ARTICLE

How to Achieve Cost Savings Through Efficient Finishing Operations

TAKE THE PAINT EFFICIENCY AUDIT

As finishing operations look to stay competitive in an increasingly global economy, it's no surprise that efficiency has become a popular topic. Many companies are looking for effective ways to reduce operating costs and improve profit margins.

Those interested in managing costs can make impactful changes by auditing the efficiency of current equipment, identifying process or equipment improvements and implementing the necessary changes.

Transfer Efficiency

When it comes to spraying parts on a paint line, efficiency improvements can lead to less material waste and lower emissions of VOCs. There are many factors that affect transfer efficiency including;

Proper gun setup—The proper air pressure and fluid pressure are critical for transfer efficiency. Too much air pressure will cause turbulence in the sprayed material, causing excessive overspray. Too much fluid pressure causes bounce back of material on the substrate. Both resulting in reduced transfer efficiency. Use the paint gun manufacturer's suggested air cap and fluid tip combination for the viscosity of the product being sprayed.

Table 1: Spray Gun Setup Comparison

	Poorly Set Up Gun	Properly Set Up Gun
Parts per Gallon of Paint	100	115 (15% increase in TE)
Paint Usage	2500 parts/100 parts per gal = 25 gallons of paint	2500 parts/115 parts per gal = 21.7 gallons of paint
Paint Cost per Week @ $60/gal	$1,500/wk	$1,304/wk
Paint Cost per Year @ $60/gal	**$75,000**	**$65,217**

Paint Cost Savings: $9,783/year

To correctly set the air pressure, turn the air pressure down and spray a test pattern. If there are "tails" at the end of the pattern or if the particle size is not even, turn up the air pressure 5 psi, then test again. Repeat this procedure until the "tails" are gone or the particle size is consistent. The key is to use enough air pressure to get a high-quality spray pattern, but low enough to optimize transfer efficiency.

Size and shape of the part—To improve transfer efficiency, it is important that your spray pattern height matches the part you are spraying. Material blow-by from too large of a spray pattern reduces transfer efficiency. The tip size should be sized to the largest spray pattern height for your parts, but not bigger. It is also important to purchase a spray gun with a fan pattern adjustment knob, so as your part size varies, the operator can adjust the spray pattern height down to match the part size.

Operator technique—To guarantee optimal transfer efficiency, operators must be properly trained on spray techniques so transfer efficiency is increased. Operator technique such as spraying the right distance from the part, spraying parallel to the part and triggering and detriggering at the proper time can affect transfer efficiency by 10% to 30%.

For example, it is important to overlap each successive stroke (e.g. 50% for conventional spraying or 25% for airless spraying) using a crosshatch overlap when required. Triggering the spray gun at the beginning and end of each stroke, is also recommended. This minimizes the lead (the distance between the point where the pattern leaves the part and the point where the gun is untriggered). Even a small decrease in leading and trailing edges can reduce overspray and result in significant improvements in transfer efficiency.

Table 2: Spray Gun Technologies

	Air Spray	Compliant	HVLP	Electrostatic Air Spray	Airless	Air-Assisted Airless	Electrostatic Air-Assisted Airless
Finish Quality	Class A Decorative	Class A Decorative	Class A Decorative	Class A Decorative	Medium to Coarse	Decorative Coating	Decorative Coating
Transfer Efficiency*							
ASTM D-5009	17-25%	25-32%	25-32%	60-75%	27-35%	30-40%	70-85%
EN 13966	60-70%	70-78%	70-78%	n/a	70-80%	75-85%	n/a

**Using ASTM standard - 50% is the maximum transfer efficiency due to conveyor methods of spraying. EN standard sprays on a flat panel.*

Applicator Selection—selecting the most efficient spray gun for the intended application is important in optimizing the efficiency of any spray operation. Conventional air spray, compliant, HVLP, air assisted airless and electrostatic all offer excellent benefits depending on the application (see table 2).

Mix Room Equipment

In the mix room of finishing operations, pumps are often the biggest consumers of energy as a result of compressed air consumption. Improving the efficiency of current equipment or switching to hydraulic or electric pumps that use less energy are a few effective ways to reduce long-term energy consumption.

Pneumatic systems are often the choice of most finishing operations because they are easy and safe to operate, they are less expensive to purchase and because they use an existing power source in the plant. Hydraulic systems are typically more cost efficient than pneumatic systems, because they offer much better efficiency of use—by about 25 percent over pneumatic systems. A system using hydraulics can match the power of a pneumatic system even if the horsepower of the hydraulic system is listed as less than that of the pneumatic system.

With typically the highest up front expense, electric motors often provide the largest energy savings in a typical finishing operation. Most notably, they offer direct conversion of electrical energy to mechanical pumping. This not only uses less energy, but it also eliminates the inefficiency of compressed air systems.

Air compressors have ongoing liabilities including leaks, maintenance, and equipment downtime that can lead to further inefficiencies. In fact, the majority of air compressor costs are not from the initial capital investment. The majority of compressor costs come from energy usage in its 10-year lifespan.

Table 3: Pump Comparison

	Pneumatic Pump	Electric Pump
Power	3:1 Ratio	2 hp
Displacement per Cycle	1500 cc	1500 cc
Usage	24 hrs/day, 365 days/yr	24 hrs/day, 365 days/yr
Fluid Pressure	250 psi	250 psi
Fluid Flow Rate	4 gpm	4 gpm
Cost per kWh	$.07	$.07
Energy Cost per Year	**$1,660**	**$435**

Cost Savings: $12,050/year*

**Based on an average mix room with ten circ lines at $1,225 per line per year.*

Another benefit of electrical pumping is the improved control and automation potential. Pumps can be set up to operate only when absolutely needed. These off production settings greatly reduce or eliminate energy consumption during off shifts or non-peak operating modes.

The following comparison illustrates how switching from pneumatic to electrical pumps can yield thousands of dollars in savings for finishing operations.

Another area to evaluate for efficiency is the process of proportioning plural component materials. More and more finishing operations are using two-component (2K) paint because of its better adhesion, hardness, durability and lower VOC output and oven cure. But in order to be successful with 2K paint, the material needs to be mixed at the correct mix ratio and used before it cures.

One way to manage this process is to use electronic proportioning machines that mix the 2K materials on demand as you spray them. In addition to saving operators time compared to hand mixing, electronic proportioners reduce waste and contain state-of-the-art diagnostics that can keep manufacturing processes running smoothly and efficiently. In most cases, an electronic proportioning system pays for itself within months of purchase and is well worth the investment.

Coupled with the savings potential from improvements in quality from a consistently mixed material that is always on ratio, an electronic proportioning system is really something any 2K coating operation cannot afford to be without.

Even with these large savings opportunities, evaluating long-term cost savings is critical when considering the expense of purchasing and installing new equipment. There are several manufacturers that provide tools and return

Table 4: Mixing Comparison

	Hand Mixing One 5-Gallon Batch of 2K Paint		Electronic Proportioning One Proportioner Purge	
Setup Labor	15 min @ $20/hr	$5.00	n/a	$0.00
Paint Waste	.5 gal @ $40/gal	$20.00	.2 gal @ $40/gal	$8.00
Paint Disposal	$10/gal	$5.00	$10/gal	$2.00
Solvent Cost	1 gal @ $3/gal	$3.00	.3 gal @ $3/gal	$1.00
Solvent Disposal	$10/gal	$10.00	$10/gal	$3.00
Cleaning Labor	15 min @ $20/hr	$5.00	n/a	$0.00
Cost	**per Batch**	**$48.00**	**per Purge**	**$15.00**
$48.00 per batch x 3 batches per shift x 2 shifts per day x 250 production days per year			$15.00 per purge x 1 purge per shift x 2 shifts per day x 250 production days per year	
Cost per Year		**$72,000.00**		**$7,500.00**

Cost Savings: $64,500/year

on investment calculators to help determine if installing electrical equipment is right for your application. In addition to this, many utility companies provide resources, and even rebates for manufacturers that install new energy efficient equipment in the plants.

Facility Assessments

Not sure of where the trouble spots are? One effective step is to get a formal assessment done to determine where the efficiency opportunities exist in a plant. Some manufacturers may offer facility reviews to help identify product or process improvements.

The Department of Energy also has many free tools that help manufacturers through an energy efficiency process, from measuring energy use at specific points in a production line, to determining the best approach to installing more efficient equipment and developing an energy-savings plan. These include the department's Pumping System Assessment Tool, the Compressed Air Scorecard and many other energy-management resources.

Overall, developing a long-term plan is essential for manufacturers looking to achieve significant energy and bottom-line savings. Operating with the most energy-efficient equipment available may provide the largest savings, but no opportunity is too small, because it all adds up.

Nick Strauss, Marketing Manager, Industrial Products Division,
Graco Inc., Minneapolis, MN