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Opening photo: The DKC Group is a leading manufacturer of cable tray systems, especially in the industrial automation sector.



FOCUS ON TECHNOLOGY

DKC Group: Optimising the Pre-Treatment Process for Easier Plant Management and Constant Quality

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In the age of digitisation, high tech, and the pursuit of ever-increasing quality levels, sometimes the ease of management of the plants themselves can be neglected despite its actually important role in achieving a high final

quality degree. That is why the DKC Group has recently made significant investments to simplify the management of its coating systems without sacrificing product quality and process consistency.

Established in 1998 and now present on

different markets through 6 divisions – DKC Europe, DKC Russia, DKC Ukraine, DKC Hungary, DKC Romania, and DKC Maghreb – the Group is a leading manufacturer of cable tray systems, especially in the industrial automation sector (**ref. Opening photo**).

Over the years, it has diversified its production through the acquisition of local companies. Its product range now includes metal cable trays, protection systems for electric cables, mounting modules for photovoltaic panels, carpentry components, and air conditioners for electric boards. In Italy, DKC has production sites in Novi Ligure (AL), Villanova sull'Arda (PC), Rome, Travagliato (BS), Collegno (TO), and Bellinzago Novarese (NO). The Ram Block production unit of the Bellinzago Novarese factory, formerly known as Costel, was the first to modify its coating process with a view to cost efficiency and quality improvement and management. "Our unit produces cabinets, boxes, and pulpits for industrial automation and low voltage energy distribution processes. We perform in-house every sheet metal processing phase, from technical design to delivery (Figs. 1 and 2)," explains Michele Oberti, the manager of the Ram Block production unit (Fig. 3). "However, we used to face various paint adhesion issues and high management costs, mainly due to inadequate pre-treatment." Therefore, DKC turned to DN Chemicals Srl, a Milan-based company specialising in the production and distribution of industrial chemicals. Together, they developed a new pre-treatment process ensuring higher quality and better plant integration and management.

The critical aspects of the pre-treatment process

The plant dates back to 2012 and it was supplied by O.M.SA. (Besana in Brianza, MB, Italy), specialising in the design of automatic surface



Figure 1 and 2: Cabinets for industrial automation and low voltage energy distribution processes, produced by DKC's plant in Bellinzago Novarese (Italy).

treatment and finishing systems (Fig. 4). "Our coating cycle starts with a pre-treatment phase including phosphodegreasing, rinsing with mains water, rinsing with demineralised water, nanotechnology conversion application, drying, and coating (Figs. 5 and 6)," says Oberti. "Since the sheets often undergo further processing after coating, such as punching or drawing, it is crucial for us that they are properly treated to ensure optimum adhesion and flexibility of the paint film." "However, we had noticed that the coating tended to chalk, with both aesthetic and qualitative problems. Moreover, our specifications require a 200 hours salt spray resistance value, which we could not achieve with the chemical process we used. This also entailed rather high management costs, mainly due to the high replacement frequency of the pre-treatment active baths," states Oberti. Therefore, DKC developed a new pre-treatment process together with DN Chemicals, which could adapt to its production needs and solve its performance, costs, management, and quality issues. "We decided to keep the plant installed in 2012 and only modify the pre-treatment chemicals. First of all, in order to solve the critical issues found by DKC, we integrated a conventional cycle featuring a phosphodegreaser for carbon steel additivated with surfactant mixtures for higher degreasing power and a final passivation stage with Dollcoat SA116," says DN Chemicals technical sales specialist Roberto Rebuffo. "The acidic nature of



Figure 3: From left to right: Maurizio Bovio from DKC, Roberto Rebuffo from DN Chemicals Srl, Alessia Venturi from ipcm, and André Bernasconi from DN Chemicals Srl.

the phosphodegreaser solved the coating adhesion issue without sacrificing quality. Indeed, since they also treat very glossy laminate sheets, it was essential to adopt a functional but not too aggressive product, able to preserve the aesthetic properties of

the material (**Fig. 7**).
 “Based on the improvements obtained after the adoption of this first process, we conducted several tests and created a tailor-made cycle for DKC. The current process includes a better performing

phosphodegreaser able to maintain a constant pH value lower than 4 as well as a final nanotechnology conversion stage with Dollcoat SA111. This product contains silane-based oligomers, whose quantity varies depending on the product to be treated and its intended use. The oligomers’ silanic characteristics allow the product to interact with the coating through the creation of chemical bonds that increase the adhesion of paint,” states DN Chemicals sales manager André Bernasconi. “We chose this nanotechnology passivation product because DKC’s plant includes no nebulisation system for the last pre-treatment stage; therefore, the product is recirculated, unlike what happens when using spraying bars



Figure 4: The pre-treatment tunnel supplied by O.M.SA. (Besana in Brianza, MB, Italy).



Figure 5: Components at the entrance to the pre-treatment tunnel.

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Figure 6: A stage of the spray pre-treatment process using DN Chemicals products.

with an always fresh product. The more the oligomers contained in the formulation, the greater the product's sensitivity to pollution. With Dollcoat SA111, the DN Chemicals' product featuring the best anti-corrosion properties, the lower content of oligomers enables to replace the passivation bath only once every two months, or when the conductivity of water exceeds 800 μS ."

The coating process is performed by applying polyester or epoxy polyester powders in a quick colour change booth supplied by Gema (**Fig. 8**), equipped with 2 reciprocators with 4 guns each (**Fig. 9**) and two pre and post-retouching stations. "Our products are generally intended for indoor use, but for several customisation requests calling for higher performance levels we prefer to apply outdoor coatings or a two-coat system with a zinc primer," explains Michele Oberti.

"With the adoption of this pre-treatment process, the salt spray test results achieved by our workpieces range between 250 and 300 hours, which enables us to fulfil DKC's specifications. Also the film adhesion properties have improved considerably, allowing us to further process our parts without any quality problems," states Oberti.

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Figure 7: Components at the end of the coating process.



Figure 8: The quick colour change booth supplied by Gema.

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A gradual transformation for higher yield

The first phase of intervention required the adoption of a process that could minimise the problems caused by the previous pre-treatment, in order to enable DN Chemicals to design a new optimal cycle for DKC's plant configuration. "The current process with a phosphodegreaser and the passivating product Dollcoat SA111 was implemented a year and half ago. Since then, it has ensured optimal paint adhesion, higher final quality levels, and the achievement of the salt spray resistance values required by our customers and the DKC specifications," explains DKC production technology specialist Maurizio Bovio. "Since we mainly treat carbon steel with our phosphodegreasers, our sludge production is quite high compared to those dealing with metals of different nature. In order to avoid any qualitative problems and based on the optimal management parameters provided by DN Chemicals, we replace our active baths around once every three months. This has ensured higher quality degrees and reduced operating costs and waste," says Michele Oberti. "This performance improvement went hand in hand with an increase in the ease of management of the plant itself, which is a very important factor for us. Our operators can manage the entire production cycle more easily, thus achieving a process consistency level that we could not obtain in the past."



Figure 9: The automatic coating booth is equipped with 2 reciprocators with 4 guns each and two manual pre and post-retouching stations.

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Towards ever higher production versatility

"DKC is constantly growing and it has managed to expand thanks to the acquisition of several local companies, reorganised according to the group's standards in order to guarantee constant quality to all our global customers," states Michele Oberti. "The pre-treatment process currently performed by our Bellinzago Novarese plant has been adopted also by DKC Romania, whereas O.M.SA., which installed the system at our premises, subsequently upgraded also the DKC Hungary factory's line." "In future, we intend to make further investments in coating. Our Bellinzago Novarese plant has 95 employees working on two shifts and our paint shop is currently saturated. The current space is limited, but we could make new space by fully exploiting the area available. In this way, we could add a rinsing stage to the pre-treatment process, thus making it even more functional and suitable for the use of an alkaline pH product that, if not rinsed properly, inhibits polymerisation; we could also install a second spray paint booth to speed up the application and colour change operations. Our goal is to become even more competitive on the market, offering our customers maximum customisation levels while ensuring reduced delivery times and a high quality level," says Michele Oberti. ○