



## Imoberdorf: Productivity with Swiss rotary transfer systems.

A few years ago, rotary transfer machines were only tailored to large-scale production. Nowadays, with the latest models of Imoberdorf rotary transfer machines, extremely quick component changes can be conducted and even medium-sized series of 12,000 parts can be produced economically.

Matthias Böhm, SMM Editor-in-chief / 10.08.2016

**B**earing housings, watch plates, pistons, conrods, crankshafts, control valves or watch crowns: Imoberdorf rotary transfer machines not only ensure the full machining of such workpiece ranges but also guarantee top productivity and efficiency. Furthermore, Imoberdorf rotary transfer machines provide high flexibility: It can be easily retrofitted from one series to another in a short period of time. That is certainly not something to be taken for granted.

### Full machining on rotary transfer machines

In addition to milling and drilling, Imoberdorf AG has also relied on the high-performance „imo-rot“ turning technology for its rotary transfer machines over the past few years. With a rotational performance of up to 15 kW and a maximum of 10,000 rpm.

### Milling, drilling and rotating – all in a single station

The „imo-rot“ turning technology is based on workpiece transportation via pallets. Workpieces are not fixed to the rotary table as was the case previously but rather clamped in so-called workpiece pallets and transported from one machining station to another. The precision pallets are a key aspect of the high flexibility of the machines. The workpiece pallets are no longer affixed to the indexing table of the rotary transfer machine. When they reach the respective machining station, they are coupled, positioned and locked in the base machine with the CNC synchronous rotation

axis (C-axis) via the zero-point clamping system.

This provides the option of not only performing conventional milling and drilling operations on the machining station of a rotary transfer machine but also high-quality, CNC-controlled turning operations.

### **Innovations are the key to success**

Innovations are the key to long-term success. That is why Imoberdorf has consistently invested in research and development. Imoberdorf AG sales engineer Michael Amoos sums it up as follows: „In just the last six years, tremendous technological progress has been made with regard to Imoberdorf rotary transfer machines.

But: There is still a preconception that rotary transfer machines are inflexible. That, however, is ancient history. Contemporary rotary transfer machines are not just extremely fast but also highly flexible. Our customers no longer have to select the machine for a specific large-scale production. With our latest machine generations, setting up for a new range of workpieces is no problem at all. That makes it possible to efficiently produce series with a few thousand workpieces on our machines and then switching to another workpiece range.“

### **Efficient production starting at a lot size of 12,000**

Obviously, when it comes to rotary transfer machines, it's always about the highest level of productivity and series production. While rotary transfer machines were only considered for lot sizes starting at 100,000 workpieces a few years ago, rotary transfer machines that are completely CNC controlled can be used to efficiently produce series starting at about 12,000 workpieces.

The reason is simple, Amoos says: „In the past, you sometimes had to schedule a week for retrofitting to a new range of workpieces. But the current Imoberdorf machines are developed with an eye toward absolute flexibility and speed. The key is the previously described „imo-rot“ (C-axis) pallet system, in which the workpieces are clamped and transported.

### **Up to 5-axis simultaneous machining in a rotary transfer system**

The pallet transfer system developed by Imoberdorf now services independent and extremely versatile production stations, consisting of a rotation axis with CNC synchronous drive (C-axis) and a CNC machining unit with up to 4 axes and one or more tools, which can also be driven. As a result, even 5-axis simultaneous machining is possible with the rotary transfer machine. Amoos: „They are the world's first 5-axis transfer machines.“ These self-contained stations are also characterised by their extremely high system accuracy.

### **Linking multiple rotary transfer machines**

Furthermore, the „imo-rot“ pallet transfer system also supports the linking of other Imoberdorf AG rotary transfer machines. The pallet with the clamped workpiece can be transported onwards via the conveyor system and effortlessly fed into the machining process of a second „imo-rot“ rotary transfer machine.

### **Retrofitting within two minutes**

Amoos uses an example to describe this flexibility: „One of our customers produces 150 different door locks. These are similar workpieces but each lock has its own CNC program. Thanks to the tremendous amount of available tools and CNC axes in our machines it is possible to switch from one lock to another ‚on the fly‘. That is sensational. If you were to try that with older rotary transfer machines, retrofitting would



*Thanks to their sophisticated design, Imoberdorf rotary transfer machines are extremely precise.*



take one to two working days.  
Supported by a master computer, similar components can be produced unmanned.

### **Flexibility has now become reality**

The retrofitting concept does not only work if the workpieces are similar. Thanks to CNC-controlled axes, completely different workpieces can also be produced in succession. In this context, Amoos states: „If necessary, specific tools have to be set up anew but even that can be done very quickly with our machines. Twenty-five years ago, rotary transfer machines were reputed to be flexible: But let's be honest, that was merely for the purpose of advertising, and not reality. But that flexibility has now become reality.“



*Modularly designed rotary transfer machines from Imoberdorf AG are generally specifically designed according to the requirements of the application.*

### **Three rotary transfer system concepts**

Imoberdorf AG has three rotary transfer system concepts:

imo-compact – a compact rotary transfer machine

imo-smart – medium-sized rotary transfer machine

imo-space – the largest Imoberdorf rotary transfer machine solution

#### **imo-compact – the compact model**

imo-compact is the smallest of the three Imoberdorf series. On an area of only 12 square metres at a height of 2.30 metres, the imo-compact unites to form a complete, highly-productive rotary transfer system: The imo-compact controls 4 to 8 machining stations with up to 21 spindles per CNC.

Its machining area per spindle (with dual spindle) is ZYX = 50 x 60 x 40 mm. ISO-10, HSK-E 25 or collet chucks are available as tool holding devices. The machining capacity per tool spindle is 2 kW. The CNC-controlled C-axis of the imo-compact can feature a maximum of 7.5 kW.

#### **imo-smart – the medium size**

The imo-smart has 4 to 16 machining stations with up to 45 spindles. The machining capacity per tool spindle is up to 5 kW. The machining area per spindle is ZXY = 120 x 100 x 130 mm. The tool holding devices are HSK-C 25 through HSK-C 63 or collet chucks.

#### **imo-space – the big one**

imo-space is Imoberdorf's biggest rotary transfer system in terms of productivity and functional possibilities. The imo-space can be equipped with 6 to 24 machining stations with up to 69 (or even more) spindles. The imo-space has an enormous production potential with a large metal removal volume. The machining area per spindle of the imo-space is ZYX = 200 x 200 x 100 mm. Depending on the machine tool size, the machining capacity is adjusted upwards.

### **Rotary table and parts handling**

For precise positioning, the rotary table of the rotary transfer machines is equipped with Hirth gearing. A direct drive with torque motor is available as an option. The parts feed is carried out optionally from bar stock, by means of load handling, pick and place, robot or manually. The reproducibility of the rotary transfer machines of  $\pm 0.001$  millimetres means Imoberdorf rotary transfer machines are among the most precise rotary transfer machines in the world.

### **In-process measurement provides top process reliability**

In order to increase the precision at the workpiece and the process reliability, workpieces can be

measured right in the machine. If the actual values move in the direction of the edges of the tolerance ranges, there is an option to automatically correct the CNC axes in the process. There are three intervention limits in order to reach the medium tolerance area. This is a sophisticated process that is very important, in particular for series production.

### **Modular production solutions**

Imoberdorf rotary transfer machines are designed as modular system solutions that can be adapted individually to the customer solution.

M. Amos: „We launched the machine concept in 2013. We made a very large technological leap in this area. The modular system and its flexibility are key. You can equip a machine with four stations today and two years later, when the range of orders is supposed to be expanded, you can add additional stations. That allows you to work very efficiently with a staggered investment volume.“

### **Customer-oriented rotary transfer machines**

Imoberdorf machines are not „off the shelf“ products. They are modularly designed machine tools that can be designed together with the customer in a user-specific manner. Generally, customers bring one or several workpieces to the application specialists from Imoberdorf AG. The materials, geometries, raw materials (from bars, forged parts, chuck parts) and lot sizes can be derived from them.

Imoberdorf AG engineers then designs a machine concept that is tailor-made for the parts range. They determine the number of machining stations (and the number of fixed and rotating stations), the type of parts feed and the workpiece clamping, and the types of the machining units per machining station.

### **Coordinate machining cycles**

The key is to design each production cycle of the rotary transfer machine in a way that the machining time of each machining cycle takes the same amount of time so that not a single second is lost. This requires a significant process know-how that the Imoberdorf specialists have acquired over decades.

### **Prepared for the future**

Since the machines are often used in the automotive and watchmaking industries, Imoberdorf engineers know the demands placed on the machines. And they know how they can meet them. As this article shows, Imoberdorf rotary transfer machines are perfectly designed for future developments: flexible, quick, productive and reliable.



The 70 employees at Imoberdorf AG ensure that everything runs smoothly.

The assembly hall of Imoberdorf AG: The machines are designed according to customer specifications and assembled here.

## Interview with Mr. Michel Amoos, Imoberdorf AG sales engineer

„Our roots are in the watchmaking industry. That means precision, precision and more precision.“

**Even series starting at 12,000 workpieces are ideal**

**SMM:** Can you explain the relatively high flexibility of state-of-the-art rotary transfer machines?

**Michel Amoos:** Our pallet system is the key to the high flexibility. It is used to switch from one lot to another in a practically non-manual way. Here is another aspect: The axes have not always been CNC-controlled. That has changed drastically over the past years. Virtually all axes are CNC controlled in state-of-the-art rotary transfer machines. That means that fewer special tools are required compared to before.

**SMM:** What about upgrades with regard to expansion options of existing rotary transfer machines?

**M. Amoos:** We are also offering flexible options in this area. Our customers can get machines with an initial eight stations designed. Then, if the customer's order volume increases, the machine can, for example, be upgraded to 16 instead of eight stations.

**SMM:** Still, the processes of the different machining cycles must be coordinated perfectly.

**M. Amoos:** Absolutely, that is our daily business. In rotary transfer machines, the longest process has to be shortened whenever possible. In large series, cycle time reductions of only 1-2 seconds can quickly save SFR 200,000 per year during ongoing production. That is why we have to develop the shortest cycle times while maintaining top precision. If one station has to be sped up, for example, you would use linearly-driven stations. They speed things up by 12 m/s<sup>2</sup>.

**SMM:** In the automotive industry, nearly everything is about the cpk value. With your production solutions, how do you reach the high cpk values?

**M. Amoos:** Ever-increasing cpk values are a challenge for all automotive suppliers and, in the end, also for us as machine tool manufacturers. But we are providing solutions. We can integrate in-process measurement technology, through which closed control circuits perform corrections if the dimensions exceed tolerances. If we measure all workpieces with in-process, it is possible to always achieve tolerances that are within the required tolerance ranges. As a result, there is a high degree of certainty of achieving the cpk value.

**SMM:** Which developments do you currently have in the pipeline?

**M. Amoos:** Currently, we have only integrated processes with geometrically defined cutters in the machines. In the near future, we will also integrate grinding operations. That will also allow us to process hardened materials, carbide and ceramics. The combination of milling, rotating, drilling and simultaneous grinding will further increase the areas of application and the profitability of our rotary transfer machines.

**SMM:** Which industries do you supply with the machines?

**M. Amoos:** Our roots are in the watchmaking industry. That means precision, precision and more precision. And this precision has to be combined with top productivity and process reliability. These are the ideal preconditions to score points in the automotive industry, where we have gained another extremely strong foothold. The typical workpiece range includes brakes, injection, power steering, air-conditioning compressors, etc. But our rotary transfer machines are also doing an excellent job in the lock industry as well as in medical and electrical technology (keyword: plug connections).

**SMM:** This was mentioned in the article, but starting at which lot sizes are rotary transfer machines efficient?

**M. Amos:** It depends a lot on the parts families. But if I had to provide a number, I'd say that, currently, series starting at 12,000 workpieces are perfect for our machines.

**SMM:** What role do the international markets play?

**M. Amos:** Our machines are generally made for mass production – regardless of where they are located. As a typical Swiss machine tool manufacturer, we have a strong base in Switzerland and Germany but we supply all important industrial countries. This year, we are launching a branch in China that includes a service department.

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