TEN STEPS TO MORE GREEN FOR WOOD

TO A GREAT FINISH, ENVIROMENTAL EQUIPMENT

COMPLIANCE AND MAXIMUM PROFITABILITY

SAMES KREMLIN Inc.
45001 5 Mile Rd.
Plymouth, MI 48170
Phone: (734) 979-0100
Fax: (734) 927-0064

www.exel-na.com

October, 2009
Revision D

Table of Contents

1.0 A Great Finish - Your customers demand it!

1.1 Background

Today, the consumer is well educated and has many choices. This has created a consumer that intelligently buys on value. They want a great product that meets their budget. And a great product demands a great finish!

Unfortunately, it is not uncommon to see large resources spent on building the great product and often not enough on the final phase, the finish. Yet the finish is the first thing that hits the eyes of the potential consumer.

A great finish does not necessarily require high costs. It requires good planning.

In wood finishing, planning is especially important. Finishing wood is much more complex than finishing metal or plastic. This is because the substrate, the wood is alive.

This ten-step guide is designed to demonstrate the many ideas that can be applied to finishing equipment to increase the finishing quality, reduce finishing costs, increase productivity, reduce pollution, reduce waste and meet environmental regulation.

This article does not cover coatings, which is best left to coating suppliers.

2.0 Ten Steps to More Green

To A Great Finish, EPA Equipment Compliance and Maximum Profitability

2.1 Step 1 - Choose the right spray gun

The single most wasteful action a finishing facility can do to increase finishing costs, waste and pollution is to purchase a conventional spray gun. It typically delivers only 25% of the paint to the substrate and the remaining 75% goes to your filters, floor, booth walls, atmosphere and waste.

This is why in the US; NESHAP virtually eliminates the conventional gun from medium to large wood furniture manufacturers and we recommend the same to the smaller facilities.

Why is the conventional gun still available today?

The initial up-front cost of the conventional gun is low, and a good quality spray gun can still deliver among the best finish quality in the industry.

2.1.1 Criteria for Selecting a Right Spray Gun

There are a number of factors to consider when selecting the correct spray gun for the job. Below is a table that outlines some of the features and benefits of available spray technologies.

Table 1 - Features and benefits of various spray technologies

	Conventional	HVLP	Airmix®/NGAA*	OGAA*	Airless
Finish Quality	Extra Fine	Fine at low flow rates	Fine	Medium	Coarse
Productivity	0 to 30 oz./min.	0 to 15 oz./min	4 to 40 oz./min	4 to 40 oz./min.	10 oz./min. and up
Application Transfer Efficiency	Low	20% better than conventional	35% better than conventional	30% better than conventional	20% better than conventional
NESHAP Compliant	No	Yes	Yes	Yes	Yes
Booth Maintenance	Very high due to high overspray	Mid level due to some overspray	Very low due to very low overspray	Low due to low overspray	Mid level due to some overspray
Pattern adjustment	Yes – Full	Yes – Full	Yes – Partial	Yes – Partial	No
Operating & Purchase Cost	Highest	High	Lowest	Low	High

NGAA – New Generation Air Assisted Airless

OGAA – Old Generation Air Assisted Airless

2.1.2 What is the right gun for a wood finisher?

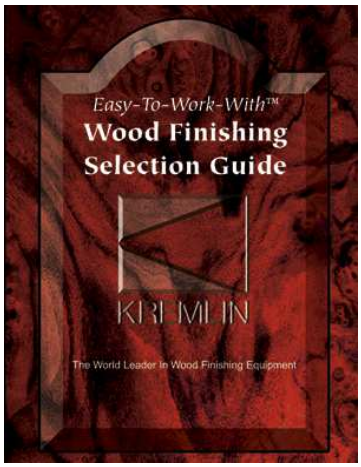
There is no one answer to this question. To simply recommend one gun for all coatings and production requirements is like recommending the same eyeglasses for every person in need. Each spray application must be evaluated, and then proper equipment recommendations can be made.

However, ninety-five percent of wood product manufacturers can meet their finishing requirements with the combined use of two compliant technologies:

- HVLP for NGR or Dye Stains
- Airmix® or NG AA for all other coatings

To ensure that these recommendations fit your needs contact your equipment supplier for a personal assessment and an opportunity to try the new compliant technologies.

A few manufacturers have a wood finishing guide to help you choose your own equipment. Here is Kremlin's.



Typical performance of coatings with different spray equipment

Square feet coverage at one mil with different Spray Technologies

Solids Content of the Paint	ATE at production flowrates for Various Technologies		Coverage with one gallon of paint
17%	30%	Conventional	80 sq. ft.
17%	45%	Airless	120 sq. ft.
17%	65%	HVLP	173 sq. ft.
17%	70%	OGAA	186 sq. ft.
65%	30%	Conventional	306 sq. ft.
65%	45%	Airless	460 sq. ft.
65%	65%	HVLP	664 sq. ft.
65%	70%	OGAA	715 sq. ft.
65%	78%	Airmix®/NGAA	797 sq. ft.

2.2 Step 2 - Choose the right tip/nozzle/aircap for the job

Having the right high-performance vehicle without the right tires is as bad as having the wrong vehicle. Outside of equipment supplier error, there are three areas where an operator can have a poor-performing tip/nozzle/aircap.

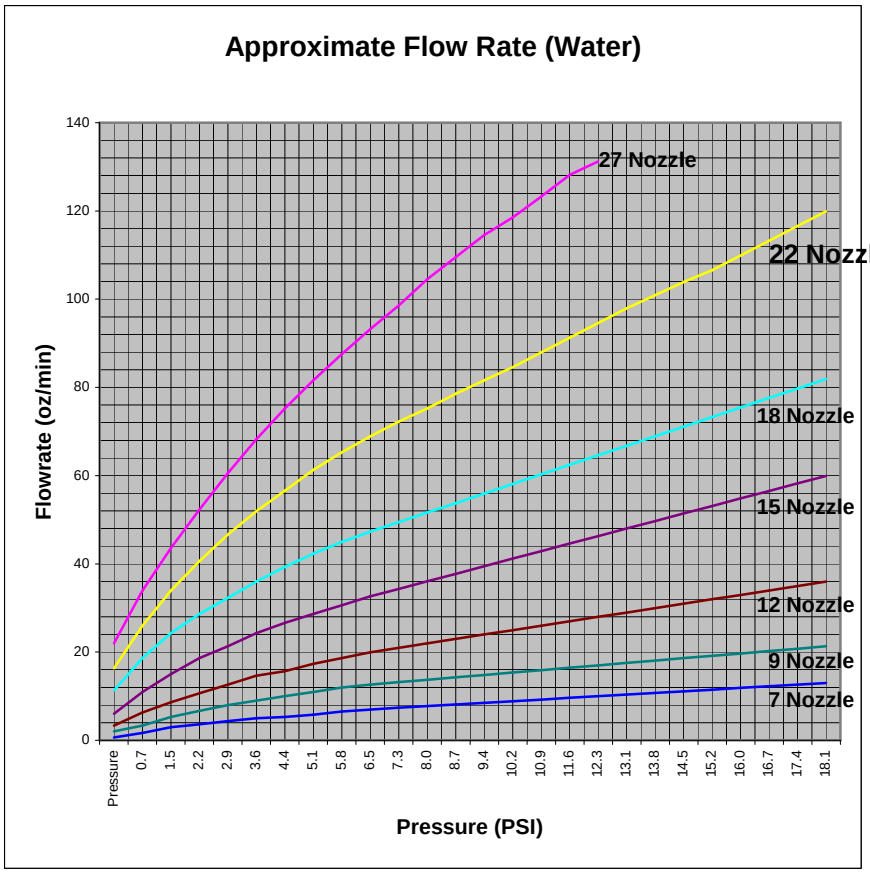
(1) The gun has been moved to new location. We can now have an operation that requires higher flowrates, or the coating is of different viscosity and hence requires a different nozzle.

(2) Increased/decreased production. If the gun was purchased during a slow period and now the production has increased 25 to 50% or vice versa, it is time to look at the tip/nozzle/aircap.

(3) Overused. If the tip/nozzle/aircap has not been replaced in over a year, it is time to replace them.

In any of these circumstances, the wrong tip/nozzle/aircap means paint waste, lower productivity and poor finish quality.

For example, below is a graph or flowrate of water vs. fluid pressure with different nozzles. A 7 nozzle will never flow over 14 ounces per minute. If the viscosity of the coating being sprayed is greater than water this figure is further reduced.



For HVLP, the operator is balancing finish quality against fluid flow control. If the nozzle is too small the required fluid delivery will be too low and the fluid velocity too high thus resulting in poor atomization. If a nozzle is too large, the back pressure is insufficient causing fluctuating flowrates. Some finishers turn the needle in to increase back pressure which affects finish quality. The result is again poor finish quality.

Similar results occur with the Airmix® or air/assist airless technologies.

2.3 Step 3 - Choose the right hose for the job

The guns mentioned above require two hoses, the fluid hose and the air hose.

2.3.1 Fluid

Choosing the right fluid hose for the job means balancing four things:

(1) Pressure Loss. Will it be large enough to deliver the necessary fluid to the gun?

If we are using an HVLP gun, we usually have no more than up to 10psi allowable pressure loss. For design purposes pressure loss in excess of 10psi is too noticeable on the gun and will cause quality problems. In Table below, for a 25 ft hose, the smallest hose possible is 1/4".

For Airmix® or NGAA where the feed pressure can go much higher, pressure loss is less critical. A loss of 100 psi will not affect finish quality. In Table below, for a 25 ft hose, the smallest hose is 3/16".

(2) Waste generation. Choosing a hose larger than necessary creates unnecessary waste.

For instance, in the example above for an HVLP gun, a 3/8" hose will typically generate 147 gallons (0.59 tons) of additional waste per year.

For the Airmix®/NGAA going from a 3/8 to 3/16 hose results in a savings of over 110 gallons per year (0.44 tons) or going from 1/4" to 3/16" results in a savings of 30.5 gallons per year (0.12 tons).

If you have 10 guns online the waste grows proportionally.

(3) Engineered for the job. The burst pressure rating must be 5 times that of the operating pressure limit and for Airmix®/NGAA it must be grounded.

(4) Ergonomics. A good hose must be both flexible and light. The smaller the hose the more flexible and lighter it will be. Some companies have even added a "whip" hose to the end of the fluid hose to lighten the hose for the operator. A "whip" hose is usually a 3-foot hose with a smaller diameter for easier gun handling.

Table 2 - Fluid hose performance characteristics

Hose Diameter Inches	Volume Ounces/foot	Waste (1) Gallons/yr	Pressure Loss (2) psi/ft
3/4"	2.95	598	0.004
1/2"	1.31	265	0.06
3/8"	0.73	147	0.09
1/4"	0.33	67	0.41
3/16"	0.18	36.5	1.29
1/8"	0.08	16.2	6.55

(1) Four Flushes per day, 5 days a week, 25ft of hose

(2) 24 sec. #2 Zahn, 15 ounces/min.

2.3 Air Hose

For the air hose, a well-designed system will balance pressure loss with ergonomics. A HVLP system demands about 20 cfm to operate and a 5/16" air hose is recommended while the Airmix®/NGAA system uses only 3 to 5 cfm and will operate with a 3/16" air hose. This lightens the gun for the operator.

2.4 Step 4 - Choose the right feed system

There are basically five different forms of fluid feed systems. They are:

- The suction cups
- The gravity cups
- The pressure pot/cup
- The local feed pumps
- The remotely located feed pump

2.4.1 Criteria for Selecting the right feed system

There a number of factors to consider when selecting the right feed system for the job. They are:

- Volume of fluid being transferred
- Number of colors
- Coating's tendency to settle out
- Pressure requirements at the spray station
- Two component paint pot life

Why not use pressure pots for everything?

After gravity and suction cups, pressure pots are the simplest and least expensive (purchase price) feed systems available and consequently they are the most common among the local feed systems.

However, filling, color changing, priming and cleaning with a pressure pot is awkward and time consuming when compared to a pump system. Pressure pots can also be the dirtiest feed systems because of the excessive handling of the pot covers causing particles to collect on the suction rod and agitator. Dry particles on the cover and tank wall can be deposited into the fresh coating and find its way onto the finish.

A pump system is much easier to handle, delivers higher productivity, is cleaner and if the pump is selected correctly reduces pollution.

2.4.2 What is the right feed system for a wood finisher?

The same logic that applied to the selection of the gun applies to the selection of the right feed system. A small wood finisher does not need the same feed system as a large wood finisher. Each finishing operation requires a personal evaluation.

However, many general statements can be made that apply to most finishers.

2.4.3 Feed System Recommendation for the Hobbyist Wood finisher

We assume that the primary concern for a hobbyist are resources and not productivity. For a hobbyist using our recommended gravity gun, he simply needs the gravity cup.

2.4.4 Feed System Recommendation for the small wood finisher

Productivity and paint cost are beginning to be an important component of finishing for a facility of this size.

Feed system selection for facilities of this size depend on the financial resources of the shop, the finish quality needs, the productivity needs and the waste & pollution reduction needs. Typically, we find that a small wood finisher keeps all his coatings at the booth and needs only localized feed systems.

For a small wood finisher, we recommend the following:

NGR or Dye Stain

A small facility may wish to apply multiple stains and need ability to change stains quickly and conveniently, yet not have the resources for multiple feed systems. For this reason, we recommend a pressure pot, HVLP gun and 5/16" air and 1/4" fluid hose.

All other coatings

We recommend a small wall mounted pump feeding an Airmix®/NGAA gun with 3/16" fluid and 3/16" air and fluid hoses.

2.4.5 Feed System Recommendations for a medium to large wood finisher

A medium to large wood finisher has higher productivity requirements and paint cost and labor are an important component to the overall cost of the product.

Facilities of this size will need more planning in the selection of their feed system. What is the cost of moving fluid from a storage area to the booths, what are the factory insurance allowances, what does OSHA require, what are the hazards of moving fluids and how can the sprayer's job be made easier.

Typically, for a medium to large wood finisher we recommend the construction of a paint kitchen. The paint kitchen serves two functions; as a safe storage area for all hazardous fluids; and a central point for almost all coating pumps.

It is beyond the scope of this guide to propose the ideal feed system for all facilities. We recommend when planning an efficient cost-effective system that your equipment supplier be contacted.

In a very general sense, the typical medium to large finisher will have a wall mounted recirculation system with filtration located in the paint kitchen.

For small batch colors, a small booth mounted piston or diaphragm pump is recommended.

Note : Increasingly, 2K coatings a being used in the wood industry. Typically, they are hot potted, however, automatic metering machines are now available to mix these 2K coatings at precise proportions. Consult your equipment supplier.

2.5 Step 5 - Choose heat when applicable

Heat brings many benefits to sealer and topcoat finishers. A heated recirculation system will provide:

(1) Higher finish quality. The paint is warmer and hence will flow much better than when it is applied cold

(2) Consistent Finish quality. Spray at the same temperature all year long. No more temperature fluctuations from the cool morning to the hot afternoon.

(3) Increase transfer efficiency. Since the fluid is warmer, the particles are easier to break up and less compressed air is required to atomize the paint. With lower atomization air the result is higher transfer efficiency.

(4) Increase productivity. With heat the fluid needs less or no reducing and can be applied thicker. The result is a material that flows as well as thinned material but thickens quickly as it cools, reducing the possibility of runs. This feature allows the operator to apply a thicker film per pass without sacrificing quality.

(5) Reduces HAP emissions. HAPs are reduced for two reasons; less reducer is required, and the equipment is more efficient.

Note: If you are using a 2K coatings consult your coating supplier. Heat accelerates the cure cycle.

2.6 Step 6 - Choose the right agitation equipment

Except for NGR or Dye Stains, coatings solids will settle out and cause finish quality problems. Non NGR or Dye stains are especially sensitive to this. Good agitation such as air driven agitators on drums or five-gallon covers are a must for these coatings.

Some waterbornes are less prone to settling and do not require the same level of agitation. In some cases, too much agitation creates foaming and can introduce air into the fluid lines. In these cases, use gear driven agitation with large paddles for soft agitation can be used.

2.7 Step 7 - Choose the right compressed air feed system

A poor compressed air system can introduce dirt onto the finished product. To avoid this source of dirt we recommend some basic steps:

1. Drain the water from the air compressor on a regular basis.
2. Install pre-filters before the refrigerant dryer
3. Install a refrigerant dryer located near the compressor to remove excessive water condensation that not only affects finish quality but also the performance of the pumps.
4. Install a final filter and desiccant drier near but outside the booth for final particle and condensation removal.

Note : Filters, under sized hoses and piping will create pressure drops thus reducing the performance of the equipment. Choose the size, accordingly, see table below.

Table 3 - Air consumption of typical finishing equipment

Equipment	Air consumption
HVLP Gun	20 to 25 CFM
Airmix® Gun	4 CFM
Air/assisted airless	6 CFM
Agitators	8 to 15 CFM
Large Pumps (Paint Kitchen)	10 to 25 CFM
Small Pumps (Booth mounted)	2 to 7 CFM

2.8 Step 8 - Use the right safety equipment for your painters

A good sprayer is a valuable asset and their protection is critical. The following equipment is recommended for sprayers:

1. Respirators or fresh air systems.
2. Lint free paint suit and hoods. In a well-designed finishing room where the sanding is completely separated from the finishing, a lint free paint suit for the sprayers, especially the topcoat booths will help reduce dirt.
3. Barrier creams or gloves. These keep the hands clean and free of dirt.
4. Eye wash stations.
5. Fire extinguishers & sprinklers. Fire in a finishing facility is very common occurrence.

2.9 Step 9 - Optimize your paint booth

It is very common in the wood industry to see booths that have not been maintained. Every booth system should have as a minimum:

1. Good ventilation. OSHA requires that at the point when the filters are dirty, the average face velocity of the booth be no less than 100 fpm for manual booths and 60 fpm for automatic booths.

Too much ventilation and the application transfer efficiency of the spray equipment is affected resulting in increase coating cost. Too little and the booth does not meet code.

The right balance is required.

2. Good lighting. A great finish requires good lighting to ensure that the operators sees all surfaces of the work they are finishing.
3. Select the proper filter. The cheapest filter is not the best choice when looking to reduce operating costs. Choose a filter that can carry a larger load and hence reduce the labor cost of filter replacement and the cost of disposal.

Selecting the proper filter will also protect the booth fan making cleaning easier and booth performance more reliable.

Use pressurization meters to help operators identify the time of filter replacement.

4. Good cleaning practice. With the air movement created by the booth ventilation and the spray guns, (especially HVLP) a regular booth-cleaning program will reduce rejects caused by dirt and the hazards of spontaneous combustion. The program should include the use of a vacuum and cleaning the fan.

2.10 Step 10 - Train your finishing staff

2.10.1 Introduction

The best tools in the world are worthless if the users are not trained and willing to adapt to them.

Training reduces finishing costs by 30%.

Training results in greater finish quality.

Training increases loyalty.

Training Pays!

In Germany and France, a finisher is a certified profession. They go through more than 2 years of wood finishing training before they begin their career.

There are many sources of training. If you have someone already skilled in finishing, then you can rely on your own in-house training program or you can contact your coating or equipment supplier, they sometime have schools or can direct you to the local finishing schools.