gear TECHNOLOGY®

NOV/DEC 2012

STATE OF THE INDUSTRY

GEAR INDUSTRY TRENDS

OUR ANNUAL GEAR INDUSTRY SURVEY

THE "MANUFACTURING MIDDLE CLASS" – WHAT HAPPENED?

TECHNICAL

Predicting Scuffing to Spur/ Helical Gears in Commercial Vehicle Transmissions

Morphology of Micropitting

Ask the Expert:
Gleason Machinery Setup

ADDENDUM

Paper + Scissors (No Rock) = Gears!

www.geartechnology.com

THE JOURNAL OF GEAR MANUFACTURING

Solutions for all your gear cutting tool needs

Gear cutting tools and services

Star SU offers a wide variety of gear cutting tools and services, including:

- Gear hobs
- Milling cutters
- Shaper cutters
- Shaving cutters
- Chamfer and deburring tools
- Rack and saw cutters
- Master gears
- Ring and plug gauges
- Advanced coatings including Alcrona Pro
- Tool re-sharpening

Total tool life cycle management

Control your tool costs and let Star SU manage your tool room. From new tools to design work to re-sharpening and recoating, we have the equipment and resources to help keep your gear cutting operation running smoothly.

Star SU · Star · SU · SAMPUTENSILI · BOURN & KOCH INC

Phone: 847-649-1450
5200 Prairie Stone Pkwy. • Ste. 100 • Hoffman Estates • IL 60192

PTG-1

GS 400

Affordable hob sharpening and in-house tool maintenance

Star's PTG-1 sharpens both straight and spiral gash hob designs up to 8" OD x 10" OAL. Additionally, it sharpens disk, shank and helical type shaper cutters and a wide range of round tools, making it a versatile tool room machine.

Shaving cutter and master gear grinding

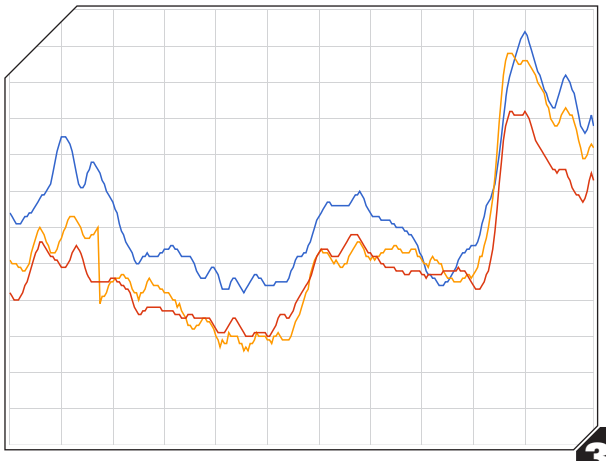
Designed to grind shaving cutters and master gears, the GS 400 sets new standards for precision, reliability and ease of use. An integrated measuring unit automatically checks the quality of the first tooth ground without unclamping the workpiece.

www.star-su.com

gear TECHNOLOGY

contents

NOV/DEC 2012



features

technical

Vol. 29, No. 8 GEAR TECHNOLOGY, The Journal of Gear Manufacturing (ISSN 0743-6858) is published monthly, except in February, April, July and December by Randall Publications LLC, 1840 Jarvis Avenue, Elk Grove Village, IL 60007, (847) 437-6604. Cover price $7.00 U.S. Periodical postage paid at Arlington Heights, IL, and at additional mailing office (USPS No. 749-290). Randall Publications makes every effort to ensure that the processes described in GEAR TECHNOLOGY 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 GEAR TECHNOLOGY, The Journal of Gear Manufacturing, 1840 Jarvis Avenue, Elk Grove Village, IL, 60007.

Customers Say it Best





GEARED BY ODG
CELEBRATING 50 years 1962-2012 ...and geared up for our next 50

Ontario Drive and Gear Limited has maintained its competitive advantage by investing in state-of-the-art technology, including three Kapp KX 300P grinding machines. ODG chose Kapp because of their reputation for quality and ingenuity. ODG utilizes the full of array of the KX300 P's capabilities to form, generate, topological and sub spindle grind. *"We are extremely pleased with the flexibility and sophistication of the machine solutions from Kapp. We plan to continue to grow our business thanks in part to Kapp."*

Joel Wright, General Manager, ODG.

Ontario Drive and Gear Ltd. is a high quality custom gear manufacturer that offers design, manufacture, assembly, and test services from their 60,000 sq. ft. facility in New Hamburg, Ontario. ODG celebrates its 50th anniversary this year.

The testimony of our customers reflects our mission. Ninety six of every one hundred KAPP and NILES machines delivered in North America since 1980 are still generating profits for our customers today. When you purchase a KAPP or NILES machine, you get a commitment for support that does not expire.

KAPP NILES

KAPP Technologies
2870 Wilderness Place Boulder, CO 80301
Phone: (303) 447-1130 Fax: (303) 447-1131
www.kapp-niles.com info-usa@kapp-niles.com

gear TECHNOLOGY
Vol. 29, No. 8

departments

Cover Design by David Ropinski

Power Skiving – A Milestone in Gear Manufacturing

IMTEX **Bangalore, India**
Hall 3A Booth B 108
24.-30. January 2013

Power Skiving – KLINGELNBERG Presents its Latest Innovation

The newly developed tool system can be used on Klingelnberg bevel gear cutting machines. It guarantees a productive, stable and precise production process, particularly for internal gears. Klingelnberg enables the breakthrough of Power Skiving by finally unleashing the full potential of this 100 year old manufacturing method.

- up to 10 times faster processing times compared to other manufacturing methods
- smooth flanks with advantageous surface texture
- high gear quality due to precise tooling and dynamic machines

► Learn more about Power Skiving at www.klingelnberg.com

www.klingelnberg.com info@klingelnberg.com

KLINGELNBERG

THE GEAR INDUSTRY'S INFORMATION SOURCE

www.geartechnology.com

How to Conduct a Heat Treat Audit

Do you know how well your current heat treat provider is doing? Are you shopping for a new provider? Then you don't want to miss the article by Daniel H. Herring ("The Heat Treat Doctor") that appeared in our November 2012 e-mail newsletter. The online article describes what you need to do to ensure your heat treated parts are getting the attention they deserve.

www.geartechnology.com/newsletter/1112.htm

Gears on Mars!

Forest City Gear employees talk about their work manufacturing gears for the Mars Rover Curiosity in a short documentary web series by Pablo Korona.

Star SU Plant Tour

Take a virtual tour of the Star SU Federal de Mexico Service Center, a modern plant for sharpening and reconditioning tools for gear manufacturing.

Stay Connected

Follow us on Twitter
twitter.com/#!/Gear_Technology

Connect with us on LinkedIn
www.linkedin.com/groups/Gear-Technology-Magazine-3893880

Subscribe Online
www.geartechnology.com/subscribe.htm

gear TECHNOLOGY

RANDALL PUBLICATIONS LLC
1840 JARVIS AVENUE
ELK GROVE VILLAGE, IL 60007

(847) 437-6604
FAX: (847) 437-6618

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

Managing Editor
Randy Stott
wrs@geartechnology.com

Senior Editor
Jack McGuinn
jmcguinn@geartechnology.com

Associate Editor
Matthew Jaster
mjaster@geartechnology.com

Editorial Consultant
Paul R. Goldstein

Technical Editors
William (Bill) Bradley
Robert Errichello
Octave Labath, P.E.
Joseph Mihelick
Charles D. Schultz, P.E.
Robert E. Smith
Dan Thurman

DESIGN
Art Director
David Ropinski
dropinski@geartechnology.com

ADVERTISING
Advertising Sales Manager
Dave Friedman
dave@geartechnology.com

Materials Coordinator
Dorothy Fiandaca
dee@randallpublications.com

CIRCULATION
Circulation Manager
Carol Tratar
subscribe@geartechnology.com

RANDALL STAFF
President
Michael Goldstein

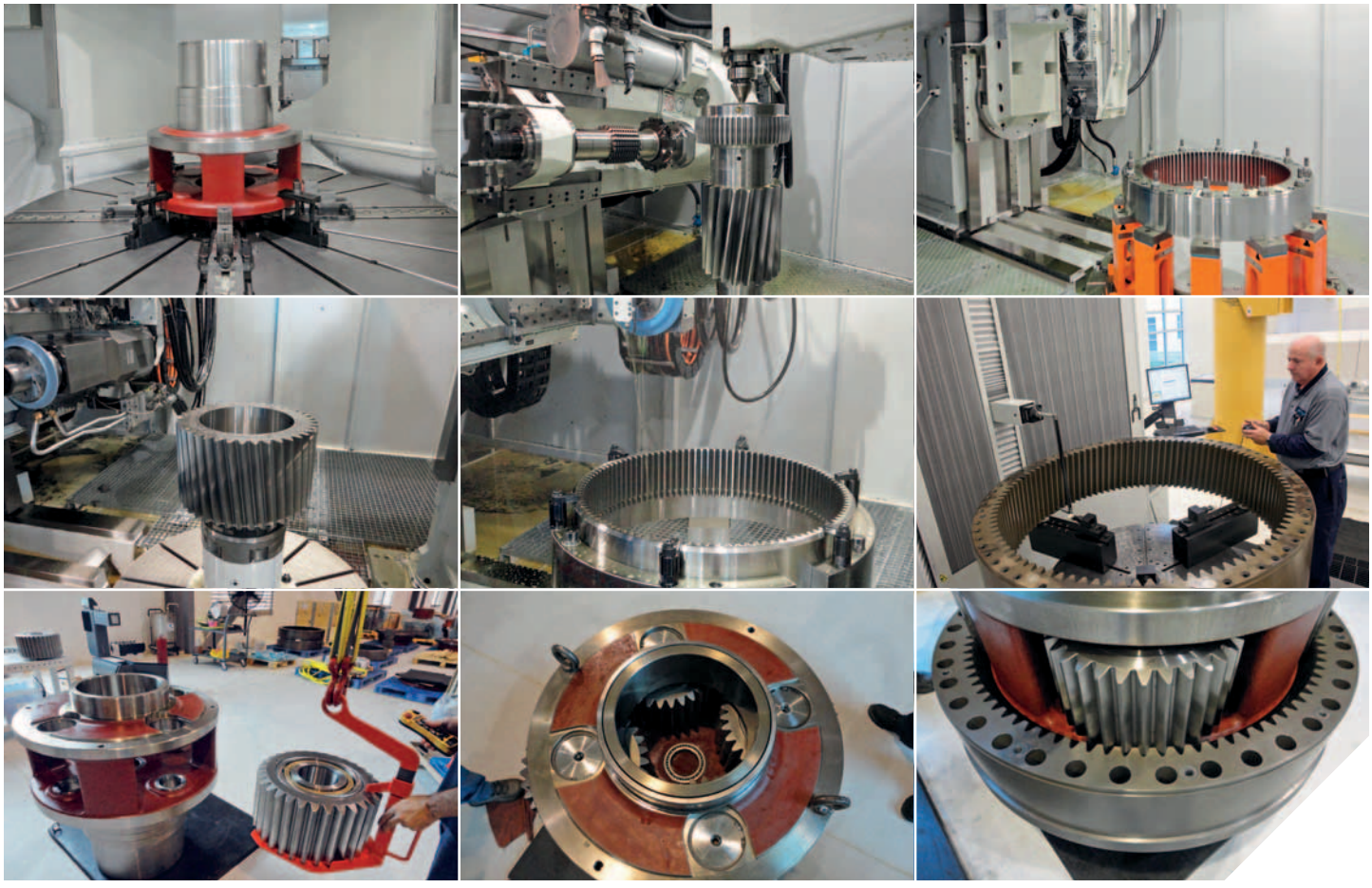
Accounting
Luann Harrold

BPA WORLDWIDE

brevini
YOUR PLANETARY PARTNER

WHERE PASSION FOR MANUFACTURING

LARGE PRECISION PLANETARY COMPONENTS FOR ANY INDUSTRIAL APPLICATION IS A CORE COMPETENCY



The latest advancements in manufacturing technology for the production of large precision gears and gear related components await your demanding applications in our new manufacturing facility located in Yorktown, Indiana.

- **Internal Ring Gears:** Spur and helical to 2.4-meter diameter size with modules up to 30 max. Processes include gear shaping, internal milling (gashing) and gear grinding.
- **External Gears:** Spur and helical to 1.6-meter diameter size with module up to 35 max. Processes include gear hobbing, external milling (gashing) and gear grinding.
- **Large Turning Capacity:** Maximum diameter 2.8 meters. Modern vertical CNC turn/mill center offering exceptional capabilities for producing large planet carriers.
- **Deep-Case Carburizing:** 8,800 lb capacity Integral Quench Batch Furnace, Shot-Blasting, Complete Materials Laboratory.
- **Metrology Laboratory:** CNC Analytical Gear Inspection capabilities to 3-meter diameter size via Gleason 3000-GMM, Large Capacity Zeiss 30/40/30 CMM.
- **Large Gearbox Assembly Capabilities:** Modern Manufacturing Facility including significant overhead crane capacity for transporting heavy components and assemblies.

For your inquiries, contact:
Dale E. Harder
(765) 759-2128
dale.harder@brevini.com

Brevini Wind USA, INC
2400 N. Priority Way
Yorktown Indiana, 47396/USA
Phone +1 765 759 2125
Fax +1 765 759 4728
breviniwind.us@brevini.com

For more information about Brevini manufacturing possibilities in the US visit WWW.BREVINIWIND.COM

MITSUBISHI
HEAVY INDUSTRIES AMERICA, INC.

Our Technologies, Your Tommorow

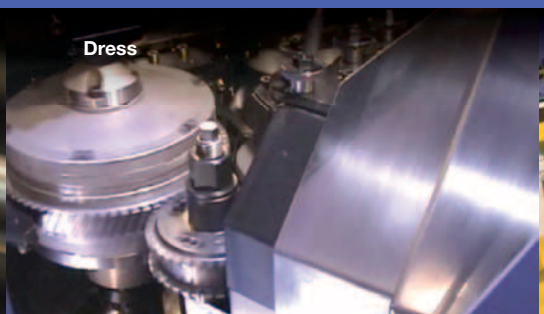
The Efficiency of Process Integration

ZE40A

PROCESS+ integration

Maximize Production and Profits With Mitsubishi's Multiple Process Capabilities Machines.

When you reduce steps you reduce costs. With that in mind Mitsubishi developed its Process Integration platform. It allows various operations, such as chamferring, deburring, inspection, timing and meshing, to be incorporated into our existing gear machines. The advantage is clear. It's simply more efficient to have one machine completing two or more processes. With numerous options and configurations available you can customize our shaping, grinding or hobbing machines to incorporate the additional services that precisely meet your needs—and maximize your efficiencies, production and profits. To learn how you can leverage all the possibilities of Process Integration visit **www.mitsubishigearcenter.com** or contact sales at **248-669-6136**.



The Results Are In

Publisher & Editor-in-Chief
Michael Goldstein

The past several months have been filled with uncertainty. Everyone wanted to wait and see who would be our next president and how the political landscape might change. Now the elections are over, and the polls are all closed, so we should all be getting back to business, right?

Well, not so fast. We've still got that huge budget deficit to worry about. The fiscal cliff looms. And the balance of power in Washington remains pretty much as it was before the elections. So there's still a lot of uncertainty out there. If we do go over the cliff, the impact will be worldwide, and the gear industry will be affected along with all other industries.

But it isn't *all* bad news. We've been doing some polling of our own, in the form of our annual State-of-the-Gear-Industry survey, and the results are presented beginning on page 32. As expected, those results reflect the overall economic uncertainty facing our country and the rest of the world, and they point out many of the serious challenges manufacturers face today. But overall, the business of gear manufacturing remains steady, with our respondents reporting significant optimism about the future.

No matter what else is going on in the world and the economy, gears are still being made. Gear manufacturers continue to invest in technology, improve their quality, increase their productivity and grow their businesses.

Before you jump right into the statistics, I encourage you to read through Jack McGuinn's article on the manufacturing middle class (p. 22) and Matt Jaster's article on current trends in the industry (p. 28). These articles include interviews with a number of industry leaders, who help put the raw numbers into better perspective.

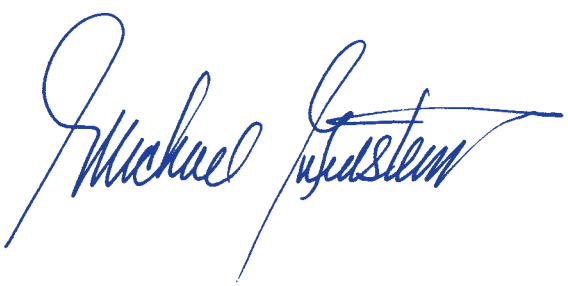
In addition to the questions we ask about business conditions, sales, production, capital spending, and so on, we also use the survey as an opportunity to ask our readers what subjects they're interested in and what types of articles they'd like to read more of. I find some of these results to be the most interesting and insightful regarding our marketplace.

For example, more than half of our respondents indicated they'd like to see more articles on gear inspection and gear grinding–by far the most popular subjects. Heat treating, cutting tools, bevel gears and lean manufacturing were also highly ranked, with more than 40% of respondents indicating they'd like to see more articles on those subjects.

We also asked our readers to rank (on a scale from 1-10) the types of articles that are of most value to them. Not surprisingly, technical articles received the highest ranking, with a median score of 8. This has always been the bread-and-butter of *Gear Technology*, and the area where we spend the most effort to ensure that our content is accurate and useful. Our "Ask the Expert" feature scored almost as high, at 7.4. But our staff-written feature articles are also highly valued, with a median score of 7.2. Providing the kind of in-depth coverage we give you every issue in all of these areas requires us to maintain a much larger, more experienced editorial staff than most magazines our size. It's rewarding to know that you value our commitment to the industry.

Clearly we seem to be doing something right. According to the survey, 80% of our readers spend 20 minutes or more with each issue of the magazine, and almost 25% of you spend more than an hour. In a time when attention spans are hard to come by, that really means something.

It also gives us a good road map for the future. With your continuing support and interest, we'll keep producing the highest quality content possible on the subjects you care about most.

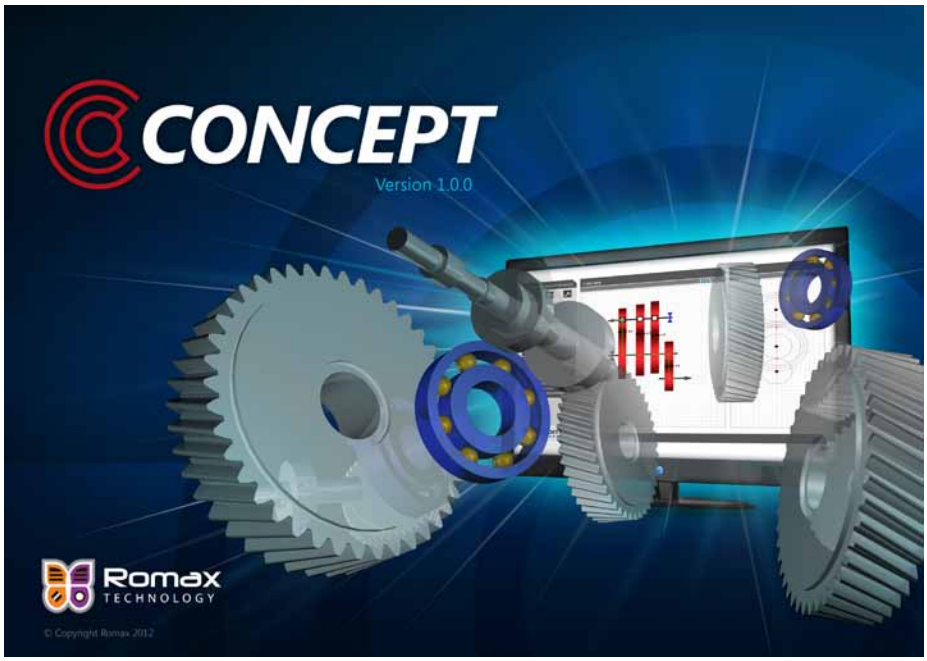


P.S. While our survey gives us very good insight into what our readers like and don't like, we'd still like your feedback. If there are gear-related topics you'd like to see covered more, please tell us at *publisher@geartechnology.com*.

Romax Technology

LAUNCHES GEARBOX AND DRIVELINE DESIGN SOFTWARE PACKAGE

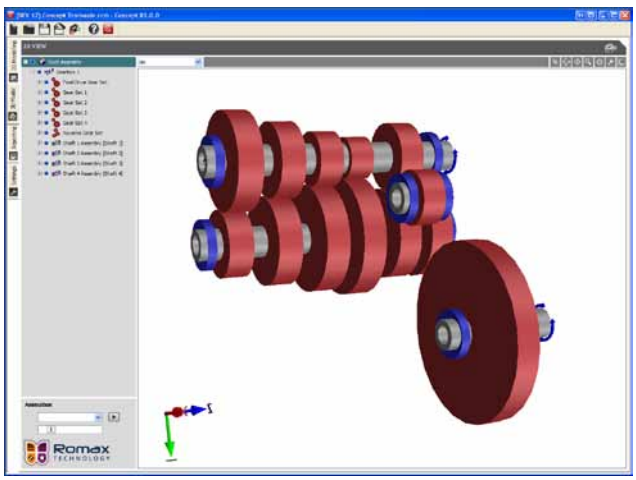
Romax Technology, the gearbox, bearing and driveline engineering specialist, has launched a new design software package that will increase speed, quality, creativity and innovation when designing gearboxes and drivelines. Called *Concept*, the new product delivers on the Romax vision of streamlining the end-to-end, planning-to-manufacture process with open, easy to use software solutions. It has been developed in close collaboration with engineers in the largest ground vehicle, wind energy and industrial equipment companies around the globe.



The result is a highly intuitive drag-and-drop design environment enabling rapid creation of concept models. It provides semi-automated sizing, definition and rating of gears, shafts and bearings, with advanced 3-D visualization capability allowing evaluation and manipulation of key parameters. As a result, it promotes creativity as new design ideas can be evaluated rapidly.

Concept also utilizes Romax's analytical capabilities to enable initial NVH assessments, as well as preliminary mechanical design assessments of alternative concepts.

It is applicable for any gear, shaft and bearing system application, from power tools to mining equipment and from complex automotive planetary automatic transmissions to the largest wind turbine gearboxes. The new software not only enables creativity, effectiveness and efficiency, it also promotes a seamless workflow, either as a stand-alone solution or used in conjunction with other CAD packages.



Its innovative, easy-to-learn interface allows new users to become productive extremely quickly, which means both graduate designers and experienced gearbox and driveline design teams can use it. Romax Technology product manager Dr. Jamie Pears, who is heading up the product launch, believes concept design is one of the most important aspects of the gearbox and driveline product development process.

"Early decisions can be crucial in shaping product performance, robustness and durability, as well as minimizing manufacturing and operating costs," he said. "However, this stage of development can be expensive and time-consuming too, meaning that many engineered products fail to reach their full potential. This next-generation design package, which incorporates many of our advanced analytical algorithms, helps users to pull forward new concepts into robust and highly optimized designs capable of subsequent, detailed development. It not only saves development time and cost but also improves the quality and robustness of the finished product."

Also supporting Romax's vision of streamlining end-to-end, planning-to-manufacture processes is another significant, new capability in the company's flagship product offerings for detailed design and analysis—*RomaxDesigner* and *RomaxWIND*. This enhanced capability for improved manufacturability of end-products includes a comprehensive suite of tools that enables the gear manufacturing process to be considered part of the gear design and analysis process. Romax announced *Concept* in October and will be shipping the software in December.

For more information:

Romax Technology
Rutherford House
Nottingham Science & Technology Park
Nottingham
NG7 2PZ
Phone: + (44) (0) 115 951 8800
www.romaxtech.com

ITAMCO
OFFERS INDUSTRIAL BLUETOOTH TRANSMITTER

Indiana Technology and Manufacturing Companies (ITAMCO) has released iBlue—the first handheld bluetooth transmitter that gathers crucial production data and sends it to bluetooth-enabled smartphones, tablets and computers. iBlue replaces several tools, including hardness testers, micrometers and temperature readers. When iBlue is paired with a bluetooth-enabled device, it gathers, records and sends data through its three ports: a K-type thermocouple port—iBlue comes with a K-type thermocouple probe; a 3-pin metal hardness probe port; and a USB Human Interface Device (HID)-enabled port that connects with a wide range of non-proprietary tools including keyboards, micrometers, calipers and barcode scanners. No special software is required, and data from iBlue can be sent as a text email or placed into Microsoft Excel and Notepad. iBlue is compatible with the most common operating systems including Apple's iOS, Android, Blackberry, Windows and Linux.

Expanding Mobile Technology

iBlue isn't ITAMCO's first foray into mobile technology; the company has launched several free smartphone apps for industrial applications. Two of their apps, Hardness Tester and Convert Temperature, extend iBlue's capabilities. Hardness Tester calculates approximate hardness conversion numbers between popular Rockwell, Vickers and Knoop hardness scales for non-austenitic steels. The Hardness Tester smartphone app converts data acquired with iBlue and a hardness probe. (iBlue accepts D/DC, D+15, E, C, DL and G hardness probes.) The Hardness Tester will graph results, and previous tests (Max, Min and Average) can be recalled with the touch of a button. The data can be sent to any compatible Air Print printer from the app. The app is in conformance with ASTM A956-06 and ASTM E140-07.

The Convert Temperature app converts different scales of temperature, such as Fahrenheit, Celsius and Kelvin. Temperature readings can be emailed, printed and graphed, the same as the Hardness Tester data. The app works seamlessly with iBlue and its K-type thermocouple probe (included). The apps are available for Apple, Android and Blackberry smartphones.

iBlue and the Technology-Driven Shop Floor

iBlue and smartphone apps are part of ITAMCO's overall initiative to bring technology to their own shop floor. Joel Neidig, an engineer at Indiana Gear (a division of ITAMCO) and one of iBlue's developers, said, "We're in the process of connecting our machine tools to a plant monitoring system, so it just made sense to have an electronic method of gathering and distributing the temperature, dimensions and hardness data of our gear products." iBlue is used by machine operators, engineers and quality control staff at Indiana Gear. "iBlue is saving me a lot of time on the shop floor because it's an all-in-one tool," said Michael

Blum, one of Indiana Gear's quality control specialists. "It's easy to carry around and it's accurate. We're already using data gathered from iBlue to electronically track and analyze production processes." iBlue has worked so successfully at Indiana Gear that the ITAMCO staff decided to market it worldwide.

iBlue Is Bundled and Priced for Economy

iBlue comes with a USB charger cable, OtterBox belt clip and a K-type thermocouple probe. The iBlue package is priced at $499 and can be ordered online with Google wallet at *http://www.itamco.com/iBlue* or by calling ITAMCO at (574) 936-2112. The Hardness Tester and Convert Temperature smartphone apps can be downloaded from the Apple App Store, Google Play, Windows Marketplace and the Blackberry App World. Search "ITAMCO" to locate the apps. iBlue is easy to pair with bluetooth devices and simple to use. ITAMCO has provided how-to videos and a FAQ page at their website below.

For more information:
ITAMCO
6100 Michigan Road
Plymouth, Indiana 46563
Phone: (574) 936-2112
www.itamco.com

Polygon Solutions

DESIGNS ROTARY BROACHING BRAKE

Rotary broaching can be utilized for making small forms like hexagons and squares in soft materials like aluminum, brass and mild steel. However, when it comes to aligning multiple holes using a rotary broaching tool, the operation becomes extremely challenging. Most rotary broach holders have a free-turning spindle which does not allow for alignment of the holes. The rotary broaching brake is a new mechanical solution for aligning broached forms in machined products.

Polygon Solutions Inc. designed the

broaching brake to be used as an attachment to its innovative GT Series rotary broach holder. The brake mounts to the tool holder using set screws. Additional screws are included at the opening of the brake to gently tighten against the spindle. The broach is fastened into the spindle, and must make contact and be aligned at the first hole.

When the broach is engaged with the part, the brake is loose enough to allow the spindle to turn without interfering with the broaching operation. Unlike typical rotary broaching operations, turning must stop before removing the broach. When the broach is removed the brake screws are tight enough to hold

From the Forest City Gear Family To You and Yours…Merry Christmas

During exceptionally busy years like this one we never truly stop thinking about our customers and their gear production challenges. Yet the holiday season reminds us of how blessed we are – for our family and team members, our industry and all our business associates.

From all of us at Forest City Gear: wishing you a very Merry Christmas and may your 2013 be a joyous and prosperous one.

FOREST CITY GEAR

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

A little downtime over the holidays?
Visit our new website at:
www.forestcitygear.com.

the broach's position until it makes contact with the part at the next hole.

The rotary broaching brake can be used to hold orientation for single or multiple parts. Tightening the screw to be loose enough to allow broaching, but tight enough to hold orientation, requires patience and a level of experience. Some trial-and-error can be expected and the broach orientation will need to be checked at regular intervals. The hardware consists of standard screws and nuts that can be replaced or reordered easily.

The rotary broaching brake was used recently at the 2012 IMTS show in the Hardinge booth. Hardinge's innovative Bridgeport GX 480 APC Vertical Machining Center held multiple broach holders by Polygon Solutions. However, the block was machined with square holes which were aligned to other features on the part. The squares were machined using a broach holder with Polygon's new rotary broaching brake.

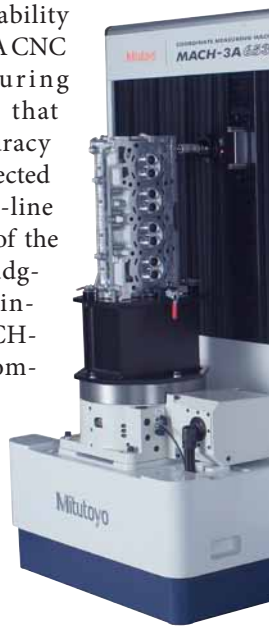
The rotary broaching brake is a lightweight, low-profile tool and easily fits into the VMC's tool changer. It easily slides onto the head of the holder and does not require special tools for adjustment or assembly. The brake can also be easily removed for operations where it is not required.

For more information:
Polygon Solutions Inc.
16770 Link Court, Suite 106
Fort Myers, FL 33912
Phone: (239) 628-4800
www.polygonsolutions.com

Mitutoyo

RELEASES MACH-3A CMM

Mitutoyo America Corporation announces the availability of the new MACH-3A CNC Coordinate Measuring Machine - a CMM that attains levels of accuracy and performance expected from Mitutoyo to in-line applications. Instead of the basic GO/NO GO judgments common to in-line gaging, the MACH-3A CNC provides comprehensive measurements to enable statistical control utilizing numeric data. The MACH-3A is a clean slate design embodying



numerous features dedicated to functionality and high performance for in-line applications.

The Mitutoyo MACH-3A CMM is a horizontal-arm-type machine with high speed and high acceleration (max. speed of 1,212 mm/s, max. acceleration of 11,882 mm/s2 - both in vector direction) that contributes to high throughput for greater productivity and lower total owning and operating costs.

The MACH-3A is compact, requiring only a minimal envelope which minimizes its impact on line layouts. This, plus high environmental resistance, make the MACH-3A easy to integrate into both upstream and downstream processes - even under demanding production floor conditions.

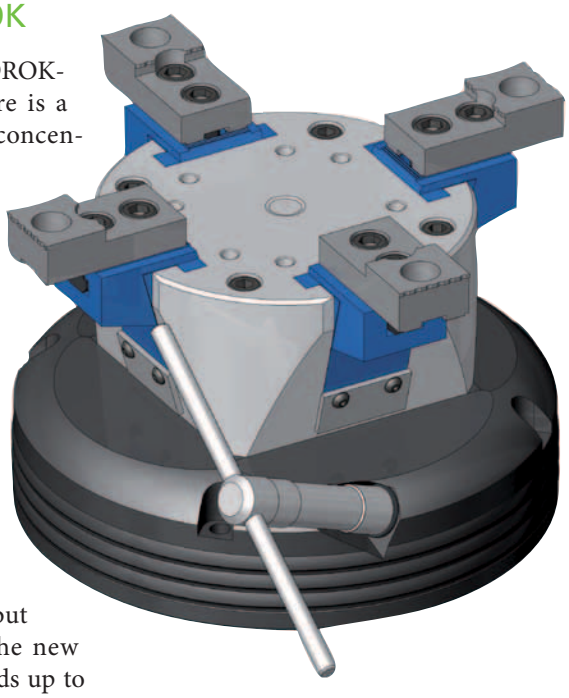
Conventional CMMs typically require dust-controlled environments to maintain accuracy. But with a drive unit protected by covers, precision linear guide systems for each axis instead of air bearings, and with its controller and PC installed in a dust-proof housing, the Mitutoyo MACH-3A is highly-resistant to the effects of dust, mist and humidity. Additionally, the MACH-3A tolerates a wide range of operating temperatures - guaranteed to maintain accuracy between 5° and 40°C. Additional production-oriented features include a machine status indicator (signaling machine fault or abnormal measurement), an ergonomically positioned touch-panel monitor with built-in compact keyboard, plus a built-in, industrial-grade controller and PC. It all means the MACH-3A CMM offers the functionality, durability and stability required for 24/7 in-line operation.

The MACH-3A CMM comes with standard with *MCOSMOS* (*Mitutoyo Controlled Open System for Modular Operation Support*) which supports virtually every CAD format while providing routines for in-line measurement, data feedback and process management. MACH-3A architecture, together with available Mitutoyo software packages, make it easy to integrate this machine with high-level network environments for true enterprise-wide functionality.

For more information:
Mitutoyo America Corporation
965 Corporate Blvd.
Aurora, IL 60502
Phone: (630) 820-9666
www.mitutoyo.com

Hainbuch

DELIVERS OPTIMAL HOLDING POWER WITH QUADROK



In addition to the flexible QUADROK-plus from Hainbuch, now there is a "'slimmed-down" variant that concentrates completely on the essentials. The new QUADROK is a manually activated parallel vise with a compensating 4-sided clamping and a radial clamping force of 60 kN. Thanks to its pull-back effect against the end stop, extremely rigid clampings at minimum clamping lengths are possible - with a repeatability of < 0.02 mm in all axes. This does not only guarantee optimal holding power for cross-machining between the jaws, but also for 5-sided machining. The new QUADROK can be used at speeds up to 1,200 rpm, even under rotation. When a little more is required and diverse clamping possibilities are demanded, with the more flexible QUADROK-plus, a mandrel or chuck clamping are also available, thanks to a quick- change-over interface.

For more information:
Hainbuch America Corp.
10541 N. Commerce St.
Mequon, WI 53092
Phone: (414) 358-9550
www.hainbuch.com

Oelheld

OFFERS COOLING AND CORROSION PROTECTION FLUID

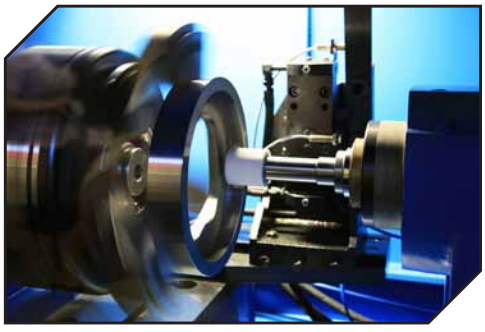
ControXid 1642 is a ready-to-use rust protection fluid for coolant circuits based on synthetic, water-soluble corrosion inhibitors. It affords reliable protection against corrosion and offers high resistance to fungal and bacterial contamination. It is OEM recommended as coolant for machine tool spindles and corrosion protection in coolant circuits. ControXid 1642 is not caustic; it does not contain nitrites, chromates, heavy metals, phosphates, chlorine compounds or amines. ControXid 1642 protects ferrous metals (steel, cast iron) against corrosion and has no effect on aluminum alloys, other non-ferrous metals or mineral oil-based sealing materials.

For more information:
Oelheld U.S., Inc.
1760 Britannia Drive Unit 1
Elgin, IL 60124
Phone: (847) 531-8501
www.oelheld.com

Acculube

DISTRIBUTES NEW BIO-BASED LUBRICANTS

Acculube, distributor for Castrol, Exxon Mobil and other leading global brands of industrial fluids, has been appointed one of just a few distributors nationwide who are authorized to sell and service Castrol's new Performance Biolubes product line. The Performance Biolubes technology platform adds a range of bio-based (vegetable) lubricants and metalworking fluids to Acculube's extensive existing line of lubricants for the aviation, metalworking and clean energy markets. The line includes neat cutting



and grinding oils, specialty oils, maintenance oils and forming fluids. Acculube is a leading distributor of Castrol products and specializes in helping companies identify fluids that will extend tool life, streamline cycle times for parts production, minimize equipment downtime and reduce disposal expense. Castrol Industrial is a leader in the development of environmentally responsible products, and was one of the first suppliers to voluntarily remove chlorinated paraffins from its products. Castrol also supplies products which are free of boron and secondary amines.

For more information:
Accurate Lubricants and Metalworking Fluids, Inc.
403 Homestead Avenue
Dayton, OH 45417
Phone: (937) 461-9906
www.acculube.com

Emuge

INTRODUCES TAP HOLDERS

Emuge Corp. has introduced the KSN5 and KSN6 Softsynchro Tap Holders. The holders are designed for tapping operations in components used in oil, power generation and wind turbine applications and in the production of large diesel, locomotive and ship engines.

"We are seeing an increased need for larger tapping applications such as in the energy sector," said Mark Hatch, product director of Taps and Threads Mills at Emuge Corp. "The new KSN5 and KSN6 Softsynchro Series are ideal for work in energy and other large component applications."

The KSN5 series is for tap sizes M16 to M56 and ANSI sizes to 1¾". The KSN5 series uses the ER50GB collet and is available in both DIN and ANSI tap sizes. Tension and compression of 2 mm is used in machines with rigid tapping cycles. Coolant-through capability is available up to 50 bar and the KSN5 series is also available with an integral shank CAT50 or HSK100A.

The KSN6 series is for sizes M24 to M76 and uses Emuge HE2 large QC Tap Adapters used currently on Emuge HF20 tap holders. Emuge HE2-IKZZ adapters are available in both DIN and ANSI tap sizes 1" through 2½". The KSN6 has 2 mm of tension and 2 mm of compression for rigid tapping cycles. The tool is coolant-through capable, to a maximum of 50 bar.

Emuge KSN Series Tool Holders are designed, engineered and manufactured with the utmost precision and quality and provide excellent concentricity, rigidity and safe tool clamping in machines with synchronous spindles. Axial forces that occur in the threading process are minimized by the use of an integrated minimum length compensation on tension and compression.

For more information:
Emuge Corp.
1800 Century Drive
West Boylston, MA 01583
Phone: (800) 323-3013
www.emuge.com

Seco Tools

DISPLAYS LATEST MACHINING SOLUTIONS

At the JEC Americas 2012 Composites Show that took place Nov. 7–9 in Boston, Seco Tools spotlighted advanced solutions for efficiently machining composite parts including products from its Jabro and Feedmax lines. Developed to meet the rise in composite machining applications, the new Jabro JC800 family of solid carbide milling cutters – JC840, JC 850, JC860, JC870, JC 871 and JC 880 – eliminates fiber breakout and delamination as well as provides improved edge finish. Each cutter employs a high degree of specialization to meet the diverse requirements of composite materials and features a CVD Diamond coating with low surface roughness and high substrate adhesion characteristics.

- The JC840, a double-helix end mill for machining laminated materials, ensures cutting forces are directed inward and toward the component filler material.

- The JC850, a four-flute ball nose cutter with low helix, is ideal for 3-D machining operations in carbon fiber and peek materials.
- The JC860 is a router for cutting non-ferrous honeycomb materials with carbon and/or glass top layers, such as those used to produce aircraft cabin walls and floor panels for the aerospace industry.
- The JC870 diamond cut router is a multi-flute design with two frontal teeth. It is capable of side milling, slotting and plunging in all types of composite materials.
- The JC871 diamond cut router is a multi-flute design with two different frontal tip configurations. It is capable of side milling, slot milling (open) and slotting in all types of composite materials.
- The JC880 low-helix end mill with a four-flute design effectively performs slotting and side milling operations in carbon fiber reinforced polymer and glass reinforced plastic materials

As the latest additions to Seco's series of Feedmax solid carbide drills, the Feedmax-C1 and Feedmax-C2 prevent delamination upon entry or exit when working in carbon fiber reinforced polymer materials. The–C1 geometry features sharp optimized double points, while the–C2 geometry is specifically designed to drill stacked CFRP materials with aluminum or titanium outer layers.

To combat the abrasive properties of carbon fiber reinforced polymer, the Feedmax –C1 and –C2 incorporate a polycrystalline diamond coating, which also provides good dimensional tolerance. The drills are 5xD with diameters ranging from 0.1260" – 0.5". All –C1 and –C2 drills also feature through-coolant holes.

Further advancements have also been made with the addition of solid PCD dome tip technology that makes it possible to grind geometries, such as the -C1 and -C2, into a solid PCD tip that is brazed onto a solid carbide drill. The edge sharpness that can be achieved with solid PCD further reduces delamination, uncut fibers, and improves performance.

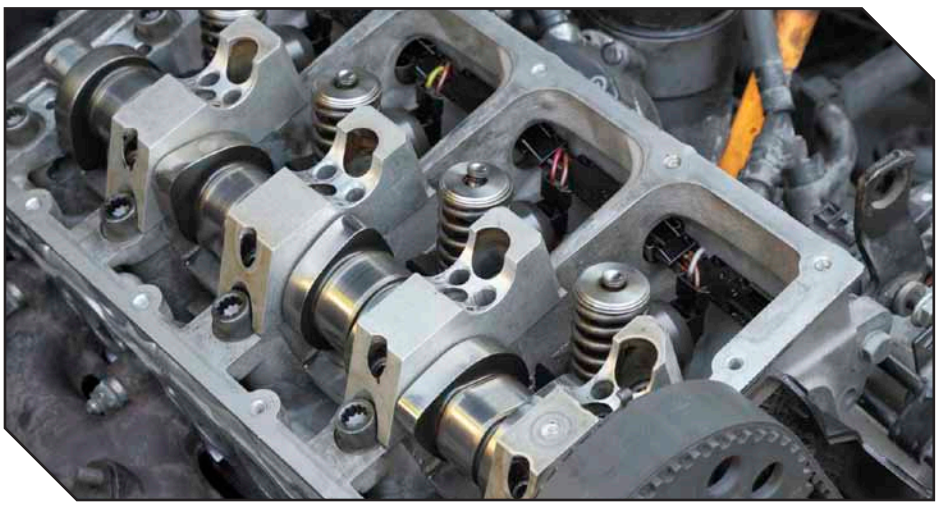
For more information:
Seco Tools Inc.
2805 Bellingham Drive
Troy, MI 48085
Phone: (248) 528-5200
www.secotools.com

Cimcool

OFFERS HYBRID FLUID TECHNOLOGY FOR AUTOMOTIVE INDUSTRY

Cimcool Fluid Technology has announced the release of a new lubricant technology for machining and grinding of hard metals. These new Cimtech synthetic fluids feature synergistic lubricant blends that provide huge increases in productivity without the use of chlorine or other high levels of extreme pressure additives. Cimcool delivers significant cost reductions from the higher production rates these fluids can provide. More production and lower cost per part coupled with environmentally responsible fluids provide significant advantages to customers concerned with being competitive. With unique hybrid blends, including patented Milacron lubricants, only Cimcool can provide customers with these innovative fluids. Customers with heavy duty performance requirements looking to eliminate chlorine from their operations now have options never before available. "We have developed something that is completely new and unique to the industry," said Tina Hunter, automotive product manager. "These fluids work best when really pushed to the limit. The tougher the operation, the better results we see. The performance of these fluids is significantly better. They have outperformed some popular heavy duty, sulfo-chlorinated oils by up to 300 percent. This is a huge jump in technology." Products include Cimtech 627 (a synthetic fluid used in heavy duty machining and grinding), Cimtech 609-E, (a water-based fluid used for hard metal valve grinding), Cimtech 610, (a unique Milacron Synthetic Lubricant blend for titanium and other hard metals), and Cimtech 612NF (a water-based synthetic for machining high-silicon aluminum alloys).

For more information:
Cimcool Fluid Technology
3000 Disney Street
Cincinnati, OH 45209
Phone: (888) 246-2665
www.cimcool.com



OVERTONCHICAGOGEAR

PROCESS-DRIVEN PRECISION

PROPELLING FORWARD

TODAY AND TOMORROW

Today, advances in hydraulic fracturing and horizontal drilling have made extracting natural gas from shale economically feasible. Virtually anywhere oil or gas is drilled, our ability to produce gears and gearboxes for pumping applications has made us a top supplier to the industry.

Wherever the engineers of the future take us next, Overton Chicago Gear will be supplying the gears that keep us moving forward.

(Use your smartphone for quick access to our site)

CHICAGO ADDISON LOMBARD

(630) 543-9570 | www.oc-gear.com | sales@oc-gear.com

100% Employee Owned

Manufacturing and Pursuit of the American Dream: *Reality or Fool's Quest?*

By Jack McGuinn, Senior Editor

"The 'American Dream' is that dream of a land in which life should be better and richer and fuller for everyone, with opportunity for each, according to ability or achievement."

~ from American writer and historian **James Truslow Adams'** *The Epic of America*

"They call it the 'American Dream' because you have to be asleep to believe it."

~ George Carlin

It wasn't so very long ago that a high school-educated, able-bodied person with a will to work typically had little trouble finding a decent job in manufacturing. Whether at an area job shop, an OEM plant or auto plant—work was to be had. Work that paid well enough to marry, buy a home, feed, raise and educate a family—with even enough left over for a modest retirement pension.

There was also a time when government-fueled jobs programs were not the "third-rail" political risk they have become today. Example: In 1956 President Eisenhower's Federal Aid Highway Act was passed—with strong bipartisan support—that led to millions of jobs for Americans. (While the bill's collateral damage inflicted upon many of the country's urban centers—Chicago, Oakland, Atlanta, for example—is another story altogether.)

Things change—witness the battle over the president's stimulus program upon his 2008 election. It eventually passed, but in a partisan, much-weakened version. (Can any rational person envision any reality-based scenario in which a "big government" employment stimulus program such as that could ever pass in today's Congress? Say, perhaps, a nationwide infrastructure build-and-repair program (bridges, roads, schools, etc.)?

Meanwhile, today's workplace—even, to a lesser degree, our military—is equally represented in numbers—if not pay, by women. They are commonly referred to as "working women," "working moms" or "career women." Setting "nuclear" family issues aside, reasonable people would agree the struggle for equal rights by and for women was hard-fought and a long time coming. Indeed, Archie Bunker doesn't live here anymore.

Here's the question—define "middle class" as you will—but does it in fact still exist? Or has it been banished to the same dark corner as our nation's fading manufacturing spirit? What has become of what once was the symbiotic relationship enjoyed for decades between the majority of the country's working citizenry and its manufacturing entrepreneurs, i.e.—our greatest jobs producers?

According to a report issued in August by the Pew Research Center, middle class households—with incomes between $39,000—$118,000—experienced its "worst decade in modern history" due to income reversals not seen since the end of World War II.

And reported in an August 2012 *Associated Press* story by Hope Yen,

"These are the disaffected middle class who work hard and play by the rules of society, but increasingly see their situation declining by forces beyond their control," said Timothy Smeeding, a University of Wisconsin-Madison economics professor. "The climb back up for the middle class and the recovery will be slow and often painful."

Also from the AP story in reference to the Pew report: "The notion that the middle class always enjoys a rising standard of living is a big part of America's sense of itself. And in modern times, it's always been true—until now," said Paul Taylor, executive vice president of the Pew Research Center."

Henry R. Nothhaft, in an opinion piece in *Bloomberg News* last year, says "Given how desperately the U.S. needs jobs, it's amazing how little effort Congress and the president devote to revitalizing manufacturing—the most potent of all job creators. For more than 30 years now, economists and policy makers have instead worshipped the false God of 'comparative advantage,' believing that the U.S. could prosper by specializing in innovation while letting China and other nations do the manufacturing. Simply put, manufacturing is what created an American middle class that was the envy of the world. Its loss is now destroying that middle class."

"Recapturing the American dream starts with the manufacturing middle class," says Carlos M. Cardoso, head of Kennametal Inc., in a guest columnist piece in the *Cleveland Plain Dealer* in August. "For decades, good manufacturing jobs allowed workers to own homes and cars, take nice family vacations, satisfy their health care needs, send children to college and retire with financial security."

The above is a brief sampling of a growing crescendo of recent observations from people in a position to know something about the nation's withering middle. Fact is, you can't deal with a problem until acknowledging that one exists.

Some facts we ignore at our peril

- Eighty-three percent of all U.S. stocks are in the hands of one percent of the people.
- For the first time in U.S. history, banks own a greater share of residential housing net worth in the United States than all individual Americans put together.
- In 1950, the ratio of the average executive's paycheck to the average worker's paycheck was about 30-to-1. Since 2000, that ratio has exploded to between 300- and 500-to-one.
- The bottom 50 percent of income earners in the U.S. now collectively own less than one percent of the nation's wealth. (*Source*: Business Insider, *2010*—"22 Statistics that Prove the Middle Class is Being Systematically Wiped out of Existence in America.")

Forget about whether you are better off today than you were four years ago—think generationally. If you are a parent or grandparent—or you simply care about your country—isn't it all about tomorrow? And the tomorrows after that?

Too many of our youngest soldiers enlist in the military simply because no other job opportunities or pathways to training programs exist for them. Think of the GI Bill—the greatest boost to the middle class since the New Deal.

We invited people from various perspectives to weigh in on the interconnected issues of U.S. manufacturing, a well-trained workforce and what was once known as the "manufacturing middle class." They are teachers, longtime gear industry experts, AGMA members, businessmen and socio-economic policy influencers. As their comments reveal, they agree—and disagree—strongly on the issues raised here. But there is one hopeful constant: they care. What's more, each—in his own way—is doing something about it.

Our Panel

Bart Aslin (*baslin@sme.org*), chief executive officer, SME Education Foundation; **William "Bill" Bradley** (*billb111@att.net)* former AGMA vice president–Technical Division, winner of AGMA Lifetime Achievement Award and *Gear Technology* technical editor; **Doug Bowman** (*dbowman@vinu.edu*), HTEC director, Vincennes University (Vincennes, IN); **Scott N. Paul** (*spaul@aamfg.org*), executive director, Alliance for American Manufacturing; **Jerry Ruble** (*jruble@vinu.edu*), director, ABB Robotics Lab and Industrial Maintenance Training Business & Industry/ South, Vincennes University; **Chuck Schultz** (*gearmanx52@gmail.com*), owner/operator, Beyta Gear Service, AGMA member and *Gear Technology* technical editor; and **Dwight Smith** (*dsmith@colemfgsystems.com*), owner/operator Cole Mfg. Systems, Inc., and current chairman of the AGMA Nomenclature Committee.

Gear Technology: What role would you like to see government and educational institutions do to promote careers in manufacturing?

Chuck Schultz (CS). We need a rational *industrial* and *trade* policy. Then we can talk about German-style apprenticeship programs.

Bill Bradley (BB). Provide the manufacturing industries with more incentives, like tax breaks that promote jobs.

Bart Aslin (BA). Besides the funding of a nationwide PR/marketing plan, government should stay out of the way. Lower the tax burden on industry and remove onerous regulations.

Jerry Ruble (JR). I'm not a big fan of government. My view is they are there to protect our county and uphold the constitution. I think it is the job of the manufacturing world to get people interested. (Vincennes University) just signed an agreement with Toyota Motor Manufacturing Indiana to recruit high school students into the high tech manufacturing jobs. It's called the Toyota Advance Manufacturing Technician program. They will do this by showing the students what is available these days in manufacturing. Then they will agree to hire the students two days a week to work at TMMI while going to school three days a week for five semesters to earn an associate degree. After that, they can choose to continue on to a bachelor's degree or enter the work force with a well-paying secure job.

Dwight Smith (DS). Promoting manufacturing with incentives for 'on-shoring,' for example, will boost manufacturing and therefore, boost careers in manufacturing.

Scott Paul (SP). At the federal level, the Administration has put some resources behind the Skills for the Future Initiative, which already has strong support from industry and academia. This initiative is designed to attract new talent into technical school and community college programs to gain skills certifications for manufacturing careers. There's also a higher-level need, as well, to ensure that people know the government backs manufacturing and insourcing. Our polling showed that other than aspirations of achieving a four-year degree, the biggest obstacle to getting Americans to pursue manufacturing was a belief that the jobs would be outsourced. The (often cited) 'dirty job' and 'mundane' aspects of manufacturing were very far down the list of concerns.

Doug Bowman (DB). Just projecting a positive attitude about the importance of manufacturing to our nation would go a long way. I know SME and NTMA do a lot to promote careers in manufacturing. Maybe promoting careers in manufacturing would be a great role for all of the professional organizations to engage in.

Do you believe companies are spending enough to train their own workers?

CS. No, many spend more on landscaping.

BA. Smarter government tax policy should be enacted in order to incentivize ongoing education of our workforce.

JR. Absolutely not! Part of it is the economy; the other part is just competition. Companies are forced to quote their products with lower and lower prices. At some point they are just trying to survive and make 0.5 or 1 percent on their investment. They won't allocate the money for training because they don't see the return on their investment.

DS. Most companies do not invest enough in their employees in the way of training. Some company owners have told me that they don't want to train workers for their competition. However, studies have shown that training employees actually improves employee retention.

SP. I think the mistake that too many companies make is expecting a perfectly suited, highly skilled worker to show up on their doorstep, willing to start for relatively meager wages and needing no additional training. That's fantasy land. But too many businesses live in it. Investing in human capital is smart and pays dividends. Manufacturers succeed by being lean but also by being smart. There are also companies that have been smart about training, wages and recruitment.

DB. Some probably aren't, but I think many companies are starting to invest more in training out of necessity.

If you accept the premise that unions once played a significantly positive role, why has that perception changed? Do we blame it all on Jimmy Hoffa?

CS. Cumulative PR by "Big Business" and some real stupidity on the unions' part; and lots of jealousy from people misunderstanding how much they were really being paid. Who else talks about their salary with benefits and overhead rolled in?

DS. Labor unions certainly played a positive role in protecting workers during a less enlightened time. I believe the perception changed when the

unions became more powerful and failed to put the workers' needs in perspective. They may have become more interested in their own furtherance, and relationships with company management became adversarial.

SP. Unions and management have both made a lot of mistakes over the years, but they have also come together in times of crisis. Large industrial unions like the steelworkers' and UAW have accepted reduced wages, more cost-sharing for retiree health care, and work rule flexibility to help save entire industries. Scapegoating unions serves no real purpose today. Jack Welch helped to lead a wave of corporate outsourcing. President Bill Clinton opened up trade with China without demanding real accountability. Really smart engineers developed robots that replaced workers. Wall Street became the master of manufacturing rather than the provider of capital. Who's really to blame? You tell me.

Aside from the actual training, what more can companies do on their own to generate interest in manufacturing?

BA. They can establish a coalition that will develop a nationwide campaign to inform people about the dignity of all workers and the importance of manufacturing to our future economy.

JR. They need to show the benefits of manufacturing—good pay, good benefits, job security with technical knowledge, etc.

DS. Manufacturers can strive to be good places to work and be involved in their communities.

SP. Putting out the help-wanted sign is a start. For years, manufacturers shed workers without hiring many new folks at all. I'm not concerned about the ability of the large manufacturers to compete for and attract a skilled workforce—otherwise I'd call it a management failure. But there is certainly work to be done in connecting small manufacturers with qualified workers for positions that require specialization or a high degree of skill.

DB. I think that the companies that provide frequent, upbeat tours of their plants, educate people about the benefits of manufacturing to the local and national economy, sponsor students in training programs, and provide internships generally generate a lot more interest, and are more successful in filling their skilled positions with qualified people.

Is time to stop blaming China for everything?

CS. Why blame them for acting rationally? Blame the people in Washington and London who set this system up for their gain. Check out Billy Bragg's NPWA (No Power Without Accountability).

BA. Global competition spurs innovation and growth in the U.S. (Facing) the challenges that global competition offers will lead to improved productivity and innovative processes.

BB. I don't blame China. They have taken every economic advantage that world governments have let them have, and will soon own the U.S. if we let them. (Our) government needs to change the things that have driven the majority of manufactured products sold in the U.S. to be manufactured (outside) the U.S.

DS. It never has been correct to blame China. If we became complacent and failed to compete, we have no one to blame but ourselves.

SP. No—I don't think China is blamed nearly enough. Yes, we must get our 'own house' in order, but China is a blatant rule-breaker: on currency, intellectual property, government subsidies, technology transfer, labor rights, environmental regulations, rule of law, piracy, etc. But so many multinational companies have a China-centric sourcing strategy that it would cause a lot of pain to stop China's cheating. The bottom line is that I blame our government for not holding China accountable. We're not acting in our own national interest when we let China get away with cheating on trade rules.

DB. I think that China is only taking advantage of our follies. They are using basically the same manufac-

turing model that we did to become a prosperous nation: capitalism. The interesting thing is that they are doing it in spite of the handicap of being a communist nation. Sure, it is well documented that some leaders in China promote suppressing their currency, stealing intellectual property and disregarding patents, but perhaps America has also helped to sponsor China's industrial growth. I think that the world is big enough for (both) China and the United States to be manufacturing giants. I have met many Chinese workers and they are good people, very hard working and friendly. They deserve a good quality of life also and manufacturing can provide that. I think some of the blame for our financial problems should fall rather to the greedy and powerful 'elite' financiers that work mostly behind the scenes to promote damaging agendas to their own financial gain.

Our middle class—some refer to it as "the manufacturing middle class"—is shrinking and in danger of eventually losing its majority status (nearly 6 million factory jobs lost since 2000--NY Times).

CS. (Due to) totally reciprocal trade agreements. If you have tariffs on my stuff you get the same tariffs on yours. Brazil charges an 80 percent tariff on goods that could be made in-country. Any surprise they are growing so fast?

JR. (We need to) control the amount of people entering the country; keep jobs in our country and not send them to other countries. Then, figure out how to compete with the other up-and-coming countries.

BB. First, I am not sure what defines middle class. Is it wages, net worth, type of job or what? If the average wage or net worth increases, is there more in the 'middle class,' more rich, or less poor, a combination, or what? There seems to be moving definitions of poor, middle and rich, depending on political need. We need to change our cultural perspective on class. Perhaps there are those that can live without assistance, contribute, and those that can't—some of which take from government. Job loss or gain and unemployment are (other) areas where there seems to be a disconnect in definition.

DS. The emphasis on non-value-added activities, i.e.—financial services—has caused the best and brightest to seek their fortunes there rather than in science and engineering. When manufacturing is once again strong, young people will want to be part of it.

SP. When manufacturing is doing well, our economy does well. We are exporting more, creating jobs that pay relatively well. It means the 'ripple effect' produced by manufacturing and its value chain has a larger impact. Manufacturing is not likely to ever employ 30 or 40 percent of our nation again, but that doesn't mean its impact is unimportant. We need a smart (national) manufacturing policy (addressing) taxes, trade, innovation, infrastructure, skills and energy.

Do you envision any scenario in which Washington—or at the state level—would enact an education program based on the GI Bill model that would incentivize young people to pursue—or teach—STEM-type coursework—science, technology, engineering, and mathematics?

JR. I think a program like that is a real possibility. I think a program could be started to have the STEM educators that are off work in the summer work with local companies and manufacturers so they can keep up with this very quickly evolving technology in manufacturing. I think this would strengthen the relationships between education and manufacturing. The manufacturer would receive help in the form of not only another headcount (everyone is running extremely lean now days), but someone with a very good understanding of manufacturing that could pick up and be productive quickly. The educator would benefit by seeing the newest technology and how manufacturers really manage and react to the changing work environment. While the educators are (embedded) there, they could make suggestions of other types of training that would help improve the skills of current

workers. There are a lot of pluses on both sides when you start to think through the possibilities.

BA. One of the most promising (STEM programs) is in the area of providing funding to those who will begin their post-secondary education at community colleges. This gives a tremendous boost to young learners and also allows them the opportunity to figure out what educational path and eventual career path fits their passions. Too many young people are pushed into four-year institutions, only to leave during their first year with debt and frustration over their future. (Government) needs to understand that all people deserve the opportunity to pursue lifetime learning. (But we must first) fix the STEM problem at the elementary, middle school and high school level. The SME Education Foundation (and) Project Lead the Way are dedicated to (that).

BB. We can't cure a perceived problem with young people pursuing coursework in science, technology, engineering and mathematics by using taxes to reduce an individual's secondary education costs or increase pay to educators; manufacturing jobs still operate on a supply-and-demand basis. We need to have government make it desirable to return manufacturing jobs on-shore and promote them to stay in the U.S. Thus there would be a greater need for those who pursue science, technology, engineering and mathematics to support manufacturing.

DS. Unfortunately, it may take a further decline in America's status and position in the world to make education the priority it needs to be (and the priority it is overseas). For example, a recent study reported that the U.S. ranked 25th out of 50 countries in math literacy.

SP. I think there is general awareness among our lawmakers of the need for more Americans to pursue STEM education and careers. We're falling behind—there's no doubt about it. We may be at such a crisis stage that the time is right for a GI Bill-like effort.

Hypothetically, would you want your son or daughter to have a career in manufacturing?

CS. I discouraged it.

JR. Yes, it's a good job. Making stuff (manufacturing) is the building block for everything else in the economy.

DS. I hope for an America where my grandson can have a fulfilling career in manufacturing.

SP. Absolutely. I have twin five-year-olds (boys); they love to tinker and imagine. I hope they never lose that. I enjoy nurturing those innate abilities. There are lots of careers in manufacturing. I hope they will strongly consider whether or not such a career makes sense for them.

DB. Yes! I have four children in manufacturing careers already and more to come.

BB. Yes.

If Only We Had a Crystal Ball …

Insiders Weigh In on the Present and Future of Gear Manufacturing

Matthew Jaster, Associate Editor

Before we get into projections and prognostications about the future, let's take a minute to review 2012. For many in the gear industry, the year was better than expected. Some manufacturers had a very successful year leading up to an even more successful manufacturing trade show (IMTS 2012). Others were searching for more business, hoping that the general state of the economy wouldn't make things worse. In some cases, it did.

Some companies invested a great deal in manufacturing education and training while small job shops tried to hang on to what's left of their skilled workforce. There was optimism, pessimism and perpetual talk of fiscal cliffs, economic uncertainty and political turmoil. 2012—for all intents and purposes—can be summed up in one word: polarizing. You'll see this in the quotes from gear manufacturers throughout this magazine as well as data collected for our 2012 State of the Gear Industry Survey (*Ed's note: See survey results starting on page 32*).

But like other segments of manufacturing, the gear industry endures, simply because it has to. North America remains one of the largest manufacturing sectors in the world, producing more than 20 percent of the world's manufactured products. Whether business was slow and steady, fast and furious or underwhelming in 2012, there's work to do in 2013. Plan accordingly.

The Gear Market Today

In our 2011 State of the Gear Industry survey, respondents reported that the significant challenges to their business included lack of skilled labor, material costs, the overall economy and supply chain issues. These continue to be prevalent one year later.

"Growth of the world's major economies stalled in 2012 after beginning to recover from the recession," says Joe Franklin, AGMA president. "China and Europe are suffering more than North America, but orders from most end-markets turned down this summer. The United States had a good run from 2010 to the middle of 2012, but seems to have stalled. Additionally, coping with the volatile, uncertain political environments here in the United States (taxation, health care, fiscal issues, etc.) and the related uncertainty makes mid- to long-term planning difficult."

"We've been very pleased with overall sales in 2012, though we noticed customers

pulling back in the summer," says Fred Young, owner and operator of Forest City Gear in Roscoe, Illinois. "I expect it to pick back up again at the end of the year."

Fred Young, Forest City Gear

"There is a lot of uncertainty," adds John Walter, president and CEO of Precipart Corporation, located in Farmingdale, New York. "We saw a lot of programs pushed out as our customers waited for the outcome of the election. Some programs may disappear entirely. Budget cuts and deficit reduction will come into play no matter who is in office. Meanwhile, we remain in touch with our customers in order to react to changing demands."

"I think there will be a slight contraction in 2013, compared to 2012," says Dylan Smith, president of Vancouver Gear Works, located in Richmond, British Columbia. "The economy has leveled off or slightly declined after the initial strong recovery."

Joseph L. Arvin, president of Arrow Gear, located in Downers Grove, Illinois, believes things look OK today for Arrow's gear business, but it could change overnight. "Not knowing what is going to happen with the sequestration and its $109.3 billion cut per year could be devastating, because 35 percent of my work is in government defense."

Joseph L. Arvin, Arrow Gear

Arrow Gear's challenges include the banks' unwillingness to loan money, finding skilled help and the state of taxes and EPA regulations. "I wish the banks would give us more money for the latest equipment and the U.S. government would help manufacturing like other countries who realize it's the backbone of economic growth and prosperity for the middle class," Arvin says.

"The general economy is affecting us, particularly the work we do in business jets," Walter at Precipart says. "The cost, quality and lead-time issues related to supply chain led us to bring in some secondary operation capability in-house, which will help us control processes and ultimately keep us highly competitive."

"We had a lot of management turnover in 2012, which is both a challenge and an opportunity," Vancouver's Smith says. "It was difficult to find skilled workers in 2012, but the workforce we have now should carry us through 2013."

But much like *Gear Technology's* survey respondents, the skilled labor shortage remains the *greatest* challenge. "Machinists are a dying breed and this shortage of skilled labor will be a major drag on business performance unless companies employ strategies to overcome hiring difficulties," Walter says.

"Some AGMA members are looking for a couple of people, but a number of companies are looking to hire 10 to 20 today. End markets are not being fully served," Franklin says.

AGMA's Education Advisory Council and the Board of Trustees are doing their part by developing a Skills Assessment document that will allow manufacturers to evaluate the current and needed skills for a variety of production and engineering positions, including machine operators, gear technicians, engineers, maintenance workers and managers.

"One of the most expedient ways to help younger engineers or those new to a technical topic is to get them involved with the industry's technical community. AGMA's 25 technical committees continue to develop standards on focused topics, including the analysis of micropitting and gear failure from sub-case crack initiation. There's no better way for an engineer to learn a subject in great detail than working side-by-side with the industry's top subject matter experts," Franklin says.

Joe Franklin, AGMA

"One of the top priorities for Citizens for American Manufacturing (CAM) is to high-profile the need for entry level employees to have some basic machining skills which can be provided by high schools, trade schools and colleges," Arvin says. "It's also to educate parents, teachers and our politicians about the need for an educated and trained technical staff."

"I think the most serious skill deficiency is with the new machinists," Smith says. "It is very hard to find someone who is capable of working with modern equipment but also understands theory and practical aspects that a manual machinist would understand."

The Promise of IMTS

In September 2012, IMTS in Chicago attracted more than 100,000 registered attendees for the first time in more than a decade. "The energy level among visitors and exhibitors was at an all-time high," said Peter Eelman, IMTS vice president – exhibitions and communications in a press release. "The most exciting take-away from IMTS 2012 is what it says about the prospects for manufacturing over the next year. The overall activity and buzz indicates that we are entering a period of sustained growth that will fuel economic prosperity and job creation."

The most telling sign of the future of U.S. manufacturing may be the emphasis on process integration displayed during the show. Large machine tool companies like DMG/Mori

Seiki and Mazak continue to release multifunctional machines that include a variety of gear operations. Additionally, the collaboration/partnerships between Gleason/Heller, Star SU and MAG and the recent acquisition of Höfler by Klingelnberg, support the theory that flexibility, productivity and quality will be addressed in single machine operations in the future.

"We've watched the industry consolidate for decades. Most of the combinations were between smaller and larger companies," Franklin says. "Over the last few years, several mergers have been between larger companies. The demands of greater technological capability and a more global reach demand larger companies. Customers in developing markets want the same high quality as those in the most developed parts of the globe. Meeting these demands is complex and costly. Another factor supporting mergers gets back to the availability of management knowledge and skill. Some very fine manufacturers do not have a very deep management bench."

On the gear manufacturing side, companies like Forest City Gear work frequently with others in the industry. "You don't find many people who are as open with peers and competitors, but we regularly provide work for a number of our friends in the industry. Collaboration is becoming the norm," Young says.

"It has been interesting to see this happen," Smith adds. "It seems to be letting each company focus on their own expertise rather than trying to be everything to everyone. Mind you, the openness and cooperative spirit is something that has always uniquely characterized the gear industry in my mind."

Making Progress

AGMA's recent Fall Technical Meeting included topics on higher processing speeds, multitasking machine tools, advance heat treating capabilities, advanced gear design software and improved lubricants to enhance wear and efficiency. The technology is improving, here's hoping there's a stable market for it.

Regardless of economic forecasts, uncertainty has not stopped the gear community from investing in new equipment and their workforce. Downtime has always given organizations an opportunity to play "catch up" and prepare for the next business cycle.

"We've increased our workforce this year throughout the organization," Walter says. "This increase is to prepare for forecasted ramp-ups in key aerospace and medical technology programs. New machinery is allowing us to hold tighter tolerances while increasing throughput.

"It's not just the acquisition of more machines that operate faster and better that we need, but now more and different types of tooling and attachments are available to optimize productivity and the quality of parts produced."

John Walter, Precipart Corporation

"We've spent $3.5 million in new equipment over the last 18 months," Arvin adds. "We have hired 60 people during the same period."

"I've never met a gear machine I didn't like," quipped Young when discussing machine investments. "We're constantly buying new equipment that enables us to provide rather unique capabilities in the size range and the types of gears we manufacture. There's no plan to change the way we approach our business in the future."

Dylan Smith, Vancouver Gear Works

"I am investing in workforce training for our existing staff because I think it's always important to improve your skills," Smith says. "I will also be replacing/upgrading some of our aging equipment."

Manufacturing technology orders are up, according to the AMT, and Washington D.C. has promised a renewed focus on clean energy and science and engineering education. So what needs to be done to keep gear manufacturing on the right track, moving forward?

"We must continue to grow our custom-engineered, value-added assemblies for customers in our core industries," Walter says. "Additionally, we will utilize our continuous improvement team to find opportunities for us to operate leaner and more efficiently, while remaining focused on providing world-class customer service."

"It is a relief to see that the public is viewing manufacturing as an important part of our economy. There has been a lot of talk about on-shoring or re-shoring this year, and consumers are starting to pay more attention to where things are made, and seeing that as an important factor in their purchasing decisions," Smith says.

The image and realization that manufacturing is important *has* improved in the public eye, according to Arvin. Now it's time for the manufacturers to validate this by continuing to produce the very best products.

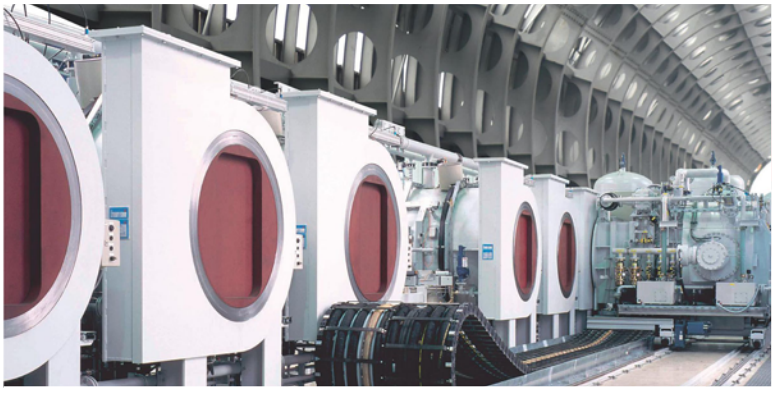
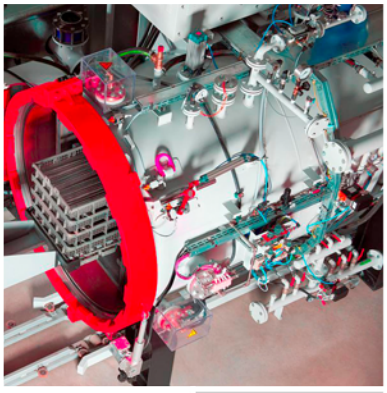
Though no one knows what's really in store for 2013, more substantial evidence should be collected by the time the industry regroups in Indianapolis for AGMA's Gear Expo (September 17-19, Indiana Convention Center).

"Predicting the future is beyond my abilities, but I do believe that our industry has many very talented and clever individuals," Franklin says. "The manufacturers of machine tools, tooling and related products will continue to push the envelope. Customers will continue to be demanding—as they should—which will drive our industry to bigger and better solutions."

Vacuum Furnace Innovations

Providing Profitability Through Technology



Innovative vacuum furnace technologies available for every production requirement.

Modul*Therm*®.....**high volume** production designed for incremental growth.

Syncro*Therm*®...**high profits** by synchronizing with machining centers.

Dual*Therm*®.....**high performance** via separate heating and quenching chambers.

Mono*Therm*®.....**high flexibility** with a variety of processes and configurations.

ALD-Holcroft Vacuum Technologies
49630 Pontiac Trail
Wixom, MI 48393-2009 USA
Ph: 248.668.4130
Fx: 248.624.3710
E-mail: sales@ald-holcroft.com
www.ALD-Holcroft.com

2012 State of the Gear Industry

Reader Survey Results

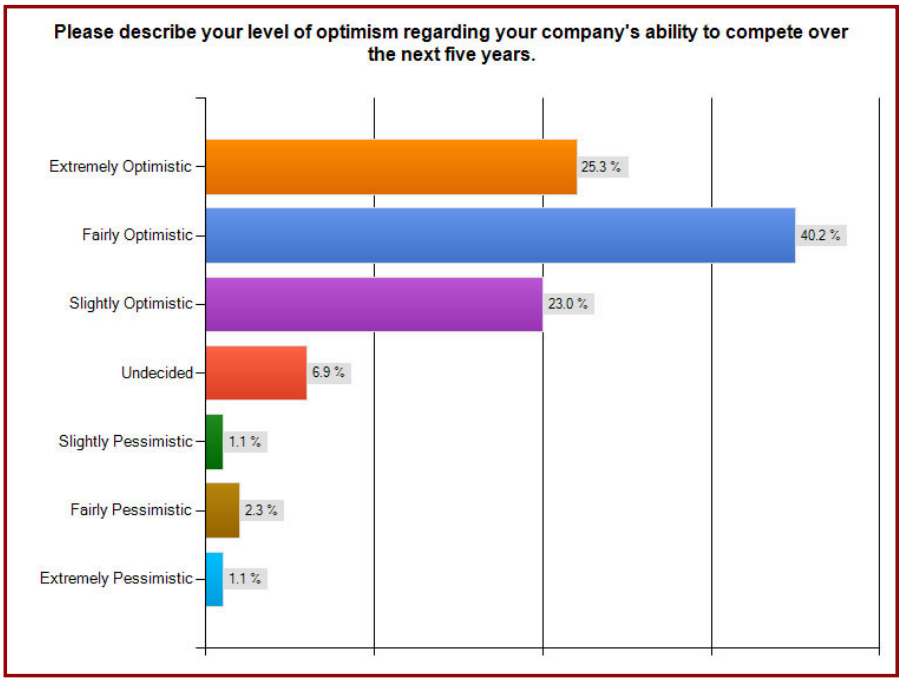
Gear Technology's annual state-of-the-gear-industry survey polls gear manufacturers about the latest trends and opinions relating to the overall health of the gear industry. As in years past, the survey was conducted anonymously, with invitations sent by e-mail to gear manufacturing companies around the world.

Hundreds of individuals responded to the online survey, answering questions about their manufacturing operations and current challenges facing their businesses.

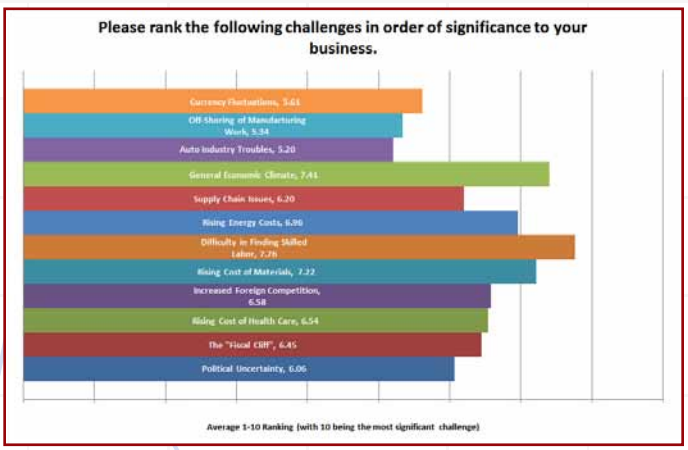
All of the responses included in these results come from individuals who work at locations where gears, splines, sprockets, worms and similar products are manufactured. They work for gear manufacturing job shops, captive shops at OEMs and end user locations.

A full breakdown of respondents can be found at the end of this article.

Gear Industry Optimism Remains High
A Look at the Results



Significant Challenges



"European quality and Asian price is the concept of OEMs nowadays."

"Global economic climate."

"Uncertainty on a global scale."

"Health care costs."

"Retaining and nurturing skilled employees."

"Economic slowdown in Europe."

"Four more years of Obama."

"International shipping costs."

"Maintaining a high level of quality at all locations."

"Process optimization."

"Labor with low skill level."

"Maintaining the current level of business in light of perceived softening of the economy."

"Do more with less."

"Meeting rapidly changing customer requirements."

"Trained workers and money available for new equipment."

"Lean six-sigma implementation."

"Increasing capital spending to a level commensurate with long-term financial success."

"Find ways to reduce cost!"

"Getting and keeping qualified machinists and engineers."

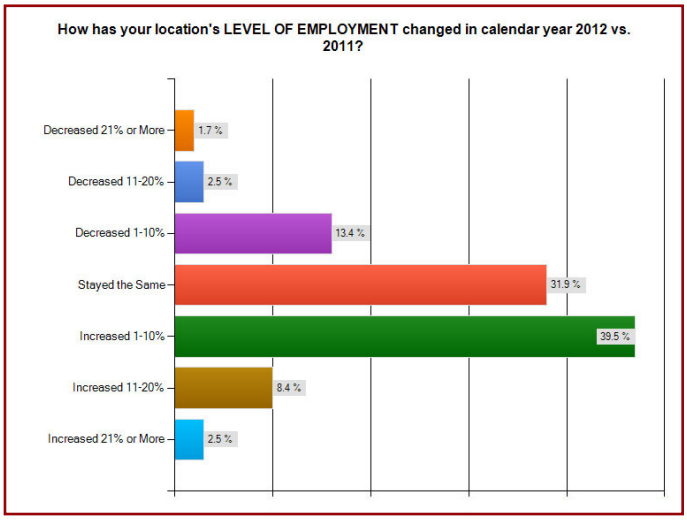
"Implementing Lean in more areas and reducing the cost to manufacture."

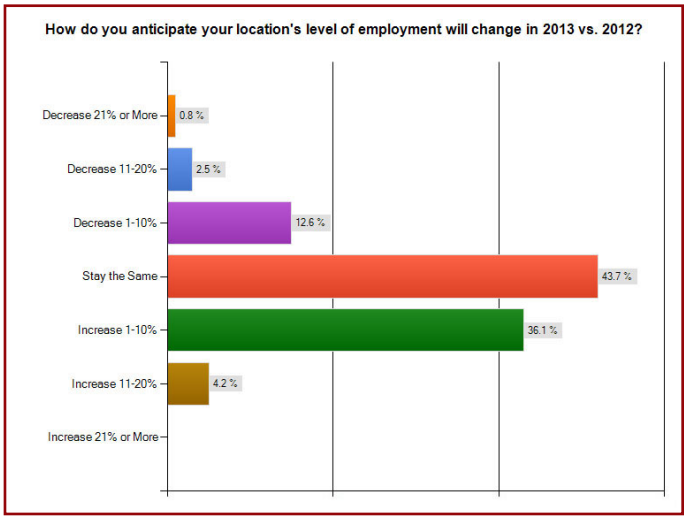
"Need for increased capacity and the capital cost of providing this when other companies have excess capacity."

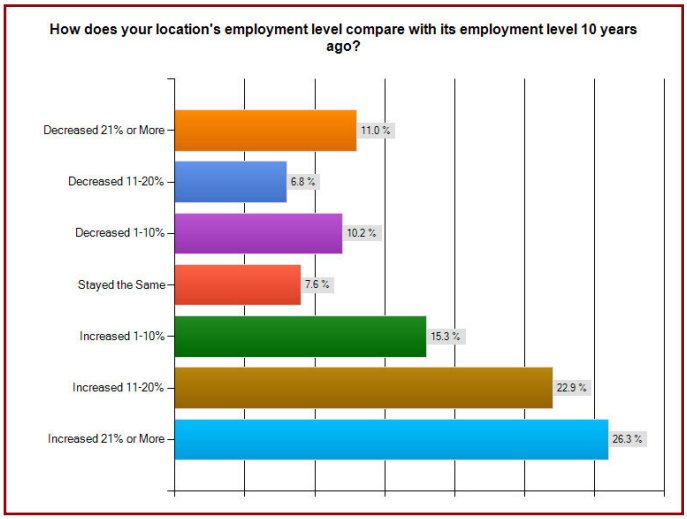
"Skilled production labor and skilled process engineers. OEMs are outsourcing more and losing their internal experience and expertise. They look more and more to the supply chain for gear expertise."

"The increasing problem of finding skilled labor."

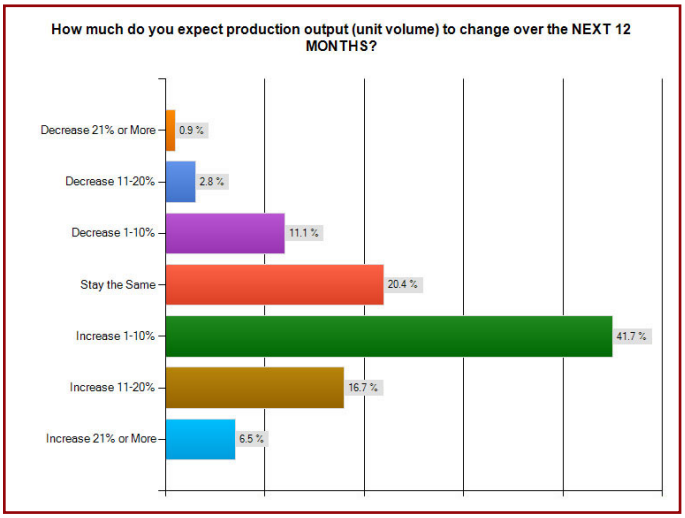
Employment

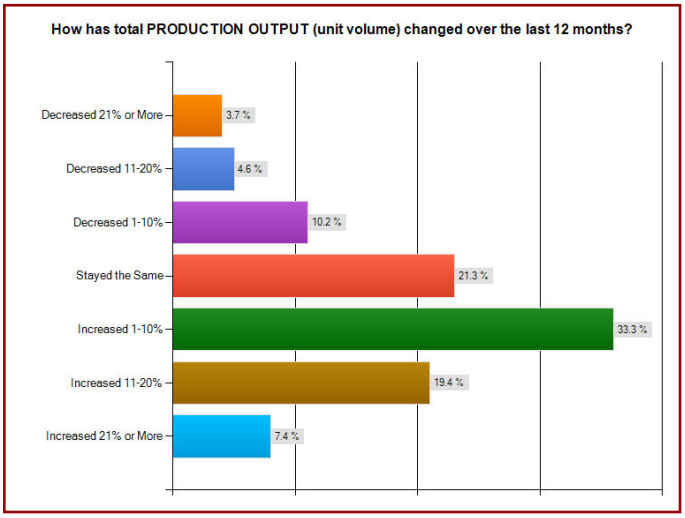






Production Output

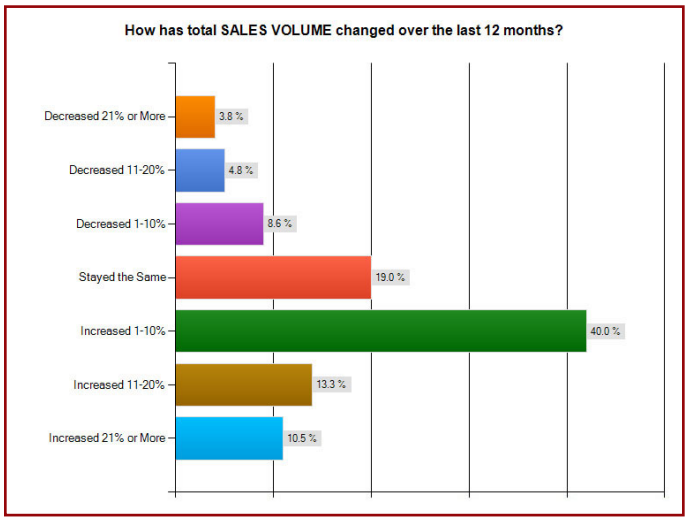


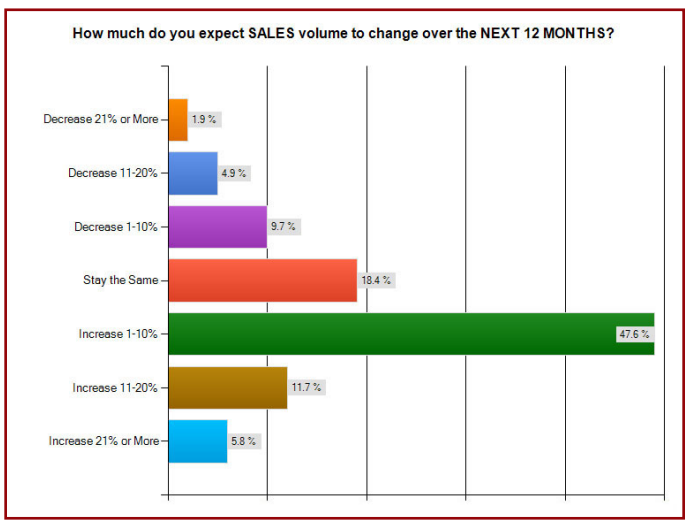


Why was production up this year?

- "Sales were up."
- "Gear units are getting larger; increase of production capacity."
- "New orders."
- "Increased demands from our customers."
- "Business growth."
- "Increased car sales."
- "Boom in business."
- "Added solar energy customers."
- "Industries like steel and automotive doing well."
- "Offshore supplemental product dramatically greater portion of product mix."
- "Equipment acquisitions and increased staffing of 2nd shift."

Sales Volume

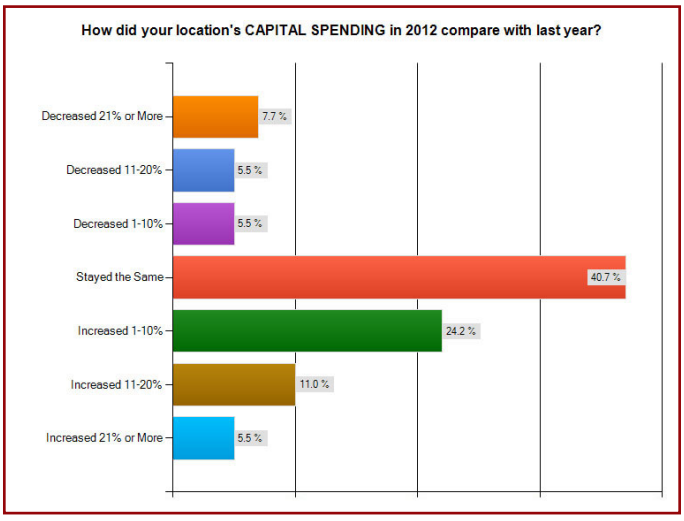


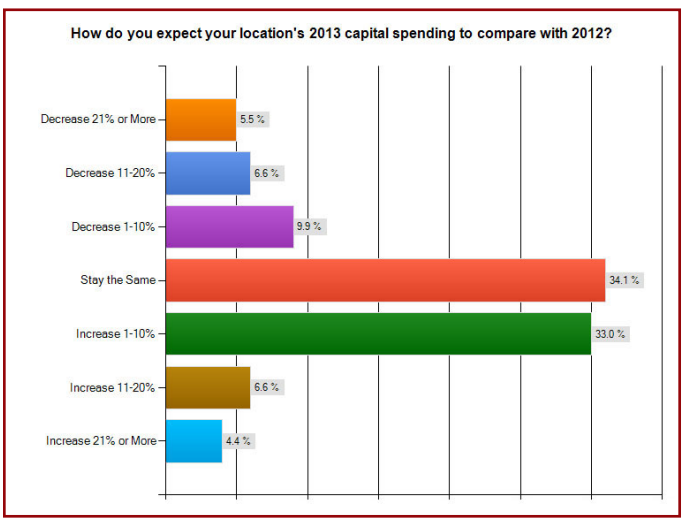


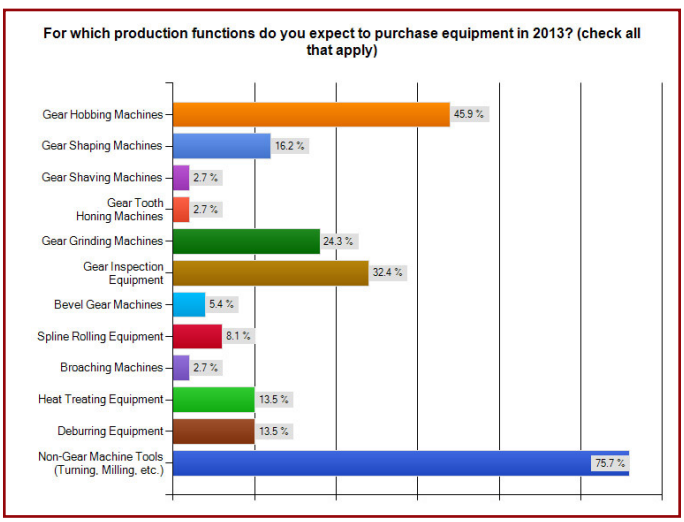
Why were Sales up this year?

- "New markets, new applications, utilization of group of companies sales network."
- "Business growth."
- "New programs."
- "New orders/customers."
- "Mining increase, primarily."
- "Increased workload and increased pricing."
- "New customers."
- "A large sales increase occurred in the first half of the year, followed by a substantial reduction in volume."

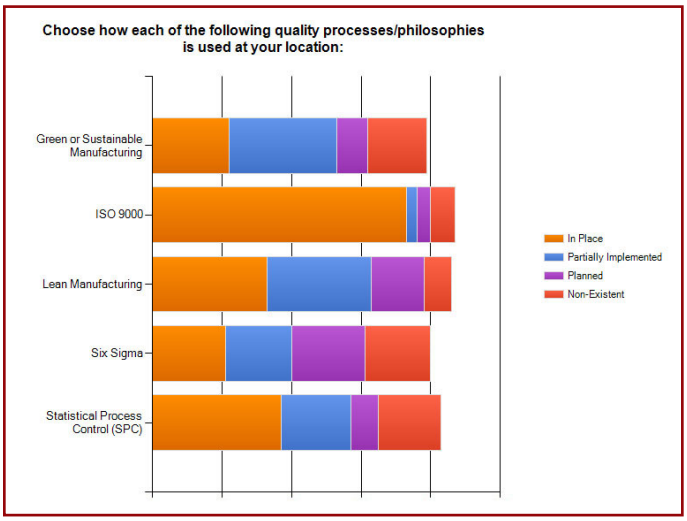
Capital Spending

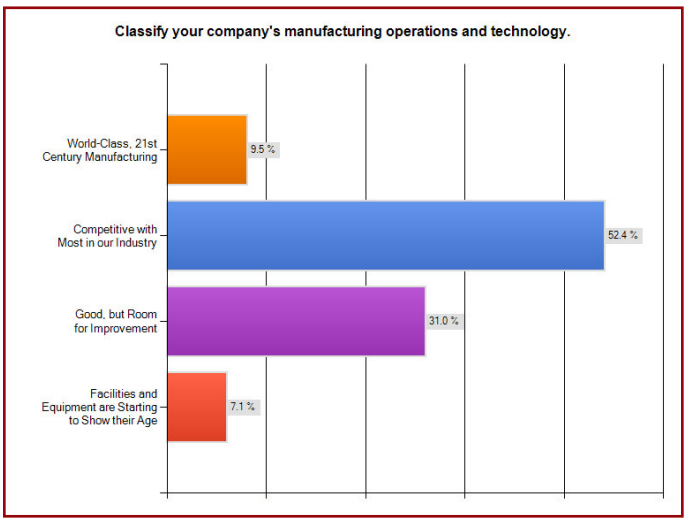






Quality





What other quality processes or philosophies are used at your location?

"Opex."

"5S."

"TPM, TBEM."

"TQM."

"Kaizen, productivity improvement."

"TQM, 5S."

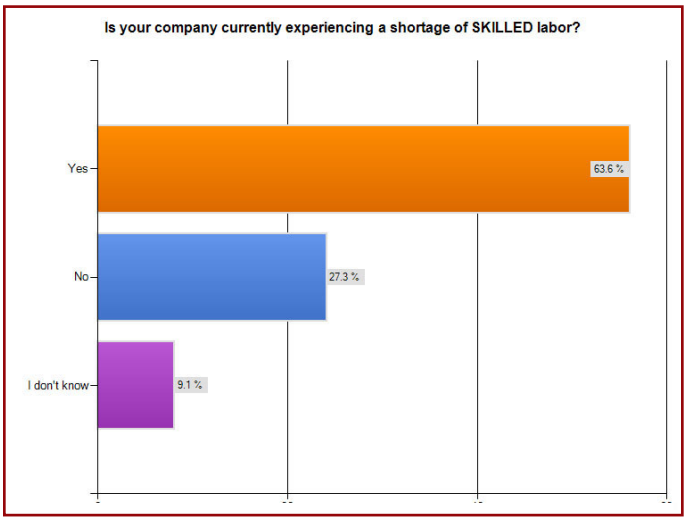
"ATEX."

"Automatic process validation and tracking."

"ISO/TS-16949, AS-9100, MIL-I-45208A, MIL-STD-45662."

"RoHS, REACH."

Skilled Labor



"Average age of skilled machinists rising rapidly."

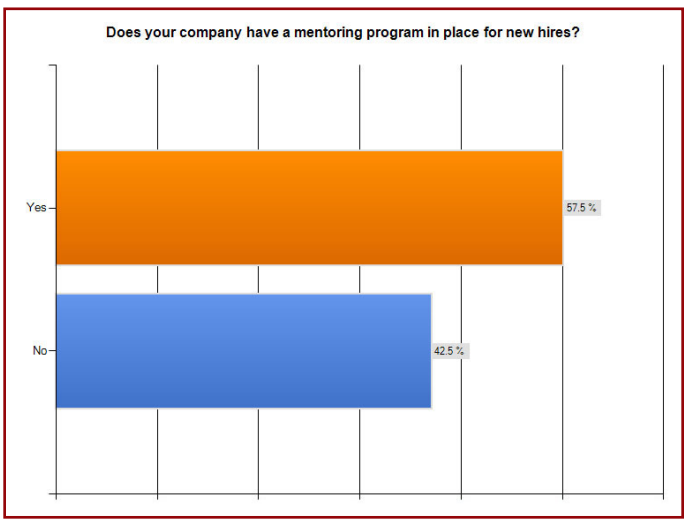
"Plenty of workers looking for jobs."

"Shortage of technical staff."

"Gear knowledge is going away fast."

"Cannot afford truly skilled labor."

"Good people are always hard to find and sometimes hard to keep."



How successful is your current mentoring program?

"It is important for new employees to identify with the entire "Team" before commencing with their full-time job."

"It's far from perfect."

"It will create trust and support for new employees."

"Very successful. The older workers share their knowledge/skills with the new, inexperienced workers."

"Seems valuable but hard to measure."

"Not sure yet, it's relatively new."

"Just started this year, no measurable results yet."

"Only way to get people in this area."

"GOOD."

"It is new here - results pending."

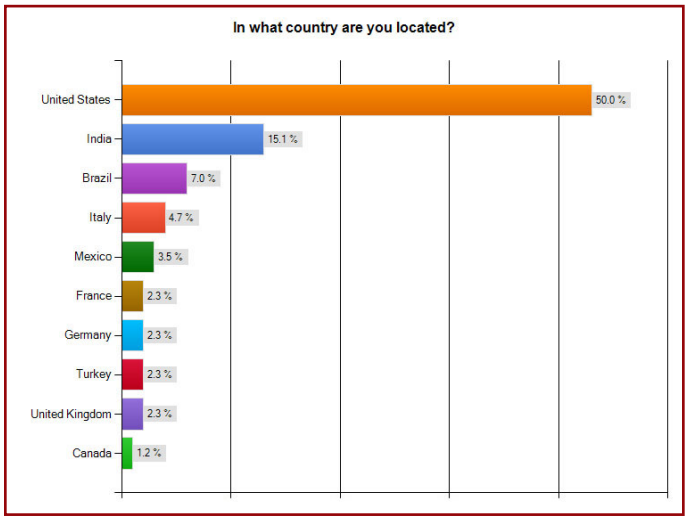
"Still in the early stages."

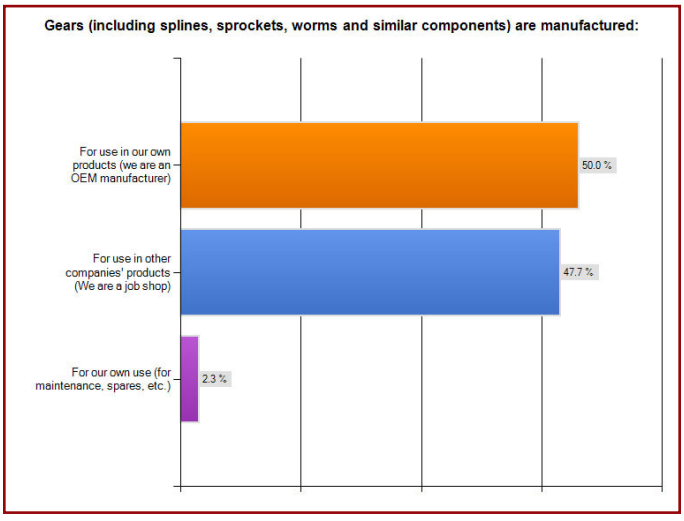
"Very successful; less resistance to lead people taking time off."

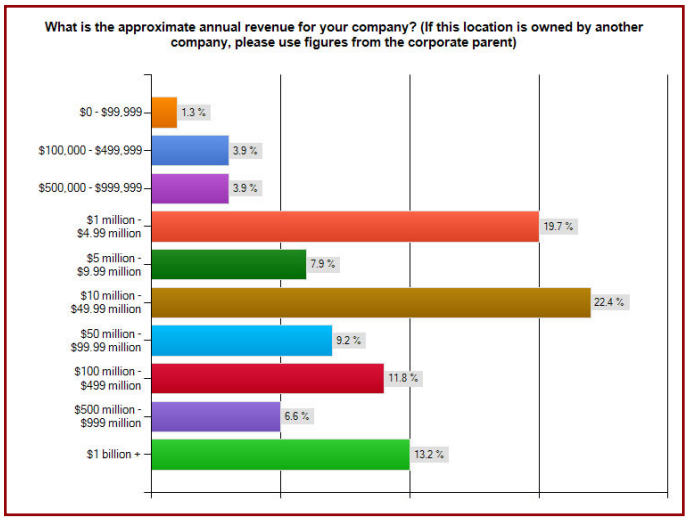
"New hires are put in a structured program to give them a taste of every aspect of the company."

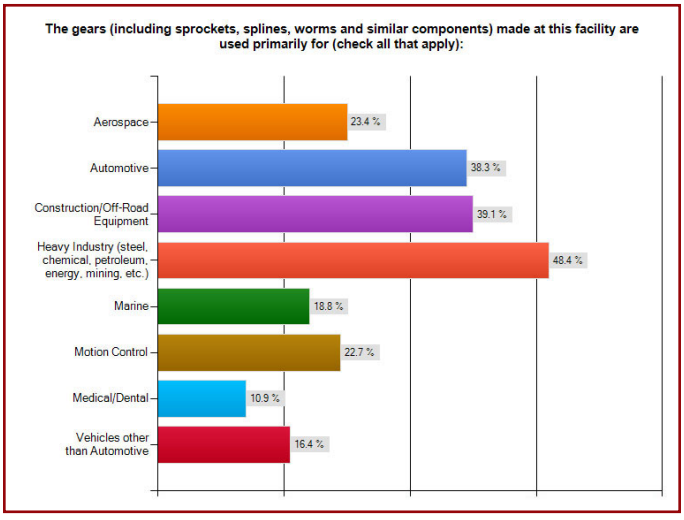
"For new engineers it has been very helpful in learning their job."

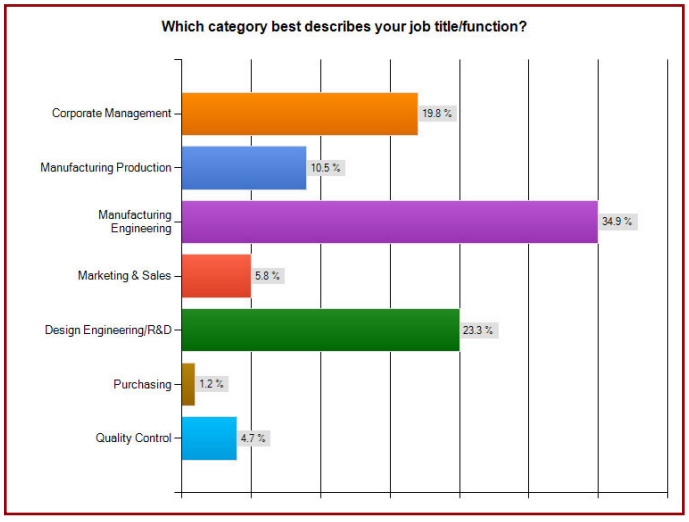
Demographics

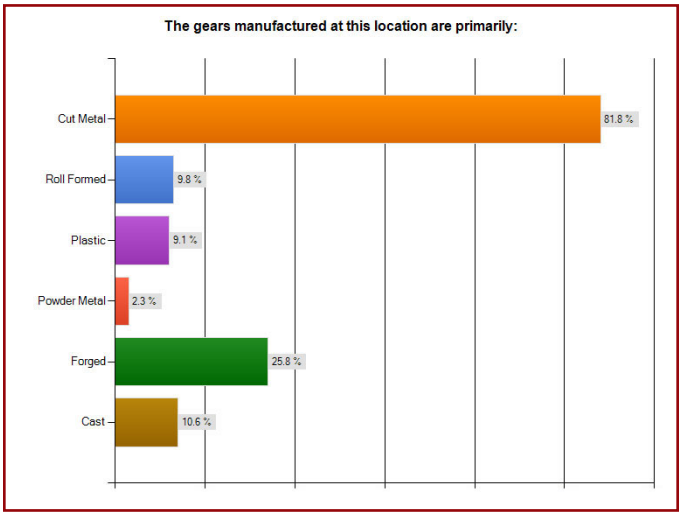












Gear Industry Buyers Guide

About This Directory

The 2012 *Gear Technology* Buyers Guide was compiled to provide you with a handy resource containing the contact information for significant suppliers of machinery, tooling, supplies and services used in gear manufacturing.

Bold Listings throughout the Buyers Guide indicate that a company has an advertisement in this issue of *Gear Technology*.

But Wait! Where are the Gear Manufacturers Listed?

If you are looking for suppliers of gears, splines, sprockets, gear drives or other power transmission components, you will find our comprehensive directory in the December 2012 issue of *Power Transmission Engineering*. If you can't wait for that issue, you can also visit our online directory at *www.powertransmission.com*.

How to Get Listed in the Buyers Guide

Although every effort has been made to ensure that this Buyers Guide is as comprehensive, complete and accurate as possible, some companies may have been inadvertently omitted. If you'd like to add your company to the directory, we welcome you. Please visit *www.geartechnology.com/getlisted.php* to fill out a short form with your company information and Buyers Guide categories. These listings will appear online at *www.geartechnology.com*, and those listed online will automatically appear in next year's printed Buyers Guide.

Handy Online Resources

The Gear Industry Buyers Guide – The listings printed here are just the basics. For a more comprehensive directory of products and services, please visit our website, where you'll find each of the categories here broken down into subcategories:

www.geartechnology.com/dir/

The Power Transmission Engineering Buyers Guide – The most comprehensive online directory of suppliers of gears, bearings, motors, clutches, couplings, gear drives and other mechanical power transmission components, broken down into sub-category by type of product manufactured:

www.powertransmission.com/directory/

CUTTING TOOLS

2L Inc.
A.L. Tooling cc
ANCA, Inc.
Accu-Cut Diamond Tool Co.
Acedes Gear Tools
Alliance Broach & Tool

American Broach & Machine Co.
575 SOUTH MANSFIELD
YPSILANTI, MI 48197
Phone: (734) 961-0300
Fax: (734) 961-9999
american@americanbroach.com
www.americanbroach.com

American Gear Tools
Anderson Cook Inc.
Apex Broaching Systems
Ash Gear & Supply
Banyan Global Technologies LLC
Broach Masters / Universal Gear Co.
Broaching Machine Specialties

broaching TECHNOLOGIES LLC
Broaching Services, Tools & Machines

Broaching Technologies, LLC
SEE OUR AD P70
N63 W22621 MAIN STREET
SUSSEX, WI. 53089
P: 262-820-1200
F: 262-820-1201
sales@broachingtechnologiesllc.com
www.keyway-spline-broaching.com

Capital Tool Industries
Carborundum Universal Ltd.
Cold Forming Technology
Cole Manufacturing Systems Inc.
Colonial Tool Group
Comco Inc.
Continental Diamond Tool Corporation
D.C. Morrison Company

DTR Corp.
(formerly Dragon Precision Tools)
SEE OUR AD P18
2400 E. DEVON AVE.
SUITE 210
DES PLAINES, IL 60018
Phone: (847) 375-8892
Fax: (847) 699-1022
alex@dragon.co.kr
www.dragon.co.kr

Dathan Tool & Gauge Co. Ltd.
EMAG LLC

ESGI Tools Pvt. Ltd.
SEE OUR AD P4
B-6, FOCAL POINT
PATIALA PUNJAB 147004
INDIA
Phone: +(91) 175-2233991
Fax: +(91) 175-2233990
esgi@esgitools.com
www.esgitools.com

Elmass Production
Eltool Corp.
Emuge Corp.
Engineered Tools Corp.
Faessler Corporation
Federal Broach & Machine
Fuji Machine America Corp.

ATLAS

Ipsen's ATLAS® integral quench furnaces are highly engineered, sophisticated machines that are easy to operate and maintain, all while being extremely cost effective. ATLAS delivers top quality uniformity through cutting-edge technology and design:

- Intelligent controls, Carb-o-Prof®, provide you with your very own electronic metallurgist
- SuperQuench with adjustable oil speed and powerful agitators
- Muffle system for uniform temperature control
- Safety – all ATLAS furnaces are water free for maximum safety
- 30% less gas consumption
- Recon® burners – single-ended recuperated tubes (SERT)

HybridCarb®

The unique HybridCarb® from Ipsen is an ultra-efficient gassing system designed to replace endothermic generators and other gassing systems. Its core strength is precision gas control. Instead of burning off excess gas, the process gas is reconditioned and reused, increasing efficiency up to 90 percent.

Other benefits of HybridCarb include:

- Quick and easy hook-up
- Increased carburizing efficiency
- Reduces CO_2 emissions by 90%
- Significantly less expensive to operate than endogenerators
- Consumes significantly less gas
- Environmentally friendly and cost efficient
- Lowers heat output, creating a more comfortable work environment
- Powers up and down at anytime, quickly and easily

For more information, please visit www.IpsenUSA.com/ATLAS

www.IpsenUSA.com

Ipsen

SPEED UNIFORMITY EFFICIENCY

Galaxy Sourcing Inc.
General Broach Company
German Machine Tools of America

Gleason

Gleason Corporation
SEE OUR AD P48-49,95
1000 UNIVERSITY AVENUE
P.O. BOX 22970
ROCHESTER, NY 14692-2970
Phone: (585) 473-1000
Fax: (585) 461-4348
sales@gleason.com
www.gleason.com

Gleason Cutting Tools Corporation
Gleason Pfauter Maschinenfabrik GmbH
Great Lakes Gear Technologies, Inc.
Greg Allen Company
Hanro Tools Incorporation
Hindustan Enterprises Co. (Radar Broach)
HobSource Inc.
Huff Carbide Tool
Ingersoll Cutting Tools
Interstate Tool Corp.
Khemka Broach & Spline Gauge
Kinefac Corporation

Klingelnberg AG
SEE OUR AD P5, BACK COVER
BINZMÜHLESTRASSE 171
ZURICH CH-8050
SWITZERLAND
Phone: +(41) 44-2787979
Fax: +(41) 44-2781556
info@klingelnberg.com
www.klingelnberg.com

Klingelnberg America Inc.
SEE OUR AD P5, BACK COVER
118 E. MICHIGAN AVENUE, SUITE 200
SALINE, MI 48176
Phone: (734) 470-6278
Fax: (734) 470-2158
frank.irey@klingelnbergusa.com
www.klingelnberg.com

Klingelnberg GmbH
SEE OUR AD P5, BACK COVER
PETERSTRASSE 45
HUECKESWAGEN 42499
GERMANY
Phone: +(49) 2192-810
Fax: +(49) 2192-81200
info@klingelnberg.com
www.klingelnberg.com

Knuth Machine Tools USA, Inc.
Koepfer America, LLC
LMT-Fette
Lalson Tools Corporation
Leistritz Corporation
Liebherr America
Liebherr-Verzahntechnik GmbH
Longevity Coatings

Luren Precision Chicago Co., Ltd.
SEE OUR AD P20
1320 TOWER ROAD
SCHAUMBURG, IL 60173
Phone: (847) 598-3555
Fax: (847) 598-3552
gerald_kuo@luren.com.tw
www.luren.com.tw

Luren Precision Co., Ltd.
SEE OUR AD P20
1-1, LI-HSIN 1ST ROAD
HSINCHU SCIENCE PARK
HSINCHU TAIWAN 30078
TAIWAN
Phone: +(886) 3-5786767
Fax: +(886) 3-5784933
gerald_kuo@luren.com.tw
www.luren.com.tw

Maheen Enterprises
Maxwell Tools Co. USA
Maxwell Tools Company
Miller Broach

Mitsubishi Gear Technology Center
SEE OUR AD P8
46992 LIBERTY DRIVE
WIXOM, MI 48393
Phone: (248) 669-6136
Fax: (248) 669-0614
mail2@mitsubishigearcenter.com
www.mitsubishigearcenter.com

Mitts & Merrill L.P.
Modern Gearing
Mutschler Edge Technologies
Nachi America Inc.
ORT Italia
Ohio Broach & Machine Co.
P.S.Tools
PDM Engineering Pvt. Ltd.
Parker Industries Inc.
Philadelphia Carbide Co.
Pioneer Broach Co.
Polygon Solutions
QC American
R.A. Heller
Razorform Tools
Roto-Flo / U.S. Gear Tools
Russell Holbrook & Henderson
S.S.Tools
SU (Shanghai) Machine & Tools Co., Ltd.
SU America
Saazor
Samputensili S.p.A.

Sandvik Coromant
SEE OUR AD P87
1702 NEVINS ROAD
FAIR LAWN, NJ 07410
Phone: (201) 794-5000
Fax: (201) 794-5257
us.coromant@sandvik.com
www.sandvik.coromant.com/us

Schnyder SA
SEE OUR AD P57
JAKOBSTRASSE 52
CH-2504 BIEL
SWITZERLAND
Phone: +(41)(32) 344-0406
Fax: +(41)(32) 344-0404
george.boon@schnyder.com
www.schnyder.com

Schunk Inc.
Seco Tools Inc.
Shape-Master Tool Company
Slater Tools Inc.
Star Cutter Co.

Star SU LLC
SEE OUR AD P95, INSIDE FRONT COVER
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com

REPRESENTING
SAMPUTENSILI
STAR CUTTER

Steelmans Broaches Pte. Ltd.
Super Hobs & Broaches Pvt. Ltd.
Superabrasivi
TSA America, LLC
Tazz Broach & Machine, Inc.
Techcellence
Thornhill Machine Australia Pty Ltd.
Tool Masters India
Ty Miles
U.S. Equipment
U.S. Gear Tools
United Tool Company
V W Broaching Service, Inc.
Watkins Mfg. Inc.
Weihai Weiying Tool Co. Ltd.
West Michigan Spline, Inc.
Wolverine Broach Co., Inc.
Yash International
Yuvraj Tools & Forgings

GEAR BLANKS & RAW MATERIAL

All Metals & Forge Group
OPEN DIE FORGINGS & SEAMLESS ROLLED RINGS

All Metals & Forge Group, LLC.
SEE OUR AD P26,71
75 LANE ROAD
FAIRFIELD, NJ 07004
Phone: 800-600-9290
Fax: (973) 276-5050
www.steelforge.com

Ajax Rolled Ring and Machine
SEE OUR AD P11
500 WALLACE WAY
YORK, SC 29745
Phone: (803) 684-3133
Fax: (803) 684-1000
sales@ajaxring.com
www.ajaxring.com

American Friction Welding
Anihas Castings
Autoparts Solutions Pvt. Ltd.
Beijing Jiali Continuous Cast Iron International
Bhandari Precision Forgings Pvt. Ltd.
Bharat Forge Ltd.
Bohler High Performance Metals Pvt. Ltd.
Boltex Manufacturing
Brooker Bros. Forging Co.
C.E. Sweeney & Associates
China Machinery Pufa Industry & Trade (Group)

Clifford-Jacobs Forging
SEE OUR AD P27
P.O. BOX 830
CHAMPAIGN, IL 61824-0830
Phone: (217) 352-5172
Fax: (217) 352-4629
sales@clifford-jacobs.com
www.clifford-jacobs.com

Cole Manufacturing Systems Inc.
Cornell Forge
DSM Engineering Plastics
DuPont
Dura-Bar
Ellwood City Forge
Elmass Production

Erasteel Inc.
SEE OUR AD P12
95 FULTON STREET
BOONTON, NJ 07005-1909
Phone: (973) 335-8400
Fax: (973) 335-8420
infonorthamerica@eramet-erasteel.com
www.erasteel.com

Forging Solutions LLC
Fuji Machine America Corp.
Galaxy Sourcing Inc.

Gleason Corporation SEE OUR AD P48-49,95
1000 UNIVERSITY AVENUE
P.O. BOX 22970
ROCHESTER, NY 14692-2970
Phone: (585) 473-1000
Fax: (585) 461-4348
sales@gleason.com
www.gleason.com

Hanro Tools Incorporation
Hunter Chemical LLC
Intech Corporation
Interstate Tool Corp.
Lalson Tools Corporation
Lefere Forge
Masternet Ltd.
Maxplus Enterprise
Maxwell Tools Co. USA

McInnes Rolled Rings SEE OUR AD P16
1533 EAST 12TH STREET
ERIE, PA 16511
UNITED STATES
Phone: (814) 459-4495
Fax: (814) 459-8443
sales@mcrings.com
mcinnesrolledrings.com

McKees Rocks Forgings
Midwest Themal-Vac Inc.
Moore-Addison
National Bronze & Metals, Inc.
PCK Buderus India
Parag Casting Co.
Penticton Foundry Ltd.
Pometon España, SAU

Presrite Corporation SEE OUR AD P15
3665 E. 78TH STREET
CLEVELAND, OH 44105
Phone: (216) 441-5990
Fax: (216) 441-2644
info@presrite.com
www.presrite.com

QSC Forge & Flange
QuesTek Innovations LLC
Ralf Schaffer
Reade Advanced Materials
SU (Shanghai) Machine & Tools Co., Ltd.
Schmiedewerke Groeditz GmbH
Sedlock Companies - Euskal Forgin
Sensor Products Inc.
Shree Krishna Auto Indsutries
Southwest Metal Products Ltd.
Spectrum Machine Inc.
Steuby Manufacturing Company, Inc.
Sunbelt-Turret Steel. Inc.
Ticona
Tool Masters India
UMC - United Metals Co.
United Cast Bar, Inc.
Walker Forge
Watkins Mfg. Inc.
Yash International

GEAR MACHINES

ANCA, Inc.
Abtex Corp.
Accu-Cut Diamond Tool Co.
Acme Manufacturing Co.
Allen Adams Shaper Services, Inc.
Alliance Broach & Tool

American Broach & Machine Co.
575 SOUTH MANSFIELD
YPSILANTI, MI 48197
Phone: (734) 961-0300
Fax: (734) 961-9999
american@americanbroach.com
www.americanbroach.com

Anderson Cook Inc.
Apex Broaching Systems
Banyan Global Technologies LLC
Barber-Colman, Div of Bourn & Koch
Bates Technologies Inc.
Becker GearMeisters, Inc.
Bourn & Koch Inc.
Broaching Machine Specialties

C & B Machinery
12001 GLOBE STREET
LIVONIA, MI 48150
Phone: (734) 462-0600
Fax: (734) 462-0604
sales@cbmachinery.com
www.cbmachinery.com

Cleveland Deburring Machine Co.
Cole Manufacturing Systems Inc.
Colonial Tool Group
Comco Inc.
D.C. Morrison Company
Danobat Machine Tool Co. Inc.
Donner+Pfister AG

Drake Manufacturing Services Co. Inc. SEE OUR AD P23
4371 N. LEAVITT ROAD
WARREN, OH 44485
Phone: (330) 847-7291
Fax: (330) 847-6323
info@drakemfg.com
www.drakemfg.com

Dreamtec Consulting LLC
EMAG LLC
Electronics Inc.
Elmass Production
Engineered Abrasives
Engis Corporation

Erwin Junker Machinery, Inc. SEE OUR AD P71
2541 TECHNOLOGY DRIVE, #410
ELGIN, IL 60124
Phone: (847) 488-0406
Fax: (847) 488-0436
info@junker-usa.com
www.junker-group.com

Faessler Corporation
Federal Broach & Machine
Fellows Machine Tools
Felsomat USA Inc.
Fuji Machine America Corp.

Gear Consulting Group SEE OUR AD P95
728 EL VERGEL LANE
ST AUGUSTINE, FL 32080
Phone: (904) 471-6977
www.gearconsultinggroup.com

Gearspect s.r.o.
General Broach Company
German Machine Tools of America

Gleason Corporation SEE OUR AD P48-49,95
1000 UNIVERSITY AVENUE
P.O. BOX 22970
ROCHESTER, NY 14692-2970
Phone: (585) 473-1000
Fax: (585) 461-4348
sales@gleason.com
www.gleason.com

Gleason Pfauter Maschinenfabrik GmbH
Great Lakes Gear Technologies, Inc.
Greg Allen Company
Haas Multigrind LLC
Hamai Co. Ltd.

Hans-Jürgen Geiger SEE OUR AD P37

Maschinen-Vertrieb GmbH
JAMES-WATT-STRASSE 12
D-72555 METZINGEN
GERMANY
Phone: +(49) 7123-18040
Fax: +(49) 7123-18384
geiger@geiger-germany.com
www.geiger-germany.com

Havlik International Machinery Inc.
Heller Machine Tools
Hindustan Enterprises Co. (Radar Broach)

Höfler GmbH SEE OUR AD BACK COVER
INDUSTRIESTRASSE 19
ETTLINGEN D-76275
GERMANY
Phone: +(49) 7243-599-0
Fax: +(49) 7243-599-165
info@hofler.com
www.hofler.com

I-TECH International Corp.
IMEXSU Group
ITW Heartland
Index Corporation
J. Schneeberger Corp.
JRM International, Inc.
KGK International Corp.

Kapp Technologies SEE OUR AD P3
2870 WILDERNESS PLACE
BOULDER, CO 80301
Phone: (303) 447-1130
Fax: (303) 447-1131
sales@kapp-usa.com
www.kapp-usa.com

Khemka Broach & Spline Gauge
Kinefac Corporation

Klingelnberg AG SEE OUR AD P5, BACK COVER
BINZMÜHLESTRASSE 171
ZURICH CH-8050
SWITZERLAND
Phone: +(41) 44-2787979
Fax: +(41) 44-2781556
info@klingelnberg.com
www.klingelnberg.com

Klingelnberg America Inc. SEE OUR AD P5, BACK COVER
118 E. MICHIGAN AVENUE, SUITE 200
SALINE, MI 48176
Phone: (734) 470-6278
Fax: (734) 470-2158
frank.irey@klingelnbergusa.com
www.klingelnberg.com

Klingelnberg GmbH SEE OUR AD P5, BACK COVER
PETERSTRASSE 45
HUECKESWAGEN 42499
GERMANY
Phone: +(49) 2192-810
Fax: +(49) 2192-81200
info@klingelnberg.com
www.klingelnberg.com

Knuth Machine Tools USA, Inc.
Koepfer America, LLC
Lambda Technologies
Leistritz Corporation
Liebherr America
Liebherr-Verzahntechnik GmbH

Luren Precision Chicago Co., Ltd. SEE OUR AD P20
1320 TOWER ROAD
SCHAUMBURG, IL 60173
Phone: (847) 598-3555
Fax: (847) 598-3552
gerald_kuo@luren.com.tw
www.luren.com.tw

Luren Precision Co., Ltd. SEE OUR AD P20
1-1, LI-HSIN 1ST ROAD
HSINCHU SCIENCE PARK
HSINCHU TAIWAN 30078
TAIWAN
Phone: +(886) 3-5786767
Fax: +(886) 3-5784933
gerald_kuo@luren.com.tw
www.luren.com.tw

MAG MODUL
MPT Manufacturing Process Technologies

Machine Tool Builders SEE OUR AD P71
7723 BURDEN ROAD
MACHESNEY PARK, IL 61115
Phone: (815) 636-7502
Fax: (815) 636-5912
aminer@machinetoolbuilders.com
www.machinetoolbuilders.com

Mazak Corporation

Mitsubishi Gear Technology Center SEE OUR AD P8
46992 LIBERTY DRIVE
WIXOM, MI 48393
Phone: (248) 669-6136
Fax: (248) 669-0614
mail2@mitsubishigearcenter.com
www.mitsubishigearcenter.com

Mitts & Merrill L.P.
Mutschler Edge Technologies
Nachi America Inc.
Nagel Precision
Normac, Inc.
ORT Italia
Ohio Broach & Machine Co.
PTG Holroyd
Parker Industries Inc.
Pegard Productics Division HARO
Pioneer Broach Co.
Precision Finishing Inc.
Preco Inc.
Prime Technologies

Process Equipment Company SEE OUR AD P67
4191 U.S. ROUTE 40
TIPP CITY, OH 45371
Phone: (937) 667-7105
Fax: (937) 667-2591
info@peco-us.com
www.gearinspection.com

QC American
Röders GmbH
R.P. Machine
Ravjeet Engineering Specialty Ltd.
Razorform Tools
Redin Production Machine
Reishauer AG
Reishauer Corporation
Roto-Flo / U.S. Gear Tools
Russell Holbrook & Henderson
SETCO Precision Spindles
SU (Shanghai) Machine & Tools Co., Ltd.
SU America
Samputensili S.p.A.
SerWeMa GmbH & Co. KG
Sicmat S.p.A.
Star Cutter Co.

Star SU LLC SEE OUR AD P95, INSIDE FRONT COVER
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com

REPRESENTING
SAMPUTENSILI
STAR CUTTER
BOURN & KOCH
MAG
SICMAT
FELLOWS
BARBER-COLMAN

Steelmans Broaches Pte. Ltd.
Stenhoj Broaching Machines
Sunnen Products Company
Superabrasivi
Surface Finishing Equipment Co.
Surplex GmbH
Tazz Broach & Machine, Inc.
Thornhill Machine Australia Pty Ltd.
Tianjin No.1 Machine Tool Works

Toolink Engineering SEE OUR AD P45
1921 MILLER DRIVE
LONGMONT, CO 80501
Phone: (303) 776-6212
Fax: (303) 776-4723
cgarcia@toolink-eng.com
www.toolink-eng.com

Ty Miles
U.S. Equipment
U.S. Gear Tools
Ultramatic Equipment Co.
WARDJet
West Michigan Spline, Inc.
Westminster Machine Tools Ltd.
Wheelabrator Group
Wolverine Broach Co., Inc.

GRINDING WHEELS & ABRASIVE TOOLS

2L Inc.
Abtex Corp.
Accu-Cut Diamond Tool Co.
Alliance Broach & Tool
Banyan Global Technologies LLC
Bates Technologies Inc.
Brighton Laboratories
CGW - Camel Grinding Wheels
Carborundum Universal Ltd.
Cleveland Deburring Machine Co.
Cole Manufacturing Systems Inc.
Comco Inc.
Continental Diamond Tool Corporation

DTR Corp. SEE OUR AD P18
(formerly Dragon Precision Tools)
2400 E. DEVON AVE.
SUITE 210
DES PLAINES, IL 60018
Phone: (847) 375-8892
Fax: (847) 699-1022
alex@dragon.co.kr
www.dragon.co.kr

DiaTech Tools India Pvt. Ltd.
Diamond Abrasive Products
Dianamic Abrasive Products Inc.
Dr. Kaiser Diamantwerkzeuge

ESGI Tools Pvt. Ltd. SEE OUR AD P4
B-6, FOCAL POINT
PATIALA PUNJAB 147004
INDIA
Phone: +(91) 175-2233991
Fax: +(91) 175-2233990
esgi@esgitools.com
www.esgitools.com

Engis Corporation
Gear Resource Technologies Inc.

Gleason Corporation SEE OUR AD P48-49,95
1000 UNIVERSITY AVENUE
P.O. BOX 22970
ROCHESTER, NY 14692-2970
Phone: (585) 473-1000
Fax: (585) 461-4348
sales@gleason.com
www.gleason.com

Gleason Cutting Tools Corporation
Gleason Pfauter Maschinenfabrik GmbH
Graff Diamond Products
Great Lakes Gear Technologies, Inc.
Greg Allen Company
Hindustan Enterprises Co. (Radar Broach)
Huff Carbide Tool
IMEXSU Group
Interstate Tool Corp.
J. Schneeberger Corp.
JRM International, Inc.

Kapp Technologies SEE OUR AD P3
2870 WILDERNESS PLACE
BOULDER, CO 80301
Phone: (303) 447-1130
Fax: (303) 447-1131
sales@kapp-usa.com
www.kapp-usa.com

Klingelnberg AG SEE OUR AD P5, BACK COVER
BINZMÜHLESTRASSE 171
ZURICH CH-8050
SWITZERLAND
Phone: +(41) 44-2787979
Fax: +(41) 44-2781556
info@klingelnberg.com
www.klingelnberg.com

Klingelnberg America Inc. SEE OUR AD P5, BACK COVER
118 E. MICHIGAN AVENUE, SUITE 200
SALINE, MI 48176
Phone: (734) 470-6278
Fax: (734) 470-2158
frank.irey@klingelnbergusa.com
www.klingelnberg.com

Klingelnberg GmbH SEE OUR AD P5, BACK COVER
PETERSTRASSE 45
HUECKESWAGEN 42499
GERMANY
Phone: +(49) 2192-810
Fax: +(49) 2192-81200
info@klingelnberg.com
www.klingelnberg.com

Knuth Machine Tools USA, Inc.
Koepfer America, LLC
Lambda Technologies
Liebherr America
Liebherr-Verzahntechnik GmbH
Longevity Coatings
MAG MODUL

Marposs Corporation
3300 CROSS CREEK PARKWAY
AUBURN HILLS, MI 48326
Phone: (248) 370-0404
Fax: (248) 370-0991
marposs@us.marposs.com
www.marposs.com

Miller Broach
Modern Gearing
Mutschler Edge Technologies
Nagel Precision
Norton Abrasives
Osborn International
PTG Holroyd
Particular Technology, Inc.
Philadelphia Carbide Co.
Precision Spindle & Accessories Inc.
QC American
Ravjeet Engineering Specialty Ltd.
Redin Production Machine
Reishauer AG
Reishauer Corporation
S.L. Munson & Company
SU America
Samputensili S.p.A.

Schnyder SA SEE OUR AD P57
JAKOBSTRASSE 52
CH-2504 BIEL
SWITZERLAND
Phone: +(41)(32) 344-0406
Fax: +(41)(32) 344-0404
george.boon@schnyder.com
www.schnyder.com

Special Cutting Tools
Star Cutter Co.

Star SU LLC SEE OUR AD P95, INSIDE FRONT COVER
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com

Steelmans Broaches Pte. Ltd.
Stella Keramik GmbH
Sunnen Products Company
Superabrasivi
Thornhill Machine Australia Pty Ltd.

Toolink Engineering SEE OUR AD P45
1921 MILLER DRIVE
LONGMONT, CO 80501
Phone: (303) 776-6212
Fax: (303) 776-4723
cgarcia@toolink-eng.com
www.toolink-eng.com

Ultramatic Equipment Co.
Winterthur Wendt USA Inc.
Yash International
Zhengzhou Hongtuo Superabrasive Tools Co. Ltd.

HEAT TREATING EQUIPMENT

AFC-Holcroft

ALD-Holcroft SEE OUR AD P31
49630 PONTIAC TRAIL
WIXOM, MI 48393
Phone: (248) 668-4130
Fax: (248) 668-2145
sales@ald-holcroft.com
www.ald-holcroft.com

Abbott Furnace Company
Advanced Nitriding Solutions
Aichelin Heat Treatment Systems, Inc.
Ajax Tocco Magnethermic Corporation

BeaverMatic, Inc. SEE OUR AD P37
424 BUCKBEE STREET
ROCKFORD, IL 61104
Phone: (815) 963-0005
Fax: (815) 963-5673
patrick.weymer@beavermatic.com
www.beavermatic.com

Bega Special Tools
Bodyhardchem
Cascade TEK

Comprehensive Heat Treat Specialists
Contour Hardening, Inc.
DAM GmbH
Davron Technologies
Duffy Company, The
ECM USA, Inc.
EFD Induction Inc.
East Coast Induction
Eldec Induction USA, Inc.
Electroheat Technologies, LLC
Flame Treating & Engineering
Flame Treating Systems, Inc.
Furnaces, Ovens & Baths, Inc.
GH Induction Atmospheres

Gleason Corporation SEE OUR AD P48-49,95
1000 UNIVERSITY AVENUE
P.O. BOX 22970
ROCHESTER, NY 14692-2970
Phone: (585) 473-1000
Fax: (585) 461-4348
sales@gleason.com
www.gleason.com

Grieve Corporation, The
Heatbath/Park Metallurgical
HighTemp Furnaces Limited
Induction Tooling, Inc.

Inductoheat Inc. SEE OUR AD P55
32251 N. AVIS DR.
MADISON HEIGHTS, MI 48071
UNITED STATES
Phone: (248) 585-9393
Fax: (248) 589-1062
sales@inductoheat.com
www.inductoheat.com

Inductotherm Corp.
Ionitech Ltd.

Ipsen, Inc. SEE OUR AD P39
984 IPSEN RD.
CHERRY VALLEY, IL 61016
UNITED STATES
Phone: (800) 727-7625
Fax: (815) 332-4995
sales@ipsenusa.com
www.ipsenusa.com

J. L. Becker Co.
Khemka Broach & Spline Gauge

Klingelnberg AG SEE OUR AD P5, BACK COVER
BINZMÜHLESTRASSE 171
ZURICH CH-8050
SWITZERLAND
Phone: +(41) 44-2787979
Fax: +(41) 44-2781556
info@klingelnberg.com
www.klingelnberg.com

Klingelnberg America Inc. SEE OUR AD P5, BACK COVER
118 E. MICHIGAN AVENUE, SUITE 200
SALINE, MI 48176
Phone: (734) 470-6278
Fax: (734) 470-2158
frank.irey@klingelnbergusa.com
www.klingelnberg.com

Klingelnberg GmbH SEE OUR AD P5, BACK COVER
PETERSTRASSE 45
HUECKESWAGEN 42499
GERMANY
Phone: +(49) 2192-810
Fax: +(49) 2192-81200
info@klingelnberg.com
www.klingelnberg.com

Liebherr America
Liebherr-Verzahntechnik GmbH
Metallurgical High Vacuum Corp.
Nitrex Inc. - Chicago Operations
Nitrex Inc. - Indiana Operations
Nitrex Inc. - Michigan Operations
Nitrex Inc. - West Coast Operations
Nitrex Metal Inc.
PhoenixTM
Preco Inc.
Pro-Beam USA

Process Equipment Company SEE OUR AD P67
4191 U.S. ROUTE 40
TIPP CITY, OH 45371
Phone: (937) 667-7105
Fax: (937) 667-2591
info@peco-us.com
www.gearinspection.com

Pyromaitre
Radyne Corporation
Regal Products, Inc.
SMS-Elotherm
SU (Shanghai) Machine & Tools Co., Ltd.
Seco/Warwick Corp.
Seco/Warwick Europe S.A.
Solar Manufacturing
Surface Combustion
TM Induction Heating
U.S. Equipment
Zion Industries

HEAT TREATING SERVICES

300 Below, Inc.
ALD Thermal Treatment, Inc.
Advanced Heat Treat Corp.
Advanced Nitriding Solutions
Aichelin Heat Treatment Systems, Inc.
Ajax Tocco Magnethermic Corporation
American Metal Treating Co.
Ampere Metal Finishing

Applied Process SEE OUR AD P65
12202 NEWBURGH ROAD
LIVONIA, MI 48150
Phone: (734) 464-8000
Fax: (734) 464-6314
info@appliedprocess.com
www.appliedprocess.com

Applied Thermal Technologies
Bennett Heat Treating & Brazing Co., Inc.
Bluewater Thermal Solutions
Bodycote Thermal Processing - Highland Heights
Bodycote Thermal Processing - Melrose Park
Bodycote Thermal Processing - San Diego
Bodyhardchem
Boltex Manufacturing
Burlington Engineering, Inc.
CST-Cincinnati Steel Treating
Cascade TEK
Certified Steel Treating
Cleveland Deburring Machine Co.

Clifford-Jacobs Forging SEE OUR AD P27
P.O. BOX 830
CHAMPAIGN, IL 61824-0830
Phone: (217) 352-5172
Fax: (217) 352-4629
sales@clifford-jacobs.com
www.clifford-jacobs.com

Comprehensive Heat Treat Specialists
Contour Hardening, Inc.
Cryogenic Edge, The
Cryogenic Institute of New England, Inc.
Duffy Company, The
EFD Induction Inc.
ERS Engineering Corp.
Eldec Induction USA, Inc.
Eltro Services, Inc.
Engineered Heat Treat, Inc.
Extremeion Hard Carbon
FPM Heat Treating
Felsomat USA Inc.
Flame Treating & Engineering
Flame Treating Systems, Inc.

Gleason Corporation SEE OUR AD P48-49,95
1000 UNIVERSITY AVENUE
P.O. BOX 22970
ROCHESTER, NY 14692-2970
Phone: (585) 473-1000
Fax: (585) 461-4348
sales@gleason.com
www.gleason.com

Gleason Cutting Tools Corporation
HighTemp Furnaces Limited
Horsburgh & Scott Co.
Induction Services, Inc.
Induction Tooling, Inc.

Inductoheat Inc. SEE OUR AD P55
32251 N. AVIS DR.
MADISON HEIGHTS, MI 48071
UNITED STATES
Phone: (248) 585-9393
Fax: (248) 589-1062
sales@inductoheat.com
www.inductoheat.com

Industrial Metal Finishing, Inc.
Ionitech Ltd.
Khemka Broach & Spline Gauge

Klingelnberg AG SEE OUR AD P5, BACK COVER
BINZMÜHLESTRASSE 171
ZURICH CH-8050
SWITZERLAND
Phone: +(41) 44-2787979
Fax: +(41) 44-2781556
info@klingelnberg.com
www.klingelnberg.com

Klingelnberg America Inc. SEE OUR AD P5, BACK COVER
118 E. MICHIGAN AVENUE, SUITE 200
SALINE, MI 48176
Phone: (734) 470-6278
Fax: (734) 470-2158
frank.irey@klingelnbergusa.com
www.klingelnberg.com

Klingelnberg GmbH SEE OUR AD P5, BACK COVER
PETERSTRASSE 45
HUECKESWAGEN 42499
GERMANY
Phone: +(49) 2192-810
Fax: +(49) 2192-81200
info@klingelnberg.com
www.klingelnberg.com

Kowalski Heat Treating
Lalson Tools Corporation
Lambda Technologies

Luren Precision Chicago Co., Ltd. SEE OUR AD P20
1320 TOWER ROAD
SCHAUMBURG, IL 60173
Phone: (847) 598-3555
Fax: (847) 598-3552
gerald_kuo@luren.com.tw
www.luren.com.tw

Luren Precision Co., Ltd. SEE OUR AD P20
1-1, LI-HSIN 1ST ROAD
HSINCHU SCIENCE PARK
HSINCHU TAIWAN 30078
TAIWAN
Phone: +(886) 3-5786767
Fax: +(886) 3-5784933
gerald_kuo@luren.com.tw
www.luren.com.tw

Magnum Induction
Metal Improvement Company
Metallurgical Processing, Inc.
Metlab
Mid-South Metallurgical
Midwest Themal-Vac Inc.
Nachi America Inc.
National Metal Processing, Inc.
Nitrex Inc. - Chicago Operations
Nitrex Inc. - Indiana Operations
Nitrex Inc. - Michigan Operations
Nitrex Inc. - West Coast Operations
Nitrex Metal Inc.
Paulo Products Company
Penna Flame Industries
Penticton Foundry Ltd.
Precision Finishing Inc.
Precision Heat Treating Co.
Preco Inc.
Pro-Beam USA
Progressive Heat Treating Co.
SMS-Elotherm
SU (Shanghai) Machine & Tools Co., Ltd.
SWD Inc.
Sedlock Companies - Euskal Forgin

Solar Atmospheres SEE OUR AD P51
1969 CLEARVIEW ROAD
SOUDERTON, PA 18964
Phone: (215) 721-1502
Fax: (215) 723-6460
info@solaratm.com
www.solaratm.com

Specialty Heat Treating
Specialty Steel Treating Inc.
Sun Steel Treating Inc.

Whatever your needs, we've got you covered

We're all g-EARS

Toolink
Engineering, Inc.
www.toolink-eng.com
303-776-6212

Treat All Metals, Inc.
United Gear and Assembly, Inc.
VaporKote, Inc.
WPC Treatment Co., Inc.
Wheelabrator Group
Zion Industries

INSPECTION EQUIPMENT

A.G. Davis - AA Gage
Accu-Cut Diamond Tool Co.
Alliance Broach & Tool
Ash Gear & Supply
Bates Technologies Inc.
Becker GearMeisters, Inc.
Borescopes-R-Us
Bourn & Koch Inc.
Broach Masters / Universal Gear Co.
Brown & Sharpe, Inc.
Carl Zeiss Indudustrial Metrology LLC
Certified Comparator Products (CCP)
Cole Manufacturing Systems Inc.
Comtorgage Corporation
Datapaq Inc.
Donner+Pfister AG
Drewco Workholding
Dyer Company

Erwin Junker Machinery, Inc. SEE OUR AD P71
2541 TECHNOLOGY DRIVE, #410
ELGIN, IL 60124
Phone: (847) 488-0406
Fax: (847) 488-0436
info@junker-usa.com
www.junker-group.com

Euro-Tech Corporation
FARO Technologies, Inc.
Flame Treating & Engineering
Flexbar Machine Corporation
Frenco GmbH
Fuji Machine America Corp.
Furnaces, Ovens & Baths, Inc.

Gear Consulting Group SEE OUR AD P95
728 EL VERGEL LANE
ST AUGUSTINE, FL 32080
Phone: (904) 471-6977
www.gearconsultinggroup.com

Gearspect s.r.o.

Gleason

Gleason Corporation SEE OUR AD P48-49,95
1000 UNIVERSITY AVENUE
P.O. BOX 22970
ROCHESTER, NY 14692-2970
Phone: (585) 473-1000
Fax: (585) 461-4348
sales@gleason.com
www.gleason.com

Gleason Cutting Tools Corporation
Gleason Pfauter Maschinenfabrik GmbH
Great Lakes Gear Technologies, Inc.
Greg Allen Company
Hanro Tools Incorporation
Hexagon Metrology
Hindustan Enterprises Co. (Radar Broach)
HobSource Inc.
Hydra-Lock Corporation
ITW Heartland
Interstate Tool Corp.
KGK International Corp.
Khemka Broach & Spline Gauge

Klingelnberg AG SEE OUR AD P5, BACK COVER
BINZMÜHLESTRASSE 171
ZURICH CH-8050
SWITZERLAND
Phone: +(41) 44-2787979
Fax: +(41) 44-2781556
info@klingelnberg.com
www.klingelnberg.com

Klingelnberg America Inc. SEE OUR AD P5, BACK COVER
118 E. MICHIGAN AVENUE, SUITE 200
SALINE, MI 48176
Phone: (734) 470-6278
Fax: (734) 470-2158
frank.irey@klingelnbergusa.com
www.klingelnberg.com

Klingelnberg GmbH SEE OUR AD P5, BACK COVER
PETERSTRASSE 45
HUECKESWAGEN 42499
GERMANY
Phone: +(49) 2192-810
Fax: +(49) 2192-81200
info@klingelnberg.com
www.klingelnberg.com

Koepfer America, LLC
Lambda Technologies
Liebherr America
Liebherr-Verzahntechnik GmbH
MDM-Mecatronics
MPT Manufacturing Process Technologies
Maheen Enterprises
Mahr Federal Inc.

MARPOSS

Marposs Corporation
3300 CROSS CREEK PARKWAY
AUBURN HILLS, MI 48326
Phone: (248) 370-0404
Fax: (248) 370-0991
marposs@us.marposs.com
www.marposs.com

The Modal Shop
3149 E. KEMPER RD.
CINCINNATI, OH 45241
Phone: (800) 860-4867
Fax: (513) 458-2172
info@modalshop.com
www.modalshop.com

Mitutoyo America Corporation
Modern Gearing
Mutschler Edge Technologies
Nachi America Inc.

AMETEK®

Newage Testing Instruments
820 PENNSYLVANIA BLVD.
FEASTERVILLE, PA 19053
Phone: (215) 355-6900
Fax: (215) 354-1803
newage.info@ametek.com
www.hardnesstesters.com

Ono Sokki Technology, Inc.
Optical Gaging Products, Inc. (OGP)
Parker Industries Inc.
Phase II
Pioneer Broach Co.
Precision Devices, Inc.
Precision Gage Co., Inc.
Prime Technologies
Proceq USA, Inc.

Process Equipment Company SEE OUR AD P67
4191 U.S. ROUTE 40
TIPP CITY, OH 45371
Phone: (937) 667-7105
Fax: (937) 667-2591
info@peco-us.com
www.gearinspection.com

Promess Inc.

Proto Manufacturing Inc. SEE OUR AD P19
12350 UNIVERSAL DRIVE
TAYLOR, MI 48180-4070
Phone: (313) 965-2900
Fax: (734) 946-0975
proto@protoxrd.com
www.protoxrd.com

Quality Solutions
Quality Vision Services (QVS)
RAM Optical Instrumentation, Inc.
Ravjeet Engineering Specialty Ltd.
Reska Spline Products Co.
Russell Holbrook & Henderson
S.S.Tools
SMS-Elotherm
SU (Shanghai) Machine & Tools Co., Ltd.
SU America
Samputensili S.p.A.

Schnyder SA SEE OUR AD P57
JAKOBSTRASSE 52
CH-2504 BIEL
SWITZERLAND
Phone: +(41)(32) 344-0406
Fax: +(41)(32) 344-0404
george.boon@schnyder.com
www.schnyder.com

Sensor Developments, Inc.
Sensor Products Inc.
SerWeMa GmbH & Co. KG
Spline Gage Solutions
Star Cutter Co.

Star SU LLC SEE OUR AD P95, INSIDE FRONT COVER
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com

Stone Tucker Instruments Inc.
Stotz Gaging Co.
Stresstech Oy
Sunnen Products Company
Super Hobs & Broaches Pvt. Ltd.
Superabrasivi
Surplex GmbH
TSA America, LLC
Techcellence
TechnoMax Inc.
Thornhill Machine Australia Pty Ltd.
Tianjin No.1 Machine Tool Works
Ticona

Tokyo Technical Instruments USA Inc. SEE OUR AD P25
297 KINDERKAMACK RD., #133
ORADELL, NJ 07649
Phone: (201) 634-1700
Fax: (201) 262-2187
www.tti-geartec.jp

Tool Masters India
United Tool Supply
View Micro-Metrology
Wenzel America
West Michigan Spline, Inc.
Westport Gage
ZOLLER Inc.

LUBRICANTS

Aarna Lube Private Ltd.
Aerospace Lubricants, Inc.
American Refining Group, Inc.
BFK Solutions LLC
Blaser Swisslube Inc.
Bodycote Thermal Processing - Melrose Park
Brighton Laboratories
Carborundum Universal Ltd.
Castrol Industrial North America Inc.
Cimcool Fluid Technology
Cortec Corporation
Daubert Cromwell
Etna Products, Inc.
Fuchs Lubricants Company
General Magnaplate
Great Lakes Gear Technologies, Inc.
Hangsterfer's Laboratories
Heatbath/Park Metallurgical
Hindustan Enterprises Co. (Radar Broach)
Hoffmann Filter Corporation
Houghton International
Industrial Speciality Lubricants Co. (ISLUB) S.A.
Klüber Lubrication North America LP
Lubegard / International Lubricants Inc.
Nye Lubricants
Particular Technology, Inc.
Petronomics Mfg. Group, Inc.
Pometon España, SAU
SU (Shanghai) Machine & Tools Co., Ltd.
SWD Inc.
Shell Lubricants
Sunnen Products Company
Superabrasivi
Syn-Tech Ltd.
Texas Refinery Corp.
Voelker Sensors, Inc.
oelheld U.S., Inc.

MACHINE TOOLS

2L Inc.
ADF Systems Ltd.
ANCA, Inc.
Accu-Cut Diamond Tool Co.
Acme Manufacturing Co.
Alliance Broach & Tool

American Broach & Machine Co.
575 SOUTH MANSFIELD
YPSILANTI, MI 48197
Phone: (734) 961-0300
Fax: (734) 961-9999
american@americanbroach.com
www.americanbroach.com

Ampere Metal Finishing
BFK Solutions LLC
Barber-Colman, Div of Bourn & Koch
Becker GearMeisters, Inc.
Bodycote Thermal Processing - San Diego
Bourn & Koch Inc.
Brighton Laboratories
Broaching Machine Specialties

Broaching TECHNOLOGIES LLC
Broaching Services, Tools & Machines

Broaching Technologies, LLC
SEE OUR AD P70
N63 W22621 MAIN STREET
SUSSEX, WI. 53089
P: 262-820-1200
F: 262-820-1201
sales@broachingtechnologiesllc.com
www.keyway-spline-broaching.com

C&B MACHINERY
WORLD CLASS DISC GRINDING SOLUTIONS

C & B Machinery
12001 GLOBE STREET
LIVONIA, MI 48150
Phone: (734) 462-0600
Fax: (734) 462-0604
sales@cbmachinery.com
www.cbmachinery.com

Capital Equipment LLC
Carborundum Universal Ltd.
Castrol Industrial North America Inc.
Cleveland Deburring Machine Co.
Colonial Tool Group
Comco Inc.
Cortec Corporation
Crest Ultrasonics Corp.
D.C. Morrison Company

DMG/Mori Seiki USA Inc.
SEE OUR AD P43
2400 HUNTINGTON BLVD.
HOFFMAN ESTATES, IL 60192
Phone: (847) 593-5400
Fax: (847) 593-5433
www.dmgmoriseikiusa.com

Danobat Machine Tool Co. Inc.

Drake Manufacturing Services Co. Inc.
SEE OUR AD P23
4371 N. LEAVITT ROAD
WARREN, OH 44485
Phone: (330) 847-7291
Fax: (330) 847-6323
info@drakemfg.com
www.drakemfg.com

Duffy Company, The
EMAG LLC
Electroheat Technologies, LLC
Elmass Production
Engineered Abrasives
Engis Corporation

JUNKER
partner for precision
Global leader in high-speed CBN grinding machines

Erwin Junker Machinery, Inc.
SEE OUR AD P71
2541 TECHNOLOGY DRIVE, #410
ELGIN, IL 60124
Phone: (847) 488-0406
Fax: (847) 488-0436
info@junker-usa.com
www.junker-group.com

Euro-Tech Corporation
Extremeion Hard Carbon
Felsomat USA Inc.
Flame Treating & Engineering
Flexbar Machine Corporation
Fuji Machine America Corp.
Furnaces, Ovens & Baths, Inc.
GH Induction Atmospheres
Galomb Inc.
General Broach Company
General Magnaplate

Gleason Corporation
SEE OUR AD P48-49,95
1000 UNIVERSITY AVENUE
P.O. BOX 22970
ROCHESTER, NY 14692-2970
Phone: (585) 473-1000
Fax: (585) 461-4348
sales@gleason.com
www.gleason.com

Gleason Cutting Tools Corporation
Great Lakes Gear Technologies, Inc.
Haas Multigrind LLC

Hans-Jürgen Geiger Maschinen-Vertrieb GmbH
SEE OUR AD P37
JAMES-WATT-STRASSE 12
D-72555 METZINGEN
GERMANY
Phone: +(49) 7123-18040
Fax: +(49) 7123-18384
geiger@geiger-germany.com
www.geiger-germany.com

Havlik International Machinery Inc.
Heatbath/Park Metallurgical
Heller Machine Tools
Hindustan Enterprises Co. (Radar Broach)
HobSource Inc.
Hoffmann Filter Corporation
Huff Carbide Tool
I-TECH International Corp.
IMEXSU Group
Index Corporation
Interstate Tool Corp.
Ion Vacuum (IVAC) Technologies Corp.
Ionbond USA
J. Schneeberger Corp.
Jenfab
K+S Services, Inc.
KGK International Corp.
Kinefac Corporation

Klingelnberg AG
SEE OUR AD P5, BACK COVER
BINZMÜHLESTRASSE 171
ZURICH CH-8050
SWITZERLAND
Phone: +(41) 44-2787979
Fax: +(41) 44-2781556
info@klingelnberg.com
www.klingelnberg.com

Klingelnberg America Inc.
SEE OUR AD P5, BACK COVER
118 E. MICHIGAN AVENUE, SUITE 200
SALINE, MI 48176
Phone: (734) 470-6278
Fax: (734) 470-2158
frank.irey@klingelnbergusa.com
www.klingelnberg.com

Klingelnberg GmbH
SEE OUR AD P5, BACK COVER
PETERSTRASSE 45
HUECKESWAGEN 42499
GERMANY
Phone: +(49) 2192-810
Fax: +(49) 2192-81200
info@klingelnberg.com
www.klingelnberg.com

Knuth Machine Tools USA, Inc.
Lambda Technologies
Liebherr America
Liebherr-Verzahntechnik GmbH
Longevity Coatings
MPT Manufacturing Process Technologies

Machine Tool Builders
SEE OUR AD P71
7723 BURDEN ROAD
MACHESNEY PARK, IL 61115
Phone: (815) 636-7502
Fax: (815) 636-5912
aminer@machinetoolbuilders.com
www.machinetoolbuilders.com

Mazak Corporation
Metal Improvement Company
Metallurgical High Vacuum Corp.
Metallurgical Processing, Inc.

Mitsubishi Gear Technology Center
SEE OUR AD P8
46992 LIBERTY DRIVE
WIXOM, MI 48393
Phone: (248) 669-6136
Fax: (248) 669-0614
mail2@mitsubishigearcenter.com
www.mitsubishigearcenter.com

Gleason

THE TOTAL

YOU'VE GOT THE GREEN LIGHT FOR FASTER GEAR INSPECTION

METROLOGY SOLUTIONS FOR CYLINDRICAL AND BEVEL GEARS OF ALL TYPES,

- ✓ Gear Measuring Systems
- ✓ Functional Gauges
- ✓ Master Gears
- ✓ Spline Gages, Spline Arbors
- ✓ Gleason LeCount® Inspection Mandrels
- ✓ 3-Jaw Expanding Arbors
- ✓ Software

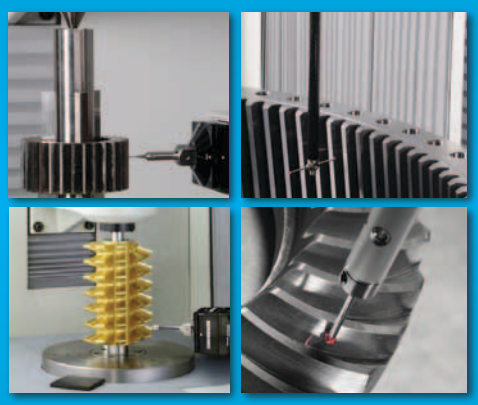
For worldwide sales locations and additional information, visit:

GEAR SOLUTIONS™
PROVIDER

Outdated gear inspection equipment slowing you down? The new Gleason GMS Series of Analytical Gear Inspection Systems deliver up to 45% faster inspection – and much more:

- ✓ Meets VDI/VDE Class 1 specifications.
- ✓ Powerful GAMA 2.0 Windows® application suite creates new programs with just a few easy steps.
- ✓ 24/7 access to our global network of service and support personnel, on-line applications, programming, machine diagnostics.

Go for more inspection speed, accuracy and reliability. Start with a visit to: www.gleason.com/GMS.



Highly versatile: inspect cylindrical, bevel, and worm gears; gear cutting tools; even prismatic parts. Models available for parts up to 3,000 mm in diameter.

UP TO 3,000 MM IN DIAMETER

✓ Global Service and Support

✓ ISO 17025 Certified A2LA Accredited Gear Calibration Lab

THE TOTALGEAR SOLUTIONS PROVIDER | Gleason

www.gleason.com • sales@gleason.com

Mitts & Merrill L.P.
Modern Gearing
Mutschler Edge Technologies
NTC America Corporation
Nachi America Inc.
Nagel Precision
Normac, Inc.
Oerlikon Balzers USA
Ohio Broach & Machine Co.
PTG Holroyd
Pegard Productics Division HARO
Penna Flame Industries
Philadelphia Carbide Co.
Pioneer Broach Co.
Precision Finishing Inc.
Preco Inc.
Pro-Beam USA

Process Equipment Company SEE OUR AD P67
4191 U.S. ROUTE 40
TIPP CITY, OH 45371
Phone: (937) 667-7105
Fax: (937) 667-2591
info@peco-us.com
www.gearinspection.com

Promess Inc.
QC American
Röders GmbH
R.A. Heller
RAM Optical Instrumentation, Inc.
Razorform Tools
Reade Advanced Materials
Redin Production Machine
Riten Industries, Inc.
Roto-Flo / U.S. Gear Tools
Russell Holbrook & Henderson
SETCO Precision Spindles
SMS-Elotherm
SU America
Samputensili S.p.A.
Schunk Inc.
SerWeMa GmbH & Co. KG
Slater Tools Inc.
Star Cutter Co.

Star SU LLC SEE OUR AD P95, INSIDE FRONT COVER
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com

REPRESENTING
SAMPUTENSILI
STAR CUTTER
BOURN & KOCH
MAG
SICMAT
FELLOWS
BARBER-COLMAN

Stenhoj Broaching Machines
Stotz Gaging Co.
Studwell Engineering
Sunnen Products Company
Super Hobs & Broaches Pvt. Ltd.
Surplex GmbH
Thornhill Machine Australia Pty Ltd.

Toolink Engineering SEE OUR AD P45
1921 MILLER DRIVE
LONGMONT, CO 80501
Phone: (303) 776-6212
Fax: (303) 776-4723
cgarcia@toolink-eng.com
www.toolink-eng.com

Toshiba Machine Co.
Tribo Surface Engineering LLC
Ty Miles
U.S. Equipment
Ultramatic Equipment Co.

United Grinding
510 EARL BLVD.
MIAMISBURG, OH 45342
Phone: (937) 847-1214
Fax: (937) 859-6915
www.grinding.com

VaporKote, Inc.
Vermont Machine Tool
View Micro-Metrology
Voelker Sensors, Inc.
Watkins Mfg. Inc.
West Michigan Spline, Inc.
Westminster Machine Tools Ltd.
Wheelabrator Group
Wolverine Broach Co., Inc.
oelheld U.S., Inc.

RESOURCES

AGMA - American Gear Manufacturers Association
American Wind Energy Association
Banyan Global Technologies LLC

Gleason Corporation SEE OUR AD P48-49,95
1000 UNIVERSITY AVENUE
P.O. BOX 22970
ROCHESTER, NY 14692-2970
Phone: (585) 473-1000
Fax: (585) 461-4348
sales@gleason.com
www.gleason.com

Kapp Technologies SEE OUR AD P3
2870 WILDERNESS PLACE
BOULDER, CO 80301
Phone: (303) 447-1130
Fax: (303) 447-1131
sales@kapp-usa.com
www.kapp-usa.com

Koepfer America, LLC
Noria Corporation
Randall Publications LLC

SERVICES

ATS - Advanced Technology Services
Acedes Gear Tools
Allen Adams Shaper Services, Inc.
Ampere Metal Finishing
Apex Broaching Systems
Banyan Global Technologies LLC
Barber-Colman, Div of Bourn & Koch
Becker GearMeisters, Inc.
Borescopes-R-Us
Bourn & Koch Inc.
Broach Masters / Universal Gear Co.

broaching TECHNOLOGIES LLC
Broaching Services, Tools & Machines

Broaching Technologies, LLC SEE OUR AD P70
N63 W22621 MAIN STREET
SUSSEX, WI. 53089
P: 262-820-1200
F: 262-820-1201
sales@broachingtechnologiesllc.com
www.keyway-spline-broaching.com

CIATEQ
Carl Zeiss Indudustrial Metrology LLC
Diehl Engineering Company, Inc.
Donkers Design Solutions
Drive Systems Technology, Inc.
Eicher Engineering Solutions
Electronics Inc.
Elmass Production
Engineered Abrasives
Estudio Piña
Excel Gear
Extremeion Hard Carbon
Frenco GmbH
Furnaces, Ovens & Baths, Inc.

Gear Consulting Group SEE OUR AD P95
728 EL VERGEL LANE
ST AUGUSTINE, FL 32080
Phone: (904) 471-6977
www.gearconsultinggroup.com

General Magnaplate

Gleason Corporation SEE OUR AD P48-49,95
1000 UNIVERSITY AVENUE
P.O. BOX 22970
ROCHESTER, NY 14692-2970
Phone: (585) 473-1000
Fax: (585) 461-4348
sales@gleason.com
www.gleason.com

Gleason Cutting Tools Corporation
Greg Allen Company
Grindal Company
Impact Finishers
Industrial Metal Finishing, Inc.
Ion Vacuum (IVAC) Technologies Corp.
Ionbond USA
K+S Services, Inc.

KISSsoft AG SEE OUR AD P61
ROSENGARTENSTRASSE 4
CH-8608 BUBIKON
SWITZERLAND
Phone: +(41) 55-254-2050
Fax: +(41) 55-254-2051
info@kisssoft.ag
www.kisssoft.ch

KISSsoft USA LLC SEE OUR AD P61
3719 N. SPRING GROVE ROAD
JOHNSBURG, IL 60051
Phone: (815) 363-8823
Fax: (815) 363-8832
dan.kondritz@kisssoft.com
www.kisssoft.com

Kleiss Gears, Inc.

Klingelnberg AG SEE OUR AD P5, BACK COVER
BINZMÜHLESTRASSE 171
ZURICH CH-8050
SWITZERLAND
Phone: +(41) 44-2787979
Fax: +(41) 44-2781556
info@klingelnberg.com
www.klingelnberg.com

No room for error?

For gears they can rely on, partner with a heat treater that you can rely on.

At Solar Atmospheres, your critical specs get the specialized expertise they deserve. From stress relief to case hardening, we'll help assure that your gears can go the distance. Precise carbon control and aerospace-qualified pyrometry produce uncompromised quality. Harness our leading-edge vacuum technology to improve the uniformity of your case depths, minimize distortion and enjoy clean parts with no IGO (intergranular oxidation). ISO 9001 / AS 9100, Nadcap accredited.

VACUUM | HEAT TREATING | BRAZING | CARBURIZING | NITRIDING

SOLAR ATMOSPHERES

www.solaratm.com
1-855-WE-HEAT-IT

Scan here for Quality Guaranteed!

Klingelnberg America Inc.
118 E. MICHIGAN AVENUE, SUITE 200
SALINE, MI 48176
Phone: (734) 470-6278
Fax: (734) 470-2158
frank.irey@klingelnbergusa.com
www.klingelnberg.com
SEE OUR AD P5, BACK COVER

Klingelnberg GmbH
PETERSTRASSE 45
HUECKESWAGEN 42499
GERMANY
Phone: +(49) 2192-810
Fax: +(49) 2192-81200
info@klingelnberg.com
www.klingelnberg.com
SEE OUR AD P5, BACK COVER

Lalson Tools Corporation
Liebherr America
Liebherr-Verzahntechnik GmbH
Longevity Coatings
MDM-Mecatronics

Machine Tool Builders
7723 BURDEN ROAD
MACHESNEY PARK, IL 61115
Phone: (815) 636-7502
Fax: (815) 636-5912
aminer@machinetoolbuilders.com
www.machinetoolbuilders.com
SEE OUR AD P71

Metal Improvement Company
Metallurgical Processing, Inc.
Milburn Engineering, Inc.
Mitutoyo America Corporation

The Modal Shop
3149 E. KEMPER RD.
CINCINNATI, OH 45241
Phone: (800) 860-4867
Fax: (513) 458-2172
info@modalshop.com
www.modalshop.com

Noria Corporation
Oerlikon Balzers USA
Peening Technologies

Proto Manufacturing Inc.
12350 UNIVERSAL DRIVE
TAYLOR, MI 48180-4070
Phone: (313) 965-2900
Fax: (734) 946-0975
proto@protoxrd.com
www.protoxrd.com
SEE OUR AD P19

Quality Reducer Service, Inc.
R.E. Smith & Co.
Red Rover
Romax Technology
SU America
SWD Inc.
Samputensili S.p.A.
Seco/Warwick Europe S.A.
Sedlock Companies - Euskal Forgin
Springfield Metallurgical Services, Inc.
Star Cutter Co.

Star SU LLC
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com
SEE OUR AD P95, INSIDE FRONT COVER

COATING SERVICES
OERLIKON BALZERS

Superabrasivi
Superior Industrial Sharpening & Grinding
Surface Finishing Equipment Co.
Thornhill Machine Australia Pty Ltd.
Ultramatic Equipment Co.
VFA Engineering Group
Vermont Machine Tool
WPC Treatment Co., Inc.

SOFTWARE

A.G. Davis - AA Gage
AKGears, LLC
ATS - Advanced Technology Services
Acme Manufacturing Co.
Ash Gear & Supply
Bourn & Koch Inc.
Broach Masters / Universal Gear Co.
CIATEQ
Carl Zeiss Indudustrial Metrology LLC
Community PC
Donkers Design Solutions
Donner+Pfister AG

Dontyne Systems
ROTTERDAM HOUSE
116 QUAYSIDE
NEWCASTLE-UPON-TYNE NE1 3DY
ENGLAND
Phone: +(44) 191-206-4021
Fax: +(44) 191-206-4001
namerica@dontynesystems.com
www.dontynesystems.com
SEE OUR AD P59

Drake Manufacturing Services Co. Inc.
4371 N. LEAVITT ROAD
WARREN, OH 44485
Phone: (330) 847-7291
Fax: (330) 847-6323
info@drakemfg.com
www.drakemfg.com
SEE OUR AD P23

Drive Systems Technology, Inc.
Dynamic Systems
Eicher Engineering Solutions

Erwin Junker Machinery, Inc.
2541 TECHNOLOGY DRIVE, #410
ELGIN, IL 60124
Phone: (847) 488-0406
Fax: (847) 488-0436
info@junker-usa.com
www.junker-group.com
SEE OUR AD P71

Estudio Piña
Euro-Tech Corporation
Excel Gear
FARO Technologies, Inc.
FastCAM Inc.
Frenco GmbH
GWJ Technology GmbH
GearOffice

Gleason Corporation
1000 UNIVERSITY AVENUE
P.O. BOX 22970
ROCHESTER, NY 14692-2970
Phone: (585) 473-1000
Fax: (585) 461-4348
sales@gleason.com
www.gleason.com
SEE OUR AD P48-49,95

Gleason Cutting Tools Corporation
Heller Machine Tools
Hexagon Industriesoftware GmbH
Hexagon Metrology
HiTech e Soft
Hindustan Enterprises Co. (Radar Broach)
Hobbing.com
ITI GmbH
Involute Simulation Softwares Inc.
KGK International Corp.

KISSsoft AG
ROSENGARTENSTRASSE 4
CH-8608 BUBIKON
SWITZERLAND
Phone: +(41) 55-254-2050
Fax: +(41) 55-254-2051
info@kisssoft.ag
www.kisssoft.ch
SEE OUR AD P61

KISSsoft USA LLC
3719 N. SPRING GROVE ROAD
JOHNSBURG, IL 60051
Phone: (815) 363-8823
Fax: (815) 363-8832
dan.kondritz@kisssoft.com
www.kisssoft.com
SEE OUR AD P61

Khemka Broach & Spline Gauge

Klingelnberg AG
BINZMÜHLESTRASSE 171
ZURICH CH-8050
SWITZERLAND
Phone: +(41) 44-2787979
Fax: +(41) 44-2781556
info@klingelnberg.com
www.klingelnberg.com
SEE OUR AD P5, BACK COVER

Klingelnberg America Inc.
118 E. MICHIGAN AVENUE, SUITE 200
SALINE, MI 48176
Phone: (734) 470-6278
Fax: (734) 470-2158
frank.irey@klingelnbergusa.com
www.klingelnberg.com
SEE OUR AD P5, BACK COVER

Klingelnberg GmbH
PETERSTRASSE 45
HUECKESWAGEN 42499
GERMANY
Phone: +(49) 2192-810
Fax: +(49) 2192-81200
info@klingelnberg.com
www.klingelnberg.com
SEE OUR AD P5, BACK COVER

MDM-Mecatronics
MESYS AG
MTI Systems

Machine Tool Builders
7723 BURDEN ROAD
MACHESNEY PARK, IL 61115
Phone: (815) 636-7502
Fax: (815) 636-5912
aminer@machinetoolbuilders.com
www.machinetoolbuilders.com
SEE OUR AD P71

Marposs Corporation
Mitutoyo America Corporation
MoldedGear LLC
Normac, Inc.
PTG Holroyd
Precision Gage Co., Inc.
Prime Technologies

Process Equipment Company
SEE OUR AD P67
4191 U.S. ROUTE 40
TIPP CITY, OH 45371
Phone: (937) 667-7105
Fax: (937) 667-2591
info@peco-us.com
www.gearinspection.com

Promess Inc.
Romax Technology
SU (Shanghai) Machine & Tools Co., Ltd.
Saazor
SerWeMa GmbH & Co. KG
Smart Manufacturing Technology Ltd.
Software Engineering Service
Spring Technologies Inc.
Stotz Gaging Co.
Techcellence
Universal Technical Systems
Vermont Machine Tool
WARDJet
Waterloo Manufacturing Software
Web Gear Services Ltd.
Wenzel America
Yash International

WORKHOLDING & TOOLHOLDING

2L Inc.
A.G. Davis - AA Gage
Accu-Cut Diamond Tool Co.
Acme Manufacturing Co.

American Broach & Machine Co.
575 SOUTH MANSFIELD
YPSILANTI, MI 48197
Phone: (734) 961-0300
Fax: (734) 961-9999
american@americanbroach.com
www.americanbroach.com

Apex Broaching Systems
Ash Gear & Supply
Banyan Global Technologies LLC
Bourn & Koch Inc.
Broach Masters / Universal Gear Co.
Cleveland Deburring Machine Co.
Cole Manufacturing Systems Inc.
Dr. Kaiser Diamantwerkzeuge
Drewco Workholding
Emuge Corp.
Engineered Tools Corp.
Euro-Tech Corporation

Forkardt
AN ITW WORKHOLDING COMPANY
2155 TRAVERSEFIELD DR.
TRAVERSE CITY, MI 49686
Phone: (231) 995-8300
Fax: (231) 995-8361
sales@forkardt.us
www.forkardt.us

Frenco GmbH
Fuji Machine America Corp.
Galaxy Sourcing Inc.

Gear Resource Technologies Inc.
49 SHIRE OAKS DRIVE
PITTSFORD, NY 14534-1523
Phone: (585) 383-9160
Fax: (585) 383-1301
sales@gear-resource.com
www.gear-resource.com

Gleason Corporation
SEE OUR AD P48-49,95
1000 UNIVERSITY AVENUE
P.O. BOX 22970
ROCHESTER, NY 14692-2970
Phone: (585) 473-1000
Fax: (585) 461-4348
sales@gleason.com
www.gleason.com

Gleason Cutting Tools Corporation
Great Lakes Gear Technologies, Inc.
Greg Allen Company

Hainbuch America
10541 N. COMMERCE ST.
MEQUON WI 53092
Phone: (414) 358-9550
sales@hainbuchamerica.com
www.hainbuch.com

Hanro Tools Incorporation
Hindustan Enterprises Co. (Radar Broach)
Hydra-Lock Corporation
I-TECH International Corp.
IMEXSU Group
Industrial Tools Corporation
Interstate Tool Corp.
JRM International, Inc.
Kitagawa - NorthTech Workholding

Klingelnberg AG
SEE OUR AD P5, BACK COVER
BINZMÜHLESTRASSE 171
ZURICH CH-8050
SWITZERLAND
Phone: +(41) 44-2787979
Fax: +(41) 44-2781556
info@klingelnberg.com
www.klingelnberg.com

Klingelnberg America Inc. SEE OUR AD P5, BACK COVER
118 E. MICHIGAN AVENUE, SUITE 200
SALINE, MI 48176
Phone: (734) 470-6278
Fax: (734) 470-2158
frank.irey@klingelnbergusa.com
www.klingelnberg.com

Klingelnberg GmbH SEE OUR AD P5, BACK COVER
PETERSTRASSE 45
HUECKESWAGEN 42499
GERMANY
Phone: +(49) 2192-810
Fax: +(49) 2192-81200
info@klingelnberg.com
www.klingelnberg.com

Knuth Machine Tools USA, Inc.
Liebherr America
Liebherr-Verzahntechnik GmbH

Luren Precision Chicago Co., Ltd. SEE OUR AD P20
1320 TOWER ROAD
SCHAUMBURG, IL 60173
Phone: (847) 598-3555
Fax: (847) 598-3552
gerald_kuo@luren.com.tw
www.luren.com.tw

Luren Precision Co., Ltd. SEE OUR AD P20
1-1, LI-HSIN 1ST ROAD
HSINCHU SCIENCE PARK
HSINCHU TAIWAN 30078
TAIWAN
Phone: +(886) 3-5786767
Fax: +(886) 3-5784933
gerald_kuo@luren.com.tw
www.luren.com.tw

Lyndex-Nikken

Machine Tool Builders SEE OUR AD P71
7723 BURDEN ROAD
MACHESNEY PARK, IL 61115
Phone: (815) 636-7502
Fax: (815) 636-5912
aminer@machinetoolbuilders.com
www.machinetoolbuilders.com

Miller Broach

Mitsubishi Gear Technology Center SEE OUR AD P8
46992 LIBERTY DRIVE
WIXOM, MI 48393
Phone: (248) 669-6136
Fax: (248) 669-0614
mail2@mitsubishigearcenter.com
www.mitsubishigearcenter.com

Nachi America Inc.
Northfield Precision Instrument Corp.
Ohio Broach & Machine Co.
P.G. Engineers
Parker Industries Inc.
Phase II
Pioneer Broach Co.
Polygon Solutions
Precision Devices, Inc.
Precision Gage Co., Inc.
Precision Spindle & Accessories Inc.
Pro-Beam USA

Process Equipment Company SEE OUR AD P67
4191 U.S. ROUTE 40
TIPP CITY, OH 45371
Phone: (937) 667-7105
Fax: (937) 667-2591
info@peco-us.com
www.gearinspection.com

QC American
Reska Spline Products Co.
Riten Industries, Inc.
Samchully Machinery Co., Ltd.
Schunk Inc.
Slater Tools Inc.
Speedgrip Chuck

Star SU LLC SEE OUR AD P95, INSIDE FRONT COVER
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com

Steelmans Broaches Pte. Ltd.
Stotz Gaging Co.
Superabrasivi
Tazz Broach & Machine, Inc.
Tecnologie FRB
Thornhill Machine Australia Pty Ltd.

Toolink Engineering SEE OUR AD P45
1921 MILLER DRIVE
LONGMONT, CO 80501
Phone: (303) 776-6212
Fax: (303) 776-4723
cgarcia@toolink-eng.com
www.toolink-eng.com

V W Broaching Service, Inc.

INDUCTOHEAT
An Inductotherm Group Company

Creating Valuable Partnerships Since 1962

Inductoheat, Inc. is committed to finding efficient, effective and economic solutions for your induction heat treating needs. We continue to embrace break-through technologies and customer service in all that we do, and look forward to serving the metals and materials industry for 50 more.

Inductoheat, Inc. • Madison Heights, MI. USA
Tel: +1 (248) 585-9393 • **www.inductoheat.com**

INDUCTOTHERM GROUP
Leading Manufacturers of Melting, Thermal Processing and Production Systems for the Metals and Materials Industry Worldwide.

A TO Z

2L Inc.
P.O. BOX 105
HUDSON, MA 01749
Phone: (978) 567-8867
Fax: (978) 562-8972
contact@2Linc.com
www.2Linc.com

300 Below, Inc.
2999 E. PARKWAY DR.
DECATUR, IL 62526
Phone: (217) 423-3070
Fax: (217) 423-3075
sbrown@300below.com
www.300below.com

A.G. Davis - AA Gage
6533 SIMS DR.
STERLING HEIGHTS, MI 48313
Phone: (586) 977-9000
Fax: (586) 977-9190
inquire@agdavis.com
www.agdavis.com

A.L. Tooling cc
P.O.BOX 215
CAPE TOWN WC 7404, SOUTH AFRICA
Phone: +(27) 21-5112628
Fax: +(27) 21-5112656
altool@mweb.co.za
www.altooling.co.za

Aarna Lube Private Ltd.
F-204, DHEERAJ PRESIDENCY
M.G. ROAD, KANDIVALI-WEST
MUMBAI MAHARASTRA 400067, INDIA
Phone: +(91) 22-28077715
Fax: +(91) 22-28631624
sales@aarnalube.com
www.aarnalube.com

Abbott Furnace Company
1068 TROUT RUN ROAD
P.O. BOX 967
SAINT MARYS, PA 15857
Phone: (814) 781-6355
Fax: (814) 781-7334
dreardon@abbottfurnace.com
www.abbottfurnace.com

Abtex Corp.
89 MAIN STREET
P.O. BOX 188
DRESDEN, NY 14441
Phone: (315) 536-7403
Fax: (315) 536-0280
sales@abtex.com
www.abtex.com

Accu-Cut Diamond Tool Co.
4238 N. SAYRE
NORRIDGE, IL 60706
Phone: (708) 457-8800
Fax: (708) 457-8061
info@accucutdiamond.com
www.accucutdiamond.com

Acedes Gear Tools
2-4 FLEMING ROAD, NEWBURY
BERKSHIRE RG14 2DE, ENGLAND
Phone: +44 (0)1635-524-252
Fax: +44 (0)1635-521-085
sales@acedes.co.uk
www.acedes.co.uk

Acme Manufacturing Co.
4240 N. ATLANTIC BLVD.
AUBURN HILLS, MI 48326
Phone: (248) 393-7300
Fax: (248) 393-4060
carlsong@acmemfg.com
www.acmemfg.com

ADF Systems Ltd.
1301 19TH ST. N
HUMBOLDT, IA 50548
Phone: (515) 332-5400
Fax: (515) 332-4475
lou@adfsys.com
www.adfsys.com

Advanced Heat Treat Corp.
2825 MIDPORT BLVD.
WATERLOO, IA 50703
Phone: (319) 232-5221
Fax: (319) 232-4952
mkt@ion-nitriding.com
www.ahtweb.com

Advanced Nitriding Solutions
1688 LAMMERS PIKE
BATESVILLE, IN 47006
Phone: (812) 932-1010
Fax: (812) 934-6068
moe@ans-ion.net
www.ans-ion.net

Aerospace Lubricants, Inc.
1600 GEORGESVILLE RD.
COLUMBUS, OH 43228
Phone: (614) 878-3600
Fax: (614) 878-1600
info@aerospacelubricants.com
www.aerospacelubricants.com

AFC-Holcroft
49630 PONTIAC TRAIL
WIXOM, MI 48393
Phone: (248) 624-8191
Fax: (248) 624-3710
sales@afc-holcroft.com
www.afc-holcroft.com

AGMA - American Gear Manufacturers Association
1001 N. FAIRFAX STREET, SUITE 500
ALEXANDRIA, VA 1587
Phone: (703) 684-0211
Fax: (703) 684-0242
franklin@agma.org
www.agma.org

Aichelin Heat Treatment Systems, Inc.
44160 PLYMOUTH OAKS BLVD.
PLYMOUTH, MI 48170
Phone: (734) 459-9850
Fax: (734) 459-9851
sales@aichelinusa.com
www.aichelinusa.com

Ajax Rolled Ring and Machine
500 WALLACE WAY
YORK, SC 29745
SEE OUR AD P11
Phone: (803) 684-3133
Fax: (803) 684-1000
sales@ajaxring.com
www.ajaxring.com

Ajax Tocco Magnethermic Corporation
1745 OVERLAND AVENUE
WARREN, OH 44483
Phone: (330) 372-8511
Fax: (330) 372-8608
sales@ajaxtocco.com
www.ajaxtocco.com

AKGears, LLC
316 OAKWOOD DRIVE
SHOREVIEW, MN 55126
Phone: (651) 308-8899
Fax: (651) 486-2716
ak@akgears.com
www.akgears.com

ALD Thermal Treatment, Inc.
2656 24TH STREET
PORT HURON, MI 48060
Phone: (810) 357-0682
Fax: (810) 357-0699
salesald@aldtt.net
www.aldtt.net

ALD-Holcroft
49630 PONTIAC TRAIL
WIXOM, MI 48393
SEE OUR AD P31
Phone: (248) 668-4130
Fax: (248) 668-2145
sales@ald-holcroft.com
www.ald-holcroft.com

All Metals & Forge Group, LLC
75 LANE ROAD
FAIRFIELD, NJ 07004
SEE OUR AD P26,71
Phone: (973) 276-6000
Fax: (973) 276-5050
laweiss@steelforge.com
www.steelforge.com

Allen Adams Shaper Services, Inc.
98 WINERY ROAD
PROCTORVILLE VT 05153
Phone: (802) 226-7891

Alliance Broach & Tool
5664 NORTH RIVER RD.
EAST CHINA, MI 48054
Phone: (810) 765-8121
Fax: (810) 765-7979
mikejohnson@alliancebroach.com
www.jlturning.net

American Broach & Machine Co.
575 SOUTH MANSFIELD
YPSILANTI, MI 48197
Phone: (734) 961-0300
Fax: (734) 961-9999
american@americanbroach.com
www.americanbroach.com

American Friction Welding
115 N JANACEK RD.
BROOKFIELD, WI 53045
Phone: (262) 797-8840
Fax: (262) 797-9932
dhoel@teamafw.com
www.teamafw.com

American Gear Tools
575 S. MANSFIELD STREET
YPSILANTI, MI 48197
Phone: (734) 961-0300
Fax: (734) 448-0130
leon@americanbroach.com
www.americangeartools.com

American Metal Treating Co.
1043 E. 62ND ST.
CLEVELAND, OH 44103
Phone: (216) 431-4492
Fax: (216) 431-1508
bruce@americanmetaltreating.com
www.americanmetaltreating.com

American Refining Group, Inc.
77 N. KENDALL AVE.
BRADFORD, PA 16701
Phone: (814) 368-1200
Fax: (814) 368-1355
ndixon@amref.com
www.amref.com

American Wind Energy Association
1501 M STREET, NW, SUITE 1000
WASHINGTON, DC 20005
Phone: (202) 383-2500
Fax: (202) 383-2505
windmail@awea.org
www.awea.org

Ampere Metal Finishing
854 WESTPORT CRES.
MISSISSAUGA ONTARIO L5T 1N5, CANADA
Phone: (905) 670-5275
Fax: (905) 670-8941
ap@amperemetal.com
www.amperemetal.com

ANCA, Inc.
31129 CENTURY DRIVE
WIXOM, MI 48393
Phone: (248) 926-4466
Fax: (248) 926-4475
usainfo@anca.com
www.anca.com

Anderson Cook Inc.
44785 MACOMB INDUSTRIAL DRIVE
CLINTON TWP., MI 48036
Phone: (586) 954-0700
Fax: (586) 954-0706
info@andersoncook.com
www.andersoncook.com

Anihas Castings
NEAR POMAL INDL. ESTATE
KOLSHET ROAD
THANE MH 400607, INDIA
Phone: +(91) 22-25893829
Fax: +(91) 22-25893857
info@anihas.com
www.anihas.com

Apex Broaching Systems
22862 HOOVER ROAD
WARREN, MI 48089
Phone: (586) 758-2626
Fax: (586) 758-2627
apexbroach@apbsi.com
www.apexbroach.com

Applied Process
12202 NEWBURGH ROAD
LIVONIA, MI 48150
SEE OUR AD P37
Phone: (734) 464-8000
Fax: (734) 464-6314
info@appliedprocess.com
www.appliedprocess.com

Applied Thermal Technologies
2169 NORTH CR 100 EAST
WARSAW, IN 46582
Phone: (574) 269-7116
Fax: (574) 269-7906
micky@appliedthermaltechnologies.com
www.appliedthermaltechnologies.com

Ash Gear & Supply
42650 NINE MILE RD.
NOVI, MI 48375
Phone: (248) 374-6155
Fax: (248) 374-6255
sales@ashgear.com
www.ashgear.com

ATS - Advanced Technology Services
8201 N. UNIVERSITY
PEORIA, IL 61615
Phone: (309) 693-4000
Fax: (309) 693-4164
paltenbe@advancedtech.com
www.advancedtech.com

Autoparts Solutions Pvt. Ltd.
307, SAKET NAGAR,
INDORE - 452018 MADHYA PRADESH, INDIA
Phone: +(91) 731-5061351
Fax: +(91) 731-2564358
sksagodbole@gmail.com
www.autopartssolutions.net

Banyan Global Technologies LLC
20836 HALL ROAD, SUITE #156
CLINTON TOWNSHIP, MI 48038
Phone: (888) 247-7933
Fax: (586) 435-0528
sales@banyangt.com
www.banyangt.com

Barber-Colman, Div of Bourn & Koch
C/O STAR SU LLC
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com

Bates Technologies Inc.
9059 TECHNOLOGY LANE
FISHERS, IN 46038
Phone: (317) 841-2400
Fax: (317) 841-1200
info@batestech.com
www.batestech.com

BeaverMatic, Inc.
424 BUCKBEE STREET
ROCKFORD, IL 61104
SEE OUR AD P37
Phone: (815) 963-0005
Fax: (815) 963-5673
patrick.weymer@beavermatic.com
www.beavermatic.com

Becker GearMeisters, Inc.
1877 BRANDES LANE
PINCKNEY, MI 48169
Phone: (734) 878-9669
Fax: (734) 878-9669
info@maagmachines.com
www.maagmachines.com

Bega Special Tools
SCHORSWEG 15
NL-8171 ME VAASSEN
THE NETHERLANDS
Phone: +(31) 578-668000
Fax: +(31) 578-668080
sales@bega.nl
www.bega.nl

Beijing Jiali Continuous Cast Iron International
22B-1 ROOM, BUILDING A
OCEAN EXPRESS BUILDING
SANYUAN BRIDGE, CHAOYANG DISTRICT
BEIJING 100027, CHINA
Phone: +(86) 10-84466367-803
Fax: +(86) 10-84466361
sales@asiabar.com.cn
www.asiabar.com.cn

Bennett Heat Treating & Brazing Co., Inc.
690 FERRY ST.
NEWARK, NJ 07105
Phone: (973) 589-0590
Fax: (973) 589-6518
davidquaglia@bennettheat.com
www.bennettheat.com

BFK Solutions LLC
16924 LIVORNO DR.
PACIFIC PALISADES, CA 90272
Phone: (310) 459-3614
Fax: (310) 459-3624
barbara@bfksolutions.com
www.bfksolutions.com

Bhandari Precision Forgings Pvt. Ltd.
A-271, 2ND STAGE,
PEENYA INDUSTRIAL ESTATE
BANGALORE - 560058 KARNATAKA, INDIA
Phone: +(91) 80-28360233
Fax: +(91) 80-28362030
forgings@vsnl.net
www.bhandariforgings.com

Bharat Forge Ltd.
PUNE CANTONMENT
MUNDHWA
PUNE - 411036 MAHARASHTRA, INDIA
Phone: +(91) 20-67042777
Fax: +(91) 20-6822387
info@bharatforge.com
www.bharatforge.com

Blaser Swisslube Inc.
31 HATFIELD LANE
GOSHEN, NY 10924
Phone: (845) 294-3200
Fax: (845) 294-3102
mailboxusa@blaser.com
www.blaser.com

Bluewater Thermal Solutions
201 BROOKFIELD PARKWAY SUITE 102
GREENVILLE, SC 29607
Phone: (864) 990-0050
Fax: (864) 990-0056
www.bluewaterthermal.com

Bodycote Thermal Processing - Highland Heights
5475 AVION PARK DR.
HIGHLAND HEIGHTS, OH 44143
Phone: (440) 473-2020
Fax: (440) 473-0947
ron.perkins@bodycote.com
www.bodycote.com

Bodycote Thermal Processing - Melrose Park
1975 N. RUBY ST.
MELROSE PARK, IL 60160
Phone: (708) 344-4080
Fax: (708) 344-4010
darius.szczekocki@bodycote.com
www.bodycote.com

Bodycote Thermal Processing - San Diego
7384 TRADE ST.
SAN DIEGO, CA 92121
Phone: (858) 586-7272
Fax: (858) 586-7598
Mike.Duke@bodycote.com
www.bodycote.com

Bodyhardchem
201, VRAJ COMPLEX,
TAPOVAN SOCIETY,
NIZAMPURA,
BARODA - 390002 GUJARAT, INDIA
Phone: +(91) 265-2780789, India1812@bodyhardchem.com
www.bodyhardchem.com

Bohler High Performance Metals Pvt. Ltd.
SURVEY NO.14/1-3, 17/1-3
VILLAGE HONAD
TALUKA - KHALAPUR
RAIGAD - 410203, INDIA
Phone: +(91) 02192-269365
Fax: +(91) 02192-269365
info@bohlerindia.com
www.bohlerindia.com

Boltex Manufacturing
4901 OATES ROAD
HOUSTON, TX 77013
Phone: (713) 675-9433
Fax: (713) 672-6527
customforgings@boltex.com
www.boltex.com

Borescopes-R-Us
2686 DAVIDSON GRAVEYARD RD.
CLARKSVILLE, TN 37043
Phone: (931) 362-4009
Fax: (931) 362-2650
customerservice@borescopesrus.com
www.borescopesrus.com

Bourn & Koch Inc.
C/O STAR SU LLC
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com

Brighton Laboratories
11871 GRAND RIVER RD.
BRIGHTON, MI 48116
Phone: (810) 225-9520
Fax: (810) 225-9528
support@brightonlabs.com
www.brightonlabs.com

Broach Masters / Universal Gear Co.
1605 INDUSTRIAL DRIVE
AUBURN, CA 95603
Phone: (800) 563-3442
Fax: (530) 885-8157
sales@broachmasters.com
www.broachmasters.com

Broaching Machine Specialties
25180 SEELEY RD.
NOVI, MI 48375
Phone: (248) 471-4500
Fax: (248) 471-0745
bms@broachingmachine.com
www.broachingmachine.com

Broaching Technologies, LLC
N63 W22621 MAIN STREET
SUSSEX, WI 53089
SEE OUR AD P70
Phone: (262) 820-1200
Fax: (262) 820-1201
sales@broachingtechnologiesllc.com
www.keyway-spline-broaching.com

A TO Z

Brooker Bros. Forging Co.
102 JEFFERSON ST
NORWALK, OH 44857
Phone: (419) 668-2535
Fax: (419) 663-1149
rickbrookersr@brookerbrosforgings.com
www.brookerbrosforgings.com

Brown & Sharpe, Inc.
250 CIRCUIT DRIVE
NORTH KINGSTOWN, RI 02852
Phone: (401) 886-2000
Fax: (401) 886-2727
www.brownandsharpe.com

Burlington Engineering, Inc.
220 W. GROVE AVE.
ORANGE, CA 92865
Phone: (714) 921-4045
Fax: (714) 921-4029
info@burlingtoneng.com
www.burlingtoneng.com

C & B Machinery
12001 GLOBE STREET
LIVONIA, MI 48150
Phone: (734) 462-0600
Fax: (734) 462-0604
sales@cbmachinery.com
www.cbmachinery.com

C.E. Sweeney & Associates
146 LAKEVIEW DR S., STE 303
GIBBSBORO, NJ 08026-1018
Phone: (856) 435-5700
Fax: (856) 448-9026
AdrianSweeney@comcast.net
www.castingsandforgings.com

Capital Equipment LLC
125 TUBEWAY DRIVE
CAROL STREAM, IL 60188
Phone: (630) 690-7200
Fax: (630) 690-7929
mark5@capitalequipment.com
www.capitalequipment.com

Capital Tool Industries
7-A, INDUSTRIAL ESTATE
PATIALA PUNJAB 147004, INDIA
Phone: +(91) 175-2351089
Fax: +(91) 175-2217102
capitaltool@usa.net
www.capital-tool.com

Carborundum Universal Ltd.
POST BOX NO. 2272
TIROVOTTIYUR
CHENNAI - 600019 TAMIL NADU, INDIA
Phone: +(91) 44 42211000
Fax: +(91) 44 25733499
deepakdurairajPL@cumi.murugappa.com
www.cumiabrasives.com

Carl Zeiss Indudustrial Metrology LLC
6250 SYCAMORE LANE NORTH
MAPLE GROVE, MN 55369
Phone: (800) 327-9735
Fax: (763) 533-0219
jlewis@zeiss.com
www.zeiss.com/metrology

Cascade TEK
5245-A NE ELAM YOUNG PKWY.
HILLSBORO, OR 97124
Phone: (888) 835-9250
Fax: (503) 648-1798
sales@cascadetek.com
www.cascadetek.com

Castrol Industrial North America Inc.
150 W. WARRENVILLE ROAD, 603-1E
NAPERVILLE, IL 60563
Phone: (877) 641-1600
Fax: (877) 648-9801
gcustomercare@castrol.com
www.castrol.com/industrial

Certified Comparator Products (CCP)
1174 GRANGE HALL ROAD
BEAVERCREEK, OH 45434
Phone: (937) 426-9677
Fax: (937) 426-4816
sales@certifiedcomparator.com
www.certifiedcomparator.com

Certified Steel Treating
2454 EAST 58TH ST.
LOS ANGELES, CA 90058
Phone: (323) 583-8711
Fax: (323) 583-1205
jeff@certifiedsteeltreat.com
www.certifiedsteeltreat.com

CGW - Camel Grinding Wheels
7525 N. OAK PARK AVE.
NILES, IL 60714
Phone: (847) 647-5994
Fax: (847) 647-1861
david@cgwheels.com
www.cgwheels.com

China Machinery Pufa Industry & Trade (Group)
79 AONA ROAD
WAIGAOQIAO FREE TRADE ZONE
SHANGHAI 200131, CHINA
Phone: +(86) 21-58681595
Fax: +(86) 21-58666641
ebd@cmpcn.com
www.cmpcn.com

CIATEQ
AV. DEL RETABLO 150
COL. CONSTITUYENTES FOVISSSTE
QUERETARO QRO 76150, MEXICO
Phone: +52 (442) 211-2631
Fax: +52 (442) 216-9963
transmisiones@ciateq.mx
www.ciateq.mx

Cimcool Fluid Technology
3000 DISNEY STREET
CINCINNATI, OH 45209
Phone: (888) 246-2665
Fax: (800) 205-3293
Daniel_L_Dwyer@cimcool.com
www.cimcool.com

Cleveland Deburring Machine Co.
3370 W. 140TH STREET
CLEVELAND, OH 44111
Phone: (216) 472-0200
Fax: (216) 472-0204
adam@cdmcmachine.com
cdmcmachine.com

Clifford-Jacobs Forging SEE OUR AD P27
P.O. BOX 830
CHAMPAIGN, IL 61824-0830
Phone: (217) 352-5172
Fax: (217) 352-4629
sales@clifford-jacobs.com
www.clifford-jacobs.com

Cold Forming Technology
44476 PHOENIX DRIVE
STERLING HEIGHTS, MI 48314
Phone: (586) 254-4600
Fax: (586) 254-4944
schirco@coldformingtechnology.com
www.coldformingtechnology.com

Cole Manufacturing Systems Inc.
750 LOGGERS CIRCLE
ROCHESTER, MI 48307-6022
Phone: (248) 601-8145
Fax: (248) 601-0505
dsmith@colemfgsystems.com
www.colemfgsystems.com

Colonial Tool Group
1691 WALKER RD.
WINDSOR ONTARIO N8W 3P1, CANADA
Phone: (519) 253-2461
Fax: (519) 253-5911
bmfroats@mnsi.net
www.colonialtool.com

Comco Inc.
2151 N. LINCOLN STREET
BURBANK CALIFORNIA 91504
Phone: (818) 841-5500
Fax: (818) 955-8365
info@comcoinc.com
www.comcoinc.com

Community PC
205 SHALIMAR DR.
DURHAM, NC 27713
Phone: (919) 484-1835
Fax: (919) 484-1835
bill@meshingwithgears.com
www.meshingwithgears.com

Comprehensive Heat Treat Specialists
P.O. BOX 6
LOGANSPORT, IN 46947
Phone: (765) 414-6522
rmcculley@comphtspecialists.com
www.comphtspecialists.com

Comtorgage Corporation SEE OUR AD P14
P.O. BOX 1217
SLATERSVILLE, RI 02876-0896
Phone: (401) 765-0900
Fax: (401) 765-2846
kgradolf@comtorgage.com
www.comtorgage.com

Continental Diamond Tool Corporation
1221 HARTZELL ST.
NEW HAVEN, IN 46774
Phone: (260) 493-1294
Fax: (260) 749-7326
www.cdtusa.net

Contour Hardening, Inc.
8401 NORTHWEST BLVD., INDIANAPOLIS, IN 46278
Phone: (317) 876-1530
Fax: (317) 879-2484
tchaplin@contourhardening.com
www.contourhardening.com

Cornell Forge
6666 W. 66TH STREET
CHICAGO, IL 60638
Phone: (708) 458-1582
Fax: (708) 728-9883
www.cornellforge.com

Cortec Corporation
4119 WHITE BEAR PARKWAY
ST. PAUL, MN 55110
Phone: (651) 429-1100
Fax: (651) 429-1122
info@cortecvci.com
www.cortecvci.com

Crest Ultrasonics Corp.
P.O, BOX 7266 SCOTCH ROAD
TRENTON, NJ 08628
Phone: 1-800-992-7378
www.crest-ultrasonics.com

Cryogenic Edge, The
144 SUTHERLAND DRIVE
AUBURN, CA 95603
Phone: (530) 852-4845
Fax: (530) 887-1291
sales@thecryoedge.com
www.thecryoedge.com

Cryogenic Institute of New England, Inc.
78 CHILMARK STREET
WORCESTER, MA 01604
Phone: (508) 459-7447
Fax: (508) 459-7426
info@nitrofreeze.com
www.nitrofreeze.com

CST-Cincinnati Steel Treating
5701 MARIEMONT AVENUE
CINCINNATI, OH 45227
Phone: (513) 271-3173
Fax: (513) 271-3510
cst@steeltreating.com
www.steeltreating.com

D.C. Morrison Company
201 JOHNSON ST.
COVINGTON, KY 41011
Phone: (859) 581-7511
Fax: (859) 581-9642
dcmorrison@fuse.net
www.dcmorrison.com

DAM GmbH
AM BUBENPFAD 2
D-67065 LUDWIGSHAFEN, GERMANY
Phone: +(49) 621-5296394
Fax: +(49) 621-587635
info@dam-gmbh.de
www.stopoffpaints.com

Danobat Machine Tool Co. Inc.
810 THORNDALE AVENUE
BENSENVILLE, IL 60106
Phone: (630) 616 6644
Fax: (630) 616 6648
danobatusa@danobatusa.com
www.danobatusa.com

Datapaq Inc.
3 CORPORATE PARK DR., UNIT 1
DERRY, NH 03038
Phone: (978) 988-9000
Fax: (978) 988-0666
sales@datapaq.com
www.datapaq.com

Dathan Tool & Gauge Co. Ltd.
MEAN LANE
MELTHAM
HOLMFIRTH WEST YORKSHIRE HD9 5RU,
UNITED KINGDOM
Phone: +(44) 1484-851207
Fax: +(44) 1484-852271
sales@dathan.co.uk
www.dathan.co.uk

Daubert Cromwell
12701 S. RIDGEWAY AVE.
ALSIP, IL 60803
Phone: (708) 293-7750
Fax: (708) 293-7765
info@daubertcromwell.com
www.daubertcromwell.com

Davron Technologies
4563 PINNACLE LANE
CHATTANOOGA, TN 37415
Phone: (423) 870-1888
Fax: (423) 870-3355
davron@ismproof.com
www.davrontech.com

Diamond Abrasive Products
A-68,69, PLOT T-204, MIDC, BHOSARI
PUNE - 411026 MAHARASHTRA, INDIA
Phone: +91-20-27129478
Fax: +91-20-30624242
dap@diamondabrasiveproducts.com
www.diamondabrasiveproducts.com

Dianamic Abrasive Products Inc.
2566 INDUSTRIAL ROW DRIVE
TROY, MI 48084
Phone: (248) 280-1185
Fax: (248) 280-2733
info@dianamic.com
www.dianamic.com

DiaTech Tools India Pvt. Ltd.
C-37 PANKI INDUSTRIAL AREA
P.O. UDYOGNAGAR
KANPUR - 208022 U.P., INDIA
Phone: +(91) 512-2691210
Fax: +(91) 512-2691214
dia.tech@rediffmail.com
www.diatechtools.com

Diehl Engineering Company, Inc. PS
P.O. BOX 1573
KINGSTON, WA 98346
Phone: (360) 297-8781
Fax: (360) 297-8784
info@diehlengineering.com
www.diehlengineering.com

DMG/Mori Seiki USA Inc. SEE OUR AD P43
2400 HUNTINGTON BLVD.
HOFFMAN ESTATES, IL 60192
Phone: (847) 593-5400
Fax: (847) 593-5433
www.dmgmoriseikiusa.com

Donkers Design Solutions
492 JOSEPH ST.
NEW HAMBURG ONTARIO N3A 2H2, CANADA
Phone: (519) 957-2217
john@donkersdesigns.com
www.donkersdesigns.com

Donner+Pfister AG
KIRCHWEG 5
CH-8855 WANGEN-NUOLEN, SWITZERLAND
Phone: +(41) 55 440 20 32
Fax: +(41) 55 440 29 80
info@dpag.ch
www.dpag.ch

Dontyne Systems SEE OUR AD P59
ROTTERDAM HOUSE
116 QUAYSIDE
NEWCASTLE-UPON-TYNE NE1 3DY, ENGLAND
Phone: +(44) 191-206-4021
Fax: +(44) 191-206-4001
namerica@dontynesystems.com
www.dontynesystems.com

Dr. Kaiser Diamantwerkzeuge
AM WASSERTURM 33 G
D-29223 CELLE, GERMANY
Phone: +(49) 5141-9386-0
Fax: +(49) 5141-9386-6
info@drkaiser.de
www.drkaiser.de

Drake Manufacturing Services Co. Inc.
4371 N. LEAVITT ROAD
WARREN, OH 44485 SEE OUR AD P23
Phone: (330) 847-7291
Fax: (330) 847-6323
info@drakemfg.com
www.drakemfg.com

Dreamtec Consulting LLC
152 LYNETTE DRIVE
FORT LEE, NJ 07024
Phone: (201) 678-1446
Fax: (201) 696-3816
kaz@dreamtec.us
www.dreamtec.us

Drewco Workholding
3745 NICHOLSON RD.
FRANKSVILLE, WI 53126
Phone: (262) 886-5050
Fax: (262) 886-5872
service@drewco.com
www.drewco.com

Drive Systems Technology, Inc.
24 MARLBOROUGH LANE
GLEN MILLS, PA 19342-1519
Phone: (610) 358-0785
Fax: (610) 358-2776
gear-doc@att.net
www.gear-doc.com

DSM Engineering Plastics
2267 WEST MILL RD
EVANSVILLE, IN 47722
Phone: (800) 333-4237
Fax: (812) 435-7702
tony.padden@dsm.com
www.dsmep.com

DTR Corp.
(formerly Dragon Precision Tools)
2400 E. DEVON AVE., SUITE 210
DES PLAINES, IL 60018 SEE OUR AD P18
Phone: (847) 375-8892
Fax: (847) 699-1022
alex@dragon.co.kr
www.dragon.co.kr

Duffy Company, The
283 E. HELLEN ROAD
PALATINE, IL 60067
Phone: (847) 202-0000
Fax: (847) 202-0004
sales@duffycompany.com
www.duffycompany.com

DuPont
CHESTNUT RUN PLAZA 713
4417 LANCASTER PIKE
WILMINGTON DE 19805
Phone: (800) 441-0575 or (302) 999-4592
Fax: (302) 999-3111
plastics.dupont.com

Dura-Bar
1800 WEST LAKE SHORE DRIVE
WOODSTOCK, IL 60098
Phone: (800) 227-6455
Fax: (815) 338-1549
sales@dura-bar.com
www.dura-bar.com

Dyer Company
1500 MCGOVERNVILLE RD.
P.O. BOX 4966
LANCASTER, PA 17601-4966
Phone: (800) 631-3333
Fax: (717) 569-6721
dyer@dyergage.com
dyergage.com

Dynamic Systems
15331 NE 90TH ST.
REDMOND, WA 98052
Phone: (800) 342-3999
refff@hotmail.com
www.abarcode.com

East Coast Induction
P.O. BOX 2039
BROCKTON, MA 02305
Phone: (800) 822-1297
Fax: (508) 587-9079
sales@eastcoastind.com
www.eastcoastind.com

ECM USA, Inc.
8920 58TH PLACE, STE 100
KENOSHA, WI 53144
Phone: (262) 605-4810
Fax: (262) 605-4814
info@ecm-usa.com
www.ecm-usa.com

EFD Induction Inc.
31511 DEQUINDRE RD.
MADISON HEIGHTS, MI 48071
Phone: (248) 658-0700
Fax: (248) 658-0701
sales@us.efdgroup.net
www.efdinduction-usa.com

Eicher Engineering Solutions
A602, SIGNATURE TOWERS
SOUTH CITY 1
GURGAON - 122001 HARYANA, INDIA
Phone: +(91) 124-4075021
Fax: +(91) 124-4072025
transmission@eicher.co.in
www.eicherengineering.com

Eldec Induction USA, Inc.
3355 BALD MOUNTAIN RD., UNIT 30
AUBURN HILLS, MI 48326
Phone: (248) 364-4750
Fax: (248) 364-4751
mail@eldec-usa.com
www.eldec-usa.com

Electroheat Technologies, LLC
3578 VAN DYKE RD.
ALMONT, MI 48003
Phone: (810) 798-2400
Fax: (810) 798-2402
mail@electroheat-technologies.com
www.electroheat-technologies.com

A TO Z

Electronics Inc.
56790 MAGNETIC DRIVE
MISHAWAKA, IN 46545
Phone: (574) 256-5001
Fax: (574) 256-5222
jack.champaigne@electronics-inc.com
www.electronics-inc.com

Ellwood City Forge
800 COMMERCIAL AVENUE
ELLWOOD CITY, PA 16117
Phone: (724) 752-0055
Fax: (724) 752-3449
ksaunders@elwd.com
www.ellwoodcityforge.com

Elmass Broaching Technologies
N63 W22621 STATE HIGHWAY 74
SUSSEX, WI 53089
Phone: (262) 677-8533
sales@elmassusa.com
www.elmassbroaching.com

Eltool Corp.
L665 CENTRAL AVE.
CINCINNATI, OH 45214
Phone: (513) 723-1772
Fax: (513) 721-8974
info@eltool.com
www.eltool.com

Eltro Services, Inc.
3570 THOMAS RD.
OXFORD, MI 48371
Phone: (248) 628-9790
Fax: (248) 628-9445
craig@eltroservices.com
www.eltroservices.com

EMAG LLC
38800 GRAND RIVER AVE.
FARMINGTON HILLS, MI 48335
Phone: (248) 477-7440
Fax: (248) 477-7784
info@usa.emag.com
www.emag.com

Emuge Corp.
1800 CENTURY DRIVE
WEST BOYLSTON, MA 01583-2121
Phone: (508) 595-3600
Fax: (508) 393-1310
info@emuge.com
www.emuge.com

Engineered Abrasives
11631 S AUSTIN
ALSIP, IL 60803
Phone: (708) 389-9700
Fax: (708) 389-4149
www.engineeredabrasives.com

Engineered Heat Treat, Inc.
31271 STEPHENSON HWY.
MADISON HEIGHTS, MI 48071
Phone: (248) 588-5141
Fax: (248) 588-6533
Sal@enght.com
www.ehtinc.com

Engineered Tools Corp.
2710 W. CARO RD.
CARO, MI 48723
Phone: (989) 673-8733
Fax: (989) 673-5886
info@engineeredtools.com
www.engineeredtools.com

Engis Corporation
105 W. HINTZ RD.
WHEELING, IL 60090
Phone: (847) 808-9400
Fax: (847) 808-9430
info@engis.com
www.engis.com

Erasteel Inc. SEE OUR AD P12
95 FULTON STREET
BOONTON, NJ 07005-1909
Phone: (973) 335-8400
Fax: (973) 335-8420
infonorthamerica@eramet-erasteel.com
www.erasteel.com

ERS Engineering Corp.
6346 ORCHARD LAKE ROAD, STE 103
WEST BLOOMFIELD, MI 48322
Phone: (248) 538-9082
Fax: (248) 538-9486
info@ersengine.com
www.ersengine.com

Erwin Junker Machinery, Inc.
2541 TECHNOLOGY DRIVE, #410
ELGIN, IL 60124 SEE OUR AD P71
Phone: (847) 488-0406
Fax: (847) 488-0436
info@junker-usa.com
www.junker-group.com

ESGI Tools Pvt. Ltd. SEE OUR AD P4
B-6, FOCAL POINT
PATIALA PUNJAB 147004, INDIA
Phone: +(91) 175-2233991
Fax: +(91) 175-2233990
esgi@esgitools.com
www.esgitools.com

Estudio Piña
H. YRIGOYEN 710
BAHÍA BLANCA B8000LPN
ARGENTINA
Phone: +(54) 2914515550
Fax: +(54) 2914510827
info@estudiopina.com.ar
www.estudiopina.com.ar

Etna Products, Inc.
P.O. BOX 23609
CHAGRIN FALLS, OH 44023
Phone: (440) 543-9845
Fax: (440) 543-1789
etna@etna.com
www.etna.com

Euro-Tech Corporation
N48 W14170 HAMPTON AVENUE
MENOMONEE FALLS, WI 53051
Phone: (262) 781-6777
Fax: (262) 781-2822
pat@eurotechcorp.com
www.eurotechcorp.com

Excel Gear
11865 MAIN STREET
ROSCOE, IL 61073
Phone: (815) 623-3414
Fax: (815) 623-3314
Chinn@excelgear.com
www.excelgear.com

Extremeion Hard Carbon
771 CROSSPOINT DRIVE
DENVER, NC 28037
Phone: (704) 489-2177
www.CarbonRaptor.com

Fässler Corporation
131 W. LAYTON AVE., SUITE 308
MILWAUKEE, WI 53207
Phone: (414) 769-0072
Fax: (414) 769-8610
usa@faessler-ag.ch
www.faessler-usa.com

FARO Technologies, Inc.
250 TECHNOLOGY PARK
LAKE MARY, FL 32746
Phone: (407) 333-9911
Fax: (407) 333-4181
info@faro.com
www.faro.com

FastCAM Inc.
8700 WEST BRYN MAWR, SUITE 730S
CHICAGO, IL 60631-3507
Phone: (312) 715-1535
Fax: (312) 715-1536
fastcam@fastcam.com
www.fastcam.com

Federal Broach & Machine
1961 SULLIVAN DRIVE
HARRISON, MI 48625
Phone: (989) 539-7420
Fax: (989) 539-7381
sales@federalbroach.com
www.federalbroach.com

Fellows Machine Tools
C/O STAR SU LLC
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com

Felsomat USA Inc.
1700 N. PENNY LANE
SCHAUMBURG, IL 60173
Phone: (847) 995-1086
Fax: (847) 885-2691
info@felsomat.com
www.felsomat.com

Flame Treating & Engineering
702 OAKWOOD AVE.
WEST HARTFORD, CT 06110
Phone: (860) 953-3519
Fax: (860) 953-1723
tbenoit@flametreating.com
www.flametreating.com

Flame Treating Systems, Inc.
715 EAST GEER ST., UNIT A-4
DURHAM, NC 27701
Phone: (919) 956-5208
Fax: (919) 956-5057
info@flametreatingsystems.com
www.flametreatingsystems.com

Flexbar Machine Corporation
250 GIBBS ROAD
ISLANDIA, NY 11749
Phone: (631) 582-8440
Fax: (631) 582-8487
sales@flexbar.com
www.flexbar.com

Forging Solutions LLC
6000 RIVERSIDE DR.
JACKSON, MI 49201
Phone: (517) 787-7665
Fax: 800.309.2352
jaoforge@gmail.com
www.forging-solutions.com

Forkardt
AN ITW WORKHOLDING COMPANY
2155 TRAVERSEFIELD DR.
TRAVERSE CITY, MI 49686
Phone: (231) 995-8300
Fax: (231) 995-8361
sales@forkardt.us
www.forkardt.us

FPM Heat Treating
1501 SOUTH LIVELY BLVD.
ELK GROVE VILLAGE, IL 60007
Phone: (847) 228-2525
Fax: (847) 228-5912
sales@fpmht.com
www.fpmht.com

Franco GmbH
JAKOB-BAIER-STRASSE 3
D-90518 ALTDORF, GERMANY
Phone: +(49) 0-9187-9522-0
Fax: +(49) 0-9187-9522-40
frenco@frenco.de
www.frenco.de

Fuchs Lubricants Company
17050 LATHROP AVE.
HARVEY, IL 60426
Phone: (708) 333-8900
Fax: (708) 333-3813
sbrewe@fuchs.com
www.fuchs.com

Fuji Machine America Corp.
171 CORPORATE WOODS PARKWAY
VERNON HILLS, IL 60061
Phone: (847) 821-2432
Fax: (847) 821-7815
info@fujimachine.com
www.fujimachine.com

Furnaces, Ovens & Baths, Inc.
4790 WHITE LAKE ROAD
CLARKSTON, MI 48346
Phone: (248) 625-7400
Fax: (248) 625-4030
sales@fobinc.com
www.fobinc.com

Galaxy Sourcing Inc.
849 S. WESTWOOD AVE., UNIT C
ADDISON, IL 60101
Phone: (630) 532-5003
Fax: (630) 749-4242
sales@galaxysourcing.com
www.galaxysourcing.com

Galomb Inc.
523 N. 22ND STREET
ALLENTOWN, PA 18104
Phone: (610) 434-3283
Fax: (610) 434-1668
inquiry@injectionmolder.net
www.injectionmolder.net

Gear Consulting Group SEE OUR AD P95
728 EL VERGEL LANE
ST AUGUSTINE, FL 32080
Phone: (904) 471-6977
www.gearconsultinggroup.com

Gear Resource Technologies Inc.
49 SHIRE OAKS DRIVE
PITTSFORD, NY 14534-1523
Phone: (585) 383-9160
Fax: (585) 383-1301
grtgears@gear-resource.com
www.gear-resource.com

GearOffice
5251 CAROL STREET
SKOKIE, IL 60077
Phone: (847) 280-6762
Yefim.Kotlyar@sbcglobal.net
www.gearoffice.com

Gearspect s.r.o.
KRÍZIKOVA 270
250 88 CELAKOVICE, CZECH REPUBLIC
Phone: +(420) 283-890-111
Fax: +(420) 604-208-575
info@gearspect.com
www.gearspect.com

General Broach Company
307 SALISBURY STREET
MORENCI, MI 49256
Phone: (517) 458-7555
Fax: (517) 458-6821
sales@generalbroach.com
www.generalbroach.com

General Magnaplate
1331 U.S. ROUTE 1
LINDEN, NJ 07036
Phone: (908) 862-6200
Fax: (908) 862-6110
gmcinfo@magnaplate.com
www.magnaplate.com

German Machine Tools of America
4630 FREEDOM DRIVE
ANN ARBOR, MI 48108
Phone: (734) 973-7800
Fax: (734) 973-3053
sales@gmtamerica.com
www.gmtamerica.com

GH Induction Atmospheres
35 INDUSTRIAL PARK CIRCLE
ROCHESTER, NY 14624
Phone: (585) 368-2120
Fax: (585) 368-2123
info@ghia.com
www.inductionatmospheres.com

Gleason Corporation SEE OUR AD PP48-49,95
1000 UNIVERSITY AVENUE
P.O. BOX 22970
ROCHESTER, NY 14692-2970
Phone: (585) 473-1000
Fax: (585) 461-4348
sales@gleason.com
www.gleason.com

Gleason Cutting Tools Corporation SEE OUR AD PP48-49,95
1351 WINDSOR RD.
LOVES PARK, IL 61111
Phone: (815) 877-8900
Fax: (815) 877-0264
gctc@gleason.com
www.gleason.com

Gleason Pfauter Maschinenfabrik GmbH SEE OUR AD PP48-49,95
DAIMLERSTRASSE 14
LUDWIGSBURG B-W 71636, GERMANY
Phone: 011 49 7141 404 - 474
Fax: 011 49 7141 404 - 512
auhlmann@gleason.com
www.gleason.com

Graff Diamond Products
35 HALE ROAD
BRAMPTON ON L6W3J9, CANADA
Phone: (905) 457-8132
Fax: (905) 457-2265
info@graffdiamond.com
www.graffdiamond.com

Great Lakes Gear Technologies, Inc.
9421 N. HAGGERTY ROAD
PLYMOUTH, MI 48170
Phone: (734) 416-9300
Fax: (734) 416-7088
inquiries@greatlakesgeartech.com
www.greatlakesgeartech.com

Greg Allen Company
5755 CANAL ROAD
VALLEY VIEW, OH 44125
Phone: (216) 642-5900
Fax: (216) 642-8837
sales@gallenco.com
www.gallenco.com

Grieve Corporation, The
500 HART ROAD
ROUND LAKE, IL 60073
Phone: (847) 546-8225
Fax: (847) 546-9210
sales@grievecorp.com
www.grievecorp.com

Grindal Company
1551 E. INDUSTRIAL DRIVE
ITASCA, IL 60143
Phone: 630-250-8950
Fax: 630-250-7082
mkmiec@grindal.com
www.grindal.com

GWJ Technology GmbH
REBENRING 33
D-38106 BRAUNSCHWEIG, GERMANY
Phone: +(49) 531-129-399-0
Fax: +(40) 531-129-399-29
info@gwj.de
www.gwj.de

Haas Multigrind LLC
137 ENTERPRISE DRIVE
WARSAW, IN 46580
Phone: 574-268-0053
Fax: 574-268-0083
d.drechsler@multigrind.com
www.multigrind.com

Hainbuch America
10541 N. COMMERCE ST.
MEQUON, WI 53092
Phone: (414) 358-9550
sales@hainbuchamerica.com
www.hainbuch.com

Hamai Co. Ltd.
5-5-15, NISHI-GOTANDA, SHINAGAWA-KU
TOKYO
JAPAN
Phone: +(81) 3-3491-0131
Fax: +(81) 3-3494-7536
k-sato@hamai.com
www.hamai.com

Hangsterfer's Laboratories
175 OGDEN RD.
MANTUA, NJ 08051
Phone: (856) 468-0216 or (800) 433-LUBE
Fax: (856) 468-0200
sales@hangsterfers.com
www.hangsterfers.com

Hanro Tools Incorporation
CB 188B, RING ROAD,
NARAINA VIHAR
NEW DELH I - 110028 DELHI, INDIA
Phone: +91-83-73904408
Fax: +91-11-25778470
www.hanrotools.com

Hans-Jürgen Geiger Maschinen-Vertrieb GmbH SEE OUR AD P37
JAMES-WATT-STRASSE 12
D-72555 METZINGEN, GERMANY
Phone: +(49) 7123-18040
Fax: +(49) 7123-18384
geiger@geiger-germany.com
www.geiger-germany.com

Havlik International Machinery Inc.
300 HOLIDAY INN DR.
CAMBRIDGE ON N1T 2B7, CANADA
Phone: (519) 624-6240
Fax: (519) 624-4119
havlik@sympatico.ca
www.havlikinternational.com

Heatbath/Park Metallurgical
P.O. BOX 51048
INDIAN ORCHARD, MA 01151
Phone: (413) 452-2000
Fax: (413) 543-2378
info@heatbath.com
www.heatbath.com

Heller Machine Tools
1225 EQUITY DRIVE
TROY, MI 48084
Phone: (248) 288-5000
Fax: (248) 288-9560
sales@hus.heller-machines.com
www.heller-machinetools.com

Hexagon Industriesoftware GmbH
KIELER STRASSE 1A
D-10115 BERLIN, GERMANY
Phone: +(49) 30-28096996
Fax: +(49) 30-28096997
info@hexagon.de
www.hexagon.de

Hexagon Metrology
250 CIRCUIT DRIVE
NORTH KINGSTOWN, RI 02852
Phone: (800) 343-7933
Fax: (401) 886-2727
info@hexagonmetrology.us
www.hexagonmetrology.us

HighTemp Furnaces Limited
MANUFACTURING DIVISION AND COMMERCIAL HEAT TREAT
1C, 2ND PHASE PEENYA INDUSTRIAL AREA
BANGALORE KARNATAKA, INDIA
Phone: +(91) 80-28395917
Fax: +(91) 80-28390490
marketing@hightemp-furnaces.com
www.hightemp-furnaces.com

A TO Z

Hindustan Enterprises Co. (Radar Broach)
PLOT NO. 695, SATSANG ROAD,
OPP. INDUSTRIAL ESTATE
LUDH IANA - 141003 PUNJAB, INDIA
Phone: +(91) 161-2530693
Fax: +(91) 161-2533693
info@radartools.com
www.radartools.com

HiTech e Soft
14TH FLOOR, TOWER B
UNITECH MILLENIUM PLAZA
SUSHANT LOK, SECTOR 27
GURGAON - 122002 HARYANA, INDIA
Phone: +(91) 124-2806088
Fax: +(91) 124-2806089
contact@hitechesoft.com
www.hitechesoft.com

Hobbing.com
3RD, FL 63-2
BANGYI-DONG, SONGPA-GU
SEOUL, KOREA
Phone: +(82) 10-3191-5992
Fax: +(82) 2-6442-5992
info@Hobbing.com
Hobbing.com

HobSource Inc.
834 E. RAND RD, SUITE 2
MOUNT PROSPECT, IL 60056
Phone: (847) 398-8320
Fax: (847) 398-8326
sales@hobsource.com
www.hobsource.com

Höfler GmbH SEE OUR AD **BC**
INDUSTRIESTRASSE 19
ETTLINGEN D-76275, GERMANY
Phone: +(49) 7243-599-0
Fax: +(49) 7243-599-165
info@hofler.com
www.hofler.com

Hoffmann Filter Corporation
7627 KENSINGTON COURT
BRIGHTON, MI 48116
Phone: (248) 486-8430
Fax: (248) 486-8439
info@hoffmannfilter.com
www.hoffmannfilter.com

Horsburgh & Scott Co.
5114 HAMILTON AVE.
CLEVELAND, OH 44114
Phone: (216) 431-3900
Fax: (216) 432-5850
www.horsburgh-scott.com

Houghton International
P.O. BOX 930
VALLEY FORGE, PA 19482
Phone: (610) 666-4000
Fax: (610) 666-1376
info@houghtonintl.com
www.houghtonintl.com

Huff Carbide Tool
6541 INDUSTRIAL AVE.
PORT RICHEY, FL 34668
Phone: (727) 848-4001
Fax: (727) 842-4849
sales@huffcarbide.com
www.huffcarbide.com

Hunter Chemical LLC
220 COMMERCE DRIVE, SUITE 405
FORT WASHINGTON, PA 19034
Phone: (866) 461-8882
Fax: (215) 461-1919
greg@hunterchem.com
www.hunterchem.com

Hydra-Lock Corporation
25000 JOY BLVD.
MT. CLEMENS, MI 48043
Phone: (800) 634-6973
Fax: (586) 783-7578
mail@hydralock.com
www.hydralock.com

I-TECH International Corp.
231 WEST PARKWAY
POMPTON PLAINS, NJ 07444
Phone: (973) 248-0099
Fax: (973) 248-0950
info@itechcorp.us
www.itechcorp.us

IMEXSU Group
8-A, VAIBHAV IND. ESTATE,
BAJI PASALKAR MARG
BESIDES MTNL SAKIVIHAR EXCHANGE
ANDHERI (E) MUMBAI - 400057, INDIA
Phone: +(91) 22-67488999
Fax: +(91) 22-67488979
np@imexsu.com
www.imexsu.com

Impact Finishers
WHEELABRATOR GROUP LTD.
107-109 WHITBY ROAD
SLOUGH BERKS SL1 3DR, UNITED KINGDOM
Phone: +(44) 1753-215676
Fax: +(44) 1753-215670
impactfinishers@wheelabrator-group.co.uk
www.wheelabratorgroup.com

Index Corporation
14700 NORTH POINTE
NOBLESVILLE, IN 46060
Phone: (317) 770-6300
Fax: (317) 770-3166
sales@index-usa.com
www.indextraub.com

Induction Services, Inc.
24800 MOUND ROAD
WARREN, MI 48091
Phone: (586) 754-1640
Fax: (586) 754-5402
heattreat@inductionservicesinc.com
www.inductionservicesinc.com

Induction Tooling, Inc.
12510 YORK-DELTA DRIVE
NORTH ROYALTON, OH 44133
Phone: (440) 237-0711
Fax: (440) 237-7009
sales@inductiontooling.com
www.inductiontooling.com

Inductoheat Inc. SEE OUR AD **P55**
32251 N. AVIS DR.
MADISON HEIGHTS, MI 48071
Phone: (248) 585-9393
Fax: (248) 589-1062
sales@inductoheat.com
www.inductoheat.com

Inductotherm Corp.
10 INDEL AVE.
P.O. BOX 157
RANCOCAS, NJ 08073-0157
Phone: (609) 267-9000
Fax: (609) 267-3537
www.inductotherm.com

Industrial Metal Finishing, Inc.
1941 PETRA LANE
PLACENTIA, CA 92870
Phone: (714) 628-8808
Fax: (714) 628-8809
info@indmetfin.com
www.indmetfin.com

Industrial Speciality Lubricants Co. (ISLUB) S.A.
18, EL ADEEB ALY ADHAM,
MASSAKEN SHERATON
CAIRO 11361, EGYPT
Phone: +(202) 22-680-301
Fax: +(202) 22-680-304
info@islub.com
www.islub.com

Industrial Tools Corporation
54/14 D2, MIDC, CHINCHWAD
PUN E - 411019, INDIA
Phone: +(91) 20-27474394
Fax: +(91) 20-27474394
pune@industrialtoolscorp.com
www.industrialtoolscorp.com

Ingersoll Cutting Tools
845 S. LYFORD RD.
ROCKFORD, IL 61108-2749
Phone: (815) 387-6600
Fax: (815) 387-6337
info@ingersoll-imc.com
www.ingersoll-imc.com

Intech Corporation
250 HERBERT AVENUE
CLOSTER, NJ 07624
Phone: (201) 767-8066
Fax: (201) 767-7797
info@intechpower.com
www.intechpower.com

Interstate Tool Corp.
4538 WEST 130TH ST.
CLEVELAND, OH 44135
Phone: (216) 671-1077
Fax: (216) 671-5431
itctoolcorp.com

Involute Simulation Softwares Inc.
10415 DU SUPERBE
QUEBEC QC G2B 2S1, CANADA
Phone: (418) 843-6828
hygears@gmail.com
www.hygears.com

Ion Vacuum (IVAC) Technologies Corp.
18678 CRANWOOD PARKWAY
WARRENSVILLE HEIGHTS, OH 44128
Phone: (888) 216-IVAC (4822)
Fax: (216) 662-5109
mail@ivactech.com
www.ivactech.com

Ionbond
1823 EAST WHITCOMB
MADISON HEIGHTS, MI 48071
Phone: (248) 398-9100
Fax: (248) 398-2110
infous@ionbond.com
ionbond.com

Ionitech Ltd.
5 CAPITAN LJUBEN KONDAKOV STR.
1582 SOFIA, BULGARIA
Phone: +(359) 2-439-0400
Fax: +(359) 2-439-0400
office@ionitech.com
www.ionitech.com

Ipsen, Inc. SEE OUR AD **P39**
984 IPSEN RD.
CHERRY VALLEY, IL 61016
Phone: (800) 727-7625
Fax: (815) 332-4995
sales@ipsenusa.com
www.ipsenusa.com

ITI GmbH
WEBERGASSE 1
D-01067 DRESDEN, GERMANY
Phone: +(49) 351-260-50-0
Fax: +(49) 351-260-50-155
info@itisim.com
www.itisim.com

ITW Heartland
1205 36TH AVENUE WEST
ALEXANDRIA, MN 56308
Phone: (320) 762-8138
Fax: (320) 762-5645
info@itwheartland.com
www.itwheartland.com

J. L. Becker Co.
41150 JOY ROAD
PLYMOUTH, MI 48170
Phone: (734) 656-2000
Fax: (734) 656-2009
sales@jlbecker.com
www.jlbecker.com

J. Schneeberger Corp.
1380 GATEWAY DRIVE, UNIT #8
ELGIN, IL 60123
Phone: (847) 888-3498
Fax: (847) 888-3665
rolf@schneeberger-us.com
www.schneeberger-us.com

Jenfab
555 WETHERSFIELD ROAD
BERLIN, CT 06037
Phone: (860) 828-6515
Fax: (860) 828-0473
sales@jenfab.com
www.jenfab.com

JRM International, Inc.
5701 INDUSTRIAL AVENUE
LOVES PARK ILLINOIS 61111
Phone: (815) 282-9330
Fax: (815) 282-9150
jrmsales@jrminternational.com
www.jrminternational.com

K+S Services, Inc.
15677 NOECKER WAY
SOUTHGATE, MI 48195
Phone: (734) 374-0400
Fax: (734) 759-0082
rniesyto@k-and-s.com
www.k-and-s.com

Kapp Technologies SEE OUR AD **P3**
2870 WILDERNESS PLACE
BOULDER, CO 80301
Phone: (303) 447-1130
Fax: (303) 447-1131
sales@kapp-usa.com
www.kapp-usa.com

KGK International Corp.
901 DEERFIELD PKWY.
BUFFALO GROVE, IL 60089
Phone: (847) 465-0160
Fax: (847) 465-0181
www.kgki.com

Khemka Broach & Spline Gauge
H-5/39, MIDC,
CHIKALTHANA
AURANGABAD - 431210, INDIA
Phone: +(91) 2402484712
Fax: +(91) 2402485517
sales@khemkabroach.com
www.khemkabroach.com

Kinefac Corporation
156 GODDARD MEMORIAL DR.
WORCESTER, MA 01603
Phone: (508) 754-6891
Fax: (508) 756-5342
sales@kinefac.com
www.kinefac.com

KISSsoft AG SEE OUR AD **P61**
ROSENGARTENSTRASSE 4
CH-8608 BUBIKON, SWITZERLAND
Phone: +(41) 55-254-2050
Fax: +(41) 55-254-2051
info@kisssoft.ag
www.kisssoft.ch

KISSsoft USA LLC SEE OUR AD **P61**
3719 N. SPRING GROVE ROAD
JOHNSBURG, IL 60051
Phone: (815) 363-8823
Fax: (815) 363-8832
dan.kondritz@kisssoft.com
www.kisssoft.com

Kitagawa - NorthTech Workholding
301 E. COMMERCE DR.
SCHAUMBURG, IL 60173
Phone: (800) 222-4138
Fax: (847) 310-8787
info@kitagawa.com
www.kitagawa.com

Klüber Lubrication North America LP
32 INDUSTRIAL DRIVE
LONDONDERRY, NH 03053
Phone: 603-647-4104
Fax: 603-647-4106
info@us.kluber.com
www.klubersolutions.com

Kleiss Gears, Inc.
390 INDUSTRIAL AVENUE
GRANTSBURG, WI 54840
Phone: (715) 598-4492
Fax: (715) 463-5996
drichter@kleissgears.com
www.kleissgears.com

Klingelnberg AG
SEE OUR AD P5, BC
BINZMÜHLESTRASSE 171
ZURICH CH-8050, SWITZERLAND
Phone: +(41) 44-2787979
Fax: +(41) 44-2781556
info@klingelnberg.com
www.klingelnberg.com

Klingelnberg America Inc.
118 E. MICHIGAN AVENUE, SUITE 200
SALINE, MI 48176
SEE OUR AD P5, BC
Phone: (734) 470-6278
Fax: (734) 470-2158
frank.irey@klingelnbergusa.com
www.klingelnberg.com

Klingelnberg GmbH
SEE OUR AD P5, BC
PETERSTRASSE 45
HUECKESWAGEN 42499, GERMANY
Phone: +(49) 2192-810
Fax: +(49) 2192-81200
info@klingelnberg.com
www.klingelnberg.com

Knuth Machine Tools USA, Inc.
590 BOND ST.
LINCOLNSHIRE, IL 60069
Phone: (847) 415-3333
Fax: (847) 415-2402
marketing@knuth-usa.com
www.knuth-usa.com

Koepfer America, LLC
635 SCHNEIDER DRIVE
SOUTH ELGIN, IL 60177
Phone: (847) 931-4121
Fax: (847) 931-4192
sales@koepferamerica.com
www.koepferamerica.com

Kowalski Heat Treating
3611 DETROIT AVE.
CLEVELAND, OH 44113
Phone: (216) 631-4411
Fax: (216) 631-8921
sales@khtheat.com
www.khtheat.com

Lalson Tools Corporation
D-277 FOCAL POINT PATIALA
PAT IALA - 147001, INDIA
Phone: +(91) 175-2232001
Fax: +(91) 175-2232001
info@lalsoncuttingtools.com
www.lalsoncuttingtools.com

Lambda Technologies
3929 VIRGINIA AVENUE
CINCINNATI, OH 45227
Phone: (513) 561-0883
Fax: (513) 322-7186
info@lambdatechs.com
www.lambdatechs.com

Lefere Forge
655 HUPP AVE.
JACKSON, MI 49203
Phone: (517) 784-7109
Fax: (517) 784-0929
sales@lefereforge.com
www.lefereforge.com

Leistritz Corporation
165 CHESTNUT ST.
ALLENDALE, NJ 07401
Phone: (201) 934-8262
Fax: (201) 934-8266
staff@leistritzcorp.com
www.leistritzcorp.com

Liebherr America
1465 WOODLAND DR.
SALINE, MI 48176
Phone: (734) 429-7225
Fax: (734) 429-2294
info@liebherr.com
www.liebherr.com

Liebherr-Verzahntechnik GmbH
KAUFBEURER STRASSE 141
D-87437 KEMPTEN, GERMANY
Phone: +(49) 831-7861316
Fax: +(49) 831-7861279
karl.sauterleute@liebherr.com
www.liebherr.com

LMT-Fette
1081 S. NORTHPOINT BLVD.
WAUKEGAN, IL 60085
Phone: (800) 225-0852
Fax: (630) 969-5492
sales@lmtusa.com
www.lmtfette.com

Longevity Coatings
6047 ADAMS LANE
ALLENTOWN, PA 18109
Phone: (610) 871-1427
Fax: (610) 871-1217
info@longevitycoatings.com
www.longevitycoatings.com

Lubegard / International Lubricants Inc.
7930 OCCIDENTAL SOUTH
SEATTLE, WA 98108
Phone: (206) 762-5343
Fax: (206) 762-7989
contact@lubegard.com
www.lubegard.com

Luren Precision Chicago Co., Ltd.
SEE OUR AD P20
1320 TOWER ROAD
SCHAUMBURG, IL 60173
Phone: (847) 598-3555
Fax: (847) 598-3552
gerald_kuo@luren.com.tw
www.luren.com.tw

Luren Precision Co., Ltd.
SEE OUR AD P20
1-1, LI-HSIN 1ST ROAD
HSINCHU SCIENCE PARK
HSINCHU TAIWAN 30078, TAIWAN
Phone: +(886) 3-5786767
Fax: +(886) 3-5784933
gerald_kuo@luren.com.tw
www.luren.com.tw

Lyndex-Nikken
1468 ARMOUR BLVD.
MUNDELEIN, IL 60060
Phone: (847) 367-4800
Fax: (847) 367-4815
inquiries@lyndexnikken.com
www.lyndexnikken.com

Machine Tool Builders
SEE OUR AD P71
7723 BURDEN ROAD
MACHESNEY PARK, IL 61115
Phone: (815) 636-7502
Fax: (815) 636-5912
aminer@machinetoolbuilders.com
www.machinetoolbuilders.com

A TO Z

MAG MODUL
5200 PRAIRIE STONE PKWY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com

Magnum Induction
51517 INDUSTRIAL DRIVE
NEW BALTIMORE, MI 48047
Phone: (586) 716-4700
Fax: (586) 716-9710
sales@magnuminduction.com
www.magnuminduction.com

Maheen Enterprises
C-151-152, FOCAL POINT,
PATIALA - 147001 PUNJAB, INDIA
Phone: +(91) 175-2281636
Fax: +(91) 175-2281636
maheenbroaches@yahoo.com
www.maheenbroaches.com

Mahr Federal Inc.
1144 EDDY STREET
PROVIDENCE, RI 02905
Phone: (401) 784-3100
Fax: (401) 784-3246
information@mahr.com
www.mahr.com

Marposs Corporation
3300 CROSS CREEK PARKWAY
AUBURN HILLS, MI 48326
Phone: (248) 370-0404
Fax: (248) 370-0991
marposs@us.marposs.com
www.marposs.com

Masternet Ltd.
690 GANA CT.
MISSISSAUGA ONTARIO L5S 1P2, CANADA
Phone: (800) 216-2536
Fax: (905) 795-9293
linda@masternetltd.com
www.masternetltd.com

Maxplus Enterprise
SAGAR ARCADE BUILDING, GROUND FLOOR
OFFICE NO. 04, GONDAL ROAD, NEAR
GURUKOOL
RAJKOT - 360002 GUJARAT, INDIA
Phone: +(91) 98-79244656
Fax: +(91) 28-12362615
forge@maxplushotforging.com
www.maxplushotforging.com

Maxwell Tools Co.
211 BRAESHIRE DR # D
BALLWIN, MO 63021
Phone: (314) 662-6510
Fax: (866) 586-7331
reply@maxwelltools.com
www.maxwelltools.com

Maxwell Tools Company
3 INDUSTRIAL ESTATE
RAJPURA - 140401, INDIA
Phone: +(91) 1762-320427
Fax: +(91) 1762-223372
info@maxwelltools.com
www.maxwelltools.com

Mazak Corporation
8025 PRODUCTION DRIVE
FLORENCE, KY 41042
Phone: (859) 342-1700
Fax: (859) 342-1865
gyamane@mazakcorp.com
www.mazakusa.com

McInnes Rolled Rings
1533 EAST 12TH STREET
ERIE, PA 16511
SEE OUR AD P16
Phone: (814) 459-4495
Fax: (814) 459-8443
sales@mcrings.com
mcinnesrolledrings.com

McKees Rocks Forgings
75 NICHOL AVENUE
MCKEES ROCKS, PA 15136
Phone: (412) 778-2020
Fax: (412) 778-2025
michael.maxeiner@trin.net
www.mckeesrocksforgings.com

MDM-Mecatronics
VIA IV NOVEMBRE 24
I - 40061MINERBIO (BO)
ITALY
Phone: +(39) 051-6605137
Fax: +(39) 051-6605543
michele.deni@mdm-mecatronics.com
www.mdm-mecatronics.com

MESYS AG
TECHNOPARKSTRASSE 1
CH-8005 ZURICH, SWITZERLAND
Phone: +(41) 44-4556800
info@mesys.ch
www.mesys.ch

Metal Improvement Company
80 ROUTE 4 EAST, SUITE 310
PARAMUS, NJ 07652
Phone: (201) 843-7800
Fax: (201) 843-3460
info@metalimprovement.com
www.metalimprovement.com

Metallurgical High Vacuum Corp.
6708 124TH AVENUE
FENNVILLE, MI 49408
Phone: (269) 543-4291
Fax: (269) 543-4750
info@methivac.com
www.methivac.com

Metallurgical Processing, Inc.
68 ARTHUR STREET
NEW BRITAIN, CT 06050
Phone: (860) 224-2648
Fax: (860) 225-0178
www.mpimetaltreating.com

Metlab
1000 E. MERMAID LANE
WYNDMOOR, PA 19038
Phone: (215) 233-2600
Fax: (215) 233-5653
sales@metlabheattreat.com
www.metlabheattreat.com

Mid-South Metallurgical
742 OLD SALEM RD.
MURFREESBORO, TN 37129
Phone: (615) 896-6212
Fax: (615) 896-6231
info@midsouthmet.com
www.midsouthmetallurgical.com

Midwest Themal-Vac Inc.
5727 95TH AVE.
BUSINESS PARK OF KENOSHA
KENOSHA, WI 53144
Phone: (262) 605-4848
Fax: (262) 605-4806
fredotto@mtvac.com
www.mtvac.com

Milburn Engineering, Inc.
12024 7TH AVE. NW
SEATTLE, WA 98177
Phone: (206) 365-2818
Fax: (206) 361-6221
andy@milburnengineering.com
www.milburnengineering.com

Miller Broach
14510 BRYCE RD.
CAPAC, MI 48014
Phone: (810) 395-8810
Fax: (810) 395-8270
info@millerbroach.com
www.millerbroach.com

Mitsubishi Gear Technology Center
46992 LIBERTY DRIVE
WIXOM, MI 48393
SEE OUR AD P8
Phone: (248) 669-6136
Fax: (248) 669-0614
mail2@mitsubishigearcenter.com
www.mitsubishigearcenter.com

Mitts & Merrill L.P.
28623 LAKE INDUSTRIAL BLVD.
TAVARES, FL 32778
Phone: (352) 343-7000
Fax: (352) 343-4400
mittsandmerrill@aol.com
www.mitts-merrill.com

Mitutoyo America Corporation
965 CORPORATE BOULEVARD
AURORA, IL 60502
Phone: (630) 820-9666
Fax: (630) 820-2614
mark.izumi@mitutoyo.com
www.mitutoyo.com

The Modal Shop
3149 E. KEMPER RD.
CINCINNATI, OH 45241
Phone: (800) 860-4867
Fax: (513) 458-2172
info@modalshop.com
www.modalshop.com

Modern Gearing
2277 RUE LÉGER STREET
LASALLE QUEBEC H8N 2V7, CANADA
Phone: (888) 595-9897
Fax: (888) 595-9860
info@moderngearing.com
www.moderngearing.com

MoldedGear LLC
8851 N. POMONA AVE. #106
KANSAS CITY, MO 64153
Phone: (202) 470-6030
Fax: (815) 642-0434
info@moldedgear.com
moldedgear.com

Moore-Addison
518 FACTORY RD.
ADDISON, IL 60101
Phone: (630) 543-6744
Fax: (630) 543-2805
mooreaddison@mooreaddison.com
www.mooreaddison.com

MPT Manufacturing Process Technologies
BOX 788
1411 HWY 21 SOUTH
DRESDEN ONTARIO N0P 1M0, CANADA
Phone: (519) 683-6122
Fax: (519) 683-6028
info@mptinc.com
www.mptinc.com

MTI Systems
59 INTERSTATE DRIVE
WEST SPRINGFIELD, MA 01089
Phone: (413) 733-1972
Fax: (413) 739-9250
jay.snow@mtisystems.com
www.mtisystems.com

Mutschler Edge Technologies
3370 WEST 140TH STREET
CLEVELAND, OH 44111
Phone: (216) 472-0200
Fax: (216) 472-0204
info@mutschleredgetech.com
mutschleredgetech.com

Nachi America Inc.
715 PUSHVILLE RD.
GREENWOOD, IN 46143
Phone: (317) 530-1001
Fax: (317) 530-1011
www.nachiamerica.com

Nagel Precision
288 DINO DRIVE
ANN ARBOR, MI 48103
Phone: (734) 426-5650
Fax: (734) 426-5649
info@nagelusa.com
www.nagelusa.com

National Bronze & Metals, Inc.
2929 WEST 12TH STREET
HOUSTON, TX 77008
Phone: (713) 869-9600
Fax: (713) 869-9124
nbm-sales@nbm-houston.com
www.nbmmetals.com

National Metal Processing, Inc.
P.O. BOX 280
RICHMOND, KY 40476-0280
Phone: (859) 623-9291
Fax: (859) 624-2735
rbell@nmpheattreat.com
nmpheattreat.com

Newage Testing Instruments
820 PENNSYLVANIA BLVD.
FEASTERVILLE, PA 19053
Phone: (215) 355-6900
Fax: (215) 354-1803
newage.info@ametek.com
www.hardnesstesters.com

Nitrex Inc. - Chicago Operations
1900 PLAIN AVENUE
AURORA, IL 60502
Phone: (630) 851-5880
Fax: (630) 851-0733
chicago@nitrex.com
www.nitrex.com

Nitrex Inc. - Indiana Operations
350 BLUE CHIP COURT
FRANKLIN, IN 46131
Phone: (317) 346-7700
Fax: (317) 346-7704, Indiana@nitrex.com
www.nitrex.com

Nitrex Inc. - Michigan Operations
822 KIM DRIVE
MASON, MI 48854
Phone: (517) 676-6370
Fax: (517) 676-6427
michigan@nitrex.com
www.nitrex.com

Nitrex Inc. - West Coast Operations
441 PERRYMONT AVENUE
SAN JOSE, CA 95125
Phone: (408) 275-0330
Fax: (408) 279-1982
westcoast@nitrex.com
www.nitrex.com

Nitrex Metal Inc.
3474 POIRIER BOULEVARD
MONTREAL QC H4R2J5, CANADA
Phone: (514) 335-7191
or (877) 335-7191
Fax: (514) 335-4160
nitrex@nitrex.com
www.nitrex.com

Noria Corporation
1328 E. 43RD COURT
TULSA, OK 74105
Phone: (918) 749-1400
Fax: (918) 746-0925
www.noria.com

Normac, Inc.
P.O. BOX 69
ARDEN, NC 28704
Phone: (828) 209-9000
Fax: (828) 209-9001
info@normac.com
www.normac.com

Northfield Precision Instrument Corp.
4400 AUSTIN BLVD.
P.O. BOX 550
ISLAND PARK, NY 11558
Phone: (516) 431-1112
Fax: (516) 431-1928
sales@northfield.com
www.northfield.com

Norton Abrasives
1 NEW BOND ST.
WORCESTER, MA 01606
Phone: (508) 795 2183
Fax: (508) 795-4130
Contactnorton@saint-gobain.com
nortonabrasives.com

NTC America Corporation
46605 MAGELLAN DRIVE
NOVI, MI 48377
Phone: (248) 560-1200
Fax: (248) 560-0215
mcsales@ntcamerica.com
www.ntcmc.com

Nye Lubricants
12 HOWLAND ROAD
FAIRHAVEN, MA 02719
Phone: (508) 996-6721
Fax: (508) 997-5285
www.nyelubricants.com

oelheld U.S., Inc.
1760 BRITANNIA DRIVE, SUITE 1
ELGIN, IL 60124
Phone: (847) 531-8501
Fax: (847) 531-8511
hutec-us@oelheld.com
www.oelheld-us.com

Oerlikon Balzers
1475 E. WOODFIELD ROAD, SUITE 201
SCHAUMBURG, IL 60173
Phone: (847) 619-5541
info.balzers.us@oerlikon.com
www.oerlikon.com/balzers/us

Ohio Broach & Machine Co.
35264 TOPPS INDUSTRIAL PKWY.
WILLOUGHBY, OH 44094
Phone: (440) 946-1040
Fax: (440) 946-0725
sales@ohiobroach.com
www.ohiobroach.com

Ono Sokki Technology, Inc.
2171 EXECUTIVE DRIVE #400
ADDISON, IL 60101
Phone: (630) 627-9700
Fax: (630) 627-0004
info@onosokki.net
www.onosokki.net

Optical Gaging Products, Inc. (OGP)
850 HUDSON AVE.
ROCHESTER, NY 14621
Phone: (585) 544-0400
Fax: (585) 544-8092
sales@ogpnet.com
www.ogpnet.com

ORT Italia
231 WEST PARKWAY
POMPTON PLAINS, NJ 07444
Phone: (973) 248-0099
Fax: (973) 248-0950
info@itechcorp.us
www.itechcorp.us

Osborn International
A UNIT OF JASON INCORPORATED
1100 RESOURCE DR. SUITE 1
BROOKLYN HTS., OH 44131
Phone: (800) 720-3358
Fax: (216) 361-1913
marketsupport@osborn.com
www.osborn.com

P.G. Engineers
24 B/8, INDUSTRIAL AREA
OPP. THERMAL POWER HOUSE GATE
FARIDABAD - 121001, INDIA
Phone: +(91) 129-4027592
Fax: +(91) 129-2261119
sales@pgcollets.info
www.pgcollets.info

P.S.Tools
D-304, AZAD NAGAR,
SIRHIND ROAD,
OPP. D-315
PATIALA - 147007, INDIA
Phone: +(91) 92-16292234
Fax: +(91) 175-2232648
pstool@rediffmail.com
www.pscuttingtool.com

Parag Casting Co.
338-B, G.I.D.C
AJI VASHAHAT - PHASE - II
RAJKOT - 360003 GUJARAT, INDIA
Phone: +(91) 281-2389146
Fax: +(91) 281-2360492
sales@paragcasting.com
www.paragcasting.com

Parker Industries Inc.
1650 SYCAMORE AVENUE
BOHEMIA, NY 11716
Phone: (631) 567-1000
Fax: (631) 567-1355
sales@parkerind.com
www.parkerind.com

Particular Technology, Inc.
4001 GROVE AVENUE, UNIT A
GURNEE, IL 60031
Phone: (847) 625-1602
Fax: (847) 625-1613
fjarrett@particulartechnology.com
www.particulartechnology.com

Paulo Products Company
5711 WEST PARK AVE.
ST. LOUIS, MO 63110
Phone: (314) 647-7500
Fax: (314) 647-7518
sales@paulo.com
www.paulo.com

PCK Buderus India
13, SOUTH WEST BOAG ROAD
T NAGAR
CHENNAI - 600017, INDIA
Phone: +(91) 44-24346503
Fax: +(91) 44-24341181
info@pck-buderus.com
www.pck-buderus.com

PDM Engineering Pvt. Ltd.
GAT NO. 185, HARISHCHANDRI
POST KAPURHOL
PUNE-SATAR ROAD, TAL BHOR
PUNE - 412205, INDIA
Phone: +(91) 99-70065950
cuttool@pdmengg.net
www.pdmengg.net

Peening Technologies
6289-8 VETERANS MEMORIAL HWY.
AUSTELL GA 30168
Phone: (770) 941-9573
Fax: (770) 941-1794
www.hydro-honing.com

Pegard Productics Division HARO
59, AVENUE REINE ELISABETH
ANDENNE 5300
BELGIUM
Phone: +(32) 85849964
Fax: +(32) 85849952
c.guilminot.haro@pegard.com
harotechnologies.com

Penna Flame Industries
1856 ROUTE 588
ZELIENOPLE, PA 16063
Phone: (800) 245-5084
brucec@pennaflame.com
www.pennaflame.com

A TO Z

Penticton Foundry Ltd.
568 DAWSON AVE.
PENTICTON BC V2A 3N8, CANADA
Phone: (250) 492-7043
Fax: (250) 492-6933
charlie@vip.net
www.pentictonfoundry.com

Petronomics Mfg. Group, Inc.
P. O. BOX 644
HUTCHINSON, KS 67504
Phone: (620) 663-8559
Fax: (620) 663-8560
www.petronomics.com

Phase II
21 INDUSTRIAL AVE.
UPPER SADDLE RIVER, NJ 07458
Phone: (201) 962-7373
Fax: (201) 962-8353
info@phase2plus.com
www.phase2plus.com

Philadelphia Carbide Co.
1451 ANDERSON AVE.
ORELAND, PA 19075
Phone: (215) 885-0770
Fax: (215) 576-8175
rocky00@philacarbide.com
www.philacarbide.com

PhoenixTM
8 ST THOMAS PLACE,
CAMBRIDGESHIRE BUSINESS PARK
ELY CAMBS. CB7 4EX, UK
Phone: +(44) 1353 223100
Fax: +(44) 1353 968684
sales@phoenixtm.com
www.phoenixtm.com

Pioneer Broach Co.
6434 TELEGRAPH RD.
LOS ANGELES, CA 90040
Phone: (800) 621-1945
Fax: (323) 722-1699
www.pioneerbroach.com

Polygon Solutions
16770 LINK COURT, SUITE #106
FORT MYERS, FL 33912
Phone: (239) 628-4800
Fax: (239) 628-4801
sales@polygonsolutions.com
www.polygonsolutions.com

Pometon España, SAU
DOCTOR BERGOS, S/N
E-08291 RIPOLLET, SPAIN
Phone: +(34) 935863629
Fax: +(34) 936917234
info@pometon.net
www.pometon.net

Precision Devices, Inc.
P.O. BOX 220
606 COUNTY STREET
MILAN, MI 48160-0220
Phone: (734) 439-2462
Fax: (734) 439-1461
sales@predev.com
www.predev.com

Precision Finishing Inc.
708 LAWN AVE.
SELLERSVILLE, PA 18960
Phone: (215) 257-6862
info@precisionfinishinginc.com
www.precisionfinishinginc.com

Precision Gage Co., Inc.
100 SHORE DRIVE
BURR RIDGE, IL 60527
Phone: (630) 655-2121
Fax: (630) 655-3073
sales@precisiongageco.com
www.precisiongageco.com

Precision Heat Treating Co.
660 GULL ST.
KALAMAZOO, MI 49005
Phone: (269) 382-4660
Fax: (269) 382-5699
preheat660@precisionheat.net
www.precisionheat.net

Precision Spindle & Accessories Inc.
P.O. BOX 269
OTTERVILLE ONTARIO N0J 1R0, CANADA
Phone: (519) 671-3911
Fax: (519) 652-5994
haviland@precisionspindleinc.com
www.precisionspindleinc.com

Preco Inc.
500 LASER DR.
SOMERSET, WI 54025
Phone: (715) 247-3285
Fax: (715) 247-5650
sales@precolaser.com
www.precolaser.com

Presrite Corporation
3665 E. 78TH STREET
CLEVELAND, OH 44105
Phone: (216) 441-5990
Fax: (216) 441-2644
info@presrite.com
www.presrite.com
SEE OUR AD P15

Prime Technologies
A-501, DEVDEVESHWAR
R.S.M. CROSS ROAD, ANDHERI (E)
MUMBAI - 400069, INDIA
Phone: +(91) 22-28221354
Fax: +(91) 22-26843973
primetechindia@gmail.com
www.gear-testers.com

Pro-Beam
3909 75TH STREET, SUITE 105
AURORA, IL 60504
Phone: (312) 953-8083
Fax: (312) 445-8519
rod.mourad@pro-beam.com
www.pro-beam.com

Proceq USA, Inc.
117 CORPORATION DRIVE
ALIQUIPPA, PA 15001
Phone: (724) 512-0330
Fax: (724) 512-0331
info-usa@proceq.com
www.proceq-usa.com

Process Equipment Company
4191 U.S. ROUTE 40
TIPP CITY, OH 45371
Phone: (937) 667-7105
Fax: (937) 667-2591
info@peco-us.com
www.gearinspection.com
SEE OUR AD P67

Progressive Heat Treating Co.
1701 WEST HUNDRED ROAD
CHESTER, VA 23836
Phone: 804-717-5353
Fax: 904-717-5388
sales@pecgears.com
www.pecgears.com

Promess Inc.
11429 GRAND RIVER ROAD
BRIGHTON, MI 48116
Phone: (810) 229-9334
Fax: (810) 229-8125
promess@promessinc.com
www.promessinc.com

Proto Manufacturing Inc.
12350 UNIVERSAL DRIVE
TAYLOR, MI 48180-4070
Phone: (313) 965-2900
Fax: (734) 946-0975
proto@protoxrd.com
www.protoxrd.com
SEE OUR AD P19

PTG Holroyd
PRECISION TECHNOLOGIES GROUP
HARBOUR LANE NORTH
MILNROW
ROCHDALE LANCASHIRE OL16 3LQ, UNITED KINGDOM
Phone: +(44) 1706-526590
Fax: +(44) 1706-353350
info@holroyd.com
www.holroyd.com

Pyromaitre
1081 CHEMIN INDUSTRIEL
ST-NICOLAS QUEBEC G7A 1B3, CANADA
Phone: (418) 831-2576
Fax: (418) 831-3206
pyro@pyromaitre.com
www.pyromaitre.com

QC American
575 S MANSFIELD ST.
YPSILANTI, MI 48197
Phone: (734) 961-0300
Fax: (734) 961-9999
sales@qcamerican.com
www.qcamerican.com

QSC Forge & Flange
2260 S. ARCHIBALD AVE, BUILDING A
ONTARIO, CA 91761
Phone: (626) 443-9090
Fax: (909) 947-8456
qsc@qscusa.com
www.qscforge.com

Quality Reducer Service, Inc.
620 EAST AVENUE
LAGRANGE, IL 60525
Phone: (708) 354-8080
Fax: (708) 354-8011
sales@qualityreducer.com
www.qualityreducer.com

Quality Solutions
1015 OLD FOREST RD.
CORYDON, IN 47112
Phone: 812-704-5491
Fax: 812-734-3263
info@qs-hardnesstester.com
www.qs-hardnesstester.com

Quality Vision Services (QVS)
1175 NORTH STREET
ROCHESTER, NY 14621
Phone: (866) 815-6618
Fax: (585) 506-4307
service@qvsi.com
www.qvsi.com

QuesTek Innovations LLC
1820 RIDGE AVENUE
EVANSTON, IL 60201
Phone: (847) 328-5800
Fax: (847) 328-5855
www.questek.com

Röders GmbH
SCHEIBENSTRASSE 6
D-29614 SOLTAU, GERMANY
Phone: +(49) 5191-603-43
Fax: +(49) 5191-603-39
info@roeders.de
www.roeders.de

R.A. Heller
10530 CHESTER RD.
CINCINNATI, OH 45215
Phone: (513) 771-6100
Fax: (513) 771-6102
raheller@fuse.net
www.raheller.com

R.E. Smith & Co.
3085 MT. READ BLVD.
ROCHESTER, NY 14616
Phone: (585) 621-2838
Fax: (585) 621-2838
gearman@resmithcoinc.com
www.resmithcoinc.com

R.P. Machine
820 COCHRAN STREET
STATESVILLE, NC 28677
Phone: (704) 872-8888
Fax: (704) 872-5777
sales@rpmachine.com
www.rpmachine.com

Radyne Corporation
211 W. BODEN STREET
MILWAUKEE, WI 53207
Phone: (414) 481-8360
Fax: (414) 481-8303
sales@radyne.com
www.radyne.com

Ralf Schaffer
HINTERE WEINBERGE 19
D-71111 WALDENBUCH, GERMANY
Phone: +(49) 7157695970
sales@specialsteel-forgings.com
www.specialsteel-forgings.com

RAM Optical Instrumentation, Inc.
1175 NORTH STREET
ROCHESTER, NY 14621
Phone: (585) 758-1300
Fax: (585) 506-4307
info@ramoptical.com
www.ramoptical.com

Randall Publications LLC
1840 JARVIS AVE.
ELK GROVE VILLAGE, IL 60007
Phone: (847) 437-6604
Fax: (847) 437-6618
wrs@geartechnology.com
www.geartechnology.com

Ravjeet Engineering Specialty Ltd.
S-89, MIDC INDUSTRIAL AREA
BHOSARI
PUNE - 411026, INDIA
Phone: +(91) 20-27120370
Fax: +(91) 20-66163645
sales@ravjeet.com
www.ravjeet.com

Razorform Tools
2031 PENMAR AVENUE
VENICE, CA 90291
Phone: (310) 822-2810
Fax: (310) 439-1497
info@razorformtools.com
www.razorformtools.com

Reade Advanced Materials
850 WATERMAN AVENUE
EAST PROVIDENCE, RI 02914
Phone: (401) 433-7000
Fax: (401) 433-7001
creade@reade.com
www.reade.com

Red Rover
8TH FLOOR, CHUNG HING COMMERCIAL BLDG
62-63 CONNAUGHT ROAD, CENTRAL
CENTRAL DISTRICT
HONG KONG, CHINA
Phone: +(852) 9266-6939
info@red-rover-china.com
www.red-rover-china.com

Redin Production Machine
2433 20TH ST.
ROCKFORD, IL 61104
Phone: (815) 398-1010
Fax: (815) 398-1055
sales@redinmachine.com
www.redinmachine.com

Regal Products, Inc.
4462 11TH STREET
ROCKFORD, IL 61109
Phone: (815) 387-2162
Fax: (815) 387-2161
DRenner862@aol.com
www.regalproducts.com

Reishauer AG
INDUSTRIESTRASSE 36
CH-8304 WALLISELLEN, SWITZERLAND
Phone: +(41) 44-832-22-11
Fax: +(41) 44-832-23-90
info@reishauer.com
www.reishauer.com

Reishauer Corporation
1525 HOLMES ROAD
ELGIN, IL 60123
Phone: (847) 888-3828
Fax: (847) 888-0343
usa@reishauer.com
www.reishauer.com

Reska Spline Products Co.
29171 CALAHAN DRIVE
ROSEVILLE, MI 48066
Phone: (586) 778-4000
Fax: (586) 778-3912
info@reskaspline.com
reskaspline.com

Riten Industries, Inc.
1100 LAKEVIEW AVENUE
WASHINGTON COURT HOUSE, OH 43160
Phone: (800) 338-0027
Fax: (740) 335-4622
a.lachat@riten.com
www.riten.com

Romax Technology
RUTHERFORD HOUSE
NOTTINGHAM SCIENCE & TECH. PARK
NOTTINGHAM NG7 2PZ, UNITED KINGDOM
Phone: +(44) 115 951 88 00
Fax: +(44) 115 951 88 01
sales@romaxtech.com
www.romaxtech.com

Roto-Flo / U.S. Gear Tools
20580 HOOVER RD.
DETROIT, MI 48205
Phone: (313) 526-7865
Fax: (313) 526-7864
info@roto-flo.com
www.roto-flo.com

Russell Holbrook & Henderson
17-17 ROUTE 208 NORTH
FAIRLAWN, NJ 07410
Phone: (201) 796-5445
Fax: (201) 796-5664
sales@tru-volute.com
www.tru-volute.com

S.L. Munson & Company
1404 OLD DAIRY
COLUMBIA, SC 29201
Phone: (803) 252-3211
Fax: (803) 929-0507
info@slmunson.com
www.slmunson.com

S.S.Tools
SIRHIND ROAD
PATIALA - 147001, INDIA
Phone: +(91) 175-2351272
Fax: +(91) 175-2361272
info@sstools.net
www.sstools.net

Saazor
ADOLF-SEEBACHER-STR. 4
D-75177 PFORZHEIM, GERMANY
Phone: +(49) 72319520-0
Fax: +(49) 72319520-90
saazor@saazor.de
www.saazor.de

Samchully Machinery Co., Ltd.
18 TECHNOLOGY DRIVE, SUITE 103
IRVINE, CA 92618
Phone: (949) 727-3001
Fax: (949) 727-7070
pilseung81@hotmail.com
www.samchully.com/eng/

Samputensili S.p.A.
C/O STAR SU LLC
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com

Sandvik Coromant
1702 NEVINS ROAD
FAIR LAWN, NJ 07410
SEE OUR AD P87
Phone: (201) 794-5000
Fax: (201) 794-5257
us.coromant@sandvik.com
www.sandvik.coromant.com/us

Schmiedewerke Groeditz GmbH
RIESAER STRASSE 1
D-01609 GROEDITZ, GERMANY
Phone: +(49) 0-35263-62-0
Fax: +(49) 0-35263-67944
info@stahl-groeditz.de
www.stahl-groeditz.de

Schnyder SA
JAKOBSTRASSE 52
CH-2504 BIEL, SWITZERLAND
SEE OUR AD P57
Phone: +(41)(32) 344-0406
Fax: +(41)(32) 344-0404
george.boon@schnyder.com
www.schnyder.com

Schunk Inc.
211 KITTY HAWK DR.
MORRISVILLE, NC 27560
Phone: (800) 772-4865
Fax: (919) 572-2818
info@us.schunk.com
www.schunk.com

Seco Tools Inc.
2805 BELLINGHAM DR.
TROY, MI 48083
Phone: (248) 528-5200
Fax: (248) 528-5250
lseidl@secotools.com
www.secotools.com/us

Seco/Warwick Corp.
180 MERCER ST.
PO BOX 908
MEADVILLE, PA 16335
Phone: (814) 332-8400
Fax: (814) 724-1407
info@secowarwick.com
www.secowarwick.com

Seco/Warwick Europe S.A.
SECO/WARWICK EUROPE S.A.
UL. SWIERCZEWSKIEGO 76
66-200 SWIEBODZIN 66-200
POLAND
Phone: +(48) 68-3819-800
Fax: +(48) 68-3819-805
europe@secowarwick.com.pl
www.secowarwickeurope.com.pl

Sedlock Companies - Euskal Forgin
450 N. WALES ROAD
WALES, WI 53183
Phone: (262) 968-3900
Fax: (262) 968-3960
rick@sedlockcompanies.com
www.sedlockcompanies.com

Sensor Developments, Inc.
1050 W. SILVER BELL RD.
ORION, MI 48359
Phone: (248) 391-3000
Fax: (248) 391-0107
sales@sendev.com
sendev.com

Sensor Products Inc.
300 MADISON AVE
MADISON, NJ 07940
Phone: (973) 884-1755
Fax: (973) 884-1699
info@sensorprod.com
www.sensorprod.com

SerWeMa GmbH & Co. KG
ZWICKAUER STRASSE 135 / 137
D-09116 CHEMNITZ, GERMANY
Phone: +(49) 371-909-93-0
Fax: +(49) 371-909-93-43
info@serwema.de
www.serwema.de

SETCO Precision Spindles
5880 HILLSIDE AVENUE
CINCINNATI, OH 45233
Phone: (513) 941-5110
Fax: (513) 941-6913
sales@setcousa.com
www.setcousa.com

Shape-Master Tool Company
P.O. BOX 520
801 WEST MAIN STREET
KIRKLAND, IL 60146
Phone: (888) 723-7226
Fax: (815) 522-6229
info@shapemastertool.com
www.shapemastertool.com

Shell Lubricants
700 MILAM STREET
HOUSTON, TX 77002
Phone: (800) 237-8645
www.shellus.com

Shree Krishna Auto Indsutries
127, SECTOR-24
FARIDABAD - 121005, INDIA
Phone: +(91) 129-5021922
Fax: +(91) 129-5021923
info@shreekrishnaauto.com
www.shreekrishnaauto.com

Sicmat S.p.A.
C/O STAR SU LLC
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com

Slater Tools Inc.
44725 TRINITY DRIVE
CLINTON TOWNSHIP, MI 48038
Phone: (586) 465-5000
Fax: (586) 465-3030
peter@slatertools.com
www.slatertools.com

Smart Manufacturing Technology Ltd.
CHARTWELL HOUSE
67-69 HOUNDS GATE
NOTTINGHAM NG1 6BB, UNITED KINGDOM
Phone: +(44) 0-115-941-9839
Fax: +(44) 0-115-958-1583
info@smartmt.com
www.smartmt.com

SMS-Elotherm
210 W. KENSINGER DRIVE, SUITE 300
CRANBERRY TOWNSHIP, PA 16066
Phone: (724) 553-3471
Fax: (724) 741-0612
g.burnet@us.sms-elotherm.com
www.sms-elotherm.com

Software Engineering Service
2801 RIDGE AVE.
ROCKFORD, IL 61103
Phone: (815) 963-1760
Fax: (815) 963-1760
sales@sofengsvc.com
www.sofengsvc.com

A TO Z

Solar Atmospheres
1969 CLEARVIEW ROAD
SOUDERTON, PA 18964
Phone: (215) 721-1502
Fax: (215) 723-6460
info@solaratm.com
www.solaratm.com
SEE OUR AD P51

Solar Manufacturing
1983 CLEARVIEW ROAD
SOUDERTON, PA 18964
Phone: (267) 384-5040
Fax: (267) 384-5060
info@solarmfg.com
www.solarmfg.com

Southwest Metal Products Ltd.
1737 SPRING ARBOR RD, STE 110
JACKSON, MI 49203
Phone: (517) 787-7665
Fax: (800) 390-2352
jaoforge@voyager.net
www.southwestmetal.com

Special Cutting Tools
1305 WOHLERT STREET
ANGOLA, IN 46703
Phone: (260) 665-6463
Fax: (260) 665-2665
sc.tools@verizon.net
www.specialcuttingtools.net

Specialty Heat Treating
3700 EASTERN AVE. SE
GRAND RAPIDS, MI 49508
Phone: (616) 245-0465
Fax: (616) 245-3060
info@specialtyheat.com
www.specialtyheat.com

Specialty Steel Treating Inc.
34501 COMMERCE ROAD
FRASER, MI 48026
Phone: (586) 293-5355
Fax: (586) 293-5390
todd@sstfraser.com
www.specialtysteeltreating.com

Spectrum Machine Inc.
1668 FROST RD.
STREETSBORO, OH 44241
Phone: (330) 626-3666
Fax: (330) 626-3313
barstock@spectrummachine.com
www.spectrummachine.com

Speedgrip Chuck
2000 E. INDUSTRIAL PARKWAY
ELKHART, IN 46515
Phone: (574) 294-1506
Fax: (574) 294-2465
salesweb@speedgrip.com
www.speedgrip.com

Spline Gage Solutions
3620 W. 10TH STREET, #323
GREELEY, CO 80634
Phone: (760) 586-1003
Fax: (970) 339-8188
info@splinegagesolutions.com
splinegagesolutions.com

Spring Technologies Inc.
ONE BROADWAY 14TH FLOOR
CAMBRIDGE, MA 02142
Phone: (617) 401-2197
Fax: (815) 425-2197
spring@springplm.com
www.springplm.com

Springfield Metallurgical Services, Inc.
127 MAIN ST
PO BOX 826
SPRINGFIELD VT 05156-0826
Phone: (802) 885-8026
Fax: (802) 885-8086
info@smslab.net
www.smslab.net

Star Cutter Co.
C/O STAR SU LLC
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com

Star SU LLC
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com
SEE OUR AD IFC,P95

Steelmans Broaches Pte. Ltd.
183 AJIT NAGAR
PATIALA PUNJAB 147001, INDIA
Phone: +(91) 175-2218031
Fax: +(91) 175-2212963
info@steelmans.com
www.steelmans.com

Stella Keramik GmbH
PRÄZISIONSSCHLEIFKÖRPER
KIRCHENLAMITZER STRASSE 15
D-95126 SCHWARZENBACH/SAALE, GERMANY
Phone: +(49) 0-9284-8060
Fax: +(49) 0-9284-80630
stk@stella-gruppe.de
www.stella-gruppe.de

Stenhoj Broaching Machines
SIGURD STENHØJ VEJ 2
DK-7150 BARRIT
DENMARK
Phone: +(45) 7682-1322
Fax: +(45) 7682-1300
hydraulik@stenhoj.dk
www.stenhoj.dk

Steuby Manufacturing Company, Inc.
203 RAMSEY LANE
PO BOX 1023
ST. LOUIS, MO 63021
Phone: (636) 394-2300
Fax: (636) 394-3239
sales@steubymfg.com
www.steubymfg.com

Stone Tucker Instruments Inc.
P.O. BOX 650
FONTHILL ON L0S 1E0, CANADA
Phone: (905) 892-6142
Fax: (905) 892-7613
info@stone-tucker.com
www.stone-tucker.com

Stotz Gaging Co.
2500 N. LATHAM ST.
ROCKFORD, IL 61103
Phone: (815) 962-6076
Fax: (815) 962-6483
info@ame.com
www.stotz-usa.com

Stresstech Oy
TIKKUTEHTAANTIE 1
40800 VAAJAKOSKI
FINLAND
Phone: +(358) 14-333-000
Fax: +(358) 14-333-0099
info@stresstech.fi
www.stresstechgroup.com

Studwell Engineering
11053 PENROSE STREET, UNIT C
SUN VALLEY, CA 91352
Phone: (818) 767-7504
Fax: (818) 767-1643
info@studeng.com
studwellengineering.com

SU (Shanghai) Machine & Tools Co., Ltd.
C/O STAR SU LLC
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com

SU America
C/O STAR SU LLC
5200 PRAIRIE STONE PARKWAY, SUITE 100
HOFFMAN ESTATES, IL 60192
Phone: (847) 649-1450
Fax: (847) 649-0112
sales@star-su.com
www.star-su.com

Sun Steel Treating Inc.
550 N. MILL ST.
SOUTH LYON, MI 48178
Phone: (877) 471-0840
Fax: (248) 437-3140
info@sunsteeltreating.com
www.sunsteeltreating.com

Sunbelt-Turret Steel. Inc.
55 CORNEAU WAY
SOUTH WINDSOR, CT 06074
Phone: (866) 940-4140
Fax: (860) 291-0300
Cabell@turretsteel.com
www.sunbeltturretsteel.com

Sunnen Products Company
7910 MANCHESTER RD.
ST. LOUIS, MO 63143
Phone: (314) 781-2100
Fax: (314) 781-2268
sunnen@sunnen.com
www.sunnen.com

Super Hobs & Broaches Pvt. Ltd.
B-22, FOCAL POINT
PATIALA - 147003, INDIA
Phone: +(91) 80-54531047
Fax: +(91) 175-2232772
info@supercuttingtools.com
www.supercuttingtools.com

Superabrasivi
VIALE EDISON
I-20038 SEREGNO
ITALY
info@superabrasivi.it
www.superabrasives.it

Superior Industrial Sharpening & Grinding
160 ST. CHARLES ST.
P.O. BOX 3345
BOWLING GREEN, KY 42101
Phone: (270) 843-4424
Fax: (270) 843-4381
www.superiorsharpening.com

Surface Combustion
1700 INDIAN WOOD CIRCLE
MAUMEE, OH 43537
Phone: (419) 891-7150
Fax: (419) 891-7151
info@surfacecombustion.com
www.surfacecombustion.com

Surface Finishing Equipment Co.
E-100, M.I.A., PHASE - II, BASNI
JODHPUR - 342005, INDIA
Phone: +(91) 291-2740128
Fax: +(91) 291-2740259
modi.munmun@gmail.com
www.sfecindia.net

Surplex GmbH
WAHLERSTRASSE 4
D-40472 DUESSELDORF, GERMANY
Phone: +(49) 211-422737-0
info@surplex.com
www.surplex.com

SWD Inc.
910 S. STILES DR.
ADDISON, IL 60101
Phone: (630) 543-3003
Fax: (630) 543-3028
matt@swdinc.com
www.swdinc.com

Syn-Tech Ltd.
1550 W. FULLERTON AVE. STE. E
ADDISON, IL 60101
Phone: (630) 620-7050
Fax: (630) 620-4832
tfrank@syn-techlube.com
www.syn-techlube.com

Tazz Broach & Machine, Inc.
34026 JAMES J POMPO DR.
FRASER, MI 48026
Phone: (586) 296-7755
Fax: (586) 294-5850
www.tazzbroach.com

Techcellence
C-17, FOCAL POINT, NEAR D.C.W.
PATIALA - 147001, INDIA
Phone: +(91) 175-3952100
Fax: +(91) 175-3952700
broach@broachindia.com
www.broachindia.com

TechnoMax Inc.
506, 2-6-29 UESHIO, CHUO-KU
OSAKA-CITY 542-0064
JAPAN
Phone: +(81) 6-6762-4106
Fax: +(81) 6-6762-4107
t-max@technomax-j.com
www.technomax-j.com

Tecnologie FRB
231 WEST PARKWAY
POMPTON PLAINS, NJ 07444
Phone: (973) 248-0099
Fax: (973) 248-0950
info@itechcorp.us
www.itechcorp.us

Texas Refinery Corp.
NORTH MAIN
FORT WORTH, TX 76101
Phone: (800) 827-0711
Fax: (800) 582-3329
lube1@texasrefinery.com
www.texasrefinery.com

Thornhill Machine Australia Pty Ltd.
10A TRENT STREET,
MOORABBIN VICTORIA 3189
AUSTRALIA
Phone: +(61) 3-9532-1452
Fax: +(61) 3-9532-5099
sales@thornhill.com.au
www.thornhill.com.au

Tianjin No.1 Machine Tool Works
146 JINTANG ROAD, HEDONG DISTRICT,
TIANJIN 300180, CHINA
Phone: +(86) 22-24932536
Fax: +(86) 22-24390644
sales@tmtw.com
www.tmtw.com

Ticona
8040 DIXIE HIGHWAY
FLORENCE, KY 41042
Phone: (859) 372-3244
prodinfo@ticona.com
www.ticona.com

TM Induction Heating
OVERVELD 5
HARDERWIJK 3848 BT
NETHERLANDS
Phone: +(31) 341-434454
Fax: +(31) 341-434464
e.v.dijk@tm-induction.com
www.tm-induction.com

Tokyo Technical Instruments USA Inc.
297 KINDERKAMACK RD., #133
ORADELL, NJ 07649
Phone: (201) 634-1700
Fax: (201) 262-2187
www.tti-geartec.jp
SEE OUR AD P25

Tool Masters India
29, INDUSTRIAL ESTATE
PATIALA - 147003, INDIA
Phone: +(91) 98-76300890
Fax: +(91) 175-5001405
toolmasters@gmail.com
www.tool-masters.com

Toolink Engineering
1921 MILLER DRIVE
LONGMONT, CO 80501
Phone: (303) 776-6212
Fax: (303) 776-4723
cgarcia@toolink-eng.com
www.toolink-eng.com
SEE OUR AD P45

Toshiba Machine Co.
755 GREENLEAF AVE.
ELK GROVE, IL 60007
Phone: (847) 539-1616
Fax: (847) 640-6197
hgoto@toshiba-machine.com
www.toshiba-machine.com

Treat All Metals, Inc.
5140 N. PORT WASHINGTON RD.
MILWAUKEE, WI 53217
Phone: (414) 962-2500
Fax: (414) 962-4702
www.treatallmetals.com

Tribo Surface Engineering LLC
1405 W. 178TH STREET
GARDENA, CA 90248
Phone: (310) 329-1955
Fax: (310) 329-1804
wes@tribosurfaceengineering.com
www.tribosurfaceengineering.com

TSA America, LLC
30311 CLEMENS ROAD - SUITE 2
WESTLAKE, OH 44145
Phone: (440) 614-0170
Fax: (440) 614-0173
j.thomas@tsageartools.com
www.tsageartools.com

Ty Miles
9855 DERBY LANE
WESTCHESTER, IL 60154
Phone: (708) 344-5480
Fax: (708) 344-0437
tymiles@aol.com
www.tymiles.com

U.S. Equipment
20580 HOOVER RD.
DETROIT, MI 48205
Phone: (313) 526-8300
Fax: (313) 526-5303
info@usequipment.com
www.usequipment.com

U.S. Gear Tools
P.O. BOX 548
U.S. 70 & LYTLE COVE RD.
SWANNANOA, NC 28778
Phone: (828) 686-5486
Fax: (828) 686-5977
psimon@roto-flo.com
www.usgeartools.com

Ultramatic Equipment Co.
848 S. WESTGATE DR.
ADDISON, IL 60101
Phone: (630) 543-4565
Fax: (630) 543-4569
sales@ultramatic-equipment.com
ultramatic-equipment.com

UMC - United Metals Co.
1F, 289-2 TRAI HENG NORTH ROAD
CHIAN JHEN DIST.,
KAOHSIUNG, TAIWAN
KAOHSIUNG TAIWAN 806, TAIWAN
Phone: +(886) 7-8121737
Fax: +(886) 7-8318344
info@umcmetals.com
www.umcmetals.com

United Cast Bar, Inc.
SPITAL LANE
CHESTERFIELD DERBYSHIRE S41 0EX
UNITED KINGDOM
Phone: +(44) 1246-201194
Fax: +(44) 1246-236684
www.unitedcastbar.com

United Gear and Assembly, Inc.
1700 LIVINGSTONE RD
HUDSON, WI 54016
Phone: (715) 386-5867
Fax: (715) 386-6473
customerservice@ugaco.com
www.ugaco.com

United Grinding
510 EARL BLVD.
MIAMISBURG, OH 45342
Phone: (937) 847-1214
Fax: (937) 859-6915
www.grinding.com

United Tool Company
1538, STREET NO 3. RAGHO MAJRA
PATIALA - 147001, INDIA
Phone: +(91) 98157-57555
Fax: +(91) 175-2320899
unitedtool@gmail.com
www.unitedcuttingtool.com

United Tool Supply
851 OHIO PIKE
CINCINNATI, OH 45245
Phone: (513) 752-6000
Fax: (513) 752-5599
unitedtool1@aol.com

Universal Technical Systems
202 W. STATE STREET, SUITE 700
ROCKFORD, IL 61101-1437
Phone: (815) 963-2220
Fax: (815) 963-8884
support@uts.com
www.uts.us.com

V W Broaching Service, Inc.
3250 WEST LAKE STREET
CHICAGO, IL 60624
Phone: (773) 533-9000
Fax: (773) 533-0763
info@vwbroaching.com
www.vwbroaching.com

VaporKote, Inc.
1270 N. GROVE STREET
ANAHEIM, CA 92806
Phone: (714) 632-8607
Fax: (714) 632-8658
sales@vaporkote.com
www.vaporkote.com

Vermont Machine Tool
65 PEARL STREET
SPRINGFIELD VT 05156
Phone: (802) 885-4521
Fax: (802) 885-3266
info@vermontmachinetool.com
www.vermontmachinetool.com

VFA Engineering Group
750 OLD HICKORY BLVD
BUILDING 2, SUITE 270
BRENTWOOD, TN 37027
Phone: (317) 750-3414
ed@failure-analysis-durability.com
failure-analysis-durability.com

View Micro-Metrology
1711 WEST 17TH ST.
TEMPE, AZ 85281
Phone: (480) 295-3150
Fax: (480) 889-9059
info@viewmm.com
www.viewmm.com

Voelker Sensors, Inc.
3790 EL CAMINO REAL, SUITE 336
PALO ALTO, CA 94306
Phone: (888) 484-1117
Fax: (650) 618-8544
info@vsi-oil.com
www.vsi-oil.com

Walker Forge
222 EAST ERIE STREET, SUITE 300
MILWAUKEE, WI 53202
Phone: (414) 223-2000
Fax: (414) 223-2019
mgray@walkerforge.com
www.walkerforge.com

WARDJet
PO BOX 518
180 SOUTH AVE.
TALLMADGE, OH 44278
Phone: (330) 677-9100
Fax: (330) 677-9121
sales@wardjet.com
www.wardjet.com

Waterloo Manufacturing Software
P.O. BOX 81264
WELLESLEY, MA 02481
Phone: (781) 237-2678
Fax: (781) 237-9999
sales@waterloo-software.com
www.waterloo-software.com

Watkins Mfg. Inc.
10565 MEDALLION DR.
CINCINNATI, OH 45241
Phone: (513) 563-0440
Fax: (513) 563-0451
sales@saw-lutions.com
www.saw-lutions.com

Web Gear Services Ltd.
379 GATESTONE BLVD.
WATERLOO ON N2T 2J6, CANADA
Phone: (519) 885-1387
Fax: (519) 885-0388
ereiter@webgearservices.com
www.webgearservices.com

Weihai Weiying Tool Co. Ltd.
HAOSHAN ROAD, HTDA
WEIHAI SHANDONG 264210, CHINA
Phone: +(86) 0631-5685601
Fax: +(86) 0631-5683191
whweiying@gmail.com
www.whweiying.com

Wenzel America
46962 LIBERTY DRIVE
WIXOM, MI 48393
Phone: (248) 295-4300
Fax: (248) 295-4301
inquiries@wenzelamerica.com
www.wenzelamerica.com

West Michigan Spline, Inc.
156 MANUFACTURERS DR.
HOLLAND, MI 49424
Phone: (616) 399-5550
Fax: (616) 399-3743
splinehead@aol.com
www.westmichiganspline.com

Westminster Machine Tools Ltd.
THE MINE SITE UNIT 8
MILL LANE
SOUTH WITHAM, GRANTHAM
LINCS NG33 5QN, ENGLAND
Phone: +(44) 0-1572-767922
Fax: +(44) 0-1572-768321
sales@wmtg.co.uk
www.wmtg.co.uk

Westport Gage
510 MONTAUK HIGHWAY
WEST ISLIP, NY 11795
Phone: (888) 400-4243
Fax: (631) 321-1326
info@westportcorp.com
www.westportcorp.com

Wheelabrator Group
1219 CORPORATE DRIVE
BURLINGTON ON L7L 5V5, CANADA
Phone: (800) 845-8508
Fax: (905) 319-7561
info@wheelabratorgroup.com
www.wheelabratorgroup.com

Winterthur Wendt USA Inc.
30975 CENTURY DRIVE
WIXOM, MI 48393
Phone: (248) 926-2500
Fax: (248) 926-2525
info@wdi.wendtgroup.com
www.winterthurtechnology.com

Wolverine Broach Co., Inc.
41200 EXECUTIVE DRIVE
HARRISON TWP., MI 48045
Phone: (586) 468-4445
Fax: (586) 468-1120
wolbco@wolverinebroach.com
www.wolverinebroach.com

WPC Treatment Co., Inc.
2909 OREGON COURT
UNIT C2
TORRANCE, CA 90503
Phone: (310) 782-8647
Fax: (310) 782-7624
www.wpctreatment.com

Yash International
A-291/1, OKHLA IND AREA
PHASE-1
NEW DELHI - 110020, INDIA
Phone: +(91) 11-26812754
Fax: +(91) 11-42575300
sales@yashtools.com
www.yashtools.com

Yuvraj Tools & Forgings
F-286, PHASE-VIII, FOCAL POINT
OPPOSITE HERO CYCLE UNIT,
LUDH IANA - 141010, INDIA
Phone: +(91) 161-5000886
Fax: +(91) 161-2673886
info@yuvrajtools.com
www.yuvrajtools.com

Zhengzhou Hongtuo Superabrasive Tools Co. Ltd.
NO.176, THE 7TH STREET
ECON & TECH DEVELOPMENT ZONE
ZHENGZHOU HENAN 450016, CHINA
Phone: +(86) 371-62003286
www.htcycl.com

Zion Industries
6229 GRAFTON RD.
VALLEY CITY, OH 44280
Phone: (330) 225-3246
Fax: (330) 483-3942
jbode@zscan.com
www.zioninduction.com

ZOLLER Inc.
3753 PLAZA DRIVE, SUITE #1
ANN ARBOR, MI 48108
Phone: (734) 332-4851
Fax: (734) 332-4852
sales@zoller-usa.com
www.zoller-usa.com

GOT A GEAR QUESTION?
Ask the Expert!

Welcome back to *Gear Technology*'s Ask the Expert—our popular regular feature intended to help designers, specifiers, quality assurance and inspection personnel in addressing some of the more complex, troublesome gearing challenges that never cease to materialize—whether on the drafting table or the shop floor. Simply email your question—along with your name, job title and company name (if you wish to remain anonymous, no problem)—to: *jmcguinn@geartechnology.com;* or submit your question by visiting *geartechnology.com*.

QUESTION

Gleason Machine Set-Up

We have a Gleason 116 and we want to cut a 4/49 ring and pinion set. We have cut the ring with a 6" cutter diameter on a Gleason 22. No formate type, but we are not able to develop the pinion with a 6" cutter.

The 116 Bevel and Hypoid Gear Generator (Fig. 1) is a mechanical machine that was designed for cutting gears and pinions from five teeth to 99 teeth with a limiting ratio of 10:1. In some cases—where the number of teeth is small, the ratio high and face width long—the total amount of cradle roll and work roll becomes very large. The large work roll can't be handled by the mechanical drivetrain of the No. 116 machine. For these conditions there was a special version of the No. 116 machine with special features that was renamed the No. 121 High-Reduction Hypoid Gear Generator (Fig. 2). The No. 121 machine was capable of cutting one-tooth pinions and virtually any desired ratio. The No. 121 machine modifications consisted of one additional source of motion in the drivetrain. This was a separate motor which drives the cradle and work spindle, while the standard main motor drives the cutter and the feed cam. The added motor drive is a variable speed unit which permits fast return after the relatively long generating roll required for pinion teeth under five teeth with a high ratio. The No. 116 and No. 121 are no longer offered by Gleason, but a Gleason Phoenix machine (Fig. 3) is ideally suited for cutting these types of gear sets.

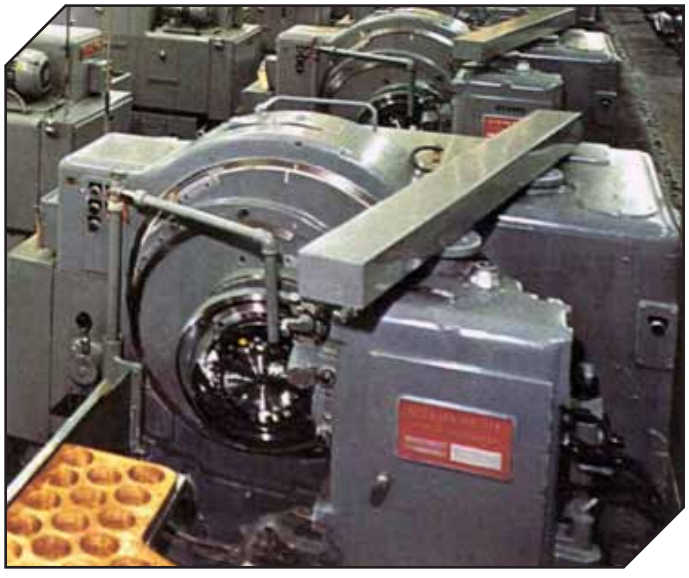


Figure 1 Gleason No. 116 bevel and hypoid gear generator.

Figure 2 Gleason No. 121 high-reduction hypoid gear generator.

The gear set in question—4 × 49 with a ratio of 12.25:1—would require approximately 31° of cradle roll and 368° of work roll to generate the pinion tooth form. Therefore, this gear set would be considered beyond the capacity of a standard No. 116 machine.

Figure 3 Gleason Phoenix 280C universal bevel gear cutting machine.

The pinion development procedure for low teeth numbers and high ratios is somewhat different than a normal hypoid or spiral bevel gear set. The following cutting changes were developed by experienced operators and can be used to develop a left-hand pinion.

Topping or flanking changes:

- ***Machine offset***: Down, flanks—both sides
- ***Machine offset***: Up, tops—both sides

Toe or heel changes:

- ***Eccentric angle***: Plus, towards heel—both sides
- ***Eccentric angle***: Minus, towards toe—both sides

From the basic data mentioned in the question, there is no reason why a 6.00" diameter cutter could not be used for this design. However, this could be better determined by a bevel gear application engineer after knowing all the required gear design data, such as pressure angle, spiral angle, face width, etc.

Anthony J. Norselli
Gleason Corp.

Morphology of Micropitting

R. L. Errichello

Understanding the morphology of micropitting is critical in determining the root cause of failure. Examples of micropitting in gears and rolling-element bearings are presented to illustrate morphological variations that can occur in practice.

General Morphology

To the unaided eye, micropitting appears dull, etched or stained, with patches of gray. Micropitting is difficult to see under diffuse fluorescent lighting and is best observed with intense directional lighting. A flashlight with a concentrated beam held in the proper direction effectively illuminates micropitting. With intense lighting, micropitting might sparkle or appear speckled. Figure 1 is a scanning electron microscopy (SEM) image that shows the floor of a micropit crater sloping gently downward from its origin at the tooth surface. The floor has a rough surface typical of that caused by ductile-fatigue-crack propagation. A feather-edge forms at the back of the crater due to plastic flow of material over the crater rim. The feather-edge appears white in SEM when it becomes charged with electrons. Material surrounding a micropit generally appears smooth and featureless, unless abraded.

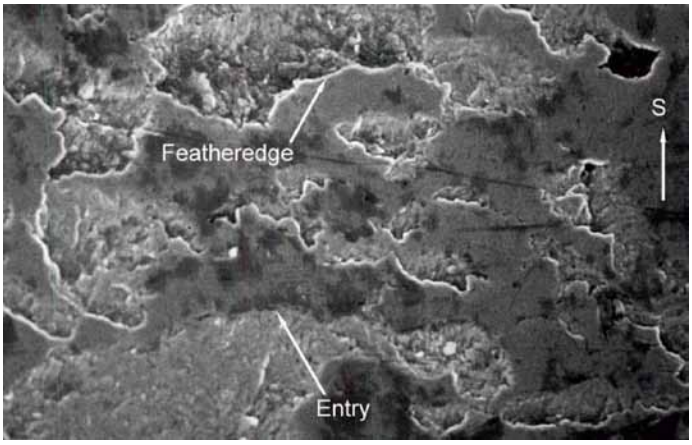


Figure 1 SEM image of micropitting.

Gear Tooth Sliding

Figure 2 shows the directions of the rolling (R) and sliding (S) velocities on the driving and driven gear teeth. Contact on the driver tooth starts near the root of the tooth, rolls up the tooth, and ends at the tooth tip. Sliding is away from the driving gear pitch line. Contact on the driven tooth starts at the tooth tip, rolls down the tooth, and ends near the tooth root. Sliding is towards the driven gear pitch line. Like macropitting, micropitting cracks grow opposite the direction of sliding at the gear tooth surface. Consequently, the cracks converge near the pitch line of the driver and diverge near the pitch line of the driven gear.

Figure 3 shows metallurgical sections cut transversely through micropits that show cracks start at or near the gear tooth surface and grow at a shallow angle (typically 10–30°, but sometimes as steep as 45°) to the surface.

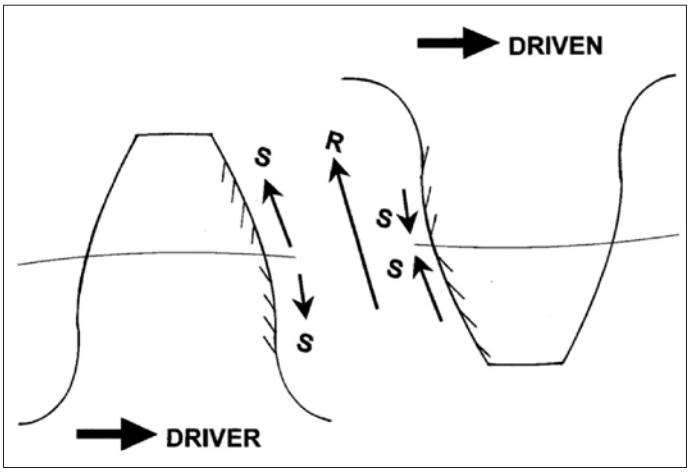


Figure 2 Rolling (R) and sliding (S) directions.

Hydraulic Pressure Propagation

Gear teeth dedenda have negative sliding; i.e., direction of rolling velocity is opposite sliding velocity. Negative sliding is significant because it promotes Hertzian fatigue by allowing oil to enter surface cracks where it accelerates crack growth by the hydraulic-pressure-propagation mechanism first proposed by Stewart Way (Ref. 1) and verified many times by experiments such as Littmann's (Ref. 2).

Figure 4 shows profile inspection charts that demonstrate typical profile damage due to micropitting on the drive flanks of a wind turbine high-speed (HS) pinion.

The charts for the coast flanks show the original accuracy of the pinion was high, but the micropitting caused severe deterio-

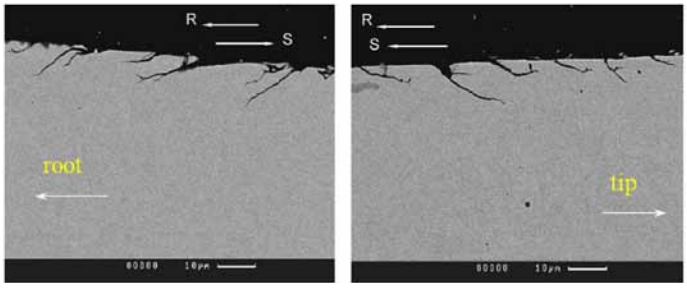


Figure 3 Micropitting cracks on a driven gear (courtesy of Newcastle University).

ration of the drive flanks. Note that the entire active drive flanks were damaged, but the damage was most severe in the dedenda in the area of negative sliding.

Figure 5 shows a form-ground wind turbine intermediate (INT) pinion with micropitting that crosses the pitch line.

Because slide directions reverse as the pitch line is crossed, micropitting cracks grow in opposite directions above and below the pitch line. Figure 5 shows that when micropitting grows across the pitch line, it makes the pitch line readily discernible because opposite inclinations of the floors of micropit craters scatter light in opposite directions above and below the pitch line.

Surface Topography

Figure 6 is an SEM image of micropitting on a high asperity of a ground tooth surface.

Micropitting begins by attacking high points on gear tooth surfaces such as crests of undulations, peaks of cutter scallops, ridges of grinding lay, and edges of grinding scratches. Figure 6 shows the surface of the asperity has been severely plastically deformed. Tractional stress from sliding has caused material to flow over the micropit craters and form a featheredge at the exit side of the craters. Growth of the micropits is opposite to the slide direction and begins at the entry (first point reached by the roll direction) and ends at the exit (last point reached by the roll direction).

Figure 7 shows a skive-hobbed wind turbine low speed (LS) wheel with micropitting on peaks of the hob scallops. Figure 8 shows a form-ground wind turbine INT wheel with micropitting on peaks of longitudinal grind scratches. Multiple cracks originate at these sites and coalesce to form micropits along lines that follow high points of surface topography. If ridges are periodic, micropitting might form in regularly spaced rows. Micropitting generally progresses until surface peaks are removed, and might continue until large areas of tooth surface become porous and continuously cracked.

Figure 8 shows a form-ground wind turbine INT wheel with micropitting on peaks of longitudinal grind scratches.

Gear teeth dedenda are vulnerable to micropitting, especially along the start of active profile (SAP) and the lowest point of single tooth pair contact (LPSTC). However, micropitting might occur anywhere on active flanks. Micropitting might occur at edges of teeth, at boundaries of surface defects such as scratches and debris dents, adjacent to damage from other failure modes such as macropitting or scuffing, and wherever the elasto-hydrodynamic lubrication (EHL) film is disrupted.

Micropitting Patterns

If the pinion and wheel were initially accurate and had little run-out, micropitting damage might be similar from tooth-to-tooth. In these cases micropitting patterns can be interpreted in much the same way contact patterns are used to assess gear tooth alignment and load distribution. For example, Figure 9 shows a helical wheel that had some misalignment.

When micropitting damage varies from tooth-to-tooth, it usually means there are tooth-to-tooth variations in tooth geometry or surface roughness. Gear sets with non-hunting gear ratios might develop micropitting patterns that repeat at

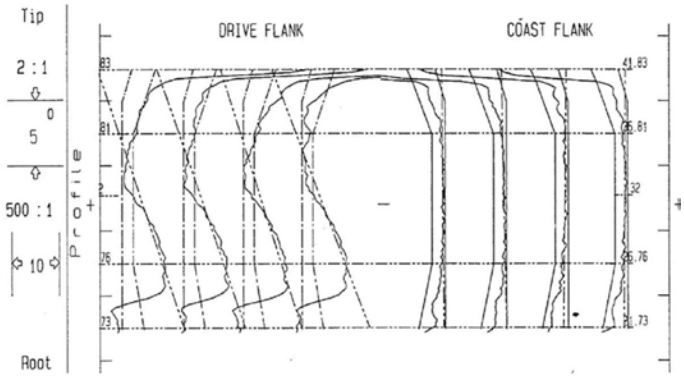


Figure 4 Typical profile damage due to micropitting on wind turbine HS pinion.

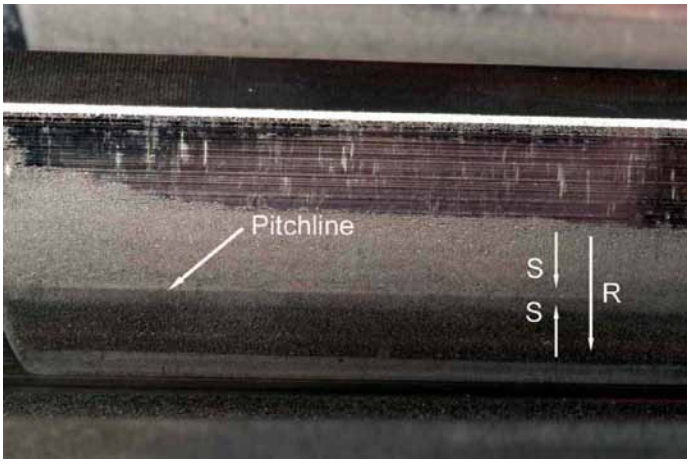


Figure 5 Pitch line is readily discernible on a driven wind turbine INT pinion.

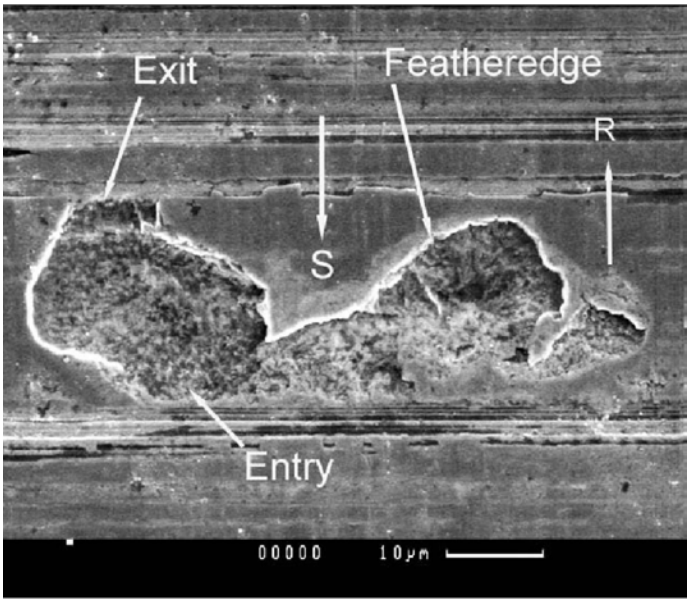


Figure 6 SEM image of micropitting on asperity peak of ground tooth surface (courtesy of Newcastle University).

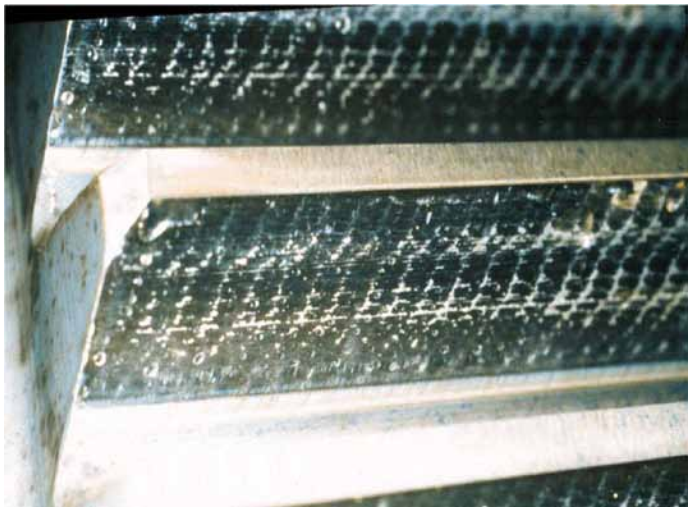


Figure 7 Wind turbine LS wheel with micropitting on peaks of hob scallops.

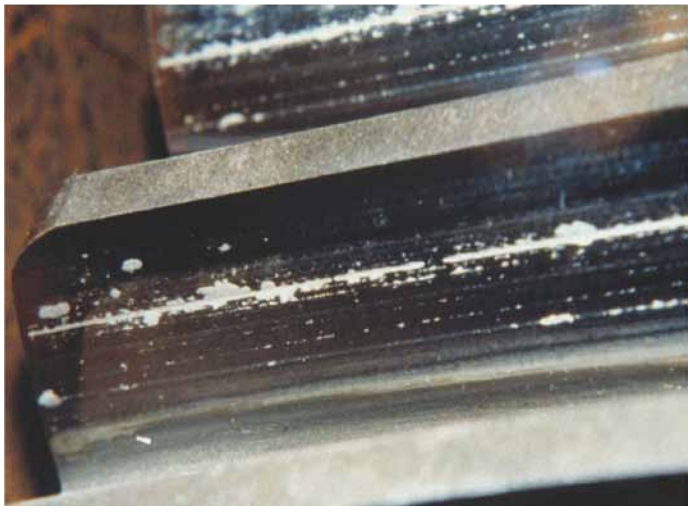


Figure 8 Wind turbine INT wheel with micropitting on peaks of grind scratches.

Figure 9 Micropitting pattern on a helical wheel that had some misalignment (courtesy of Caterpillar).

the frequency of a common factor of the tooth combination. For example, a gear set with a 25/55-tooth combination, and a common factor of five, might have similar micropitting on every fifth tooth.

There might be micropitting only on the pinion, only on the wheel, or on both. Generally, the gear with the roughest surface causes micropitting on the mating gear, especially if it is harder than the mating gear. Micropitting is most damaging when the opposing surface is rough, harder and faster. Micropitting resistance improves when the harder surface is made smooth. A worst case example would be a sun pinion that mates with multiple planet wheels that are rougher and harder than the sun pinion.

Geometric Stress Concentration (GSC)

Micropitting might occur at GSC such as:

- Edges of gear teeth
- Ends of bearing rollers
- Boundaries of surface defects such as macropitting, scuffing, fretting corrosion, or debris dents
- Tip-to-root interference at the SAP
- Corners of tip relief
- Wherever the EHL film is disrupted

Figure 10 shows a form-ground wind turbine HS pinion with micropitting at the edge of contact at the drive end of the active face width.

Figure 11 shows a form-ground wind turbine sun pinion with micropitting on shoulders of debris dents. Debris dents are local depressions that cause loss of EHL film thickness and lead to GSC at shoulders of dents. Cyclic contacts at these sites generate pressure spikes, plastic deformation, and tensile residual stresses that eventually initiate micropits.

Debris dents on rolling-element bearing raceways usually cause micropitting that frequently initiates point-surface-origin (PSO) macropitting. Therefore, debris dents are a common root cause of bearing failure.

Figure 12 shows a shaved automotive planet wheel. In addition, Figure 12 shows micropitting at edges of a PSO macropit. It is a secondary failure mode that occurred because the PSO macropit disrupted the EHL lubricant film. Other teeth show there is also micropitting on peaks of the shaving marks.

Figure 13 shows a FZG PT-C pinion with a PSO macropit that initiated at the cusp above tip-to-root damage at the SAP.

The root cause of the PSO macropit shown in Figure 13 is GSC caused by tip-to-root interference (Ref. 3). The FVA micropitting test (Ref. 4) requires the test to be terminated when a macropit occurs.

Figure 14 shows a FZG GF–C pinion with a PSO macropit that initiated at the upper edge of a 2 mm-high band of micropitting.

The root cause of the PSO macropit shown in Figure 14 is GSC caused by micropitting (Ref. 5).

FZG GF-C gears (Ref. 4) are the same as FZG PT–C gears in all respects except PT–C gears have a tooth surface roughness of Ra = 0.3 µm, whereas GF–C gears have tooth surface roughness of Ra = 0.5 µm. The rougher surfaces of GF–C gears cause more severe micropitting that removes the cusp at the SAP due to tip-to-root interference and prevents initiation of PSO mac-

ropitting at the SAP. Therefore, the micropitting prolongs the macropitting life until the micropitting spreads to the pitchline, where PSO macropits initiate at the top of the micropitting band because of GSC caused by the step in the tooth profile at the upper edge of the micropitting crater (Ref. 6). Consequently, in the FZG GF–C test, a lubricant with superior micropitting resistance might give a shorter macropitting life than a lubricant with inferior micropitting resistance.

Figure 15 shows a contact line with fretting corrosion on a wind turbine INT wheel, as well as micropitting at edges of the fretting line. The fretting corrosion occurred when the wind turbine was parked; the micropitting occurred later during operation due to GSC at the edges of the fretting line. Therefore, fretting corrosion was the primary failure mode and micropitting was a secondary failure mode.

Micropitting in Rolling-Element Bearings

Figure 16 shows micropitting on the inner ring (IR) of a cylindrical roller bearing (CRB) from a wind turbine HS pinion. The micropitting reduced the diameter of the IR, increased the bearing internal clearance, increased the roller loads, and increased stresses. Furthermore, the micropitting caused the IR to conform to the rollers and negate the crown of the rollers. This caused GSC at the ends of the rollers and resulted in macropitting at each end of the raceway. Therefore, micropitting was the primary failure mode and GSC macropitting was a secondary failure mode.

Figure 17 is an SEM image of the central part of Figure 16, showing an enlarged view of the micropitting.

Figure 17 shows that micropitting in rolling-element bearing components has a directional randomness that differs from the more directionally oriented micropitting that is typical in gear teeth. This is probably caused by differences in sliding directions, which are more random in rolling-element bearings than in gears.

Figure 18 shows a roller from a CRB from a wind turbine INT pinion. The roller has scuffing in two circumferential bands that were caused by skidding between the roller and the outer ring (OR) raceways.

The bearing has a disc-shaped cage that is guided by a groove in the two-piece OR. No contact occurs between the roller and OR raceway in the central portion of the roller because the OR raceway is interrupted by the cage groove. Consequently, no scuffing occurred in the central portion of the roller. Furthermore, the roller has end-reliefs that prevented scuffing at the roller ends.

Figure 19 shows a CRB IR from a wind turbine INT pinion that mated with the roller shown in Figure 18.

Figure 19 shows micropitting that occurred in two circumferential bands—separated by a central band without micropitting. The two bands of micropitting were caused by the scuffing-induced roughness on the rollers. There is also a band without micropitting at each end of the active raceway; GSC macropitting occurred on the left and central bands.

Figure 20 is a plot of the axial profile of the IR shown in Figure 19.

Figure 20 shows the micropitting caused two ruts in the raceway that are up to 64 µm deep. Consequently, a major portion

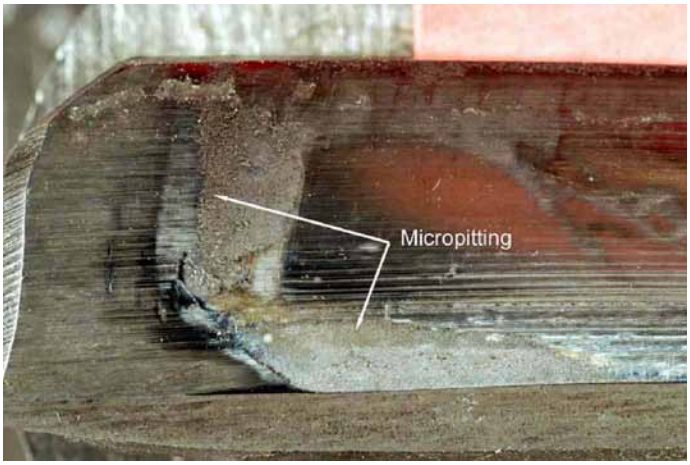


Figure 10 Wind turbine HS pinion with micropitting at edge of contact.

Figure 11 Wind turbine sun pinion with micropitting on shoulders of debris dents.

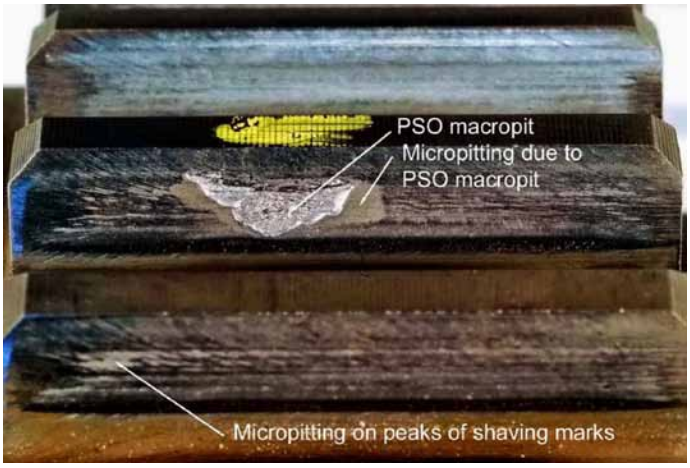


Figure 12 Micropitting at edges of PSO macropit on shaved automotive planet.

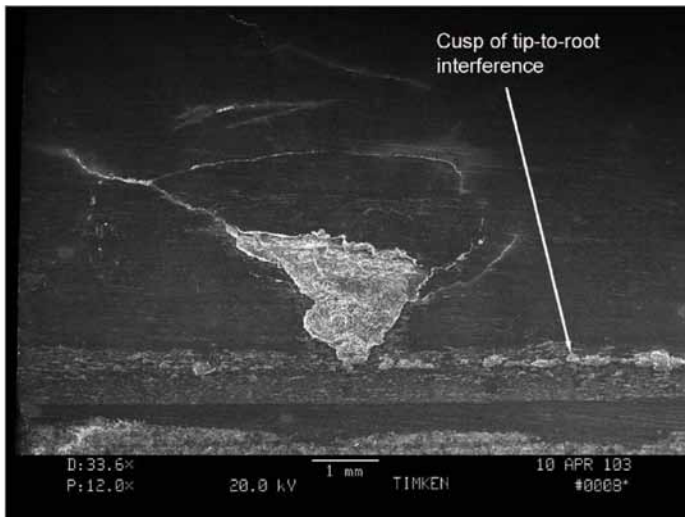


Figure 13 FZG PT–C pinion with PSO macropit starting from GSC at SAP (courtesy of Afton Chemical).

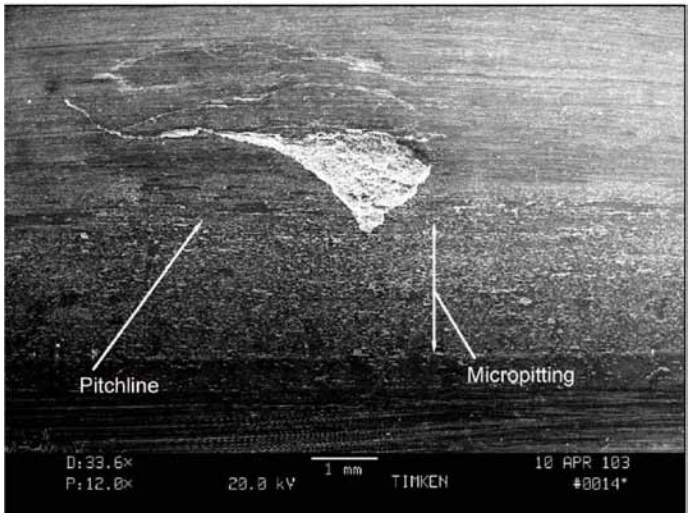


Figure 14 FZG GF–C pinion with PSO macropit starting from GSC near pitch line (courtesy of Afton Chemical).

Figure 15 Wind turbine INT wheel with micropitting at edges of fretting line.

of the load-bearing area of the IR raceway was lost, leaving only the central part of the raceway and two ends to support load; this in turn led to the GSC macropitting (Fig. 19).

This example demonstrates a complex series of failure modes that started with scuffing between the rollers and OR raceway; this was followed by micropitting on the IR raceway caused by the rough surfaces of the scuffed rollers, and, finally, GSC macropitting on the IR caused by GSC due to micropitting. Therefore, scuffing was the primary failure mode and micropitting and GSC macropitting were secondary failure modes.

Figure 21 shows the influence of oil type on micropitting. The test results were obtained with AGMA test gears (Ref. 7). The pinion and wheel have tip relief, and the pinion has a crown that limits the size of the contact pattern.

Influence of Lubricant Properties

Figure 21 shows Oil-A had the lowest micropitting resistance and Oil-E had the highest micropitting resistance. Oil-A and Oil-B initiated macropitting due to GSC at the top of the micropitting band. Oil-F had the second-best micropitting resistance, but a PSO macropit initiated due to GSC caused by tip-to-root interference.

Micropitting resistance is strongly affected by lubricant properties—especially the base oil type, viscosity at the operating temperature, viscosity-pressure coefficient (Ref. 8) and the lubricant chemistry. Anti-wear additives are generally detrimental to micropitting resistance, primarily because they inhibit run-in and preserve damaging roughness. However, some friction-reducing additives are beneficial (Ref. 9).

Oil cleanliness must be maintained to avoid micropitting caused by debris dents (Ref. 10). Furthermore, gearbox inspections have shown that water contamination promotes micropitting in gears and bearings, and experiments (Ref. 11) have shown that water contamination can significantly reduce the anti-corrosion, film formation, and friction-reducing properties of oil.

Influence of Metallurgy

Gears have maximum micropitting resistance when made from steel with sufficient hardenability to obtain microstructures consisting primarily of tempered martensite. Retained austenite of about 20% is thought to be beneficial. Retained austenite greater than 30% generally reduces hardness, strength and compressive residual stress in carburized gears, and is therefore detrimental to micropitting resistance.

Carburized gears are usually hobbed, carburized, hardened and ground, so their tribological properties depend on characteristics of ground surfaces. But some carburized, nitrided and induction-hardened gears are not ground after hardening, and their surfaces may be hard and rough. These surfaces are likely to produce micropitting on mating gears. However, if heat treat distortion is adequately controlled—and tooth surfaces are smooth—heat-treated surfaces can be resistant to micropitting. Oxidation at the surface and along grain boundaries might actually be beneficial. The oxide layer formed during heat treatment might provide boundary-film protection similar to a solid lubricant and provide protection during run-in.

Conclusions

- Understanding the morphology of micropitting is the key to determining the primary failure mode and root cause of failure.
- Like macropitting, micropitting cracks grow opposite the direction of sliding at the gear tooth surface. Consequently, the cracks converge near the pitch line of the driver and diverge near the pitch line of the driven gear.
- Metallurgical sections cut transversely through micropits show that cracks start at or near the gear tooth surface and grow at a shallow angle—typically 10–30°, but sometimes as steep as 45° to the surface.
- Gear teeth dedenda have negative sliding; i.e., the direction of rolling velocity is opposite sliding velocity. Negative sliding is significant because it promotes Hertzian fatigue by allowing oil to enter surface cracks where it accelerates crack growth by the hydraulic-pressure-propagation mechanism.
- Because slide directions reverse as the pitch line is crossed, micropitting cracks grow in opposite directions above and below the pitch line. When micropitting grows across the pitch line it makes the pitch line readily discernible because opposite inclinations of the floors of micropit craters scatter light in opposite directions above and below the pitch line.
- Micropitting begins by attacking high points on gear tooth surfaces such as crests of undulations, peaks of cutter scallops, ridges of grinding lay, and edges of grinding scratches. Tractional stress from sliding causes material to flow over the micropit craters and form a feather-edge at the exit-side of the craters.
- If the pinion and wheel were initially accurate and had little run-out, micropitting damage might be similar from tooth to tooth. In these cases micropitting patterns can be interpreted in much the same way contact patterns are used to assess gear tooth alignment and load distribution.
- When micropitting damage varies from tooth to tooth, it usually means there are tooth-to-tooth variations in tooth geometry or surface roughness. Gear sets with non-hunting gear ratios might develop micropitting patterns that repeat at the frequency of a common factor of the tooth combination. For example, a gear set with a 25/55–tooth combination, and a common factor of five, might have similar micropitting on every fifth tooth.
- There might be micropitting only on the pinion, only on the wheel—or both. Generally, the gear with the roughest surface causes micropitting on the mating gear—especially if it is harder than the mating gear.

Micropitting is most damaging when the opposing surface is rough, harder and faster; micropitting resistance improves when the harder surface is made smooth.

Micropitting might occur at GSC such as:

- Edges of gear teeth
- Ends of bearing rollers
- Boundaries of surface defects, such as macropitting, scuffing, fretting corrosion, or debris dents
- Tip-to-root interference at the SAP
- Corners of tip relief
- Wherever the EHL film is disrupted
- Micropitting in rolling-element bearing components has a directional randomness that is different from the more directionally oriented micropitting typical in gear teeth. This is probably caused by differences in sliding directions, which are more random in rolling-element bearings than in gears.

Figure 16 Micropitting on CRB IR of wind turbine HS pinion.

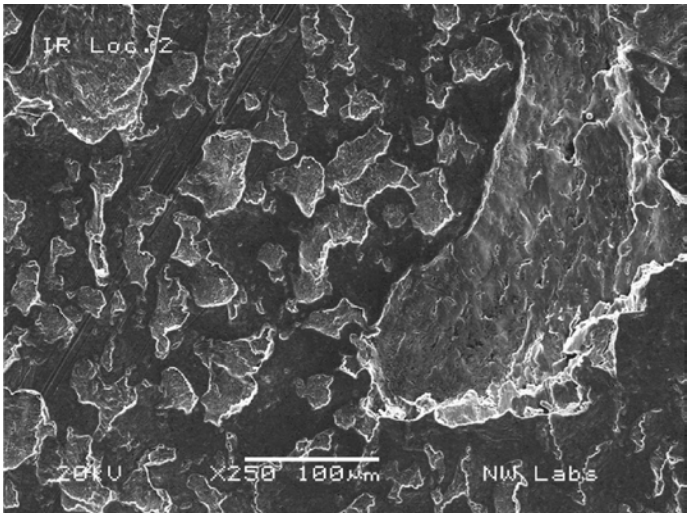


Figure 17 SEM image of micropitting on pinion (courtesy of Northwest Labs).

Figure 18 Scuffing on CRB roller from wind turbine INT pinion bearing.

- Micropitting resistance is strongly affected by lubricant properties, especially the base oil type, viscosity at the operating temperature, and the lubricant chemistry. Anti-wear additives are generally detrimental to micropitting resistance primarily because they inhibit run-in and preserve damaging roughness. However, some friction-reducing additives are beneficial.
- Oil cleanliness must be maintained to avoid micropitting caused by debris dents. Furthermore, water contamination promotes micropitting in gears and bearings, and significantly reduces the anticorrosion, film formation and friction-reducing properties of oil.
- With FZG PT–C gears, PSO macropits initiate at the cusp formed by tip-to-root interference, whereas With FZG GF–C gears, their rougher surfaces cause more severe micropitting that removes the cusp at the SAP and thereby prolongs the macropitting life until PSO macropitting occurs near the pitchline because of GSC caused by the step in the tooth profile at the upper edge of the micropitting crater. Consequently, in the FZG GF–C test, a lubricant with superior micropitting resistance might give a shorter macropitting life than a lubricant with inferior micropitting resistance.

Table 1—Metallurgy and finished method

Figure No.	Steel alloy	Heat treatment	Surface hardness	Finishing method
5	17CrNiMo6	Carburize	59 HRC	Form ground
6	17CrNiMo6	Carburize	58 HRC	Form ground
7	AISI 4320H	Carburize	59 HRC	Skive hobbed
8	17CrNiMo6	Carburize	58 HRC	Form ground
9	AISI 8620H	Carburize	58 HRC	Shaved
10	AISI 9310H	Carburize	60 HRC	Form ground
11	17CrNiMo6	Carburize	59 HRC	Form ground
12	AISI 8620H	Carburize	58 HRC	Shaved
13	16MnCr5	Carburize	60 HRC	MAAG 0° ground
14	16MnCr5	Carburize	60 HRC	MAAG 0° ground
15	17CrNiMo6	Carburize	60 HRC	Form ground
16	AISI 52100	Though hard	60 HRC	Ground
17	AISI 52100	Though hard	60 HRC	Ground
18	AISI 52100	Though hard	60 HRC	Ground
19	AISI 52100	Though hard	60 HRC	Ground
21	AISI 8620H	Carburize	58 HRC	Form ground

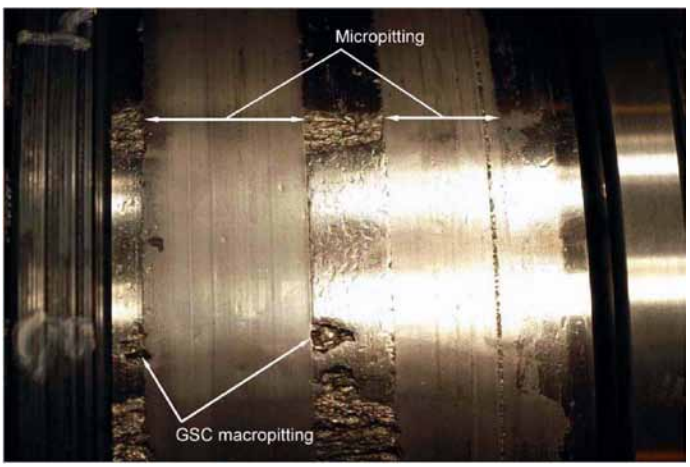


Figure 19 Micropitting on CRB IR from a wind turbine INT pinion bearing.

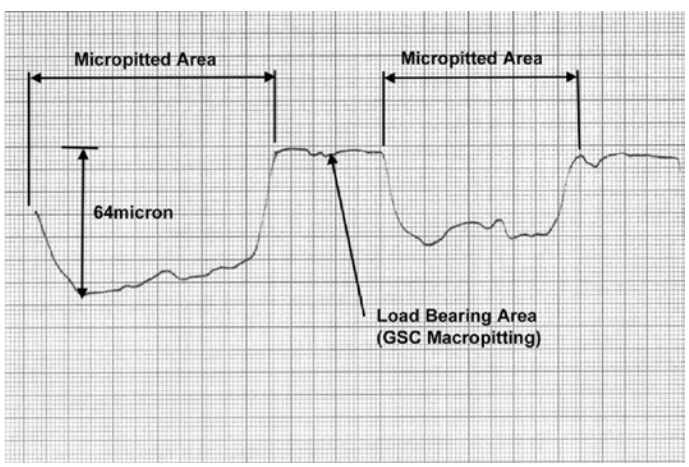
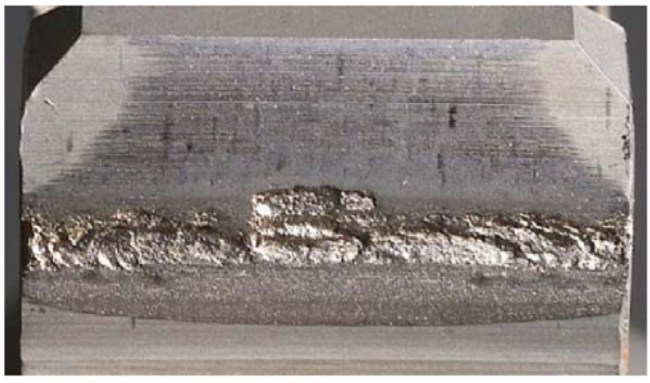


Figure 20 Axial profile of CRB IR from wind turbine INT bearing.

- Gears have maximum micropitting resistance when made from steel with sufficient hardenability to obtain microstructures consisting primarily of tempered martensite. Retained austenite of about 20% is thought to be beneficial.

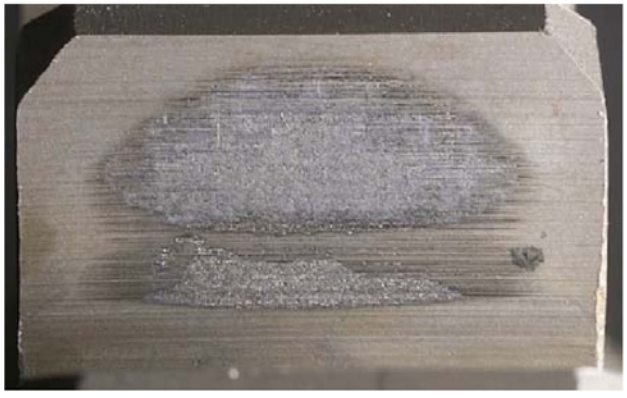
References

1. Way, S. "Pitting Due to Rolling Contact," ASME Trans., *Journal of Applied Mechanics, Vol. 57*, pp. A49–A114, 1935.
2. Littmann, W. E. "The Mechanism of Contact Fatigue—An Interdisciplinary Approach to the Lubrication of Concentrated Contacts," SP–237, NASA, pp. 309–377, 1970.
3. Errichello, R.L., C. Hewette and R. Eckert. "Point-Surface-Origin Macropitting Caused by Geometric Stress Concentration," AGMA Paper 10FTM11, Oct., 2010.
4. FVA Information Sheet. "Micropitting," No. 54/7, July 1993, Forschungsvereinigung Antriebstechnik e.V., Lyoner Strasse 18, D–60528 Frankfurt/Main, pp. 1–8, 1993.
5. Jao, T.C., et al. "Influence of Surface Roughness on Gear Pitting Behavior," AGMA Paper 04FTM4, Oct. 2004.
6. Li, S., et al. "Investigation of Pitting Mechanism in the FZG Pitting Test," SAE Paper 2003–01–3233, 2003.
7. Buzdygon, K.J. and A.B. Cardis. "A Short Procedure to Evaluate Micropitting Using the New AGMA-Designed Gears," AGMA Paper 04FTM7, Oct., 2004.
8. Errichello, R. "Selecting Oils with High-Pressure-Viscosity Coefficient," *Machinery Lubrication, Vol. 4, No. 2*, pp. 48–52, Mar.–Apr. 2004.
9. Laine, E., A.V. Olver, M.F. Lekstrom, B.A. Shollock, T.A. Beveridge and D.Y. Hua. "The Effect of a Friction Modifier Additive on Micropitting," *Tribology Transactions, Vol. 52, No. 4,* pp. 526–533, Jul.–Aug. 2009.
10. Errichello, R. and J. Muller. "Oil Cleanliness in Wind Turbine Gearboxes," *Machinery Lubrication, Vol. 2, No. 4,* pp. 34–40, Jul.–Aug. 2002.
11. Devlin, M., et al. "The Effect of Water Contamination and Oxidation on the Fatigue Life Performance of Wind Turbine Lubricants," presented at the NLGI 70th Annual Meeting, Hilton Head Island, SC, pp. 1–10, Oct. 26–29, 2003.

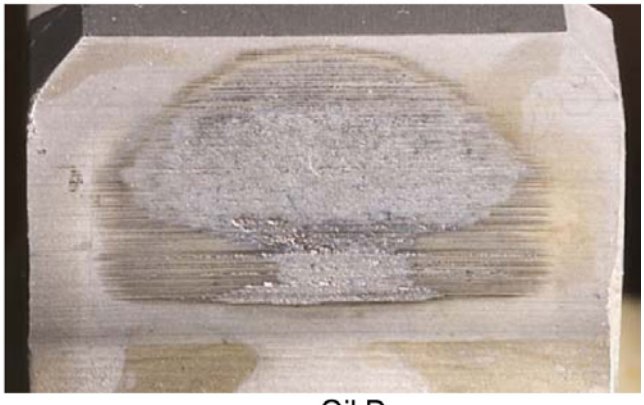


Oil A

Oil B



Oil C



Oil D

Oil E

Oil F

Oil G

Figure 21 Influence of oil type on micropitting (courtesy of ExxonMobil).

Robert Errichello, PE, heads his own gear consulting firm—GEARTECH—and is a founder of GEARTECH Software, Inc. A graduate of the University of California at Berkeley, he holds B.S. and M.S. degrees in mechanical engineering and a master of engineering degree in structural dynamics. In his more than 30 years of industrial experience, Errichello worked for several gear companies; he has also been a consultant to the gear industry for more than 20 years and has taught courses in material science, fracture mechanics, vibration and machine design at San Francisco State University and the University of California at Berkeley. He is also a member of ASM International, STLE, ASME Power Transmission and Gearing Committee, AGMA Gear Rating Committee and the AGMA/AWEA Wind Turbine Committee. Errichello has published dozens of articles on design, analysis and the application of gears, and is the author of three widely used computer programs for the design and analysis of gears. He is also a longtime technical editor for *Gear Technology* magazine and STLE Tribology Transactions, and has presented numerous seminars on design, analysis, lubrication and failure analysis of gears. Errichello is a past recipient of the AGMA TDEC award and the STLE Wilbur Deutch Memorial award.

Predicted Scuffing Risk to Spur and Helical Gears in Commercial Vehicle Transmissions

Carlo H. Wink

AGMA925–A03 scuffing risk predictions for a series of spur and helical gear sets of transmissions used in commercial vehicles ranging from SAE Class 3 through Class 8.

Introduction

The risk of gear tooth scuffing in commercial vehicle transmissions has gained more attention because of increasing demand for fuel-efficient powertrain systems in which diesel engines run at lower speeds, power density is higher, and lubricants are modified to improve efficiency and compatibility with components of new technologies, such as dual-clutch transmissions.

Accordingly, predicting scuffing risk during the design phase is vital for the successful development of commercial vehicle transmissions. AGMA 925–A03 (Ref. 1) is a comprehensive method for predicting the probability of gear scuffing. This paper presents the AGMA 925–A03 (Ref. 1) scuffing risk predictions for 50 spur and helical gear sets in transmissions used in commercial vehicles ranging from SAE Class 3 through Class 8. Limiting scuffing temperatures using two mineral and three synthetic gear lubricants was determined from FZG scuffing tests. The risk of scuffing was determined for each gear set according to AGMA 925–03 (Ref. 1). The predictions were compared with field and warranty data, and dynamometer test results. The predictor was correct in all cases. High scuffing risk was predicted for gears known to scuff, and low scuffing risk was predicted for all other cases with no history of scuffing. The document correlation between prediction, test results and actual usage instills confidence in the predictor of scuffing risk for gears in commercial vehicle transmissions.

Background

Scuffing failure causes localized damage to gear teeth, resulting in matte and rough finishes of the contacting surfaces, and tooth form changes as well. This type of damage generally occurs in the tooth contact zone where contact pressure and sliding velocity are high, far from the pitch line. The tooth damage can increase vibration and noise, compromise gear load capacity, ultimately leading to catastrophic failures (Ref. 2). As a severe adhesive wear phenomenon, scuffing occurs when the oil film thickness between the tooth contacting surfaces is insufficient to prevent metal-to-metal contact, which in turn causes local welding and subsequent tearing. Metal particles are transferred between the two surfaces or lost from them; they scratch tooth flanks in the sliding direction. Scuffing is not a fatigue phenomenon, as it may occur at the beginning of the operation (Refs. 3–4).

There are several analytical methods for predicting scuffing risk; however, the threshold for determining whether a gear set will scuff remains mostly dependent on empirical results.

The method of evaluating scuffing risk in AGMA 925–A03 (Ref. 1) is a function of oil viscosity and additives; operating bulk temperature of the gear; sliding velocity; surface roughness of gear teeth; gear materials and heat treatments; and surface pressure. The risk of scuffing is defined by comparing the calculated tooth contact temperature with the limiting scuffing temperature; this is done via gear scuffing tests for each gear lubricant.

Contact Temperature Calculation

Flash temperature across the tooth contact path is calculated by Blok's Equation 1.

$$\theta_{fl(i)} = 3162\, K\, \mu_{m(i)} \frac{X_{\Gamma(i)}\, w_n}{\left(b_{H(i)}\right)^{0.5}} \frac{v_{r1(i)} - v_{r2(i)}}{B_{M1}\left(v_{r1(i)}\right)^{0.5} B_{M2}\left(v_{r2(i)}\right)^{0.5}} \quad (1)$$

where

$\theta_{fl(i)}$ is flash temperature, °C;

K is 0.80, a numerical factor for the Hertzian distribution of frictional heat over the instantaneous contact band width;

$\mu_{m(i)}$ is mean coefficient of friction;

$X_{\Gamma(i)}$ is load sharing factor;

w_n is normal unit load, N/mm;

$v_{r1(i)}$, $v_{r2(i)}$ are rolling tangential velocities in m/s of the pinion and gear respectively, m/s

B_{M1}, B_{M2} are 13.6 $N/(\text{mm}^2 K)$, thermal contact coefficient of steel;

$b_{H(i)}$ is the semi-width of the Hertzian contact band, mm;

i is a subscript of line-of-action points

Contact temperature at each line-of-action point is given by Equation 2.

$$\theta_{B(i)} = \theta_M + \theta_{fl(i)} \quad (2)$$

where

$\theta_{B(i)}$ is contact temperature, °C;

θ_M is the tooth temperature, in °C, which is the temperature of the tooth surface before it enters the contact zone. The tooth temperature can be estimated by calculation, testing or experience.

In terms of calculation of the tooth temperature, it can be estimated by Equation 3.

$$\theta_M = k_{sump}\,\theta_{oil} + 0.56\,\theta_{fl\,max} \quad (3)$$

where

k_{sump} is 1 for splash lube and 1.2 for spray lube;
θ_{oil} is oil supply or sump temperature in °C;
$\theta_{fl\,max}$ is the maximum flash temperature found over all line–of–contact points i (Eq. 1).

The maximum contact temperature is obtained by Equation 4.

$$\theta_{B\,max} = \theta_M + \theta_{fl\,max} \quad (4)$$

where

$\theta_{B\,max}$ is maximum contact temperature, °C.

When the maximum contact temperature is closer to or higher than the limiting scuffing temperature, scuffing may occur.

Limiting Scuffing Temperature

The limiting scuffing temperature is the tooth contact temperature at which scuffing is likely to occur, given a combination of lubricant and gear material (Ref. 1). It can be obtained from gear scuffing tests, such as FZG tests—an industry standard test used worldwide to rate different lubricants for scuffing resistance. The FZG test method per CEC L–84–02 (Ref. 6) was developed by the Coordinating European Council (CEC) and is extensively used by the automotive and petroleum industries in Europe and throughout the world.

The FZG gear test rig is operated at constant speed for a fixed period of time at successively increasing loads until the failure criteria is reached. The test gears are then examined for scuffing damage to the gear tooth flanks both before and after the prescribed duration at each load stage. The test gear fails when the sum of the scuffed area widths on all teeth exceeds the gear face width (Ref. 3).

In 2004 the Eaton Corporation Vehicle Group developed an extensive project to investigate industry-standard scuffing test methods to and correlate their results with different gear lubricants in transmission tests in dynamometers. The investigation was motivated by longer oil drain intervals and new lubricants being used in Eaton transmissions. Under these conditions the former ASTM D5182–9 (Ref. 3) method did not correlate with known scuffing occurrences.

The FZG method defined by CEC L–84–02 (Ref. 6) and designated as A10/16.6R/120 yielded consistent results and true agreement with dynamometer tests. Eaton Corp. has since adopted this test method as part of its internal procedure for gear lubricant qualification and approval.

The A10/16.6R120 stands for A-type gear geometry, 16.6m/s pitch line velocity, and a sump temperature of 120°C. The A-type gear is designed with longer addendum geometry to generate high sliding velocity, and is manufactured with only a 10 mm face width to increase the contact stress so that the scuffing could be more easily produced than with the 20 mm face width. The 10 mm face width gear test is commonly referred to as the "half-tooth, double-speed test." Figure 1 shows a FZG A-type gear after a test.

Scuffing Risk Prediction

When the maximum contact temperature is close to or above the limiting scuffing temperature for the combination of lubricant and gear material, scuffing is likely to occur. The probability of scuffing can be predicted by comparing the contact temperature with the limiting scuffing temperature. The AGMA 925–A03 probability of scuffing is obtained from a Gaussian distribution of scuffing temperature assuming a 0.15 coefficient of variation. The contact temperature is a random variable, the limiting scuffing temperature is the mean value of the random variable, and the standard deviation of the random variable is assumed to be 0.15 of the scuffing temperature. AGMA 925–A03 (Ref. 1) then proposes a criterion to assess the risk of scuffing based on its calculated probability (Table 1).

Application Examples

In this study, 50 gear sets were evaluated using the AGMA 925–A03 scuffing risk method (Ref. 1). Twenty-four spur gear sets and 26 helical gear sets, whose helix angles were between 12–33°, were evaluated. The gear sets are used in nine different models of commercial vehicle transmissions, with up to 18 forward speeds and transmission torque capacity between 420 Nm–2500 Nm. Their applications include light-duty pick-up trucks, delivery trucks, buses and vocational and heavy-haul trucks.

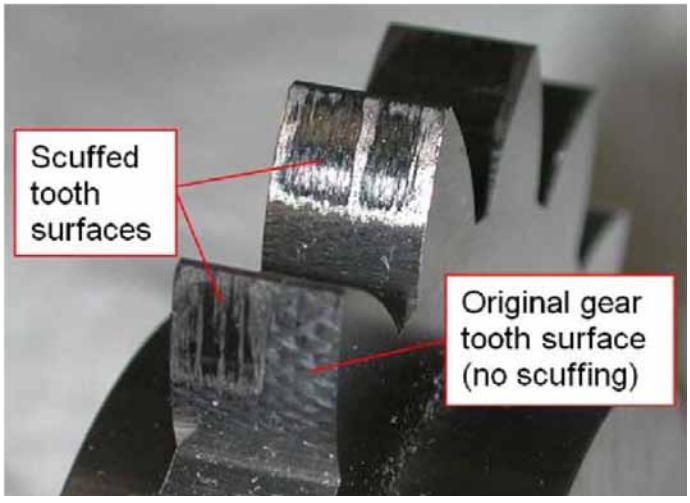


Figure 1 FZG A-type gear after test.

Table 1 Scuffing risk per AGMA 925–A03

Probability of scuffing	Scuffing risk
< 10%	Low
10% to 30%	Moderate
> 30%	High

Figures 2 and 3 show basic geometric and operating parameters of the gear sets, such as module, pressure angle, contact ratio, pitch line velocity and sliding velocity.

All gears were of case-hardened steel with a surface hardness of 58–63HRc. Among the gear sets, three tooth flank finish processes were used—1) shaving: surface roughness Ra = 1.25 mm; 2) honing: Ra = 0.40 mm; and 3) CBN grinding: Ra = 0.63 mm.

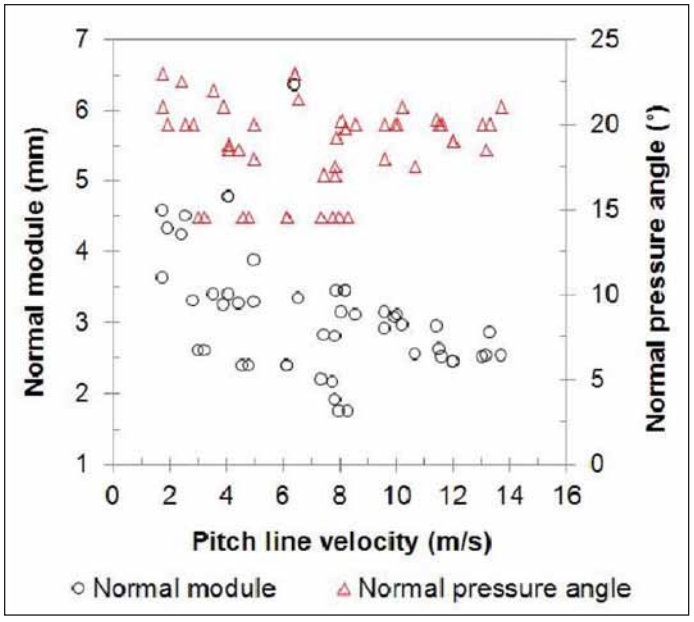


Figure 2 Characteristics of studied gear sets.

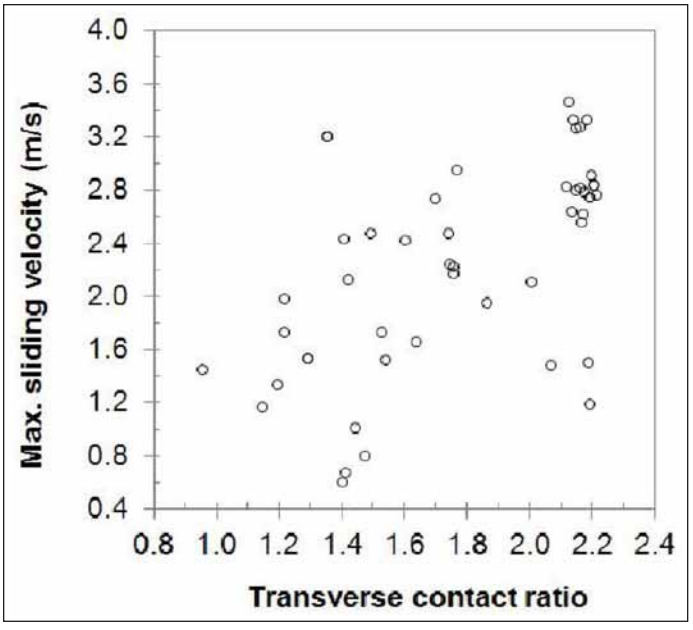


Figure 3 Sliding velocity and transverse contact ratio of gear sets.

The flash temperature was calculated for each gear set using Equation 1 for 25 line-of-action points, as recommended by AGMA 925–A03 (Ref. 1).

The coefficient-of-friction (COF) was calculated with the formulae in AGMA 925–A03 (Ref. 1) for an approximation of the COF by a constant. The COF was calculated with the average surface roughness of the pinion and gear teeth, and was assumed constant along the line-of-action. The maximum COF value was limited to 0.11. The effect of the COF on the maximum contact temperature predicted by the analytical model was investigated for one of the gear sets. The COF was arbitrarily changed from 0.03 to 0.11, and the contact temperature calculated.

The results showed that small variations on the COF may not significantly affect contact temperature results. For example, a 10% variation of a 0.10 COF caused the maximum contact temperature to vary only about 6% (Fig. 4). However, more pronounced COF changes—e.g., changing finish processes and obtaining much smoother surfaces—can significantly affect maximum contact temperature.

Another uncertainty when calculating the contact temperature of gear sets used in commercial vehicle transmissions was the load condition for the calculation; i.e.—torque and speed, or power. Vehicles powered with combustion engines run under a certain power regime, which is a function of the characteristic engine power curve. In typical engine power curves the point of maximum power does not match the point of maximum torque. Typically, the maximum torque is at a lower engine speed than the maximum power point. In order to find the critical load

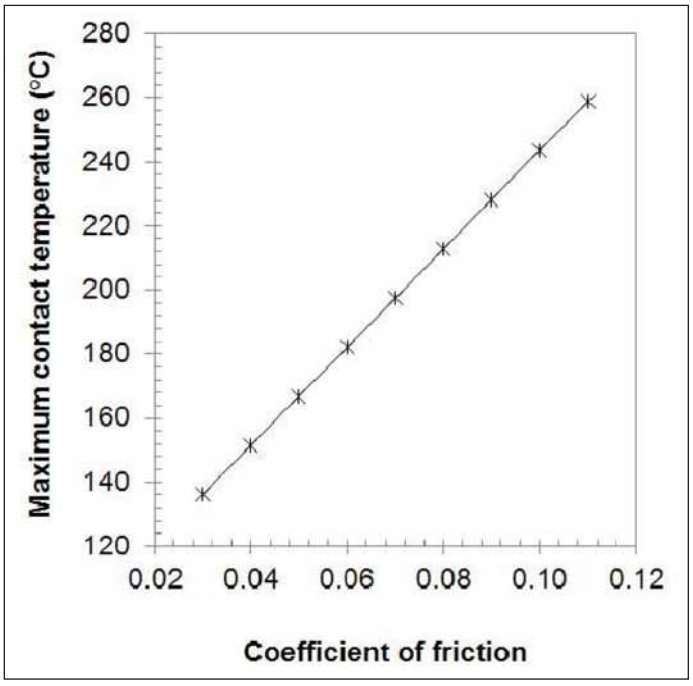


Figure 4 Effect of coefficient of friction on contact temperature results.

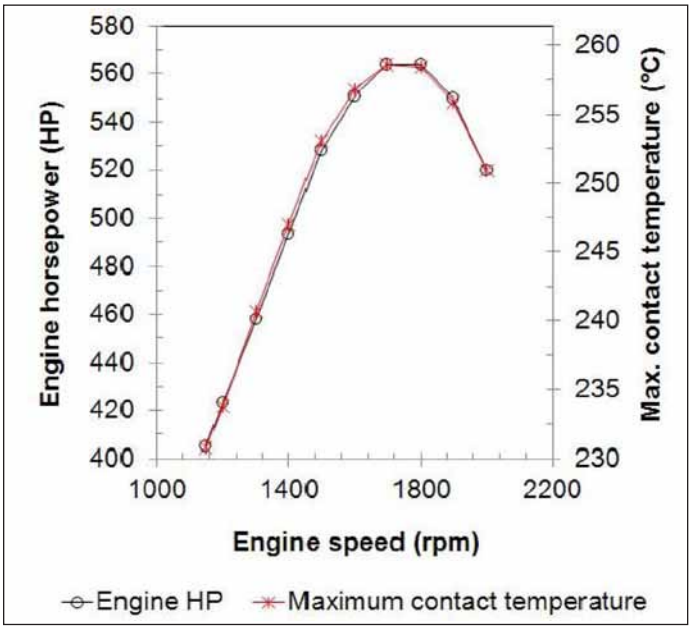


Figure 5 Effect of engine power on contact temperature results.

Table 2 Gear lubricants					
Gear lubricants	**1**	**2**	**3**	**4**	**5**
Oil base	Synthetic	Mineral	Synthetic	Mineral	Synthetic
Viscosity index (ASTM D227)	151	194	146	164	150
Kinematic viscosity @ 40°C (mm2/s)	135.0	33.8	132.0	51.0	40.5
Kinematic viscosity @ 100°C (mm2/s)	18.2	7.6	17.5	9.1	7.4
Scuffing failure load stage of FZG test*	3	6	9	7	6

* FZG A10-16.6R120

condition for scuffing, the maximum contact temperature was calculated to 10 points along the engine power curve (Fig. 5).

The maximum contact temperature followed the engine power curve; i.e., as power increases, so, too, the contact temperature. The maximum value of contact temperature was obtained at maximum engine power. Based on the results, all calculations were made at maximum engine power rather than at peak torque.

Five different gear lubricants were used in this study—two mineral and three synthetic lubricants. Table 2 shows the basic characteristic of the gear lubricants and their load stage (the torque at that stage of the test) at which scuffing occurred.

The limiting scuffing temperature was then calculated for the FZGA-type gear (A10/16.6R120) at the scuffing failure load using the AGMA 925–A03 method, which was implemented into a spreadsheet.

With the scuffing temperature defined for each one of the five gear lubricants in Table 2, and the maximum contact temperature calculated for each of the 50 gear sets, the scuffing risk was determined by comparing contact temperature and scuffing temperature. Two approaches were taken for this: 1) the ratio of contact temperature and scuffing temperature was calculated and named "scuffing ratio"; ratios close or above one usually indicate that scuffing is likely to occur; and 2) the risk of scuffing was assessed as low, moderate or high, based on the probability of scuffing defined in AGMA 925–A03 (Ref. 1).

Among the 50 gear sets studied, four showed scuffing failures in both dynamometer tests and in the field (Fig. 6).

Figures 7 and 8 show the scuffing ratio and probability of scuffing, respectively, for all 50 gear sets. The four scuffed gear sets are identified in red and with an asterisk in front of the results in Figures 7 and 8.

Scuffing ratios closer to, and above, one, were predicted for all four gear sets in which scuffing failures were known (Fig. 7). However, looking at the scuffing ratio only can lead one to think that scuffing could occur on gear set Number 5, which has a scuffing ratio of around 0.9.

This pointed out the advantage of using AGMA 925–A03 probability of scuffing (Fig. 8). The results clearly show a high risk of scuffing—greater than 30%—to all four gear sets at which scuffing was observed.

Looking at gear set Number 5, its probability of scuffing is around 20%, which is classified as moderate risk in AGMA 925–A03 (Ref. 1). Thus, a clearer assessment can be done using the probability of scuffing recommended in the AGMA standard.

Figure 6 Scuffed gear set from dynamometer test.

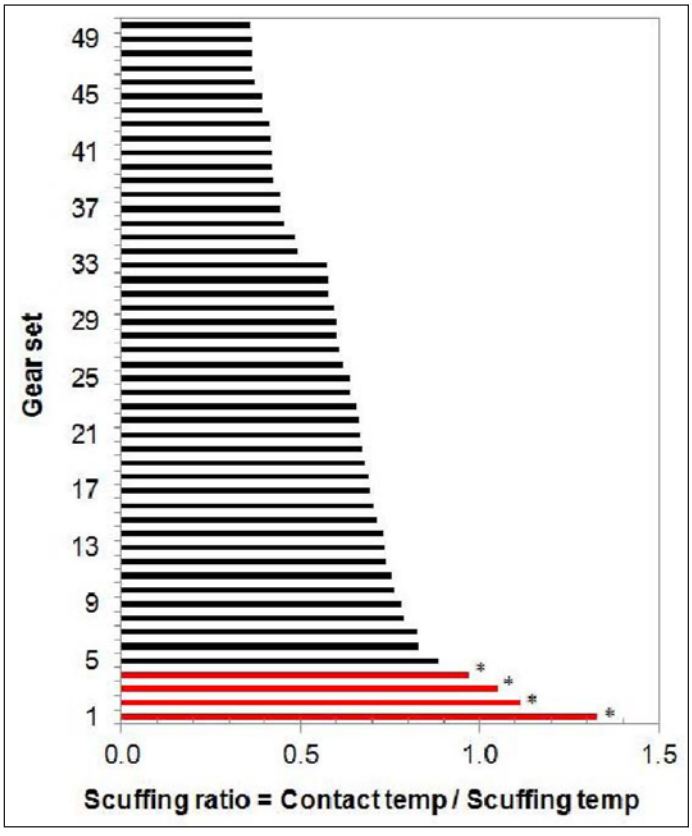


Figure 7 Scuffing ratio results (scuffed gear set).

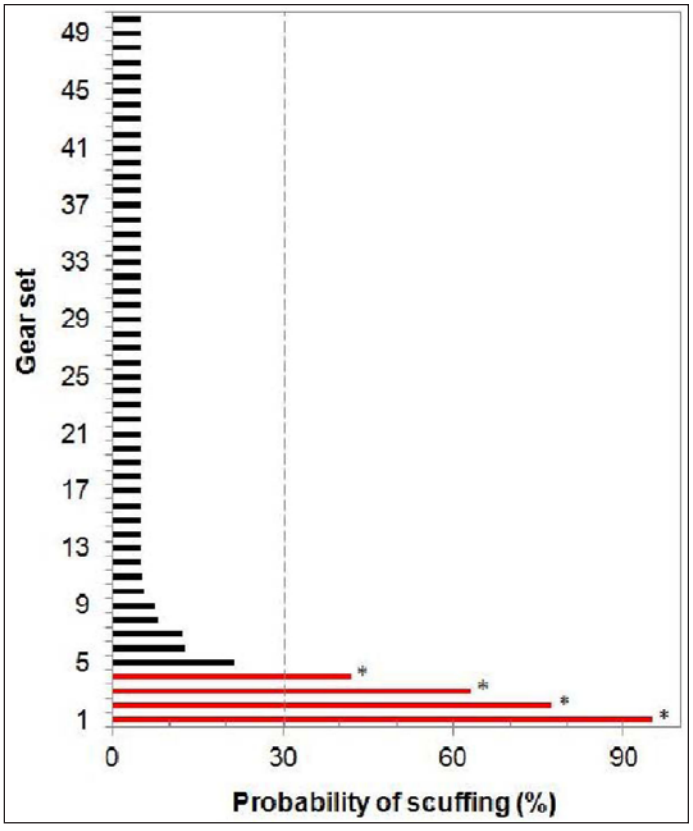


Figure 8 Probability of scuffing: > 30% = high risk (*scuffed gear set).

Discussions

The AGMA 920–A03 standard was used to predict the scuffing risk of 50 spur and helical gear sets in nine transmission models, which are applied to commercial vehicles ranging from SAE Class 3 through Class 8. Scuffing temperatures of two mineral and three synthetic gear lubricants were defined, based on FZG test results. Scuffing risks were assessed based on the probability of scuffing according to AGMA 925–A03. The results indicated that the AGMA 925–A03 is indeed effective and consistent in predicting scuffing risk, as evidenced by the good match to dynamometer and field results for the known scuffed gears, and also for the gears with no history of scuffing failures. The agreement between prediction, test results and actual usage provides confidence in the predictor of scuffing risk of gears in commercial vehicle transmissions.

Acknowledgments. The author thanks the Eaton Corporation Vehicle Group for support on the development of this paper.

References

1. AGMA 925–A03. Effect of Lubrication on Gear Surface Distress.
2. Townsend, D. P. *Dudley's Gear Handbook*, McGraw-Hill, 2nd Edition, 1992.
3. ASTM D5182–9. Standard Test Method for Evaluating the Scuffing Load Capacity of Oils.
4. Davoli, P., E. Conrado and K. Michaelis. "Recognizing Gear Failures," *Machine Design* magazine, June 2007.
5. ANSI/AGMA2001–D04. Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth.
6. CEC L–84–02. FZG Scuffing Load-Carrying Capacity Test for High-EP Oils, the Coordinating European Council for the Development of Performance Tests for Fuels, Lubricants and Other Fluids, October 2007.

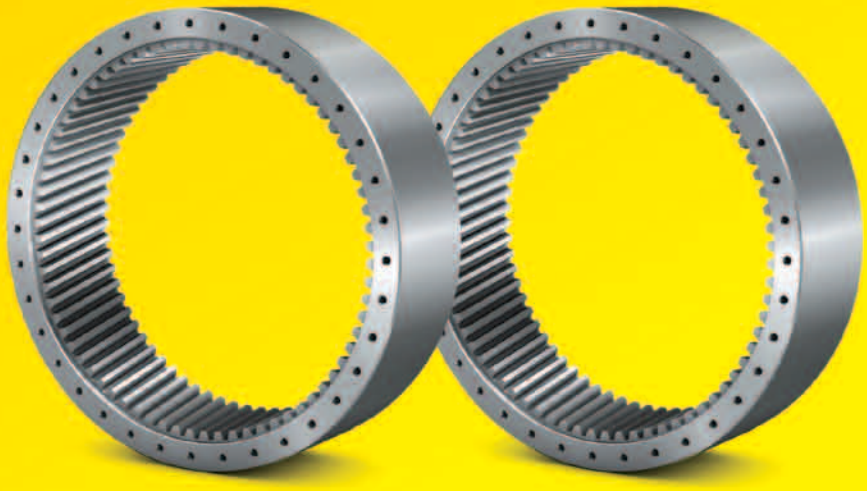
Carlos H. Wink is gear engineering manager at Eaton Corporation's Global Center of Excellence (Automotive) near Kalamazoo, Michigan, where he previously worked as a senior gear specialist. Wink has been with Eaton's Vehicle Group since 1985. He is also an AGMA member and the author of numerous technical papers.

CORRECTION

A Technical Paper in the October *Gear Technology*—"**Pitting Resistance of Worm Gears: An Advanced Model for Contact Pattern of Any Size, Position or Flank Type,**" by Dr. Karsten Stahl, Dr. Bernd-Robert Höhn, Dr. Joerg Hermes and Alexander Monz, was incorrectly attributed. Attribution should have read:

This article appeared previously—and exclusively—(in German) in the April 2012 issue of Antriebstechnik.

Can you see the difference?



The ring gear to the right takes 20% less time to machine.

How is that possible? CoroMill® 170 is a high performance cutter for large gears in module range 12-22. In combination with our latest grades, your gear machining simply is more efficient, leaving minimal and even allowance for subsequent operations. Use it for precision and reliability in roughing of external and internal gears.

Sound interesting? It's just one solution we have for gear machining. Visit www.sandvik.coromant.com/us or better yet, get in touch with a Sandvik Coromant specialist at **1-800-SANDVIK.**

Think smart | Work smart | Earn smart

SANDVIK Coromant

Your success in focus

Heller Machine Tools

MARKS 30 YEARS IN THE UNITED STATES

In 2012, Heller Machine Tools marked its 30th year of operations in the United States as a subsidiary of Gebr. Heller Maschinenfabrik, Nurtingen, Baden-Wurtemberg, Germany. Heller worldwide is a 600-milion-euro company with approximately 3,000 employees. The company specializes in designing and building high-precision flexible production systems for the powertrain operations of automotive and heavy-diesel industries, primarily. In 2012 the U.S. company expects to double sales over 2011, which was a record for the operation, and is about a third of the global total for Heller.

Heller has increased the U.S. content of the systems it produces, partly due to the cost advantages of producing the systems in the United State as compared to Europe. The company has helped to increase the amount of manufacturing technology produced and exported from Michigan, some systems shipping to China for major automotive companies and suppliers. More than 60 percent of the content of the systems produced at Heller Troy is sourced in Michigan.

The company is a full-line manufacturer in Michigan, designing, building, and servicing its machines from its 100,000-sq-ft facility in Troy. There are 130 employees at Troy working alongside 60 contractors. The company estimates it supports several thousand additional employees in 50 or more supplier companies in Michigan.

A specialty of Heller is the machining of compact graphite

iron, a very hard material cast into large diesel engine blocks. Machining CGI requires a very stable, heavy-duty machine tool, and Heller CGI machining centers have been placed in nearly all heavy-duty diesel engine and others.

Heller began its operations in the United States in 1982 in Elk Grove Village, Illinois, primarily as an importer and servicer of its crankshaft milling machines it was then selling to Ford, Deere, Caterpillar and Chevy Bay City plants. Its first generation of horizontal machining center, the BEA, was developed and first sold in 1986. Since then, the company has become the largest European manufacturer of horizontal machining centers. Originally, the company designed and produced its own CNC control for the machining centers. Now, most controls are Siemens or Fanuc, depending on customer preference.

In 1995, Heller management in Germany decided to move to the Detroit area as it was increasing its role as a supplier to the automotive industry. The thinking then was that "the auto industry will always need machine tools." So it built a plant in Troy, expanding it three times since 1996 to create more assembly space, engineering offices and service capability for repairs, machine rebuilds, and spare parts. The company has, in the last 30 years, shipped over 1,500 machining centers from its U.S. operations.

In 2000, Heller introduced the MC and MCH lines of machining centers, designed for production of heavy precision components. Heller also began producing flexible transfer lines at Troy, the first systems going to American Axle in Buffalo and Three Rivers, Michigan. In 2006, the company earned its first large flexible machining system order, comprised of 64 machining centers and ancillary equipment including automation. The system, for Detroit Diesel in Redford, Michigan, is producing that company's new generation family of three heavy diesel engines.

Since 2006, Heller has taken on multiple turnkey flexible system projects, which has accounted for its rapid sales growth in the United States to $200 million. The company is staffed today for all sales, proposal engineering, mechanical and electrical engineering, service and assembly functions—full service from Heller in Troy to the transportation industry.

Important to Heller in Germany as well as in Troy, apprenticeships in manufacturing are the source of future skilled employees. Currently, eight persons are engaged in manufacturing apprenticeships, from tooling to project management. The company in Troy also sponsors engineering internships with three candidates in various engineering disciplines. The company finds it is best to train and develop skilled workers from within rather than hiring from a competitor. For more information, visit *www.heller-us.com*.

Micro Precision

FOCUSES ON NADCAP ACCREDITATION

When it comes to industrial quality procedures, aerospace is one of the most demanding. Every component must be checked, tested and logged to an incredible level of detail and, just as importantly, all processes, procedures and standards documented to ensure traceability to a depth many engineers would find baffling. As a result of these quality demands, the vast majority of precision aerospace components are made in-house. Those that aren't, and there aren't many, are manufactured by companies prepared to have their products, processes and procedures regularly run through with a fine-tooth comb.

One of the key quality standards for the aerospace industry is Nadcap, managed by PRI, a non-profit organization set up to address the development of performance standards and the administration of quality assurance, accreditation and certification programs. Nadcap is described by PRI as "an international, independent manufacturing process and product assessment and certification service for the purpose of adding value, reducing total cost and facilitating relationships between subscribers and suppliers."

In short, it manages a set of common standards set by various bodies in the aerospace industry and then ensures that those certified comply fully with their requirements. Going far and beyond most company's in-house quality procedures, Nadcap adds another level of detail to what is already an exacting science. Nadcap accreditation is not impossible; it just takes a certain mindset and work ethic that can see the positives in terms of reputation, self-improvement, orders and, of course, the bottom line.

Hemel-Hempstead-based Micro Precision is one company that has taken the plunge and has successfully operated two Nadcap-approved processes for the last few years at its 20,000-square-foot production and testing facility. The company has held Nadcap accreditation for chemical processing (nital etch inspection) since 2004 and NDT (Non Destructive Testing?) (magnetic particle and liquid penetrant testing) since 2006.

Micro Precision supplies a number of leading aerospace OEMs and Tier One suppliers with a selection of components, including motor cores for aerospace pumps and generators and geared components for multiple applications throughout the airframe. Using its Nadcap-accredited facilities, it is able deliver its customers with a level of confidence that they would normally only see by manufacturing these components in-house.

So, why did Micro Precision seek Nadcap accreditation? Peter Skelton, general manager explains: "We actually handle a fairly significant amount of aerospace work and the post- manufacturing testing of these components is vital. We used to have to (subcontract) the testing out, which lead to inevitable lead time issues and a heavy reliance on third parties. Therefore the decision was made to get our own accreditation as we realized that there would not only be time benefits, but it would also allow us to manage costs more effectively.

"It is an onerous task," he continues, "but if I am honest, it is not that far removed from the quality procedures we already had in place. We have never been a 'get it out of the door quick' company; we believe in doing a job right the first time and to a quality level that wins us repeat orders. Nadcap simply put an official stamp on what we were already doing."

The Nadcap qualification process involves multiple steps, the first of which is an eAudit, where companies complete a preliminary questionnaire. Once this has been completed and approved, the supplier then has to send a hard copy of its quality control manual and procedures to the auditor 30 days prior to the audit visit. The audit then takes place and any subsequent remedial action is performed. Once this is satisfactory and any identified non-conformance reports (NCRs) have been closed the accreditation status is determined by the Nadcap management council and a certificate is issued.

It may sound straightforward, but the level of detail being assessed by the auditor is daunting. "To us it is also an ongoing process," Skelton elaborates. "The initial audit is just the start of it. We are then subject to regular re-approval audits, the frequency of which is determined by our test scores. If you get a good score, the frequency of audits gets longer. We are currently in the second 18-month cycle and if our scores are satisfactory, we will move on to a 24 month cycle, which is a long as it gets. So, not only are we Nadcap-accredited, we are performing to such a level that they are confident enough to audit us every two years, rather than annually."

Is it worth it? "I think that the Nadcap certificate certainly makes us more attractive to other aerospace customers," Skelton explains, "but its benefits are not restricted to this industry

alone. Nadcap accreditation speaks volumes, it means that you are doing something to an exacting standard for one of the most demanding industries in the world, and this is certainly an appealing facet for other industries. We also do NDT and chemical processing for Formula One teams; they don't have their own industry standards, primarily due to their highly competitive business model, but Nadcap certainly paints a positive message for them.

"We are certainly proud of how far we have got in the timescale that we have been doing the processing and to get to the 24-month audit window is no mean feat. A new set of checklists for conventional machining is also being prepared by Nadcap, but has yet to be mandated by the major stakeholders as yet, but you can be sure that Micro Precision is geared up to address this as and when it arrives."

Terry Grubb, managing director, says: "Micro Precision has been in business for over 30 years, quietly supplying subcontract and make-complete engineering work to some of the highest profile commercial engineering operations in the world - from the latest generation of aircraft to Formula 1 cars. We have grown organically by providing an absolutely top-class service, and this has now allowed us to make this latest investment in new machinery and factory expansion in order to satisfy demand.

"As engineering production becomes ever more streamlined and tolerances and materials become ever more exacting, our value to our customers is on the increase, mainly because of our quality and our flexibility. If a customer requires just one part, manufactured to the same tolerances and put through the same test regime as a larger batch would, then we can do it. Low-to-medium volume production is our current forte, and having continually invested in the very latest high-accuracy machines, the best people and the most exacting approvals such as Nadcap, we believe we are in the right position to provide the type of precision engineering today's growth sectors demand."

For more information"
Micro Precision Limited
Duxons Turn
Hemel Hempstead
Herts
HP2 4SB
Phone: +(44) 1442 241027
www.microprecision.co.uk

Perly L. Hahn
(1948-2012)

Perly L. Hahn passed away on October 16, 2012. He is survived by his wife Gail and children Nathan and Melanie (Hahn) Dawkins. Also surviving are his mother, Doris Henderson, and three siblings (names unavailable). Hahn worked many years in the gear industry as a service engineer, dating back to the 1970s with Barber-Colman Company and later with the Pfauter Corporation. He subsequently moved on to Liebherr Gear Technology, Inc. (1986—2011), where he worked for 25 years until his retirement. However, Hahn continued working in the gear industry—with ITC—until his death. As a result of his long-term employment at Liebherr, along with his days at Barber-Colman and Pfauter, Hahn befriended many fellow workers who now mourn his passing. Everyone who knew Hahn testify to his wit and sense of humor. He will be sadly missed.

Klingelnberg
AWARDED DOCUMENTATION PRIZE

The Klingelnberg Group has received awards for the second year in succession for the quality of its operating instructions – this year with no fewer than four commendations. The company received prizes for all four of its submitted operating instructions.

"Due to the technical complexity of our machines, we naturally provide the users with very complex operating instructions, and precisely for this reason it is important to us that these are comprehensibly structured, formulated and illustrated in accordance with needs of our target groups," explains Pascal Kesselmark, head of technical documentation of the Klingelnberg Group.

Tekom (Gesellschaft für Technische Kommunikation e.V.) had previously awarded the company two prizes in 2011. The operating instructions for four machines were singled out for prizes this year: the Oerlikon spiral bevel gear cutting machine C 50, the Oerlikon tool grinding cell for bar blades B 27, the Oerlikon spiral bevel gear lapping machine L 60 and the Klingelnberg measuring center P 65.

Dr. Hartmuth Müller, CTO of the Klingelnberg Group, is absolutely delighted with the awards: "We regard them as a validation of our meticulous work in this area. For us it is not only a matter of simple compliance with the Machinery Directive, but far more a question of our responsibility towards the users: we supply instructions that enable safe utilization of the technology. Only then do they guarantee an intuitive and smooth

machine operation in conjunction with innovative control concepts."

Since 2005, Tekom has been awarding its renowned documentation prize, an independent prize recognizing user and operating instructions for consumer and investment goods as well as online help for software products. The reviewers take into account an extensive list of criteria that, with an eye on user-friendliness and operating safety, places special emphasis on: structure and text, illustrations, design/layout, safety instructions, navigation, scope, and a comparison between the documentation and the actual product.

Gleason and SMT

FORM STRATEGIC PARTNERSHIP

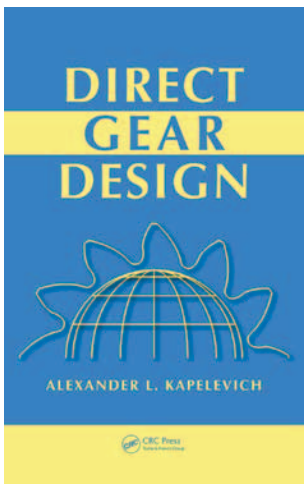
Gleason Corporation and Smart Manufacturing Technology (SMT) have formed a global strategic partnership to provide gear manufacturers worldwide a complete design to manufacturing system. Gleason and SMT will offer a system that seamlessly integrates SMT's premier System Design and Analysis Software (*MASTA*) with Gleason's software for Bevel Gear Design and Manufacturing (*CAGE*). Gear manufacturers will benefit from a fully integrated workflow when designing powertrains, gearboxes, transmissions and more. The first products from the cooperation will be available in the first half of 2013.

John J. Perrotti, president and chief executive officer of Gleason Corporation said, "We have great respect for SMT's capabilities and are excited about the integration of *MASTA* and *CAGE*, and providing designers and manufacturers of gears and power transmission drives with exciting new opportunities to enhance their processes and products. This is the first step in our partnership with SMT and we look forward to exploring other areas of mutual cooperation."

David Beedan, operations director of Smart Manufacturing Technology, adds, "Gleason Corporation has a distinguished history as the world leader in gear technology and we are delighted to be entering into this partnership to enhance the capabilities of both *CAGE* and *MASTA* to provide the user with a fully integrated design-to-manufacturing solution."

Kapelevich

TO RELEASE DIRECT GEAR DESIGN BOOK IN 2013



Direct Gear Design (Hardcover; 328 pp.; CRC Press) by Dr. Alex Kapelevich, will be available for online purchase—at both CRC Press ($129.95) and Amazon ($117.58) March 12, 2013. *Direct Gear Design* presents Kapelevich's copyrighted, alternative "direct gear design" approach and compares it to traditional methods. It covers all theoretical and practical matters of advanced gear geometry and outlines various optimization techniques for custom gear drive performance maximization. It explains asymmetric gear design and its benefits for various applications and provides real-world examples of direct gear design implementation. Direct Gear Design includes information on macrogeometry of gear, tolerancing and tolerance analysis, gear measurement, gear fabrication technologies and tooling and much more. Kapelevich is a consultant at AKGears, LLC and a regular contributor to *Gear Technology*. To order, visit *www.crcpress.com/product/isbn/9781439876183*; or *www.amazon.com/s/ref=nb_sb_noss?url=search-alias%3Daps&field-keywords=kapelevich*.

ANCA

WINS EXPORT AWARD

ANCA has won the Large Advanced Manufacturer category in Australia's Governor of Victoria Export Awards for the seventh time. According to the company, 2011 was an exceptional year of growth for ANCA, an Australian owned and based market leader in CNC tool and cutter grinder design and manufacturing. Pat Boland, co-founder and director of ANCA, made the announcement.

ANCA makes a significant investment to the Australian economy with 98 percent of its products exported globally with major markets in Germany, Japan, China and the United States. ANCA has defied the odds to achieve success on a global scale in a sector traditionally dominated by German and Swiss companies.

The award is one of the most prestigious business awards in Victoria rewarding the most successful and innovative exporters with the stamp of international success.

ANCA reported almost 20 percent export sales increase FY2011/2012, with significant success developing the Chinese, South American and Indian markets. As the EU continues to struggle, ANCA had its most successful trade show at the EMO exhibition with the highest sales ever achieved in its 38 years and has launched new machines and software into the market to remain at the forefront of machine tool technology.

Boland said "This award is an endorsement of the hard work and innovative thinking of the team at ANCA. We continue to push the boundaries, developing even more flexible and sophisticated products and identifying new untapped global markets to sell to. I am proud of the success of our business and our amazing talent that enable us to be the market-leading business we are today.

"Given that we are based in Australia but sell to the world, we have to be the best of the best. Our investment in research and development from the beginning has instilled a culture of excellence where we continue to seek out new and better innovations for our customers."

The business continues to invest heavily in research and development, create industry firsts and has built a specialist team of around 350 at its head office in Bayswater, Melbourne. Founded in 1974 the business is a market leading manufacturer of CNC tool and cutter grinders.

AGMA FTM: Where Great Minds and Manufacturing Mesh

By Jack McGuinn

Another year, another AGMA Fall Technical Conference.

But this is no ho-hum event. Not when every year, the conference attracts some of the greatest mechanical engineering minds on the planet, along with representatives of the world's greatest manufacturing entities. And who knows—perhaps one day there will be an extraterrestrial contingent—the science is that good. And all of it readily applicable to real-world manufacturing.

"The presentations on wind turbine design and testing, manufacturing considerations for large-girth gear systems, gear lubricants and bevel gear load capacity studies were all noted as practical topics for which the attendees can find direct use in their company's product lines," says Charlie Fischer, AGMA vice president, Technical Division. (Twenty-four peer-reviewed papers were presented this year.)

Convened this year in Dearborn, Michigan, attendance was "definitely encouraging," according to Fischer, with about 155 participants. Expect even greater numbers next year in Indianapolis as 2013 is a Gear Expo year—always an incentive for higher attendance.

Citing the attendee survey results, Fischer says "There were many positive remarks as to the value of the FTM this year. One such comment: 'This is one of the most important meetings I attend each year—would not miss it.'"

Concurring with Fischer was Matt Mondek, current AGMA chairman and just the second to serve a two-year term since the length of service was extended.

"The coupling of the FTM with Gear Expo next year should result in even greater attendance, as we saw in 2011."

Asked how he is enjoying his chairmanship, Mondek responds: "My selection and service as AGMA chairman has been a very rewarding, enlightening and enjoyable opportunity. I have been honored to represent a great association dedicated to supporting and providing valuable added services to its membership."

As for the two-year term, "The change was made to allow the chairman a better opportunity to more thoroughly learn the association, to meet and get to know more members and have more opportunities to represent the association internationally. My tenure as chair will end next April at our annual event being held in Carlsbad, California (April 25-27, 2013). After that I will serve as Chairman Emeritus for two more years."

Also worthy of note is the fact that the demographic seemed to skew a bit younger this year—indeed a welcome development, certainly by AGMA.

"The FTM has been a landmark event for literally generations of gear engineers, presenting practical and useful information on research and experience with power transmission systems," says Fischer, adding, "But these days it can be considered an extension of the powerful educational programs AGMA offers. Companies realize this opportunity and many are sending their younger engineers to take advantage of the knowledge transfer and networking available."

So now it is on to 2013—a Gear Expo year and another FTM. The Call for Papers has already gone out, and another strong showing is expected.

Submitting 2013 Technical Papers

Prospective authors should be prepared to meet the following schedule:

Prepare a brief abstract—one page or less—of your paper and submit to AGMA headquarters by ***December 20, 2012***.

January 11, 2013: Authors of selected abstracts notified and requested to prepare first draft.

April 12, 2013: First draft of selected papers due at AGMA headquarters for peer review.

June 4, 2013: Review comments returned to authors for preparation of final draft.

July 31, 2013: Final paper (with illustrations and figures) due at AGMA Headquarters.

For more information: Contact *ftm@agma.org*.

Gear Expo/FTM 2013
Co-located with the ASM Heat Treating
Society Conference & Exposition.
September 17–19, 2013
Indiana Convention Center
Indianapolis, IN
www.gearexpo.com

To reserve your space contact Gear Expo exhibit sales:
Phone: (800) 687–7469
Fax: (703) 706–8234
AGMASales@ntpshow.com
www.gearexpo.com

January 15–16—AWEA Wind Project Operations, Maintenance and Reliability Seminar. La Jolla, CA. Join the wind industry's leading owners, operators, turbine manufacturers, material suppliers and specialists from national laboratories to discuss strategies on how best to manage wind projects' assets to maximize the bottom line. Attendees will investigate and analyze condition-based monitoring systems to learn how optimizing them can ensure future success, evaluate case studies and best practices in the evolving wind marketplace and receive the *AWEA Operations and Maintenance Recommended Practices* that will be released at the seminar. For more information, visit *www.awea.org*.

February 5–7—Expo Manufactura 2013. Cintermex, Monterrey, Mexico. The largest event in Mexico for the processing and manufacturing industries boasts 350 companies representing more than 600 national and international brands. Expo Manufactura brings professionals together with technological solutions in aerospace, medical devices, automotive, metallurgical, aeronautics and electrical appliances. More than 9,000 industry professionals will visit the show looking for industry insights, new technologies and networking opportunities. Exhibitors will include representatives from the United States, Japan, China, Germany, Spain, Italy, England, Canada, France, Taiwan, Korea, Brazil and Mexico. For more information, visit *www.expomanufactura.com.mx*.

February 26–28—Houstex 2013. George R. Brown Convention Center, Houston, TX. The Society of Manufacturing Engineers (SME) presents this unique trade show that offers presentations and demonstrations on the latest manufacturing technologies. Manufacturing solutions have evolved from simple, off-the-shelf machines to highly specialized technologies of the future. Machines that were once mundane and common are now literal works of art — original, creative, and designed to work with a sophistication that's efficient and compelling. At HOUSTEX, the Art of Manufacturing is on full display. Whatever your industry, you'll discover unique and original solutions for your most urgent and perplexing manufacturing challenges. The event includes keynote speakers, panel discussions, new product presentations, learning lounge presentations, student activities and much more. For more information, visit *www.houstesonline.com*.

March 5–8—The MFG Meeting (Manufacturing for Growth). Hilton Waikoloa Village, Waikoloa, Hawaii. The MFG Meeting (Manufacturing For Growth) brings together a broad spectrum of manufacturing business owners and top industry executives for a 4-day forum on how we can work together to restore manufacturing to its rightful place as an engine that drives the U.S. economy. Jointly produced by three major industry trade groups, this ground-breaking event tackles the issues that affect the entire realm of manufacturing and provides a forum for a conversation that can't be found at any event presented from a single sector's perspective. For more information, visit *www.themfgmeeting.com*.

March 5–10—TIMTOS 2013. Taipei, Taiwan. This biennial event will be held at the Taipei World Trade Center. It currently boasts about 38,000 local and 5,500 foreign attendees. Four halls will feature the latest technologies in areas like Measuring Equipment, Software, Surface Treatment Equipment, Metal Forming Machinery, Casting and Forging, Metal Cutting Machine Tools, Industrial Robots and much more. Conference and seminar topics include innovative hydraulic solutions, machinery safety, rotary tables, intelligence service platforms and R&D machinery components. Taiwan is the 4th largest machine tool producing country in the world with 1/3 of its total production value contributed by machining centers. For more information, visit *www.timtos.com*.

March 12–14—Gearbox CSI – Forensic Analysis of Gear and Braking Failures. Hyatt Regency Baltimore on the Inner Harbor, Baltimore, MD. Determining the cause of a failure in a gearbox is like a "whodunnit" mystery. What caused the failure: The bearings, a gear, the lubrication or a shaft problem? Where do you start, and how can you tell? Instructors Raymond Drago and Joseph Lenski, Jr. from Drive Systems Technology, Inc. will help gear designers gain a better understanding of various types of gears and bearings. Learn about the limitation and capabilities of rolling element bearings and the gears that they support so you can properly apply the best gear-bearing combination to any gearbox, whether simple or complex. A certificate will be awarded upon completion of the seminar. For more information, visit www.agma.org.

April 8–12—Hannover Messe 2013. Hannover Fairgrounds, Hannover, Germany. The world's leading trade show for industrial technology returns in 2013 with a full lineup of trade shows under the banner "Integrated Industry." The eleven co-located shows include Industrial Automation; Motion, Drive and Automation; Energy; Wind; MobiliTec; Digital Factory; ComVac; Industrial Supply; Surface Technology; IndustrialGreen Tec and Research and Technology. Russia is the official partner country in 2013. Discover new perspectives on energy, automation and industrial supply and engineering topics as well as a broad range of events and displays affecting the global industrial market today. Other Hannover highlights include Metropolitan Solutions, TectoYou, Job and Career Market and Energy Efficiency in Industrial Processes. For more information, visit www.hannovermesse.de.

May 22–23—AGMA Marketing and Forecasting Conference 2013. Crowne Plaza, Chicago O'Hare Hotel and Conference Center, Rosemont, IL. What's going on in the gear market? What is happening in the end user market that will affect next year? How can you better prepare your company for the ups and downs of the current economic climate? The Marketing and Forecasting Conference will present a comprehensive report on the U.S. Economic Conditions, Industry Conditions for Gears, Gear Market Bookings and Gear Market Shipments. This will be broken down into a series of end user markets including total gears, industrial machinery gears, construction machinery gears, farm machinery gears, power transmission equipment, mining, ship and offshore, railroad and aerospace gears. For more information, visit *www.agma.org*.

Gears without Standards

—but Tons of Fun!!

If you enjoy working with your hands—without doubt a large segment of *Gear Technology's* audience—you *must* go to *robives.com.* There you will find one of the most clean-but-serious fun websites on the Internet. It is where you will learn—or re-learn, in some cases—how to create things from paper. Origami, you're thinking? Nah—mere *child's play.*

We're cuttin' gears, baby!

And not just dainty little paper things to admire—these are fully functioning, *meshing* gears! Bevel gears! Worm gears! Rack-and pinion gears! Yes!

Rob Ives is the mad genius—the man behind the mechanisms—Willy Wonka without the drippy drama—who has elevated child's play to an exquisitely whimsical art form—form that follows function with geometric precision.

His creations exist in many shapes and movements—not just gears. But this *is* a gear magazine, after all, so…

We recently caught up with Rob in his workshop in England, and he was kind enough to do some Q&A with us.

At what age did you begin making paper mechanisms?

I remember making a series of paper models by Peter Markey and having them on my desk in my student (dormitory). So that must have been when I was about 19.

What was the inspiration for the site?

It has been an evolution. I started the *Flying Pig* (*flying-pig.co.uk*) site in 1997, not long after the Internet began. I've always enjoyed computer programming, so when the Internet came along that seemed like the logical thing to do.

What would you call or how do you categorize what you do?

I generally call it paper engineering.

Is this your day job?

It is! It is a weird way to make a living, and from time to time I miss having a regular income and paid holidays. But I love it and wouldn't want to do anything else. I used to be a primary school teacher. I stopped teaching in 2000 to work on the paper projects full-time.

Is there a staff or are you a one-man band?

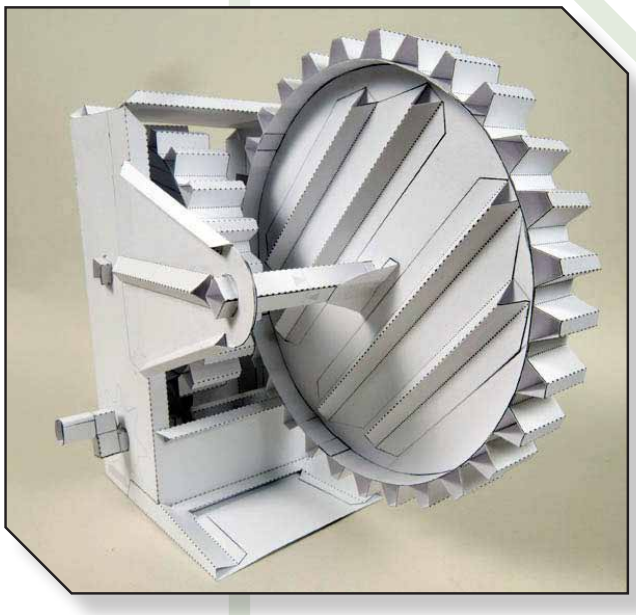
Just me.

Do you have a design and/or engineering background relative to gears?

Only in the sense that I am interested. I have no formal training, but I read a lot about science and engineering.

Do you see yourself as an educator?

Yes. I used to be a teacher, as mentioned. I think education is in my blood. I've had arguments with people I've worked with—publishers usually—where they complain that I reveal too many 'secrets' on my website. For me, it is all about sharing the knowledge and the enthusiasm.



What is the price range for the kits?

On the *robives.com* membership, the main thing I'm trying to sell is a membership. Members can download the projects from the site for free. One year's membership starts from on £9.95.

How's business?

Pretty good, actually. I had a real crisis at around the time of the banking crisis, when three big customers went bankrupt, owing me a five-figure sum. It was pretty scary at the time and it has taken ages to pick myself up. But I think I'm there now.

Any famous customers/fans?

Noel Edmonds (*British broadcaster, writer*—Deal or No Deal—*and executive*)! That's the only one that I know of. I have customers from all round the world.

What is the point or benefit of membership?

Members can download models for free. My aim in having memberships is that I get a loyal group of followers.

I assume this is a for-profit endeavor?

It is, though profit is not the main motive. I enjoy making things and sharing ideas. The membership lets me do that and put food on the table as well.

Do you have a favorite kit/mechanism?

Usually my favorite is the model that I'm working on currently. I'm really pleased with the Nessie project that I'm working on at the moment. That said, I have a Surly Jack on my desk which I'm rather fond of.

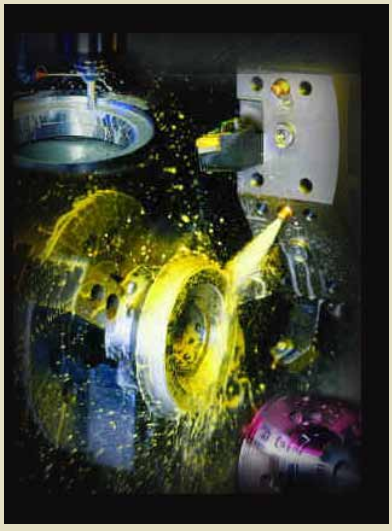
There almost seems to be something of a Zen vibe going on here.

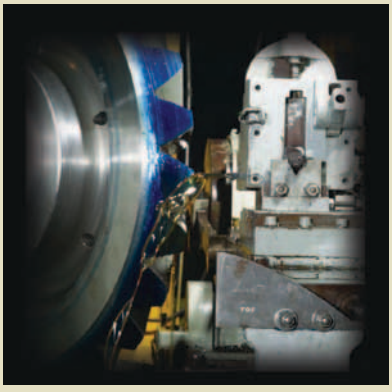
Sure. Did you see the Zen in the Art of Cardboard Engineering model? Turn the handle to hear the sound of one hand clapping!

Who is your typical customer (age, etc.)?

I'm guessing, but I think there is quite a mix. I get parents and children writing in quite a lot. Several teachers, young people, retired people. Exciting, isn't it!?

CUSTOM
BEVEL GEAR MANUFACTURING





REVERSE 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

AGMA

Claiming Quietness:
Perfecting largest Gears with *RAPID*

HÖFLER
A BRAND OF KLINGELNBERG

Marine or mining to power generators or windturbines: The ***RAPID*** series of gear grinders are not only large and powerful but they rank among the most robust and technologically advanced grinders available.

Designed and built around our exclusive torque motor table drive systems, mineral cast beds and columns, high performance wheel dressing systems, on board inspection and High-Speed-Grinding combined with Best-Fit-Grinding, **HÖFLER *RAPID*** enables to manufacture largest gears in uncomparable accuracy: Main condition for persistence and quietness – even on hardest demands.

Once again, KLINGELNBERG grinding solutions increase productivity, quality and profitability your company expects and deserves.

GEAR MANUFACTURING SOLUTIONS up to ø 8000 mm [315“]

NEXT FAIR:

IMTEX 2013

Hall 3A, Booth B108
Hall 5, Booth A102
January 24-30, 2013
Bangalore India

KLINGELNBERG GmbH
Industriestraße 19
76275 Ettlingen, Germany
www.hofler.com
www.klingelnberg.com
p. +49 7243 599-0
f. +49 7243 599-165
e. info@hofler.com

KLINGELNBERG America, Inc.
118 East Michigan Avenue, Suite 200
Saline MI 48176, USA
p. +1 734 470-6278
f. +1 734 316-2158

HÖFLER America, Corp.
26 Sky Manor Road
Pittstown, NJ 08867, USA
p. +1 908 442-4361
f. +1 908 996-6977
e. usa.sales@hofler.com