



Some keys printed, laser engraved, and coated by Barnem Technologie Plastiche Srl.



FOCUS ON TECHNOLOGY

SPECIAL ISSUE - PaintExpo



Barnem Invested in AR Coating for its Plastic Touch Screens: The Future of the Automotive Industry

Giorgia Ricchiuti, **ipcm**[®]

Touch screens for car interiors with top layers in plastic instead of glass: is it a possible solution? Yes, it is, thanks to the innovation introduced by Barnem Technologie Plastiche Srl, a firm from Brescia (Italy) that has been working in the automotive sector for fifty years and that entrusted Railtechnik Van Herwijnen BV, a Netherlands multinational company with offices in Legnago (Verona, Italy) and a production plant in Romano D'Ezzelino (Vicenza, Italy), and Airmadi Painting Srl (Castelnuovo del Garda, Verona) with the supply of a UV AR coating plant featuring a power&free conveyor equipped with a frame tilting system.

The automotive sector is constantly evolving. Continuous design innovation, the implementation of new digital technologies, and increasing consumer demands for customisation are forcing manufacturers to adapt to complex market requirements and sometimes anticipate future trends. This is the case with Barnem Tecnologie Plastiche Srl, a company from Brescia (Italy) that has been managed by the two brothers Peter and Mauro Barenfeld, and operating in the automotive market for over half a century as a Tier 2 supplier, i.e. a producer of sub-components for Tier 1 manufacturers, which in turn directly interface with OEM car makers. Barnem was established as a mould producer and then evolved into a manufacturer of finished products. Now a benchmark for many companies, Barnem is recognised as a reliable supplier of cosmetic plastic components. Its industrialisation know-how includes the production and finishing of keys, controls, touch screens, and other human-machine interface elements. With its two factories and departments devoted to mould construction, moulding, coating, chrome plating, laser engraving, and assembly, this company can industrialise and produce 1K, 2K, and 3K moulded plastic parts that can be decorated with solvent-based, water-based, or UV paints or even chrome plated or PVD coated, laser engraved, and assembled based on customer drawings.

“Our customers include Joyson, Denso, Magna, BHTC, and Magneti Marelli. Most of them are based abroad, with around 60% of our production crossing the Italian borders,” says Marcello Chessari, Barnem’s Business Development manager. “Our customers recognise our ability to anticipate market trends and OEM requirements, a skill we have mastered to the point where we are the first to launch innovative products onto the market. The latest challenge won, and the reason for the installation of our fourth coating plant, was the production of



The loading station with a 4-sided loading spindle hooked on a bar.



The first station tilts the spindle into a horizontal position to allow guided 360° rotation during treatment.



A detail of the tilting system developed by Railtechniek.



Once in a horizontal position and with only two contact points, the spindle is completely free to rotate independently of the next one.

touch screens with the top layer in plastic instead of glass. The plant we commissioned from Airmadi Painting Srl, together with Railtechniek Van Herwijnen BV for part handling, is in fact devoted solely to applying anti-reflection (AR) coatings and scratch-resistant UV coatings on touch screens and other cosmetic plastic components of the latest generation for car interiors. In particular, we asked these suppliers to design a system using solvent-free UV products with 100 per cent dry residue, in order to make our finishing operations even greener. In addition, we required high flexibility in polymerisation through the integration of the UV lamp station with another station using infrared panels in order to also apply two-component outdoor coatings, which require high resistance to sunlight."

From design to coating

"As well as developing production processes for components designed from 2D and 3D drawings supplied by customers, which is a key part of our business, we have a moulding department with around 26 presses ranging from 30 to 450 tonnes," explains Chessari. After machining, the parts reach the coating department, the core of the factory. There are 4 automated systems installed here, 2 for large batches of plastic parts, 1 for small batches, and the fourth and most recent one devoted to AR coating, which applies UV paints in one coat with around 20 different programmes depending on the product used. "This plant performs 4 process stages, beginning with an initial cleaning stage with CO₂ – a technology chosen because it leaves the parts completely dry, which is key to the quality of the subsequent UV coating phase, as it would be jeopardised by any surface moisture residue. The second stage is the robotic application of UV coatings, in a station located after a buffer that isolates the cleaning area from the coating area,



The CO₂ cleaning station.

which is pressurised and has absolute filters for maximum air cleanliness.

The 4-axis robots are hanging, so that the work surface is completely clear. The spray application is carried out by ABB's latest generation of rotating bells", adds Marcello Chessari. "One of the characteristics required of this line's paint application system was the ability to produce very thin thicknesses, because AR coatings range between 15 and 20 microns. Therefore, it was essential to achieve perfect calibration between the constant flow rate of the paint feeding pump and extreme atomisation.

"The third stage of the process is baking, in the station featuring infrared panels. We opted to install panels with more power than the energy required for polymerising the paints currently in use, because we expect that the coatings being developed now will require more energy for baking. Therefore, we can say that this plant is ready to meet both the current and future needs of AR coating. We took the same approach for the fourth process step, namely final polymerisation using UV lamps. The group of lamps is adjustable both in height and in terms of output (power and wavelength frequency), just like the IR lamps.

"The plant was designed to ensure maximum flexibility in coating depending on the chemical product used. It is interfaced with our MES system, and all operating parameters are recorded on our computer system so that we can guarantee perfect traceability of all stages."



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The pressurised, dry-filter paint application booth designed by Airmadi together with the rest of the coating plant.



The infrared polymerisation station.

Focus on the inverted conveyor

“According to the original design, Barnem’s plant should have been equipped with a much simpler inverted conveyor than the one we installed,” notes Daniele Adorno, senior key account manager at Railtechnik. “However, during the design phase, when we superimposed the layout of the plant on the building’s one, we saw the clear need to optimise space. Therefore, we supplied an inverted power&free two-rail conveyor in which we integrated a very interesting frame tilting system.”

“Due to the extreme variety of parts produced by Barnem, which can vary in size from a few centimetres up to over one metre, handling is carried out using bars consisting of 4 frames, commonly called spindles. Each of these is independent of the others, in order to guarantee full flexibility in terms of loaded product, rotation, route, and treatment programme. Each spindle is 1,500 mm high and has 4 loading faces for carrying a maximum of 24 workpieces. The bar is 1,250 mm long and can accommodate up to 4 spindles side by side; it has a rotation diameter of 300 cm and 4 rotation positions: 0°, 90°, 180°, and 360°,” indicates Adorno. “At the loading station, the spindle is hooked to the bar in a vertical position, with a very simple insertion system also designed by Railtechnik. Prior to entering the CO₂ cleaning chamber, the spindle is tilted to undergo the treatment process in a horizontal position, allowing it to rotate through 360°, independent of the spindles before and after it. This has saved 1,500 mm of space at the loading and unloading areas, where the spindles are handled vertically: at the end of the coating process, that is, after the UV polymerisation station, a second tilting system brings the spindles back upright before the unloading bay.

“Power&free conveyors are based on a two-rail system in which the drive chain runs in the upper rail (Power) while the lower rail (Free) carries the trolleys that transport the parts. We designed special trolleys for



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The UV polymerisation station.

Barnem's conveyor because, even though they transport very light workpieces to be coated, the load bars they carry are integrated with the tilting system, reaching a total load weight of 250 kg. Another very important aspect that required a lot of design effort was ensuring maximum precision of the rotation mechanisms and maximum positioning repeatability. This system is therefore very compact, but also highly complex in terms of workpiece handling."

Industry 4.0

The line is controlled by the Airmadi system's Master PLC, the only interface between the coating plant and Barnem's MES. The Master PLC cascade-interfaces with the Slave PLCs of the conveyor, the paint application system, and the CO₂ cleaning system. Railtechnik developed the entire Industry 4.0-oriented bar management interface with QR codes and a system of scanner guns used for loading, unloading, and writing output files. This system handles all the smart operations involved in virtually associating each QR code to a bar or to just one of its 4 frames. In this way, within the same load bar, each spindle has its own QR code that allows recording numerous process parameters, including the power of the UV lamps and IR panels, the

distance of the part from them, the speed and time of rotation of the spindle, the number of faces of the spindle being treated, and so on. The entire system 4.0 was designed by the Railtechnik design team in conjunction with Airmadi and with the final endorsement of Barnem, to guarantee maximum flexibility and customisation.

The plant's technical features

"One of the aspects we worked on most during the design phase," says Giovanni Genovese from Airmadi, "was that of aerualics, with the filtration system including dry filters and absolute filters to ensure perfectly clean air in the booth and optimum aerualic balance. On the coating booth, we have installed an ad hoc air treatment unit that manages temperature and humidity, whereas for the rest of the system only temperature is managed. The system is equipped with a series of inverters and rolling shutters that automatically manage all feeding and extraction ducts through temperature and flow rate sensors. The automatic system can handle any filter clogging issue in the air treatment unit as well as in the booth's feeding and extraction ducts and in the system as a whole. Like Railtechnik, we did not stop at standard solutions, but took the mechanical

and electronic engineering aspects of the system to extremes, interfacing it with the Industry 4.0-oriented management interface developed by them."

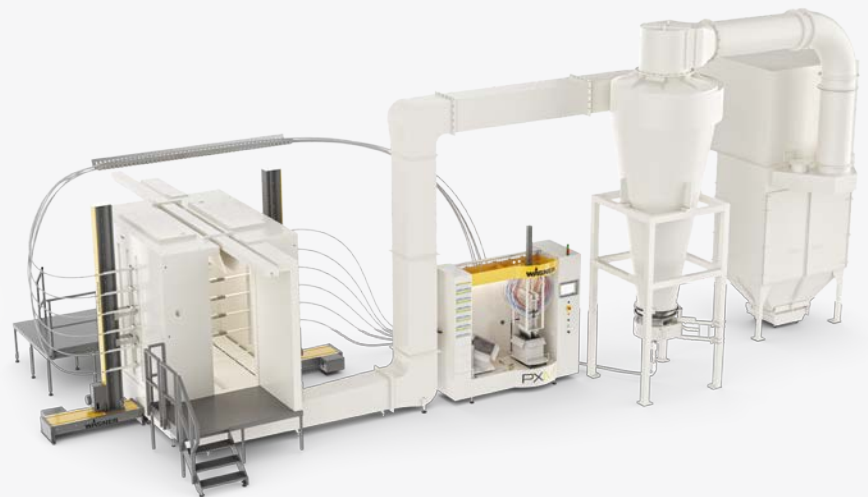
The system management software package was conceived, designed, and implemented by Airmadi, obviously in collaboration with the customer. As a whole, the installed line was the result of an in-depth collaboration among the three parties. "With this investment, we combined the elements specified by Barnem, namely the CO₂ cleaning system and the coating feeding and management system, with the equipment supplied by Airmadi, which acted as the prime contractor by choosing Railtechnik as the supplier of the conveyor," summarises Marcello Chessari. "Airmadi was chosen through a tender at the end of 2019 and it was given very detailed specifications that precisely



The second tilting station where the spindle is placed vertically before reaching the unloading area.

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From left to right, Giovanni Genovese from Airmadi, Marcello Chessari from Barnem, and Daniele Adorno from Railtechnik.

defined the process steps to be performed, the type of coating products to be applied, the power required for both air treatment and polymerisation, and the cycle times. We opted for these suppliers because they proved able to ensure the operational flexibility that our project needed, as well as a very positive benefit-cost ratio. Obviously, the implementation and try-out phase required some additional adjustments, but it was precisely here that such flexibility emerged.”

A future-oriented company

“The market is already demanding AR coatings: we receive many requests from both Italian and foreign customers for clear coat

applications. The decision to implement this plant three years ago was based on a business strategy aimed at anticipating the needs of the market,” says Marcello Chessari.

“Touch screens are the alternative to keys, and will be even more so in the next few years, even in cars. Barnem is ready to meet all current and future requirements for touch screen finishing. We are also assessing the implementation of a sputtering process for anti-fog treatment, to be applied to the inside of touch screens and combined with AR coating, which is used on the outside, to provide a premium product for the automotive market of the future.” 