

BIKE PAINTING and **electric** bikes



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WHITE PAPER

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BIKES, A MEANS OF TRANSPORT CONQUERING THE WORLD

Growing rapidly across all continents, we are expected to produce more bikes than cars in the coming years.

How many bikes are there on Earth? An estimated one billion, compared to a global fleet of 1.47 billion automotives. And this hierarchy will be soon reverse.

Annual bike sales are much higher: 133 million units compared to 82 million automotives. By 2035, our planet should have more bikes than automotives, or even sooner if governments continue to promote cycling: purchase subsidies, expansion of bike lanes in cities, incentives to move away from cars, and promoting the health benefits of cycling.

At the industrial level, this significant growth has brought in new players and surprising diversifications. Who would have expected brands like Citroën, BMW, Porsche, Harley-Davidson, and Jeep to enter the electric bike market with high-end models priced over 10,000 euros?

This boom is empowering market leaders in Southeast Asia, Europe, and the American continent. They are building production sites, increasing the capacity of existing facilities, and expanding their ranges to cover all segments.

Interestingly, this transformation is happening without significant advancements in production technologies. In painting, electrostatic powder coating and liquid paint spraying with a rotating disc in an omega-shaped booth remain the leading methods, more than 30 years after their introduction. Despite the growing labor shortage, many manual tasks still require a large workforce. Additionally, the environmental impact of these technologies is far from optimized.

In this white paper, we explore these questions from a technical perspective to inform industrial stakeholders and decision-makers about the possibilities and limitations of current technologies and describe what the future holds. Feel free to contact us for more information!

Sames and Bike Painting

For over 30 years, Sames has provided manual, automatic, and robotic spraying solutions, ranging from pumping, dosing, and mixing systems to the sprayer for all market segments. Our clients are based in China, India, Europe (Czech Republic, Hungary, Sweden, France, Netherlands...), the United States, and Brazil.

In 2025, the company will launch a unique robotic painting line for a Bulgarian industry, setting a new global standard in productivity.

MAIN CHALLENGES OF BIKE PAINTING

Why is painting so important?

- The coating is the outer skin of the product, reflecting the overall quality of the entire bike. Even the smallest coating defect can diminish the product's overall image.
- The paint beautifies and protects against chips, scratches, shocks, and more to which every bike is exposed. It ensures its durability over time.
- A broad range of skills is required to design efficient painting equipment: chemistry, fluid mechanics, hydraulics, electricity, information systems, automation, robotic... There are few players in the market with expertise in all these fields.

Liquid solvent-based paint, water-based liquid paint, or powder coating?

Each paint type has its strengths and weaknesses, and it's common to combine different types on a single frame.

Solvent-based liquid paints are distinguished by their high-quality finish and come in multiple colors. However, they contain a lot of volatile organic compounds (VOCs), which are harmful to the environment and health. They remain widely used in Southeast Asia.

Water-based liquid paints, also available in many colors, contain significantly fewer VOCs. However, they must be applied under strict temperature and humidity conditions. Predominant in Europe, they are applied in layers ranging from 10 to 80µm in dry thickness.

These liquid paints are preferred for the intermediate base coat if it needs frequent color changes, for two-tone finishes, and for carbon frames, which cannot withstand high-temperature baking.

Powder coatings emit no VOC. They have excellent uniformity, durability, and resistance to impacts and scratches. However, they require baking at temperatures exceeding 180°C, which is energy-intensive and incompatible with carbon fiber frames. The range of color choices and metallic or pearlescent effects is less diverse than with liquid paint. The paint film thickness ranges from 70 to 80µm.

Powder coatings are preferred for the primer and clear coat layers when feasible. But since it's impossible to achieve thin layers, applying three successive layers is avoided: the entire system would be too thick and could lead to defects such as cracks.

Paint System (*)	Primer	Basecoat/Topcoat	Clearcoat
Entry-Level Bike (Single-Coat Paint)	Powder - single layer		-
Mid-Range Bike (Two-Coat Paint)	Powder primer	Powder topcoat	-
	Liquid 1K primer		
Premium Bike (Three-Coat Paint)	Powder primer	Liquid 1K base coat	Powder clear coat
Premium Carbon Bike	Liquid 2K primer	Liquid 2K base coat	Liquid 2K clear coat

(*) While these paint systems are the most common, other systems may also be used.

One, Two, or Three Painting Steps?

The least expensive bikes on the market, which have minimal appearance requirements, are typically painted with just a single coat. As you move up in bike quality, models receive a primer that smooths the surface and improves adhesion for additional layers, followed by one topcoat available in limited colors. For high-end models, a three-coat system (primer, basecoat and clearcoat) is used to offer a wider variety of colors and surface finishes. This enhances the bike's appearance and improves resistance to impacts, corrosion, and fading.

In addition to automated painting steps, manual operations are added for touch-ups and corrections to cover areas that are too or insufficiently coated with paint and for applying decals or stickers.

KEY FIGURES*

A standard bike has

0.8 m²

of surface area to paint (compared to 12 to 16 m² for a car), which equates to

150 to 200 cm³

of paint per coat.

Painting a bike takes between

**12 seconds to
3 minutes**

depending on the market segment and degree of automation.

The deposited thicknesses are

25 to 80 μm for the primer,

8 to 80 μm for the basecoat,
and

20 to 80 μm for the clearcoat.

The primer costs between

€5 and €15 per liter

the basecoat between

€10 and €30 per liter

and the clearcoat between

€10 and €30 per liter

*: Values given for information purposes only

THE FOUR KEY QUESTIONS IN BIKE PAINTING



QUESTION N°1

How Can I Reduce the Environmental Impact of My Painting Operations?



QUESTION N°2

Is It Possible to Use Multiple Colors Without Losing Too Much Time and Paint?



QUESTION N°3

How to Reduce the Amount of Manual Painting Operations?



QUESTION N°4

Is It Worth Robotizing Your Painting Lines?

QUESTION N°1

How Can I Reduce the Environmental Impact of My Painting Operations?

- In liquid painting, a large portion of the paint—up to 60% when using a basic manual spray gun—does not adhere to the parts, resulting in significant waste and higher emissions of VOCs (Volatile Organic Compounds). This inefficiency creates paint waste, which, along with waste from color changes, must be either treated on-site or managed by specialized service providers. Additionally, VOCs must be captured and, if necessary, incinerated to meet the regulatory emission limits set by the respective country.
- Another crucial issue is managing energy consumption to limit both production costs and carbon emissions. Certain equipment is particularly energy-intensive, such as ovens, which reach temperatures of 80°C (for 2K liquid paint), 120°C (for 1K liquid paint), and up to 200–220°C for powder coatings.
- Manufacturers must comply with increasingly stringent regulations set by governments, which aim to reduce emissions of pollutants, with special attention to VOCs in China and Europe. Many companies voluntarily commit to reducing their carbon footprint.
- The environmental footprint of bike manufacturers also directly influences their image. To attract and retain customers, they must aim for excellence in sustainability.

Ways to improve

- For liquid paints, prioritize application technologies with higher transfer efficiency, meaning the percentage of paint that adheres to the parts. A standard manual spray gun has a transfer rate of 40%, while an electrostatic spray gun improves this to 50%. An electrostatic disc system achieves 60–70%, and a robotized rotary bell offers the highest efficiency, with a transfer rate of 70–80%.
- Using powder allows for the recovery and reuse of non-deposited material, resulting in less than 5% waste.
- Minimize paint losses during each color change: the latest systems reduce losses by up to 20 times compared to less efficient ones.
- Consider the complete line, accounting for both emissions and energy consumption. For example, powder paint contains no VOC but requires very high drying temperatures.
- For manual applications of two-component liquid paint, use an automatic mixing machine rather than manual mixing. These precision machines separate waste into several categories and reduce paint and rinse product losses.

QUESTION N°2

Is It Possible to Use Multiple Colors Without Losing Too Much Time and Paint?

In a booming global bike market, using two or even three colors per bike is a way to position oneself and differentiate from the competition.

However, each color change is costly:

- With liquid formulations, the omega-shaped line stops for 15–20 minutes to clear the bikes from the booth, purge the paint from the pipes, clean them with a solvent, and rinse them.
- When using powder paints, the spray booth requires cleaning, leading to an unavoidable 10-minute downtime. However, 95% of the unused powder is recovered for reuse.
- Manual worker is required if these operations are carried out manually.
- Productivity drops: On a liquid paint line processing 200 frames/hour, a color change can result in 50 fewer units produced.

- Paint losses: 1 to 1.5 liters are lost per stoppage. If there are six color changes daily, the annual loss amounts to at least 1,500 liters, costing up to €45,000 per year if it's a premium base coat!

- Waste management: Paint and solvent residues must be treated on-site or handled by a specialized contractor.

These constraints are so heavy that manufacturers organize their workflows to handle as many products of the same color as possible simultaneously. Therefore, the cost of color changes limits production flexibility and bike customization options.

Ways to improve

- Invest in systems with more compact distribution circuits: shorter hoses result in 50% less paint waste during purging.
- Equip lines with two parallel paint circuits to perform color changes in masked time or with two booths for powder applications.
- Invest in color change systems located close to the spray guns. Changes occur in 15 seconds, and the volume loss is measured in deciliters instead of liters. Robotized solutions are particularly suited to these systems.

QUESTION N°3

How to Reduce the Amount of Manual Painting Operations?

Currently, bike production remains a labor-intensive industrial activity.

Operators handle everything that the equipment doesn't fully cover, particularly accessing hard-to-reach areas: these are the pre-touch-up and retouching operations.

Operators are also required for tasks such as applying decals and stickers manually. On a line producing 200 bikes per hour, up to 70 people may be needed for decal application compared to six or seven for painting itself!

Finally, high-end models are hand-painted by experienced operators who ensure that the bike's weight meets exact specifications, even sanding down a portion of the paint thickness if necessary to adhere to their requirements.

These labor-intensive operations face significant challenges due to workforce shortages, low skill levels, high employee turnover, and, in some regions such as Europe and the USA, the high cost of labor.

China and Taiwan, the largest bike markets, are responding by encouraging and subsidizing automation and robotization efforts. This is the most obvious solution to recruitment, training, and turnover difficulties. European and American bike manufacturers are following the same trend.

Ways to improve

- Use more precise spraying technologies with higher transfer rates to reduce pre-touchups and retouching, improving working conditions.
- Identify the tasks that require the most labor or are the hardest to staff and consider automating them if possible. Is it the application of the primer, base coat, or finish?
- Stay updated on emerging technologies. For instance, efforts are underway to automate decal application, a process that currently demands significant labor.
- Consider automating or robotizing your operations gradually, rather than overhauling the entire production line at once. Incremental upgrades are easier to implement than a full-scale renovation.



QUESTION N°4

Is It Worth Robotizing Your Painting Lines?

An industry that has relied on the same technologies for decades cannot afford to overlook the upcoming innovations.

In bike industry, multi-axis robots are starting to gain prominence for liquid paints. They are already the standard in automotive production lines worldwide. What are their main advantages for bikes?

- Achieve precise, high-quality finishes with three-dimensional, millimeter-perfect trajectories, combined with adjustable flow rates and instantly variable spray patterns.
- Repeatability, linked to their precision.
- High transfer rates, achieved by ultra-precise trajectories optimized for the part to be painted. With an electrostatic bell, this rate can reach 70–80%, even with unfavorable geometries like tubular bike frames.
- Color changes in 15 seconds, with only 40–50 cm³

of paint loss. A robot arm can carry many colors, typically 24.

A robotized painting line produces bikes with impeccable appearances, generates fewer VOCs, doesn't limit color options, and makes pre-touch-up and retouch operations unnecessary.

Robotization is therefore attractive for all market segments, from entry-level to premium bikes.

It's also possible to use robots for touch-ups on powder installations.

Ways to improve

- Investing in a robotized painting line rather than a basic system means a much higher investment but aims for significantly lower production costs. The Return on Investment (ROI) calculation is crucial in guiding this decision.
- The ROI is much faster if the production site operates with two or even three shifts, as in automotive factories. However, this work organization is still rare in the bike industry.
- The nominal capacity of the line is almost the same, but color changes hardly cause production losses, and the manual operations that lengthen the total cycle time disappear.
- These installations require more qualified staff, which could be a chance for certain employees to advance.
- Multi-axis painting robots can be integrated into both new installations and retrofits. There's no need to fully automate the process—a robot can be used for specific tasks like applying a single layer, placing decals, or handling pre-touchups and retouching.

SAMES PAINTING MACHINES FOR BIKES

Sames powder coating solutions for bike coating

Inocart VT, a complete manual powder coating system

Partnering the Inogun M spray gun and the Inobox control module enhances the user's experience.



Inogun automatic powder spray gun

Complete range of powder guns for your manual, automatic and robotic processes, integrating TEC5 technology for efficient powder transfer.



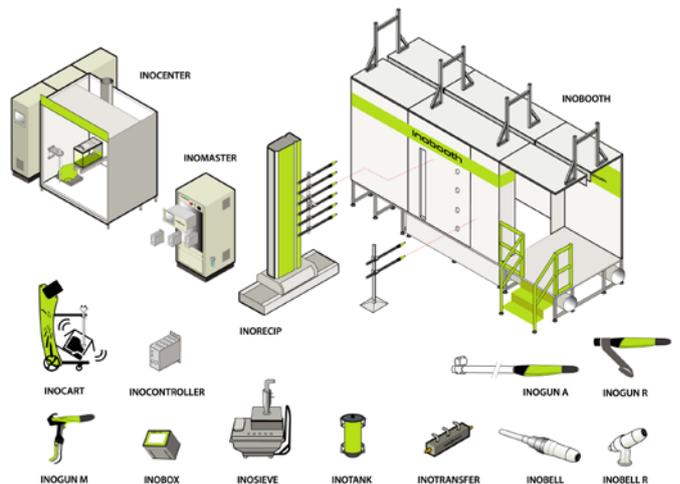
Inobell Rotating Powder Bell Sprayer

Inobell is a rotating electrostatic powder bell sprayer that delivers high performance, excellent finishing quality & easy integration.



Inocoat System Solution

A complete solution that includes a powder central unit, reciprocator, spray booth, and more.



Sames liquid solutions for coating bikes

PPH707 EXTi

Electrostatic bell cup designed for spraying WB paint on complex shaped parts such as tubular bike frames, with external charging technology without fingers.



Nanodisk

Coming soon – a new range of electrostatic sprayers with ultra-fast rotating disc will be launched.

Suitable for water-based and solvent-based paints, they are specially designed for installation in the centre of Omega loop conveyors, optimising the efficiency of paint applications.



PPH707 SB & SB-2K

The PPH707 SB robotic sprayer with internal charging is dedicated to the application of 1 or 2 component solvent-based paints.



Fpro airspray manual gun

Superior finishing spray guns, available in pressure, gravity or suction versions, available in conventional as well as HVLP and LVLP versions.



01D140 - 04D140 air-operated double diaphragm pump

Pump designed for low pressure circulation systems with ratios of 1:1 or 3.5:1



HVLP : High Volume Low Pressure
LVLP : Low Volume Low Pressure
These technologies offer a very high transfer rate (minimum 65%) with a low air pressure at the head of 0.7 bar.

INDUSTRIAL SITES USING OUR MACHINES

(Frames) **UNIBIKE, PORTUGAL.**

Manual application with a Nanogun electrostatic gun in liquid paint for the primer and Inocoat powder gun for the topcoat.

GIANT, HUNGARY. (Frames)

Robotic application of water-based paint using an electrostatic rotating bellcup - PPH707 ICWB

(Rims) **LUMING, CHINA.**

Automatic application of powder topcoat using Inobell powder bellcups.

CYCLEUROPE, SWEDEN. (Cadres)

Automatic application of liquid paint with an electrostatic bellcup - PPH308

(Frames) **MFC, FRANCE.**

Automatic application of powder coating using two EasyDrive powder booths.

DECATHLON, FRANCE. (Frames)

Liquid primer with an Accubell 708 electrostatic bellcup, and powder topcoat using automatic and manual Mach-Jet.

BIKEFUN INTERNATIONAL, CZECH REPUBLIC. (Frames)

Automatic application of powder primers with a bellcup, and topcoats with a disc. Manual touch-up using Fpro.

TECHNICAL ADVICE

Our experts have been assisting clients for over 100 years.

Feel free contact

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BOND • PROTECT • BEAUTIFY

With our manual guns, automatic and robotic applicators, supplied by our wide range of pumps & machines for fluid handling, dosing, mixing & dispensing Sames provides industrial solutions for production increase, quality improvement, material & cost savings.

We are designers and manufacturers of process equipment that is divided into 4 ranges:

sames kremlin

Liquid paint application solutions



+



+



Airspray

Coating technology that guarantees the highest finish.

Airmix®

The perfect mix between finishing quality and productivity.

Airless®

Most productive application technology to protect surfaces.

sames intec



Sealant and adhesives application solutions

sames nanocoat



Liquid coating application solutions for rotating bells, with and without electrostatic

sames inocoat



Powder coating application solutions