

Hard Finishing of Cylindrical Gears

Power Skiving with Integrated Cutter Resharpener

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For the past decade Gleason has been building Power Skiving machines at its Gleason-Pfauter facilities in Ludwigsburg, Germany. As the many benefits of this technology have become widely recognized, Gleason Power Skiving machines have been at the forefront, and the series has grown to include models for internal and external cutting and finishing of gears as large as 800 mm in workpiece diameter. Now, with the demands for gear quality reaching new levels and hard finishing becoming increasingly common, Gleason is again pushing the Power Skiving envelope to meet these requirements.

Hard Finishing Requires a New Approach

Manufacturing carburized and hardened gears with Power Skiving has always taken the traditional approach: after a cutter has reached its wear or quality limit, the operator changes the cutter, adjusts the cutter data, cuts the next workpiece, transfers it to the inspection room, waits for the first part inspection and, if necessary, corrects the process by adjusting the machine parameters before proceeding with serial production.

This traditional approach to cutter refurbishing, which usually takes anywhere from 45 to 60 minutes, is time consuming and laborious, but vital to ensure that the cutting tools produce high quality parts throughout their useful life. Of critical importance is the amount of edge roundness, which is difficult to produce and control, and has a great impact on the hard finishing process requiring precise removal of very thin chips.

The non-productive time needed for cutter refurbishment is particularly evident in Power Skiving, a very fast process that requires frequent cutter changes and first part cycles. The required procedure increases tool cost, inventory and, most significantly, non-productive time and resources needed for cutter management, handling and



As compared to the typical cutter resharpener process, the new on-board unit is remarkably fast and simple. The machine's axes position the cutter to a grinding wheel. The integrated cutter sharpening unit then executes the necessary grinding strokes while the cutter performs the infeed and the indexing from tooth to tooth, all performed automatically and based on the new cutter geometry that exists after a certain number of gears has been cut (Courtesy Gleason).

sending used cutters to refurbishing (resharpening and recoating) and returning cutters into production.

Revolutionary Concept: On-Board Cutter Sharpening for Hard Finishing

By adding the capability of resharpener carbide cutters directly on the Power Skiving machine, Gleason has taken a revolutionary step forward in raising the economy and quality for hard finishing carburized and hardened gears. This new development enhances the benefits of Power Skiving in virtually every significant area.

Today, a fully-integrated, on-board sharpening unit is available for the vertical series of Gleason Power Skiving Machines up to 600 mm in diameter. The cutter face can now be resharpener fully automatically in the machine after it has cut a certain number of gears,

without any operator involvement. The cutter geometry is continuously adjusted automatically to compensate for stock removal, and serial production is continued without interruption. Recoating the cutting face is not required because the original coating on the flanks sufficiently protects the cutter teeth.

The frequency of cutter changes is greatly reduced: a single cutter can stay on the machine for several days or even weeks before it is completely used up. The time used in the past by the operator for a cutter change is instead used for a certain number of automatic cutter grinding cycles with a reduced stock removal per grinding cycle to keep the cutter constantly sharp for a high and constant gear quality.

Additional non-productive time is saved since first-part inspection and machine corrections after cutter change are no longer necessary because the

same cutter stays in production, also minimizing cost and required capacity in the inspection room.

Cutter management and handling logistics are greatly reduced to just ordering new cutters in time to ensure a continuous production. The required cutter inventory is much less as well, because there is no longer the need to circulate cutters through an external refurbishing cycle.

Overall tool costs are very much reduced because the high cost for the frequent external refurbishing cycles of the carbide cutters is eliminated—which is typically the most significant factor in tool cost per gear.

Applications

Power Skiving of carburized and hardened gears with integrated cutter resharpener is ideally applicable for internal ring gears and for external cluster gears where the small cross axis angle of the cutter allows for cutting the smaller gear without collision with the larger gear. A high gear quality can easily be achieved with this method by grinding the cutter more frequently but faster with less stock removal.

Integrated cutter resharpener can be applied to spur and helical step sharpened carbide cutters. The resharpener process employs inexpensive standard grinding wheel technology with no need for dressing grinding wheels, as they remain sharp due to a self-sharpening effect from the grinding process.

The danger of damaging expensive carbide cutters by manual handling is greatly reduced as the cutters stay much longer in the process without being touched. The productivity of the hard skiving process is not jeopardized by having no coating on the cutter face because the required sharpness of the cutting edge is now being guaranteed by the chosen resharpener frequency.

Entering New Frontiers

With the integration of the cutter sharpening process into the machine Power Skiving becomes very desirable for the hard finishing of higher quality gears

in electro-mobility and robotic applications. Gleason Power Skiving machines ideally support these requirements for quieter and more precise gears, with lower direct and indirect tool cost.

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