Ultra-high quality hard whirling of ball screws

When the CCMT opens its doors from April 9 - 13 in Shanghai, production specialists from around the world can look forward to a rare treat: The launch of the new Leistritz LWN 160 ball screw hard whirling machine. This high-performance machine for external whirling allows ball screws to be machined using a dry and hard process to within a production accuracy of 6 microns over 6,000 mm.

Pleystein (March 1, 2018) – Ball screws have a major impact on the running noise and production accuracy of machine tools and other precision machinery. Ensuring that the ball screws used in this type of machine continue to comply with these stringent demands in the future, the optimized hard whirling process developed by Leistritz has a whole raft of impressive benefits to offer. In contrast to rough machining by milling and turning followed by grinding, the nature of the hard whirling process means that no tensile forces are imparted to the workpiece. This has decisive benefits to offer: Not only does it improve production accuracy; it also makes for more reproducible characteristics in the finished ball screws when used in machine tools or other precision applications. At the same time, the finish quality of the surface delivers extremely high profile and pitch accuracy: over a spindle length of 6,000 mm, the LWN 160 provides an outstanding dimensional tolerance of just 6 microns (ball circle diameter).

Outstanding economy and productivity

Another key benefit of the hard whirling process is its outstanding economy. The hardened solid material (up to 62 HRC) is finish machined in a single clamping operation, and the hard machining process is dry. As no coolant is used, the process saves valuable resources and eliminates the need for subsequent part cleaning. Cutting without the use of emulsions also reduces the cost of chip disposal, as no contaminated grinding swarf needs to be dealt with. At the same time, the finish quality is equal to that of grinding while investment cost is lower and the process involves minimal set-up and machining times.

These productivity gains achieved using the Leistritz external whirling machine are down to a series of features engineered into the original design which also appear in the latest generation of the LWN 160. These include complete protection for all the guideways and drive units, and a steep machine bed. The bed angle ensures that all the short chips produced during hard whirling are able to flow away unobstructed together with 80-90% of the generated cutting heat. In addition to the rigid bed design including preloaded slide guideways, a precision workpiece clamping system and highly accurate spindle/unit bearings, the LWN 160 also comes with direct length measuring systems on all axes (± 5 microns for the longitudinal axis (Z), ± 0.02° resolution for the X axis and ± 0.01° positioning accuracy for the C axis). This enables continuous process monitoring and ultimately also superb machining quality.
Flexibility for small batches

The short set-up times involved in external whirling make the LWN 160 ideally suited to cope with small batches of workpieces in a diameter range of 10 – 100 mm and a length of 200 to 6,000 mm depending on the selected machine configuration. Fitted with six CBN cutting inserts, radial whirling tools offer the guarantee of a long service life, even when finish machining material hardenesses up to 62 HRC. Threads can be finish machined in hardened steel on the LWN 160 in a single pass. With an impressive 7.5 kW output and speeds of up to 3,500 rpm, the whirling unit delivers more than enough power for the job. The resulting cut in machining time is illustrated by the case example (insert).

Great operating convenience

Alongside ensuring exceptional production quality and maximum economy, Leistritz always keeps an eye on the user experience. The digital CNC control system developed specifically for hard whirling is not only easy to operate, but also permits interactive programming. Combined with the machine’s dynamic drives, this ensures simple, rapid commissioning, a high level of process reliability, short tool changing times, low tooling costs and ultimately also shorter cycle times.

Inserts and holders are quickly mounted in the LWN 160 with a few simple steps, aided by a provided pre-setting device which reliably guarantees an accuracy of 0.01 mm.

To allow optimum adjustment of the machine to specific customer requirements, it comes in different overall lengths for machining ball screws from between 1,000 and 6,000 mm. An ingeniously designed modular system permits individual customer needs to be addressed at minimal cost. This modular concept means that customers can benefit from an all-round impressive solution without compromising on the LWN standard.

Paying due attention to the ever more important issue of the Industry 4.0 strategy amid all this mechanical engineering excellence, the Smart Software Tools from Leistritz ensure simple IT integration of the machine into any existing production set-up.

Klaus Theusner, Managing Director of Leistritz Produktionstechnik GmbH, is delighted with the new machine: “The LWN 160 is due to be presented at the CCMT in Shanghai over a video link in Hall N1 Stand B112. Back at the end of last year, we already demonstrated our high level of expertise in the manufacture of ball screws at a symposium held in Shanghai, and we’re planning another symposium to be staged in Taiwan in October 2018. There will be more details available at the CCMT. We’re really looking forward to the fair and to gauging the reaction of all the visitors.”
Machining example:

Production of a ball screw with a profile diameter of 40 x 10 R x 6.35 mm made of tempered steel DIN Cf 53 (1.1213) with a hardness of 60 – 62 HRC (corresponds to JIS S50C (Japan) SAE/AISI 1050):

Machining time (hard whirling) with a length of 1.000 mm: 14.62 min
Cutting speed (v_c): 180 m/min
Chip thickness (s): 0.0055 mm
Effective no. of teeth (z): 3
Pitch accuracy over 300 mm < 0.012 mm
Corresponds to tolerance class 3 in accordance with DIN 69051
Surface roughness: Ra < 0.4 µm
Profile accuracy / deviation from nominal profile: +/- 5 µm
Conicity of flank diameter: 6 microns over 6,000 mm
Tool life: 500 m

LWN 160: Gold standard for precision hard machining of ball screws, planetary spindles and steering spindles up to 6,000 mm in length

Leistritz Produktionstechnik GmbH

As part of the Leistritz Group, Leistritz Produktionstechnik GmbH based in Pleystein supplies solutions for the economical production of whirling machines, keyseating machines and carbide tools. Leistritz works as a partner to the automotive and aerospace industries, the oil and gas industry, the drive technology sector, as well as mould and die makers. By leveraging synergies from two different areas of competence, machine tools and tools, the company has succeeded in amassing a rich fund of expertise. Experience gathered from these two fields have driven the company on to ever greater technical advances, and enabled it to supply machines and tooling solutions of the very highest quality from a single source. Its core competence lies in the engineering and production of customized solutions and processes.

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