GROOVE MILLING CUTS OPS BY 66% FOR DESOUTTER

By using the Horn groove milling system to generate a bevel tooth form on screw-type clutch adjustment rings, power tool manufacturer Desoutter Ltd. has been able to reduce the number of operations needed to produce the parts by 66 per cent. The modified Horn Type 313 inserts, in use at Desoutter's Hemel Hempstead factory, have enabled complete machining of the components on a CNC mill-turning centre. The previous route comprised CNC turning, tooth generation using a profilator machine, followed by brush deburring.

As well as reduced set-ups, the tooth machining cycle time using groove milling is actually 20 per cent faster than the profilator. Taken with set-up and floor time savings this results in a time saving equivalent to about one man-day of machining time per batch of 1000.

A Desoutter production engineer explained. "The Horn inserts have proved very successful. Machining at the machine's maximum driven tool spindle speed of 3000 rev/min with feed of 1.394 m/min gives us a cycle time for the bevel form of about 0.8 minutes per component. This compares with just over a minute on the profilator. Insert life is about 2000 components so tooling cost compares favourably with the previous method, and component quality is more than comparable."

Desoutter is a world renowned manufacturer of pneumatic power tools for fastening and drilling applications. Its products are applied across a range of industries including automotive, aerospace and white goods assembly.

The UK factory moved to the Hemel Hempstead site in 1996. A wide range of product is manufactured using cellular manufacturing techniques. Desoutter is a major investor in sophisticated computer controlled machine tools which provide the necessary combination of flexibility and precision needed to manufacture components for a wide range of product.

Maximising manufacturing efficiency is a priority and the adjustment rings were no exception. Using profilator machines to generate the tooth forms had various drawbacks.

1. The machines were more-or-less dedicated to this style of machining, for which the requirement is regular rather than continuous, but they occupied valuable floor space.
2. Machine set-up required a particular set of skills, operation was totally manual and tool maintenance was expensive.
3. Desoutter reckoned on improved productivity and at least comparable quality if it could develop an all CNC machining route.

4. It would become feasible to reduce batch quantities as the economic batch quantities dictated by the profilator would no longer apply.

The adjustment rings (there is a family of three parts) are similar to bevel gears and form part of a torque limiting clutch assembly used in various Desoutter tools. By engaging the teeth on the ring with a mating key and turning, the threaded centre bore of the ring moves along a screw-cut shaft to vary the pressure exerted by a spring. This adjusts the torque at which the clutch assembly slips, and hence the torque applied by the tool.

The parts are produced from EN32 (210M15) heat treatable steel. Following machining the components are case hardened to Rc 54. The production sequence is to turn the basic bevel angle, drill, bore and thread cut the centre bore, then machine the tooth profiles. Though not a full gear profile the tooth is formed to fully mesh - thus providing ease of operation with the adjustment key.

Desoutter developed the application using existing mill-turning centres. The choice of Horn tooling was based on successful experience with the Horn groove milling system on milling applications. The company's engineers were also aware that the range included interpolative groove milling tooling of the right style - using the Type 313 triple tooth insert. That allowed a try-out of the process route to prove the concept before developing dedicated tooling.

The trials established that the method was capable of generating consistent results without a reduction in quality. Importantly, Horn's projected cost per insert meant that operational costs would not increase. Desoutter then proceeded to full trials with the modified cutting edge profile needed to generate the specific tapered groove form required for the part.

Type 313 inserts are of 21.7 mm overall diameter with three cutting edges. They are located in the holder by a single, central screw. A moulded-in drive dog arrangement engages the insert in the end of the compatible Series HM380 solid carbide tool shank to ensure full transmission of spindle torque. The assembled tool is designed to behave like a solid tool and benefits from excellent vibration damping and rigidity. For Desoutter's application the cutting edge is ground to a symmetric taper form prior to TiN coating.

In addition to the cycle time saving on the adjustment rings, Desoutter has introduced a final skim turning operation to de-burr in-process, followed by tumbling. Whereas machining these rings was once a three stage process it is now completed in one.