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Opening photo: One of the stadium of Russia 2018 FIFA World Cup was built using prepainted aluminium by Luxe Coat.

Advanced Technology, Process Renewal, and Industrial Research on Pre-Treatment: Luxe Coat's Strategy for Its Business Relaunch

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In continuous coating processes, e.g. coil coating operations, it is crucial to keep quality constant and ensure that the plant is versatile enough to meet the market's needs without sacrificing high productivity, crucial to competitiveness. Luxe Coat Srl (Bazzano, L'Aquila, Italy) specialises in the continuous coating of aluminium alloys. The company was founded by Luxe Perfil, a Valencian company operating in the aluminium market, which found in Italy, and especially in L'Aquila, the ideal solution to increase production capacity and expand into the European market. "Luxe Coat's current corporate structure was created in March 2016, but many of

its employees have over twenty years of experience and know-how," explains Alfredo Calvano, the Technical and Plant Manager of Luxe Coat (**Fig. 1**). "Luxe Perfil's interest has enabled the reactivation of two coil coating lines and to approach an ever-booming market thanks to targeted investments. This has allowed Luxe Coat to become one of the major players in the aluminium coil coating sector (**ref. Opening photo**) in relatively little time."
The first step for this business relaunch was the revamping of the coating systems, with the aim of making them as flexible as possible and increasing their production capacity. Two painting systems in L'Aquila (Abruzzo) have been acquired. Both lines had been stopped during the financial crisis and a turnover of different companies. Through a targeted intervention, not only have they been put back into operation, but also modernised and modified to meet the commercial and production goals set by Luxe Perfil," says Calvano. "Luxe Coat now has two continuous flow coating plants. The first one applies liquid products and it is able to treat metal strips from 0.25 up to 1.5 mm in thickness (**Fig. 2**). The second one is the old machine: it was one of the first continuous powder coating systems, dating back to 1989; we transformed into a unique hybrid plant, able to coat coils up to 3.05 mm in thickness with both powder and liquid products or with countless combinations of them (**Fig. 3**)."
The investment also involved updating the pre-treatment phase. This was performed by DN Chemicals, a Milan-based company specialising in chemical products for the treatment of metal surfaces. "We have collaborated with DN Chemicals to identify the pre-treatment process that best suited our needs and the different configuration of our systems," explains Alfredo Calvano. "Above all, however, we aimed at developing a new application method that could ensure greater treatment uniformity and, therefore, improved paint adhesion." Together with DN Chemicals, Luxe Coat conducted a series of industrial tests to assess the effectiveness of spraying bars, until then never implemented on a coil coating system, for the application of the no-rinse conversion product.

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Figure 1: **From left to right: DN Chemicals Sales Manager André Bernasconi and Luxe Coat Technical and Plant Manager Alfredo Calvano.**

Innovative pre-treatment

The pre-treatment stage employs chrome-free acids and it is the same on both plants. "The chrome-free products used are Qualicoat approved. In the first phases of the process, the product is applied by spray and the interlocking tanks have a capacity of 10 m^3," explains DN Chemicals Sales Manager André Bernasconi. "The decision to adopt an acid product instead of an alkaline one was based on the technical experience of Luxe Coat, which found acid products ensured greater cleaning efficiency and better paint adhesion."
Thanks to the arrangement of the system, which includes 7 tanks devoted to pre-treatment, Luxe Coat and DN Chemicals were able to experiment and test different types of products without slowing down the coating process (**Fig. 4**). "Over the year, we have conducted a series of industrial tests to analyse and select the best products and application methods for an optimal preparation of coils without compromising their mechanical properties. After the application of various products on different alloys and at different speeds, and after the performance of mechanical tests such as multiple bending and impact tests, data were collected and analysed to see if it was possible to apply the final conversion product by nebulisation rather than by sprinkling, as it is done today," says Bernasconi. "We then installed prototypes of spraying bars on both systems, which we are now fine-tuning to proceed to the final installation (**Fig. 5**)."
"These tests have ensured several benefits, especially in terms of quality consistency. The coil surface is in fact converted in a uniform way and the conversion layer was homogeneous regardless of speed (**Fig. 6**).

Figure 2: **The liquid coating system, able to treat metal strips from 0.25 up to 1.5 mm in thickness.**

Figure 3: **The hybrid plant can coat coils up to 3.05 mm in thickness with both powder and liquid products.**

The only difference recorded was determined by the type of aluminium alloy, as different alloys have different reactivity values and, therefore, different final conversion weights," states Bernasconi. "Another advantage ensured by the spraying bars was the substantial reduction of a problem arising in any process that applies chrome-free products, that is, sensitivity to dragged pollutants. Indeed, the nebulised product is always fresh, thus eliminating pollution. Finally, nebulisation significantly reduces costs, because it uses much less product than spraying processes. At least 40% of the cost of the conversion product is saved each year."
In July, the last test was concluded to check the functionality of the system to be implemented with the final installation stage.

Rethinking the production process

"Luxe Coat's customers belong mainly to three categories: distributors, installers in the architecture sector, and panel installation experts (e.g. honeycombs for the naval sector)," says Calvano. "This variety allows us to be present in various industrial fields but, at the same time, it forces us to offer maximum production flexibility and competitive delivery times."
"With our expansion on foreign markets, such the US, Canadian, and German ones, this need has increasingly become stringent. In Germany, for example, the motorway barrier specifications require an aluminium thickness of not less than 3.02 mm. This is one of the reasons that led us to rethink our plants with the aim of meeting the most diverse specifications," says Calvano. "Finally, we aim at helping medium-small producers grow, since they are more receptive to market innovations and, therefore, they need a supplier that is equally capable of renewing itself to keep up with technological developments."

Figure 4: **The pre-treatment tunnel.**

All these reasons led to a renewal of the production process to include two coating plants equipped with accumulators at both the entrance and exit, which allow to continuously coat without ever stopping the system, not even during the colour change or metal cutting phase at the end of the process (**Fig. 7**). "The liquid coating system, which handles thicknesses between 0.25 and 1.5 mm, can treat 500/600 metres of aluminium at a time. The hybrid system, on the other hand, was upgraded to treat coils up to 3.05 mm in thickness and can continuously apply both liquids and powders. This allows us to obtain various coating combinations by simply activating or deactivating the booths and ovens. Another peculiarity of these plants, finally, is the ability to simultaneously apply more than one layer of paint on each side in one coat," explains Calvano.

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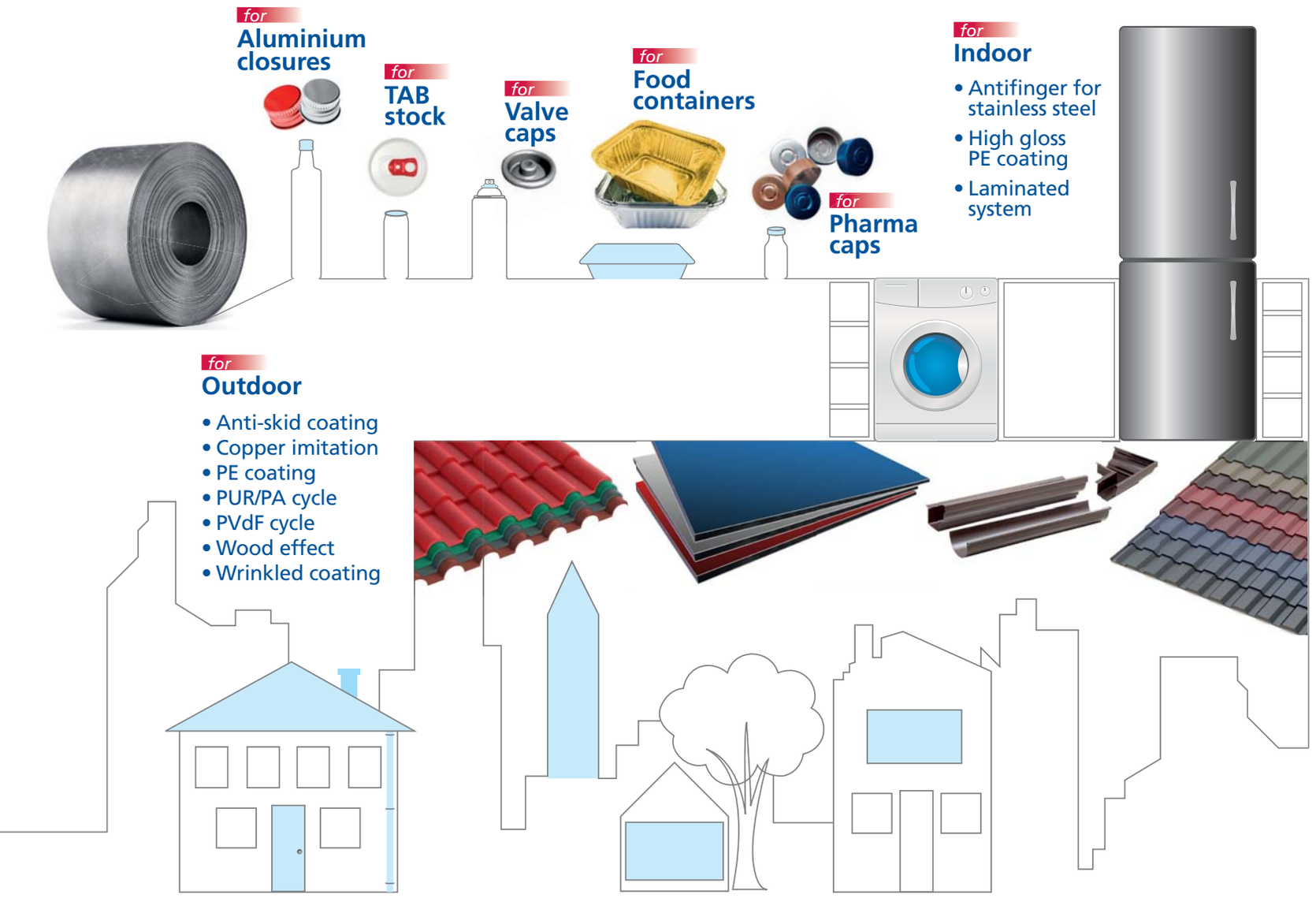

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Figure 5: **Prototypes of spraying bars have been installed on the final part of the pre-treatment tunnel.**

The coating lines

The liquid coating system performs a wet-on-wet application with the first coating head, which applies the product simultaneously on two sides (**Fig. 8**). This is followed by a 15 metre long oven with an air drying segment and a cooling segment that uses demineralised water to bring the metal to a temperature of 30 degrees. Coming out of the cooling tunnel, the coil goes back into the same booth, where the second coating head applies the coloured or special effect layer, e.g. copper-like or wood-like, through photoengraved rolls (**Fig. 9**). The plant also features a second booth equipped with a coating head able to apply 20 to 25 microns per side. After curing, the coil undergoes a final check to identify any surface defects. The accumulator at the exit of the system allows to keep the plant working even when cutting the metal strip (**Fig. 10**).

The hybrid system is vertical and it includes liquid application booths and two powder coating booths (**Fig. 11**). All the booths and their related ovens can be activated according to production needs: in this way, Luxe Coat has the ability to apply double layers and mixed powder + liquid systems. "This type of system is very versatile – and versatility is one of Luxe Coat's distinguishing features," states Alfredo Calvano. "However, this process can hide pitfalls. Therefore, it requires special measures and process control options. Continuous powder coating is a very difficult process

Figure 6: **A coated coil exiting the curing oven and passing through the quality control area.**

to control, as the guns' mechanical movement and overspray can cause pollution on the uncoated side. Luxe Coat solved this problem by installing air blades to prevent excess powder from falling on the coil's underside and by applying a liquid back coat on surfaces that are clean and free from any powder residues precisely

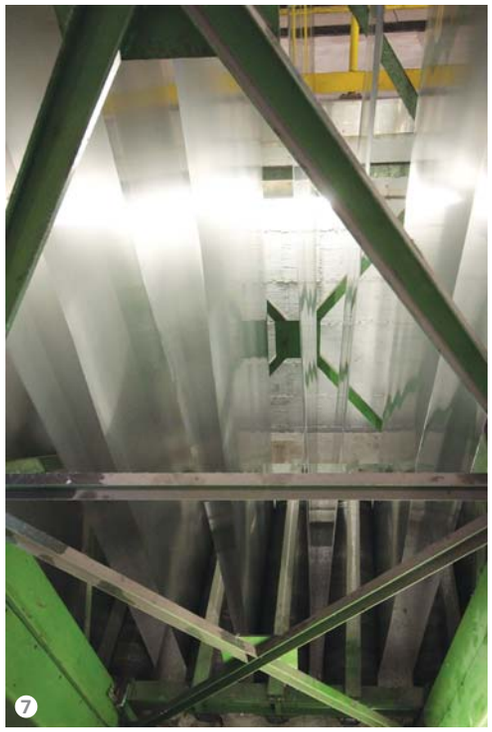

Figure 7: **Accumulators at both the entrance and exit allow to continuously coat without ever stopping the system.**

thanks to the air blades. This also enables to control thicknesses and to avoid any quality problems during press-bending of painted aluminium (**Fig. 12**)."

A sustainable, 4.0-oriented future

"Experience has taught us that the control of the production process affects the final quality of workpieces. DN Chemicals turned out to be a partner that shares this approach and is therefore able to develop solutions to meet such need, thus enabling us to give more guarantees to our customers. We have had the chance to test different pre-treatment chemicals, but DN Chemicals' technology offered the soundest solutions, in addition to a fast and professional assistance service. They were able to offer us a versatile, advanced, and unique process, which will help improve Luxe Coat's product quality even further," says Alfredo Calvano.

Figure 8: **A coating head with liquid products.**

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Figure 9: **Coils painted with different effects: from the copper-like finish to the oxidised-like and matte ones.**

Figure 10: **The final part of the plant, with a coil rewind system.**

Figure 11: **One of the two powder coating application booths.**

"Investments and innovations in the last few years have allowed us to grow a lot and give a second life to our old plants. The number of hires has increased exponentially and we have expanded by acquiring different neighbouring buildings and warehouses," says Calvano. "We did not expect this success. Initially, the goal was ensuring greater production capacity for Luxe Perfil. However, our will to grow and start again together with our old skilled and experienced employees has enabled us to meet Luxe Perfil's objective as well as to establish ourselves on the national and foreign markets with our own identity, in just two years."

"The revamping of our systems has ensured excellent quality consistency while allowing us to expand our range of products and be flexible enough to experiment and develop new ones. Some of these will be presented at the Aluminium 2018 fair in Düsseldorf on October," states Calvano. "In future, we aim at further expanding our portfolio and at implementing an automatic process control that allows remote monitoring of all phases and process parameters, thus making intervention in case of any problems easier and more timely. Together with DN Chemicals, we are also developing a water recovery system. This is a critical issue in the Abruzzo region, which entails significant costs for our type of production. With a view to sustainability and respect for the environment, therefore, we would like to adopt as soon as possible a system that allows us to exploit less and less drinking water by purifying and recirculating our process water," says Alfredo Calvano.

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Figure 12: **Powder dispensers.**