

# COMPETENCE



SPRING 2016:

PRODUCTION 10-11/2015: IN MACHINE CHECK

THE MCT 900 MACHINING CENTRE OF BURKHARDT+WEBER



# EFFICIENT TURNING IN THE MACHINING CENTRE

**BW has expanded the range of applications for turning operations on a machining centre in its MCT series. Through the use of components made in-house, the technology standard of the machine has been further elevated.**

The primary advantages of the MCT are the rigid and dynamic axis kinematics, the use of new functionalities for turning operations, and the ability to use a wide range of existing automation components for workpiece and tool handling.

## Machine design

The design of the new MCT series machines is based on modules of the MCX series. With a workpiece collision circle of 1400 to 2800 mm, it covers a large range of machines. New modules are the torque table design with balancing functionalities for eccentric table loads and an automatically loadable turning tool holder that is supported separately at the swivel head by four hydraulic clamping inserts to prevent loading the main spindle bearing. Because traversing accuracies during long-term operation are very important for BW, a variety of verification measures are implemented. Multiple cooling circuits are used to cool heat-generating components such as the gearbox, main spindle, torque table, and swivel head. In addition, a temperature measurement at the front bearing of the spindle is used by the controller to calculate a compensation of the axis positions in the Z-direction. The cooling lubricant supply is also temperature-controlled. A sensor in the Z-axis is taken into account in the closed-loop control.

## Swivel head

For its machining unit design, BURKHARDT+WEBER relies on the proven swivel head unit installed at a 45° angle. Two NC drives with a series-connected gear set rotate the milling head. This arrangement shows that the head can be moved simultaneously with all axes with full cutting performance. In the case of especially heavy cuts and fixed milling head position, the rigidity of the unit is additionally ensured by hydraulic clamping of the swivel axis. The main spindle is driven in a mechanically rigid manner by a two-stage gear set with helical teeth and 41 kW (S1) power. Up to 2000 Nm turning torque can be utilized for cutting by means of the swivel head. To implement a full-value turning function, it was essential to prevent loading of the bearings of a stationary main spindle, which, for example, are exposed to shocks when cuts are interrupted. BW has developed a turning tool holder that is loaded from the magazine and is supported by the outer enclosure of the main spindle sleeve. As a result, the turning tool holder is completely decoupled from the spindle bearing arrangement. The clamping with 8 t clamping force is carried out by a form of zero point clamping with four clamping cylinders. This strong clamping allows higher lateral forces when turning than a turning tool positioned in the main spindle holder. The tool holding fixture for the turning tools is the same as for the main spindle.

## Table unit

In the case of a directly driven turning table, heat is generated by the torque motor and, when contacting seals are used, also by friction heat at the media pass-



The tool changer transfers the tools (max. 75 kg) to the main spindle. The turning tool holder is also loaded from the magazine to the hydraulic clamping.



For the „MACHINE CHECK“, turning and milling operations were performed on a cast-iron table housing. The rigid turning tool holder ensures a very stable cut. (cutting parameters for turning:  $v_1 = 0,6$  mm/revolution;  $v_2 = 200$  m/min;  $a_p = 6$  mm).



All pallets are manufactured at BW. A double pallet changer comes standard. An expanded version that handles up to six pallets is available.

through of the table. Both effects directly influence the machining accuracy of workpieces. Through painstaking design and testing, BW has developed in-house solutions for both heat sources with very effective results. The torque motor is cooled on the head side. For the table seal, a non-contact groove seal with low leakage loss for a 16-channel media pass-through has been implemented. Another important aspect for long-term stability and accuracy of the machine is the reduction of vibration effects in the turning process. A vibration sensor is installed on the turning table that measures and indicates the position and size of any unbalance of the clamped workpiece at a speed of 80 rpm. The operator can mount appropriate counterweights on the pallet and make test runs until the turning process is released.

### Machining

For the "MACHINE CHECK" a variety of machining operations were performed on a cast-iron housing with a ready-to-delivery MCT 900. The loading of the new turning tool holder was demonstrated with turning of bearing seats and face shoulders with high chip production. It was evident that these types of cuts are only possible with the new turning adapter.

### Automation

Further strengths of BURKHARDT+WEBER lie in their automation of workpiece loading and unloading and tool handling. Flexible tool handling is their special preserve. The possibilities are almost limitless based not only on the number of tools but also on the tool lengths. Tools up to 1200 mm in length, 350 mm in diameter (bridge tools up to 900 mm), and 60 kg (optionally to 75 kg) can be transported. The transport

## MACHINE CHECK THE RESULTS

| For the detailed table go to <a href="http://www.fertigung.de">www.fertigung.de</a> | Maximum no. of points | No. of points BW MCT 900 |
|-------------------------------------------------------------------------------------|-----------------------|--------------------------|
| <b>Commissioning of the machine</b>                                                 | <b>25,00</b>          | <b>21,00</b>             |
| Time required up to 1st job                                                         | 12,50                 | 8,75                     |
| Evidence of machining quality                                                       | 2,50                  | 2,25                     |
| Axis measurement                                                                    | 2,50                  | 2,50                     |
| User instruction                                                                    | 7,50                  | 7,50                     |
| <b>Ease of maintenance</b>                                                          | <b>100</b>            | <b>98,50</b>             |
| Accessibility for maintenance work                                                  | 25,00                 | 25,00                    |
| Accessibility for malfunctions                                                      | 35,00                 | 35,00                    |
| Time to replace main spindle                                                        | 15,00                 | 15,00                    |
| Time to replace feed components                                                     | 15,00                 | 13,50                    |
| Automatic monitoring functions                                                      | 10,00                 | 10,00                    |
| <b>Automation</b>                                                                   | <b>100,00</b>         | <b>100,00</b>            |
| Machine start/reference run                                                         | 30,00                 | 30,00                    |
| Operation/loading                                                                   | 30,00                 | 30,00                    |
| Effort to set-up/transport a part                                                   | 40,00                 | 40,00                    |
| <b>Control</b>                                                                      | <b>50,00</b>          | <b>46,00</b>             |
| Control/automated functions                                                         | 30,00                 | 30,00                    |
| Collision monitoring                                                                | 20,00                 | 16,00                    |
| <b>Ease of retooling</b>                                                            | <b>50,00</b>          | <b>50,00</b>             |
| Flexibility of clamping table                                                       | 25,00                 | 25,00                    |
| Setting up effort                                                                   | 15,00                 | 15,00                    |
| Multiple clamping/model mix                                                         | 10,00                 | 10,00                    |
| <b>Service</b>                                                                      | <b>75,00</b>          | <b>66,00</b>             |
| Availability of service staff                                                       | 30,00                 | 30,00                    |
| Spare parts store/manufacture of spare parts                                        | 22,50                 | 18,00                    |
| Archive of part drawings; Internet availability                                     | 15,00                 | 12,00                    |
| Maintenance agreements                                                              | 7,50                  | 6,00                     |
| <b>TCO</b>                                                                          | <b>85,00</b>          | <b>52,70</b>             |
| Cost driver analysis available                                                      | 34,00                 | 23,80                    |
| Evaluation and numbers: Downtimes/repair times                                      | 34,00                 | 17,00                    |
| Machine supplier's CIP on failure reports                                           | 17,00                 | 11,90                    |
| <b>Form of contract</b>                                                             | <b>15,00</b>          | <b>10,00</b>             |
| Guarantee time                                                                      | 5,00                  | 4,00                     |
| Conditions of payment                                                               | 5,00                  | 4,00                     |
| TCO process fixed                                                                   | 5,00                  | 2,00                     |
| <b>Total</b>                                                                        | <b>500,00</b>         | <b>444,20</b>            |



### My opinion

The MCT900 is highly qualified for turning operations with its new components, turning tool adapter and torque table. The support of the turning tool adapter on the tilting head housing is absolutely suitable to manage difficult cuts; this was shown during an impressive machine check.

The access to the work area, all necessary operation elements within easy reach and also the new operation panel with a clear layout, support the operator in an excellent way. A large range of components are available for the automation of the work piece and tool supply. Customers are served according to their individual needs.

Edwin Neugebauer

# PUTTING THE MACHINE TO THE TEST

## THE MACHINE CHECK

speed at up to 200 m/min is controlled according to weight by means of a rack-and-pinion drive. Capacities ranging from 128 to 608 tools are implemented by BURKHARDT+WEBER with rack systems. A handling device removes tools from the movable storage gantry and provides them to the main spindle.

### Control system

The scope of delivery includes the Siemens 840D sl control with Operate plus Siemens options and a variety of BW's own software. The main control console and the visualization on the 24-inch screen are newly designed. Operator input via the touchscreen is intuitive. The screen is easy to understand and allows many functions to be displayed. A separate collision monitoring program also runs on the controller.

### At a glance: MCT 900 Machining Centre of BURKHARDT+WEBER

#### Strengths:

- + Many years of expertise in machine building
- + Rigid milling head
- + Turning function by means of rigid support by the milling head enclosure
- + Dynamic table axis with balancing function
- + Dynamic linear axes
- + Excellent accuracy characteristics
- + Optimum operator interface on the main console
- + Variety of automation tools for workpiece and tool handling
- + Good service availability

#### Weaknesses:

- + TCO analyses not systematic

## FACTS+FIGURES

| Machine data<br>BURKHARDT+WEBER MCT 900   |                      |
|-------------------------------------------|----------------------|
| Working area (X/Y/Z-axis) (mm)            | 1600x1400x1800       |
| Rapid traverse (X/Y/Z-axis) (mm)          | 65                   |
| Swivel head                               | Self-made; 0 to 360° |
| Torquetable (min <sup>-1</sup> , kW, Nm)  | 500, 50, 2900        |
| Max. pallet load (t)                      | 3,5; turning: 2,5    |
| Pallet size (mm)                          | 800x800              |
| Pallet changing time (s)                  | 38                   |
| Main spindle (min <sup>-1</sup> , kW, Nm) | 8000, 41, 1400       |
| Chip-to-chip-time (s)                     | 9                    |
| Tool holder                               | HSK-A 100            |
| Tool magazine                             | up to 608 locations  |
| Tools (kg, mm, Ø mm)                      | 75, 1200, 350        |
| Control system                            | Siemens 840D sl      |
| Floorspace (m <sup>2</sup> )              | 64                   |
| Weight (t)                                | 37                   |
| Price (Euro)                              | depends on equipment |

The machining sequences can be simulated. By means of a camera installed on the inside, all sequences can be shown on the screen in HD quality. This allows detection of details of the machining process such as the formation of built-up cutting edges on the tool.

### Service/TCO

The hotline is well-staffed and available until 10 PM. On-site service in Germany within 12 hours or less is the target. TCO analyses are manually performed without system support. Neither is their consistent demand for TCO by customers. In the case of machine failures, an information exchange with the user is carried out regularly. At BW, first trials of machines are performed in-house. This has been done specially for the turning technology. The advantage of these in-house trials is that weaknesses are detected early and the required degree of maturity is ensured in the delivered technology.

*Edwin Neugebauer*

Member of the



Publisher

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