PRESS RELEASE

Date: 09.12.2019

MAPAL Präzisionswerkzeuge
Dr. Kress KG
Postfach 1520 | D-73405 Aalen

Contact:
Andreas Enzenbach

Phone: +49 7361 585-3683
Fax: +49 7361 585-1019
E-mail: presse@mapal.com

Highly precise machining of truck engine cylinder bores

Modern truck engines are produced at the Mercedes-Benz plant in Mannheim. The requirements for ideal engine properties include extremely tight tolerances for the decisive dimensions of the engine blocks. Thanks to the close cooperation between the specialists from Mercedes-Benz, the machine manufacturer and MAPAL, significant progress was made when a new production line for machining engine blocks was designed.

Successful teamwork between users, machine manufacturers and MAPAL

Manufacturing engines requires the highest level of precision. In order to ensure the best-possible engine properties, the corresponding surfaces in the engine block must be machined with the utmost accuracy. They have a complex geometry and numerous key characteristics (KC) for which the highest tolerance classes must be reliably observed. Depending on the engine type, these include multiple H7 fits, various areas with accuracy specifications less than 15 µm as well as chamfers with tight tolerances, including a 20° chamfer with an outlet, for which an angle tolerance of just ± 0.025° (1' 30") must be observed while meeting the high requirements in terms of surface quality at the same time. Aside from all the accuracy, the focus is also on cost-effective manufacturing.

Only manageable with actuating tools

A first line for machining these engine blocks was commissioned in 2011. When planning a second line, the persons responsible drew on their experience with the first line. They identified the machining of the bores for the cylinder liner adapters as particularly challenging. The machining was divided into two stations: one for pre-machining and one for fine machining.

To this end, MAPAL has developed complex actuating tools that are equipped with up to 20 indexable inserts, including ISO inserts and custom inserts. The actuating

Date: 09.12.2019

MAPAL Präzisionswerkzeuge
Dr. Kress KG
Postfach 1520 | D-73405 Aalen

Contact:
Andreas Enzenbach

Phone: +49 7361 585-3683
Fax: +49 7361 585-1019
E-mail: presse@mapal.com

tools feature a tool body in monoblock design. The HSK-160 connection shows an enlarged face surface with a diameter of 200 mm. One tool weighs a total of up to 60 kg. Despite the connection and a tool length of 380 mm, it must be ensured that the tool has a radial run-out accuracy of 3 µm. The slides are actuated by a drawbar via an additional NC axis in the machine controller. It had to be integrated in the HSK connection and suitable for the automatic tool change. This challenge was solved with a high-precision bayonet coupling. It is used to couple the drawbar automatically during a tool change.Inside the tool, the movements of the drawbar are transferred to the slides by means of carbide ramps.

Safety logistics for the tools with a high proportion of manual manufacturing

In order to achieve the required quantities, three bores are machined simultaneously with three spindles. The three tools per machine are each assigned to a particular spindle, thus ensuring process reliability. For each tool, there is a sister tool and a further reserve tool for regular maintenance work and repairs at MAPAL.

The very high manufacturing precision required for actuating tools for Mercedes-Benz makes a large amount of manual production necessary. For example, the specialists from MAPAL lap the slide shafts in the tool body by hand. The accuracy of the tie rod mechanism must also meet the highest precision requirements. For each of these tools, this results in a manual workload of several man-weeks.

Replacing the cutting edges and adjusting the tools outside of the machine

With machining operations like these, the cutting edges of such tools are usually replaced and adjusted in the working area of the machine. Due to the cooling lubricant, this is not only uncomfortable for the machine operator, the machine also cannot produce during this time. In three-shift operation and with three tools per machine, this downtime would amount to three to four hours per day.

PRESS RELEASE

Date: 09.12.2019

MAPAL Präzisionswerkzeuge
Dr. Kress KG
Postfach 1520 | D-73405 Aalen

Contact:
Andreas Enzenbach

Phone: +49 7361 585-3683
Fax: +49 7361 585-1019
E-mail: presse@mapal.com

Unique setting fixtures for hanging tools

In an effort to ensure that the external adjustment is as simple as possible, MAPAL developed the corresponding devices for transporting, adjusting and maintaining the tools. This included a handling solution for inserting and replacing tools in the magazine, as the tools are inserted into the machining system while hanging, which is quite unusual. Due to the high tool weight of around 60 kg, the effort of just “turning over” the tool twice manually would have put the personnel under a lot of strain. When working with such a weight, the safety aspect also plays a major role. Furthermore, there would have been a risk that the tool could be damaged in the process. This is why MAPAL realised two unique setting fixtures into which the tools are inserted in a hanging position. A cart for hanging transport between the machining system and the setting fixture was also developed. The tools are thus transported and adjusted in the same position in which they are used in the machining system.

Closed quality control loop

The measurement results determined on the setting fixtures are transmitted directly to an RFID data medium on the tool. The controller of the machining system reads it out when the tools are inserted. This way, the machine can readjust some of the important measurements using the actuating slides during machining. As from the second workpiece, the results of the routine QA measurement are taken into account. This closed quality control loop for the tools was a high priority for Mercedes-Benz.

PRESS RELEASE

Date: 09.12.2019

Captions:

Maximum precision is required when machining the connections for the cylinder liners in lorry engine blocks.

Indexable inserts with special contours are used in certain areas of the actuating tool.

MAPAL Präzisionswerkzeuge
Dr. Kress KG
Postfach 1520 | D-73405 Aalen

Contact:
Andreas Enzenbach

Phone: +49 7361 585-3683
Fax: +49 7361 585-1019
E-mail: presse@mapal.com

PRESS RELEASE

Date: 09.12.2019

The run-out variation of the tool must not exceed 3 µm for a length of 380 mm.

The actuation of the slides of the actuating tool are operated using a drawbar with a high-precision bayonet coupling.

MAPAL Präzisionswerkzeuge
Dr. Kress KG
Postfach 1520 | D-73405 Aalen

Contact:
Andreas Enzenbach

Phone: +49 7361 585-3683
Fax: +49 7361 585-1019
E-mail: presse@mapal.com

PRESS RELEASE

Date: 09.12.2019

MAPAL Application Engineer, Christoph Wilhelm, on the measuring and setting fixture with suspended tool arrangement specially developed for this application.

If published, please send a voucher copy
by mail to Patricia Müller
or by e-mail to patricia.mueller@mapal.com.

MAPAL Präzisionswerkzeuge
Dr. Kress KG
Postfach 1520 | D-73405 Aalen

Contact:
Andreas Enzenbach

Phone: +49 7361 585-3683
Fax: +49 7361 585-1019
E-mail: presse@mapal.com