

# Winds of Change in Profile Grinding

by Michael T. Hayes

**Recent breakthroughs in profile grinding software are helping Anderson Precision Gears and others meet wind power's insatiable appetite for faster production of large, high-quality gears.**

Stand out in the open on the Scottish Highlands or on a golf course or beach along the North Sea for any length of time, and you'll understand why Scotland is considered one of the world's fastest growing and most promising renewable energy markets. The British government has estimated that construction of a new £1 million wind turbine must be completed every day for the next seven years to meet the country's ambitious renewable energy target—all part of the European Union's 2010 objective of producing 22% of its electricity using renewables.

Companies like Anderson Precision Gears (APG) of Motherwell, United Kingdom, are gearing up to get a piece of this business, knowing full well that hundreds of wind turbine gearboxes multiplied by thousands of gears equals, well, you do the math. APG managing director Willie Wales and APG sales and marketing director Ian Kinstrie evidently have, because they've just made a significant investment in a Gleason-Pfauter P 2000 G.

"With gearboxes accounting for fully 20% of the total cost of a wind turbine, gearbox manufacturers are keen to take cost out of the gear production process," says Wales. "But complicating matters is the size of these gears and the need for very high quality, since reliability is an enormous concern. These wind turbines are often installed in the most remote locations and operate under adverse and extreme temperature and wind conditions."

**New frontiers, revolutionary software.** Gleason has unveiled new profile grinding software, driven by the latest Siemens 840D CNC, for its new-generation Gleason-Pfauter profile grinders. According to Gleason product manager Richard Scoda, the new software reduces non-productive time—a disproportionately large and costly part of overall part processing that has defied big improvements. The approach taken by Gleason Pfauter reduces the "dead time" in the cycle through adaptive control. The machine knows where the grinding wheel is and moves quickly when there is air between the wheel and gears.

"New grinding wheel compounds and grades, combined with improvements in machine kinematics, have optimized the grinding cycle to the point where only incremental improvements can be made," says Scoda. "We're now machining about as fast as we can with current wheel technology. That leaves nonproductive time—setup, cutting air, inspection—as the areas still left where we can make a big impact on cost per piece and quality. The new software is a big part of that process."

**Setup measured in minutes vs. hours.** Among the benefits to end-users like APG is Gleason's new patent-pending software, which automatically compensates for clamping misalignments and eliminates the possibility of both radial eccentricity and axial runout after the setup.

Traditionally, manual setup can take four, even five times as long as the actual machining cycle, as the operator, using a dial indicator and rubber hammer, painstakingly bangs a part into a centered position relative to the table and machine axes.

The software, combined with a special measuring device and the calculating power of the CNC unit, initially determines the position of the part after clamping and then compensates for actual eccentric or oblique positioning using the machine's five axes during machining.

The Gleason-Pfauter P 2000 G



Willie Wales, managing director, and Ian Kinstrie, marketing director, of Anderson Precision Gears.

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Gears



**Cutting cycle times, not air.** Using Gleason's new Adaptive Process Control software, APG will also be able to squeeze out additional savings in its actual cycle times, by greatly reducing the cutting of air.

"Typically, the grinding cycle is programmed based on the pre-determined size of a 'perfect gear,' but the distortion caused by heat treat makes this difficult to accurately determine," says Scoda. "As a result, the grinding wheel might not be actually in contact with the tooth flank as much as we think, so that the cycle might take longer than it needs to, and dressing intervals might be more frequent than required, given how much material is actually removed."

Gleason's Adaptive Process Control system can actually detect when there is no contact between the grinding wheel and the workpiece flank during axial infeed, and then a higher axial feed rate kicks in. The normal feed rate is used only when the grinding wheel is engaged. This dynamic adaptation of the axial feed rate to actual part size after distortion ultimately can save many minutes of cycle time on a large part.

**Dual-flank speed, single-flank flexibility.** The P 2000 G software also will give the machine the ability to perform dressable grinding of both tooth flanks simultaneously—a normal procedure on basic, identical involute profiles—but with the flexibility to grind special profiles on one of the flanks at the same time. According to Scoda, this is particularly vital in the hard finishing of gears for wind turbine gearboxes. "Creating a special tooth twist for optimum contact conditions is critical in wind power in order to compensate for the enormous loads placed on these gears and make them more reliable," Scoda says. "Now you can do what normally could only be done with single-flank grinding, but at dual-flank production rates."

Other features of the P 2000 G include an integrated Windows®-based user interface, fully automatic stock division, on-machine dressing with automatic compensation for wheel wear, the ability to use either vitrified or plated CBN wheels, a built-in grinding technology database, K-chart inspection and the ability to grind both external and internal gears.

The ability to finish internal ring gears is a key capability, according to Kinstrie, since planetary gear systems are the most common found in wind turbine gearboxes.

Kinstrie is optimistic about his company's chances at expanding its wind power business throughout the U.K. and Europe, while further improving its product offering to traditional markets like mining, earthmoving, aerospace and rail. "This new Gleason-Pfauter technology meets the need for faster production and better quality, the watchwords in all of these industries today," he says. "An investment in the latest technology, while sizable, is the only way we know of to achieve our future growth potential in the world of big gear production."

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