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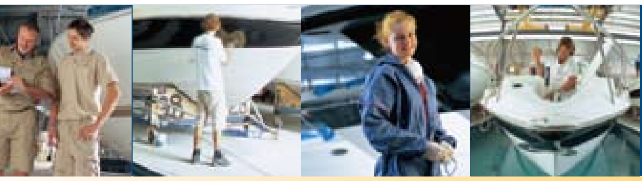
Efficient painting



Efficient painting – Are you getting good coverage for your money?

6

Eco-efficiency for the Marine Industry Fact Sheet

Do you want to

- ✓ reduce your raw material costs?
- ✓ reduce your waste disposal costs?
- ✓ improve your site's working conditions?

Save paint—improve your transfer efficiency!

Transfer efficiency is the fraction of paint leaving the spray gun that reaches the part being painted. For example, '60% efficiency' means 60% of the paint adheres, while the remaining 40% is wasted through overspray, bounceback or fogging. There are a number of eco-efficiency opportunities to improve transfer efficiency, including better operating practices, using more efficient spray coating equipment and reducing the solvent content of the paint.

Better operating practices[1,2]

To guarantee optimal transfer efficiency, operators must be properly trained and have the correct tools.

- ✓ Optimise spray width—a painter should use a spray width of 15 cm to 20 cm when painting small or narrow parts. For facilities where parts are constantly changing size, an option is to purchase a cap that allows the operator to adjust spray width quickly and easily.
- ✓ Reduce atomising air pressure where possible—when using high volume low pressure (HVLP) conventional air atomising and electrostatic technology, reduce air pressure to the lowest possible levels. For airless and air-assisted airless guns, using a smaller orifice can achieve the same painting results at a better transfer efficiency.
- ✓ Reduce fluid pressure—if fluid pressure is higher than necessary, transfer efficiencies will reduce. In electrostatic technology, unnecessarily high fluid pressure can prevent the coating from wrapping the parts properly.
- ✓ Reduce leading and trailing edges—operators may set the spray guns so that they trigger sooner or cease later than necessary. Even a small decrease in leading and trailing edges can result in significant improvements in transfer efficiency.
- ✓ Proper gun setup—use the paint gun manufacturer's suggested air cap and fluid tip combination for the viscosity of the product being sprayed. Check the spray gun to see that it produces a proper spray pattern, and keep the air and fluid pressures at the lowest possible setting.
- ✓ Triggering and overlap—overlap each successive stroke (e.g. 50% for conventional spraying or 25% for airless spraying), using a crosshatch overlap when required. Trigger the spray gun at the beginning and end of each stroke, making sure that the gun is in motion before triggering. By doing this, operators can minimise the lead (the distance between the point where the pattern leaves the part and the point where the gun is untriggered), reducing overspray.

Case study: The benefits of good technique pay dividends at LeCentre[3]

Fibreglass fabricator LeCentre in Minnesota, USA, uses a mounted laser touch unit on their fibre composite spray guns. The unit has two beams that converge into one when the gun is properly positioned, ensuring accuracy and consistency in spray technique. Using this technology in conjunction with better operating practices, the business has reduced solid waste and raw material costs by nearly 28% or about $31,000 annually.

[1-3]Case study: Vision East's change from manual to robotic painting[4]

Vision East, a yacht painting facility in Finland, is now able to paint a 100ft yacht in about a week with robotic technology, a task that previously took about one month to complete.

For more information on robotic painting and coating technologies, the Queensland Department of State Development, Trade and Innovation has released a Technology Roadmap for Recreational Boat Builders (see www.sdi.qld.gov.au).

Efficient spray painting equipment

To calculate the true cost of the paint, you must estimate the transfer efficiency of the equipment you are using. Table 1 lists the transfer efficiencies of different technologies.

Table 1: Comparison of transfer efficiencies of different spray paint technology[1,2]

Technology	Approximate transfer efficiency [1] (%)	Approximate setup costs[2]	Important to consider[2]
Air *	20	$600-$2,000	High air emissions, low transfer efficiencies and high compressed air use
Airless	35	$4,500-$9,500	Low air consumption, higher maintenance requirements, poorer quality for thin coats, mostly suitable for large areas
Air-assisted airless	50	$3,000-$6,000	Better quality finish than airless, but more training and maintenance required
HVLP (high volume low pressure)	70	$600-$2,000	Sprays well into recessed areas and cavities but produces atomisation that may not be sufficient for fine finishes. May not be able to operate with high production rates
LVLP (low volume low pressure)	70	$3,000-$6,000	Sprays well into recessed areas and cavities but not as fine a finish compared to air spray
Electrostatic	75	$6,000-$9,000	Requires extra maintenance and training, not suitable for all shapes

If considering a change to a more efficient spray technology, ensure that the new equipment is trialled before committing to large capital costs. Improved transfer efficiencies and cost savings (see table 2) depend on the characteristics of a particular process, proper training and maintenance of the equipment.

Table 2: Potential savings from converting to a more efficient technology[1]

Existing technology	Air	Airless	Air-assisted airless	Electrostatic air	Electrostatic air-assisted airless	HVLP	LVLP	Electrostatic discs and bells
Air	0%	50%	65%	73%	76%	76%	77%	79%
Airless		0%	30%	46%	52%	52%	53%	59%
Air-assisted airless			0%	23%	31%	31%	33%	41%
Electrostatic air				0%	10%	10%	13%	24%
HVLP					0%	0%	3%	15%
LVLP						0%	3%	15%
Electrostatic air-assisted airless							0%	12%
Electrostatic discs and bells								0%

Example: How much could a business potentially save by converting from airless spray guns with a transfer efficiency of 35% to HVLP guns, if its current paint costs are approximately $9,000 per year.

How much of the paint that you use is actually making it onto the product?

Annual paint costs using your current spray technology ____________________	$/yr
Transfer efficiency of your current spray technology (from table 1) ____________________	%

The value of paint on the product		Annual paint costs		Transfer efficiency (from table 1)
$/yr	=	$/yr	X	______ % / 100

Example: What is the value of the paint making it onto the product for a business that currently uses airless spray guns with a transfer efficiency of 35%? Paint costs are currently $9,000 per year.

$3,150/yr on the product	=	$9,000 /yr	X	35% / 100

How much could you save in paint costs by switching to a more efficient technology?

Saving in paint costs		Annual paint costs		Potential savings (from table 2)
$/yr	=	$/yr	X	%

Example: How much could the business above save in paint costs by switching to HVLP guns with a transfer efficiency of 70%?

$4,680/yr	=	$9,000 /yr	X	52% / 100

Therefore, $4,680/yr in paint savings is possible by converting from air assisted to HVLP technology.
Note that this example does not consider changes in operating and maintenance costs.

High solids paints

Conventional solvent-based liquid paints include volatile organic compounds (VOCs), which evaporate during and after application, and a solid component that remains on the part. Therefore, estimated painting costs should be based on the fraction of paint solid and not the price per litre. Using paint with a higher solid content requires fewer applications for the required film thickness, but increases the paint viscosity. Sometimes paint with a higher solids content, although more expensive per litre, may be cheaper per boat, while also reducing the amount of VOCs released to the atmosphere.

Example: A business uses a topcoat on 500 boats annually (each 12m²). The paint costs $12/L and contains 40% solids by volume. A suitable alternative has been identified that costs $15/L, with a solids component of 60% by volume. Determine which paint is more cost-effective.

$$\frac{\text{\$ price per litre x 100}}{\text{\% of solids}} = \text{cost of paint per solid (\$/L)}$$

Case 1: Existing paint	Case 2: Alternative paint
$\frac{12/L \times 100}{40\%}$ = $30/L of solid	$\frac{15/L \times 100}{60\%}$ = $25/L of solid
Selecting paint 2 would provide a saving of $5/L of solid	
What is your business' cost of paint per solid? $/L x 100 = $__________/L %	

Cost per surface area (e.g. $/m²) is a useful measure of painting efficiency and can be estimated using the desired surface thickness.

Example: Using the previously determined paint costs, estimate the costs per year for the two kinds of paints.

To find the cost of paint per m^2: ($/L of paint solids) x (surface thickness in mm) = cost in $/$m^2$

To find the annual cost of paint: (cost in $/$m^2$) x (surface area in m^2/boat) x (boats/y) = costs in $/y

Case 1: Existing paint	Case 2: Alternative paint
$30/L x 0.05mm = $1.50/$m^2$ Each boat requires 12 m^2 of painting There are 500 boats per year Cost: $1.50/$m^2$ x 12 m^2/boat x 500 boats/y = $9,000/y	$25 x 0.05mm = $1.25/$m^2$ Each boat requires 12 m^2 of painting There are 500 boats per year Cost: $1.25/m2 x 12 m2/boat x 500 boats/y = $7,500/y
Therefore an annual saving of $1,500 is achieved by using Paint 2. A 33% reduction in VOC emissions also occurs.	
What are your paint costs? (assuming 100% transfer efficiency) _________ $/L x ________ mm x ________ m^2/boat x _______ boats/y = ______ $/y	

Note—higher solids paints may require a paint heater to reduce viscosity and the film thickness maybe possibly more difficult to control.

Catalysed paints

Two-component or catalysed paints are an alternative to organic solvent-based paints and are applied by mixing two low-viscosity liquids, just prior to application. One liquid contains a reactive resin and the other a catalyst to promote polymerisation of the resins. Such coats can greatly reduce or eliminate solvent use and are capable of curing at low temperatures.[5]

Water-based paints

Many manufacturers are now concentrating on water-based coatings that use water as a solvent, thus reducing VOC emissions and waste disposal costs, lowering the possible risk of fire hazards and making cleanup easier. However, water-based paints may require stainless steel painting equipment, a cleaner surface and longer drying times than solvent-based paints.[5] Water-based paints are particularly suitable for inflatable boats as they will not crack.

Case study: International Paint produces low VOC primer and paints for fibreglass boats

International Paint produces a low VOC Fibreglass No Sand Primer that can be used below the waterline. The primer eliminates the need for sanding by creating a chemical bond between the gelcoat and the first coat of paint and has virtually no odour. Waste may also be cleaned with water. The primer is to be used with the water-based ablative antifouling paint 'Micron Optima'. Ablative antifouling coatings continuously release fresh biocides, and thus eliminate paint build-up on the boat's surface when additional coats are added. Conventional paints, however, lock in biocides, and often require sandblasting after several coats. Note that water-based products may not be suitable for high speed craft, where the paint can thin prematurely. [6]

'There is a growing need for low VOC products. We at International Paint are focusing our development efforts on products that are safe for the environment and safe for the user to apply in order to remain a global player.'
Steve Schultz, Global Market Development Director, International Paint. [7]

Antifouling paints for the future

- Copolymers are 'strings' of alternating, repeating chemical units. One unit contains a toxin and the other a binder allowing the paint to slowly dissolve away, layer by layer, to expose fresh toxicant. When the paint dissolves, there is no need for sanding or abrasive blasting to prepare the surface before applying fresh paint. Further information on alternative paints and their performance can be found at www.dockwalk.com/issues/2003/may/paint2.shtml
- Natural biocides are extracted from marine animals and plants such as seaweed, sea grasses, sponges, sea squirts and coral. At least 50 natural substances have been identified as potentially useful antifoulants.[8] Research is currently being undertaken to isolate the compounds active in local red seaweeds. [9]
- Incorporation of metabolically active bacteria or enzymes into paints is currently being researched by the University of NSW, to deliver bacteria or enzymes into coating systems that prevent marine organisms from adhering to the surface.[10]
- Non-stick coatings that reduce the strength of adhesion of different organisms, such as silicone, can be effective on vessels that move regularly and at speeds that enable them to self-clean (e.g. high speed catamarans). Teflon has not proven as effective as originally expected because of its microstructure, which allows micro-organisms to attach. It is, however, popular with racers, as the smooth surface greatly reduces the drag co-efficient.[11]
- Nanotechnology is being developed aimed at producing surfaces that are difficult for fouling organisms to settle upon, using properties such as surface conductivity, porosity, roughness, wettability, friction, physical and chemical reactivity. Scientists from BASF are collaborating with researchers from 14 countries to develop this technology during a five-year project that was launched in 2005.[12]
- Electrical systems and sounding devices can prevent fouling by creating a difference in the charge between the hull and the sea water. Currently, this is an expensive system, can be easily damaged and can create a higher corrosion risk.[13] Sounding devices use small electronic nodes installed inside the hull to create a low-frequency shield to keep the hull free of growth.[14]

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For further information

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Eco-efficiency Project Officer
Marine Industries and Fibre Composites Group
Department of Tourism, Regional Development and Industry
Telephone: 07 3227 5756
marine@dtrdi.qld.gov.au
www.marine.industry.qld.gov.au

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