

# COMPETENCE



SUMMER 2016:

MTU FRIEDRICHSHAFEN

FLEXIBLE PRODUCTION SYSTEM FOR THREE-SHIFT OPERATION



strong. precise. customised.

# HIGH QUALITY STANDARDS FOR JUST-IN-TIME PRODUCTION IN THREE-SHIFT OPERATION

## **MTU has invested in a complex and ultra-flexible production cell**

For years, MTU Friedrichshafen GmbH (MTU) has consistently driven down the cycle times of their engines, while increasing the complexity of their production processes.

## **The company**

MTU is one of the world's leading manufacturers of large diesel engines and complete drive systems. It produces diesel engines for the marine and energy supply industries as well as heavy land and rail vehicles. A division member of Rolls-Royce, the company has consistently driven down the cycle times of their engines for years, while increasing the diversity of their products characterized by different state emissions standards, while increasing the complexity of the production processes.

## **Safe and low-manpower machining in three-shift operation**

MTU has primarily produced the crankcases and attachment parts for the different series on machining centres such as from BURKHARDT+WEBER (BW). In order to respond to the changes in production and process requirements, the approach taken by MTU was to create a complex and flexible production system. A further planning parameter was the option for low-manpower and safe processing in three-shift operation. This requires close adherence with very high quality standards even for production with low manpower.

## **No retooling or repositioning of tools**

When planning the flexible production system, special attention was given to increasing production flexibility while adhering to the high production safety requirements. MTU produces a wide range of different engine types in line with demand and according to the just-in-time principle. Retooling of fixtures is therefore no longer provided for – all the tools required in the production process are managed online in the system and are available for use at any time.



Tooling stations with fixtures and workpieces; boring bars can also be inserted.

Two machining centres from the MCX1400 series by BW were selected and on the basis of the BW modular system they were customised and designed precisely in line with the requirements of MTU.

This required a powerful gear spindle, high axis dynamics, a hydrostatic table bearing with very high tilting rigidity, handling of up to 75 kg of special tools and tool lengths of up to 1,200 mm as well as NC-controlled facing.

## **Quick loading and unloading of engine blocks**

In order to reduce tooling times, centralise the operating materials and primarily simplify the transporting of materials, the production system was equipped with a tooling zone designed by MTU experts. Rotatable and moveable tooling stations enable engine blocks to be quickly loaded and unloaded from hydraulically-controlled fixtures. All the required auxiliary equipment is available directly on site and is ergonomically optimised.

» Highly-efficient system with considerable potential to reduce previous cycle times.«

Volker Wachter, Head of Production Plant 2, MTU Friedrichshafen

The series boring bars which are required for machining crankshaft bore holes up to 1,200 mm length are inserted with micrometer precision in one of the tooling stations that are NC-adjustable in position by means of an insertion fixture.

### Designed and produced at BW

A floor-based, track-guided pallet transport vehicle from BW transports the engine blocks; the complete system was designed and produced by BW. The vehicle completes the NC-controlled transport requests at a driving speed of 40 m/min and with a stiff rack-and-pinion drive. Finally, pallets can be moved very dynamically in the system to transport loads of up to 16 tonnes.



Transfer of a workpiece pallet from the tooling station to the pallet transport vehicle

### The production master computer

The complete system is controlled by a central control centre with two operating stations. The management of the two machining centres and the transport system are linked with the higher-level master computer, where order management is also carried out with the latest production status and preliminary planning as well as NC programme management, tool management and the recording of the system status with output statistics. The workpieces are assigned to the pallets, temporarily stored in the system on storage stations and depending on production prioritisation, are automatically transported to the corresponding machine to be machined. Besides workpiece management and transport, the master computer organises the required machining programmes. The master computer is the interface between programming and the machines. The programmes are automatically transferred to the right machine, where they are started. Any programme modification that the operators make on the machine are recorded, logged, versioned and transferred back to programming. Furthermore, the master computer incorporates the tool situation of the machines. It is possible to determine if tools are missing for an operation or if downtimes are insufficient. In these cases, a tool request is generated.



The control centre is intuitive to use and enables order planning, NC programme management as well as the recording of the system status, for example.

# VERTICAL NETWORKING OF THE PRODUCTION SYSTEM AN INDUSTRY 4.0 MODULE

Virtually the entire user interface is graphical and intuitively designed, making it easy to use. All the management and planning tasks as well as the transport are visualised in a system overview.

Vertical networking within the production system is a module within the context of the Industry 4.0 technology developments. The machining centres exchange information independently and are self-optimising. The available interfaces of the master computer offer additional networking options: on the one hand an extension of the internal interlinking, on the other hand an external system connection, e.g. for closely-integrated service management.

## Facts:

With a total of 9 storage stations, 2 tooling stations, 2x2 pallet changing stations at both of the MCX1400 machining centres as well as the transport vehicle, this means that a total of 14 pallets can be used in the system.

Therefore, there is a sufficient buffer for low-manpower shifts, and at the same time the fixtures required for all engine variants are retained.

The complete production system was planned and designed within four months. Construction, production, commissioning at the customer's site and finally the training of MTU employees were all completed within 14 months.

Complete system with storage stations, tooling stations, pallet transport vehicle and two MCX 1400 machining centres.



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