemblies for battleship gun turrets. That's the breadth of design, build and testing capabilities Excel brings to your company for high speed and high power, with smooth and quiet operation. Gear grinding to AGMA 15 (DIN 2) at 60" external diameters, gear hobbing to 70" maximum pitch diameter. All with our personalized service and guaranteed performance.



Excel seeks wind turbine gearbox builders looking to source in USA

EXCEL GEAR, INC.
A TOTAL SERVICE COMPANY
excelgear.com
815.623.3414

GEAREXPO
The Worldwide Gear Industry Event
2011

Gear Manufacturing



Ground Gear Manufacturing

GEAR MOTIONS, INC.
An Employee Owned Company

Learn about one of the most modern fleets of Gear Grinders, including the Höfler 700 and Gleason Tag 400 at ISO 9001:2008 registered Oliver Gear. See the latest Reishauer and Kapp Gear Grinding technology, at ISO 9001:2008 registered Nixon Gear, as well as the latest in CNC Gear Hobbing and cellular manufacturing.

PH: (315) 488-0100
ron.wright@gearmotions.com
www.gearmotions.com



GEAR MACHINERY EXCHANGE.COM

Sponsored by
Goldstein Gear Machinery
GET THE EXPERT in MACHINERY TRADING
at
Goldstein Gear Machinery LLC

The Gear Industry Buyers Guide

At www.geartechnology.com

Find Suppliers of

- ⚙️ Gear Machines
- ⚙️ Cutting Tools
- ⚙️ Grinding Wheels
- ⚙️ Heat Treating
- ⚙️ Inspection Equipment
- ⚙️ Services

...and everything else you need to make gears.

Contact hundreds of the gear industry's leading suppliers, quickly and easily, all in one place.

www.geartechnology.com

PTE October 2011

Focus
The "Big" Issue

Product Spotlight
Linear Motion

Industry Focus
Packaging & Material Handling



Meet Paro, the Robotic Baby Seal

IS IT THERAPY OR JUST PLAIN CREEPY?

I robot. You robot. He robot. Robots are everywhere. For decades, they have been as prevalent on TV and in science fiction novels and movies as they are now on the world's factory floors—and operation rooms. Fiction is now fact.

But have you ever heard of a therapeutic robot? No, not merely a hand puppet like Mel Gibson channels in the recent film oddity, *The Beaver*.

This is a robot with five—not senses, as most of us lucky ones are born with—rather, sensors. He possesses tactile, light, hearing, temperature and posture sensors—all of which he employs interacting with people.

As the identified sensors suggest, Paro—inspired by a baby harp seal—the un-bludgeoned variety—can discern light from dark. Like your beloved cat or dog—well, sort of—he warms to being stroked via a tactile sensor. And perhaps unlike your cat or dog, he loves being held (posture sensor).

And Paro is no dummy. He identifies voice sources, understands his name when called, and acknowledges greetings and praise courtesy of his audio sensor. He even lets you know when he's hungry—which in fact means his battery needs recharging.

Yet, Paro is even more than that. He's an extremely advanced, interactive robot that was developed by Takanori Shibata, a researcher at Japan's National Institute of Advanced Industrial Science and Technology (AIST) in Tokyo.

"Birth records" vary, but they indicate Paro was "born" around 2002 and is now in his eighth generation—no—make that iteration. Shibata is said to have designed Paro to produce emotions relevant to pets and babies. And no wonder: It weighs in at 6 pounds, exudes "body" warmth and sucks on a pacifier that doubles for a charger.

OK—how does it work?

By virtue of two 32-bit processors, three microphones, 12 tactile sensors, touch-sensitive whiskers and a system of motors that silently move its parts—all of which allow the beloved bot to recognize voices, track motion and "remember" behaviors that press positive emotional buttons in hospital and nursing home patients.

And while it certainly is true that one can't put a price on a human life, Paro, the "World's Most Therapeutic Robot,"—so certified by Guinness World Records—was born with a \$15 million price tag—and can be "adopted" for \$6,000.

Paro's popularity and acceptance can vary with the culture of a given country. But he has certainly made a splash



Paro, the therapeutic robot that looks like a baby harp seal (photo courtesy of Takanori Shibata).

in Denmark, according to a 2010 *Wall Street Journal* story by Anne Tergesen and Miho Inada. Since late 2008, they report, "Danish nursing homes have purchased 110 Paros, mainly with public funds," says Troels Vilms Pedersen, a team leader at the nonprofit Danish Technological Institute (DTI), Paro's European distributor. Since a 2008 study found that Paro soothed dementia patients and helped them communicate, DTI has encouraged every Danish nursing

home to buy one, Pedersen says."

The story also cites Sherry Turkle, a professor in the Science, Technology and Society program at the Massachusetts Institute of Technology—and, sad to say, a bit of a downer on the subject—in that while she "acknowledges Paro's potential as a communication aid, (she) warns against regarding it as a companion. 'Why are we so willing to provide our parents, then ourselves, with faux relationships?' she asks."

Another scoffer can be found at Lakewood Manor, a continuing-care retirement community in Richmond, VA. The *Journal* piece relates how the facility borrowed a Paro last year from U.S. distributor Paro Robots U.S. Inc. of Itasca, IL.

They sent it back after three months.

The story quotes Holly Raidabaugh, Lakewood's director of marketing: "I think the staff took to him more than the residents did."

Nevertheless, Paro was "confirmed" in 2009 by U.S. regulators as a Class 2 medical device (a category that includes powered wheelchairs).

But who's to say whether Paro earns his keep or is just a motorized pacifier?

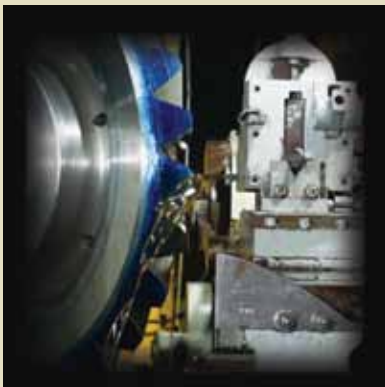
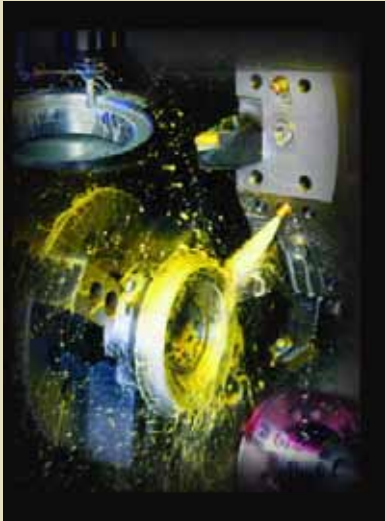
At the Vincentian Collaborative's nursing homes in the Pittsburgh, PA area, Lois Simmeth, 73, is a bit of a loner—not uncommon to people of advanced age—but she willingly leaves the solitude of her room when she hears Paro sounding off out in the hall.

"I love animals," Simmeth explains to the *Journal* reporters.

And then, holding and whispering to Paro: "I know you're not real, but somehow, I don't know—I love you."

CUSTOM

BEVEL GEAR MANUFACTURING



INVERSE ENGINEERING

BREAKDOWN SERVICES

IN-HOUSE STEEL MATERIAL WAREHOUSE

STRAIGHT BEVEL GEARS: 80" PD

SPIRAL BEVEL GEARS: 66" PD

FULL HEAT TREATING SERVICES

SPURS, HELICALS, SPLINE SHAFTS

GEARBOX REPAIR/REBUILDS

EDM WIRE BURNING

B&R

Machine and Gear Corporation

Toll Free: (800) 238-0651

inquiry@brgear.com • www.brgear.com



the MANUFACTURING

that sets SDP/SI above the others is superior personnel employing top-notch equipment.

GEARS & TIMING BELT PULLEYS & TIMING BELTS

Consistently setting standards for innovative designs with advanced manufacturing techniques, SDP/SI is an all-inclusive engineering and manufacturing facility, able to furnish turnkey design and production services for virtually any size or type of project. For fifty years we have been providing precision components for industrial, medical, defense and aerospace applications.

SDP/SI ADVANTAGES:

- SDP/SI: ISO 9001 - SI: AS9100 Registered
- Custom designed components and/or assemblies
- 130,000 off-the-shelf standard components
- Engineering:
 - + Expert technical support
 - + Applications
 - + Complete design capabilities
 - + Reverse engineering
- Product support from prototypes to large production runs
- Cost-effective solutions

CAPABILITIES:

- State-of-the-art milling and turning centers
- CNC Swiss style lathes
- CNC Gear Cutting
- Gears and Racks: 200 DP to 12 DP
0.25 module to 3.0 module
- Worms and Worm Wheels: 72 DP to 16 DP
AGMA tolerancing to Q14
- Timing Pulleys, metal and molded
from 1 mm pitch to 10 mm pitch
- Largest timing belt inventory
in urethane and neoprene materials

Call today for a free quote or to speak
to an engineer about your application



SDP/SI

STOCK DRIVE PRODUCTS/STERLING INSTRUMENT

www.sdp-si.com

800.819.8900