Coating Application

JK Surface Coatings Pvt. Ltd.

Introduction

One of the most important step in coating management is the Paint application process which includes

- Proper mixing
- Proper Induction Time
- Respect Pot Life
- Appropriate application technique (Brush/Spray/Roller)
- Right time interval between coats
- Appropriate dry/cure time for service
- Appropriate inspection at Wet and Dry Stage

Curing/ Drying Mechanisms

- Solvent Loss
- Air Reaction
- Radiation Curing
- Chemical Reaction
- Epoxy , Polyurethane

Classification of Paint Application Techniques

- **Manual Methods**
  - Brush
  - Roller
- **Spray Techniques**
  - Air Spray
  - HVLP
  - Airless
  - Air Assisted
  - Electrostatic
  - Air spray
  - Air Assisted
- **Alternative Coating Methods**
  - Electroplating
  - Galvanizing
  - Powder Coating

Choice of Application

- Type of coating
- Size and type of Job
- Accessibility of areas to be coated
- Configuration of areas to be coated
- Presence of critical areas that could be damaged by overspray
- Availability of skilled workmen
- Budget constraints

Brush Application

Brushing is slower than other methods and generally used:

- For smaller jobs (new construction and maintenance) where application by roller or spray may not be feasible
- For cutting in corners or edges, and for crevices, such as pits
- In critical areas where spray application, if used, may cause damage due to overspray
- For striping of welds, rivets, bolts, nuts, edges, flanges, corners, etc.

Paint Application – By Brush

- **Advantages**
  - Applicable of Low viscosities paints and low volumes.
  - Can reach any profile
  - Least Expensive

- **Disadvantages**
  - Very Slow Application
  - No Consistency with film thickness (Non Uniform coating thickness)
  - High Fatigue to the applicator
  - Speeds of painting is generally defined by the applicator
  - Applicator is in contact with harmful solvents for longer periods of time.
  - Not suitable for High solids and low pot life paints.

Rollers

- Rollers are not as effective as spray application in applying coatings evenly and uniformly, nor are they as effective on such surfaces as hand-cleaned, rusted or pitted steel.
- Roller Application is quicker than Brush and enables semi-skilled painter to achieve a reasonable and consistent standard of finish
- Rollers are excellent for large, flat surfaces, such as tank shell or roof, floors, concrete pits, etc.

(Rollers hold much more coating than the typical brush, and application is two to three times as fast.)

Pressure Rollers :

These rollers allow for a continuous coating film by steadily supplying material from a pressurized tank directly into the roller. The roller cover is made of a perforated metal case which allows the coating to flow from inside the roller to the outer surface of the roller, where it is steadily available for application.

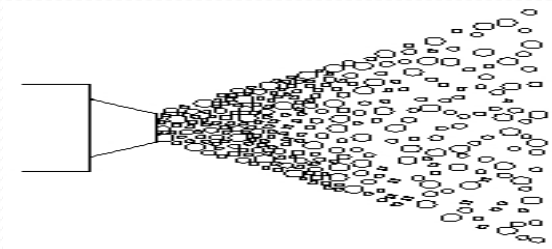
Paint Application By Rollers

- **Advantages**
- 3-4 times faster than Brush
- Suitable for Low viscosities
- Best suited for low / medium volumes
- Superior over Brush finish
- Least Expensive

- **Disadvantages**
- Slow Application
- High Fatigue to the applicator
- Speeds of painting is generally defined by the applicators skill.
- Applicator is in contact with harmful solvents for longer periods of time.
- Not suitable for High solids and low pot life paints.
- Cannot be used on all profiles

Spray Application

There are two major types of spray application:



Conventional spray –

The coating is atomized by a stream of compressed air and semi-floats to the surface on a current of air. Both air and coating enter the gun through separate passages, are mixed, and are driven through the air cap in a controlled spray pattern.

Airless spray –

The coating is atomized without the use of compressed air. The coating is pumped under high pressure to an airless spray gun, where it is forced (under high pressure) through a precisely shaped and sized opening at the front of the valve, called the orifice or spray tip, as it is being driven to the surface.

Spray Applications –derivatives

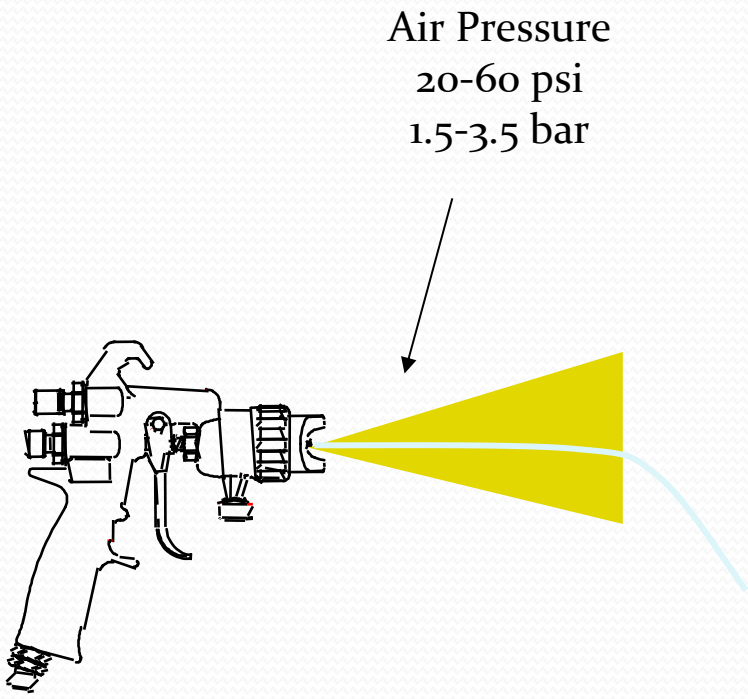
Both conventional and airless spray equipment are modified i.e.

- Plural component
- Hot spray
- Electrostatic Spray
- HVLP
- Air assisted airless

Air spray, Theory of Operation

- Air spray atomization is created by **<u>air flow</u>** disrupting a **<u>fluid stream</u>**.

- Air spray gives the finest finish quality referred to as an Automotive finish or **Class A Finish.**



Transfer efficiency = 20 - 30%

Air spray Equipment

Conventional spray equipment consists of:

- Air compressor to provide continuous
- supply of compressed air.
- Spray Pot to contain coating to be applied.
- Hoses to transport air and coating.
- Conventional gun to mix air and coating
- Air control equipment to provide supply of clean, dry air

Two hoses involved:

Air hose (usually red) transfers compressed air from the air regulator to the gun. Air hoses should not be used for coatings.

Fluid hoses (usually black) are electrically conductive so the system can be grounded. They are lined with solvent-resistant materials to prevent chemical attack.

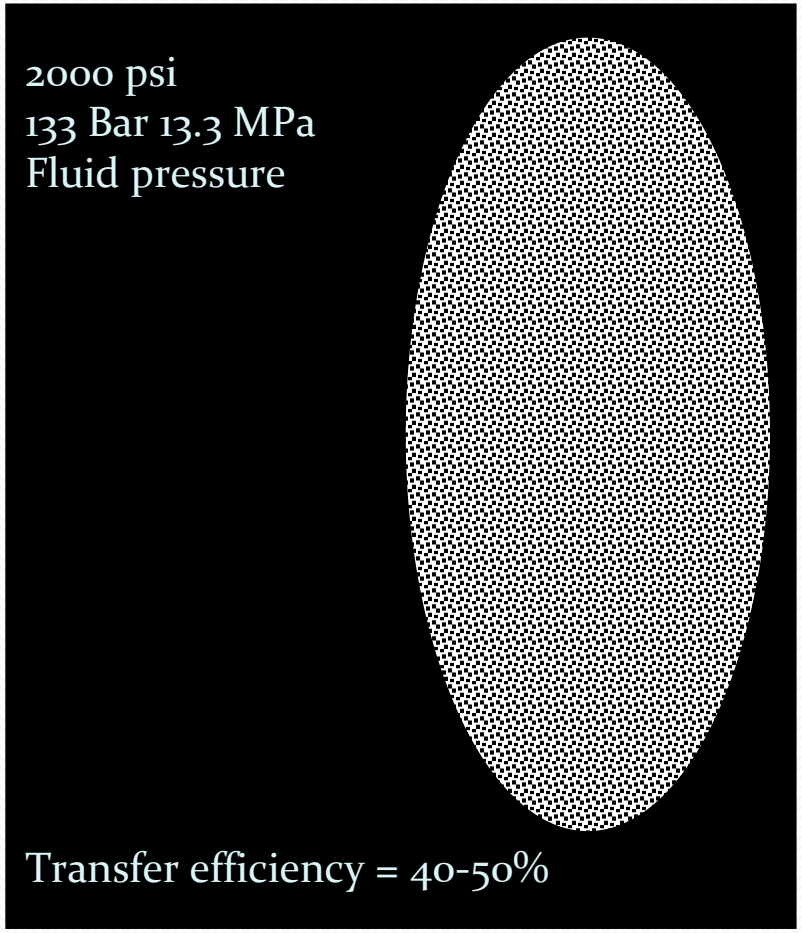
Air Spray

- **Advantages:**
  - Spray pattern is easily adjusted to almost any desired fan width
  - High-quality finishes, such as required for automobiles and/or furniture can be produced
  - Easy To Use-Simple Operation
  - Low pressure required and hence is safe in nature.

- **Disadvantages:**
  - Easy to Over atomize and cause over spray
  - Poor Transfer Efficiency.
  - Billowing and air turbulence are created by compressed air required
  - Reduction of coatings with solvent is often necessary for proper atomization, resulting in lowered DFT/coat and higher VOC.

Airless, Theory of Operation

- Airless spray atomization is created by hydraulic force pushing material through an orifice.
- As the fluid exits the orifice, friction between the fluid stream and atmosphere disrupts the stream into small particles.
- Airless spray gives the fastest and heaviest spray finish and is measured in gallons per minutes.
- Used when a protective coating is the priority.
- Higher pressure is needed for a complete pattern .



Airless Spray

ADVANTAGES

- Overspray and bounce back are reduced
- Heavier film build are usually possible
- Compressed air is not required for atomization
- Pressure pot is not required
- Equipment can be powered by air, electricity or hydraulics
- Faster production rates

DIS ADVANTAGES

- Fixed fan width.....not variable
- Little control of quantity of coating applied except by changing tips
- Difficult to coat small, intricate items because of the speed of fluid flow
- Danger of accidental injection
- More Wear and Tear

Typical Airless Applications

Airless spray -equipment

Typical direct airless spray system consists:

- Paint supply (container)
- Pump
- Filter
- Hose
- Spray gun

Airless Spray -Pump

- The spray pump draws the coating from the container and supplies it under pressure to the rest of the airless spray system. Most are reciprocating, positive-displacement types and deliver coating under pressure on the up and the down stroke.

- Pump volume is rated in gallons per minute (gpm) which is dependent on the pump displacement and the number of cycles per minute at which it operates. Usually, coating application pumps deliver between 2.5 gpm and 15 gpm.

Airless spray –pump pressure

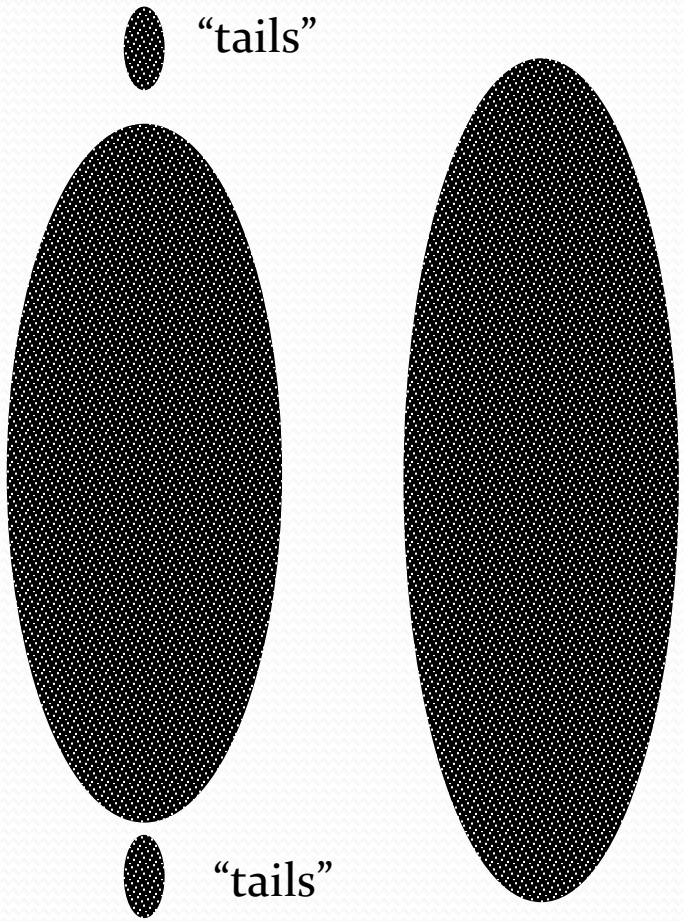
- Fluid pressure can vary from 100 to 6500 psi, depending on pump design.
- Most commonly used airless spray pumps deliver paint at pressures between 1500 to 2500 psi.
- Pumps may be driven by air, but the air does not come in contact with the paint and is not used to atomize the paint

Airless spray –pump ratio

- The pump output pressure (in psi) is dependent on the ratio of air-motor piston area to paint-pump piston area and incoming air pressure. Ex: a 30:1 pump, driven by 80psi incoming air would deliver approximately 2400 psi (30 X 80).
- Typical ratios are 25:1, 28:1, 45:1, 65:1, and 75:1.

Air-Assist, Theory

- Air-Assist spray atomization similar to airless, but less pressure
- Better finish than airless
- High flow rate
- 800+ psi fluid pressure
- ~20 psi air pressure
- Transfer efficiency = 60-65%



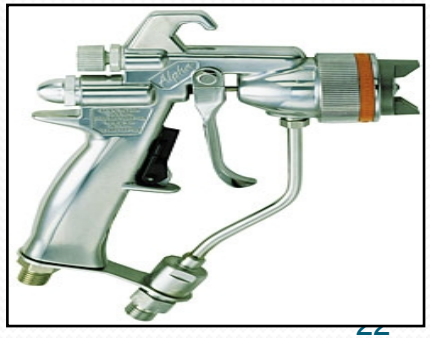
Air Assisted Airless Spray

❑ Advantages

- Reduced flow rates compared to airless
- Increase operator control due to lower fluid flow rates and pressure
- Increase finish quality due to reduced particle velocity
  - the softer the particles, the better the finish quality.
- Higher transfer efficiency.
- Reduced parts wear.

❑ Disadvantages

- Takes two hoses, air and fluid
- Higher Cost.



Airless Tip Selection Guide

Tip Is very important for Airless Application . Main controlling factors are Orifice Size and Fan Width.

Orifice Size:

- Defines the amount of paint that will flow through the tip.
- It is indicated by the last two digits. Example:17 corresponds to a hole size of 0.017 of an inch or 0.43 mm

Fan Width :

- Represented by First Digit and Width can be determined by multiplying the first digit by 2. Example if tip is 515, it means fan width is 10 inches.

Factors That CAN Influence Tip Size

- **Surface Porosity**: A more porous surface will absorb more material so a larger tip size should be used, while a sealed surface requires less material and a smaller tip size should be used.

- **Wind**: When wind conditions become strong switching to a smaller tip will help reduce excessive overspray.

- **Overspray:** If overspray is a problem for surrounding surfaces switching to a smaller tip can help.

- **Humidity:** High humidity can greatly increase dry time of the applied paint. In situations where high humidity exists, switching to a smaller tip can also reduce the likelihood of runs and sags.

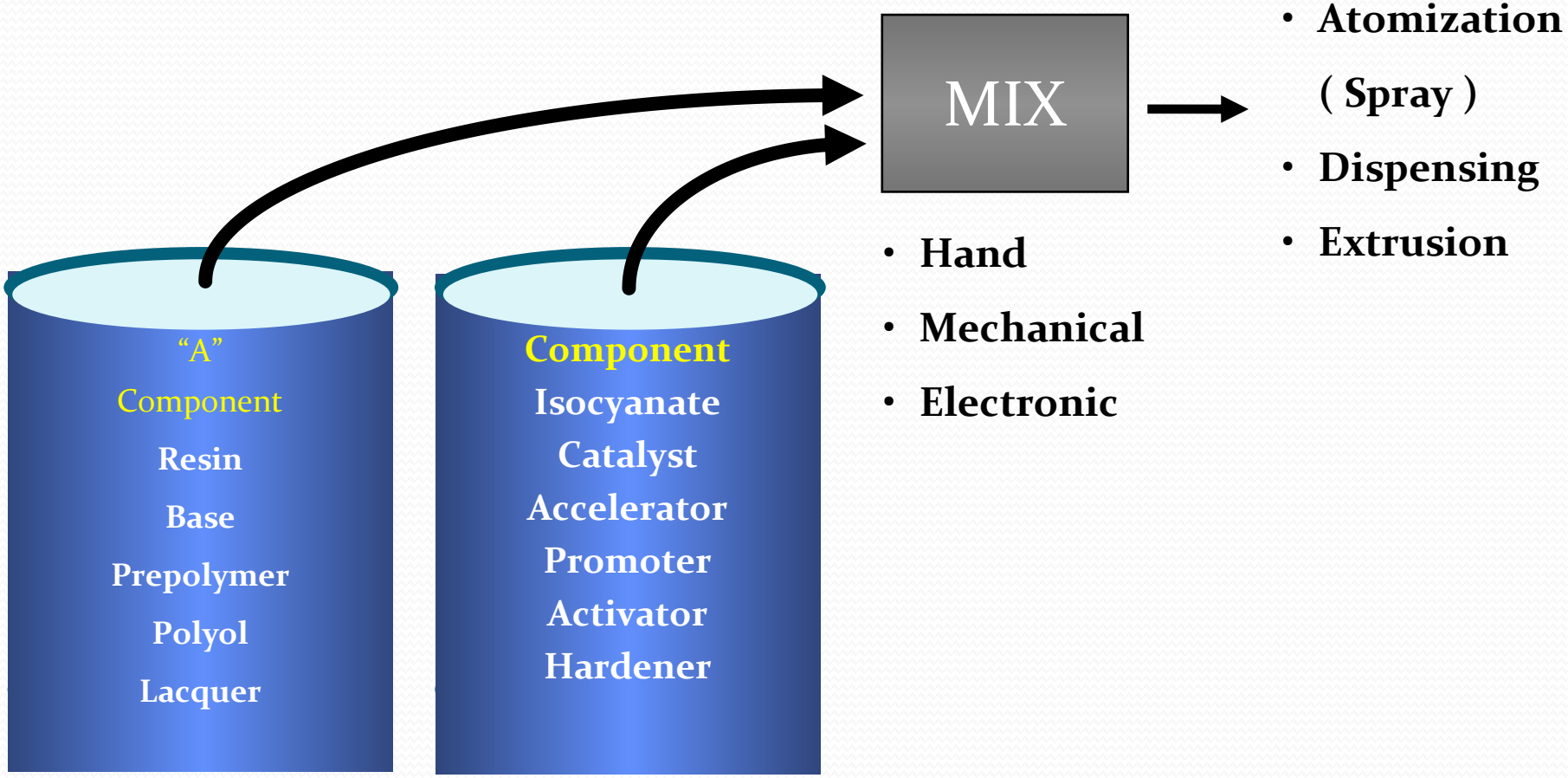
Measures To Control Bad Coverage

- Slow down Gun Speed
- Select Tip With Larger Orifice
- Select tip with Narrow Fan pattern(use 417 instead of 517)
- Hold the Gun closer to Surface

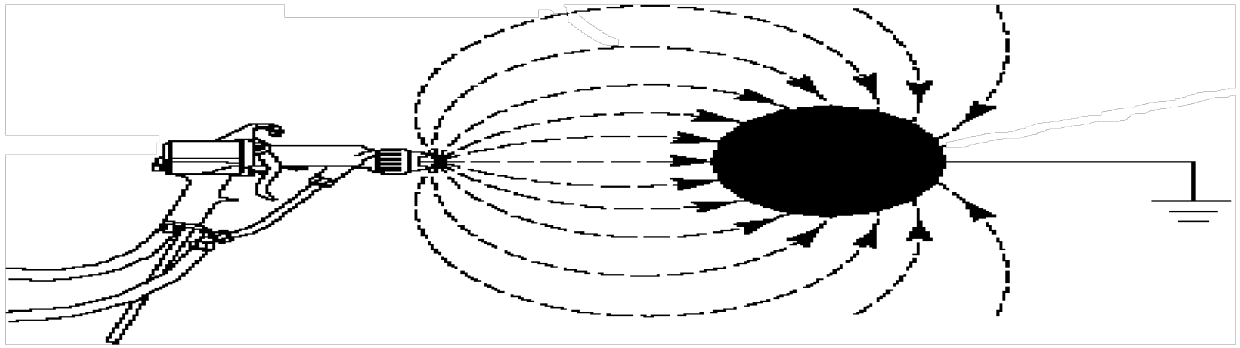
Multi Component Airless

Plural-Component Sprayer is designed to pump, mix and atomize high-viscosity, high-solids coatings with superior results.

Plural Component Materials Names



Electrostatic Technology

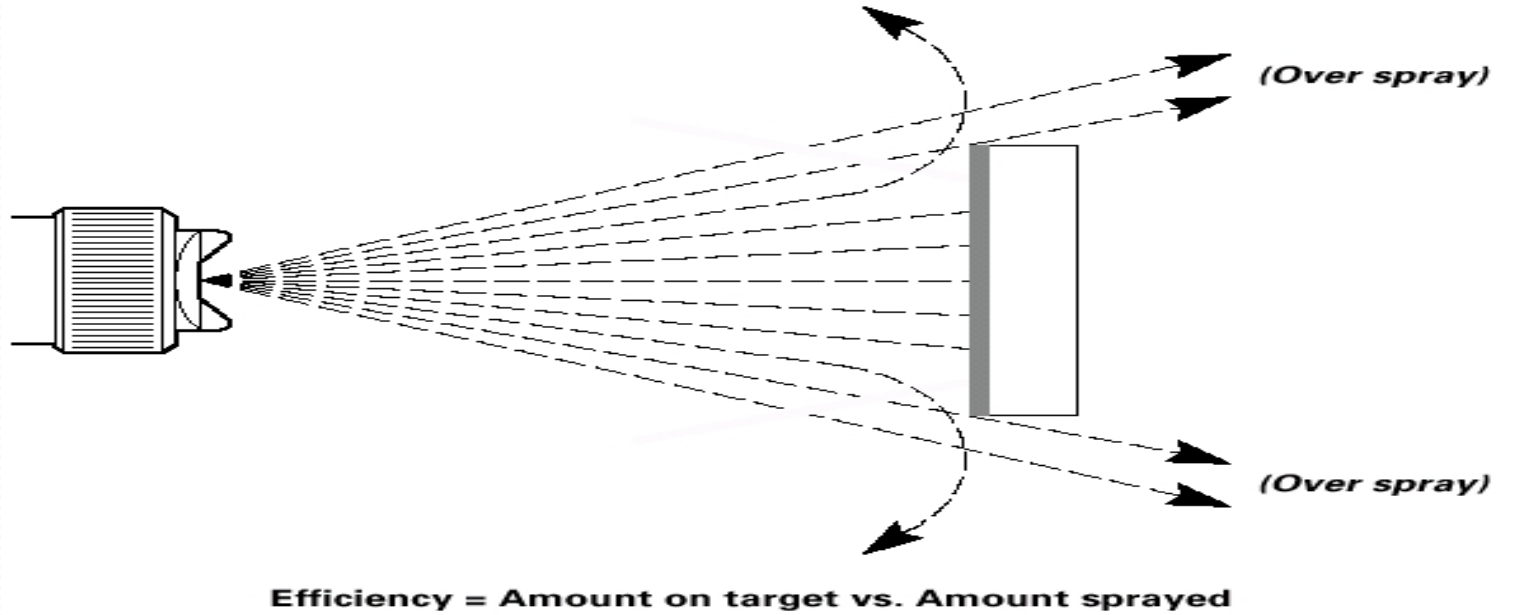


Electrostatics & Transfer Efficiency

- **Factors that effect electrostatic transfer efficiency.**

- Distance from gun to grounded part
- Gun distance should be 10 to 12 inches (250 - 300 mm) from the target
- Material conductivity
- Highly conductive (low resistivity) materials
- Shape of the target
- Corners or enclosed area cause a Faraday Cage Effect

Transfer Efficiency



- Transfer efficiency (TE) = (paint deposited on a part)/(total paint sprayed)
- TE = $(W_p/W_s) \times 100\%$

  W_p = Weight of wet coating on the part

  W_s = Weight of liquid coating sprayed

Transfer Efficiency Comparison

Application Method	Transfer Efficiency
Air Spray	30%
HVLP	45%
Airless	50-55%
Air Assisted Airless	60%
Electrostatic Air Spray	75%
Electrostatic Air Assisted Airless	85%

1500 liters of wet paint is required yearly to coat the parts. Using a 3 lbs/gal VOC material that is 10 lbs/gal overall.

Higher Transfer Efficiency

- Less solvent emissions and cost
- Less exposure of personnel to harmful solvents
- Less paint sludge to dispose
- Lower booth maintenance costs
- Less production downtime for cleanup
- Less paint handling and cost

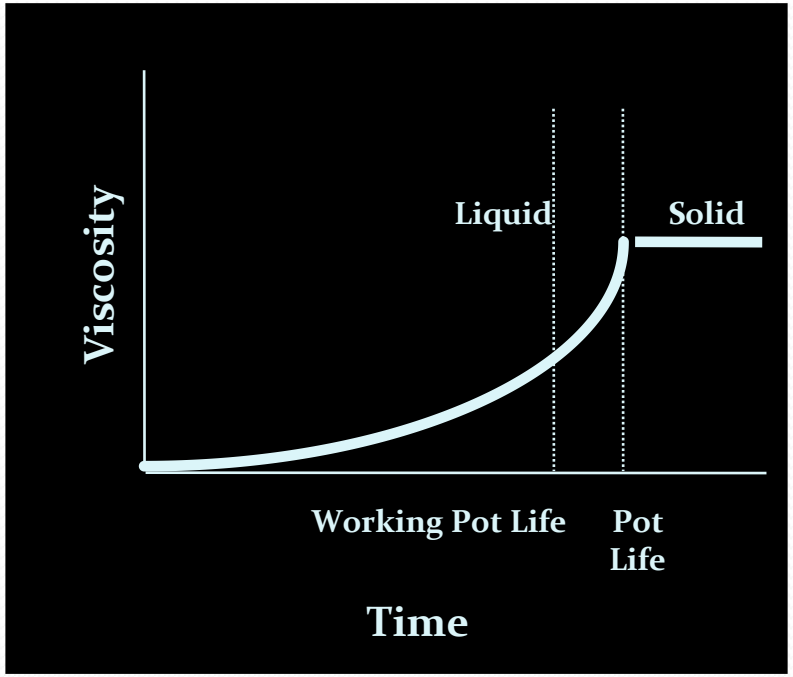
Working Pot Life / Pot Life

Working Pot Life

The period of time after mixing that the material provides *Good Application Characteristics*. a.k.a.; Spray Life for coatings.

Pot Life

The period of time prior to the material hardening.



Common Results of Faulty application

- Improper Thickness (HIGH dft is bigger problem them low DFT, due to development of stress during the coating drying and curing cycle and is more difficult to correct than low DFT)
- Pinholes

(Inability of solvent to escape from rapid cure coating, high ambient temperature resulting in faster cure)

- Overspray
- Holidays (Discontinuities)
- Pin Point Rusting

Breathing Apparatus

There are four (4) primary types of respirators available to protect the worker:

- Hood
- Air supplied
- Organic Vapor
- Dust

Breathing Apparatus

- **Hood Respirators**

Designed to cover the entire head and neck area and supply the wearer with clean, dry air. They protect the wearer from heavy concentrations of vapor, fumes, dust, and dirt that might be harmful.

- **Air-supplied Respirators**

Similar to hood respirators, but operates from an external air supply. It covers the nose and mouth only and would not provide the degree of protection against splash and spill that a full hood respirator would. Other safety equipment, such as eye protection should be worn, along with the air-supplied respirator.

Breathing Apparatus

- **Organic Vapor Respirator**

Covers the nose and mouth and is equipped with a replacement cartridge designed to remove organic vapors by chemical absorption. Not recommended for use in commercial coating operations, and must not be used in oxygen-deficient areas.

- **Dust Respirators**

Usually only used in preliminary surface preparation operations like sanding, grinding, or buffing. Not designed to remove vapors. Separate eye protection must be worn. Not to be used in oxygen-deficient areas.

THANK YOU