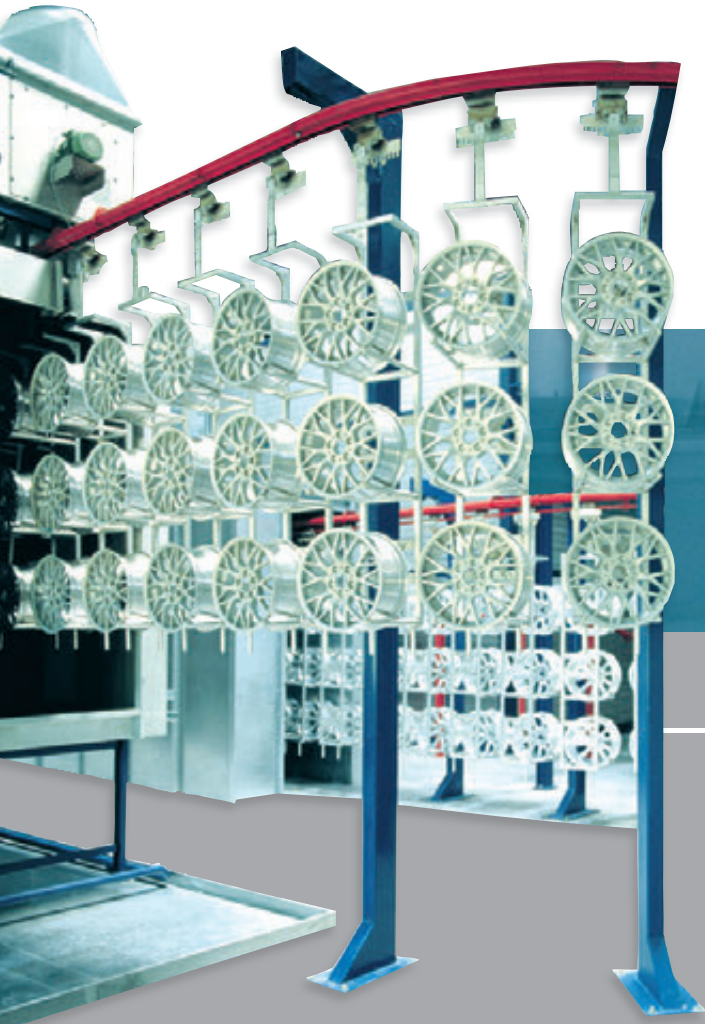


**EISENMANN**



**COATING ALUMINUM WHEELS**



AS A LEADING INTERNATIONAL SUPPLIER OF SYSTEMS FOR SURFACE FINISHING TECHNOLOGY, ENVIRONMENTAL ENGINEERING, MATERIAL FLOW AUTOMATION AND HIGH-TEMPERATURE TECHNOLOGY, WE OFFER OUR CUSTOMERS A LEADING EDGE BASED ON SOPHISTICATED PLANTS, INDIVIDUAL SOLUTIONS AND GLOBAL SERVICE.

*Eisenmann Education Centre Böblingen.*

## EISENMANN – PARTNER FOR THE ALUMINUM WHEELS INDUSTRY

Our name is synonymous with comprehensive systems competence, top quality and reliability. Our products set standards and revolutionary technological advances. We employ approximately 3,700 people worldwide with more than 1,700 in Germany. Of these, roughly 800 are engaged in engineering.

Eisenmann is developing and combining individual processes to form an overall process solution from a single source, tailored to encompass all the customer's specific requirements. Our systems are extensively optimized with regard to production costs, quality and sustainability.

To this end, we combine the knowledge of our individual divisions and utilize the synergistic results:

- **Surface Finishing**
- **Process Technology**
- **Environmental Technology**
- **Material Flow Automation**

### **The coating of aluminum wheels**

Aluminum wheels or more technically correct aluminum wheel rims, on motor vehicles have become increasingly popular in recent years. As the manufacturers of wheels increase their production capacity so competition amongst them also grew.

The quality and economics of coating have therefore become factors not to be underestimated. For those who wish to establish themselves firmly in this market, high-performance surface treatment plants are essential. The state-of-the-art technology in this field is defined here from the point of view of the plant contractor.

To put the statements made here into context, it should be remembered that Eisenmann, with nearly 70 customers or installations, must surely have the longest list of references for wheel paint shops in the world. The company's success in this market is the result of many years of experience as well as the broad range that are manufactured. In practical terms, it is almost always a question of powder or wet coating with individually tailored application techniques, high-quality pretreatment, waste water disposal and, if required, exhaust air cleaning. Material handling and management of technology are geared to meet precisely the requirements of the job. When everything is supplied from one source, it saves the customer unnecessary interfaces and provides him with a solution to his problem with an integrated system.

Throughput, the degree of automation and the resulting investment required for the plants differ widely. The customer's requirements are the key here. A significant trend, is that progress made in terms of quality and environmental impacts. In recent years our technology are used increasingly both by first and second suppliers on a worldwide basis.



*Discharge of the pretreatment.*



## SURFACE FINISHING THE MOST IMPORTANT FACTS

The processes are depending on the required surface quality. There are two types of wheels – standard wheels or machined wheels. Up to 6 layers will be coated on the wheels surface. The most important processes are:

- Pretreatment (up to 16 stages)
- Priming with principally light-grey or black powder
- Silver top coat application and
- Final application of a transparent coating (powder or liquid paint)

For machined wheels there are additional layers like corrosion protection paint or anti-break-dust paint.

The different ways by which workpieces can be transported to the various surface treatment areas have a major influence on product development. The present state of the art processes outlined as follows for these areas, as well as for the most important peripheral tasks and their potential automation.

### **Pretreatment**

The "classical" process of yellow chromate conversion with chemicals containing chromium (VI) oxide has for many years paled to insignificance throughout the world for ecological reasons. Many manufacturers have developed pretreatment

chemicals that do not contain the highly toxic chromium (VI) oxide and manage without any heavy metals at all. Examples are Chemetall under the designation "Self Assembling Molecules" (SAM), or Henkel's Alodine 4850, both of which have already proved themselves in use in Eisenmann plants. These transparent, chromium-free conversion treatments are particularly important for the automobile industry, because the content of chromium (VI) oxide in a motor car is limited to 2 g by EU regulations for all vehicle registrations from 1 July 2003 onwards. The new developments are also directly beneficial for the user because no waste water treatment is necessary and consequently no waste products requiring monitoring are created.

The pretreatment system for wheels consists of 9 to 14 stages, depending on the quality demands and chemicals used. Less than 10 stages is quite a rarity even today. To save fresh and waste water, cascade flow of rinsing water is utilised. A dry off oven and a cooling zone are arranged downstream of the pretreatment system. Depending on the aluminum alloy used and the casting process employed, forced-air oven temperatures up to 220 °C are required to completely dry off micropores. This minimizes surface defects in the subsequent process.



*Pretreatment plant for chromium-free conversion treatment.*

*Clear powder coating.*

### Priming

For years now the standard procedure has been to use light grey epoxy powder for priming. The solvent-free powder coating is environmentally friendly and thanks to overspray recovery, most economical. Also, it produces an excellent base for additional coating layers and smoothes out potential unevenness in the aluminum casting.

The powder booth – preferably in a separate enclosure and air-conditioned for reasons of quality – should be equipped with a high-performance filtering system.

Compact filters made of synthetic sintered materials have proved to be especially suitable for this. For the fully automatic application of powder, instead of the electrostatic spraygun (with automatic powder quantity control), it is also possible to use powder bells, and as a means of ensuring high quality, separate conveyor systems for the coating area and the powder curing oven are recommended.



*Infrared oven for preheating.*

### Top coating

If solvent based coatings are used for the silver coat (also for the transparent finish) exhaust air cleaning is required. In the case of hot exhaust air streams, this is done using a thermal incinerator with for example heat recovery for hot water preparation for the pretreatment area. Exhaust air streams are cleaned by means of regenerative thermal oxidation RTO. They contain only traces of solvent and in combination with equally environmentally acceptable priming and finishing systems

make the need for exhaust air cleaning superfluous. However, waterborne paints require an additional preheating oven so that the paint can be applied to wheels which have been heated up to 70 °C.

The silver coating spray booths should be equipped with efficient wet scrubber for paint overspray. The electrostatic version has become standard for application. A combination of highspeed rotating atomizers for the surface coating capacity and HVLP spray guns for the penetration depth has proved to be especially useful here. The level of application efficiency of at least 80 % that can be attained in this way results in a substantial reduction in the quantity of coating required, the coagulation and cleaning effort and the amount of coating sludge.

If solventbased silver and clear coats are used then the process can take place wet-on-wet with intermediate flashoff. In the case of using colouring water coating systems that are preferred these days, the workpieces are often preheated. Flashoff and cure oven then follow the application of coating before the wheels reach the finishing area.

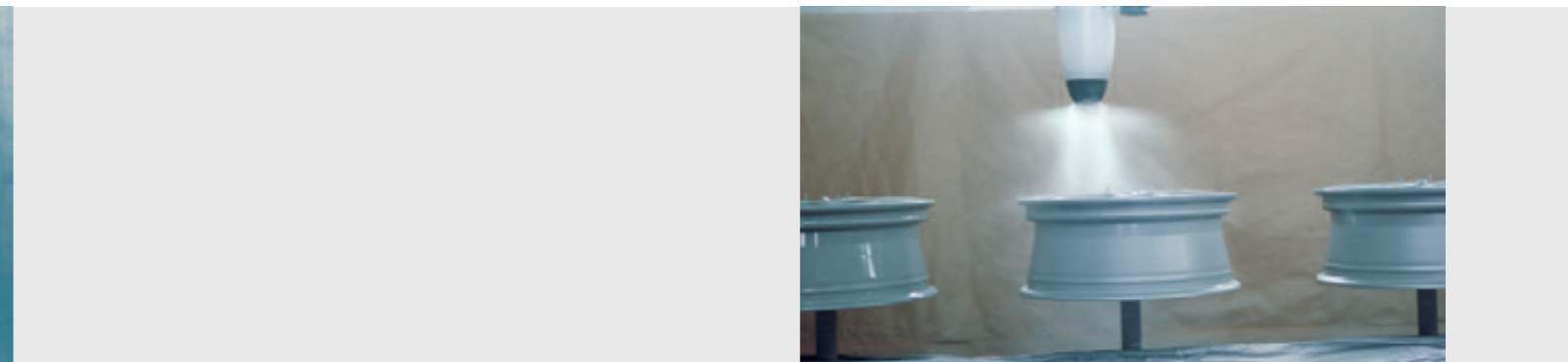
### Finishing

Clear coat finish coating provides the shine and surface protection against scratches for the aluminum wheels. The predominantly solventbased clear coat used in the past is now increasingly being replaced by a clear powder coating based on acrylic material. The acrylic-based clear powder, also used for car bodies, enables all the advantages of powder coating to be exploited, no solvent emission, no waste water, no coating sludge, robust surface, little susceptibility to problems and high efficiency through direct reuse of the overspray.

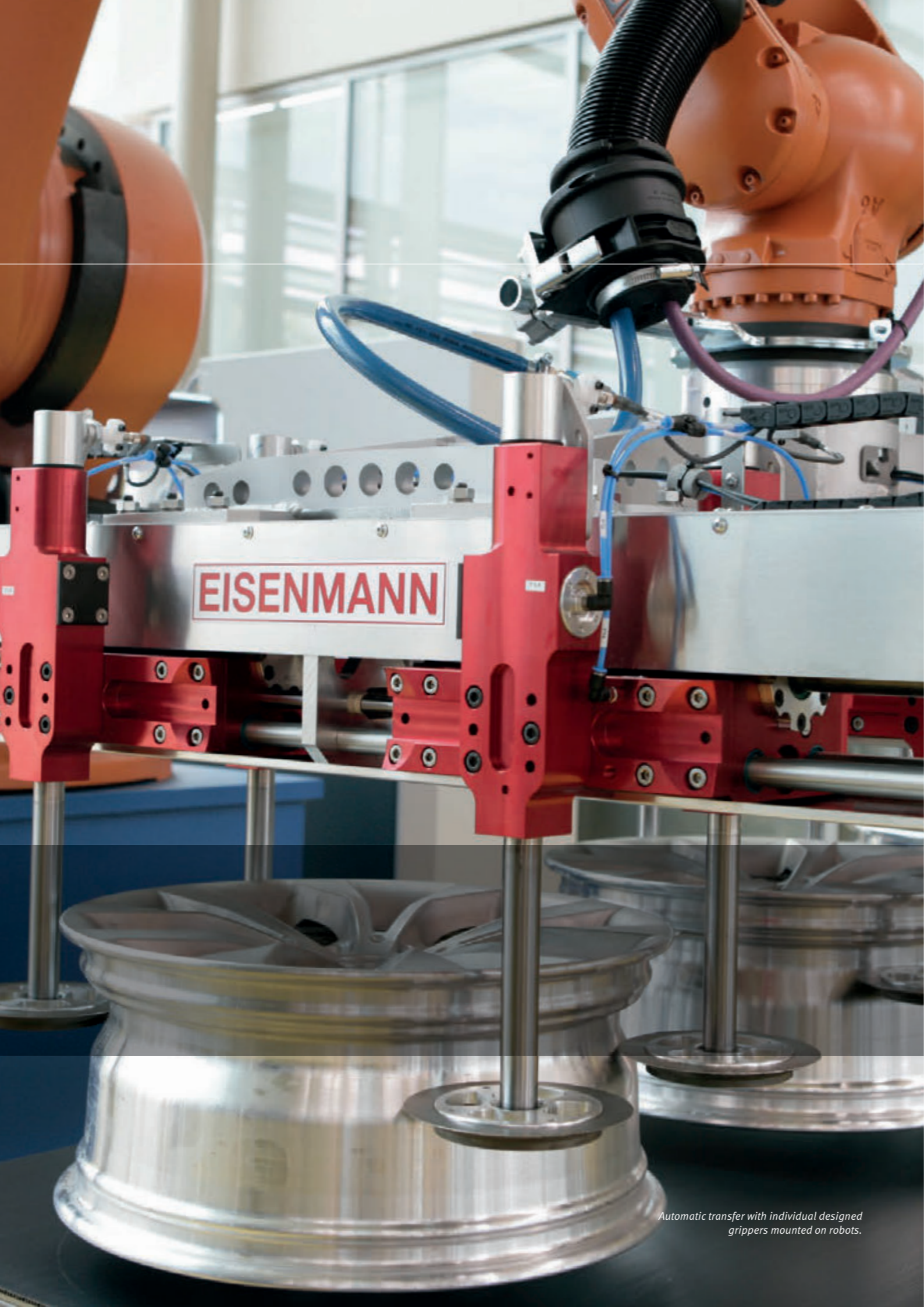
Despite the relatively high cost of acrylic-based clear powder and certain prerequisites for the process (e.g. air conditioning is imperative), this coating has proved to be advantageous not only ecologically but also economically. As surface brilliance and strength have been established as being superior, the OEM (Original Equipment Manufacturer) release of the system has been approved by numerous automobile manufacturers.



*Clear powder coating.*



*Water-based silver coating.*



## HANDLING & AUTOMATION

### Material handling

The means by which the workpiece is transported hanging or lying down has a significant influence on product quality. Nowadays hanging transportation on a continuous conveyor is used mostly by less demanding secondary suppliers in the pretreatment field. While in the coating areas horizontal transportation of workpieces has largely come to be state-of-the-art. For several reasons a much more even distribution of coating is achieved on the wheels, which are transported lying flat on the spindle conveyors, inverted monorail or power & free conveyors with special workpiece holders - which rotate when the powder or coating is applied. Additionally, there are no moving parts above the workpieces which coating overspray can condense or from which dust or dirt particles can drop down. A further separation of the coating and drying conveyors also reduces the danger of contamination - especially important with powder coatings - and so also minimizes the effort required for paint stripping.

### Transfer procedures

As a rule, several wheels stacked one on top of the other are manually transferred to the circular pretreatment conveyor, with robots to simplify the handling. In particular if higher throughput rates are required, articulated arm or portal robots are used so that personnel can concentrate on control and monitoring activities.

Articulated robots are installed for the other transfer operations between the various spindle conveyors. For the additional transfers

between the various spindle conveyors robots are installed, depending on the available space. Depending on the state of the wheel to be transported wet coated or powder coated multiinternal or external grippers are used.

### Masking

The introduction of powder coating provided wheel manufacturers with many advantages but also with a problem. In order to ensure that the bolt connection between the car wheel and the wheel flange remains permanently flawless, the screw holes must be kept free of powder during the coating process. For years this meant the manual insertion and later removal of type-specific stoppers or universally usable balls.

It was already in 2000 that Eisenmann automated this process. Controlled by an image recognition system, an articulated arm robot locates the balls or alternatively taps into the bolt holes of the various wheel types. Using a tilting mechanism the balls are then later removed, cleaned and made available for the insertion station again.

The capacity of such a fully automatic system is approximately 3,000 balls per hour, which for a maximum of 6 bolt holes for each wheel corresponds to a surface throughput of about 500 wheels per hour. Due to steadily rising quality standards, the flange and surfaces of the hub bore are cleaned by patented brushing and suction devices between the powder coating area and the powder baking oven.



Automated masking of bolt holes with balls or taps.

Automatic transfer with individual designed grippers mounted on robots.

## ENVIRONMENT & SERVICE

### Inverted power & free system

The system is characterized by the “inverted” floor-mounted construction. It has the advantages of the floor-mounted circular conveyor, multi-track spindle conveyor and skid conveyor combined with those offered by conventional power & free overhead conveyors. Even though it is extremely versatile, the system requires fewer drives and control components. The compact dual-rail system can be integrated in and around paint lines without the need for a base or complicated steel construction. All this keeps costs down. The conveyor below the workpieces prevents soiling of the components.

### Variable operating modes and speeds

With the inverted power & free-system, the carrier trolleys holding the workpieces are conveyed in one rail. These trolleys can be engaged or disengaged. The conveying chain runs in the second rail with fixed pusher dogs. This intelligent mechanical solution ensures a fast, reliable and simple transfer from chain to chain – even where speeds in the various processes differ. This ensures highly efficient production. Moreover, the system is fitted with switches for merging or diverting the carriers to different process destinations, for overtaking, sorting or counting off the required number of carriers. It is also useful for creating flexible buffers or time windows for application rinsing processes. Moreover, the system allows specified carriers to make repeated circuits, while other carriers can be sent directly to certain processes – eliminating detours to unnecessary heating and cooling zones.

In many cases, transfers between separate spindle circular conveyors, which are usually performed by robot or transfer devices, can be omitted.

### Control technology

Eisenmann wheel coating systems are PLC controlled and are equipped with a PC for plant visualisation. Eisenmann's own Finion® system is used for this. Where the transfer of hanging to lying workpiece transportation takes place automatically, it often makes sense to install an image recognition system that is equipped with additional cameras for automatic ball insertion or suction out of the screw holes, whichever is required.

If required, particularly in larger systems, a controller based uninterrupted data tracking system will also be implemented. Thus, the data entered during the part loading stays with the wheel throughout the entire process. The data records are passed from conveyor to conveyor. Additionally the articulated arm or portal robots get the required information to identify the wheel type at every point of transfer. The data also serves the automatic adjustment of the application in the various coating areas.

Requirements in accordance with DIN (German Industrial Standards) EN ISO 9000 ff, VDA (German Automobile Industry Association) 6.4 and other quality assurance regulations can also be met and documented through the uninterrupted tracing of goods.

### Environmental technology

A safe environment and modern production do not need to exclude one another. To the contrary: they go hand in hand. How can it be done? With the help of sophisticated engineering, where the manufacturing process is designed to work in concert with ecological principles.

### The Program

- Exhaust air purification systems
  - Recuperative thermal oxidation TO
  - Regenerative thermal oxidation RTO
  - Concentrator unit CU
- Water treatment
- Wastewater treatment
- Wastewater decontamination
- Residue utilization
- Thermal waste disposal
- Resource recycling

### Service concepts

The Eisenmann Service Group offers an extensive range of services. They are tailored individually to the customer's needs, based on the know-how of the customer's employees, the cost structure, the processes and the need for expertise into consideration.

- Maintenance management
  - Inspection
  - Servicing
  - Repair and improvement
- Spare parts management
- On-call service
- Service contracts
  - Maintenance and full service
- Operator models



*Inverted power & free-system.*



*Eisenmann exhaust air purification.*

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