SOLVENT SELECTION AND CLEANING GUIDE FOR ELECTROSTATIC EQUIPMENT

INTRODUCTION

Research Engineers are continuously working to improve the electrostatic coating processes and equipment, including techniques, service and the overall transfer efficiency.

This guide provides insight on the importance of solvents in the paint to improve electrostatic spray ability. It also helps the user to understand how to measure coating resistivity. We explain the differences of polar and non-polar solvents how they affect the electrostatic charge.

Controlled Paint Resistivity - A Factor in Formulation

Electrical resistivity is a characteristic which must be built into the paint formulation. It has generally been found that most materials can be adjusted to have suitable resistance requirements.

No single, simple characteristic or adjustment provides optimum spray ability for any given coating. However adjustment of paint resistivity through appropriate selection of solvents improves many paints. Otherwise these paints could not be sprayed efficiently by the electrostatic process.

Solvent Classification for Electrostatic Usage

Solvents maybe classified as POLAR or NON-POLAR. For our purposes, the differences in polarity between different solvents provides a means to adjust the total resistivity of a paint mixture.

NON-POLAR solvents normally do not improve spray ability. These solvents include aliphatic and aromatic hydrocarbons. Chlorinated solvents and the terpenes.

The addition of POLAR solvents compatible with the base coating material often improves electrostatic spray ability. POLAR solvents include the keystones, alcohols, glycol ethers, esters, and nitroparaffins.

Basic definitions for POLAR and NON-POLAR Solvents in the Application of Electrostatics

POLAR solvents are extremely electrically conductive. NON-POLAR solvents exhibit electrical resistance and have low electrical conductivity to none.

Viscosity Guide for testing Resistivity of Materials

The initial paint formulation should be of high viscosity (preferably exceeding 50 seconds on a No. 4 Ford Cup.) so that the reduced formula will have satisfactorily high solids content after solvents are added. It is usually best to adjust viscosity after resistivity, since viscosity is a less critical factor for electrostatic spray ability.

Procedure for Electrical Resistance Adjustment of Coating Formulations

General Procedure:

1. Formulate paint sample with high viscosity, preferably exceeding 50 seconds using No. 4 Ford Cup.
2. After thorough mixing, measure the resistance of the unreduced paint with any one of the following test instruments as available.
   - (76652-03) Paint Test Meter, Paint Probe and Test Leads
   - (76652-04) Paint Test Meter, Deluxe with Paint Probe, Test Leads High Voltage Probe

Procedure for Electrical Resistance Adjustment of Coating Formulations (Cont.)

Follow test procedure instructions provided with the test equipment. Record resistance reading. If resistance is above recommended values (Table 1), procced to steps 3 and 4. If resistance is below the (Table 1) values, proceed to step 5.

3. Add minimum amounts of preferred solvents to adjust paint resistivity to the optimum range. Several trials may be necessary. (See section on solvent classification on page 3 Table 2.)

4. Adjust viscosity by adding the minimum amount of a non-polar solvent to obtain the desired film flow characteristics.

5. When measured resistance is below the desired value, add nonpolar solvents to adjust resistivity.

Resistance Adjustments by Solvent Selection

Non-polar solvents may be used as extenders to vary paint viscosity or flow properties without seriously changing the electrical resistance of the mixture. An exception occurs with paints that are of low resistivity, for example vinyl solutions or nitrocellouse materials. The conductivity of these special mixtures may sometimes be reduced to a useable factor by the addition of non-polar solvents.

Generally, the addition of solvents of highest polarity will give the greatest electrical resistance reduction to a mixture. Solvents of intermediate polarity provide intermediate resistance reductions, etc. (Table 2) lists typical commercial available solvents in the order of there increasing polarity. Use (Table 2) as guide for the selection of solvents to adjust resistance of the paint to the desired spray-ability range as indicated. The Adjustment of paint to the specify optimum ranges will usually improve its spray-ability.

A specific selection should be based on the best compromise to obtain the desired resistivity, viscosity, flowrate, evaporation rate, cost and other conventionally considered factors.

Evaporation Rate vs. Electrostatic Equipment Used

Ransburg No. 2 Process disk equipment requires slower formulations than normally used for conventional hand air guns. The larger the disk diameter and the higher the speed rotation, the slower the evaporation rate should be made. No. 2 Process bells requires paints in about the same evaporation as for conventional air gun, while the No. 2 Process handguns require still faster solvents.

Because of complex interactions of solvents, resins, and binders, it may happen that a solvent of certain polarity will reduce the mixture resistance more than equal amount of a second solvent which has higher polarity. As these reactions are not always predictable, the adjustment of resistivity is necessarily a guided trial and error procedure.

TABLE 1 - APPLICATOR MODELS

	VECTOR, EVOLVER	RANSFLEX	NO. 2 HAND GUN	TURBODISK	AEROBELL 168/268 AEROBELL 33	RMA SERIES
RECOMMENDED VISCOSITY USING A ZAHN NO. 2 CUP	18 TO 30 SEC	18 TO 30 SEC	20 TO 60 SEC	20 TO 60 SEC	20 TO 60 SEC	20 TO 60 SEC
PAINT ELECTRICAL RESISTANCE**	.1 M ohm TO ∞	.1 M ohm TO ∞	.1 M ohm TO 1 M ohm	.1 M ohm TO ∞	.1 M ohm TO ∞	.1 M ohm TO ∞
RECOMMENDED DELIVERY (UP TO)	1000 cc/min	1500 cc/min	180 cc/min	1000 cc/min	500 cc/min	1000 cc/min

TABLE 2 - GUIDE TO USABLE SOLVENT SELECTION

Chemical Name	Common Name	Category	*CAS Number	Flash Point†† (TCC)	Evap. Rate†	Elec. Res.**
DICHLOROMETHANE	Methylene Chloride	Chlorinated Solvents	75-09-2		**14.5**	HIGH
MYTHYL ACETATE		Esters	79-20-9	90°F	**5.3**	LOW
VM & P NAPHTHA	Naptha	Aliphatic Hydrocarbons	803-232-4	65°F	**10**	HIGH
ACETONE		Ketones	67-64-1	-18°F	**5.6**	LOW
BENZENE		Aromatic Hydrocarbons	71-43-2	12°F	**5.1**	HIGH
ETHYL ACETATE		Esters	141-78-6	24°F	**3.9**	MEDIUM
2-BUTANONE	MEK	Ketones	78-93-3	16°F	**3.8**	MEDIUM
ISO-PROPYL ACETATE		Esters	108-21-4	35°F	**3.4**	LOW
ISOPROPYL ALCOHOL	IPA	Alcohols	67-63-0	53°F	**2.5**	LOW
2-PENTANONE	MPK	Ketones	107-87-9	104°F	**2.5**	MEDIUM
METHANOL	Methyl Alcohol	Alcohols	67-56-1	50°F	**2.1**	LOW
PROPYL ACETATE	n-Propyl Acetate	Esters	109-60-4	55°F	**2.1**	LOW
TOLUOL	Toluene	Aromatic Hydrocarbons	108-88-3	48°F	**1.9**	HIGH
METHYL ISOBUTYL KETONE	MIBK	Ketones	108-10-1	60°F	**1.6**	MEDIUM
ISOBUTYL ACETATE		Esters	110-19-0	69°F	**1.5**	LOW
ETHANOL	Ethyl Alcohol	Alcohols	64-17-5		**1.4**	LOW
BUTYL ACETATE		**Esters**	**123-86-4**	**78°F**	**1.0**	**LOW**
ETHYLBENZENE		Aromatic Hydrocarbons	100-41-4	64°F	**.89**	HIGH
1-PROPANOL	n-Propyl Alcohol	Alcohols	71-23-8	74°F	**.86**	LOW
2-BUTANOL	sec.-Butyl Alcohol	Alcohols	78-92-2	72°F	**.81**	LOW
XYLOL	Xylene	Aromatic Hydrocarbons	133-02-07	79°F	**.80**	HIGH
AMYL ACETATE		Esters	628-63-7	106°F	**.67**	MEDIUM
2-METHYLPROPANOL	iso-Butyl Alcohol	Alcohols	78-83-1	82°F	**.62**	LOW
METHYL AMYL ACETATE		Esters	108-84-9	96°F	**.50**	LOW
5-METHYL-2-HEXANONE	MIAK	Ketones	110-12-3	96°F	**.50**	MEDIUM
1-BUTANOL	n-Butyl Alcohol	Alcohols	71-36-3	95°F	**.43**	LOW
2-ETHOXYETHANOL		Glycol Ethers	110-80-5	164°F	**.38**	LOW
2-HEPTANONE	MAK	Ketones	110-43-0	102°F	**.40**	MEDIUM
CYCLOHEXANONE		Ketones	108-94-1	111°F	**.29**	MEDIUM
AROMATIC-100	SC#100	Aromatic Hydrocarbons		111°F	**.20**	HIGH
DIISOBUTYL KETONE	DIBK	Ketones	108-83-8	120°F	**.19**	MEDIUM
1-PENTANOL	Amyl Alcohol	Alcohols	71-41-0		**.15**	LOW
DIACETONE ALCOHOL		Ketones	123-42-2	133°F	**.12**	LOW
2-BUTOXYETHANOL	Butyl Cellosolve	Glycol Ethers	111-76-2	154°F	**.07**	LOW
CYCLOHEXANOL		Alcohols	108-93-0	111°F	**.05**	LOW
AROMATIC-150	SC#150	Aromatic Hydrocarbons		149°F	**.004**	HIGH
AROMATIC-200		Aromatic Hydrocarbons		203°F	**.003**	HIGH

FASTER ↑ SLOWER ↓

Figure 1: Paint and solvent specifications

NOTES:
* CAS Number: Chemical Abstract Service Number.
** Using the Ransburg Meter.
*** Solventborne Configuration Only.
† Information Obtained From: http://solvdb.ncms.org
†† The lowest temperatureat which a volatile material will ignite
Evaporation Rate is Based Upon Butyl Acetate Having a Rate of 1.0

GENERAL CLEANING GUIDE FOR PLASTICS USED IN ELECTROSTATICS APPLICATIONS ADDRESSING SOLVENT AND CITRUS BASED WATERBORNE SOLUTIONS

Cleaning of Plastic Electrostatic Applicator Parts Using Solvents

Plastics that are used in manufacturing of the electrostatic equipment are selected to withstand all solvents commonly used in the coating industry as shown in our solvent selection guide. Some exceptions are related to the cleaning process involved in repairs and soaking of the part to remove the paint. Its recommended not to allow plastic parts to sit soaking in solvents longer than 20 minutes. We also warn against plastic parts being soaked in heated solvents for more than 10 minutes. While we realize that users clean parts in the solvent best suited to break down paint residue, its important that the surface of the parts when clean be wiped down with non-polar solvent. Polar solvents can conduct electricity on surfaces even though they have been dried. This conductive surface can allow unwanted current to leak across during operation of applicator. This power leakage can result in excessive current draw and or component failure over period time.

Heated and Non-Heated Citrus Based Cleaners.

Using citrus based cleaners to remove waterborne paint residue from plastic electrostatic parts has become popular. While they have been cited as less harmful to the environment than petroleum based solvents, they sometimes cause damage to plastic parts of electrostatic applicators, especially when the citrus based cleaners are heated, primarily used in conjunction with water based paints.

Unfortunately the citrus cleaners can damage the plastic part if pH level is not balanced correctly. We have seen issues with brittleness, rough surfaces and cracking from pH not being controlled. This is problematic when parts are soaked for longer than 10-15 minutes in both heated and non-heated solutions.

If using ultrasonic feature with cleaner tank we are suggesting parts don't remain in heated cleaner longer than 10 minutes.

To minimize risk of both parts and the user, citrus cleaner temperatures should not exceed 120F (49C)

Once parts are out of the solution we recommend using de-ionized water flush to remove the conductive citrus cleaner from the plastic electrostatic part.

We have seen some citrus cleaners when even flushed with deionized water, the parts surface, is still conductive and may require final non-polar solvent wipe before re-assembly of the Electrostatic part back into the applicator.

This conductive surface can allow unwanted current to leakage across during operation. Thus reducing the benefits of HV transfer to the material being applied.

Overall the surface charging from conductive cleaning solution can result in excessive current draw and or component failure over period time.

Final Recommendations on Cleaning Plastic E-Stat Parts.

Regardless of the E-Stat cleaning solution used, ie.. solvent, citrus based or other. Its recommended to perform final wipe down of the part using a non-polar solvent as shown on our solvent guide. Reducing surface conductivity will extend the life of the E-Stat applicator. The goal is to eliminate surface charging on the E-Stat part keep the charge focused on the material being applied.

If there are any issues or concerns on cleaning plastic Electrostatic parts or assemblies feel free to contact customer support locations noted on page 5. We will gladly help answer questions on best practices on cleaning Electrostatic parts or assemblies.

For technical assistance or to locate an authorized distributor, contact one of our international sales and customer support locations.

Region	Industrial / Automotive	Automotive Refinishing
Americas	Tel: 1-800-992-4657 Fax: 1-888-246-5732	Tel: 1-800-445-3988 Fax: 1-800-445-6643
Europe, Africa Middle East, India	Tel: +44 (0)1202 571 111 Fax: +44 (0)1202 573 488	
China	Tel: +8621-3373 0108 Fax: +8621-3373 0308	
Japan	Tel: +81 45 785 6421 Fax: +81 45 785 6517	
Australia	Tel: +61 (0) 2 8525 7555 Fax: +61 (0) 2 8525 7575	

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