No Nonsense Advice on Improving Your Waterborne Spray Application

Chris Walters
Marketing Manager
Liquid Systems Group

Published By
Nordson Corporation
Engineering Breakthrough Eliminates Common Problems with Spraying Waterborne Materials Electrostatically

For many years manufacturers have tried to do three things in their finishing operations:

1. Reduce VOCs by switching from solvent-borne coatings to environmentally-friendly waterborne coatings
2. Spray electrostatically to increase transfer efficiency
3. Change colors fast

Individually, each task could be done, but to combine the benefits of all three into one solution was impossible. Due to the high conductivity of waterborne coatings, manufacturers must typically decide between spraying non-electrostatically, where they lose transfer efficiency, or spraying electrostatically, where they maintain high transfer efficiency but have to deal with expensive and unreliable solutions such as isolation systems or external charging.

Then came voltage block technology that provided a safe, reliable, and efficient way to spray waterborne coatings electrostatically. Unfortunately, the color change process with a voltage block system was still slow and costly.

However, with recent advances in voltage block design, you can now get all of the cost savings of spraying electrostatically and achieve fast, efficient color changes, without replacing your current equipment.

What Is Electrostatic Coating and Why Is It So Important?

The principle of electrostatic coating is “opposites attract”. The paint is charged negatively as it leaves the spray gun. The parts to be coated are securely grounded, giving them the opposite charge. As the paint and the parts come together, the charged paint is electrostatically drawn toward the grounded parts. As illustrated in the picture on the left, even paint that would have otherwise missed the part is pulled toward it. This helps increase transfer efficiency, improve finish, and lower total cost.

The primary benefit of spraying waterborne material electrostatically is the increase in transfer efficiency. In a non-electrostatic coating system, typical transfer efficiency is between 25-45%. With electrostatics, this can be increased up to 75-90%, depending on the method used, translating into thousands of dollars in paint savings per year.

Solutions to Electrostatically Charged Waterborne Coating

Waterborne coatings are much more conductive than conventional solvent-borne coatings. With waterborne coatings, the electrostatic charge finds an easier path to ground via the conductive paint in the fluid hoses than through the airborne particles being sprayed at the grounded part. It is essential for the waterborne system to be fully isolated from the ground or the paint will not charge and it will not attract to the part being coated. This means a drop in transfer efficiency as if no electrostatics were being used.
There are three ways to charge waterborne materials electrostatically:

1. Isolation System
To isolate a complete waterborne system, every pump, drum, pipe, spray device, or other ancillary equipment in the paint stream must be kept away from ground. This can be done best by setting all equipment on plastic appliances or hanging them from plastic hangers. Usually, a cage surrounds the system to further isolate it from any outside material that might endanger the operators or damage the equipment.

There are generally two problems with this type of system. First, as all the equipment is electrostatically charged, frequent and elusive shorts develop, eliminating electrostatic effects and decreasing transfer efficiency. Isolating the root cause of the short is very difficult since it could be at any point in the spray process. Second, the bigger the system, the higher the capacity of stored energy. If the system is grounded out by human contact, that electrical energy is discharged through the person, and could result in serious injury. (Imagine shuffling your feet across a carpet and then getting shocked by a doorknob. Now imagine that sensation multiplied a thousand times.)

Additionally, this system is costly to maintain, with additional capital expenses for the plastic equipment and additional labor expenses for operators who must inspect the system constantly to make sure that there are no current leakages.

2. Indirect Charging
Indirect charging prevents hardware from coming into direct contact with high voltage. The waterborne paint is charged by an electrode that is installed outside the spray gun. The electrode creates a high-voltage field around the end of the spray gun. As the paint particles pass through this field, they take on an electrical charge. The charged paint then attracts to the part being coated.

While indirect charging does eliminate the two biggest problems found with complete isolated systems, it still results in lower transfer efficiency than direct charging. In fact, recent tests in the automotive industry indicate that indirect charging is 12-27% lower in transfer efficiency than direct charging, leading to higher operating costs.

3. Voltage Block System
A voltage block system is a device that acts as a one-way valve between the paint reservoir and the spray gun. Charged paint passes from the pump to the spray gun, but the system blocks the high-voltage electrostatics from leaking back to the paint reservoir. With this, only the spray gun and the hose that connects it to the voltage block system are electrostatically charged.

Manual Gun Spraying

Gun triggered off, paint fills from the grounded paint supply. Gun triggered on, the paint reservoir immediately disconnects from the grounded paint supply. An air gap prevents the electrostatic charge from conducting back through the system.
There are three main advantages of a voltage block system. First, they allow for direct charging of the paint material, giving the highest possible transfer efficiency. Second, they limit the amount of hardware that is charged with high voltage. This minimizes both safety concerns and the problem of maintaining system isolation. Third, a voltage block can be used with any electrostatic gun set up to spray waterborne materials, so if you are changing from solventborne to waterborne materials, you do not necessarily have to purchase new spray devices.

Compared to all the other isolation methods, voltage block costs are considerably lower. The table below compares the costs of all three methods.

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<tr>
<th>Costs of Electrostatically Charged Waterborne Materials</th>
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<tr>
<td>Totally Isolated</td>
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<td>INSTALLATION COSTS</td>
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<td>LABOR COSTS</td>
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**Advances in Voltage Block Design**

Clearly, a voltage block system offers the most economical and flexible option for spraying waterborne coatings electrostatically. However, until now, slow expensive color changes were a major disadvantage of voltage block systems. During color changes, the paint reservoirs must be dumped, cleaned and refilled with the new color. This resulted in color change times of 10-15 minutes and the loss of up to ½ gallon of paint. In addition, the cleaning solutions used to rinse the paint reservoirs resulted in two gallons of additional waste material.

Recent reductions in the cost of controls and almost a year of development work have allowed Nordson Corporation to completely redesign our patented Iso-Flo® voltage block system, yielding faster color change with minimal paint waste.

First, controls are added to index the production line. Then, a flag is used to indicate the last part to be sprayed with the current color. The Iso-Flo then calculates the amount of paint needed to spray the parts remaining before the color change occurs, so that both paint reservoirs are empty after the last part passes. Finally, a minimal amount of water is circulated through the system to clean it and the paint reservoirs fill with the new color.
The updated Iso-Flo voltage-block system cuts color change time from over 10 minutes to less than two minutes. Paint waste is limited to the amount of paint in the fluid hose between the voltage block and the spray gun, usually a few ounces. Wastewater created from rinsing the reservoirs is reduced from two gallons to less than ½ gallon.

**Conclusion**

Advances in technology have made spraying electrostatically charged waterborne material safer and more economical. With the Iso-Flo voltage block system, you can achieve:

- Better transfer efficiency
- Less paint waste
- Faster color change
- Increased productivity

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*Nordson pioneered voltage block technology with the Iso-Flo system. To prove the savings and benefits the Iso-Flo system can provide, we are offering the system to you free for 30 days.*

*To learn more about this offer or about the Nordson Iso-Flo voltage block system, please contact Dawn Barnes at 440.985.4606 or visit our website at www.nordson.com/waterborne.*