Swiss Quality Production

2014

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SWISSMEM

HANSER

5-axis machining centre Mikron HPM 1350U

Giving shape to design

Two micron milling machining centres from GF Machining Solutions are helping to double productivity in the BMW toolmaking facility in Munich.

1 Giving shape to design: the BMW 2 series

→ As part of a continuous optimization programme in BMW's Munich-based toolmaking facility, every process is regularly reviewed and improved. Since the beginning of 2012, there have been two micron machining centres from GF Machining Solutions permanently at work in the production of precision components which are mounted in large-scale forming and trimming tools to create bodywork parts. Their use has not only improved part quality, but also extended machine running times and doubled the productivity of the department within a year. And there are more improvements in the pipeline.

»The continuous optimization of all processes has become second nature to us«, says Herbert Winkler, talking about the attitude of his team to the continuous improvement process. »The fact that we have been able to achieve such an effect with two new machines did actually come as something of a surprise – but also as confirmation that we are on the right track«, explains the Head of Mechanical Tool Production in the BMW toolmaking facility in Munich.

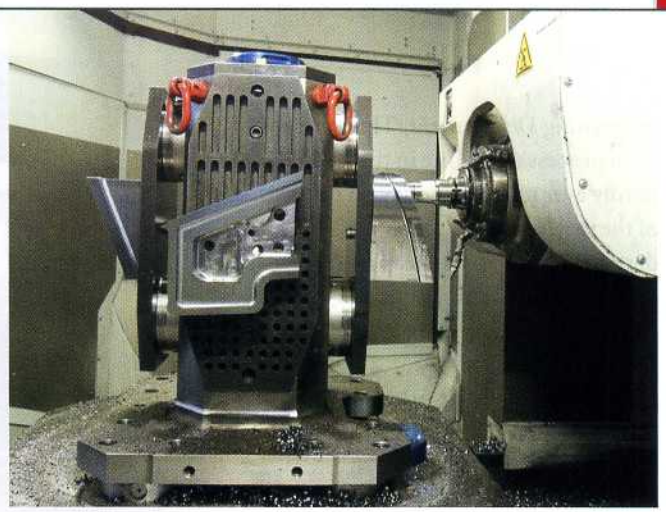
Giving shape to designs for BMW, Mini and Rolls-Royce

Responsible for these improvement are two 5-axis Mikron HPM 1350U machining centres from GF Machining Solutions. Equipped with tool changers, pallet magazines and zero-point clamping systems, they have been instrumental in helping to double the productivity of small component manufacture within a year as part of an overall program optimization measures. And the productivity increase is set to continue through 2014.

As one of three BMW Group toolmaking locations, the Munich facility employs a workforce of 220 to develop and produce tools for the outer bodywork and structural components of the new BMW models, working in close collaboration with the development department. »We see our role as that of the forming and bodywork technology partner and supplier, it is our job to give shape to the design«, summarizes Winkler. This includes the whole product creation process including planning, prototype construction, engineering, mechanical production and tool design. The team of around 80 toolmakers are able to call on a pool of five large-scale milling machines and a number of smaller ones. Tools are tested on six trial presses with a

Figures: GF Machining Solutions

2 Daniel Princip and Herbert Winkler (left to right) are impressed by the efficiency of the two Mikron HPM 1350U centres



3 GF Machining Solutions adjusted the two Mikron HPM 1350U centres to work with the dry milling method customary at BMW

pressing force of up to 23,000 kN before being commissioned in pressing plants around the world. Together with the Dingolfing and Eisenach locations, the Munich facility produces around half of all BMW tools. The other half is produced by partner companies.

Around 500 tools, with an average of four to five work sequences per tool set, leave the three locations every year. The time required to produce the tool sets has been drastically reduced over recent years, due to improved interlinking of all the processes involved. Unproductive mechanical production processes have been separated out from the main runtime and outsourced to other units working in parallel. This applies not only to set-up and clamping processes but also programming and tool pre-setting. Another improvement was achieved by extending low-manned and unmanned productive time.

At the same time, there has been a continuous improvement in the quality of all workpieces produced. This is a vital development according to Winkler, who explains: »Our schedule no longer has room for an ›intermediate assembly‹ stage.« All the parts have to be delivered ready for tool mounting to the Installation and Com- »»

missioning Department. The once common process of milling in the assembly is hardly ever practised today. »The picture of the machine operator has generally undergone a major change: The once classical milling machine operator has now become a milling manager who bears extended responsibility for a good result across all the related processes«. This is all the more relevant given that tool development and production at BMW are heavily assembly-oriented.

Quiet running is the key to precision

During the manufacture of smaller tool components, the team in Munich quickly came to realize that certain parts are simply too large for small machines and too small for medium-sized ones. This prompted a search to find the right machining centres suitable for the manufacture of knives, moulding jaws, lifters, hot-forming shells, slides, holding-down devices and punches. »We opted for the two Mikron HPM 1350U machines from GF Machining Solutions, because they came out on top in our benchmarking analysis for almost every important factor«, explains Jürgen Heinzer, responsible for the technical planning and procurement of production facilities.

As Project and Key Account Manger Michel Eder from GF Machining Solutions adds: »The team was not disappointed«. This positive verdict was confirmed by Daniel Princip, Mechanical Production Foreman at the BMW toolmaking facility. He works with the machines on a daily basis: »We have seen a major improvement in terms of flexibility, precision and productivity compared to the previous setup. The Microns permit optimum adjustment to practically any production situation.«

The 1350U models of the HPM (High Performance Milling) series are designed on the basis of the moving column principle, and they are the successful culmination of a whole raft of individual measures. A single cast machine bed mounted on three main feet makes for a highly stable basic structure. The table is symmetrically structured and the X axis guideways are arranged on two levels for outstanding torsional rigidity – a particular bonus if heavy workpieces cannot be centrally

4 The use of tombstones in the Mikron machines is part of the toolmaking optimization spectrum at BMW Munich

clamped on the rotary table and have to be turned. At BMW tombstones are frequently used and these benefit particularly from this enhanced level of rigidity. The linear guides also have scraped support surfaces, resulting in extreme geometric accuracy. »Machines fitted with basic characteristics of this calibre are able to cope with even the most stringent precision requirements with the utmost ease«, promises Eder. The ability to clamp the A and C axis for roughing work helps to further enhance stability and so extend tool life.

Downtime transformed into productive time

Powerful high-tech motor spindles from the GF subsidiary Step-Tec ensure high torque even in the low speed range, rotating with the HSK tool interface at up to 24000 rpm. Like the round axis, the swivelling head is directly driven by torque motors and water cooled, allowing the HPM 1350U to perform simultaneous 5-axis milling operations. All the axes are fitted with a direct measuring system. These quality components promise a high level of precision and economy in continuous operation – a promise which is rigorously put to the test at BMW.

Both machines are equipped with tool changers, each loaded with 92 tools. Pallet changing systems with three pallets each allow tooling to take place in a parallel process alongside productive time. »This transforms downtime into productive time«, says Eder. Princip adds: »Our machines run for around 22 hours every day – almost six times longer than five years ago«. Despite this relentless work schedule, the quality of produced workpieces is better than ever. The high rigidity of the machines, for instance, has meant that the surface properties of the produced components are close to achieving the specified 80 per cent load capability. As a result, today only half an hour of downstream lapping work is sufficient, compared to between three and four hours of manual finishing work which had to be performed in the past.

In another key development, GF Machining Solutions adapted the machines for the dry machining method customarily used by BMW since 2002. This entails the preparation of compressed air to a pressure of 12 bar, and air cooling of the machining zone both from the inside via the cutting edge and from the outside. At the same time, the chip transport method was adjusted for dry machining. In concrete terms, this involved the manufacturer fitting the conveyor chain with an active lubrication system to substitute for missing coolant.

Key component of the optimization processes

With the functional features of the kind described here, the two machines from GF Machining Solutions have made an instrumental contribution towards enhanced productivity at the BMW toolmaking facility in Munich. Output has increased to match: While in 2012, 770 small components were produced annually, by 2013 this more than doubled to 1550 components, and for 2014 an output of 1900 parts is planned. Just like Heinzer, Winkler is entirely positive in his summing up: »As things stand across our overall optimization program, we have been pleasantly surprised by the efficiency, precision and stability of the two Mikron HPM 1350U machines, which have provided impressive confirmation that our purchase decision was spot on.« ▮

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