Dry Hobbing: Another Point of View

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I would like to comment on David Arnesen's article, "Dry Hobbing Saves Automaker Money, Improves Gear Quality," in the Nov/Dec, 1996 issue.

An article like this could irritate engineers because of its commercial emphasis. It states that Ford's goals were "to improve gear quality, surface finish and pitch diameter runout and meet increased production demands." Though these are very legitimate expectations, only two can be attributed to the dry carbide hobbing operation: potential improvement of surface finish and higher surface speed of the hob. The other two goals, improving gear quality and pitch diameter runout, have nothing to do with dry carbide hobbing, since they can easily be achieved by improving the machine accuracy, the hob accuracy and the workholding fixture, which is exactly what Liebherr did in the dry carbide application.

The helicoid surface of a parallel axis gear tooth generated by a hobbing operation has two errors: the involute error and the lead error. The involute error is a function of the number of gashes of the hob. By going from 15 to 12 gashes, this error was increased, and since I am assuming these gears are finish-cut, the involute error overall worsened. The lead error is generated mainly by the hobbing machine, while the surface finish (of finish-cut gears) is mainly attributed to the scallops' depth. The scallops are a function of the hob diameter and the feed rate per revolution of the workpiece. The major contribution to improving the surface finish of the helicoid in the hobbing operation is the reduction of the feed rate that can be achieved at the expense of increasing the machine cycle time. Using carbide hobs that can run at about 3 times the surface speed of the actual HSS hob, it is easier to compromise both parameters.

Therefore, I conclude that a carbide hobbing operation has the potential to improve the surface finish of the gears just hobbed with additional finish operations just while the cycle time is still lower than that achieved by a HSS hob. The capital investment to produce a certain amount of gears per year could therefore be lower using carbide instead of HSS hobs.

The article also states that "tool life improved to 252,000 pinions per hob (14 regrinds) using dry carbide from 39,000 pinions per HSS hob (12 regrinds) on existing wet grinding machines. Machining cost fell by 44%." Here we are far from comparing the HSS hob to the carbide hob.

I can manufacture a hob with 8-9" length and one with 4-5" length and claim that one cuts more parts than the other. The author should have compared the number of pieces produced by the carbide hob by giving the number of pieces cut per hob unit length of the total shiftable length and the measured wear. The same figures should have been given for the HSS hob . . .

Next, considering the resharpening cost and the cost of recoating after each resharpening, the author should have given the cost per piece produced by each hob. Finally, the author should have mentioned whether the existing hobs at Ford Indianapolis plant were optimized. It would also have been interesting to know what results would have been obtained if the hobs were optimized and used on new generation machines.

It appears to me that Ford's continuing efforts to improve to dry carbide hobbing was forced by initial poor life of the carbide application and better results have now been accomplished. Could it have been done with the existing HSS hobs? The author does not say.

I refuse to accept articles such as this one strictly devised to promote brand name dry carbide hobbing sales.

To conclude, I urge the author [and the editors] to distinguish among strictly commercial articles and technical ones.

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