Manual powder spraying—
technique is everything

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Manual powder spraying doesn’t require years of experience or fancy techniques. It does require more than just knowing which end of the gun to hold, however.

Easy as powder is to apply manually, most finishing shops that do it use inefficient spraying methods. The results are predictable: increased rejects and lower line speeds and part density, all of which reduce production. In addition, film build becomes excessive, which raises material costs.

Usually, poor manual spraying occurs because the operator uses liquid spray techniques to spray powder. The critical problem in spraying liquid is the creation of runs, or sags; and most liquid application techniques are designed to avoid this. As an example, liquid sprayers often make several passes across a part because that is the only way to achieve the specified film thickness while eliminating sags.

This technique is unnecessary when applying powder, however, because it is almost impossible to create a run unless at least 50 mils of powder is applied. This explains why powder application has a deserved reputation for being a forgiving process.

But that does not mean that powder can be applied manually without taking some precautions. Operators need to pay attention to how they handle the spray equipment and consider the shape of the part. In addition, manual operations that involve more than one operator, or that combine manual and automatic equipment, present special challenges. Finally, equipment maintenance and operator safety are no less important in manual operations than in automated ones.

Handling the spray equipment

Gun triggering. When applying liquid coatings, operators trigger the gun off at the end of each pass across the part surface to conserve paint and limit overspray. Since liquid systems operate on hydraulic principles, triggering on the part, as it is called, has no adverse effects.

Target distance. An important variable in powder application, target distance, also called gun-to-part distance, determines how evenly and efficiently powder is applied to the part surface. The optimum distance between the gun and target is 6 to 8 inches.

Gun settings. Next to gun motion, gun settings cause the most problems in manual powder operations. Operators usually adjust the powder output and voltage to the highest settings in the belief that this is necessary to coat the part with the least amount of effort. This isn’t the case at all, however. Operators end up compensating for high powder output with faster gun motion and longer-than-desired target distances. This only creates more work.

Gun motion. In a manual liquid coating operation, fast gun motion assures that multiple coats are applied thinly enough to avoid the creation of runs. Slower gun motion is preferred in a manual powder operation, however, because it provides the dwell time needed to charge the powder efficiently and does not distort the powder pattern.

Also, slower gun motion allows the powder to build to the desired film thickness in a single pass (coat). As mentioned, powder is forgiving in that it can build to a great thickness without producing runs. Therefore, the powder sprayer needs to slow down and let the gun do the work. Slower gun motion actually allows the operator to coat the part more quickly and easily.

Powder guns do not operate under hydraulic principles, however. With the exception of the guns produced by one supplier, manual powder guns eject a large puff of powder when they are triggered on. It’s important that the operator triggers the gun on only when it is off the part. The powder must be allowed to flow evenly before the operator brings the gun to the part surface. The operator should not trigger the gun off until the part surface is coated.

Also, it has been well documented that powder guns can spray much more powder than they can effectively charge. Unlike paint, powder must be charged or it will not stick to the part. When powder output reaches the point that the powder doesn’t get charged, overspray becomes excessive. Sometimes there is so much overspray in the booth that operators have difficulty seeing the parts they are coating. Operators must therefore adjust gun settings so the gun dispenses just enough powder to coat the part surface to the required film thickness.
Pattern devices. A variety of powder-pattern devices exist. Choosing the correct one can mean the difference between success and failure in powder coating a part. Effective coating of certain part shapes requires the use of specific powder-pattern devices. Having an inventory to select from can be helpful. (For more information on pattern devices, see “Powder-pattern control—use the right tool for the job,” Powder Coating, February 1993.)

Adapting to part shape

Faraday cages. Adjusting the powder output, velocity, and pattern, as well as the charge (voltage), helps in coating Faraday cage areas. But the only firm rule in coating these difficult areas is coat them first. When surfaces near a Faraday cage area are coated first, the presence of charged powder in the vicinity of the Faraday cage intensifies the Faraday effect.

Also, when coated surfaces surround a Faraday cage, they limit the operator’s ability to position the gun to penetrate the cage. This is because positioning the gun in certain ways can mar already-coated surfaces, reducing productivity. When the operator coats the Faraday cage area first, however, efficiency increases because the surrounding and adjacent surfaces get coated with the overspray powder.

Part cavities. When painting parts that have recessed areas, operators should avoid painting themselves into a corner. Operators should always coat the inside back surface of a part first and continue to coat as they move the gun out of the part cavity. This keeps the overspray controlled within the part, making it possible for the operators to see what they are doing. In addition, the technique of coating on the way out gives the overspray powder a chance to be attracted to the inside surfaces of the part, reducing the work required to cover them all.

If the gun is surrounded by coated surfaces, however, gun motion is restricted. For example, if the operator happens to touch the outer wall of an uncoated part with the gun while trying to spray the back of the part—no problem. But if the operator touches the same surface after it has been powder coated—big problem: It creates a reject.

Adapting to complex manual systems

Two-operator systems. In powder systems that use two or more manual sprayers to coat a part, most problems stem from not identifying which areas each operator is responsible for. This causes the part to get over coated. The work should be divided between the operators based on which areas of the part are most accessible to each. Under no circumstances should an operator recoat an area already coated by the other operator.

When an operator has completed the assigned task, the operator should stop spraying the part. Believe it or not, this is a major problem in every manual operation I have visited. Operators continue to coat a part as long as it is in front of them so that they always look busy. Management must encourage manual operators to stop coating when their assigned areas are covered and to wait patiently for the next part.

Automatic systems with manual touch-up. Figuring out where to locate the touch-up station is the big question in designing an application system that combines automatic and manual guns. In most cases, the manual touch-up station should be located after the automatic guns. This lets the operator see if an area requires touch-up before spraying.

Following, however, are some situations that may call for locating the touch-up station ahead of the automatic guns:

- The areas that require manual touch-up are sometimes difficult to see once a part has been coated automatically, especially when dark colors are sprayed. This calls for touching up before automatic powder application.
- Faraday cage areas sometimes pose exceptional problems; when they do, it’s a good idea to touch up parts before sending them through the automatic system.
- The presence of coated surfaces next to uncoated surfaces makes it hard to spray recessed areas. It’s best to spray part cavities first, therefore.

Opposing touch-up stations should always be staggered, rather than facing each other directly. This will prevent operators from spraying each other while coating the part. No matter where a touch-up station is located, the operator should stop the machine and look at his coatwork before proceeding. Many manual systems insist on dusting surfaces already coated by the automatic guns, thus over coating the part.

Maintaining equipment and assuring operator safety

Maintenance. Soldiers graduate from basic training knowing the importance of keeping their weapons in good order. Why? Because their drill instructors have impressed this fact on them: Take care of your weapon, and your weapon will take care of you. The same concept applies to manual powder coating equipment. To assure that the equipment functions as expected each time it is used, operators need to perform the following tasks regularly:

- Check the powder level in the hopper
- Clean the powder gun and nozzle
- Clean the powder feed hose and powder feed pump
- Check for air leaks
- Check for worn parts
• Make sure the gun cable and electrode are in good condition

• Make sure the ware and equipment are grounded properly

Operators should make a habit of blowing compressed air inside and outside the manual gun whenever the gun is not being used to coat parts. This rids the gun and nozzle of powder build-up, preventing it from being deposited on the ware. For this reason, it’s a good idea to equip each manual spray station with a compressed-air drop, complete with hose and safety nozzle.

**Safety.** Before using the equipment, operators must read and understand all equipment operator manuals. Operators should be encouraged to take advantage of the many training opportunities available. (For more information on training and training sources, see “How important is training?” *Powder Coating*, February 1991.)

In addition to learning how to operate equipment safely, manual spray operators need protection from the powder they spray and from electrostatic shocks:

**Powder.** When using manual spray equipment, operators should wear safety glasses and approved dust masks. Overalls made from lint-free paper will keep operators and their clothes from being coated with powder.

MSDS sheets should be obtained from the material supplier(s) for the powder coatings being used. In compliance with OSHA regulations, these should be posted in a prominent location for ready reference.

**Shocks.** If operators wear gloves, they should remove the palm area on the glove worn on the hand that holds the gun. This will ensure that the system ground is transmitted to the operator. If this is not done, ground straps must be used to keep the operator properly grounded.

**Conclusion**

People throughout the powder coating industry agree that it is much easier to teach manual powder-spray techniques to people who have no liquid spray experience than to those who do. Liquid spraying is an art form that depends on many years of experience; and the methods liquid sprayers use should not be used to spray powder manually.

However, with minimal instruction in the basic techniques, anyone can spray powder manually without problems. By keeping track of the overspray powder, management can gauge how effectively it has instructed its operators in basic spray techniques. Too much overspray signals that something is wrong and that maximum first-pass transfer efficiency hasn’t been achieved. This important feedback lets operators know that they need to adjust some or all of the manual-spray variables discussed in this article.

When the variables are regulated correctly, first-pass transfer efficiency will be high, and the operator will be able to powder coat parts with minimal effort. The motto in manual spraying is “work smarter not harder.” When operators are working too hard, chances are good that the parts are not being sprayed efficiently and correctly.  

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