

Gear Milling on Non-Gear Dedicated Machinery

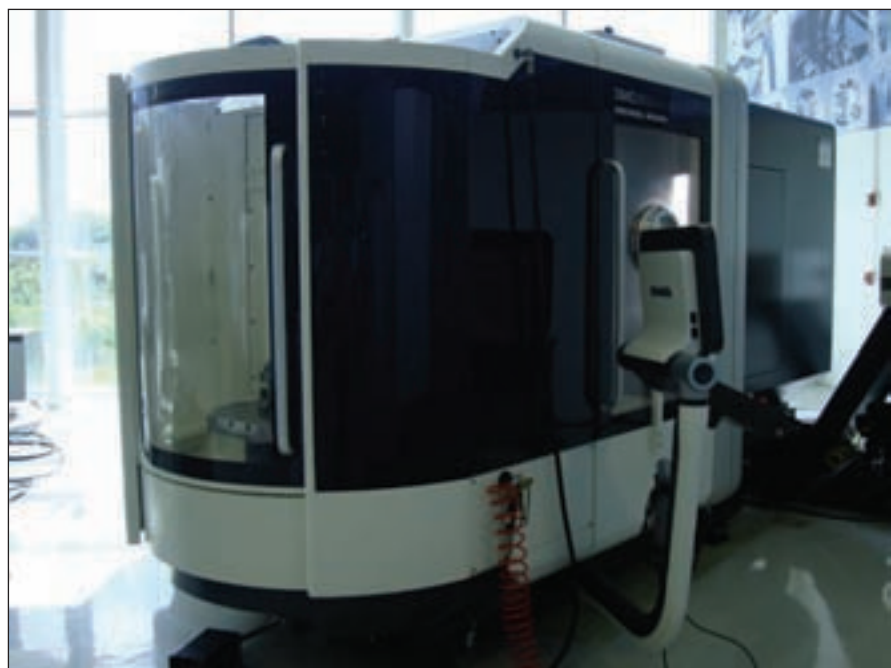
MAKES MARKET DEBUT

Imagine the flexibility of having one machine capable of milling, turning, tapping and gear cutting with deburring included for hard and soft material. No, you're not in gear fantasy land. The technology to manufacture gears on non-gear-dedicated, multi-axis machines has existed for a few years in Europe, but has not yet ventured into mainstream manufacturing. Deckel Maho Pfronten, a member of the Gildemeister Group, took the sales plunge this year, making the technology available on most of its 2009 machines.

The initial focus bringing this technology to market stemmed from increased demand for energy applications, wind primarily. Spiral bevel gears have been the most common type produced using these machines, but DMG is capable of manufacturing many other types as well, including internal and external spur gears, helical and double helical gears, straight and spiral bevel—both the Klingelnberg cyclo-paloid and Gleason types—and hypoid gears.

The potential exists to make most any type of gear using this method, but the technology is so new that DMG has not yet touched upon all the possibilities. They rely on the customer to present them with a blueprint to proceed. DMG has developed software for creating the 3-D data necessary for production of high accuracy gears.

"We have developed very accurate,



DMG has the potential to cut any type of gear on a universal five-axis machine, though spiral bevels have been the focus (courtesy of DMG).

very specific software to calculate the tooth geometry," says Dietmar Haberlag, product sales manager for DMG America.

The gear milling software consists of several modules for design, CAM, simulation, measuring and training. DMG intends to have the components merged into one software package by EMO in October, at which time they also expect the interface to have a new, more user-friendly look, and an application for programmers. The concept for the software was prompted by some of DMG's customers who approached them with numbers and nothing more. "The idea was because not every customer is able provide the necessary gear design information data," says Albert Schäftner, team leader of the five-axis group for Deckel Maho in Germany.

The design module is a program for calculating the tooth geometry. It serves as an interface for gear data entry, designing fillet radius, defining gear backlash and profile correction and engaging simulation and collision monitoring.

The CAM module is responsible

for defining tool geometry, creating roughing and finishing functions, and it serves as a post-processor for the five-axis machines. The simulation module replicates the part process. It represents the turning part geometry, provides gear geometry output, optical simulation of machine movements, optical collision check and analysis of working travels.

There are also optional modules for measuring and training. The CMM module measures data output in Deckel Maho format; other formats are possible by request. The training module offers startup, process and technological support. DMG is currently offering extra support for customers in order to cut the learning curve. They plan to make improvements based upon customer feedback and requests.

"Gear experience is not our technical expertise," Schäftner admits. "We have to rely on the customer for [this] knowledge. That's how we approach our goals."

The gear milling capability is not a retrofit option, although this may be a possibility in the future. Most of Deckel Maho Pfronten machines will be equipped for cutting gears with a



Most new DMG machines can be equipped with the gear milling technology (courtesy of DMG).

few standard options, such as a B- or A-axis, touch probe, Blum laser and 3-D quickset.

This technology essentially launches DMG's entry into the gear market, but they do not have any illusions about where they stand competitively with the industry's big machinery players. Habermag is quick to draw a distinction between what DMG is trying to do with this technology as opposed to what a Gleason or Klingelnberg does.

"We are doing this on a five-axis machine, which is different to that which a main manufacturer like Gleason or Klingelnberg is doing. They are making this on a special purpose machine. We are doing this on a multi-tasking machine. This means on that machine you can make a turning process, you can make the milling, drilling, the tapping process and gear finish machining process in hard and soft material condition," he says.

"We are not so much in the field of mass production. We are more for multiple model types, less batch sizes, for very large parts. We don't take their business away; however, we are offering a much higher benefit in many fields."

The biggest appeal to manufacturers with this is that it provides them with the capability to use a machine to cut gears and other parts as well. So there is much more flexibility for manufacturers that produce parts that include but are not limited to gears.

"Gleason and Klingelnberg are only in the field of gear machining," Habermag says. "We are in a very wide field. Gears are just a small part of our business. We are trying to get more because we are seeing particularly in the field of wind energy, spiral bevel gears, larger gears. It is much more economic to make them on our universal milling machines than on standard gear machining models. The idea is to use a five-axis machine with standard tooling and all the features of a machining center or universal mill-turn machine.

"Klingelnberg or Gleason, they need special tools, very expensive, very long delivery and only for this particular gear profile."

The consensus among some gear makers is that the technology is new and in an experimental stage, but there is definite potential for the industry.

Louis Ertel, president and CEO of

Overton Chicago Gear, takes a cautious, wait-and-see-stance. "It's all a question of how fast they can do the machining and how accurate and how good the surface finish is," he says.

For Larry Delp, manufacturing engineer for Fairfield Manufacturing, "The size of the machines that we have or they are capable of producing would be of interest to us.

"[The larger equipment] would give us some larger capabilities for bevels,

continued




also hard-finishing capabilities. Also you get big parts that have hubs or areas that a face mill-type cutter wouldn't be able to go through, so you can do some things a regular bevel type machine can't do," Delp says. "It's interesting. Looks like it has a ways to go on the

technology and maybe the software, but I think it has certainly got potential."

For more information:

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The MonoTherm single chamber vacuum furnace, a product known on the global market through ALD Vacuum Technologies of Hanau, Germany, is available to the North American market through ALD-Holcroft of Wixom, MI.

The MonoTherm is offered in "kit" style, meaning the system is designed for specific customer needs per a customer's choice of standard system options. The configurations can include a 360 degree cooling pattern, or top/bottom, left/right cooling gas flow. Cooling pressures are available from 1.4 to 20 bar positive using nitrogen, argon or helium. Graphite and metallic hot zones are standard options as well as convection heating, soft starters, variable frequency drives and partial pressure control.

Applications for the MonoTherm include vacuum annealing, vacuum hardening and tempering, case hardening (low pressure carburizing), vacuum brazing and vacuum sintering. Special applications and load sizes make additional processes possible. MonoTherm provides a ± 10 degrees Fahrenheit temperature uniformity from 300 to 2,280 degrees Fahrenheit.

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Hexagon Metrology's combination laser scanning metrology package

includes a Brown and Sharpe Global Performance bridge CMM with a Romer Infinite 2.0 seven-axis portable arm with ScanShark V4ix laser scanner. The package is plug-and-play, and both systems can be swapped. A TESA kinematic joint is responsible for the system's compatibility. The joint

is shared by all Romer scanning arms and TESASTAR-m equipped bridge machines.

"This package leverages several existing Hexagon brands and technologies into one complete package offering," says Eric Bennett, product

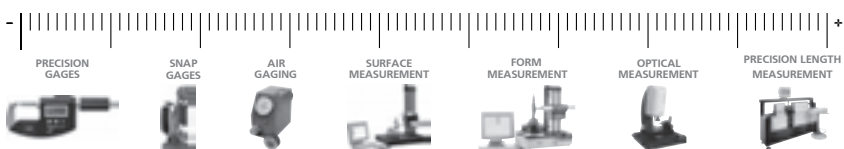
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manager for bridge products. "There are definitely times when scanning with an arm is the fastest and most effective technique, for example, when the part is large and must be measured in place. Conversely, if you have lots of smaller identical products you would like to scan repeatedly, then it is useful to set

up a program to scan batches of them automatically. With this package, you don't have to choose between one or the other."

A shared system such as this one can work as an inspection system while performing reverse engineering and 3-D point cloud gathering tasks.

Both machines can perform point-to-point inspection without attaching the scanner. This means they both can be used simultaneously, regardless of which is using the laser scanner.

The shared scanner package comes with a Brown and Sharpe Global Performance bridge CMM (nine standard sizes available), a Romer Infinite 2.0 seven-axis arm (six standard sizes available), a ScanShark V4ix probe, complete cabling, software and control boxes for each system, application software and a computer for each system. The packages can be shipped immediately.

"There was a time when the substantial investment in a laser scanner meant it came down to buying either the bridge machine or the arm," says Dave Armstrong, product manager for portable products. "With our offering, you don't have to choose, you can have both. Other systems where the scanner is integrated or the connectors are incompatible simply don't have this flexibility."

For more information:

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Federal are designed to offer a low-cost alternative to all-digital gaging amplifiers. They feature dual input ports for single or differential ID or OD measurements with selectable ranges in inch or metric units. They can be used with "Federal" or "Mahr" type inductive probes. It is available as portable or bench mountable and is rugged enough for the shop floor but equally compatible in the laboratory.

"Even though we live in a digital world, analog displays still offer advantages in a number of applications," says Paul Mailloux, manager precision gages for Mahr Federal. "Analog indicators instantly reflect true measurement size. They're easier to use than digital instruments and can more readily detect trends or rates of change."

Series 830 Amplifiers are suitable for both dynamic and static gaging applications. Common applications include part centering and leveling on machine tools, exploring a surface for defects on a surface plate, detecting part out-of-roundness on a V-block and machine leveling using level sensors.

A dimensional-measuring model calibrated in both inch and metric units is included as well as a model that supports both leveling and dimensional applications in arc-seconds and inches. These two models offer three measurement ranges and resolutions designed to suit most setup and inspection jobs.

The Series 830 features two gage inputs that can be used simultaneously with polarity either normal or reversed

for differential measurement setups. Calibration adjustment is an option for each input. The amplifiers include a ± 2 volt analog output port and rechargeable batteries with a minimum eight hours of continuous use in addition to the 120 or 240 AC line voltage the system operates on.

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AGMA Tolerance Calculator

ASSISTS IMPLEMENTATION OF BEVEL GEAR STANDARD

The ISO 17485, Bevel Gears-ISO System of Accuracy standard

was adopted by AGMA in 2008 to complement the library of standards for gear manufacturers and power transmission products. To help implement the standard, AGMA's Computer Programming Committee developed a tool to accurately perform the calculations necessary to determine the tolerances for the gear features.

This program supplements the tool developed to aid calculating tolerances in accordance with ANSI/AGMA 2015-1-A01 for spur and helical gears, which has been available to members for several years.

The standard ANSI/AGMA ISO 17485-A08 provides tolerances for single pitch, total cumulative pitch, runout and tooth mesh component single flank composite. The tolerance calculator determines the tolerance values for gears based on their geometry and accuracy grade.

The tolerance values in the standard are determined by equations based on tolerance diameter, mean normal module (diametral pitch) and accuracy grade. Alternate geometry is an input option due to the availability of mean normal module.

The calculator functions as an MS Windows-based program where users input the basic data for a specific gear geometry, run the program, and the software displays the values of all tolerances. The software is provided free of charge to AGMA member companies. It can be found at www.agma.org/content/navigationmenu/publications/17485calculator/default.htm.

For more information:

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Holroyd introduces the Gear and Thread Grinder (GTG2) for precise grinding of helical/spur gears up to 350 mm in diameter. The machine aims to meet market demand for accuracy in small volume for aerospace and automotive applications, industrial optics and custom designed industrial products.

The machine is capable of grinding master gears, precision prototyping, timing gears for aerospace applications and helical gears for high performance automotive gearboxes and oil pumps.

"The new machine draws on the technology and expertise gained by Jones and Shipman in designing and manufacturing precision creepfeed, surface and cylindrical grinding machines, and combines it with the specialist helical tooth and thread profile grinding expertise of Holroyd," says Tony Bannan, chief operating officer for Precision Technologies Group, parent company of Holroyd and Jones and Shipman. "The new machine is a relatively low volume machine that provides high accuracy with fantastic flexibility and very short set-up times


thanks to a lot of onboard technology making it ideal for aerospace and specialist automotive applications."


The GTG2 grinder was developed in collaboration with the Gear Design Unit at Newcastle University. It features onboard software capable of complex forms and advanced profile results from

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prediction and many other features, the technology onboard this machine is ahead of anything else on the market for high precision gear grinding," Bannan says. "We ourselves have also used these machines to manufacture bespoke worm and helical gears, which has assisted in the development of such a

machine, which coupled with feedback from research institutes and customers, we continue to develop our ongoing database of manufacturing experience and provide solutions to challenges faced by users of machine tools worldwide."

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Inova GMM

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Wenzel Gear Tec introduced the Inova gear measuring machine at the Control Exhibition in Stuttgart, Germany in May. The Z-axis with its integral rotary table is positioned independently from the X and Y-axes of the Inova. Highly-accurate servo drives provide dynamic performance for all linear axes.

An integrated pneumatic vibration damping system isolates the machine base, so there is no need for a special foundation. The guideways are made of impala black granite.

The Inova detects grinding burn by using multiple scanning sensors including probes. The probes and sensors are protected from dirt and damage by a probe change rack that features a protective cover.



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The basic Inova GMM includes a SP600 or SP80 Renishaw scanning probe, calibration sphere, three- or six-jaw chuck, CNC controller installed in a 19-inch cabinet with PC and power unit, LAN board for centralized network integration, software for online service and an integrated joystick for manual positioning and measurements.

The GMM can be equipped with a range of Wenzel gear measuring software modules for gears, gear cutting and finishing tools and grind burn detection. Workpiece diameters range from 5-270 mm. It is capable of measuring internal gear diameters greater than 12 mm. Gear face widths up to 500 mm and gears with helix angles less than 90 degrees are measurable.

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The Heidenhain-Certo program measures gages in range of 0-25 mm at $\pm 0.1 \mu\text{m}$ accuracy/ $\pm 0.03 \mu\text{m}$ after error compensation, and 0-60 mm at $\pm 0.01 \mu\text{m}$ accuracy/ $\pm 0.05 \mu\text{m}$ after error compensation. Error compensation is stored by the ND 287 along with manual

input of values from the accuracy chart included with the Certo length gage.

The ND 287 has a capacity for four inputs with varying interfaces and permits toggling between multiple gages, sensors and encoders. The SPC function allows users to write up to

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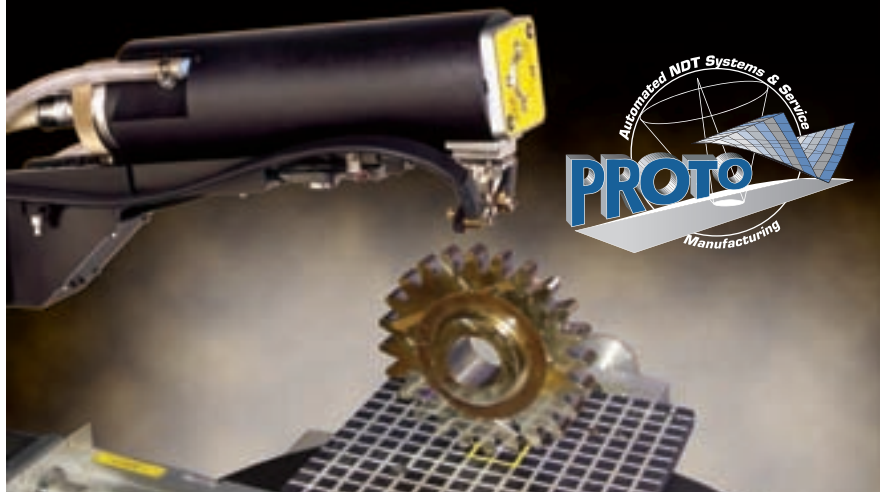
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Elterma S.A., a member of the Seco/Warwick global organization, commissioned two electrical PEGat-1000/18x30 pit furnaces and a G-4000-ET atmosphere generator for a Spanish manufacturer of wind turbine gears.

The furnace and generator join other PEGat furnace products including an electrical PEG-750/18x30 furnace for tempering, a WHO-18x30 oil quench tank and a MKV2-18x30 washer. The equipment has doubled the plant's capacity, according to a press release.

"The advantage of the pit furnace is that the round gears can be stacked quite high in the furnace, and bridge cranes, a relatively inexpensive material handling system, maybe used for very heavy loads," says Gary Armour, project engineer. "Large loads are the best way to affordably process these long cycle (24-48 hour) parts."

For more information:

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L&L Furnace

SHIPPED TO GOODRICH FACILITY

A model FB series fiber-lined box furnace was shipped to the Goodrich Aerostructures' Mexicali production facility by L&L Special Furnace Company. The furnace, the second Goodrich has purchased for this location, will be used to process aerospace components.

The L&L Special Furnace model FB668 was custom made with dimensions of 72" x 72" x 96" with a 3,200 lb load capacity. A motorized loader to facilitate material handling was included with the system.

The FB model series is designed specifically to meet ASM2750D specifications for pyrometry. The furnace can achieve temperature uniformity of +/-5 degrees Fahrenheit. A convection fan provides uniformity at low temperatures.

For more information:

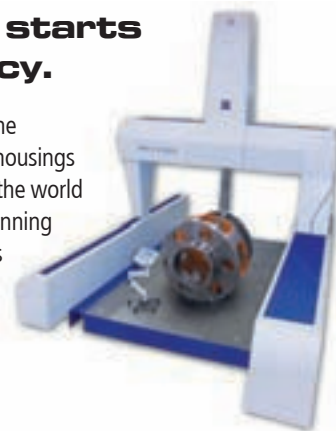
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The glossy black magnetite coating is 0.5 microns thick. The Tru Temp coating operates at 200 degrees F and uses mild alkaline chemistry, so steel does not become brittle in the process. The finish is not made with any EPA-regulated chemicals, which eliminates the need for waste treatment equipment.

Processing time takes about 25 minutes. Most tank lines can be retrofitted for the Tru Temp solution, and the process can be automated by a CNC programmable hoist system.

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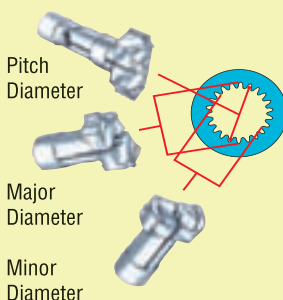
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AC Option

JOINS BISON'S FLEXTORQ GEARMOTOR LINE



The FlexTorq 762 series hollow shaft offset AC gearmotors from Bison Gear and Engineering Corp. are single and three-phase AC motors added to gearing for face or foot mount and hollow or stub shaft. They are designed as high torque, tight space drives, and they feature either a 1.25 inch inside diameter hollow shaft or a 1.25 inch diameter solid shaft in either the u-shaped or s-shaped configuration.

The fractional horsepower gearmotors are driven by 1/20, 1/4, or 1/2 hp (37, 186 or 373 W) single- and three-phase 115 and 230 volt AC electric motors. They operate with fixed output speeds from 60 to 1 rpm and provide continuous duty torque outputs from 430 to 2,500 in-lbs (48.5 to 283 N-m).

"These new FlexTorq AC gearmotors are a nice complement to our DC FlexTorq offering and are ideally suited for a variety of conveying, food service and athletic equipment applications," says Jim Parejko, vice president of continuous improvement and engineering for Bison Gear. "We have added 15 standard models to our In-Stock, Instant-Ship (ISIS) program to support our distribution partners and can readily design variations to meet specific OEM needs."

The AC FlexTorq standard package includes two dual voltage (115/230) models, nine 115 volt models and four energy saving Verdant Duty three-phase models for use with variable frequency drives. Find complete specifications and CAD drawings for these units at Bison's website.

For more information:

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Are you interested in reducing your gear costs while increasing their quality? Presrite hot-forges intricate gears to net and near-net shapes, so little or no hobbing is required.

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See why customers from a wide range of industries and countries come to Presrite for forged gears. Contact us now for more information or a quote.

Weight Savings — As a blank, this large spur gear weighed 55 lbs. As a forged tooth gear with 1 millimeter of stock on the tooth profile for hobbing, it weighs just 37 lbs.



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**PRESRITE NEAR-NET GEARS GIVE YOU THE
STRENGTH OF A FORGING WITH
LITTLE OR NO MACHINING.**



Building A Better Business

ISO 9001:2000 TS 16949:2002

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