

# solutions



One Booth,  
Total Gear  
Solutions  
on Display  
at AMB 2016

## New Solutions

Today's most exciting new gear production and inspection technologies.

## Customer Success

Faster grinding and shop floor inspection at Schafer Gear.

## Special Reports

Advances in hobbing, cutter build and workholding.

# Welcome to Gleason



John J. Perrotti

President and  
Chief Executive Officer

Dear Valued Customers:

For the first time we are exhibiting at the AMB Show with our own booth in a new design, and – most importantly – with many new exciting products and technologies. These innovative solutions will allow our customers to take a major step forward in terms of productivity, quality, versatility and cost effectiveness.

Some of the new technologies on display include Power Skiving of hardened parts which can open new dimensions for high volume finish machining of internal gears.

We will also be displaying our new 100HiC Hobbing Machine with integrated chamfering. This machine is fast, accurate and has a cost-effective chamfer cutting process along with a new generation of machine software using a touch screen and intuitive navigation for ease of use and optimal performance.

For bevel gear technology we will introduce our 500CB machine which builds bevel gear cutter systems with extreme accuracy with virtually no manual involvement. The machine even learns each time it builds a cutter and gets better the next time!

Rounding off our products at the show are Gleason automation systems, the latest in cutting tools, workholding products and global service solutions.

Throughout the show and within many of our exhibits we will be highlighting our Gleason 4.0 initiatives which are focused on digital manufacturing and how data and information can be used to optimize gear manufacturing.

It will be a great show.

Please follow us on our website, [www.gleason.com](http://www.gleason.com), and social media outlets throughout the year to stay on top of the latest in gear technology.

We look forward to seeing you in Stuttgart.

#### 4 What's New at AMB 2016

See some of our most gear manufacturing technologies in action.

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New solutions for hobbing and high-volume grinding of cylindrical gears.  
 New processes and cutter systems for bevel gear manufacturing.  
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The new solution for fine finishing of internal gears.

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Adding precious hard finish grinding capacity and greatly reduced gear inspection queue time are among the many benefits.

#### 16 Integrated Chamfering/Deburring on Hobbing Machines

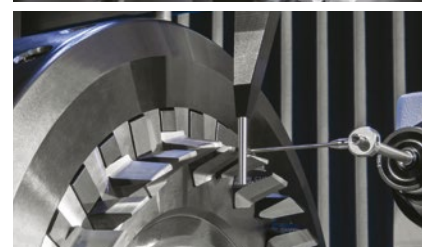
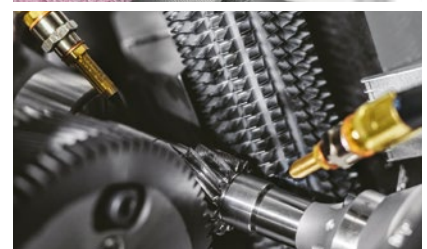
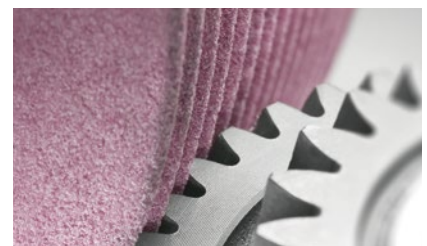
The key to more economical production of quiet, dependable, smooth-running gears and shafts required by the latest automotive transmissions.

#### 20 Automated Bevel Gear Cutter Builds

The new 500CB delivers faster, more accurate, and highly automated build, truing and inspection of stick-blade type bevel gear cutters.

#### 22 Gear Lab Workholding for Bevel Gears

Greatly reduce the time it takes to get fully functional, extremely accurate workholding for bevel gear testing and development efforts, with the new FLEX-SPAND™ (gears) and FLEX-GRIP™ (pinions).





# One Booth, Total Gear Solutions

You'll find a host of new technologies on display...

## Highly Automated Gear Hobbing/Chamfering



**100HiC Gear Hobbing with Chamfering:** Featuring time-parallel chamfering and integrated Gleason automation to produce geared shafts and disc-type workpieces more economically.

### Gleason Automation Systems with Modular, Integrated Solutions:

Outperforms costly, operator-dependent, conveyor automation at every level. Easily integrated with most machine tools and combines advanced robotics and stackable tray technology for faster, more efficient load/unload. Integration of secondary operations enables this system to function as a highly versatile work cell, further enhancing productivity.



### The Gleason Global Services

**Organization:** Dedicated to maximizing the uptime of Gleason production equipment, employing a full array of new resources to give our customers faster, easier and more efficient access around the world, around the clock.



## Hard Power Skiving



**Hard Power Skiving – the Breakthrough in Fine Finishing of Internal Gears:** The complete solution: machine, automation, tooling, inspection and software to produce internal gears faster, with hard finish quality.

## Automated Cutter Build



**500CB – Cutter Build Inspection Machine for Automated Cutter Builds:** Delivers more accurate and highly automated build, truing and inspection of all types of stick-blade bevel gear cutters.



# GEMS

Gleason Expert Manufacturing System

**Optimizing Bevel Gear Production:** Introducing the next generation of the popular suite of Gleason bevel gear design and manufacturing software. GEMS is the powerful software design tool that helps optimize your bevel gear designs and ensures that all of your Gleason bevel gear cutting, grinding, blade sharpening and gear inspection machines are working together to produce the highest quality bevel gears fast and efficiently.

## Gear Manufacturing Tools

**Advanced Cutting Tools:** New tool materials and advanced carbides, latest wear coatings; Hard Power Skiving tools; innovative Pentac®Plus RT and Pentac®Mono RT Cutter Systems for bevel gears; the latest hard finishing tools.



## Workholding Solutions

**Advanced Workholding Solutions:** Try the new Stir-Able workholding, and take the Gleason Quik-Flex®Plus Challenge to experience just how easy it is.



# New Solutions for Cylindrical Gears

## Taking High-Volume, High-Quality Gear Grinding to the Next Level

New Genesis® 200GX and 260GX Threaded Wheel Grinding Machines combine maximum productivity with minimized idle and setup times. They are the ideal machines for customers in high productivity, high-quality environments seeking improved grinding performance. Features include:

- Very short idle time due to the double spindle concept; loading and unloading as well as spindle acceleration done in parallel.
- Fast, easy software-guided machine setup of the machine with just one tool.

- “First Part Cycle” – fully automatic workflow after setup until grinding the first workpieces.
- Twist-controlled grinding.
- Polish grinding to achieve extremely good surface quality.
- VRM grinding to positively influence the ground surface textures regarding noise emission.
- CNC dressing unit for four different dressing methods – from maximum productivity to maximum flexibility.

- Easily integrated with Gleason automation systems offering fast, efficient parts handling.



## Expanding the Series of Horizontal Hobbing Machines

Two new machines have been added to Gleason’s popular line of horizontal hobbing machines, providing optimized solutions for applications which require particularly high productivity and efficiency:

### **New P90CD Hobbing Machine for Disc-Type Workpieces Such as Automotive Pinions and Short Shafts:**

- Featuring an integrated CNC chamfering/deburring station which works in parallel to the cutting process; hence productivity is not compromised by the added auxiliary process.
- For hobbing parts up to 60 mm diameter and module 3 mm; larger diameters are available on request.
- Cycle times are as short as 10 sec for planetary pinions. The chamfering/deburring station includes an auto-meshing feature which avoids tooth-on-tooth cut workpieces and chamfering tools for consistent cycle times and to avoid damage to workpieces.

### **New P90iC Hobbing Machine for Both Geared Shafts and Disc-Type Workpieces:**

- Featuring an integrated chamfering/deburring unit which eliminates burrs and creates even and precise chamfers.
- For workpieces up to 100 mm diameter and module 3 mm; larger diameters and modules are available on request.
- Ideal for one or two-cut processes for

finish hobbing or to create a quality base for subsequent hard-finishing operations.

- Two-cut process is executed in a single setup (cutting-chamfering/deburring-cutting) and eliminates secondary burrs and residue on the gear flanks. Benefits subsequent hard-finishing processes and protects the tool life of expensive finishing and dressing tools and, in particular honing tools.



# Introducing Hard Power Skiving Fine Finishing of Cylindrical Internal Gears



The new Gleason 300PS Power Skiving Machine is part of the complete Hard Power Skiving solution to produce internal gears with hard finish quality many times faster than traditional methods. Gleason Power Skiving is tailored to the customer's application using a complete system that includes not only a highly automated machine platform, but also:

- **Process Simulation:** Powerful simulation tools to optimize the process, and calculate chip geometry, chip formation and contact geometries for each specific process step.
- **Cutting Tools:** Cutting tools designed and manufactured specifically for each application, along with the logistics and service for resharpening and maintaining the tools.
- **Tool Management System:** Includes an innovative cutter measuring system that measures changes in cutter size after each resharpening to ensure first-part size accuracy after a cutter change.
- **Modular, Quick-Change Workholding:** Making it fast and easy to change over for different workpiece diameters and face widths.



# More Shaping Productivity for Smaller Face Widths

The Gleason 100S Shaping Machine combines the very high productivity of 3,000 stroke rates/minute with minimum chip-to-chip times to greatly reduce gear processing times. It's the perfect solution for internal and external spur and helical gears with smaller face widths, and offers:

- Chip-to-chip times under six seconds with cam driven loader which reduces workpiece load/unload times to under three seconds.
- Equally well suited for both dry and wet machining.
- Optional automatic adjustment of stroke position after re-sharpening of the cutter.
- Fast clamping and unclamping system, high repeatability.
- A compact and robust machine design with significantly reduced floor space requirements; fast and easy to install, move and start up. Supply power to the machine and it's ready to go.





# New Solutions for Bevel Gears

## PENTAC®PLUS RT Cutter System

**Fast, precise cutter build; improved productivity.**

PENTAC®Plus RT takes PENTAC® performance to yet another level. Design modifications to the blade seating surface and the addition of a screw for radial blade adjustment enable the system, in conjunction with a Gleason 500CB Cutter Build Machine, to be built and 'trued' much faster and more precisely than possible with stick blade systems of the past. The new design also assures a very high blade seating stiffness during cutting, ultimately resulting in greatly improved cutting productivity and tool life.

## PENTAC®MONO RT Cutter System

**Half the blade blanks, 50% longer tool life.**

New Pentac®MONO RT is the world's first cutter system that features outside and inside slots using the same identical blades. As a result, it's possible for users to reduce the number of different blade blanks by 50%, and double tool life by swapping the blades from the outside slots to the inside slots and vice versa, and then using the cutter with the same blades for a second run.



PENTAC®Plus RT



PENTAC®MONO RT

## New UNIMILL™ Process: Empowering Bevel Gear Jobbers

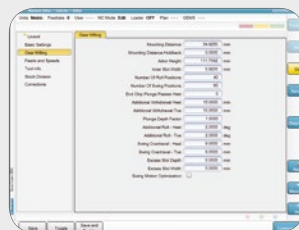
Bevel gear jobbers using older machines and 2-tool generators to cut parts now have a powerful new incentive to invest in new Gleason Phoenix® bevel gear cutting machines. Proprietary new Gleason UNIMILL™ process delivers these many long-sought benefits:

- UNIMILL™ enables Gleason Phoenix® cutting machines to produce straight bevel gears with front hubs faster and with much higher quality, using standard tools.
- UNIMILL™ and Phoenix® can produce high-strength, difficult-to-machine front hub jobs that can't be done on 2-tool generators.
- UNIMILL™ gives every jobber the versatility for prototype runs of straight and spiral bevel and hypoid gears using standard tools and simple CNC programming changes.
- UNIMILL™ produces large face width straight bevel gears using Coniflex®Plus cutters – gears which previously could only be cut on 2-tool generators.
- Standard Coniflex®Plus cutter heads combine with the UNIMILL™ swing motion to produce straight root lines just like a 2-tool generator but faster and in a high speed dry cutting process. Even grinding after heat treat is possible with UNIMILL™ by employing CBN coated Coniflex grinding wheels.

Using standard tools...



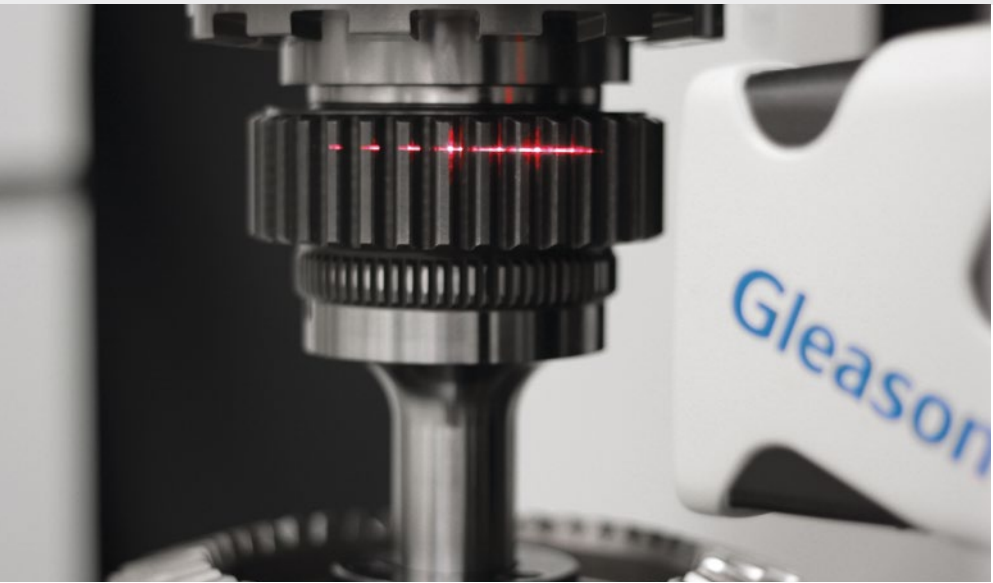
Easy programming...



And Phoenix® 280C and 600HC Bevel Gear Cutting Machines



# New Solutions



Left: Laser scanning capability speeds development efforts of increasingly complex gears.

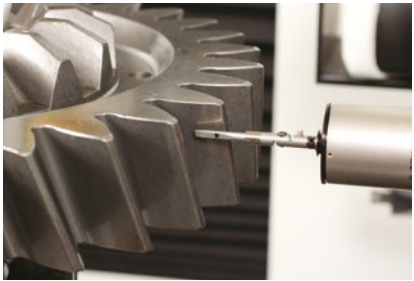


Tactile probing, for the complete inspection of a wide range of gear types, gear cutting tools and even non-gear, CMM-type measurement.

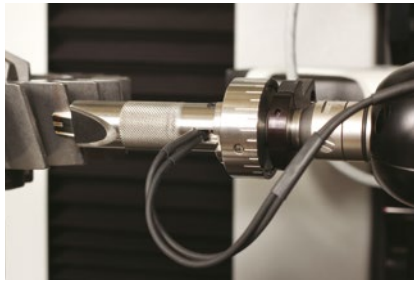
## Revolutionizing Gear Inspection with the New Gleason 300GMSL Multi-Sensor Metrology System

In response to increasing gear profile complexity and challenging new quality requirements, Gleason has introduced the new 300GMSL, giving users four different gear measurement capabilities combined in one compact, reliable and easy-to-operate platform. Gear producers now can use this single platform for:

- Tactile probing, for traditional gear feature data collection on spur and helical gears and spiral and straight bevel gears and beveloid gears up to 300 mm in diameter; and many types of gear cutting tools.
- Laser probing of a similarly wide range of workpieces, a process particularly well-suited for gear development efforts where massive amounts of data need to be collected many times faster than possible with conventional tactile probing, yet with similar accuracies.
- Surface roughness probing, for measurement of the surface texture of gear teeth, shaft journals and faces through the indexing probe head.
- Barkhausen noise detection, and the analysis for residual and compressive stresses in the material after the grinding on gear tooth flanks and shaft bearing race features.



Surface roughness measurement, to help ensure consistently high-quality surface finishes.



Barkhausen noise analysis, for evaluating surface modifications after finishing processes.



## Quik-Flex®Plus: A Change Will Do You Good

Increased spindle time, more productivity and lower cost per workpiece are just a few of the many benefits users can experience with the new Quik-Flex®Plus, Gleason's latest generation of modular, tool-less and extremely accurate workholding solutions for cylindrical gears:

- Cuts cylindrical gear changeover time to just 30 seconds or less.
- Eliminates all the usual tools and hardware.
- Helps ensure exceptional accuracy and repeatability.
- Available in different modular sizes to meet the requirements of different cylindrical gear processing applications on Gleason and non-Gleason machines.



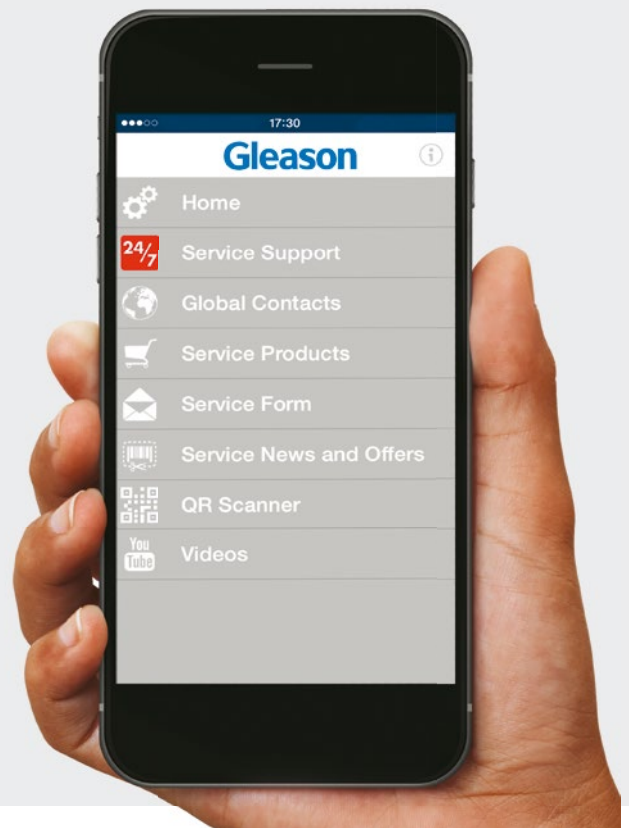
## Gleason Global Services: Now There's an 'App' for That!

Gleason customers now can use their smartphones and tablets to open the new "Gleason Global Services" app, giving them instant access to service-related news, the most up-to-date videos, and an easy means to contact Gleason Global Services. The app also allows customers to instantly inform Gleason about problems they might be experiencing, and transfer fault messages and/or pictures to Gleason via the app.

An integrated scanner functionality is available to directly transfer the QR Code of a machine along with all relevant machine data.

Additionally customers can use the app to easily forward any questions or requirements they may have, as well as manage their spare-parts requirements directly through the app.

The Gleason Global Services App is available at no cost today, through the APP STORE and Google Play.



# High-Volume, High Quality Gear Grinding Gets Faster

Single sourcing a highly automated Genesis® 200GX Gear Finishing System and new 'shop hardened' 300GMS®P Gear Inspection System from Gleason helps Schafer Gear Works gain capacity, minimize non-productive time and simplify setup and operation.



**WHEN SCHAFER GEAR WORKS** Operations Manager Paresh Shah visited the Gleason booth at Gear Expo last fall, he wasn't shopping for a new Gleason gear grinder. One hard finish grinding cell at the 100,000 sq. ft. South Bend, IN facility that Mr. Shah manages was already equipped with two Gleason Genesis® 160TWG Threaded Wheel Grinding Machines, and a second cell had a larger Gleason 300TWG, with another 300TWG on order. These machines, along with four other gear grinders, would give Schafer Gear one of the highest gear grinding capacities of

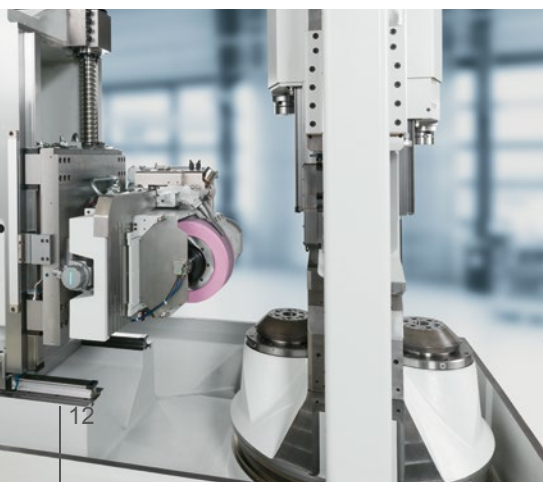
any privately owned gear manufacturer in the U.S. – and the ability to handle the throughput requirements of some 15 to 20 different tight-tolerance, 150 to 200 mm diameter gears in volumes as high as 100,000 annually.

“We weren't planning on buying another grinder but when we saw the new Gleason Genesis® 200GX on display benefits of the new system were almost immediately apparent,” Shah recalls. “Most obvious were the twin-spindle design that would allow us to save enormously on non-productive time, and the integration of Gleason automation. We ultimately purchased the 200GX, which has proven to be a very good decision.”

Double-spindle concept allows load/unload and spindle acceleration in parallel with grinding. For Schafer Gear, this feature alone reduces chip-to-chip time per part by as much as 12 seconds, multiplied by hundreds of parts per day.

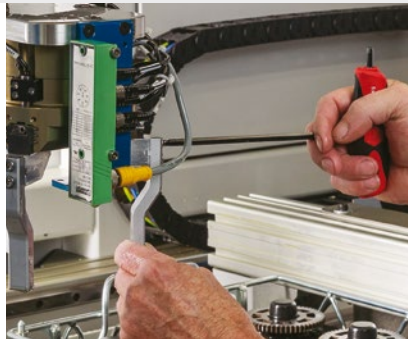
## Faster chip-to-chip.

The latest threaded wheel grinding technology has been instrumental in helping Schafer meet ever-increasing demand for faster production of high quality gears. Yet, Paresh Shah and his team at Schafer, seeking to gain still more productivity, have increasingly focused on reducing costly chip-to-chip time. Cutting even seconds in unproductive idle and setup time can quickly add up to truly significant savings in a high volume production environment like Schafer's, where throughput is measured in hundreds of parts per machine per day. Shah says that the 200GX, with its double-spindle design, reduces chip-to-chip time to just a few seconds per part by performing load/unload and spindle acceleration in parallel to the grinding cycle.





A single setup tool is all the operator needs to change over workholding, grippers and tools, helping to cut new part changeover time from 30-40 minutes to about 20 minutes.



Menu-guided setup takes the operator through all the steps in the re-tooling process using helpful images.

The 200GX makes significant reductions in setup times as well, according to Shah, with a host of innovative new features that greatly simplify, and automate, changeover from one part type to another. "A process that would take 30 to 40 minutes on our other grinders has been cut in half on the 200GX," Shah says. "It's not only faster, but much easier for our machine operators."

Just ask Jim Smith, who runs the finish grinding cell that now includes the new 200GX, an existing Gleason 300TWG, and a new Gleason 300GMS®P 'shop hardened' gear inspection system. Smith credits the 200GX's fast, simple setup as one of the reasons he's able to juggle so many balls. "Everything is easier on the 200GX. For example, I use the same simple tool to chuck and unchuck the workholding, change over the grippers on the loader, and change the grinding and dressing wheels."

Smith also cites Gleason's Quik-Flex®Plus workholding system as being particularly beneficial to the setup process. It consists of a base unit which is installed and aligned on the machine workspindle just once, and part-specific modules that can be installed

or removed from the base unit in just seconds using the aforementioned tool.

### Completing 'first parts' automatically.

On the 200GX a new, fully automatic "First Part Cycle" process is available to speed and simplify the additional steps required after completion of mechanical set-up up to and including grinding the first two new parts. The operator starts by setting the nozzle for the cooling oil, setting the ideal position for the stream of lubricant using the hand wheel. Automatic cooling oil nozzle adjustment then ensures that once found, this position is maintained even if the diameter of the grinding wheel becomes smaller. Then, the dressing tool is engaged fully automatically into the gaps in the grinding worm. A sensor integrated in the grinding spindle is combined with the corresponding algorithm to make this process fast, simple and, above all, reliable. The grinding worm is given its first dressing immediately after the dressing tool has been engaged.

After dressing, the worm is engaged with the workpieces. Once the workpiece is engaged, it is then

measured by the index sensor and serves as a reference for all the following workpieces. The "First Part Cycle" is completed by grinding two workpieces, one on each work spindle, which then are easily extracted for inspection from a convenient drawer. Tooling-up for a new component is thus completed simply, accurately, and in the shortest possible time.

### The many benefits of a complete system.

The easy integration of Gleason Automation Systems' DS1200 Machine Tool Loader (MTL) was a powerful selling proposition as well, according to Paresh Shah. "This automation stores and conveys parts in stackable trays which allows us to load and unload up to 180 parts at a time," he says. "Compared to the conveyors servicing the other grinders this puts, depending on part size, three to six times more parts in-process and unattended, thus freeing up our machine operators to be doing other, more productive things than loading and unloading parts. The machine and automation also take up considerably less floor space, an important consideration in this particularly confined area."

Integration of a Gleason Automation Systems' modular Machine Tool Loader puts 180 parts in stackable trays ready for robot load. This is up to 6 times the number of unattended parts in the queue as compared to a traditional conveyor system.



## Customer Success



Putting a 'shop-hardened' 300GMS®P in close proximity to Schafer's two high-volume hard finish grinding cells saves hours of queue and transport time every day. Vibration from forklifts and nearby shaping operations, as well as temperature changes, have had no impact on the system's ability to deliver exceptional inspection results.

### Freeing up the inspection bottleneck.

Schafer Gear and Mr. Shah also sought to add capacity by focusing attention on the quality lab which, according to Shah, had become an expensive bottleneck. "We have eight grinders that each require perhaps one new gear setup a day – and each setup requires a first-part inspection in the gear lab and acceptance before the operator will run the next part," he explains. "Shuttling these parts back and forth between the machine and the quality lab can take upwards of 20-30 minutes, multiplied by the two or three times it typically takes to dial in the machine. If this is happening just once a day for our eight machines, you're looking at some very expensive idle time for many millions of dollars of machinery that should instead be making parts."

Additionally, Schafer's quality lab also must support, two or three times a day, the typical in-process inspection of a sample gear produced on each grinder during a production run. When a decision was made to add much-needed capacity to the lab, Shah and his team had a better idea: why not eliminate the wait altogether by bringing the lab to the grinders?

### Shop-hardened inspection adds throughput.

Gear inspection bottlenecks of the type faced by Schafer have increased significantly in recent years, as low noise, increased power density, greater reliability and other factors have all combined to increase gear complexity and the inspection requirements that come with it. The search for a true

'shop-hardened' inspection solution – one that could work alongside and service gear production equipment on a moment's notice – has proven futile, with temperature variations, vibration and contamination proving to be too much for machines built for pristine lab conditions.

Fortunately, Shah also saw the new Gleason 300GMS®P Analytical Gear Inspection System on his visit to the Gleason booth at Gear Expo 2015. "Seeing is believing, and the demonstration convinced us that the 300GMS®P could be put out on the shop floor – essentially part of the grinding cells themselves – to eliminate hours of queue time every day, and even impervious to the considerable vibration from nearby shaping operations," recalls Shah. "Even better, the machine was so user-friendly that our machine operators



Machine operators now perform setup and in-process part inspections independent of the quality lab, saving precious time. The 300GMS<sup>®</sup>P is essentially part of the grinding cells, so they can perform in-process inspection, check charts and make machine adjustments on the fly.

could easily perform the inspections themselves.”

Today, this show machine is now nestled in among the other Gleason machines that make up most of the two finish grinding cells. According to Shah and the two machine operators running the cells, queue time for setup part inspection has been reduced from 20-30 minutes to as little as five minutes – savings that are multiplied by two to three times every day for each machine. Machine operators Jim Smith and Steve Allmon are particularly excited about the new inspection technology. “What a difference the system has made – walk over, set up the part, load a probe and start the inspection program with the touch of a button,” says Smith. “While that’s running I’m back at the cell making sure there are plenty of parts for these hungry machines. No more waiting for inspection results – we’re in control.”

## **Adding value in a shop environment.**

When asked if the 300GMS<sup>®</sup>P is operating just as well on the shop floor as it would in his tightly controlled lab environment, Schafer Quality Technician Jim Shinall says that he’s seen no evidence in the inspection results that vibration or temperature are in any way having an impact. “If that nearby shaping hammering was effecting anything we’d see spikes in the charts, and there’s been nothing,” says Shinall. “And while the shop is, to some degree, temperature controlled we will have temperature swings out there of plus or minus 10 degrees F and this has not had any effect. We had an older inspection machine and if the temperature fluctuated just a few degrees it wouldn’t operate without a probe re-calibration. This machine works and performs as advertised in the production area, pure and simple.”

The ‘shop-hardening’ of the 300GMS<sup>®</sup>P required a completely new design starting with a proprietary machine base material that’s well-suited for the sustained higher temperatures experienced on the shop floor. The new base material, coupled with a completely new patent-pending ‘H’ base design with active leveling system, has proven to be an excellent solution. Air springs mounted on risers, which support the machine work platform. These air springs detect, and automatically compensate for, vibratory forces on the fly, such that the machine work platform is both isolated from, and immune to, vibration.

The high precision guidance systems used to position linear and rotary axes on inspection systems are inherently susceptible to even minor temperature changes. The use of enclosed glass scales ensure exceptional accuracies, but also come with a thermal coefficient. The 300GMS<sup>®</sup>P development effort also addressed this challenge,

with a new type of scale made from a material that has essentially zero thermal expansion within the typical shop floor temperature range.

Finally, the 300GMS<sup>®</sup>P incorporates a system of new software and sensors that work in combination to detect, and compensate for, typical thermal fluctuations found on the shop floor.

“It has lightened up lab work load considerably, thus adding capacity overnight to the quality lab for the rest of the facility,” says Shinall. “Most importantly, the machine operators love it. They put a part on, click ‘start program’, say OK and it runs. I also like the fact that you can take a picture of the setup with the Advanced Operator Interface pendant and it’s on the screen so there’s no way you can not put the probe in the right place before the start of a program.”

This user-friendliness stems from GAMA<sup>™</sup> 3, Gleason’s object-oriented Windows<sup>®</sup> 7 compatible operating software that puts a host of powerful features right at the operator’s fingertips, creating a simple, intuitive human/machine interface. With GAMA<sup>™</sup> 3, creating a new program is as easy as point and click, and can be done in a few easy steps regardless of experience level, language requirements or the gear or application type.

## **A total gear solutions approach.**

“Gleason is excellent to work with – and their service is second to none,” concludes Shah. “So it has made great sense to source a complete system with them. With Gleason’s help, we have never been better positioned to take on the high-precision, custom-engineered gear projects that Schafer excels at.”

# Gleason Products and Technology



The P90iC fully integrates the chamfering/deburring operations in sequence with hobbing to accommodate the requirements of shaft-type parts and subsequent fine finishing processes like honing.





Gottfried Klein

Director, Product Management Hobbing, Shaving and Chamfering Solutions  
Gleason Corporation

## New Hobbing Solutions for Faster Production of Automotive Transmission Gears

Machine platforms that integrate hobbing and chamfering/deburring operations are key to more economical production of quiet, dependable, smooth-running gears and shafts required by the latest automotive transmissions.

**CONSUMERS TODAY** take for granted that their cars' transmissions – whether manual, automatic or differential; luxury or entry-level – will operate quietly, smoothly and dependably. But behind the scenes, auto manufacturers, gear designers and suppliers have worked hard to design, develop and produce the high-quality transmission gears and shafts that make it all possible. Quality requirements are such that many of these gears today are routinely hardened and then finished with threaded wheel grinding or honing. The reliability and productivity of these 'hard' processes – and the manufacturers' ability to master them while at the same time driving down cost and delivery times – are very dependent



on the technologies used to perform the 'soft' processes done upstream: hobbing, chamfering and deburring.

### Hobbing with integrated chamfering and deburring.

It's no secret that a completely burr-free tooth slot and a precisely defined chamfer are fundamental prerequisites for the honing process, used most often with shaft-type parts where minimal clearance prohibits grinding and to reduce the noise issues that may result from a ground shaft running with ground gears. For both gears and shafts, generating a chamfer to precise customer specification for size, shape and angle is of critical importance in order to minimize the potential for sharp, brittle edges after heat treat, as well as to optimize material plus conditions in the tooth flank prior to the finishing operations. Additionally, excessive stock and hardened burrs can diminish honing tool life and increase cost per piece significantly.



### New Gleason P90iC At a Glance...

- Featuring an integrated chamfering/deburring unit which eliminates burrs and creates even and precise chamfers.
- For workpieces up to 100 mm diameter and module 3 mm; larger diameters and modules are available on request.
- Ideal for one or two-cut processes for finish hobbing or to create a quality base for subsequent hard-finishing operations.
- Two-cut process is executed in a single setup (cutting-chamfering/deburring-cutting) and eliminates secondary burrs and residue on the gear flanks. Benefits subsequent hard-finishing processes and protects the tool life of expensive finishing and dressing tools, particularly honing.

# Gleason Products and Technology

Today, Gleason is meeting the challenge of making these operations more efficient by fully integrating them into two new horizontal hobbing machine solutions: the P90CD, for disc-type parts such as planetary pinions, sun gears and small shift gears; and the P90iC, for shaft-type parts. In both cases, the aforementioned chamfering/deburring operations – often still done on separate machines in multiple setups – now can be done on a single machine. Customers benefit with improved cycle

times, lower equipment costs and more consistent quality.

Both of these new solutions are based on Gleason's well-known small horizontal hobbing machines, operating now in nearly 1000 installations worldwide. Horizontal machines, with optimized chip flow away from the work area, are ideal for the dry cutting conditions preferred today in many of the world's high volume manufacturing environments. The P90 platform offers a hob head design that delivers the torque and RPMs needed to take full advantage of Gleason's most advanced solid carbide or G90 hobs, with AlCroNite®Pro coating, for dry, high-speed cutting.

The P90CD features a chamfering/deburring unit that gives users the ability to perform chamfering/deburring in parallel with hobbing, resulting in a remarkable cycle time of just 10 seconds chip-to-chip using high-speed gantry load/unload automation and Gleason workholding with a very fast clamp/unclamp capability. The gear is hobbed and the rough burr that results from hobbing removed in a single setup. The gear then is unloaded by the gantry and loaded into the chamfering/deburring station, where rotary chamfering with deburring is performed simultaneously while another gear is hobbed. The gantry then unloads the finished gear onto input/output automation and picks up a blank to repeat the process.

The P90iC also integrates chamfering/deburring, but is configured differently to accommodate shaft-type parts – and to eliminate the burrs typically formed by rotary chamfering in the tooth flanks in a subsequent, second cut. As a result, the processing of workpieces on the P90iC is sequential – but all performed in a single setup: load; first hob cut



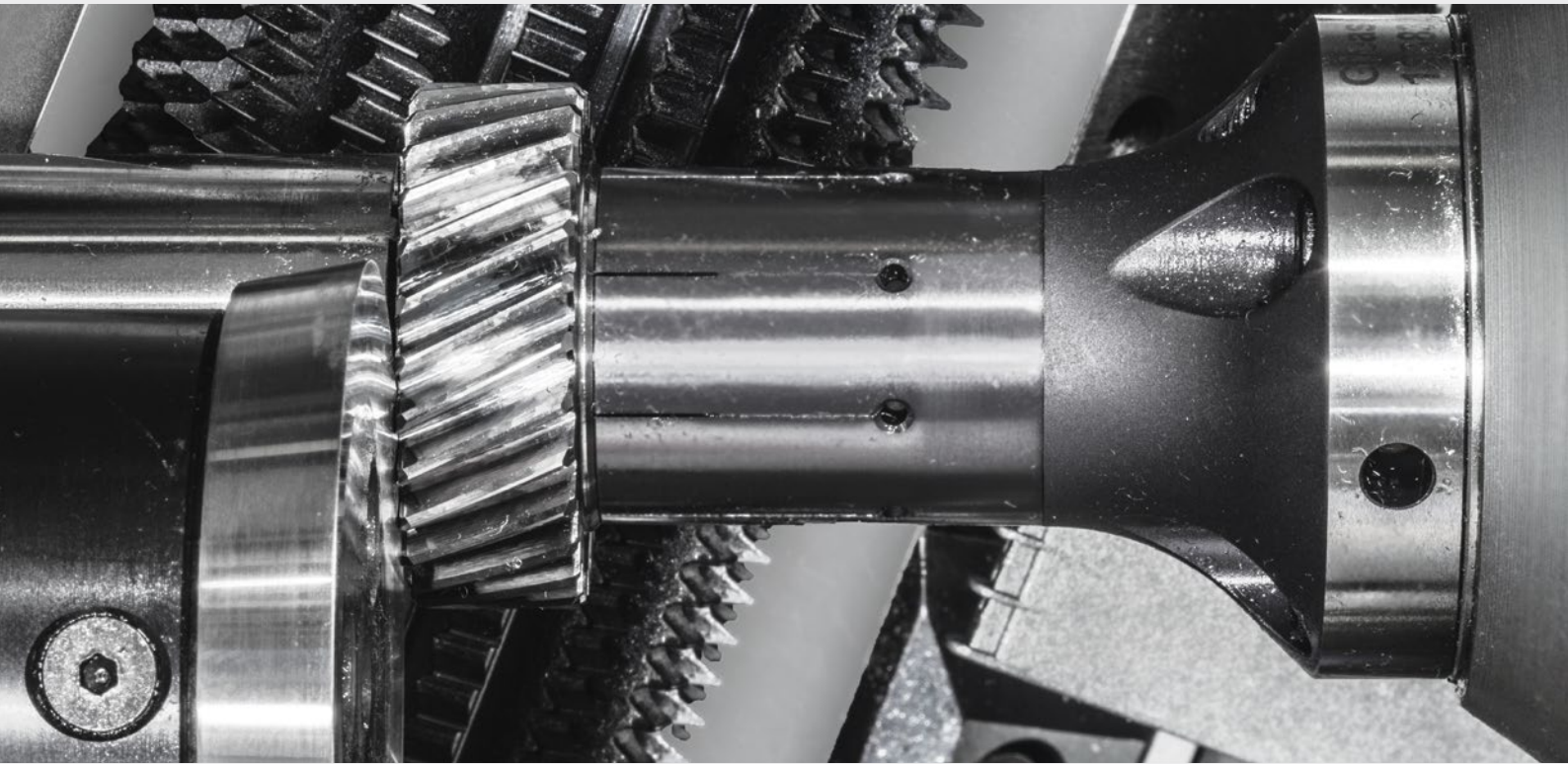
## New Gleason P90CD At a Glance...

- Integrated chamfering/deburring station works in parallel to hobbing; hence productivity is not compromised by the added auxiliary process.
- For hobbing parts up to 60 mm diameter and module 3 mm; larger diameters are available on request.
- Cycle times are as short as 10 sec for planetary pinions. The chamfering/deburring station includes an auto-meshing feature which avoids tooth-on-tooth cut workpieces and chamfering tools for consistent cycle times and to avoid damage to workpieces.



The P90CD features an integrated chamfering/deburring station to perform chamfer/deburr in parallel to hobbing, thus achieving a cycle time of just 10 seconds chip-to-chip.

# Hobbing with Integrated Chamfering/Deburring



The P90CD is well-suited for dry, high-speed machining and the use of the latest Gleason solid carbide or G90 hobs featuring advanced AlCroNite®Pro coating for maximum productivity

including removing the rough burr; rotary chamfering and deburring; second hob cut to remove the burr on the tooth flank and to generate the required scallop depth; unload and repeat.

It's important to note that, in conjunction with these machines, Gleason offers a wide array of rotary chamfering and

deburring tools, and expertise. Solutions range from simple chamfer tools for basic chamfer requirements to highly sophisticated chamfering tools that include burnishing options for producing precise chamfers with very tight tolerances.

Versatile automation systems. Both machines are easily adaptable to different customer stocking systems – from simple input/output conveyors to much more robust solutions that can add many highly desirable processing stations either pre- or post-hobbing. Among the most versatile are those built by Gleason Automation Systems. Automated load/unload is performed from stackable tray systems that prevent part-to-part contact common to free flow conveyor systems. Secondary operations such as coolant spin-off,

laser marking, in-process gauging, pin stamping and others can be easily added to meet many customer objectives.

In summary, these new Gleason machines, built on a globally-proven platform and supported with the latest cutting tool, workholding and automation solutions – all from a single source – represent a significant step forward for manufacturers of automotive transmissions seeking to achieve that delicate balance of very high quality with reduced cost per workpiece. No single technology can make it happen – it takes a *Total Gear Solutions* approach.



# Automated Cutter Build, Truing and Inspection of Bevel Gear Cutter Systems



Alan Metelsky

Chief Controls Engineer  
Gleason Corporation

The 500CB delivers faster, more accurate, and highly automated build, truing and inspection of stick-blade type bevel gear cutters.



**BUILDING AND TRUING** today's advanced bevel gear cutter systems and returning them to the production floor is largely dependent on the skills and expertise of the men and women in the tool room. Yes, CNC blade re-sharpening and inspection systems are now readily available – but when it comes to building and truing the heads, there is still a heavy reliance on doing it the old-fashioned way – by hand. This, despite the fact that just a few microns of deviation in the axial and/or radial

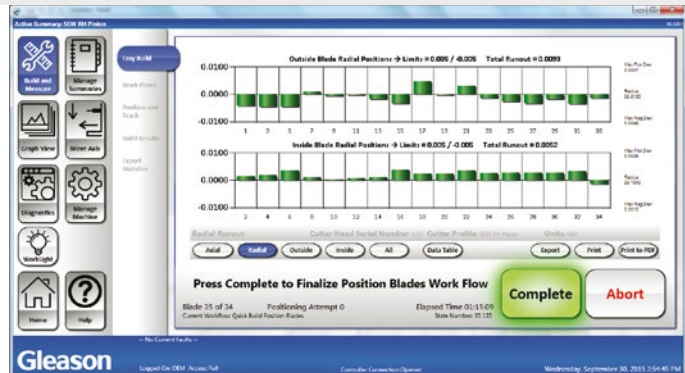
position of a blade can result in a costly reduction in tool life. It's remarkable that so many manufacturers still rely on the 'feel' that their experts have for this process as opposed to the advanced technologies so prevalent – and productive – everywhere else on their production floor.

Thankfully, there's a new, fully automated cutter build, truing and inspection solution now available that greatly reduces the experience level

needed by the technicians to deliver high-quality, repeatable results – while at the same time greatly reducing their workload. Depending on skill level and the size, number of blades and type of cutter system, what once took an hour or two of meticulous, labor-intensive manual work now can be done in about 40 minutes – almost all of it with no operator involvement at all.



Closed-loop system corrects for blade movement during automatic clamp screw torquing and provides 'intelligent' feedback for more precise truing.



Blade position and runout are charted in real time, enabling the operator to easily monitor a build as it progresses.

## Reducing the workload, improving the results.

The new Gleason 500CB Cutter Build Inspection Machine is the first machine of its kind to fully automate most of the critical steps in the cutter build and truing process. Its predecessor, the Gleason CB machine has, for years, been a solid workhorse in toolrooms worldwide, and succeeded in lifting some of the burden from the operator's shoulders by automating a few of the critical steps in the build sequence. But the 500CB goes much further than the original CB or, for that matter, any other machine on the market. Now, after cutter build data is input, all the operator does is load the cutter head, position the build carriage, and load the blades into their respective slots. Next step? Press GO and walk away, with 30 minutes or so of precious time now available for other tasks.

Now, all the other steps that have taken so much time, and been so dependent on the operator and his expertise are performed automatically by the 500CB. Blades are positioned in their slots, clamp screws precision-torqued, and blade axial and radial position measured. As this process unfolds, the 500CB actually learns from the measurement feedback it receives, and

Intuitive operator interface with software 'Wizards' guides even less experienced operators through setup and operation.

loosens, tightens and measures blades again as needed – just as the technician would do – until blades are trued to their optimum radial and axial position within +/- 2 microns. It's an adaptive process too, with the 500CB learning from every build to optimize future builds.

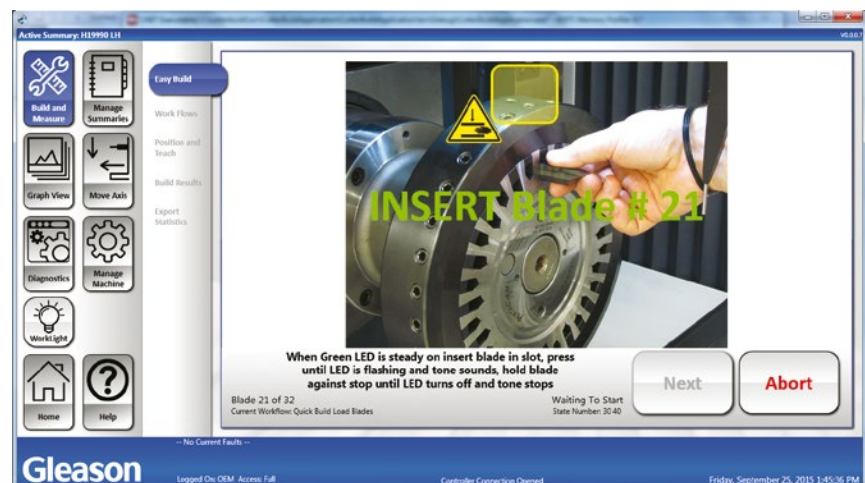
If the operator had stayed to watch, he would have been free to view a screen on the machine's CRT charting every blade's position and runout in real time. And, at any point in the process, start to finish, the operator can use the intuitive operator interface with software 'Wizards' to guide him through every step of setup and operation.

Of course, the 500CB has the powerful, user-friendly controls, direct-drive cutter spindle, and the other robust design features that you'd expect to find on the

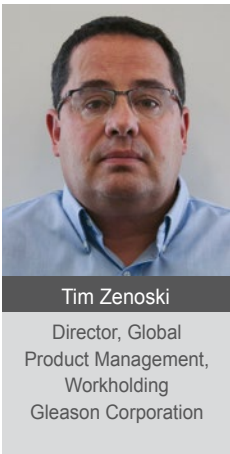
latest Gleason production and inspection systems.

## Cutters: from small to very large, Gleason to non-Gleason.

This impressive functionality isn't limited to just a few cutter systems. It can be easily applied to a wide range of stick-blade face mill and face hob cutters, from as small as 70 mm (2.75") to as large as 533 mm (21"), including the latest Gleason PENTAC®PLUS, PENTAC®AERO, and PENTAC®PLUS RT systems, and even comparable non-Gleason cutter systems. It's available to almost any bevel gear manufacturer seeking to gain a lot more productivity in the toolroom – and put higher quality and longer tool life into their bevel gear cutting operations.



# Taking the Wait Out of Workholding to Speed Bevel Gear Development



Tim Zenoski

Director, Global Product Management, Workholding  
Gleason Corporation



Bevel gear manufacturers now can greatly reduce the time it takes to get fully functional, extremely accurate workholding for their gear testing and development efforts, thanks to the new FLEX-SPAND™ (gears) and FLEX-GRIP™ (pinions) workholding solutions from Gleason.

**BEVEL GEAR** manufacturing has changed greatly in recent years, particularly for producers of driveline components for the light truck and automotive markets. The days of producing long dedicated batches of the same gear have given way to smaller batch production to meet fast-changing consumer demand. In response, revolutionary new quick-change workholding solutions have been developed to greatly reduce workpiece changeover time in these fast-paced production environments.

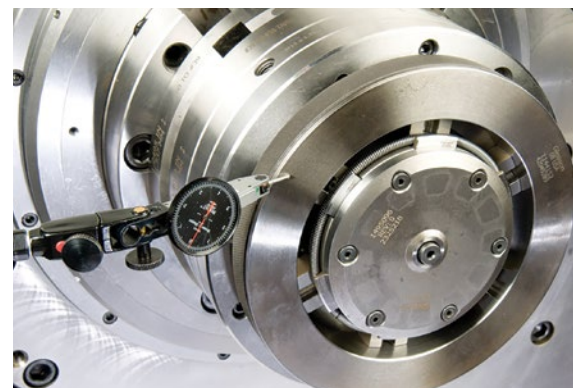
Yet, workholding is still slowing down these producers – not on their production floors but in the gear labs, where new quieter-running, more fuel-efficient and longer lasting gears are in continuous development. Here, ‘quick-change’ isn’t

nearly as important as ‘quick delivery’. The new bevel gear development process is inherently slow and expensive, with a lot of trial and error – often exacerbated by the 10 or 12 weeks that it might take to get workholding for cutting and grinding a new-design gearset. Now we’ve found a way to cut deliveries of workholding for gear lab, and even many jobber applications, down to just a few weeks, with our economical new FLEX-SPAND™ and FLEX-GRIP™ workholding solutions, for gears and pinions respectively.

### Keeping it simple.

Gleason workholding experts in the U.S. and Germany set about developing these new solutions with the recognition

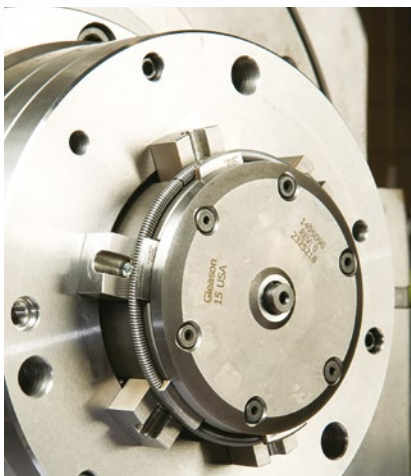
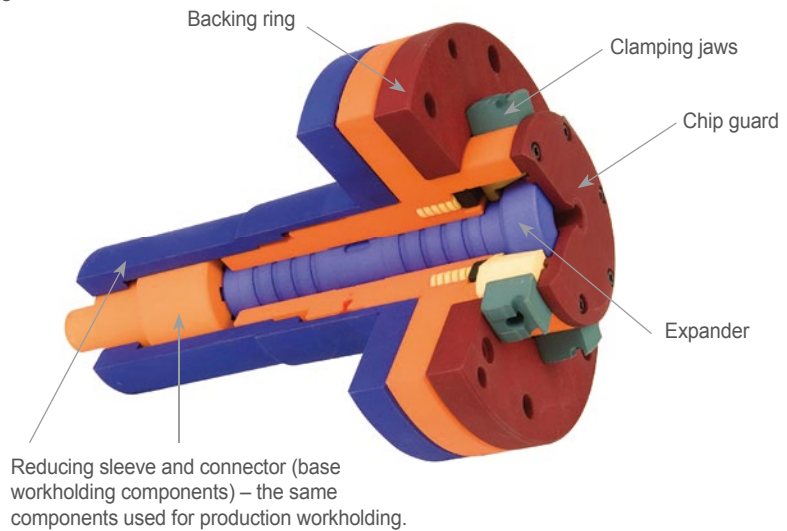
that production workholding is ‘over-designed’ for many gear lab, prototyping and other small-batch applications. What was missing from the marketplace was the closest thing yet to a universal workholding system. Without sacrificing functionality and, most importantly,



# FLEX-SPAND™ and FLEX-GRIP™



Fig. 1



Above: FLEX-SPAND™ for a typical automotive or light truck bevel gear application. The process of installing this workholding module into the #39 taper machine spindle is identical to that of traditional production workholding. Note the six interchangeable clamping jaws which, for gear lab applications, replace Gleason's production Uni-Spand® and X-Pandisk® springs.

Left: FLEX-SPAND™ module being inspected in the machine spindle. A master gauge representing the gear blank is used to check axial and radial runout. Accuracy and repeatability of 5 microns (0.0002") TIR is the same as production workholding.

typical workholding accuracies of  $\pm 0.005$  mm (0.0002") total indicator reading, we now can offer a system where just three standard size modules can meet the requirements of gears and pinions ranging in size from 3.5" in diameter up to 8" in diameter. For gear development and short-run prototyping or even some production, this means you'll need far fewer Gear Lab workholding systems, on order or in inventory, for a wider range of gears.

Gleason Gear Lab workholding functions much like the other bevel gear workholding in Gleason's wide array of solutions, where a workpiece is chucked firmly in place when the production machine's draw rod pulls back on an expander in the arbor to actuate the collet that grips the gear. The gear is, at the same time, pulled securely against a backing ring to ensure precision. In the case of FLEX-SPAND and FLEX-GRIP, however, the expanding collet has been replaced with a set of bolt-on, interchangeable jaws to perform the clamping function, and one backing ring can be used for a wider range of gear diameters. While the application

of standard workholding is inherently limited by the exact gear diameter that its collet and backing ring were designed for, the use of interchangeable jaws design means that jaws can be easily ground to accommodate a different gear diameter and changed out in an existing arbor much faster and at less expense than ordering a completely new system. Additionally, the backing ring does not have to be changed in many instances, even if its diameter is not exactly the same as the gear's, because wear is not an issue as it would be in a production environment.

### Three sizes fit all.

Both FLEX-SPAND and FLEX-GRIP are available in three standard modules: 3.5" to 4.5" diameters; 4.5" to 6.5" diameters; and 6.5" to 8.0" diameters. The system can be applied to Gleason bevel gear cutting and grinding machines for both soft cutting and hard finishing of gears and pinions, as well as Gleason bevel gear lapping and testing machines – and competitive machines with workspindles that have a Gleason-type taper.

# See You at These Events

## 2016

IMTS	Chicago, IL USA	September 12-17
AMB	Stuttgart, Germany	September 13-17
JIMTOF	Tokyo, Japan	November 17-22

## 2017

IMTEX	Bangalore, India	January 26-February 1
CIMT	Beijing, China	April 17-22
EMO	Hannover, Germany	September 18-23
Gear Expo	Columbus, OH, USA	October 24-26



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