

Error-free manual workplaces for the automotive industry in the Martinshof Bremen

Ratingen, November 12, 2018

In spite of advancing digitalisation, the following still applies: Manual workplaces are indispensable, because automation is not always profitable with small batch quantities or complex processes. Such workplaces are preferred at the Martinshof Werkstatt Bremen – a sheltered workshop for people with handicaps – as they are ideally suited for integrating persons with physical or cognitive handicaps into working life. The Japanese Poka Yoke principle, which aims at the systematic elimination of human errors, coupled with Mitsubishi Electric's "Guided Operator Solutions", ensures the high quality. Martinshof customers include well-known automakers in the region.

With some 2200 workplaces, Werkstatt Bremen is one of Germany's oldest and largest workshops for people with and without handicaps, and also one of the city's largest employers. Apart from job order and contract production in the fields of metal and woodworking, electrical assembly, filling, and packaging, Werkstatt Bremen employs 500 persons alone in the automotive business sector, and has been supplying local automakers for more than 30 years.

Handke Industrie-Technik, a long-standing provider of Werkstatt Bremen for the installation of manual workplaces, and a premium solution partner of Mitsubishi Electric, recognised the special potential. Together with Mitsubishi Electric, Handke developed this poka-yoke solution in the field of adapted working. The prototype of the error-free workplace convinced the customer, and was installed in the production line. Since May of this year, a total of four identical zero-error workplaces are in use for automotive production.

Consistent operator guidance excludes mistakes

In a three-shift system, large quantities of torsion bars (vehicle suspension components) are pre-assembled in five different versions, transferred to a buffer store, and delivered "just in sequence" to the automakers' assembly line. During assembly, small stabilisers – which are very similar but must not be mixed up – are bolted to the left and right sides of the torsion bar. "Previously, we always had to carry out a very time-consuming manual final inspection to ensure that no faults had been made. Now we can be sure right from the start that no incorrectly assembled components are delivered, and have dispensed with the final manual process step", says Miriam Berger, in production planning at Werkstatt Bremen.

Process description

Each of the new manual workplaces consists of an aluminium profile frame fitted with hydraulic height adjustment for adapting to different ergonomic requirements, plus illumination and workpiece receptacle. Delivered in pallet cages, the torsion bars are placed in the workpiece receptacle, where their barcode is scanned by an intelligent, WiFi-linked torque wrench. Subsequently, the receptacle is locked.

In the next step, a parts bin is opened, which contains the component for the right side. A physical access barrier to the parts bin is provided by means of an intelligent door flap mechanism. Simultaneously, an illuminated push button on the bin prompts the operator to remove the part and acknowledge this by pressing the button (pick to light).

Subsequently, the removed part is held in front of a camera to verify it again. In this way, possible marking errors by the supplier are detected reliably, thereby preventing assembly errors. After release by the camera, the part can be installed.

An additional check is then carried out by inserting a sensor. Only if this check is OK, will the torque wrench be enabled, so that the bolted joint can be tightened to exactly 100 Nm. Every individual step must be carried out, and the tightening torque must be correct, before the second parts bin is opened, and the process can be repeated for the left side. When the entire procedure has been completed successfully, the receptacle releases the finished workpiece for transfer to the sequencer.

Integrating on-site technology and visualisation

"The main challenge of this project involved the integration of existing technology into the new error-free workplaces. But thanks to the interfacing features of our poka-yoke controller, this was no problem", says Nils Knepper, Senior Product Manager Modular PLC/Software at Mitsubishi Electric. Installed in a small cabinet on-site, the PLC of the MELSEC iQ-F series is the intelligent, individually configurable and expandable heart of the solution that controls the removal and assembly sequences. Apart from Mitsubishi's own components, the system can

also handle third-party sensors and actuators. Here, this includes the digital torque wrench and a system for industrial image processing. The connection of a barcode printer is being implemented, and thanks to existing conventional interfaces, this can be done easily by the sequence controller.

"During design of the user interface, Mitsubishi was highly flexible, and took all our requirements into account. Because many of our employees cannot read very well, we make use of smileys and other symbols", explains Miriam Berger. "In addition to process reliability, the poka-yoke workplaces have the advantage for us that in contrast with the previous situation, practically any employee can now do the job." The supporting visualisation is communicated in the background from the poka-yoke controller to the 10-inch touchscreen terminal.

The hardware and software from Handke and Mitsubishi Electric is featured by simple scalability, convenient configuration, programming, and commissioning as well as comprehensive connection possibilities (including MES and ERP). As soon as freedom from errors is ensured, and the technical potential is available, Werkstatt Bremen will investigate whether the buffer store can be dispensed with in future, so that pre-assembly is done directly in sequence for the automaker.

Wide range of components for individualisation

"The need to prevent errors exists everywhere during production and assembly. Most important is the fast and flexible adaptation to the needs of the persons working there, and to the process requirements", remarks Andreas Kebbel, company manager of Handke Industrie-Technik.

That is why Mitsubishi Electric and Handke offer their solution in the form of a modular system with a wide range of components and interfaces for operator guidance. Amongst others, these include mechanisms to ensure the correct removal of parts, e.g. light barriers, pick-to-light push buttons (alternatively: pick-to-voice), barcode scanners, and proprietary pick-to-door devices with stroke switches. Moreover, there are monitoring devices such as electric screwdrivers with torque & angle detection, plus vision systems as well as possibilities for robot integration. Operating units from Mitsubishi Electric's GOT2000 series are available for displaying the individual processing steps. They offer direct connectivity to the poka-yoke controller, and meet every display requirement from text through graphical symbols up to animations and augmented reality. Depending on requirements, PLCs of the latest iQ-R or iQ-F generations are used as controllers for the guided manufacturing solutions. Guided Operator Solutions can be integrated in production management systems, enabling workplaces to be networked and resources controlled and monitored in realtime.

"Werkstatt Bremen is a full-fledged supplier for industry, able to ensure zero errors and meet schedules. Hereby, our new workplaces are a tremendous help", confirms Miriam Berger. News about the positive results in Bremen spread quickly. According to Andreas Kebbel, inquiries have come in country-wide from other sheltered workshops.

The poka-yoke success story on YouTube:

<https://www.youtube.com/watch?v=poEZw7A-4uQ&t=12s>

Internet:

More information about poka-yoke:

de3a.mitsubishielectric.com/pokayoke

Photo captions:



Fig. 1: Each of the new manual workplaces consists of an aluminium profile frame fitted with hydraulic height adjustment for adapting to different ergonomic requirements, plus illumination and workpiece receptacle.

[Source: Mitsubishi Electric Europe B.V.]



Figs. 2+3: Thanks to the poka-yoke controller, existing technology – like a digital torque wrench in this case – was integrated into the error-free process without problems.

[Source: Mitsubishi Electric Europe B.V.]



Fig. 4: Mitsubishi Electric's HMI GOT 2000: "During design of the user interface, Mitsubishi was highly flexible, and took all our requirements into account." reports Miriam Berger, production planner at Werkstatt Bremen.

[Source: Mitsubishi Electric Europe B.V.]



Fig. 5: A physical access barrier to the parts bin is provided by means of an intelligent door flap mechanism (pick-to-door). Simultaneously, an illuminated push button on the bin prompts removal of the part, which is acknowledged by pressing the button (pick to light).

[Source: Mitsubishi Electric Europe B.V.]



Fig. 6: "The main challenge of this project involved the integration of existing technology into the new error-free workplaces. But thanks to the interfacing features of our poka-yoke controller, this was no problem", says Nils Knepper, Senior Product Manager Modular PLC/Software at Mitsubishi Electric.

[Source: Mitsubishi Electric Europe B.V.]

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With some 142,340 employees, the group recorded consolidated sales of 4,431 billion Yen (41.8 billion US dollars *) in the fiscal year ending March 31, 2018.

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* Exchange rate 106 Yen = 1 US dollar, status of 31.03.2018 (Source: Tokyo Foreign Exchange Market)

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