Paint Equipment: Upgrades and Automation

Probability has it that no company ever concludes, out of the blue, that money needs to be spent on the paint shop. There has to be some external or internal motivational push. For example:

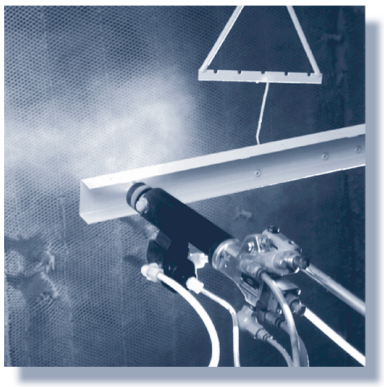
1. Production bottleneck
2. Increase transfer efficiency — save paint
3. Product mix becoming more diverse
4. EPA regulations
5. New business prospects
6. Contract painting with another shop
7. Long-term company growth
8. Alternative paint types
9. People requirements

Automate or upgrade, and impact all of the above.

Having identified any one or several motivational forces, next comes the question of budget — and to what extent the equipment and process expenditures will improve the targeted areas.

1 Relieving a Bottleneck Means Greater Throughput

Painting-related equipment aside, most systems are integral with specific lengths of floor space dedicated to power washing, dry-off and paint cure. In some cases, conveyor speeds can be increased without reducing the effectiveness of the dedicated functions. More often than not, however, increasing conveyor speeds will compromise the integral functions to an unacceptable level. Short of replacing this equipment, specific additions might be made to extend the capacity of the dedicated areas. With convection dry-off and cure ovens, auxiliary infrared may be added at the entrances to reduce bring-up time and free more time for cure or dry-off. With the washer, additional tanks and risers may be added, space permitting.



Painting with automatic electrostatic

With the painting process and the finite spacing between spray booths, increasing conveyor speed will decrease “flash” time between coats and final flash to the oven entrance. At the other end, higher speeds won’t permit adequate cool-down time. As a result, parts entering the first application booth may be hot or too warm to be painted. Some relief may be gained by directing cooled air on hot parts and warming various flash areas.

Depending on various paint types and formulations, solvent balances can be altered, but only to a point. The painters must also be considered. There is a point where they may fall behind and

compromise the finished product. Some relief in this area may be gained through the use of electrostatic hand guns. They inherently apply more paint than conventional guns and even HVLP because of the reduction in overspray. There is a twofold benefit: operators "keep-up" more readily and higher transfer efficiency is achieved.

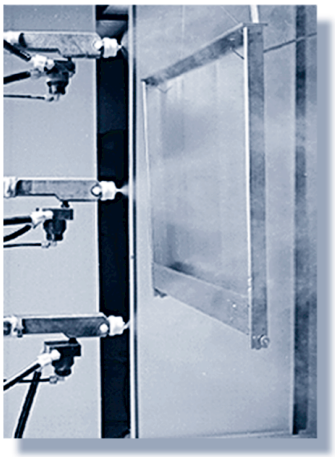
2 Transfer Efficiency and Using Less Paint

For any given paint application use of more efficient application equipment can provide a very effective return on investment (ROI). First, however, is an analysis of the product's finish requirements.

Utilitarian: Non-cosmetic coatings for weather protection until assembly or installation may be dip, flow coated, or curtain coated. Processes that can be 90 percent efficient over the long term can be relatively unsophisticated compared to today's paint systems. Suitable products for dip and flow may be automotive radiators, undercarriage parts, exhaust system components, heat exchangers, weldments and other irregular items. Curtain coating lends itself to such things as mirror backing, sheets, panels and other large, flat, fast-moving products.

Cosmetic: Coatings for appearance, as well as substrate protection for either indoors or outdoor weatherability can be airless, air-assisted airless, HVLP and electrostatic versions of each type. Electrostatic rotary atomizers (bells) are sometimes employed if product shapes are not prohibitively complex. Suitable products may be stationary machinery, farm machines, sheet metal fabrications, pole buildings, architectural applications, commercial shipping vessels, flat-stock steel, flooring, etc. Efficiencies can be in the range of 30 to 55 percent.

Decorative fine finishes: Coatings for high quality sheet metal products, automotive bodies, plastic auto body accessories and aluminum extrusions, to name a few, can be air spray and some HVLP, along with electrostatic versions of each type. Efficiencies with non electrostatic will range from 20 to 40 percent; with electrostatic to 60 percent. Electrostatic rotaries (bells) will push efficiencies to the 80-to-90 percentiles, although color matching with metallics could become a factor.



Stationary guns with moving product

3 Diverse Product Mix

Whatever paint application equipment is involved, there is always the attendant "set-up" time required with a change in product. Even with hand spray, there could be a change in the application device — say from air spray to airless — each requiring vastly different fluid-delivery systems. With automation, on-off triggering length (lead & lag) could vary significantly as could fluid-delivery rates, pattern-shaping air and atomization levels.

Realistically, plant production control needs to study the product mix with an eye to how each part is hung and painted on the line. If processes are similar with some, then basic groups can be identified and run in sequence to keep set-up time to a minimum.

Having done that, certain related questions arise: Can manufacturing build the product mix we're scheduling? Will there be expanded inventory and warehousing? Will this scheduling impact the JIT program? What will it cost?

If the hanger mix and random line loading could be accomplished, sophisticated automation is available. Six-axis, computer-controlled robots carrying several applicators (one of each type), which can be pre-programmed for the painting paths or gun movements, and any other variables occurring between different parts.

4 State and County EPA

These folks, far more so than the Federal Bureaus, are in close touch with most manufacturing and painting facilities in their areas. The significant reason for this is that they are in receipt of, and pursue, the Emission Fee reports generated each year by every polluting facility. These reports reveal VOC emission levels and will reflect any significant changes.

Any new facility must be permitted, and during that process will submit to an assessment of the proposed emissions. Recent rulings in some Ohio counties include particulate — not just VOCs. Depending on the numbers submitted, they will rule on how exhaust emissions will be handled. If upgrades of existing systems are proposed, new booths, ovens, flash areas, etc., existing stacks can be used, or even relocated within the facility. The agency, in most cases, will "grandfather" these stacks as long as emission levels and application efficiencies remain unchanged. Where application efficiency is concerned, increases are favored. In

many cases you may be able to put new equipment in place and raise production rates, all without a change in reported emission levels.

With transfer efficiency increases, the obvious equipment upgrade would be to electrostatic, but it can be taken a step further. With automatics, booth air flows can be almost halved from hand operations. Here lies another opportunity to enhance transfer efficiency. Reduced air flows, extraneous cross currents or rolling overspray traps are reduced, or even eliminated. There is also the attendant reduction in paint-arrestor booth-pad use or even water-wash compounding and sludge removal.

5 New Business Prospects

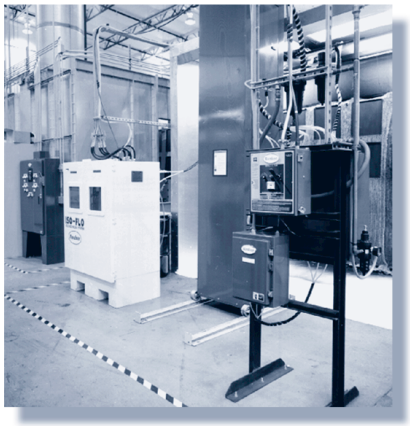
6 Contract Painting

7 Long-Term Growth

To the small or medium-sized manufacturing business, the contract painter can be a valuable asset, particularly if a quality paint job is required. In many cases the contractor can forward the finished product to the user or distributor. While the relationship may be comfortable, there will be an inherent ceiling at which the profit margin will remain. Establishing an in-house facility can be expensive and critical to long term growth — from both a negative and positive viewpoint.

The coating of any product with any specified paint can be a modest outlay: compressor, spray booth, handgun and a simple fluid supply. The powerwash, dry-off and cure-oven phases, however, may be quite expensive, depending on a prospective customer's requirements.

Any automotive account, particularly GM, will have definite specifics for wash temperature, time, soap concentration, rinse times and the types of rinsing processes. Cure ovens are typically convection, and the minimum specification is 25 minutes at 250° F, which does not include bring-up time. The painting process *per se*, is not specified, although the several coats of paint involved must meet minimum film-build requirements. While base coats (color) specs vary, color matching is the key. With clear coats, 1.5 mils dry is the literal standard almost without exception. There are also the attendant quality standards involving documentation for film builds, color match and paint-film resistance to various conditions.



Long stroke machine with automatic guns

If any automotive account is part of the business plan, capital investments should sequence as wash, dry and cure first, then automate or upgrade the actual painting process. If only industrial or commercial business prospects are being sought, there may not even be cleaning or cure specifications involved, so capital spending can be funneled to different avenues.

8 Alternative Paint Types

The paint "type" spectrum is extremely broad and dovetails, somewhat, with topic #2 — cosmetic, protective, aesthetic, or a combination thereof. For equipping a finishing line, however, the range is reduced to two categories — one- and two-component (1K and 2K) paints. The "K" comes from the first letter of the German word for "component."

Most 1K materials cure, or polymerize through absorption of moisture or oxygen at elevated temperatures. Others simply dry out through solvent or water loss and do not actually "cure" in the strictest sense. 2Ks are two separate solutions — the first is resin and pigments; the second is a solution of cross linkers or catalysts. Unless the two solutions are brought together, neither will solidify. The catalyst phase, in some cases, may crystallize in the presence of moisture in the air, or from small amounts of water dissolved in certain solvents. The moment 2K solutions are brought together polymerization begins and the mixture thickens slowly at room temperature. The greater the temperature and/or the concentration of catalyst, the faster curing occurs.

These materials must be applied after mixing, but if more than several quarts are premixed, an unsprayable viscosity may be reached before the mix is used completely. Worse, the material may solidify inside the spray equipment rendering it useless (equipment may be salvageable after total disassembly and cleaning). Successful and continuous painting requires a mixing device that meters the components on demand from two separate and closed containers.

While the devices can be expensive ($15,000+), the ROI on the system can be realized quickly by avoiding the mishaps of "hot potting" or premixing large volumes of the material. 2K paints are typically used by the automotive industry because of their excellent weatherability — particularly UV resistance.

9 The People Factor

However sophisticated an automatic finishing system may become, people are required. As painters or set-ups are eliminated from the process, there becomes an immediate need for technically skilled personnel who will observe, adjust, optimize, troubleshoot and understand the intricacies of the system at every phase of the process.

Hand spray with electrostatic

A case in point is the application of an automotive clear coat with reciprocating bells connected to a computer-operated 2K mixer. For any given color, the clear-coat film build must remain fixed. The program calls for a clear-coat flush every hour, and line conditions — three minutes of line time with no parts — are arranged. Two such breaks occur with no flush signal initiated. A third occurs, but again, no flush. By this time, due to pot life and laminar flow, the fluid delivery tube IDs are being severely reduced, restricting flow. As no compensatory increase in fluid pressure has occurred, film build is dropping to an unacceptable level. By the time this condition is noticed, 45 to 60 minutes of production could have been lost — not to mention the time lost to replace the fluid tubing. An expensive lesson.

Film-build loss would also be affected by an inadvertent instance of not checking clear-coat conductivity, which is a very real possibility in a busy paint kitchen. There are many other influencing factors which can go awry simply because of lack of observation, or even the technical expertise to recognize what is being observed.

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