

# CMM Gear Inspection

MITUTOYO OFFERS CAPABLE, AFFORDABLE AND FLEXIBLE GEAR INSPECTION OPTION

Gear inspection has long been considered a highly specialized, expensive and difficult part of the gear manufacturing process, requiring a wide variety of complicated gages, testers, dedicated CNC equipment and highly trained experts.

But if you want to make good gears, you need to have all that stuff, right?

Well, maybe not, says John Fox, senior CMM software application engineer for Mitutoyo America Corporation. According to Fox, the time may be right to consider a CMM for your gear inspection needs.

"We have many customers that are using a CMM for gear measurement, production and setup," Fox says. "Customers including Honda, Kawasaki, Hitachi, Molon Motors, etc. use the CMM to measure purchased gears. And there are high-precision gear companies such as Gear Manufacturers Inc. that incorporate our higher-accuracy CMM for setup and some production."

A lower price tag is one of the main reasons to consider CMMs over conventional dedicated gear inspection equipment, Fox says. A single piece of today's sophisticated, fully programmable, fully automated dedicated gear-checking equipment, limited to a single gear size range (gears up to 15" diameter, for example) plus software, might cost twice as much as a CMM machine equipped with a rotary table, high-speed scanning probe head and gear-checking software, Fox says.

Of course, exact prices for either type of system depend on options and machine size, but a smaller-sized Mitutoyo CNC coordinate measuring machine starts out around \$55,000, Fox says. Adding in Mitutoyo's *GEARPAK* software for cylindrical gears adds about \$11,000. *GEARPAK* for bevel gears adds about \$9,000. *GEARPAK* for worm gears adds another \$10,000. So for around \$85,000, you can get a Mitutoyo CMM capable of inspecting cylindrical, bevel and worm gears. Dedicated gear inspection systems

have been known to cost as much as four times that amount, Fox says.

The type of CMM used to measure gears depends mostly on the part's size and weight. When measuring large gears—those with diameters of more than a meter or which are extremely heavy—a high-precision, horizontal-arm CMM with a rotary table would be required. This style of CMM is generally used for inspecting large-scale gears such as those used in ship and heavy equipment powertrains, turbine gearing, and gears used in nuclear and thermal power plants and wind turbines. Inspection of large-scale gears is easier to perform with this style of CMM due to its open-access structure.

On the other hand, bridge CMMs are usually the right machine for measuring small or medium-size gears. Two styles of bridge-type CMM are available. One has a fixed table with moving bridge, and the other has a moving table with a fixed bridge. This second style of CMM offers greater accuracy. Some models of bridge CMMs have quite large capacities, over-

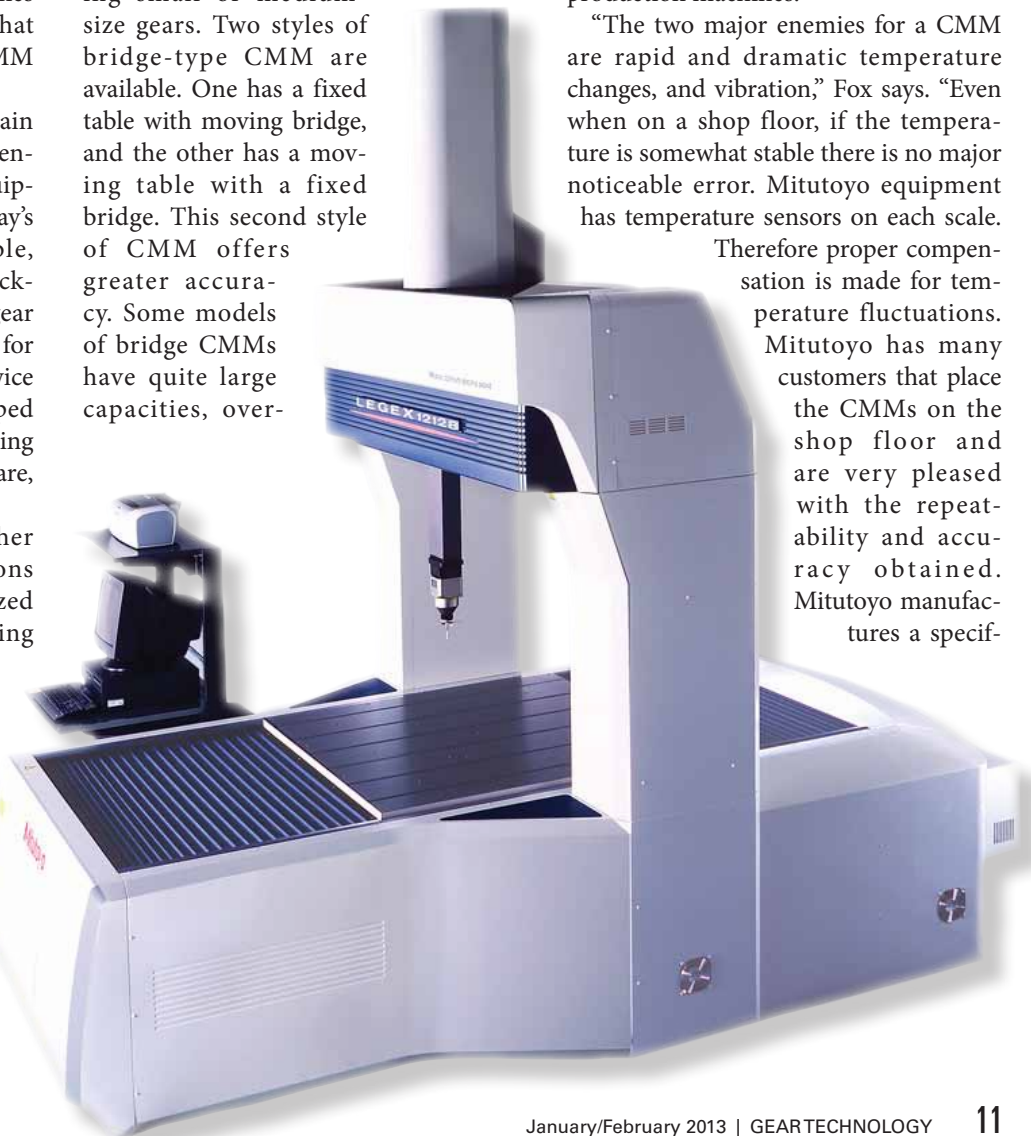
coming the need for a horizontal arm machine.

In addition to replacing dedicated gear inspection equipment, CMMs can also replace many of the smaller, hand-held and functional gages often used in gear inspection. "Hand-held gauges are subject to operator interpretation," Fox says. "Repeatability between operators using manual inspection methods is lower. Speed of measurement is certainly slower. Written reporting is open to incorrect values being recorded. An automated CMM can be measuring parts, while the operator continues to produce parts. Once the CMM program is proven out, you know you will get good accuracy, repeatability and reporting."

In some cases the CMM can even be placed right on the shop floor, alongside production machines.

"The two major enemies for a CMM are rapid and dramatic temperature changes, and vibration," Fox says. "Even when on a shop floor, if the temperature is somewhat stable there is no major noticeable error. Mitutoyo equipment has temperature sensors on each scale.

Therefore proper compensation is made for temperature fluctuations. Mitutoyo has many customers that place the CMMs on the shop floor and are very pleased with the repeatability and accuracy obtained. Mitutoyo manufactures a specif-



ic CMM, the Strato, which is made for use on a shop floor. The Strato scales incorporate non-expanding glass scales; the ways are completely protected with covers and bellows and active vibration dampening using auto leveling air spring units.”

Those who might have considered CMMs in the past should definitely take another look, Fox says.

“In the past 5-10 years, Mitutoyo CMMs have become much more precise with the incorporation of high-performance controllers, greater scanning technology, minimizing internal heat generation, faster servo drive mechanisms with accelerations of up to 2.598 mm/sec<sup>2</sup>,” Fox says.

With regard to precision, Mitutoyo makes both high-accuracy CMMs as well as commodity-level equipment. The commodity-level machines allow a maximum permissible error ( $MPE_E$ ) of 1.7+3L/1,000 microns, while Mitutoyo’s mid-range and high-accuracy machines allow 0.9+2.5L/1,000 microns and 0.6+1.5L/1,000 microns, respectively.

“It is because of the accuracy at the mid-range and high end that Mitutoyo CMMs are very well suited for the extremely tight tolerances required for gear measurement,” Fox says.

“One thing to be aware of is Mitutoyo manufactures every component that is used in all Mitutoyo equipment, including all of our CMMs,” Fox says. “We have excellent control over the quality of the components that go into our CMMs.

This enables Mitutoyo CMMs to have the longest meantime between failure, which is from 25,000 to 30,000 hours.”

Some of the key ingredients to Mitutoyo machines’ accuracy include machine construction and precision components. “The Y axis is cut and ground from the same piece of granite as the plate,” Fox says. “The Y axis will never change because of this, unlike CMM manufacturers that use a separate piece of granite that is glued and attached by lag bolts. In addition, Mitutoyo has always produced the best scales, which have very minimal to no expansion. Mitutoyo incorporates temperature compensation on each scale.”

Beyond the precision and accuracy of the machines, one of the keys to accurate gear measurement—whether on a CMM or a dedicated machine—is the software, Fox says. For example, calculation of whether an involute curve is correct based on data points extracted during measurement requires the use of high-level mathematical formulas and sophisticated algorithms. *GEARPAK* is very exact in these calculations, Fox says, and Mitutoyo has received certification of the algorithms from Physikalisch-Technische Bundesanstalt (PTB), Germany’s highest national technical certification authority.

In order to achieve certification of the software, Mitutoyo had to provide PTB with *GEARPAK* calculations based on data points supplied by PTB. The range of calculations included complex gear

flank evaluation for gear tooth profile and flank line; tooth profile deviations, such as slope and form; profile crowning; tip and root relief data; helix slope and form deviations; crowning of the flank line; a variety of end relief data, including modifications of curvatures and reliefs; gear pitch; tooth thickness; tooth spacing; dimension over wires, or balls; displacement dimensions; and tip and root diameters including concentricity, or runout. The results were sent back to PTB where they were compared with the correct results. In order to receive PTB Certification the results of test data must be less than 0.1  $\mu\text{m}$  (0.0001 mm or 0.000004») from the PTB’s reference values.

Mitutoyo’s *GEARPAK* software for bevel gears supports Gleason geometry straight bevel, spiral bevel and hypoid gears. The *GEARPAK* for worm gears module supports ZA, ZN, ZI and ZK tooth forms, as well as single- or multi-start worms.

The *GEARPAK* software is incorporated with Mitutoyo’s *MCOSMOS* software package (*Mitutoyo Controlled Open System for Modular Operation Support*). By combining intuitive icon-based programming with the ability to import native CAD models, *MCOSMOS* enables even novice users to easily import part and fixture models and “virtually” place them in the volume of their specific CMM. *MCOSMOS* graphically defines the CMM, racks, probes, and even styli. Selected graphically, all measurement points are clearly displayed on a 3-D graphic view which can be rotated, zoomed, or panned to any convenient viewpoint. Animation enables offline running of a workpiece before ever placing it on the CMM, thus providing machine volume verification and collision avoidance. Then, *MCOSMOS* enables users to choose various software modules to analyze measurement results, to document and present results, and to archive the data in practical structures. Furthermore, *MCOSMOS* integrates with networked systems for in-line process control applications as well as to enable true enterprise-wide functionality.

The other attractive feature of CMMs for gear inspection is that they can easily be used to inspect other features,



Fox says. By incorporating high-level software, CMMs can measure virtually any type of geometry. For example, airfoils, compressor scrolls or turbine blade geometry can be inspected with the appropriate software. In addition, “the ability to incorporate components such as vision probes using edge detection technology and laser line scanning probes have made CMMs much more flexible and powerful,” Fox says.

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## Progress in Gear Milling

BY AARON HABECK,  
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COROMANT US

### Sandvik Offers Latest Tool Technologies

In addition to volume gear manufacturing on dedicated machines, gear teeth are increasingly being machined as features on various components, as well as gear wheels in smaller batches. Whatever the application, gear milling should perform as well as other metal cutting operations, where technology has moved on considerably. The conventional scene—i.e., specialized production of gear milling using high-speed steel hobs or cutters at moderate speeds, bathed in oil—is changing. Such are the pressures of competition.

Machining centers and multitask machines are increasingly players in this scene, putting gear teeth on wheels and multi-feature components while providing new opportunities. Just like more traditional, dedicated gear cutting machines, these newcomers to the gear industry achieve maximum efficiency. Newly developed, indexable-insert technology is now providing new means to change gears in the machining process.

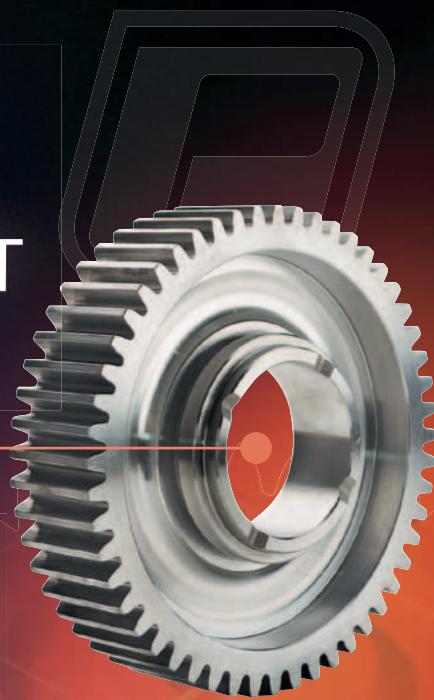
**Progress in tool technology.** Manufacturing gears, whether in the form of a gear wheel or a component with gear elements, is a machining-

intensive process, therefore efficiency is key to cost effectiveness. High-speed steel (HSS) has for some time been the dominant tool material for gear cutting; however, it is being replaced by cemented-carbide. Most machining areas are today dominated by modern indexable-insert technology based on cemented-carbide cutting edges. This is complemented by solid-carbide tooling, particularly when size makes inserts impractical. The hot hardness difference between HSS and cemented-carbide is consider-



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able, determining the difference in performance.

Indexable-insert tools have been used in gear cutting for some time, but overall the technology did not provide the performance advantages or meet the precision demands that are possible today. Gear manufacturers tend to hold on to the solid HSS cutters because it remains a secure, accurate and reliable process. However, HSS is a cutting tool material over 100 years old with a limited development scope. Although it has under-

gone considerable development as a cutting tool material, it is inherently limited in standing up to the machining temperature and wear-loads that are expected from a modern tool. Today, there is no reason why tools should be the limiting factor in raising productivity and achieving lower machining costs in gear cutting. Generally, the tool life of a modern cemented-carbide insert is five times that of an HSS edge—and at more than 2.5 times the cutting speed as HSS.

**Precision—the final hurdle.** Recent advancements in indexable-insert technology have overcome the accuracy and tolerance maintenance questions that detractors once cited. This has been an area where ground HSS cutters excelled and held their own—until now. Gear milling with modern, dedicated indexable-insert tooling is achieving results within even closer tolerance classes, according to DIN.

Standards for new indexable-insert tools are Class B-guaranteed, with most criteria holding A—some even AA ratings. Quality on the machined gear wheel is usually at 9, and often even 8. In addition, minimal tool run-out contributes to longer tool life and the elimination of step tendencies on the machined surface. The machined gear profiles are uniformly close to the required finished form while small and even machining allowances for any subsequent operations are achieved. Ground indication surfaces on cutters also make for easy and clear set-up control in machine.

**Speed makes the difference.** The main advantages that the specially developed indexable-insert technology has provided include metal removal rates in roughing and finishing large volumes of gear profiles, along with the flexibility to improve the economics of small-to medium-volume machining. Efficient and easy tool handling is important in gear milling because of the number of inserts to be indexed. Some tools use clamps instead of screws, which allow accurate changing of inserts within



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The recently introduced insert technology for gear milling is partly based on advances in other machining areas. Along with extensive area-dedicated development, this has contributed to a new generation of gear milling tools. This creates a comprehensive program of tools for modules 3–30, disc cutters and hobs along with new machining methods.

**New cutting edges.** Gear milling is performed with robust disc-type cutters and the process is characterized by interrupted cutting action. In addition to thermal variations on the cutting edge, mechanical interruptions require a suitable balance of hardness and toughness to provide durability and strength for high cutting data. The degree of toughness needed from the tool material is determined by shape and geometry, in addition to entering and exit conditions. However, in gear milling, the demands for edge toughness are influenced also by the relatively small radial depths of cut in combination with the large tool diameters.

Dry machining, without any coolant application, is the preferred method with indexable- insert milling tools and today's high machining rates. It is difficult for even high amounts of coolant to have much effect at the cutting edge, most of which is vaporized. Any remaining coolant will marginally cool the insert as it goes in and out of the

cut. Thermal variations are thus amplified, which has more of a negative effect on the insert than with heat. Coolants in gear machining are very much inherited from the use of high-speed steel tooling or the need to reduce heat in the component. However, gear milling with cemented carbide can stand up to high temperatures—eliminating the need for coolant. When applied correctly, there is minimal heat transferred to the component.

In gear hobbing, however, the process is quite different—often involving over 100 cutting edges in a single tool. It is a relatively smooth machining process with continuous cuts, varying in both chip thickness and cutting-force direction. Hobs are designed to provide high precision. HSS hobs normally allow around 50–100 m/min (165–330 SFM) in cutting speed, necessitating coolant. Cemented-carbide hobs, on the other hand, work well at 250–300 m/min

The advertisement background features a blue and white color scheme. At the top, the 'Leistriz' logo is prominently displayed in a bold, italicized font. Below the logo, several 3D rendered gears and a hob are shown in a dynamic, overlapping arrangement. In the lower right, a white and blue CNC keyseating machine is depicted. The machine has a control panel on the right side and a large, open front door. The overall aesthetic is clean and industrial.

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(820–985 SFM)—with or without coolant.

**The tool material makes the difference.** A modern coated insert grade has the capability to provide high security at the temperatures generated by high cutting speeds and feeds. However, many grades function well in both dry and wet conditions if or when the coolant is necessary for chip evacuation and maintaining component temperature for keeping within dimensional tolerances. When it comes to milling normalized case-hardening steels, the advantage of cemented-carbide inserts is particularly highlighted in the form of higher productivity. For tempered steels a marked extension of tool life at higher cutting data will be the main advantage.

In materials harder than 300 HB, the possible cutting speed with indexable carbide tooling is usually five times higher than with traditional HSS tooling. Important success factors of indexable-inserts in gear milling are those of geometry and manufacturing. Edge geometry and edge preparation are important combination factors with insert grades for achieving the best solution. Establishing the right microgeometry in the form of lands, chamfers and edge rounding decisively affect the strength of the cutting edge and its durability. This has a direct influence on cutting data capability, security and, very importantly, the predictability of quality consistency. Well-developed insert geometry will also provide good chip forming, which is important for evacuation and handling. Finally, the macro- and microgeometry and position of the cutting edge in the tool will not alter, as occurs when an HSS cutter is reground.

**A good location is decisive.** There are a great number of large inserts in a gear milling cutter where the position of one cutting edge affects the others during a cut. If these positions vary too much, they can negatively affect machining performance (cutting forces) and the capability to achieve the right quality level. In this context the insert location, tool manufacturing techniques and precision insert tolerances are crucial to achieving solutions in a marketplace



where quality demands are escalating constantly.

Machine tools and tool holding are also crucial to success. This is where the modern, and especially stable, machines from companies like Höfler, in combination with Coromant Capto as the spindle-tool interface, provide the basis for full utilization of the new indexable-insert technology for gear milling.

The new indexable-insert technology is increasingly used for both disc cutters and hobs. It's also used on specialized machinery through new methods such as uP-Gear Technology and the InvoMilling process, where gear milling can perform very efficiently in multitask machines and five-axis machining centers. This new technology is supported by local and global specialist teams dedicated to gear milling, involving design, application and commercial backing.

The focus has been on the development of a new generation of tools, machining methods and tool manufacturing with full control of all technology and support involved. The result, that which was deemed unthinkable in gear milling less than two years ago, is now a practical reality, available broadly for reviving gear milling performance.

**New methods open up new possibilities.** In addition to a new generation in tooling, the development of methods for gear milling has resulted in the uP-Gear Technology for bevel gear machin-

ing, as used on Gleason Heller five-axis machines. These machines are equipped with user-friendly software and a tool set suitable for the application, providing a new, flexible, productive and cost-efficient solution. The machining time is short compared to an end milling process. Moreover, the actual machine cost is no higher than a traditional five-axis machine as the tool cost is much lower than using dedicated bevel-gear tools. Also, the number of steps needed with this method is reduced thanks to the versatility of the process.

Another unique, new method development is the InvoMilling method for machining centers and multi-task machines: a combination of slot- and turn-milling. It enables the machining of gears with any module and helix angle, both involute and non-involute profiles. Through collaboration with machine tool makers DMG/Mori Seiki, a user-friendly interface in the CNC-control of the machine makes gear-milling easy to perform in a vast number of applications. Previously, most were only possible to do on special-purpose machines.

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# LMT Fette

## FOCUSES ON LARGE GEAR EFFICIENCY

The market for large gear wheels is growing – in a great variety of industries: wind turbines, construction vehicles and ships need transmission systems that use large gear wheels to move very large masses. The gearing experts at LMT Fette know exactly what kind of challenge is involved in producing these components. LMT gear cutters and hobs offer considerable advantages also and especially in demanding finishing applications. In 2012, according to forecasts by the World Wind Energy Association, installed wind power capacity worldwide increased by over 16 percent. By the end of the year, wind turbines will be able to generate up to 273,000 megawatts of electricity. (In comparison, the output of all the world's operating nuclear power plants currently totals nearly 390,000 megawatts.) And this boom is continuing: green electricity's share of the global energy mix is rapidly increasing. However, other industries that rely on large gears are also booming. For example, according to the German Association of the Automotive Industry (VDA), the global market for heavy commercial vehicles will grow by five percent this year.

What impact is this dynamic growth having on the production of the gears used in wind turbines, large commercial vehicles, building equipment and mining technology? "Requirements in many sectors have increased massively," explains Thomas Falk, who is responsible for gear cutting at LMT Tools. "Wind turbine engineering makes that especially clear. These installations are not only getting larger and larger, but they also have to be able to work longer without breakdowns. That naturally also applies to transmission systems and gears." As a result, very special attention is being paid to cutting processes. It is important here not only to machine components swiftly and efficiently, but also to achieve the highest possible surface quality during the finishing process. "When it comes to very large gear elements, machining quality and tolerances also and especially play a great role," confirms Falk. "Ultimately



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they are responsible for the efficiency of the overall transmission system.”

The machining is carried out using hobs or gear cutters—each with indexable inserts. Both types of tools can be used for both roughing and finishing. The choice depends on batch size or the required number of cogs. “This is where customers benefit from LMT’s extensive range of tools and our pool of knowledge and experience. We can provide very exact advice when, for example, the blueprint of the component is available and the customer’s operating conditions are known. We can then develop the most efficient tool solution,” explains Falk.

The great benefits of LMT tools then become evident in practical use. On the one hand, the standardized and readily available range of indexable inserts and standardized tool bodies keep costs low for users. On the other, LMT specialists have developed innovations that guarantee quantum leaps in machining performance. Examples of this include the new LCP35H cutting material and the new range of sizes for gear cutters:

LMT developers combined an extremely tough, ultra-fine grain carbide with the wear-resistant Nanotherm coating for the LCP35H. This combination significantly boosts performance in wet machining, for example, and prevents the formation of fractures. This increases the operating life of the indexable insert and also makes the process extremely reliable. The new gear cutters with standardized indexable inserts for roughing stand out because of their very smooth cut in practical operation. LMT Fette designs the desired tooth flank contour to meet customers’ requirements. This gives rise to powerful roughing and finishing tools that guarantee the highly cost-effective production of gear wheels.

“Overall, we can provide appropriate tool solutions for all applications in the large gear sector. We are a technology

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leader here — especially when it comes to perfect surface qualities and the lowest possible machining tolerances. This combination is giving us major opportunities in an increasingly important market,” Falk sums up the enormous potential opening up for LMT Fette.

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## Zoller

### OFFERS INSPECTION FOR HOB CUTTERS

Gear cutting is a challenging task. Only perfect and re-sharpened tools can guarantee correct workpieces, short setup times and low downtimes of expensive gear cutting machines. Complete documentation and logging are fundamental requirements. The measurement and inspection of hob cutters has remained the domain of highly complex and extremely expensive measuring systems. Tactile sensors are in wide-spread use, requiring especially trained operators and considerable time. High costs and supply bottlenecks are the result.

With its new *hobCheck* Zoller now offers a quantum leap for the measurement of hobs: the first truly shop floor compatible and at the same time economical specialist for the overall measurement of hob cutters. Zoller combines image processing technology with

a measuring sensor, a swiveling optic carrier and six CNC-driven axes to provide distortion-free complete measurement of hobs. This gives the user an exact replica of the tooth profile on the cutting edge.

The user-friendly software *pilot 3.0* offers a simple operation by displaying the desired parameters according to DIN 3968. The calculation of the quality classes and graphic logging is fully automated. The link to *esco*, the standard software for hobs, avoids duplicate

data entry, saves time and guarantees an error-free measured result taking current parameters into account.

These include concentricity and run-out, deviations in the shape and position of the cutting face, of the cutting edge, tooth thickness and flute direction. The quality class is assigned automatically and marked appropriately in the protocol.

The *hobCheck* not only solves the challenge of measuring hobs economically with high precision, but also



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# Drake Manufacturing

CO-EXHIBITS WITH VMT AT IMTEX 2013

Drake Manufacturing Services of Warren, Ohio, with its representatives, VMT Technologies India, displayed a high accuracy work head and linear motor demonstration unit in its booth at IMTEX. The unit helped visitors visualize the technologies used in Drake machines. The display featured Drake's high-accuracy work

head and the various components of the linear motor platform including linear motor and magnets, rails, and roller cars and 8-million count Heidenhain encoders. Linear motor drives mean no drive train windup, backlash, or lead error due to aging ball screws, couplings, or bearing blocks. Drake also demonstrated its built-in *Part Smart* programming and menu screens on a Fanuc CNC control system. With Drake's *Part Smart* menus, no programming knowledge is required. The *Part Smart* approach allows users to run parts and change-over jobs with menu-driven ease. In conjunction with IMTEX, Jim Vosmik, Drake's president, presented, "The Latest Developments in Fine Pitch Thread Grinding" on January 23 at the International Seminar on Machining Technologies (ISMT). Attendees learned about the latest developments in wheel, machine, and dressing design for fine-pitch thread grinding. Drake has many machine installations in India and throughout Asia including thread grinders, ball screw grinders and profile gear grinders for a variety of applications. Local Indian sales, service and support is handled by VMT Technologies-Bangalore.

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## Breathe New Life Into Your Old Gear Grinding Machines

**CNC Super-Precision Dressers & Dressing Stations**  
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**Customized For Your Machine**

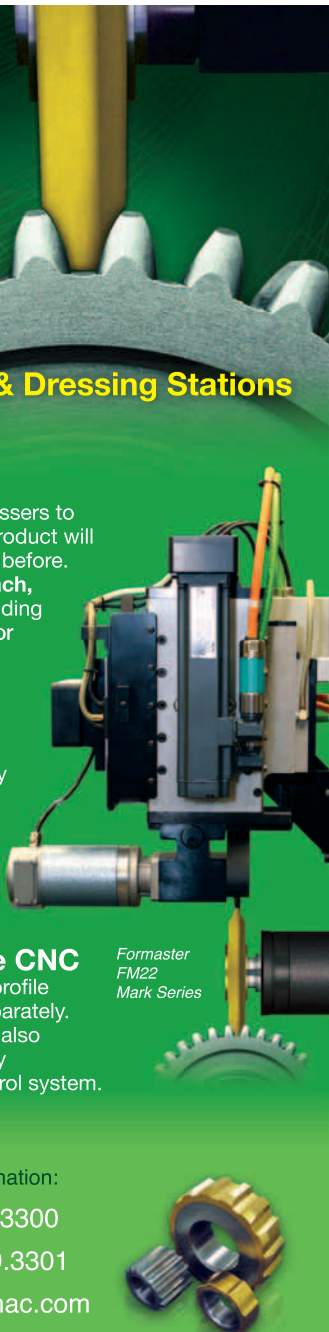
Normac custom retrofits Formaster CNC wheel dressers to your existing grinding machine. In doing so, your product will gain a level of precision that it may never have had before. Formaster has been installed on **gear, spline, broach, OD/ID, surface, curving coupling** and **thread** grinding machines, among others. Also available to OEMs for integration in new products.

**Works With Most Wheel Types**

Formaster's super-precise positioning and slide system stiffness provide the capability to accurately profile and condition grinding wheels with **aluminum oxide, silicon carbide, ceramic, CBN and diamond abrasives** in either vitrified or **resin bonds** in addition to **electroplated** wheels with CBN and diamond abrasives.

**Advanced Gear Software & Flexible CNC**

Formaster works with sophisticated Normac gear profile and program generating software which is sold separately. Standard configuration includes Siemens CNC but also available with other controls or in a mechanical only configuration for integration with your existing control system.



Formaster  
FM22  
Mark Series



For more information:  
Tel 248.319.3300  
Fax 248.319.3301  
[sales@normac.com](mailto:sales@normac.com)

720 Baseline Rd, Northville MI 48167 | [normac.com](http://normac.com)

# Coord3

## LAUNCHES UNIVERSAL CMM TO NORTH AMERICAN MARKET

Earlier this year, Coord3 launched its all new 'Universal' line of CMM machines at the Control Expo show in Stuttgart, Germany. Now, Coord3 Metrology LLC, headquartered in Wixom, Michigan is introducing the new European-manufactured 'Universal CMMs' to the North American market.

Coord3 CEO Angelo Muscarella states "since taking the company into pri-

formance. This design overcomes the issues associated with operating traditional granite CMM structures, in the typical, less than perfect, CMM operating environments. In addition, the Universal CMM introduces a wireless CMM thermal compensation system of both machine and part, allowing the measuring system to automatically and

dynamically compensate for changes in the CMM operating environment. This system allows the CMM to perform with stated measuring accuracy between 16 and 26 degrees C. Gold-plated 0.1 μm measuring scales are free-floating in support tracks, eliminating any CMM structural changes from influencing its measuring accuracy.



vate ownership three years ago, we have focused on rebuilding our international distribution and engineering growth in the large CMM market segment. With the introduction of the Coord3 Universal bridge CMM, we focus the company into the highly competitive vertical bridge CMM market at a time when all of our major competitors are supplying an increasing array of cost-focused Chinese manufactured CMM units. The Universal CMM applies our 'design-for-manufacture' focus that dramatically reduces CMM assembly and calibration times and allows Coord3 to not only compete in global markets against low-cost China manufacturing operations, but also allows Coord3 to double our CMM manufacturing capacity, with a negligible increase in factory space or workforce."

The Universal CMMs utilize a high-technology alloy, moving frame design that provides the benchmark for dynamics and measuring accuracy perfor-



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The Coord3 Universal CMMs provide a highly rigid structural coordinate measuring platform, allowing the use of point-to-point, analog contact scanning and laser scanning sensors, making it suitable for full five-axis and gear measuring applications.

Universal CMMs have a very efficient design in terms of machine complexity, which improves long-term reliability and ultimately cost of CMM ownership. The Coord3 Universal CMMs have an isostatic design for each axis that provides optimum machine geometrical alignment in the construction of the machine, which ultimately benefits the ability to make accurate field calibrations. Universal has a monolithic base-plate, with integral inverted dovetail guide-way, and a generous 90 mm (3.5 in.) x 90 mm (3.5 in.) Z Ram section. Direct axis drives, using toothed drive belts, provide the vibration-free motion with zero hysteresis.

Universal CMMs can also be equipped with an optional SZP (Safety Zone Protection System), which uses laser scanners to monitor the defined protection zone when the CMM is in high speed automatic measuring mode. SZP reduces the CMM speed upon infringement of the safety zone by an operator and automatically returns the CMM to its full measuring speed, only after the zone infringement has been cleared. The SZP system allows safe use of the CMM in a production, shop-floor and fully-automated applications.

The higher accuracy nano technology (NT) version of the Universal CMM that uses a silicon carbide Z ram and enhanced measuring scale system to provide higher speed enhanced scanning accuracy offering a 0.3 µm reduction in measuring uncertainty.

The Coord3 Universal CMM family of machines is currently available with measuring strokes for the X-axis of 1,500 mm, 2,000 mm, 2,500 mm and 3,000 mm; Y-axis of 1,000 and 1,500 mm; and Z-axis of 900 and 1,000 mm.

**For more information:**

Coord3 Metrology LLC.  
48861 West Road  
Wixom, MI 48393  
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**Sunnen**  
INTRODUCES NEW HONING FEATURES

Sunnen Products introduces new servomotor and drive technology under the hood of its three primary vertical honing platforms, bringing additional capabilities, speed, accuracy and safety to the machines. As a result, the company's existing SV-1000, SV-400 and SV-500 models are being replaced with the SV-2000, SV-2400 and SV-2500 series of machines that feature the same outward appearance as the predecessor models.

The various new models have upgraded capabilities such as selectable tool-



feed, constant crosshatch and faster automatic bore detection for reduced cycle times. The SV-2000 and SV-2400 machines are already in production, while remaining SV-400 and 500 models will be replaced later this year. The range of machines can process bores ID's from 3 mm to 300 mm, typically found in parts such as fuel injectors, piston pumps, gun barrels, hydraulic components, engine/compressor cylinders, diesel cylinder liners, landing gear and similar.

All of the new models now include a 7.5 kW (10 hp) servo spindle. The new SV-2000 platform offers a new choice of controlled-force or controlled-rate tool feed. Controlled-rate allows automatic tool feed in increments as fine as 0.1 µm (0.000010"). Controlled-force tool feed monitors force in the tool feed system. It feeds the abrasive at the highest rate possible for part conditions, ensuring short-

est cycle times and longer abrasive life. The new SV-2400 platform now includes selectable "constant spindle load" and controlled-rate tool feed as standard. Other new capabilities on the upgraded models include whole-bore, constant crosshatch angle. Constant crosshatch eliminates the "flattening" of the crosshatch angle at stroke-reversal points, a feature required by some engine manufacturers and MilSpec parts.

The new drive technology also enables the machines to be setup to hone only on the pull stroke, or easily produce custom profiled and tapered bores. All the new platforms include safe-drive technology that monitors all safety devices on the machine with a separate PLC, which stops or limits the speed of the drives if triggered.

**For more information:**

Sunnen Products Company  
7910 Manchester Road  
St. Louis, MO 63143  
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## Mahr Federal

### DISPLAYS MEASURING SYSTEM AT MD&M WEST

Mahr Federal will be featuring the MarSurfR XR 1, an economical, mobile, PC based surface measuring system, at MD&M WEST, February 12-14, 2013, at the Anaheim Convention Center, Anaheim, CA, Booth #2885. With the MarSurfR XR 1 surface measuring sys-



tem, Mahr has bridged the gap between portable surface measuring devices and larger, full-featured, PC-based surface measurement and evaluation systems. The MarSurf XR 1 combines the skidded and skidless drive units of Mahr's portable M-Series instruments,

with its MarWin evaluation software. The new XR 1 provides an affordable entry into the world of modern, PC-based measurement and evaluation systems, including compliance with all International Standards, diverse evaluation methods, extensive documentation, large storage capacity, data export and import, as well as networking and other benefits.

The MarSurf XR 1 is suitable for use either in the measurement lab or on the shop floor, and provides over 80

parameters for R, P, W profiles according to current DIN, ISO, JIS, ASME and MOTIF Standards. The system can utilize both the MarSurf RD 18 drive unit with skidded probe and the MarSurf SD 26 drive unit with skidless probe, and virtually any number of drive units can be connected to the evaluation unit via Bluetooth or cable. Measuring units can be used alone in different orientations, in combination with various accessories, or mounted on measuring stands. Measurements can be initiated either by

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touch screen on a PC or manually on the drive units.

Mahr Federal will also feature their line of Dimensionair air gaging products for orthopedic and other non-contact applications. Air gaging is a proven, highly precise and accurate way of measuring bores and tapers often found in orthopedic implants. It is quick and easy to use, requiring little skill on the part of the operator, and is highly adaptable

to measuring special features for both dimensional and geometric tolerances.

**For more information:**

Mahr Federal Inc.  
1144 Eddy Street  
Providence, RI 02905  
Phone: (401) 784-3100  
[www.mahr.com](http://www.mahr.com)

## Ingersoll Cutting Tools

SWITCHES TO OELHELD'S SINTOGRIND

To advance its grinding capabilities and improve the working environment, Ingersoll Cutting Tools has switched to SintoGrind IG, a synthetic based grinding fluid, to ensure reliable high quality and improved performance. Since their first cutting tool patent in 1889, Ingersoll has strived to provide innovative and productive metal removal solutions on the market including indexable carbide end mills and on-edge insert configurations. Bob Arndt, manager of carbide manufacturing in Rockford, Illinois says, "We take great pride in producing a quality product supported by superior service to our customers." The Rockford plant is a significant U.S. manufacturer of industrial tungsten carbide high feed inserts for the automotive, aerospace and agricultural industries. "We have invested heavily in leading edge CNC equipment to retain our quality edge and delivery promise. The key to manufacturing a good tool," Arndt says, "is in controlling the grinding process through a variation of princi-

pals. Our tools need to have a long life which starts with a clean, chip free cutting edge. Therefore, close monitoring of the grinding speeds/feeds, grinding wheel and especially the grinding fluid is critical. Synthetic grinding fluids developed and produced by Oelheld U.S., Inc. coupled with a clever and smart filtration system exactly meet the demands of Ingersoll Cutting Tools." With the install of a fine filtration system and switching over to SintoGrind IG, a super high performance synthetic grinding fluid, new benchmarks have been set in carbide production at Ingersoll.

**For more information:**

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# Rex-Cut

## OFFERS COTTON FIBER ABRASIVE WHEELS

A line of Type 27 cotton-fiber abrasive wheels that can remove fillet welds on stainless steel and aluminum and produce food-grade finishes in one-step is available from Rex-Cut Abrasives of Fall River, Massachusetts. Rex-Cut Type 27 Cotton Fiber Grinding Wheels feature multiple layers of cotton fiber that are impregnated with aluminum oxide grains and then pressed and bonded together. Suitable for remov-



ing fillet welds on stainless steel and aluminum, they constantly reveal fresh abrasives to provide smooth controlled grinding action and can grind with both the side and face. Available in 4½", 5", and 7" sizes, ⅜" and ¼" thick, with A36 or A54 grit sizes, and a GFX latex bond, Rex-Cut Type 27 Cotton Fiber Grinding Wheels provide finishes that are two to three grit sizes finer than comparable wheels and are non-loading on aluminum, claims the firm. Optional ⅝"-11 throw away adapters are offered. Rex-Cut Type 27 Cotton Fiber Grinding Wheels are priced from \$7.37, depending upon size and quantity. A price list is available upon request.

### For more information:

Rex-Cut Products, Inc.  
960 Airport Road  
P.O. Box 2109  
Fall River, MA 02722  
Phone: (800) 225-8182  
[www.rexcut.com](http://www.rexcut.com)

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