



Paint by numbers

At Fiat, a car body painting line uses robots to apply eco-friendly water-based paints.

By Claudia Magli
Photos courtesy Fiat

> The painting of cars may not be the most important process of production, but for consumers, the end result is probably the most important part of the car visually. For manufacturers, to get the painting right requires finesse and smart automation. So when Fiat started a new car body painting line with eco-friendly paints for cars at its Mirafiori factory in Turin, it turned to ABB.

The interior and exterior surfaces of seven different body models of the Fiat/Lancia range are painted at Mirafiori using 25 painting robots and 14 special mechanical hands for the automatic opening and closing of the doors, the hood and trunk. Soon to be added will be painting of the Alfa Romeo Junior and four-door models, production of which is due to begin shortly.

The composition of the line layout includes six stations: two for interior base painting; one for the first-coat exterior base painting; one for second coat exterior base painting; one for the interior varnish >



>FACTS

More robots, more support

Over the last three years ABB has also implemented the painting lines of the SEVEL factory situated in Val di Sangro in the province of Chieti in Italy. Three production lines, with a total of 25 robots for the painting of interiors and exteriors, produce approximately 1,100 Ducato vans per day, working three shifts per day, six days a week. This amounts to almost 300,000 vans per year. A further six ABB handling robots carry out the sealing and the application of the protective PVC on the underbody.

ABB's collaboration with SEVEL has also progressed far beyond the simple supply and implementation of automated lines: The factory has requested the active collaboration of ABB which has led to an assistance and maintenance contract. The contract relies on a team of five technicians who, in rotation covering all of the production shifts, guarantee a very high technical efficiency thanks to their know-how, combined with the onsite availability of all of the spare parts required for the fastest possible resolution of any problem which may arise during the production phase.

The painting line of the factory in Termini Imerese in the province of Palermo is also currently in the full production phase. Some 14 robots are carrying out the automatic painting of the Lancia Ypsilon model in all of its versions, including the two-tone version.

Fiat alone is now using more than 120 ABB robots for the processing of its products in the paint shops of its factories in Italy.

and one for the exterior varnish. The average cycle time of each individual treatment is 87 seconds for a line productivity of approximately 250 bodies processed per shift. 64 production shifts per month bring the production capacity of the line to approximately 180,000 vehicles per year.

The interior surface painting stations operate on the stop&go principle. In exactly the same way as a team of Formula 1 mechanics, the robots wait until the body is in position before beginning work. The

first to move are the four door openers and the hood and trunk opener, which prepare the body for painting. In continuous contact with the four painting robots, the openers communicate and carry out the operations required to enable the robots to reach all of the surfaces to be painted. The average cycle time for all seven models, 87 seconds, includes the conveyance time, during which the body is maneuvered, painted and sent to the next station.

The robots used for painting the exterior surfaces, on the other hand, operate on the principle of tracking conveyance. In simple terms, the robots are synchronized with the body moving on the conveyor and paint the surfaces which pass through their working area. The stations related to the painting of the first base coat and of the varnish are equipped with ABB electrostatic sprayers supplied by ABB Japan (see story on page 17).

This technology enables the paint particles to be charged, meaning that, following the spraying carried out by means of the 30,000 rpm rotation of the turbine cup, they are attracted to the sheet metal of the body.

By using the electrostatic application technology, the efficiency of transfer of the product increases from approximately 35 percent to more than 80 percent. The main advantage to this is less paint waste while still achieving the required application thicknesses.

The disadvantage when applying the base coat for metallic paints is that the charged particles are distributed in such a way that they are all oriented in the same direction which makes the body appear extremely glossy or extremely matt depending on the direction from which it is viewed. This is why a second coat is necessary in which the paint is applied using the conventional technology.

The final result of the metallic paints is a load, relative to the total thickness, of 70 percent on the first coat and 30 percent on the second coat.

The application of pastel paints, on the other hand, due to the absence of metal in the paint itself, does not require the second coat and therefore the bodies are processed fully with a single coat applied with electrostatic technology at the first station.

At the varnish painting station, with solvent-based one-part resin, the same process is used as for the pastel paints. As the product does not contain metal, no further finishing is necessary following the electrostatic application.

The arrangement of all of the process components on the arm of the IRB 5400 robot, the management of the application integrated in the control unit of the robot itself and the simultaneous management of 30 water-based colors all provide further advantages in terms of reducing paint consumption.

Each of the six different stations is interfaced with a Movicom/Shop Floor Editor graphic station, latest-generation software from ABB that permits "real time" control of the application process by means of

The main advantage is less paint waste while still achieving the required application thicknesses.

the continuous display and correction of the painting parameters without ever having to "distract" the robot from its work.

This powerful software even permits off-line modification of the working trajectories of the robot, by means of graphic display of the path on the body, permitting rapid modifications. Without the software, it would require hours of on-line work and consequent significant shutdowns of production.

The six stations are also connected to each other via a protected ethernet which allows the entire

installation to be viewed from any of the monitoring PCs positioned on the line, enabling rapid checking of the operating status of any of the stations.

In testament to the effectiveness of the line, Fiat ordered a further 10 robots for base/varnish exterior painting which are currently in full production on a second production line where the historic "job one," the first painted and approved body, has already been achieved within the time allocated. The Mirafiori factory has, to date, 61 ABB robots installed in the paint shop alone. ☺

**Production statistics**

- Production statistics
- Average cycle time 87 seconds
- Approximately 250 bodies processed per shift
- Yearly capacity 180,000 vehicles
- Movicom/Shop Floor Editor graphic station offers real-time control of the robots and prevents downtime by providing off-line programming
- Electrostatic application technology from ABB means 80 percent of paint adhesion versus 30 percent without

Six successful stations

The painting stations at Mirafiori include:

- **Interior Base Zone 3:**
9 robots using conventional guns with stop&go conveyance
- **Interior Base Zone 4:**
9 robots using conventional guns with stop&go conveyance
- **First Coat Exterior Base Zone 5:**
4 robots using electrostatic cups with tracking conveyance
- **Second Coat Exterior Base Zone 6:**
3 robots using conventional guns with tracking conveyance
- **Interior Varnish Zone 7:**
8 robots using conventional guns with stop&go conveyance
- **Exterior Varnish Zone 8:**
6 robots using electrostatic cups with tracking conveyance