

Gear Inspection at Light Speed

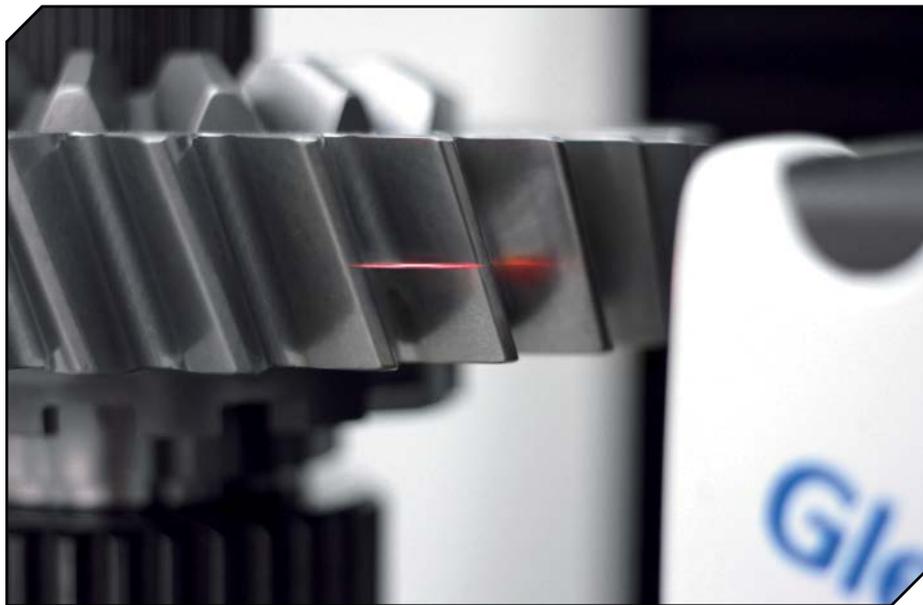
Revolutionary new inspection technologies are helping gear manufacturers develop and produce more complex, higher quality gears in a fraction of the time it used to take.

Dennis Traynor, Sales Manager, Gleason Metrology Systems

In the world's gear design rooms and on the production floors, speed is imperative, as manufacturers race to meet stricter vehicle fuel economy and emissions regulations, the weight and efficiency requirements of electric vehicles, and other challenges impacting every product category. No stone

is being left unturned in the search for better performance—right down to the transmission gears that account for a small but increasingly significant portion of overall fuel consumption. But the innovative new designs that squeeze more efficiency, less noise, greater strength and longer life out of these gears have also upped the 'inspection ante' in the Quality Room. Conventional tactile probing is highly accurate and reliable—but relatively slow, particularly when something like the entire topography of a tooth flank needs to be analyzed. As gear designers dial in even the most minute improvements in gear performance, they're placing an increasingly heavy burden on the Quality Room—and often adding many precious hours to the time it takes to optimize a new gear design.

Let there be light. With the new Gleason 300GMSL Analytical Gear Inspection System, we're harnessing the power of new non-contact laser technology to take full flank inspection to a completely different level. Never before have gear manufacturers had the ability to record, analyze and validate gear data at the speeds and with the detail that's possible with the 300GMSL. This is particularly important with the recognition that, while traditional lead and profile trace analysis continues to define gear quality classification, gear performance in the real world is determined by how a gear actually meshes with a pinion. Now, in the time it takes a conventional



inspection system using tactile probing to do a single lead trace, the 300GMSL can scan a complete tooth flank, a process that, depending on gear size, might require hundreds of individual lead traces when done conventionally. Additionally, the tremendous data density (as many as 685,000 data points might be gathered from a single tooth flank on a typical small helical gear) inherent in non-contact laser scanning enables the technology to 'see' more subtle surface finish conditions such as micro-pitting, scalloping, and waviness patterns resulting from processes like twist-controlled grinding and Power Skiving, but which aren't discernable with tactile probing. This data also makes it possible, in conjunction with the GAMA user interface software, for the operator to generate 3D graphical analysis charting of the gear tooth using easily interpretable color changes to show variations from nominal data and where modifications are required—particularly helpful in reverse engineering efforts.

Four machines in one. While its laser scanning capability is particularly well-suited for R&D applications, the 300GMSL also offers the additional fea-

tures and functionality required for gear measurement and analysis of production parts. These include:

- Tactile probing for traditional gear feature data collection and fast set-up on spur and helical gears, spiral and straight bevel gears and beveloid gears up to 300 mm diameter; and many types of gear cutting tools.
- Surface finish measurement, and the ability to evaluate data for the most common surface roughness measurement parameters.
- Barkhausen noise analysis for residual and compressive stresses after grinding on gear tooth flanks and shaft bearing race features.

All the sensors, including the one used for laser scanning, can be changed arbitrarily and in any random sequence without the need for recalibration. A Renishaw PH10 two-axis indexing probe head is used for the laser scanning sensor, thus providing the additional axes necessary to always position the sensor normal to the work surface regardless of the different positional attitudes required of any workpiece, including spiral bevel gears and worms. Tactile and surface finish testing are both done in conjunction with the Renishaw SP25

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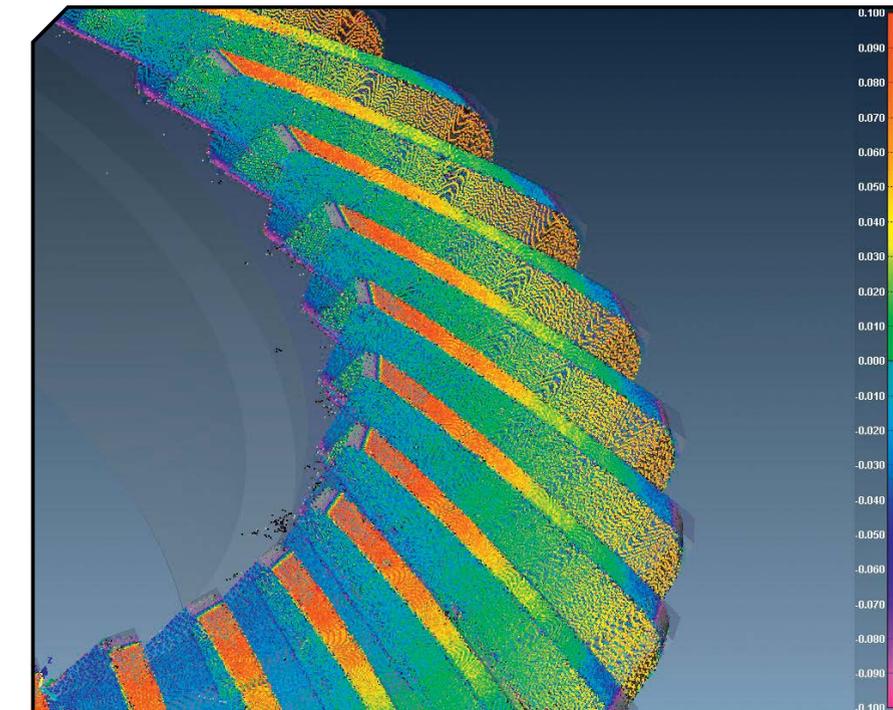
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probe head; Barkhausen probing connects through the auto-joint function of the PH10 indexing probe head.

Faster to first-part qualification with 300GMSP. Time-saving inspection technology is now available for the production floor as well. This will come as welcome news to the many gear manufacturers who have long had to cope with the wasted time needed to transport finished gears to the lab, and the additional time needed for parts to work their way through the inspection queue. Manufacturers have long sought a truly 'shop-hardened' inspection system — one that could be put in close proximity to the production machines, be extremely resistant to temperature, vibration, and contamination variations, and deliver inspection data almost instantaneously back to the production machines so that first-part qualification could happen almost on the fly. The Gleason 300GMSP does all that, and more. The shop-hardening of the 300GMSP 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 resolution guidance systems are similarly designed for harsh environments and help to ensure exceptional system accuracies. The 300GMSP also 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. In fact, the 300GMSP has proven to deliver exceptional accuracies (2 microns) within a wide temperature range from 15 to 40 degrees C.

Closing the Loop on quality. The 300GMSP can also be interfaced with the Gleason Closed Loop System, which allows measurement data to be networked from the inspection machine directly to the latest Gleason production machines. With Closed Loop, it is no longer necessary to transfer the neces-



sary measured values manually, a process which often leads to costly errors and wasted time during setup. The path to first-part qualification is now much more efficient, enabling the production machine to quickly compare inspection data with nominal values, calculate the corrections required, and produce a qualified first-part.

Advanced technologies, proven platforms. While the 300GMSP and 300GMSL are designed for opposite ends of the gear manufacturing spectrum, both share in common a host of design features that have been proven in hundreds of GMS installations around the world. These include:

- **GAMA**, the object-oriented *Windows*-compatible operating software that puts a host of powerful features right at the operator's fingertips, creating a simpler, more intuitive human/machine interface. With **GAMA**, the process of creating a new program can generally be done in fewer steps and with less reliance on experience level, language requirements, or the gear or application type. **GAMA** supports VDI/ VDE 2120 GDE (Gear Data Exchange) capability as standard, reducing the need for redundant programming and allowing gear data/parameters to be transportable between different machines. This HTML-based standard is just one of the advanced features incorporated into this robust platform.

- An optional Advanced Operator Interface (AOI) with dual display SPC, voice, photo, video, QR code/barcode read/import, and environmental monitoring/recording.
- Equipped with a broad range of styli, a stylus calibration library, and easily accessible probe storage in the storage cabinet at the operator's workstation. A six-position Automatic Probe Change (APC) is also available.

Whatever your needs — R&D or production — gear inspection has never been faster, whether at the light speeds of a laser, or just a few steps away on the production floor. 

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Dennis Traynor is Sales Manager for Gleason Metrology Systems. He is responsible for managing the company's sales and marketing efforts globally for metrology products and aftermarket programs. His 30-plus years of metrology experience has encompassed management roles in sales, engineering, product development and customer support.



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