

HIGH QUALITY SURFACE WITH POWDER INSTEAD OF WET PAINT

# Successful conversion thanks to good planning

The manufacturer of lighting solutions changed the surface finishing process 2 years ago from wet paint to powder. The user report informs about the decision factors for the technology selection and the challenges during the transition period from wet to powder.

The Zumtobel lighting division located in Dornbirn (Vorarlberg, Austria) produces industrial, office, safety and clean room lighting systems. The part spectrum consists of casings for lightings, reflectors and individual parts, mainly made of steel and zinc coated steel. In addition aluminum profiles, casted aluminum and zinc parts as well as small items made of steel, aluminum and plastic are coated.

The new powder coating system commenced production in March 2007. The powder system replaces 2 old wet paint systems, one ATL dipping line and one electrostatic line, both put into operation in 1986.

## Wet paint system too big and inflexible

In 1985 Zumtobel decided to invest in a wet paint system. The main reason at that time was that the powder coating technology at this time didn't fulfill the expectations regarding surface finish quality such as smooth finish and thin film thickness.



## LIGHT EVEN FOR SPECIAL APPLICATIONS

The Zumtobel group with the head office in Dornbirn is one of the leading global players in the lightening industry. The Zumtobel Group established in 1950 counted 7'500 employees and an annual revenue of € 1'234 Billion in the Year 2006/07. Actually the Group consists of 2 divisions: The Zumtobel Lightening division distributes lightening systems under the brand name of Zumtobel and Thorn. The Tridonic Atco division is specialized on Light components such as electronic and magnetic operating units, lightening control systems, connector technology and LED components.

With the foundation of the 2 new LED companies- Lexedis Lighting GmbH and Ledon Lighting GmbH- Zumtobel strengthen the position in this market segment.

In the year 1990 the lighting industry started to use pre-coated steel for casings and reflectors. Zumtobel developed at this time a new lighting system and extended in 2005 the use of coil coated steel. As a result the wet painted volume was reduced significantly. The remaining part spectrum for the wet coating consisted of a big number of different parts of small quantities and special products. The main color "Lighting white" decreased and frequent color change became a must.

The well designed wet paint systems were not able anymore to meet the new requirements. The lines were inflexible and no longer economical to use. Increasing maintenance and repair costs for the 18 years old lines encouraged Zumtobel to start in 2005 the planning process for a new powder coating line.

#### Successful transition from wet paint to powder

Several options for the new powder coating plant were discussed; differentiating in content and investment cost. The best option would have been to build the new line in the existing wet paint factory. A consequence of this solution would have been that all the parts had to be coated by subcontractors for a period of at least 9 months. To avoid the high external coating costs as well as longer lead times and the lack of flexibility Zumtobel decided in 2005 to invest in a new production hall. The higher cost in comparison to integration into an existing hall was relatively low.

The main advantage of the selected solution was that during the transition from the wet paint to the powder coating process the existing line was still in operation. The change from wet application to powder could be done in a seamless manner.

During the production period from March to December 2007 the loading and unloading of the parts was done in

| Goals                                    | Realized actions  |
|--|---|
| <b>Flexibility</b>                       |   |
| Variable capacity adjustment             | <ul style="list-style-type: none"> <li>_ Capacity increase by:</li> <li>-Parallel operation of the powder coating booth</li> <li>-Increased capacity of the pretreatment line</li> </ul>  |
| Handling of Small production batches     | <ul style="list-style-type: none"> <li>_ Additional equipment installed on the automatic booth:</li> <li>-Manual Unit with own powder supply</li> <li>-Cup gun</li> </ul>   |
| Color change time negligible             | <ul style="list-style-type: none"> <li>_ Two automatic system working in parallel. One system always in operation.</li> </ul>   |
| <b>Higher productivity</b>               |   |
| Reduced manpower                         | <ul style="list-style-type: none"> <li>_ Optimized workflow in the loading and unloading area. Physically placed at the same position.</li> <li>_ Manually or automatically operated system control.</li> </ul>   |
| Reduced preparation time                 | <ul style="list-style-type: none"> <li>_ Parallel operation of the 2 powder coating booth reduces the number of color changes</li> <li>_ Compact booth design allows color change within a very short time.</li> </ul>  |
| <b>Cost reduction</b>                    |   |
| Cost reduction of coating                | <ul style="list-style-type: none"> <li>_ Cost reductions are achieved by reduced manpower and higher plant utilization</li> </ul>   |
| Reduced costs per coated unit            | <ul style="list-style-type: none"> <li>_ Reduced system cost/hour</li> <li>_ Lower cost for powder</li> </ul>   |
| Reduced rework, higher quality           | <ul style="list-style-type: none"> <li>_ Reduced cost for rework</li> <li>_ Scratch resistant coating, less transport damage</li> </ul>   |
| <b>Market expectations</b>               |   |
| Quality                                  | <ul style="list-style-type: none"> <li>_ Surface appearance identical to wet paint</li> <li>_ Powder coating is recognised as a higher quality product</li> </ul>   |
| Project oriented and customized lighting | <ul style="list-style-type: none"> <li>_ Increased competence for customized solutions due to flexibility and higher quality</li> <li>_ Better corrosion protection for products used in the wellness/spa sector</li> </ul>   |
| <b>Environmental protection</b>          |   |
| Environmental aspects                    | <ul style="list-style-type: none"> <li>_ Environmental friendly coating process</li> <li>_ No dangerous discharge</li> <li>_ No critical emission</li> <li>_ Clean working environment</li> <li>_ Energy saving for electricity and gas</li> <li>_ Reduced water wastage</li> <li>_ Reduced waste water quantity</li> </ul> |

Table 1: Targets for the change to powder coating

| Parameter   | Critical points  | Solutions  |
|---|--|--|
| <b>Surface finish</b>                                 |  |  |
| Film thickness  | Film thickness too high: picture frame effect, inhomogenous surface              | _ Use of a kind of thin film powder  |
| Gradient  | Non even gradient  | _ Use powder with a large utilisation window<br>_ Matt gloss                               |
| Metallic powder                                       | Metallic effect differs from wet paint   | _ Use of bonded metallic powder only   |
| Inclusions  | Object surface with dust and fiber particles etc.                                | _ Powder coating hall separated from production<br>_ Separated air ventilation             |
| <b>Object geometry</b>                                |  |  |
| Joint measure   | High film thickness --> joint measure not correct anymore                        | _ Design adaptation required   |
| Fitting measure                                       | High film thickness --> parts doesn't fit anymore                                | _ Design adaptation required   |
| Wrap around   | Uncoated sections on hidden surface (no problem for ATL technology)              | _ Use of zinc coated steel if required   |
| Micro perforated sheets                               | Perforated holes closed due to high Powder thickness                             | _ Controlled thin film thickness   |
| <b>Functional aspects</b>                             |  |  |
| Earthing  | Because of high film thickness normal earthing measure do not work correctly     | _ Use of higher quality dented disques<br>_ Masking of surfaces                            |
| Thread  | Due to the higher film thickness the earthing by scratching is not valid anymore | _ Use of plugs   |
| <b>Surface properties</b>                             |  |  |
| Recoating<br>Gluing<br>Foaming<br>Sealing<br>Printing | Adherence problems   | _ To be recognized in advance<br>_ Use of powder quality with corresponding specifications |
| <b>Regulations</b>                                    |  |  |
| Certification of products (ENEC)                      | Product properties must be maintained (example corrosion resistivity)            | _ Necessary modifications have to be announced to ENEC                                     |

Table 2: Occuring problems and solutions

the existing old production hall. After the disassembly of the old line and the renovation of the old production hall, the loading and unloading section was equipped with a new power and free conveyor system. The total investment incl. building and powder coating line was in a range of € 4.5 million.

#### Decision factors for powder coating

The goal of the technology selection could be described as follows: Powder coating with optimized film thickness distribution by using thin film powder.

During the planning process all critical points which could occur by the process change from wet to powder were addressed, especially the "new" finish appearance (table 2).

To be able to judge the finish quality of complex parts, coating trials were organized in the laboratory of the possible plant suppliers.

During the transition period of 2 months (from wet to powder) all products were coated with the same part numbers in a mixed production. No complaints were reported from the market regarding

the powder coated products. Fitting and earthing issues were addressed in advance by the design department.

#### Well-designed system layout

The construction of the new production hall started in April 2006 and in December the powder coating system suppliers started with the assembly of the components. The new system is totally separated from the manufacturing process.

The fresh air supply in the area was designed especially to avoid any uncon-

trollable air flow in the area of the 2 powder coating booth. The pretreatment and the cooling zone, located in the first floor, have their own air-conditioning system. The filtered exhaust air is automatically rejected into the working room in winter time and rejected out of the factory in summer time.

Perfect working conditions in the powder coating booth and the load / unloading sections are achieved with the implementation of a high quality lighting system. The reduced noise level is guaranteed by the integration of acoustic noise damping elements.

At the unloading station, hooks and hangers remain on the trolley and move directly to the loading station to be reused. The power and free technology of the conveyor system allows an easy and flexible loading of all type of products.

The PLC control of the complete system can be managed manually or in an automatic mode. The dates of all orders are automatically transferred into the powder coating line from the main production server. The identification of the orders is secured by barcode reader.

The hot exhaust air of the curing oven is used for the heating of the dryer and the preheating of fresh air supply into the working zone. All pumps of the pretreatment are equipped with frequency drive units and help to optimize the energy consumption.

### Impressive balance

The calculated cost reductions were achieved within the first year of operation. The market and customers didn't recognize the change from wet to powder. The difference in the surface finish appearance and quality is negligible. All standard products are produced with the same part numbers. A clear separation of wet coated and powder coated parts was necessary for specific orders during the transition period.

No customer complaints were registered within this period. Coating issues



### TECHNICAL DATA

|                         |                      |
|-------------------------|----------------------|
| Max. object size LxHxW: | 4200 x 2000 x 600 mm |
| Cycle time:             | 24-30 trolley/hour   |
| Conveyor speed:         | 2.0-2.6 m/min        |

#### Line concept

- \_ Loading and unloading station
- \_ Power and free conveyor
- \_ Pre-treatment with 6 zones: degreasing, 3x rinsing, conversion, rinsing
- \_ Dryer 160° C°
- \_ 2 x Automatic Powder coating booth with 18 automatic guns (Corona)
- \_ Automatic fresh powder system BigBag
- \_ Curing oven 170-200°C

#### Powder quality

- \_ Polyester UV stable
- \_ Gloss matt ( 25-30 GE)
- \_ Smooth surface
- \_ Film thickness 80 micron, white and color, 60 micron metallic
- \_ Metallic powder, bonded quality



(top) The powder coating line has been separated from the loading area.

(right) Two fully automated powder coating booths with each 18 automatic guns.



could be solved internally by recoating of the products. The thickness control on micro perforated sheets was the most challenging work. In cooperation with the powder supplier the problem was quickly resolved.

Color change is not negatively influencing the productivity. One of the 2 in parallel working powder coating booths is continuously in operation whilst the other one can be prepared for the next color. Production capacity can be increased when both systems operate in parallel.

The ecological balance is impressive. The energy consumption of electricity and gas was reduced by 40% and the CO<sub>2</sub> output reduced by 500 t. The fresh water consumption and waste water quantity was reduced by 90%.

20 t of paint discharge material are completely eliminated.

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