Operation and Maintenance Techniques for Spray Coating

FACT SHEET

In typical spray coating operations, three factors are paramount: production, quality, and cost. One activity that has a positive effect on these factors is proper operation and maintenance of spray equipment. As shown in Table 1, good operating practices also play a critical role in the efficient use of coating materials by reducing air emissions and solid and hazardous waste generation.

Table 1. Production and Environmental Impacts of Poor Spray Techniques

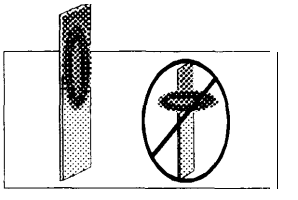
Waste Category	Production Impact	Environmental Concern
Overspray	• Increased frequency of booth cleanup and filter replacement	• Solid and hazardous waste
	• Lost coating materials	• Additional air emissions
Product Rework	• Lost time and profit	• Hazardous waste and air emissions from stripping and refinishing
	• Extra handling and packaging	• Solid waste

The following sections overview tips for good operation and maintenance of spray equipment.

Equipment Setup and Adjustment

Good operation begins with proper equipment setup and adjustment. Four factors to consider in setting up equipment are the viscosity of the coating material, air and fluid pressure, the shape and size of the spray pattern, and the proper positioning of the workpiece.

- Viscosity. Generally, less viscous coating materials are easier to atomize and can be atomized at lower pressures. Two ways to control viscosity are by dilution with a solvent and heating. Heating the coating material to the desired viscosity instead of diluting it with solvent can give not only comparable atomization but also lower potential for VOC emissions.
- *Air* and *Fluid* Pressure. To minimize overspray, blowback or bounce back, and worker exposure, fluid pressure should be no higher than necessary to provide good atomization. A slower particle speed reduces the impact of the particle onto the part surface and increases the opportunity for even coating distribution and a smooth finish.
- *Spray Pattern. The* spray pattern should be optimized to the workpiece size, shape, and orientation. Slender pieces should be coated with a narrow pattern while a larger pattern can be used for wider pieces.



- *Workpiece Positioning.*
  - The piece to be finished should be positioned such that spraying is as comfortable as possible for the operator. If the operator must strain or reach to spray the part, spray technique and quality are likely to suffer. The operator also needs to be able to see the piece well in order to aim the spray gun appropriately; thus, a clear line of sight and proper lighting of the work area is essential.

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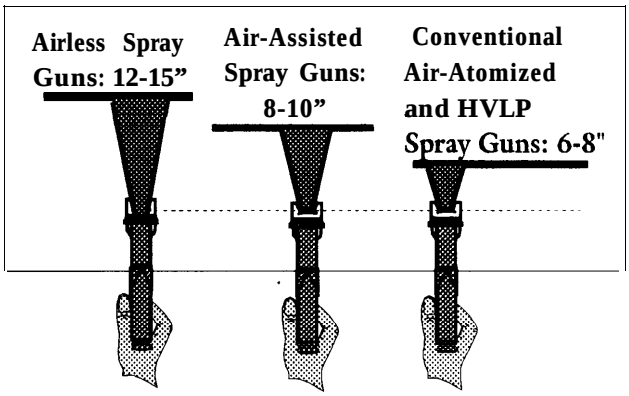
- Workpieces should be mounted such that they can be rotated and tilted. The operator should not need to move around the piece and, thus, inadvertently tangle hoses that can then damage the finish of the workpiece.
- Where possible, pieces should be positioned close together so that overspray from one piece will fall onto another.

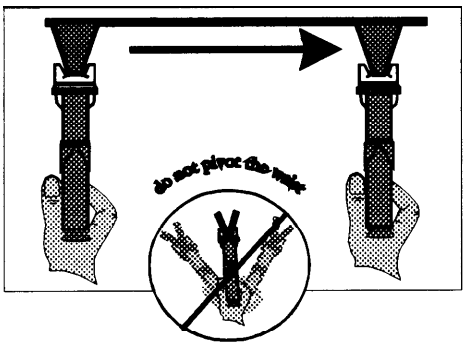
Operator Spray Techniques

A very small investment in spray operator training can pay huge dividends in reducing the time and profit lost in product rework, spray booth cleanup, and excess coating usage. Operators that are well trained on proper spray techniques can also help assure good finish quality and efficient use of material. Operators should be trained to use proper gun position, arm motion, triggering, and overlap techniques.

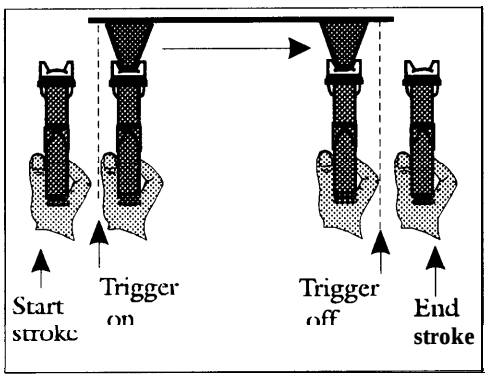
Training should not be considered a one-time event. Even the best trained operators will fall back into old habits over time. Training should be repeated periodically, i.e., once or twice a year, to reinforce proper technique and to ensure that new employees are also trained properly.

- ***Gun position.***
  - The recommended distance from the spray gun to the workpiece depends on the type of spray gun to be used. Table 2 lists recommended distance for several general gun types. A dry spray, uneven coverage, and decreased transfer efficiency may result if the gun is held too far from the workpiece, while runs and sags may occur if the gun is held too closely to the piece.
  - To minimize uneven paint coverage, the operator should hold the gun as perpendicular to the workpiece as possible.

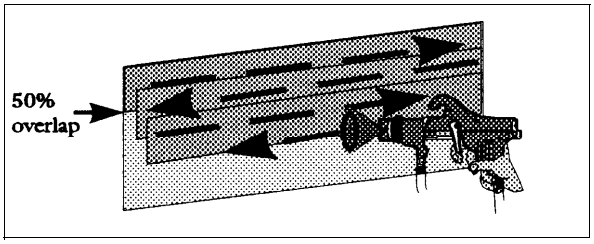




- ***Arm motion.***
  - To help ensure that the gun is perpendicular to the workpiece, the operator should move the gun in a sweeping arm motion rather than pivot the wrist, which causes the gun to tilt. If the gun is tilted, the coating will be applied unevenly. A gun held at a 45-degree angle can result in a spray loss of approximately ***65*** percent.
  - For long pieces, the operator should make strokes of 18 to 36 inches in order to maintain the gun in a nearly perpendicular position



- ***Triggering*** the Gun. Proper triggering reduces material usage and finish defects. The gun should be triggered with each stroke. The stroke should be started before the trigger is pulled, and the trigger should be released before the end of the stroke. This method produces a feathering effect for more even coverage, conserves paint, and reduces material buildup at the beginning and end of each stroke. Proper triggering can save an estimated $1cm^3$ of paint per stroke, which amounts to about 52 gallons per month and $6,000 per year (at $10 per gallon). This saving assumes six strokes per part and two parts per minute, 420 minutes per shift (Source: DeVilbiss Literature).

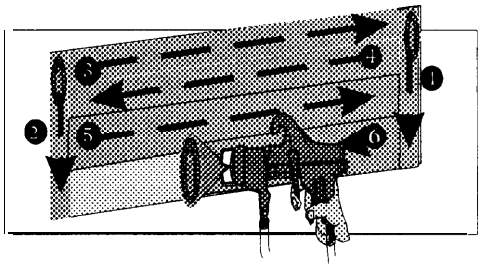


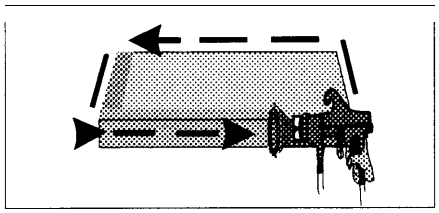
- *Overlap*. Strokes should overlap by 50 percent. A good rule of thumb to obtain 50 percent overlap is to aim the gun at the edge of the last stroke.

Special Techniques for Specific Workpiece Configurations

Some workpiece configurations require specific spray techniques. The following sections outline techniques for coating flat panels, edges, inside and outside comers, and slender and round parts. If possible, the operator should spray the more difficult locations first, e.g., comers, edges.

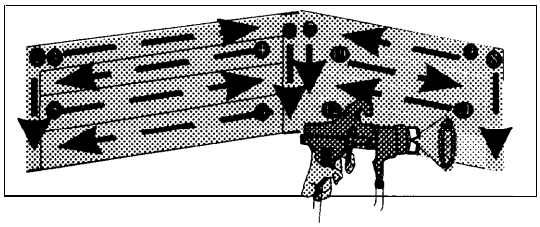
- *Flat Panels*. To reduce overspray on a flat panel, the operator should use a *banding* technique. In banding, the operator applies a vertical stroke on each end of the panel and completes the remainder of the piece with horizontal strokes. This method reduces paint usage and overspray.



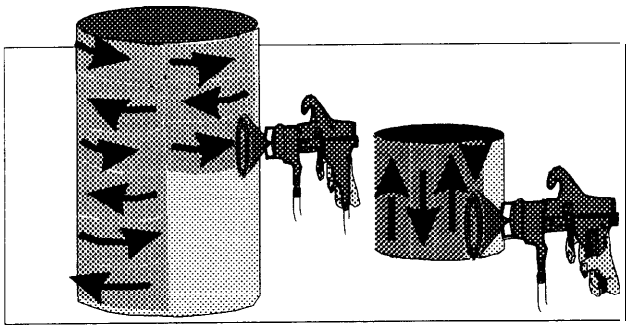


- *Edges and Outside Corners.*
  - A banding technique should also be used on the edges of workpieces such as tables. If the operator aims the spray gun at the leading comer of the part, both the edge and the surface are banded.
  - Similarly, outside comers of pieces such as boxes should be sprayed straight on to band the adjoining surfaces.

- *Inside* Corners. If space allows, inside comers should be sprayed as if the workpiece is two separate flat panels. This technique involves vertical banding for both sides of the comer. If the comer is sprayed straight on, thicker coatings will be applied on the edges of the pattern than in the comer itself.



- *Slender and Narrow Round Parts.*
  - Slender pieces should be coated with a narrow horizontal pattern or a vertical pattern. For a vertical pattern, the gun speed should be increased to account for the additional time that a particular portion of the part is in the pattern. Gun motion should always be lengthwise to the part.
  - A narrow horizontal spray pattern and three or more strokes should be used for round pieces. If a slender piece such as a table leg is part of a larger object and it is not feasible to adjust the pattern size, it may be possible to partially trigger some spray guns to reduce the pattern size. The operator should be careful in applying this technique as incomplete atomization may result.



- ***Large Round Parts.*** Round objects of large diameter should be sprayed as for a flat surface but with shorter strokes.

Planning for Efficient Spray Operation

- It is usually helpful for spray operators to rehearse techniques and strokes before beginning work on a new piece. Planning will enable the operator to use fewer strokes, which will reduce paint use/overspray and fatigue and produce a higher quality finish.
- Many companies find it effective for a finishing supervisor or team to study each piece before it is sent to the production line to determine the most efficient spraying procedure. Each operator is then trained to use the preferred technique. This approach also continuously reminds the operator of proper techniques.
- It is important that if an operator discovers a way to improve the technique, it should be shared with the supervisor or team to help others.

CASE STUDY - OPERATOR TRAINING:
Ethan Allen Furniture, Old Fort, NC

Ethan Allen videotaped spray gun operators as they applied coatings to typical workpieces. The operators then met in groups of two or three with the supervisor and finishing experts to review the tapes. The operators identified their own poor techniques by watching themselves work, and they were also given constructive advice and hands-on instruction on techniques to improve their work. The operators were videotaped again and given a chance to compare the before-and-after tapes. The company projected an 8- to 10-percent reduction in coating material usage through improved spray techniques. This reduction translated into an estimated savings of $50,000 to $70,000 annually.

Equipment Maintenance

- Spray guns must be kept clean and lubricated daily for proper operation. The trigger, control valves, and springs should be lubricated periodically according to manufacturer's recommendations.
- When the gun is cleaned in solvent, only the tip, not the entire gun, should be immersed. If the entire gun is immersed, scale buildup can compromise finish quality, and the solvent removes internal lubricants and deteriorates internal seals. The result is accelerated gun wear.
- The spray pattern should be checked periodically for wear or clogging. Worn parts should be replaced as needed as they can significantly reduce painting transfer efficiency.

Summary

The techniques and case study presented in this fact sheet show that improved operation and maintenance of spray equipment can reduce raw material usage, air emissions, and hazardous waste generation. A conservative estimate of the savings in a finishing operation through improved operating techniques would be 10 percent or more of coating material purchases. Good managers cannot overlook savings of this magnitude, especially when they consider that proper techniques also improve product quality and reduce environmental concerns.

Assistance Available

Pollution prevention has been proven by countless companies to be the most cost-effective approach to environmental protection. The North Carolina Division of Pollution Prevention and Environmental Assistance is available to help companies identify opportunities for pollution prevention.

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The North Carolina Division of Pollution Prevention and Environmental Assistance provides free, non-regulatory technical assistance and training on methods to eliminate, reduce, or recycle wastes before they become pollutants or require disposal. Telephone DPPEA at (919) 715-6500 or 800-763-0136 or e-mail nowaste@owr.ehnr.state.nc.us for assistance with issues in this Fact Sheet or any of your waste reduction concerns.

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