

Liebherr's LDF 350

OFFERS COMPLETE MACHINING IN NEW DIMENSION

The objective, according to Dr.-Ing. Hansjörg Geiser, head of development and design for gear machines at Liebherr, was to develop and design a combined turning and hobbing machine in which turning, drilling and hobbing work could be carried out in the same clamping arrangement as the hobbing of the gearings and the subsequent chamfering and deburring processes. The result of this new development, Liebherr's response to current trends and demands of the market, is the LDF 350. "This offers the latest technical options for the machining of cylindrical gear gearings, not only of wheels but also of shafts," Geiser says.

These kinds of innovative machine concepts are in demand because of: increasing workpiece complexity and the wish for increasingly smaller batch sizes; reduced cycle times; and the need for intermediate layers in production to be as small as possible. The LDF 350 enables the combination of different machining processes, ranging up to complete machining in a single clamping arrangement.

"One special challenge we faced was the controllability of both processes (turning and hobbing) for workpieces up to a maximum diameter of 350 mm, a total length of up to 500 mm and a maximum module of 5 mm," Geiser says. "The most important component of the LDF is therefore the workpiece table, which fulfills two main requirements."

These requirements include the



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high rotation speeds of the turning process and the high rigidity of the gear hobbing.

Aligned in the center of the rotation machine and permanently connected with the machine bed, the table ensures high production turning and gear hobbing. The gripper for loading the machine and the pressure deburring unit are also aligned on the turret lathe (revolver) to the left of the workpiece table, in addition to the necessary tools for the turning and drilling processes. The gripper takes up the blank directly from the storage belt and sets it down on the rapid clamping system of the workpiece table.

To the right of the workpiece table is the hobbing head. This absorbs the high forces of the hobbing process. In order to absorb the forces of the gearing process, Liebherr optimized the entire machine by means of FEM and designed the guides of the radial infeed and of the stroke and its drives to be extremely solid. This type of construction guarantees maximum stability during the machining process, so that even the highest of cutting speeds are

possible in dry machining.

The combined machining enables new dimensions for the workpieces—geared parts up to module 5 mm with diameters of 25 to 350 mm. This makes the utilization of the LDF 350 of particular interest, even in the range of larger geared parts.

For tool changes, the hob head swivels the tool axis into a vertical position so that the machine operator can insert the hob mandrel in an ergonomically efficient manner. The counterbearing is automatically tensioned and clamped. After the gear hobbing, the revolver presses the pressure deburring wheel into the gearing and thus eliminates the burrs and/or applies a chamfer to the workpiece. Residual burrs on the face sides can be eliminated by repeated stripping.

In comparison with a conventional production line with three individual processing machines for turning/drilling, hobbing and deburring, the so-called combination cell also reduces, in addition to the logistics outlays for loading and unloading, the non-productive times

continued

between the machining processes. "This results in a shortening of the throughput times and intermediate storage of the workpieces is dispensed with," explains Dr. Geiser. "Product changes also proceed more economically and more rapidly, as only one machine needs to be retooled for this purpose. The LDF 350

can be operated completely automatically and in conjunction with one or more turning cells."

The machine enables the complete processing of a wide spectrum of gear shafts and gears in only one clamping arrangement. In comparison with the other processes, this ensures a greater

amount of flexibility and an optimized throughput. Time-consuming retooling from one workpiece type to the next with several individual machines is dispensed with. Given optimum conditions, the processing times of the LDF 350 can match those of the single specialized machines. This was one of the most important objectives for the development of the LDF 350.

As a result of the utilization of the LDF 350, the number of required machines, setup procedures and the overall throughput times for the complete machining of gears is drastically reduced, which means that both the investment expenditures and the workpiece costs are considerably lowered for the user. Advantages include no reclamping, no non-productive times and no intermediate buffering.

Complete machining also opens up new qualitative possibilities: It enables, for example, turning over the bearing seats once more after gear hobbing. This makes it possible to minimize deviations prior to hardening and any warpage which might occur to be held out in an accordingly precise manner.

"Being a specialist for gearing processes, we implemented this innovation together with the lathe manufacturing company of Scherer from Mömbris, a professional partner who has mastered the initial turning process," Dr. Geiser summarizes.

The result of this joint development work, the Liebherr LDF 350, is expected to be available the end of 2011.

For more information:

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