



Completely automated powder coating with the help of robots

## Quality, efficiency and high availability

In the Swedish city of Mjölby, Toyota extensively automated its powder coating with the help of robots. The new powder-coating system markedly increased capacity and efficiency, improved surface quality and measurably reduced powder consumption.

### KEYWORDS:

ROBOTS, MATERIAL HANDLING, VEHICLES, LIFT TRUCKS MAGIC COMPACT

One of the world's largest facilities for manufacturing material-handling vehicles is located near the city of Mjölby in Sweden's Östergötland County. There, some 1500 employees working in an area measuring 76,000 m<sup>2</sup> develop and manufacture platform lift trucks, fork lifts and reach trucks in a variety of designs.

These material-handling vehicles are manufactured to individual customer

specifications. Depending on the spaces in which these vehicles will operate, the model, lifting height and other customer-specific details are worked out. Each customer thus gets the solution that best fits his needs. Given this high degree of customization, designing the automation of the complex manufacturing processes is particularly challenging

Mastering such challenges, though, is a part of Toyota's corporate philosophy. This is implemented in a consistent manner and places considerable demands on the performance of partners and suppliers.

The goals set for the construction of the latest coating system were correspondingly high. First of all, capacity had to be significantly increased. To save costs, the coating of some parts was no longer being out-sourced to job coaters but rather was once again brought in-house. Products also took on larger dimensions, so the system needed the ability to coat longer, wider and higher components. The consumption of both energy and powder had to be kept as low as possible, and if that were not enough of a challenge, cleaning the booth had to be done completely automatically.

For the design of this new system, it was possible to draw on many years of experience because back in 1992 the company had already converted from wet painting to powder coating. A total of eight coating lines are in operation, of which seven are equipped with systems supplied by Gema.

Today, the Mjölby facility processes approximately 150 tons of colored powder each year. Some 65 percent of the components are coated black, and the other parts are done in the company's familiar orange color. Only in a few exceptional cases does an order come in where, besides the custom-designed product, a special color is also requested. It obviously made sense to set up the lines proportionately for the different colors; and as a result, today there are two single-color lines



and one multi-color line in operation.

A difficult task was finding out how to move the spray guns in a suitable way. The particularly complex geometries of the parts were the decisive factor in selecting a programmable solution based on 6-axis robots from ABB. Toyota previously had experience in using robots in powder coating and thus was

very familiar with their advantages. The robots ensure that the guns operate at the proper speed, tilt and position to achieve optimal surface quality and minimize powder consumption. All coating programs are simulated on a PC with the support of what are known as "paintbrushes."



These show graphically how the powder will be applied to the actual object. The operator can see on the screen how the object is coated in successive steps. If needed, corrections to the program can also be carried out offline without interrupting production.

To create the automated booths, the company chose specially adapted MagicCompact booths from Gema whose openings for the robots are equipped with automatic sliding doors. The material of the plastic booths ensures minimal powder collection on the walls. The uniform airflow supports the consistent formation of layer thickness and results in excellent coating quality. The supply of fresh powder is ensured with three BigBag fresh powder systems from Gema.

In each booth, coating the parts is done with two multi-axis robots that are each outfitted with a twin-gun head. Each shift, 220 objects suspended from conveyor hooks are coated. With this capacity, it was possible to reduce system operation from three to now just two shifts. The coating is performed 100 percent by robots. Despite the

very complicated parts, no manual coating is necessary, which has a positive effect on the economics of the operation.

Hand-coating is reserved for individual parts or very small runs. The entire system can be operated with just 11 people, whose job is primarily to insert and remove parts from the suspension hooks. Changing colors takes place virtually automatically, and the booths are cleaned by robots. Because of this,

only very few manual operations are needed for a perfect change of color.

The entire coating process is completely automated. Between the time objects are inserted into and removed from the system, none of them is touched by hand. System availability meets the highest standards. Maintenance is carried out at the end of the day following a shift. A complete system check is conducted once each year.

### The coating system

- 3 Optiflex A2 control cabinets, each with controls for 4 powder guns
- 12 OptiGun GA02 automatic powder guns
- 3 control systems
- 3 MagicCompact quick color change booths
- 3 BigBag fresh powder systems
- 1 central powder supply
- 1 OptiFlex-2F hand coating unit
- 1 OptiFlex-1B hand coating unit
- Fire-protection system

To ensure the highest level of reliability, each element in the process must offer the corresponding safety, which begins with inserting the object. Here monitors are put to use to show operating personnel exactly how the current object must be placed correctly on a suspension hook. This continues with the reliability of each component in the system, from pre-treatment through coating up to baking, cooling and removing the object.

The process of finding such a solution has its own name at Toyota: *Genchi Genbutsu* essentially means “go to the source to find facts in order to make the best decisions, reach a common agreement and achieve goals.”

The result of the collaboration with the experts at Gema is impressive: at 99 percent availability, the system achieves an extremely high value and the best possible cost-effectiveness



Working instructions are displayed on computer screens.



Once the objects are suspended, pre-treatment and coating are carried out fully automatically.