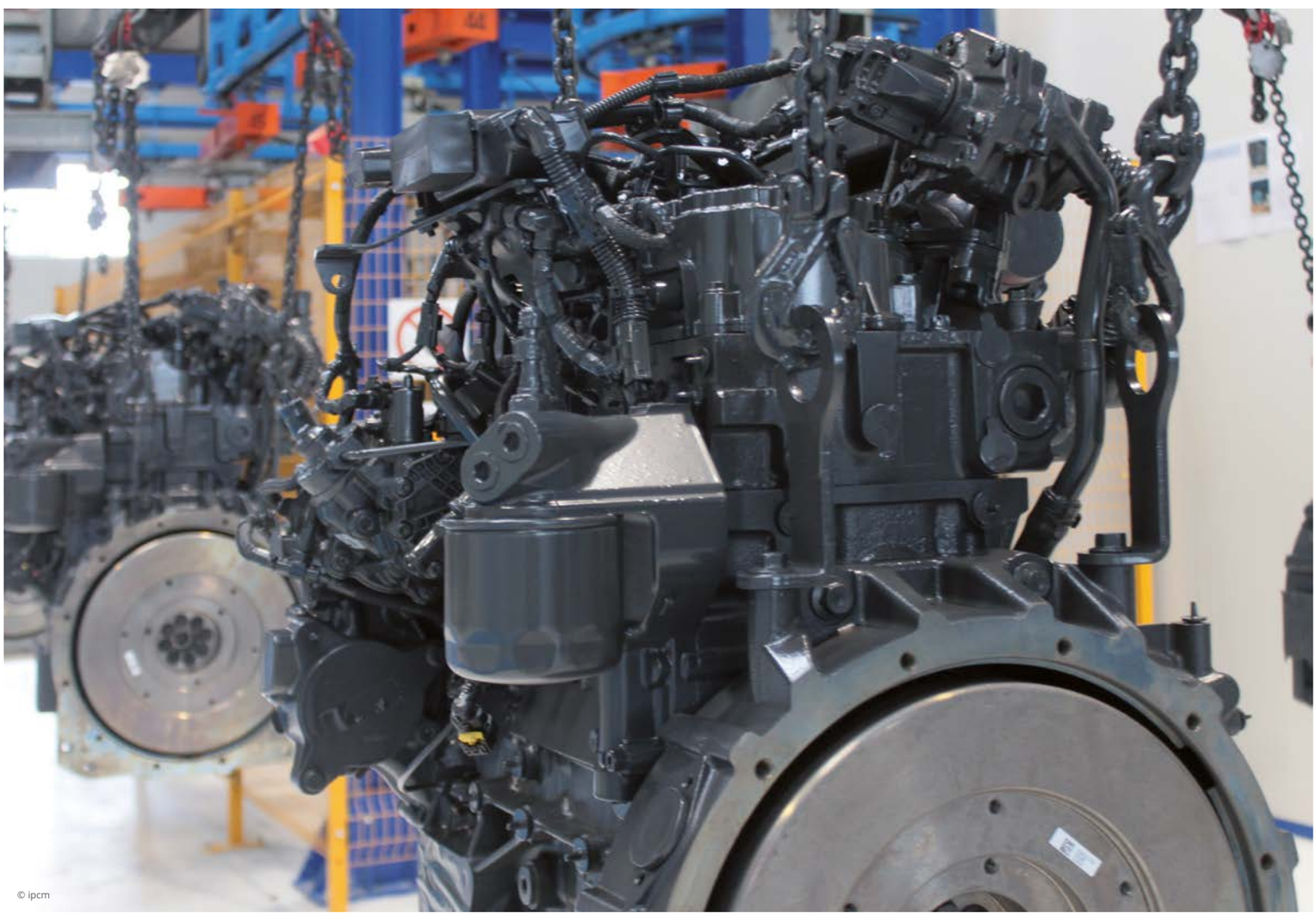
MANTA Group: Flexibility and Speed of Production Guaranteed by Automation and Digitalisation of the Commercial Vehicle Engines Coating Phase

Edited by MANTA Group

Flexibility. Automation. Digitalisation. Respect for the environment. These criteria guided MANTA Group in its project for the installation of a new automatic engine coating line that combined the expertise of Gaiotto, Graco, Savim, and CM Automazione to meet Iveco Group's aesthetic and performance requirements.



With its new automatic coating plant, MANTA Group paints up to 370 engines per day for FPT Industrial.

A thirty-years history in the assembly and coating of aerospace and automotive components

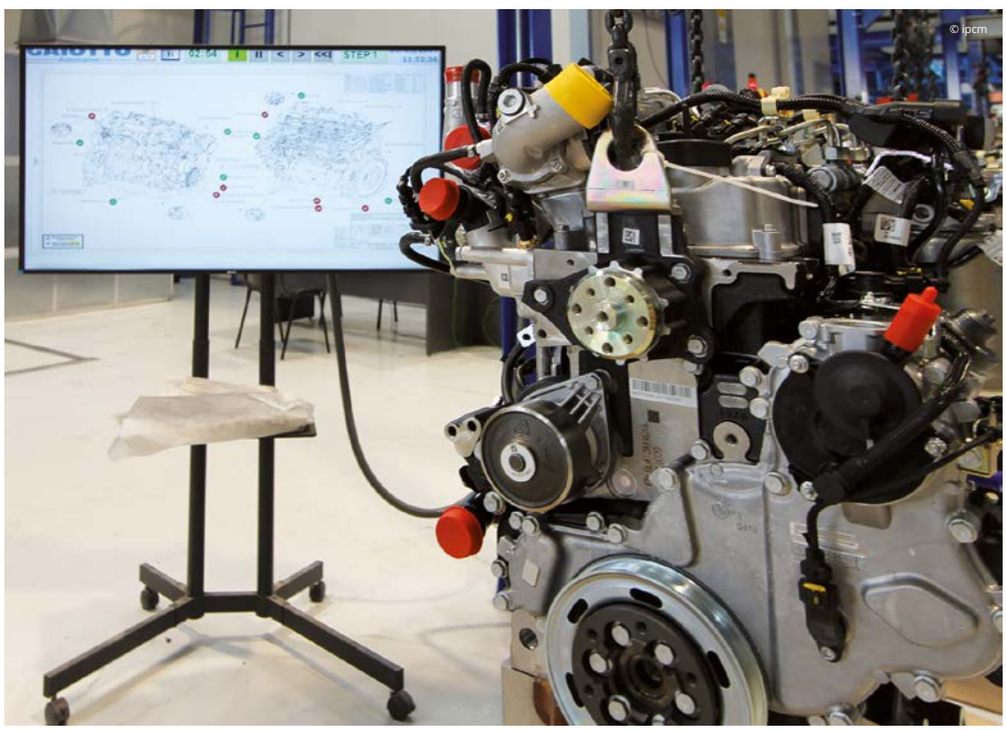
The story of MANTA Group began in 1986 in Orsara di Puglia (Foggia, Italy) from the ambition of a family of entrepreneurs determined to manufacture reliable and innovative products.
In 1989 began the production of some parts for the Foggia plant of Alitalia, now Leonardo.
"In 1996, my father bought TMC, a company specialising in the manufacture of components in composite materials for the rotor wing industry," says Michele Frisoli, the current CEO of MANTA Group. "In 2007, MANTA Group acquired the final assembly of complex structural axles for fixed-wing aircraft. When FPT Industrial (the brand of Iveco Group specialising in powertrains) also started producing engines for the Japanese market in its Foggia plant, we were entrusted with the application of the corrosion protection treatment (a liquid clear coat) thanks to the painting experience we had gained in the aerospace sector. To this purpose, in 2009 we installed an automatic painting line featuring our first two articulated robots supplied by Gaiotto. In 2021, MANTA Group was entrusted with the painting of engines for agricultural machines to be produced in Foggia. In order to cope with this task, MANTA invested in a new painting plant identifying a pool of suppliers that have cooperated to create a painting line which is fully digital, automated, flexible and fast with an installed capacity of 85,000 engines per year".

Over 700 engine variants

"The finishing of engines for agricultural applications has long-lasting aesthetic and functional requirements to be satisfied," emphasises Matteo Sforza, Procurement, Sales & Special Projects at MANTA Group. "By leveraging the skills acquired and involving in the project experts of the field and universities departments with specific expertise, we designed with Gaiotto, Savim and CM Automazione the plant engineering aspects, and with Graco the application ones to develop a finishing line that is highly flexible and fully Industry 4.0 compliant.

The loading and unloading area of the automatic plant designed by Savim (Arbizzano, Verona) with a conveyor supplied by CM Automazione (Giussano, Monza e Brianza).

The XD45/59 step-by-step conveyor provided by CM Automazione houses up to 116 handling units equipped with a ring-gear idler swivel hook.



The pick-to-light system that monitors the correct execution of the engine masking operations before pre-treatment and then before coating.

This system is complex not only for the over 700 engine variants with four different colours, but also for its full digital integration with our company's management system. This enables us to monitor the process stage reached by each engine and the fulfilment of the quality requirements."

"The water-based one-coat paint system applied on the engines was validated and homologated by an external laboratory (CRF) before the start of the production. The plant manages the incoming engine variant identifying the masking needed and the colour to be applied. The integration and digitalisation of this line were a challenge that required the collaboration of all our suppliers, also because our commissioning schedule was very tight. Eventually, we hit the mark and we are very satisfied with this pool of technology providers," notes Sforza.

Technical characteristics of the line

The painting plant built by Savim (Arbizzano, Verona, Italy) and equipped with Gaiotto robot paints 370 engines/day. It is equipped with an XD45/59 step-by-step conveyor designed and provided by CM Automazione (Giussano, Monza e Brianza, Italy). This accommodates up to 116 handling units with a maximum load capacity of 850 kg each, featuring a ring-gear idler swivel hook, normally locked in a unique position for safe part handling.

From the loading area, the transport units proceed across the pre-treatment and drying tunnel until the masking area with a step-by-step movement and a pitch of 2000 mm; their transfer time is less than one minute. In the coating area with two application booths the main conveyor (TR1) transfers the task to a dedicated conveyor (TR2), which also operates with a step-by-step flow and a pitch of 3200 mm, maintaining the correct spacing of the parts. The two coating booths feature rotation systems of the transport units to allow the completion of the painting operations in case of a robot malfunction. Inside the baking oven,

The pre-treatment tunnel.

CM Automazione has positioned four drive units that allow for the storage of the handling units.
For the supply of the paint feeding and application equipment and the colour change system, MANTA relied on Graco and on the technical expertise of its integrator Comaind (San Giovanni Lupatoto, Verona, Italy), whose collaboration was fundamental in one of the most critical phases of this project. All the operations are performed in-line, except for the incoming and recording of the engines.
The first station is the masking one, to protect sensitive surface areas against water ingress during the pre-treatment phase. A pick-to-light system borrowed from Toyota reads the type of engine matched with the incoming load bar and a screen displays the image of the engine and all the different masking devices required.
Station no. 2 is devoted to the 3-stage chemical pre-treatment with phosphodegreasing, cleaning with demineralised water, and drying in three steps: pre-drying tunnel (station no. 3), robotic blow-off with two Gaiotto robots (station no. 4), and an oven at 90 °C (station no. 5). The engines then pass through a cooling area (station no. 6) before entering station no. 7, masking 2, also with a pick-to-light control system where about 100 masking devices are applied.
The cycle proceeds with the application of the liquid paint in two pressurised, temperature and humidity-controlled water curtain booths, supplied by Savim, each with a Gaiotto articulated robot rotating 180° that paints one side of the engine. The minimum thickness applied is 50 microns. A third manual booth is used for touch-ups. The line ends with a flash-off tunnel and an oven that accommodates 50 engines at 100 °C for 1 hour and 30 minutes. The

Automatic spraying with the Gaiotto GA2000 robot and the Graco AirPro gun.

The Graco PD1K mixing machine with four separate pumps for each colour, installed by Comaind (San Giovanni Lupatoto, Verona).

engines then proceed to an in-line quality gate for final approval. A demineralisation system and a Hydro Italia dirt separator complement the plant.

The application and automation system

"We designed the paint feeding and application system together with Gaiotto to handle the four colours applied by MANTA," states Davide Galvani of Comaind. "The most used one is grey, which accounts for almost 90% of the production. The other three colours (yellow, perkins grey, and transparent) are wildcard tints for the remaining 10% of the volumes. Since coating planning is not done on a batch basis but rather by individual engines, we designed a very quick colour change system taking a time equal to that needed to move a load bar by one pitch, i.e. 30 seconds. The paint management unit is equipped with a 1000 kg container for the black colour and 200 l drums for the other tints. The paint is kept agitated by an ATEX-certified electric agitator with expandable vanes and a refill system linked to a 100 l tank where a Graco Endura-Flo pump circulates the paint at a pressure of 2.5-3 bar. This tank pre-feeds the PD1K machine equipped with four separate pumps, one for each colour, to guarantee maximum colour change speed on board the robot."

"60-mesh filtration is performed on the recirculated product," adds Galvani. "The PD1K device also has its own filtration unit at the gun's outlet. The two coating robots are equipped with two automatic Graco AirPro compliant-technology guns each: one gun only handles grey paint, whereas the other is fed by colour change valves positioned about 40-50 cm from the gun, almost on the robot's wrist; one valve is for flushing the circuit, the other three are for the wildcard colours. The paint management unit also pre-feeds the touch-up booth where there is a gun available for each colour that is activated with the correct colour

depending on the incoming engine."
"We selected the PD1K machine together with Gaiotto with the aim of controlling the paint flow directly at the gun and adjusting it according to the movement of the robot during the painting stage. In addition, this unit allows analysing the technical/production parameters and also interfaces with the line's 4.0 system. For the latter, Gaiotto designed the master control of all the machines in the line, then MANTA extrapolated data from it to interpolate them with its own management system for engine advancement and plant remote control," concludes Davide Galvani from Comaind.
In addition to installing four self-learning 6-axis robots, two for blow-off and two for coating operations, Gaiotto also worked on the identification numbers management system (e.g. the date and time of the entry of each engine on the line, the end of each phase and the departure of the load bar from individual stations, the programme used by the robots, the colour used in the first coating station and the amount of paint used, and so on).
At the loading station, based on each part's identification number, the MES communicates to the Gaiotto master the colour and ITEM with which the engine is to be processed on the line. The system thus defines the following parameters:
• Masking: at each of the two masking islands, a drawing of the engine is displayed illustrating the specific surface areas to be masked. The pick-to-light systems indicate to the operator the type and quantity of caps to be picked;
• Oil filling: for engines that require oil filling, the MES communicates the amount of oil to be filled into the engine based on its identification number. The filling system feeds the amount of oil tracked;
• Blow-off: in addition to drying, two blow-off robots remove any cleaning water remaining inside the holes with a specific programme managed by the system according to the variants;

The paint management unit set up by Comaind with Graco Endura-Flo pumps.

Hydro Italia's sludge separator treating the water coming from the coating booth's overspray collection curtains.

These painted engines leave the drying oven and head for the unloading station.

From left to right, Michele Frisoli, Matteo Sforza, Luigi Vitobello, and Antonio Lafaenza from MANTA Group, Roxanne Conings from Graco, Davide Galvani from Comaind, and Marco Caporello from Graco.

• Coating: performed in two booths equipped with GA2000 robots with a programme selected by the identification number management system. If required, the colour change is performed with a 30-second downtime during the load bar change.
• Touch-up: performed in a manual booth where the operator is shown the colour to be used by a light switching above the four spray guns.

Reliability and technological expertise: the criteria for choosing the right suppliers

"Production on this line started at the end of 2022" indicates Michele Frisoli. "With the new plant and especially thanks to the automation and application systems supplied by Gaiotto and Graco respectively, we immediately saw a high-quality level. In the beginning, manual retouching was required more frequently because the robots' painting programs were not optimised yet, whereas today with the production ramp up moving forward, the manual process has been progressively reduced. The start-up phase involved a learning process, especially when it came to handling water-based paint, which is much more liquid than its solvent-based. Our choice of suppliers proved to be a winning one: we started by turning to a long-standing partner – Gaiotto, with which we had previously worked on the automation of our old coating line and in whose products, we had found reliability and solidity – and we then built the whole companies pool together with its team, selecting Savim among three other possible suppliers and Graco for the quality and technological content of its systems. Ultimately, we are very satisfied because we managed to realise a very complex system in a short time."