

The Wait is Over for Lab-Level Shop Floor Inspection

Schafer Gear Works greatly reduces gear inspection queue time and adds precious capacity by installing Gleason's new 'shop-hardened' 300GMS P gear inspection system.

As Operations Manager at Schafer Gear Works' 100,000 sq. ft. South Bend, Indiana facility, Paresh Shah is justifiably proud of the investment his company has made in a new generation of gear grinders to meet the demand for precision ground spur and helical gears as large as 250 mm in diameter. Two highly automated hard finish grinding cells now give Schafer the capacity to produce some 15 to 20 different gears in volumes ranging from 5,000 to 100,000

each annually. These include tight-tolerance applications such as the twin turbochargers that help power the hot-selling Dodge Challenger Hellcat, and Schafer's own 'Driveline' golf car axles, reputed to be the quietest axles in the industry.

Schafer Gear and Shah sought to squeeze more capacity out of the operation. This meant focusing attention on the quality lab which, according to Shah, had now 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 expensive idle time for many millions of dollars of machinery that should be making parts."

Additionally, Schafer's quality lab also must support, two or three times a day,



Putting the '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.

the typical in-process inspection of a sample gear produced on each grinder during a production run. Finally, even these priority gears must compete for lab time, and sometimes wait in queue with parts produced throughout Schafer's blanking, hobbing, shaping, shaving and bevel gear production areas. When a decision was made to add much-needed capacity to the lab and Schafer's existing inspection systems, 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 typical shop floor temperature variations, vibration and contamination proving to be too much for machines built for pristine lab conditions. So when Shah came across the new Gleason 300GMSP Analytical Gear Inspection System on display for the first time last fall at Gear Expo 2015, and said to be the first truly 'shop-hardened' gear inspection system, he was intrigued. "Seeing is believing, and we came away from a demonstration convinced that the 300GMSP 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 coming from nearby shaping operations," recalls Shah. "Even better, the machine was so user-friendly that our machine operators could easily perform the inspections independent of the lab technicians."

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 on average, 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

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Paresh Shah, Operations Manager,
Schafer Gear Works

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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.”

Both operators agree that the system is remarkably easy to learn and operate. “We learned everything we needed to know in a day: calibrating probes, load/unload, how to pull up programs,” says Allmon. “Fast and easy. This checker’s the way to go!”

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



Machine operator Jim Smith now performs setup and in-process part inspections independent of the quality lab, saving precious time. The 300GMS P is essentially part of the grinding cell, so he can perform in-process inspection, check charts and make machine adjustments on the fly.

required a completely new design starting with a proprietary machine base material that’s better suited than granite for the sustained higher temperatures experienced on the shop floor. The use of this new base material, coupled with a completely new patent-pending ‘H’ base design with active leveling system, has proven to be an excellent solution. The new base design consists of a bottom base with four air springs mounted on risers, which support the machine work platform. These air springs detect, and

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Jim Smith, Machine Operator,
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This new Gleason Genesis 200GX Gear Grinding Machine offers Schafer many performance advantages, including dual-spindles for load/unload in parallel with machining, and integration of Gleason Automation Systems’ stackable tray automation to reduce floor space requirements and add capacity as compared to typical conveyor automation.



automatically compensate for, vibratory forces on the fly, such that the machine work platform (axes, table and work-piece) 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. While scales of this material type must be left open rather than enclosed, they are exceptionally resistant to dirt. In addition, the GMS P’s new design helps

mitigate the collection of particulates that can build up on scale surfaces and reduce accuracy and reliability.

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. This ability to identify and apply compensation for factory floor temperature influences contributes greatly to 300GMS P's exceptional accuracies in an uncontrolled temperature environment.

"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. GAMA 3 now supports VDI/VDE 2610 GDE (Gear Data Exchange) capability as standard, a significant capability for reducing redundant programming and allowing gear data/parameters to be transportable between different machines.

A total gear solutions approach.

Schafer has also invested heavily in the latest Gleason high-volume gear grinding technologies, including Gleason Genesis 160TWG and 300TWG Threaded Wheel Grinding Machines and Gleason's next-generation Genesis 200GX Gear Grinding Machine. All are fully automated. The 200GX is particularly noteworthy because of its twin-spindle design that allows load/unload to take place in parallel with machining, thus eliminating several seconds of non-productive time for every part;

and the use of a Gleason Automation Systems' stackable tray-type load/unload system that is both extremely compact and enables the machine to run unattended for much longer than possible with the typical conveyor system. This automation system also incorporates a 'spin' station that spins off coolant so that parts can be packaged directly from the machine completely dry.

"It has made great sense to source a complete system with Gleason," adds Shah. "With Gleason's help, we have

never been better positioned to take on the high-precision, custom-engineered gear projects that Schafer excels at." 

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