

Machining

Choosing the Proper Grinding Wheel

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Experts with Norton | Saint-Gobain Abrasives discuss the challenges of gear grinding and how advances in technology are improving the efficiency of grinding methods.

Methods of gear grinding have changed over the years. As manufacturing standards get tighter, the right machines and abrasives needed to meet specifications have become even more critical. Product Manager Josh Fairley and Senior Application Engineer Phil Plainte with Norton | Saint-Gobain Abrasives share their expertise on how gear grinding — as well as using the correct grinding wheel — plays an important role in gear manufacturing. They also reveal how their company is addressing this essential process.

What changes have you seen in terms of what gear manufacturers need for grinding wheels?

PLAINTE: High-volume automotive manufacturing has made the greatest impact for changing and transforming the way gears are mass produced. Automotive manufacturers are building transmissions with aircraft quality gears, which meet the highest quality standards. The newer transmissions are a fraction of the size of the older designs and handle significantly higher torque, horsepower, and higher RPMs. The efficiency of these transmissions has increased miles per gallon tenfold. These changes have pushed machine builders and grinding wheel manufacturers to develop products that meet the new requirements.

Gear manufacturers did not always need grinding wheels to provide the final surface finish and form required. They could get by with hobbing and shaving, and on special jobs they might use lapping ring and pinion sets. Aerospace was the first industry to embrace grinding gears, but the aerospace industry was not as cost focused as automotive.

FAIRLEY: Quality standards have increased dramatically over the years for all gear applications. The need to improve efficiency while maintaining high quality and driving down the cost per piece has made choosing the right grinding wheel for the job much more important. Depending on the goals of the gear manufacturer, different grinding wheel specifications are needed to optimize the desired metrics.

What are the most common gear-grinding challenges you see from gear manufacturers? (i.e. higher speeds, burring, finishes, etc.?)

FAIRLEY: The most common challenges in gear grinding stem from the strict quality standards and efficiency/flexibility needs of gear manufacturers. Gear manufacturers are looking for very fine finishes and excellent gear geometry results from using their grinding wheels. They are also looking for precise form holding and reduced dimensional variation along with significant cycle time reductions. These quality metrics are more challenging to obtain because of the risk of burning gears. High-grinding area of contact, fine surface finish requirements, and tight form-holding requirements all work against a burn-free grind. Therefore, it is critical to specify the best grinding wheel matrix and grinding parameters for the job.

Another big challenge is operator and engineering knowledge of grinding. Norton | Saint-Gobain offers on-site technical training through our “Norton School of Grinding,” as well as our Precision

Customer Seminars in Worcester, Massachusetts. These training classes give gear manufacturers the opportunity to learn grinding theory and ask application-specific questions to our grinding experts.

When evaluating a grinding solution for gear manufacture, what are the top five key tips for determining a suitable grinding wheel?

FAIRLEY: 1) Identify the goal and what the key metrics are for the grinding process: If you are looking for high quality, high efficiency, or both, different grinding wheel specifications will get you there. We offer different specifications for each of these performance metrics in order to provide the most optimized solution for the customer, rather than one specification for everything.

2) Know your application: There are different types of gear grinding, and depending on the type, different grinding wheel specifications and sizes should be used.

3) Gear information: To pick the optimal grinding wheel for your gear grinding process, all aspects of the gear should be communicated. The material being ground, the desired surface finish, and profile to hold are all critical to picking the right wheel.

PLAINTE: 4) Coolant delivery and machine characteristics: It is well known how critical coolant is in the gear-grinding process. In an ideal scenario, coolant temperature, flow, targeting, pressure, and filtration are all set up properly. However, if one of these is not at an ideal condition, a modification to the grinding wheel specification or grinding parameters can alleviate those issues.

5) Dressing methodology: The dresser technology, application, and dressing parameters have a huge impact on grinding performance. Different grinding wheel technologies will be optimized depending on the dressing tool and parameters used.

In terms of technology and application support, what should gear manufacturers expect from their grinding wheels' manufacturer/supplier?

PLAINTE: We work with the customer at all levels, from design to manufacture. We have excellent relationships with machine-tool builders and are happy to begin at Day 1 during the gear-grinding application design process. We also get involved when gear manufacturers are faced with challenges and are looking for new ways of producing gears and developing processes.

In what ways is Norton tackling the future of gear grinding?

PLAINTE: Norton | Saint-Gobain is a world leader in the abrasives industry that is focused on engineered material development. A considerable percentage of gross sales is reinvested in R&D. We have six grinding technology centers located throughout the world.

FAIRLEY: Dedication to innovation. Advancements in grain, bond, and engineered porosity, all developed in-house. Norton was the first to develop ceramic, micro-structured grains, changing the game in terms of what grinding processes could achieve. We were the first to develop shaped grains, allowing for unprecedented removal rates. As the gear industry quickly evolved, we too evolved to support the market.

Norton | Saint-Gobain is at the forefront of grinding wheel technology and expertise. We also have a large and diverse team of experienced sales personnel and application support, both locally and globally.

We recently introduced the Norton Xtrimium™ range of gear solutions designed for high-performance gear grinding in extreme, tight tolerance environments. The newly structured portfolio of gear-grinding products is specifically designed by category to provide higher-profile accuracy, supreme form holding, and burn-free grinding in worm, profile, and bevel applications. Highlighting the new range is an innovative dual-worm wheel design that enables two operations in one grinding wheel, substantially saving time and cost.



New Norton Xtrimium dual-worm gear grinding innovation allows one wheel to grind and polish.

How is Norton | Saint-Gobain addressing Industry 4.0 initiatives?

FAIRLEY: To address Industry 4.0 initiatives, we have introduced Norton 4Sight process monitoring and diagnostic system, which provides real-time monitoring and improved vision of the machine and operation, as well as in-depth insight into the grinding cycle for optimization and troubleshooting. This also enables customers to work with Norton application engineers remotely to provide real-time troubleshooting and optimization. We are also investigating the use of QR coding and RFID technologies in collaboration with customers, to help gear manufacturers achieve their Industry 4.0 goals.

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