



# Colour change time cut in half

Case Study: Kemper Maschinenfabrik | Germany

Case Study

# Kemper Maschinenfabrik, Germany

Significant increases in efficiency in the powder line of a mower manufacturer



High Transfer Efficiency



Fast Colour Change



Clean Environment



Specification	
Type of products	Tools for Mowers
Material	CDC painted Steel
Capacity	
Conveyor type	continuous
Line speed	max. 2 m/min
Surface approx.	180 m <sup>2</sup> /h
Application	
Booth type	ColorMax <sup>®</sup> 3
Cyclone	Twin Cyclone with After Filter System
Powder feed center	Spectrum <sup>®</sup> HD
Feed Center Control	PowderPilot HD
Pumps	2x HDLV high capacity pump 12x HDLV gun pump
Application	HDLV <sup>®</sup> – dense-phase technology
Quantity of spray guns	
Automatic Guns	10x Encore HD
Gun layout	vertical stacked on Oscillator
Manual Guns	2x Encore HD



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## Project Overview

<p><b>What's new on the installation?</b></p>	<ul style="list-style-type: none"> <li>■ Thanks to dense-phase technology and the new Powder Feed Centre Spectrum HD – quality colour change in 4:15 min and highest first pass coverage efficiency</li> <li>■ The outline of the drawing-in rollers follows up by a third oscillator</li> <li>■ Replacing 3 existing booths by 1 ColorMax<sup>3</sup> fast colour-change booth enables an increased productivity speed also safe and clean environment: No need for the operator to enter the booth</li> </ul>
<p><b>What was the main value proposition for the customer?</b></p>	<p>By using the dense-phase technology instead of the traditional Venturi Technology (Tribo Application) = Increased transfer efficiency and coating penetration thanks to softer spray, optimised electrostatic powder cloud, superior edge and corner coverage with one pass.</p>
<p><b>What was the biggest challenge?</b></p>	<p>Safety and ergonomics in the workplace during coating of the large drawing-in rollers – this process is now be done by the automatic guns</p>

## Customer Statement

Individualisation, increasing demands on the appearance and the customer's corporate colours are becoming more and more important, even in the area of mowing equipment. "We are at a point where many of our customers receive their harvest attachments painted in their corporate colours right off the conveyor belt", explains the System Operator at Kemper.

"In addition to the short colour change times, the ergonomic design of the new booth is much better for our employees", says the System Operator. "We are using a total of ten automatic spray guns, whereby two can be used from underneath

if demand requires it. Based on the geometry defined by the components scanner, the position of these spray guns can be optimised. This is extremely important since at Kemper a considerable range of parts are suspended from the chain conveyor at random sequence and the geometries of the parts can be very complex. For instance, large drums can be very challenging. On average, the new booth makes it possible to coat 85% of the component's surface automatically. Furthermore, the System Operator estimates that the new booth, when compared with the old Tribo system, saves approx. one-third of the compressed air required.

## Significant increases in efficiency in the powder line of a mower manufacturer

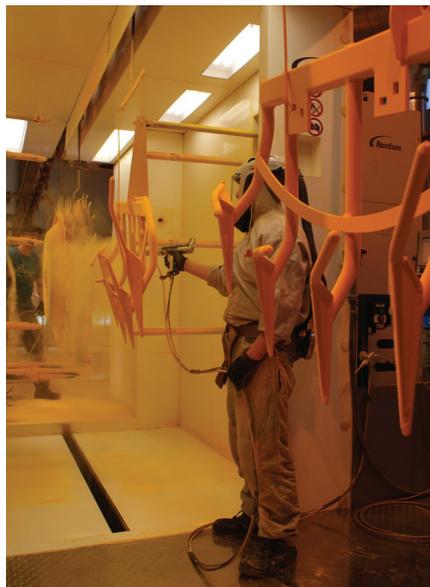
Due to the extremely short colour change time and the introduction of dense-phase technology for powder feed systems, a manufacturer for agricultural machines manages to use only one fast colour change booth, while up till now three standard booths were required.



The history of agricultural equipment and tools goes far back in time. There is evidence that, what is referred to as a scratch plough (ard), was used as early as 5,000 BC to score the top soil and made working the land much easier than using hoes or similar tools. However, it took until the middle of the 19th century until an American blacksmith invented the first self-scouring steel plough – and thus opening the doors wide for a new way of farm-



ing. The name of this talented blacksmith was John Deer, who laid the cornerstone



for his enterprise and forging it into what is today the biggest manufacturer of agricultural equipment in the world.

### The self-propelled forage harvester – a real workhorse

Today, however, ploughs, combine harvesters, and tractors are not the only machines state-of-the-art farming must rely on. For-

age harvesters also play a significant role. They are utilised for harvesting forage such as grass and maize and during the production of the substrate for biogas systems. Depending on the supplier and model, the input rating of a harvester can exceed 800 hp. These workhorses can harvest and chop up to 400 tons of material per hour. But how do the grass and maize get from the field to the chopper? The effective cutting and transporting of the stalks to the inside of a forage harvester requires a well-engineered mechanical system and a great amount of expertise. This is the key element for the efficiency of these farming machines. This is why even large manufacturer of self-propelled harvesters rely on experts and purchase this type of equipment as finished module.

Considering these facts, the machine manufacturer KEMPER, now part of John Deere, gained an excellent reputation in its more than 100-year history. Many renowned agricultural machinery manufacturers purchase these harvesting attachments from Kemper: Ranging from the parent company John Deere, to New Holland,



Agco and even Russian manufacturers. Kemper also manufactures header attachments for Claas and Krone forage harvester and supplies them to the market.

Originally, the company started with single-row tractor-mounted choppers. Later, fertiliser spreaders, dump trucks, and slurry spreaders were added. In the course of the company's history, Kemper specialised in harvesting headers for maize, making it the company's core business. However, pickups for grass are also part of the product range. These pickups are mounted to the front of the self-propelled harvesters and, depending on the application, are interchangeable. Since John Deere also procures such equipment from its suppliers, Kemper came to the attention of this industry giant and was integrated as independent brand into the John Deere group of companies in 1997.

In addition to excellent harvesting power, the design of such harvesting headers also requires that the self-propelled machines are permitted to travel public roads in order to reach the fields. Therefore, all Kemper harvesters come with the appropriate permit in all relevant target markets worldwide. This applies in particular to large attach-

ments, e.g., for harvesters with 12 rows, which makes the operating configuration as wide as 12 m. This cannot be looked upon as trivial as it requires well in engineered and elaborate folding and support mechanisms.

In the meantime, energy efficiency and weight have also become an important aspect for harvesters. Why? If the harvester weighs less and is fuel-efficient, the harvesting header must match these require-

ments as well. Needless to say, wherever it is feasible and meaningful, the design intends to reduce the weight of the equipment as much as possible. For instance, covers made of plastic instead of sheet metal are used more and more often. Instead of gears made of steel, housings made of aluminium are used. "Each year, we focus on other key issues", says Stefan Plate, System Operator at Kemper.

### High vertical integration

Kemper's vertical integration is very high, and many parts/components are manufactured in-house. A staff of approx. 300 who are members of the variety of different trades – from welding to machining technicians – work in the expansive factory buildings.

"Our customers buy the header attachment because we have many years of technical know-how, and we have the best header attachments available on the market – at least, this is how I see it", says Stefan Plate self-confidently. Kemper offers these harvesting headers in a variety of models, from rigid to foldable and up to twelve rows. Approximately 80% of the manufactured harvesting equipment is exported.



The ColorMax<sup>3</sup> Booth with twin cyclone and dense-phase technology replaced three conventional powder booths. The new booth enables a quality colour change in 4:15 minutes.



### Substantial pretreatment

After suspending the components on an overhead track system, the parts are ready for a 13-zone spray pretreatment with zinc phosphate by Eisenmann. The cathodic dip coating process follows next. During this process, a light grey is applied since Kemper uses many shades of light paints – and only slight fluctuations in the coating thickness would cause a darker CDC paint to shimmer through. The burn-in requires one hour at a temperature of 180°C; subsequently, the cooling process is started.

The John Deere group of companies places great importance on energy efficiency. Therefore, two years ago, all spray and heating pumps were equipped with frequency converters. “Using these frequency converters saved 40% of our pumps’ energy consumption”, Plate reports happily. “Before, the 10 kW motors were simply powered down mechanically. When it comes to the large CDC pumps, we could save approx. 60% by applying a demand-based operation.”

### Intensive quality control

Kemper does not leave the pretreatment, paint and process to chance. Each day, a metal test sheet and analyses are used to verify all process steps in our in-house paint laboratory. Each morning, four metal test sheets are painted and tested to verify that the zinc phosphating process is correct and the sequence is OK. Metal test sheets are moved through the CDC system, and coating thicknesses are analysed. The powder coating is not only tested for the proper colour hue, but a conical mandrel bend test, an impact and a cross-cut adhesion test are also performed.

“As soon as abnormalities are detected – regardless how minute they are – we will contact our suppliers in order to clarify what can be done”, says Plate. In the course of

## The Application

- Spectrum HD Powder Feed Centre
- Twin Cyclone
- ColorMax<sup>3</sup> Fast Colour Change Powder Booth
- PowderPilot HD
- 10 Encore HD Automatic Guns
  - 2 Guns at the bottom
  - 2 Guns at the top
  - 6 Guns at Gun Mover
- 2 Encore HD Manual Guns
- 12 HDLV Gun Pumps
- 2 HDLV Transfer Pumps
- 5 colour changes per shift

changing a paint manufacturer in 2012, an additional benefit could be implemented: A new paint made it possible to reduce the oven temperature by 30°C. In the future, there will be discussions about NT paints. The affiliated company in Bruchsal, Germany, is already working on the conversion. If this conversion is successful, it can be expected that the NT process will also be adapted in other factories of the John Deere group of companies.

### Function counts, but appearance is also important

Individualisation, increasing demands on the appearance and the customer’s corporate colours are becoming more and more important, even in the area of mowing equipment. “We are at a point where many of our customers receive their harvest attachments painted in their corporate colours right off the conveyor belt”, explains the System Operator. “These customers are, for example, New Holland and of course John Deere.”

This, however, took a long time and, as the engineering of agricultural machinery has developed, so has surface technology. In the past, all components were coated with



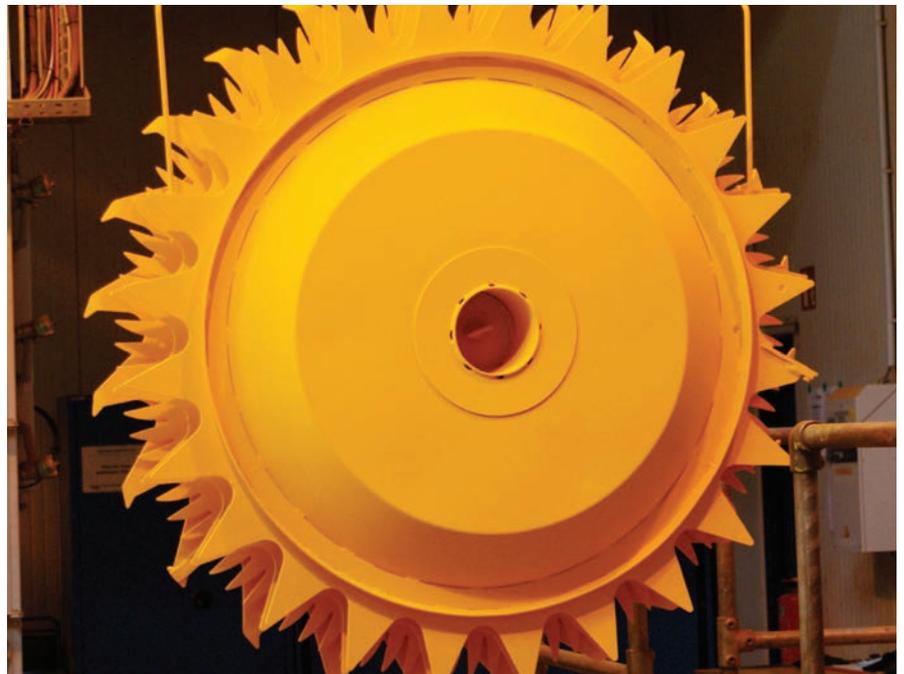


Spectrum HD – Closed-loop Powder Feed Centre for fast, clean color change. It integrates Nordson's HDLV pumps with our latest generation feed center system. As a result, you can achieve precision dispensing, sophisticated color change control, and ease of use – all for the lowest cost per painted part.

liquid paint – they were immersed in large tanks. By using a gantry crane or a manual operating mode, the workpiece carriers or large workpieces were immersed individually in a bath of solvent-based lacquer. The last paint tanks were taken out of service in 2000 when immersion painting was successfully replaced with spray painting. The next technological change took place in 2001 when the first powder coating booth was taken into operation at Kemper – using a system made by Tribo. “The results were so amazing that a decision was made to change to powder coating in the intermediate term”, explains Plate. “Powder coating has a special appeal. There is no solvent involved, it is easy to handle, it can be vacuumed off, and using tape for masking purposes is simple. It is much more resilient than liquid paint – especially when the farmer uses high-pressure cleaners intensively.”

First, two single-paint booths, made by Nordson, were rolled into the chain conveyor belt and cleaned off-line. However, this took about 45 minutes. “In those days, we used only four colours and this proce-

dure was manageable. Nevertheless, especially if lesser amounts of paint are used, it could happen that the colour change in the second booth could not be completed on time.”



Subsequently, an additional third powder booth was installed to alleviate this problem. “Eventually, new markets opened that

required additional colours. Today, we are using eight colours in our product line and changed the colour four times per day on average”, explains Plate. “Our flexibility had to be increased, and the colour change had to become faster.”

Therefore, in 2012 we decided to invest in a new application technology. Again, Nordson was awarded the contract since, after several tests, the application technology manufacturer guaranteed in writing that a colour change with the new ColorMax3 both including dense phase technology was possible within 4 min and 15 sec.

“In addition to the short colour change times, the ergonomic design of the new booth is much better for our employees”, says the machine operator happily. “We are using a total of ten automatic spray guns, whereby two can be used from underneath if demand requires it. Based on the geometry defined by the components scanner, the position of these spray guns can be optimised. This is extremely important since at Kemper a considerable range of parts are

suspended from the chain conveyor at random sequence and the geometries of the parts can be very complex. For instance,



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### Colour change in 4:15 min

The dense-phase technology was new to Kemper since previously only one Tribo system was employed. From now on, only two people are required to proceed with the colour change – one person for the pre-coating and one for the post-coating process. If a colour change becomes necessary, the technician prepares a gap in the chain conveyor consisting of 25 links – equal to the length of a paint booth. As soon as the pre-coating is done and the powder is used, the technician closes the rear door and goes to the powder centre, where he interrupts the powder supply from the carton. He also places the previous powder carton underneath the hopper in order to collect the powder residue. Once the last part is coated, the technician at the post-coating station presses the colour changing button. From now on, the control system sets the cycle and starts the cleaning program. During this process, compressed air is used to clean the inside of the pumps and spray guns automatically. The spray pistols leave the booth automatically along the Z-axis and

nozzles are used to clean the spray guns with compressed air. A pneumatic lance is used to clean the booth manually. Cleaning the floor of the booth requires no time at all since it is high-pressure cleaned during the normal paint operation cycles. Once these steps are completed, the powder return mode is interrupted, and the system switches to operation loss mode. Now, the technician at the pre-coating station cleans



the powder storage tank, the hopper and the ultra sound screen. Subsequently, he places the new colour carton into position and inserts the after-dosing lance. This step is acknowledged by the controller, after that the new paint is pumped into the system.

When Kemper changes four colours today in only 4:15 minutes per day, it takes only 17 minutes. Previously, it took 10.5 minutes to

change the booth just once. Therefore, four colour changes means a 42-minute pause of coating time. In addition, there was the manpower requirement in order to proceed with the actual change of colours off-line in 45 minutes in each of the change booths.

This clearly demonstrates how drastically the productivity increased due to the new fast colour change booth. On average, the coating process at Kemper takes place over nine hours per day; whereby the start of the work shifts is staggered – depending on the advancement of the parts on the 700-meter long endless chain conveyor system. This means that the technicians can sleep three hours longer while the suspension trolleys start their shift already at 5:30 AM. At about 8:30 in the morning, the first components have passed through the pretreatment and CDC station and arrive at the paint coating hall. After about six hours, the first parts are ready to be removed from the suspension trolley.

This is an impressive example how modernisation of application technology can increase the productivity and efficiency in a spray paint shop. At the same time, it becomes evident how demanding the painting requirements have increased in the agricultural machinery industry in the past years.