Reaming with side milling cutter ? ? ?

At first glance, the new reaming tool CircoTec RX by URMA appeared like a side milling cutter to those in charge of production at the pump manufacturer LEWA. However, they got quickly convinced by best surfaces, quickness, easy handling, and long tool life.

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Reaming inside pump housings

"He talked about reaming. And now he comes along with a sidel milling cutter." That's how foreman Pavlos Vrakas describes his very first response when the new reaming tool by URMA had been initially introduced at the premises of LEWA in Leonberg. However, it turned out very quickly that this particular tool opens up enormous potentials and, at any rate, justifies in-depth trials in manufacture.

What came along in such an unconventional manner was the new reaming tool designated as CircoTec RX by URMA from Rupperswil / Switzerland. It practically turns some features of customary reaming tools upside down. When looking at the novel reaming tool it becomes obvious that the length of the reaming edge is only 4.3mm and long cemented carbide inserts are no longer necessary. The cutting tool consists of a flat plate made of tungsten carbide or cermets, similar to an indexable insert. It carries many cutting edges, thus resembling a side milling cutter. This tungsten carbide disc is extremely sturdy and, quite obviously, able to stand radial forces arising from the pressure of the material to be cut during machining much better and impact-resistant than customary tools. Examinations of used reaming tools showed that cutting edge wear normally takes place in the very first millimetres

Taking the same tool for 42 different materials makes happy

of the tools, so that long and costly cemented-carbide bodies appear to be unnecessary.

Long cantilevers without problems

These cemented-carbide of the URMA CircoTec RX tool discs with reamer cutting edges at the outer diameter are placed on top of a cylindrical tool holder with relatively large diameter, thus giving the tool a high sturdiness. Similar to indexable inserts, they can be easily exchanged. A conical seating bore is ground-in in the insert, which is placed onto a small hollow-shaft conical fitting at the top of the tool holder. Three screws being tightened by means of a torque wrench ensure best fit, and, at the same time, the centring of the insert. With this patented system, the function of a hollow-shaft conical fitting has simply been reversed compared to the well-known mode of operation at state-of-the-art tool interfaces. The hollow-shaft conical fitting is positioned at the holder and not, as usual, at the fitted tool. This results in change accuracies of the cutting plates of 3 µ, making adjustment completely superfluous. While with customary systems cutting edge changes take quite a few minutes up to half an hour, and, moreover, time and again trial machining – and thus reject - is inevitable, this revolutionary system only needs a few seconds and few manipulations to change the cutting edges: Loosening of three screws, change of insert and retightening of three screws. Subsequently, immediate continuation of work with precision as usual and steady-state dimensions is possible. This shortens machine downtime and reduces resulting reject to zero.

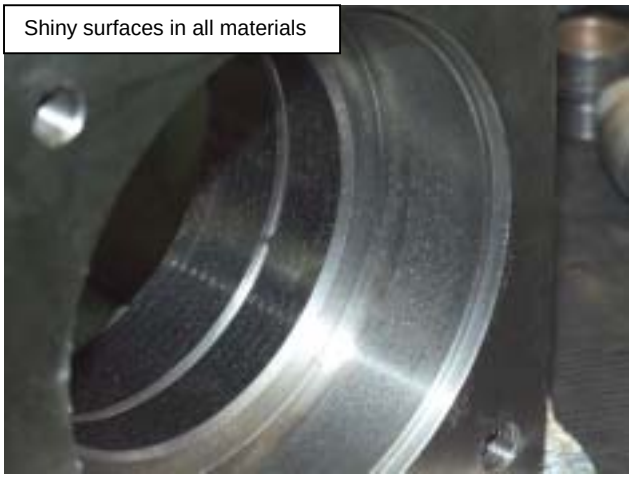
Only prior to its very first use, the tool should be checked for concentricity and adjusted as precisely as possible. For this purpose the rod-shaped cutting edge holder is clamped into a so-called compensating chuck allowing easy centring. Since the holders are ground, the tool can also be taken by very precise hydro-expansion chucks. For larger tool diameters, a balancing insert is fitted into the holder head, which considerably facilitates concentricity adjustment, particularly with highly cantilevering tools being used at LEWA. After concentricity has once been adjusted, normally only the inserts are exchanged during the tool's service life. As a rule, no further readjustment is necessary, provided the tool remains in its adaptor.

However, this tool not only ensures quick cutting edge exchange. Also machining takes place proverbially as fast as the wind. In order to prove this statement, Pavlos Vrakas reads out the data from the machine programs in our presence and compares reaming at a diameter of 75 H7 with a customary multiple-edge reamer to the machining data of a boring with a diameter of 80 H7, where reaming is

made using the URMA CircoTec RX system. With the customary method, first 3mm are machined with 100 rpm and a feed of only 80mm/min, then the tool is accelerated to 630 rpm and a feed of 510mm/min to machine the remaining 37mm of the bore. Since the bearing bore begins at a depth of 197mm inside the pump casing and goes to 240mm, the tools are relatively long. With the new URMA reamer, a bore is reamed starting at 215mm up to a depth of 285mm with diameter 80mm H7. This is done in one go with a rotational speed of 714 rpm and a fabulous feed of 1,886mm/min. This high cutting speed considerably shortens the manufacturing process.

Bearing deep inside is machined precisely with URMA tool

Meanwhile, the tools are in operation for more than one year without any problems. “Process reliability is remarkable“, Hans Friedrich confirms the comments of his colleague Vrakas. A statement of even higher significance when taking into consideration that pump casings are manufactured at LEWA using a variety of different materials. “We have a workpiece being manufactured of up to 40 different materials“, Pavlos Vrakas describes his manufacturing problem. Finally, the pump casings come from a modular system offering the components both in different size and different material options. „It is one of the strong points of our company to manufacture dosing pumps and facilities exactly tailored to customer’s specifications. Even spare parts are delivered for facilities having been built 30 years ago. Quite often, the customer requests precisely that particular component in order to avoid the possible necessity of recertification of the entire equipment.” tells Pavlos Vrakas. Although mainly GG 25 and GGG 40 are machined, there is a variety of other materials and alloys up to stainless steels that are particularly hard to cut. What’s worse, the batches vary considerably, and, as a rule, are approx. between three and fifteen pieces per batch.



Shiny surfaces in all materials

Since the bore in question is a bearing seating, in which the pump shaft is running without an additional liner, surface quality is also an important criterion. “All bores have a surface quality of R_a 1.6 or even better after reaming, also for grey cast iron. With some materials, we

even achieve R_a 0.8," Mr Vrakas describes his positive experience.

Reaming large dimensions in series

There has always been uncertainty with customary tools. Often, tools have been made subject to precautionary change. In particular, frequent deviation of material quality has given both the tools and the production staff at LEWA a hard time. The reaming tools by URMA turned out to be surprisingly universal. Cutting edges made of coated cemented carbide are being used. They refrained from using cermets cutting edges due to frequent change in materials. At present, the insert is exchanged when a surface roughness of Ra 1.6 is exceeded. Then it is still dimensionally stable within the required tolerance. The actual time of use of the tools under operating conditions can hardly be measured at LEWA, since extremely frequent component exchanges in this universal manufacture hardly allow for tracking the service life of the individual inserts. However, reduction of the current tool costs for reaming to less than 1/10 of the previous year's value is very revealing. When using the previous reaming tools, which already was a multiple-edge reamer, total tool paths between 500 and 800mm were recorded, with the URMA CircoTec RX total tool paths up to 10m are achieved.

It is not surprising though that LEWA has changed over quite a few always recurring diameters to URMA reaming tools in the meantime. "Since the order has been placed, I didn't hear anything about it", emphasizes Hans Friedrich, head of manufacturing preparation at LEWA. "That's a rare experience to me." Diameters 12, 16, 20, 25, 39, 40, 47, 64, 80, and 88 are machined at tolerances H7, K6, or J6 with the high-performance reamers CircoTec RX by URMA. All the different materials are machined with the same cemented-carbide reaming edge and are within the required tolerance without additional adjustment. The reaming tools for the individual diameters remain on call in the tool magazines of the machines. This not only resulted in enhanced productivity and shortening of machining time, but also in actively saving money. While for reamers of the said diameters approx. 40,000 Euros have been spent in the past, this amount has decreased to less than 4,000 Euros in the meantime. At the same

Reamers stay in the tool magazine and are used in all materials with the same tight tolerances, no adjustment.

time, production reliability could be increased and the workpiece quality enhanced. Finally, an important criterion should be mentioned: All staff members have immediately accepted the tool system and are pleased to work with it. It speeds up their work, what the boss is particularly fond of, but also demonstrably facilitates their daily work. Or could you imagine anybody who likes adjusting reamers? Hans Friedrich agrees with Pavlos Vrakas: “We are enthusiastic.“

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All pictures are factory-taken pictures by URMA AG, Rupperswil.

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