

# 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 the 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 including grinding the first two new parts. The operator starts by setting the nozzle for the coolant, setting the ideal position for the stream of coolant using the hand wheel. Automatic coolant 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 workspindle, 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.

# Schafer Gear Works



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®P is essentially part of the grinding cells, so the machine operators 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®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®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 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 co-efficient. The 300GMS®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®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™ 3, Gleason’s object-oriented Windows® 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™ 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.”