Fundamentals of Paint Application

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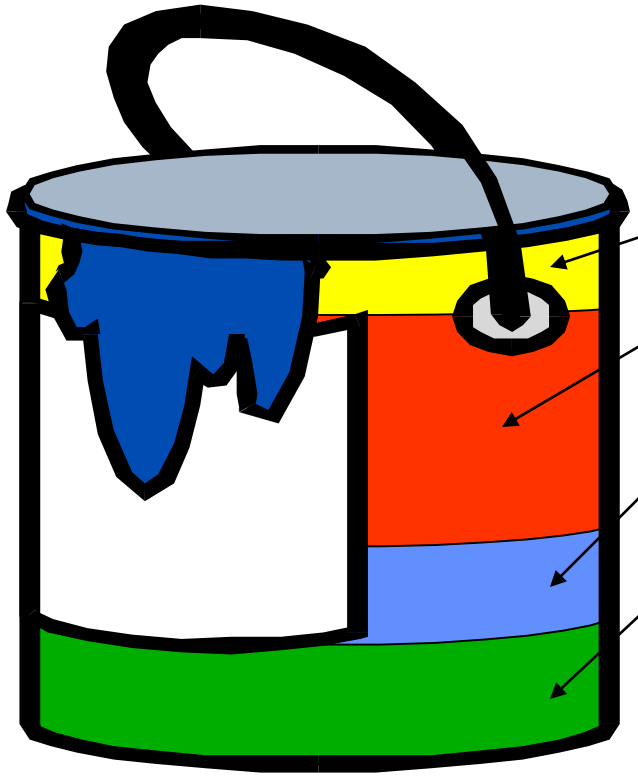
Main Coating Components



- Four components of paint:
  - Additives (0 - 5%)
  - Solvent (30 - 80%)
  - Binder, resin, or polymer (20 - 60 %)
  - Pigment (2 - 40%)

Curing/ Drying Mechanisms

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

Types of Coatings

- Conventional Solvent-borne
- High-solids Solvent-borne
- Water-borne
- Plural Component
- Powder

Classification of Paint Application Techniques

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

Paint Application – By Brush

- Advantages

1. Applicable of Low viscosities paints and low volumes.
2. Can reach any profile
3. Least Expensive

- Disadvantages

1. Very Slow Application
2. No Consistancy with film thickness (Non Uniform coating thickness)
3. High Fatigue to the applicator
4. Speeds of painting is generally defined by the applicator
5. Applicator is in contact with harmful solvents for longer periods of time.
6. Not suitable for High solids and low pot life paints.

Paint Application – By Roller

- **Advantages**

1. 3-4 times faster than Brush
2. Suitable for Low viscosities
3. Best suited for low / medium volumes
4. Superior over Brush finish
5. Least Expensive

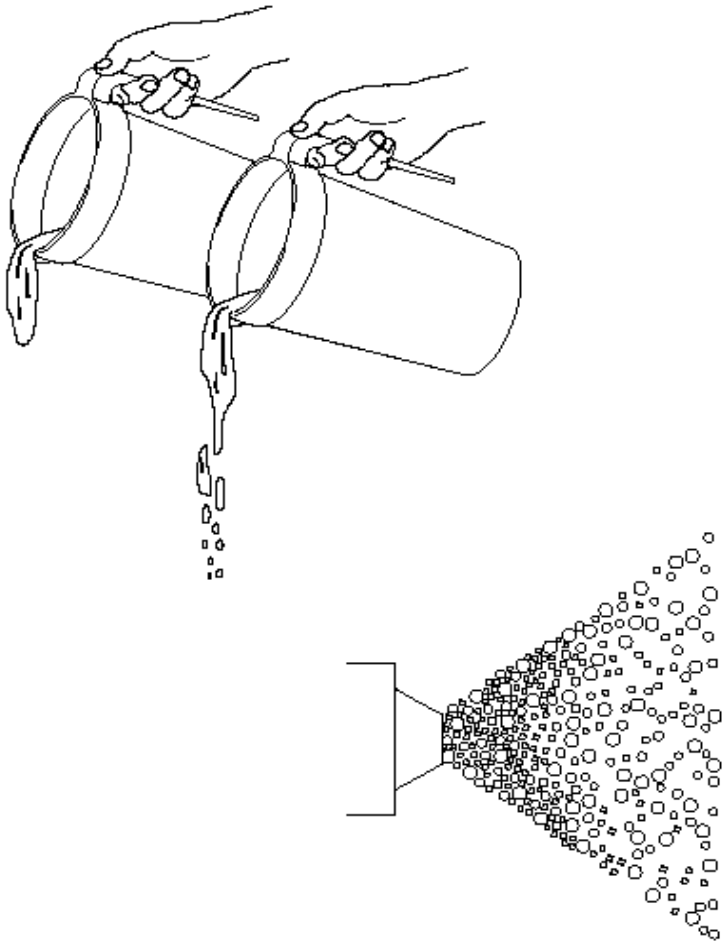
- **Disadvantages**

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

Spray Application

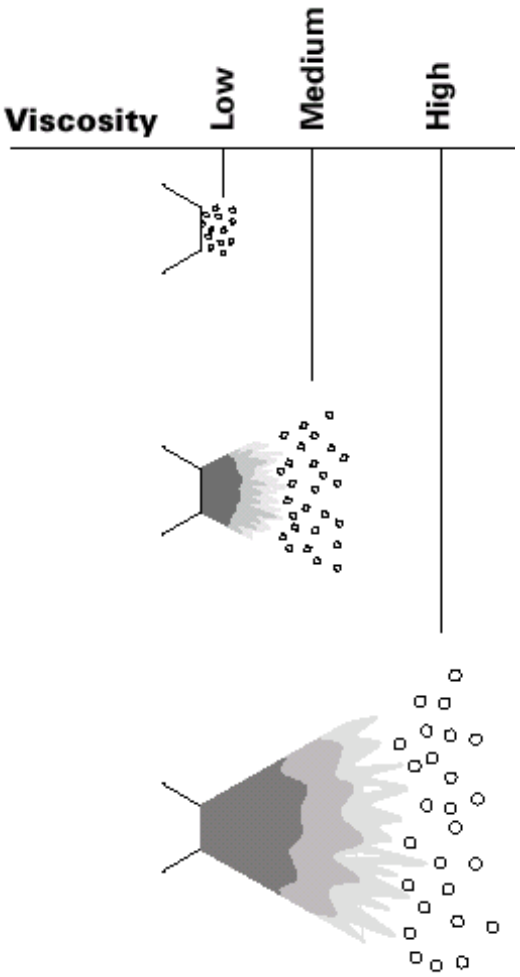
Atomization is:

- Breaking up fluid into small particles
- Collection of moving particles on surface is known as spray
- Spray pattern can be created by variety of means

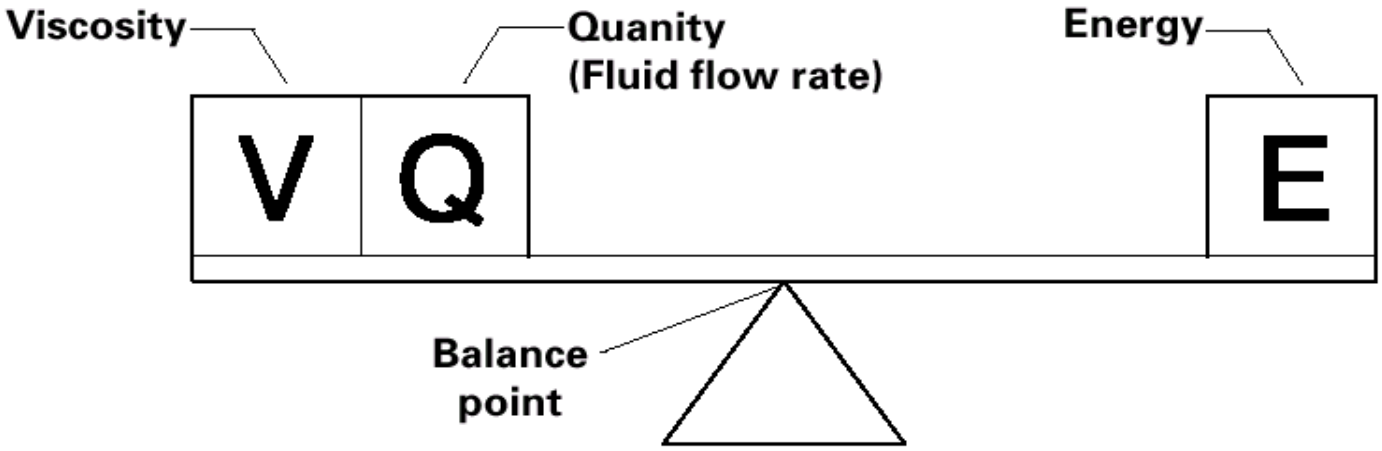


Fluid Properties & Particle Size

- Fluid viscosity
- Density
- Surface Tension of the paint.



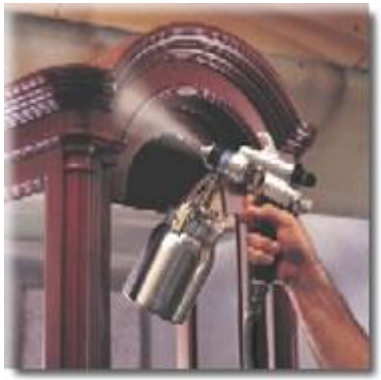
Adjusting Atomization



- Viscosity
- Quantity - fluid flow rate
- Energy - air and/or fluid pressure required to atomize the paint.

Liquid Spray Application

Types of Atomization



Air Spray/ HVLP

Airless

Air Assisted

Electrostatic

Low Pressure Application

- Generally use **Airspray Conventional** or **HVLP**
- Common applications:
  - Decorative coating
  - Primers
  - Top Coats
  - Clear Coats
  - Stains

Air Spray Atomization

Advantages	Limitations
Fine finish quality.	Easy to over-atomize and cause excessive overspray.
Flexible -- operator control of all aspects of atomization including pressure, fan width, and fluid delivery.	Typically, too much control for inexperienced operator. Takes an experienced operator to set-up the gun for optimum performance
Inexpensive equipment required	Purchased due to price too many times.
Easy to use. Simple operation	easy to operate outside of the guns design limits.
Low pressure safety.	Not recommended for protective coating application,
Typically thought of as the only way to get a good finish.	Transfer efficiency is poor, cannot handle high solids paints.

KEY MATERIALS

Enamels
Epoxies
Urethanes
High Solids
Plural Components

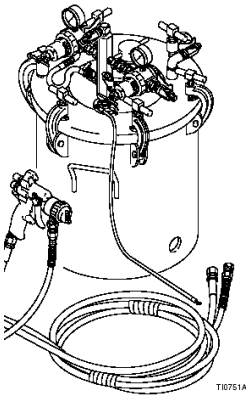
KEY TECHNOLOGIES

Conventional Air Spray
High Volume Low Pressure (HVLP)
Air-Assisted
Electrostatic Air Spray
Electrostatic Air-Assisted

KEY INDUSTRIES

Aerospace
Auto Assembly
Auto Feeder
Bus
Farm & Construction
General Metal
Rail Car
Truck

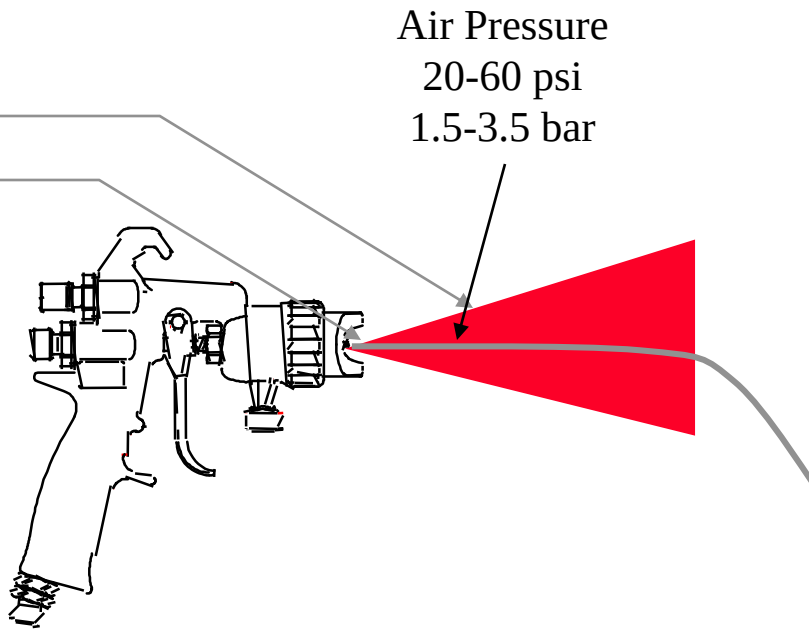
Different Air Spray Applications Equipment



- Gravity Feed system
- Siphon Feed System
- Pressure Pot Feed system
- Low Pressure Pump feed system

Airspray, Theory of Operation

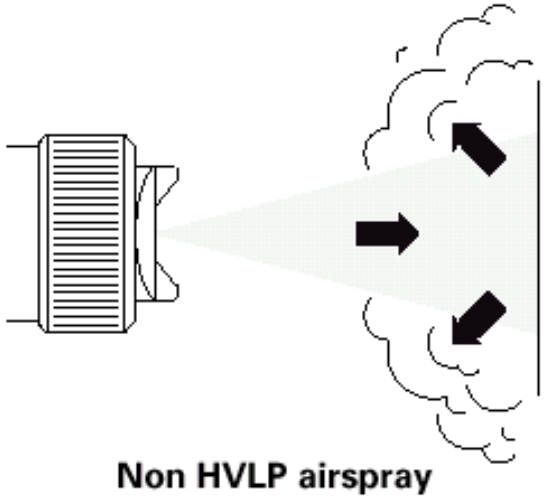
- Airspray atomization is created by **air flow** disrupting a **fluid stream**.
- Airspray gives the finest finish quality referred to as an Automotive finish or **Class A Finish.**

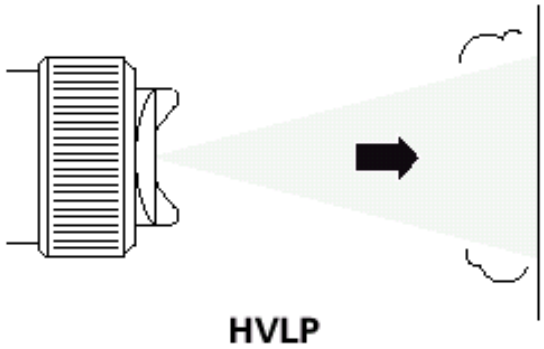


Transfer efficiency = 20 - 30%

HVLP Theory

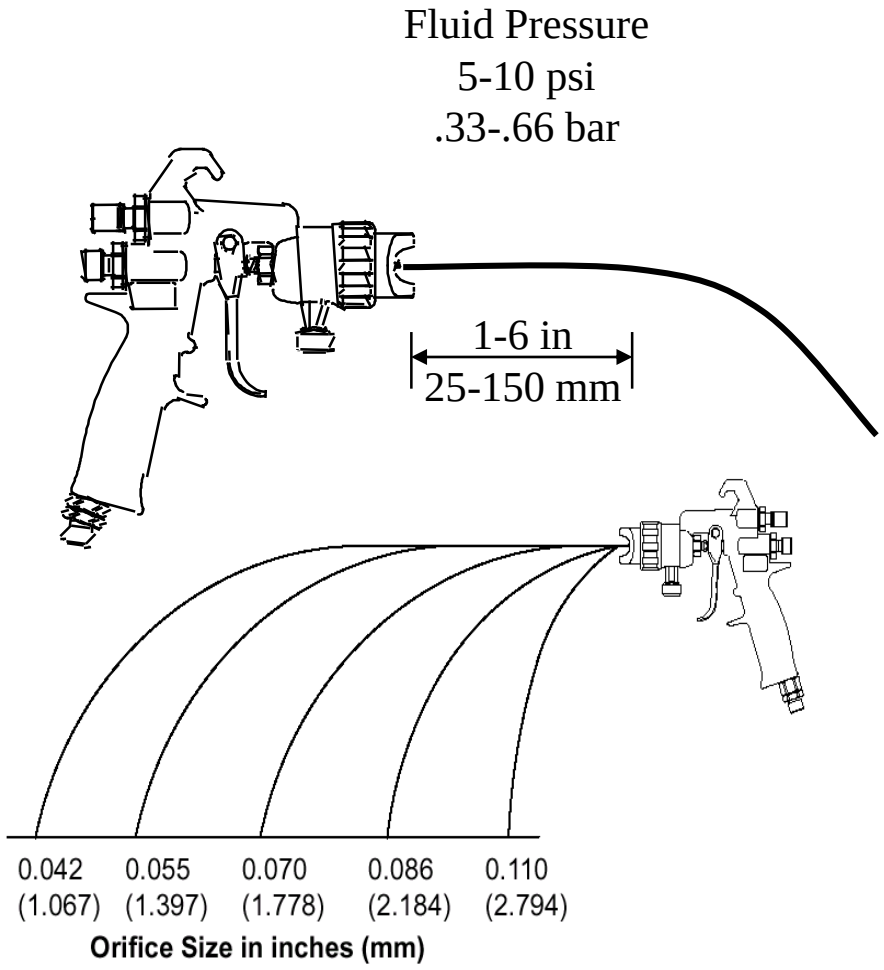
- Similar to airspray
- High volume, low pressure
- Atomizing air limited to 10 psi
- Air consumption 20 scfm
- HVLP reduces or eliminates bounce back
- Environmental compliant





HVLP Setting Fluid Stream

- Apply fluid pressure to create an 1-6 inch fluid stream
- Different materials - different fluid pressures
- Measured in ounces per minute (cc/minute)



Airless, Theory of Operation

- Airless spray atomization - hydraulic force through a cats eye shaped orifice
- 2000+ psi fluid pressure
- Fastest and heaviest spray finish and is measured in liters per minutes
- Transfer efficiency =

  50-60%
- Protective coatings

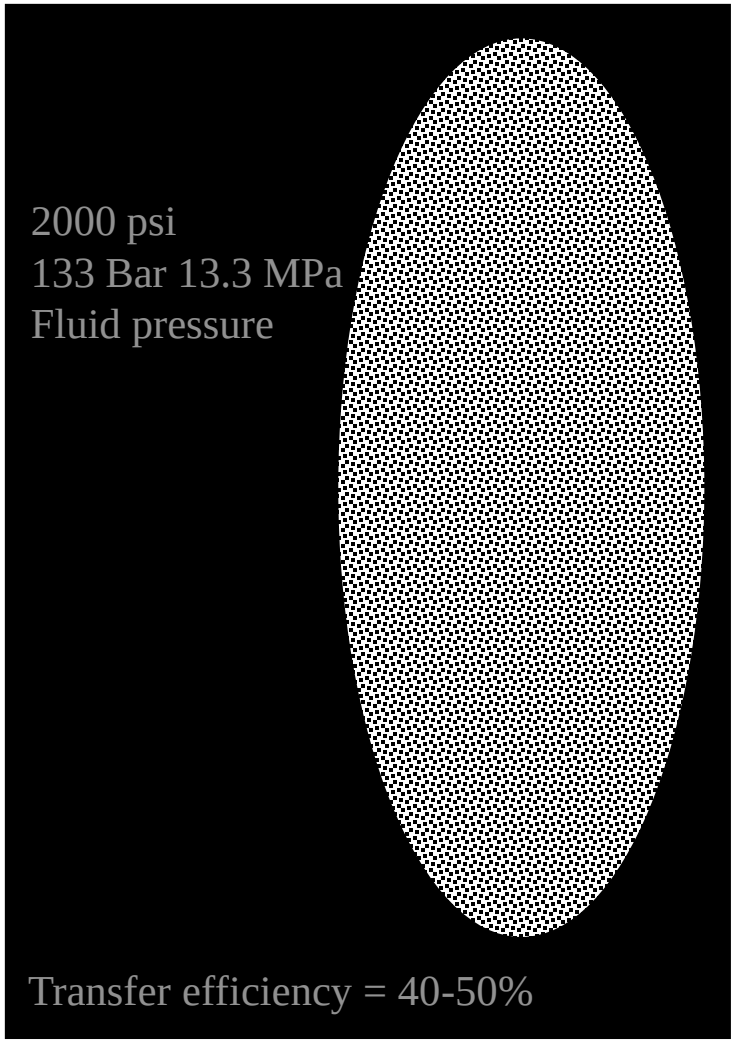
2000+ psi fluid pressure

Transfer efficiency = 50 - 60%

Click to see spray

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 Application

Advantages

- High Productivity
- Bonding between the Coating and surface to be coated
- Penetration of coating into the blasted profile.
- Very Low chances for coating failure
- High Transfer Efficiency

Disadvantages

- Applicable where surface finish quality is not the criteria.
- Not suitable for small job works where less than 5ltr of paint is consumed in one batch
- Expensive Equipment
- Required skilled operator technique

Typical Airless Applications

Application Equipment &Applications

Airless Sprayer Product Family

80:1

33:1

Zinc 24:1

80:1

AA 41:1

Choosing the Right TIP.

- Choosing the right tip is important for maximum productivity – Tip determines the fluid flow and size of the spray pattern
- Right tip results in maximum control and minimum over spray
- It is easy to determine which tip size to use when you know the material you will be spraying.
- Need to know the maximum flow rate of the Pump- * (Flow rate of the pump should always be higher than the flow of the tip)
- Recommended Best Fan size for the Job
- **Recommended Tip Recommended Tip Sizes for Common Coating**

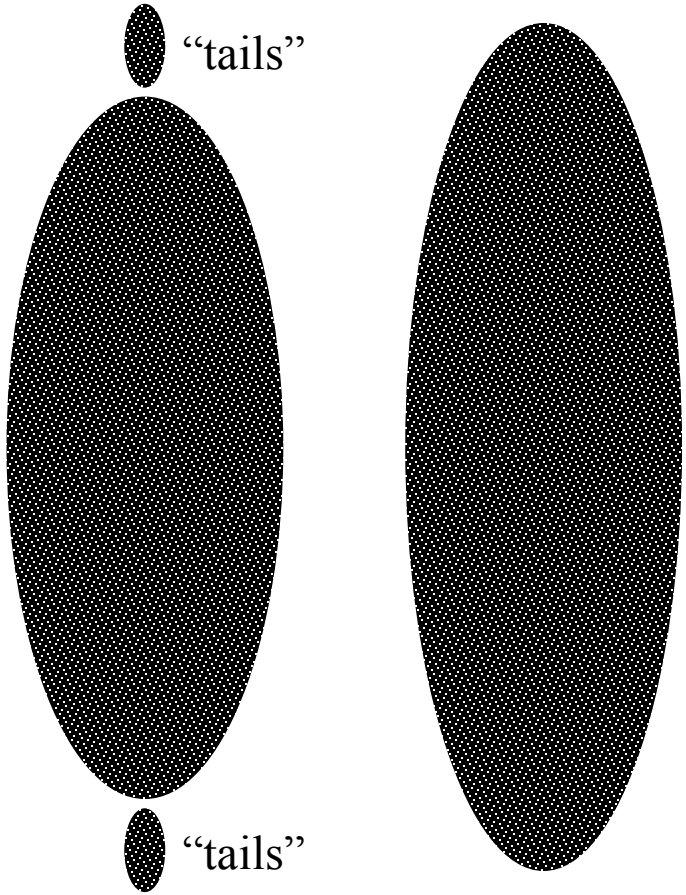
Material	Tip Size (in.)
Stain or Lacquer	.011 to .013
Oil Base Paint	.013 to .015
Latex Paints	.015 to .019
Heavy Latex & Smooth Electrometric	.021 to .025
Electrometric and Block Fillers	.025 to .035+

Eg : Tip xxx415 and xxx 515 have a 1 ltr flow rate with different fax sizes. Tip 415 sprays a 8in fax with a thicker coat (More mil build) , and tip 515 sprays a 10” fan with a less mil build.

- DO not try to increase the area covered with each pass by backing the gun away from the surface , Further away from the surface , less paint will reach the surface and go to waste as over spray .
- Spray at the lowest possible pressure greatly extends the life of major pump components – and the spray tips too.
- Watch for runs or sags in the pattern as a sign of a worn tip. DO not increase pressure of the pump to combat this problem
- You will only waste paint and increase the wear on the pump. – Simply replace the tip.

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.

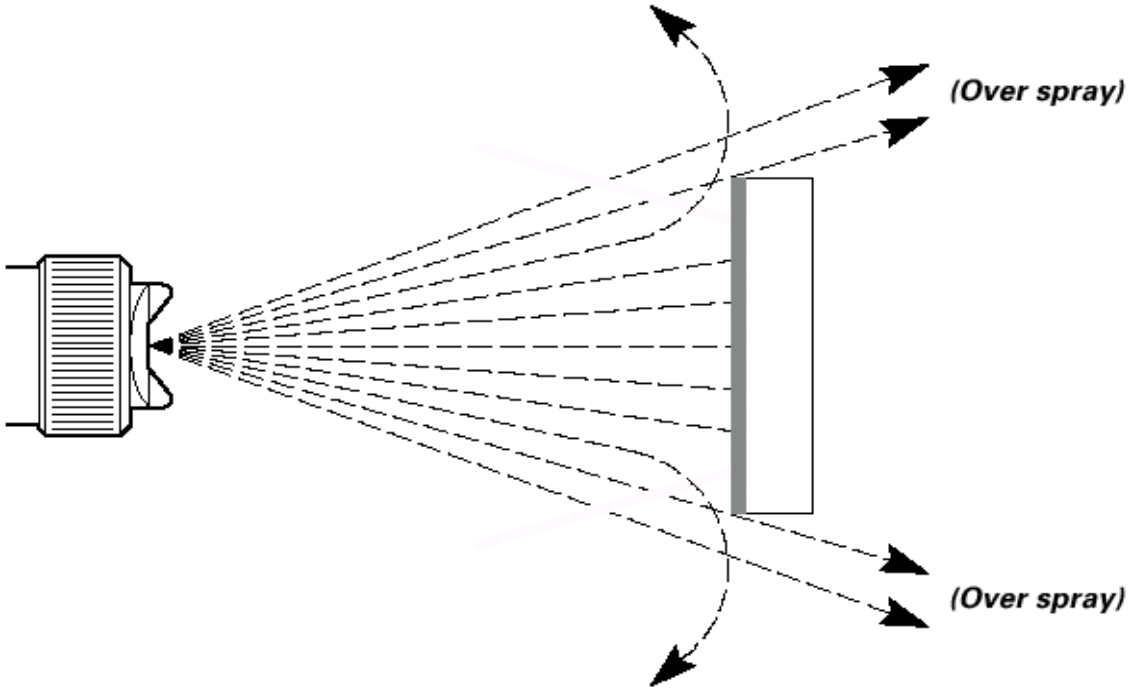
•Disadvantage

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

Air Assisted Airless Electrostatic Applications

- Structural Steel
- Tubing
- Ornamental Iron, metal tubing, trim work
- Engineering Equip.Manufacturing
- Handrails
- Aircraft and Ground Support Equipment
- Farm Equipment

Transfer Efficiency



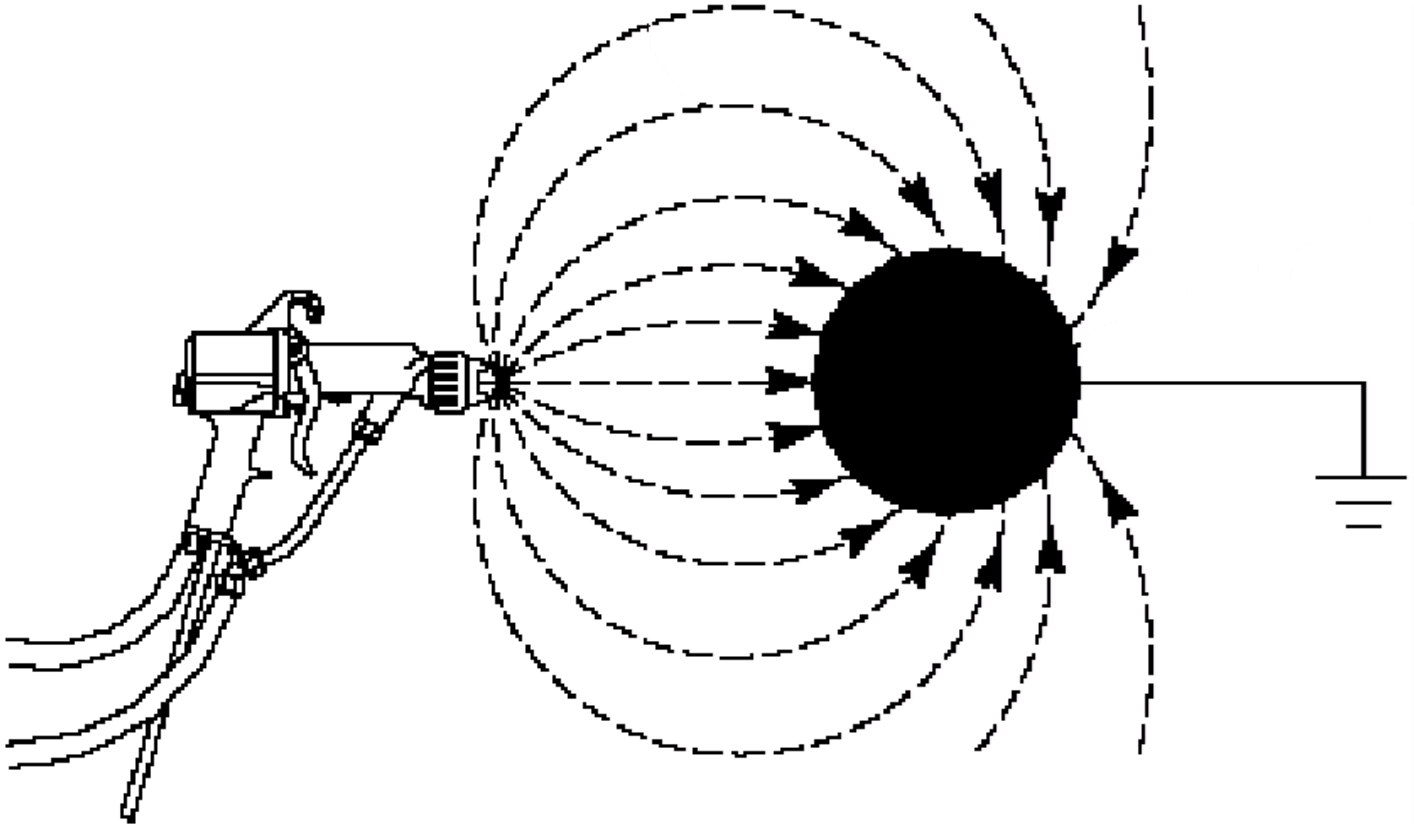
Efficiency = Amount on target vs. Amount sprayed

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

  W_p = Weight of wet coating on the part

  W_s = Weight of liquid coating sprayed

Electrostatic Technology



Transfer Efficiency Comparison

Application Method (Transfer Efficiency)	**Liters of Paint/Yr**	**Tons of VOC's/Yr**	**Liters of Paint Wasted/Yr**	**Tons of Paint Sludge/Yr**
Air Spray (30% Efficiency)	5000	7.5	3500	12.25
HVLP (45% Efficiency)	3333	5	1833.3	6.4
Airless (50-55%)	2800	3.25	1500	4.5
Air Assisted Airless (60% Efficiency)	2500	3.75	1000	3.5
Electrostatic Air Spray (75% Efficiency)	2000	3	500	1.75
Electrostatic Air Assisted Airless (85% Efficiency)	1765	2.65	265	0.93

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

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

Typical Installation Equipment for Electrostatic Application

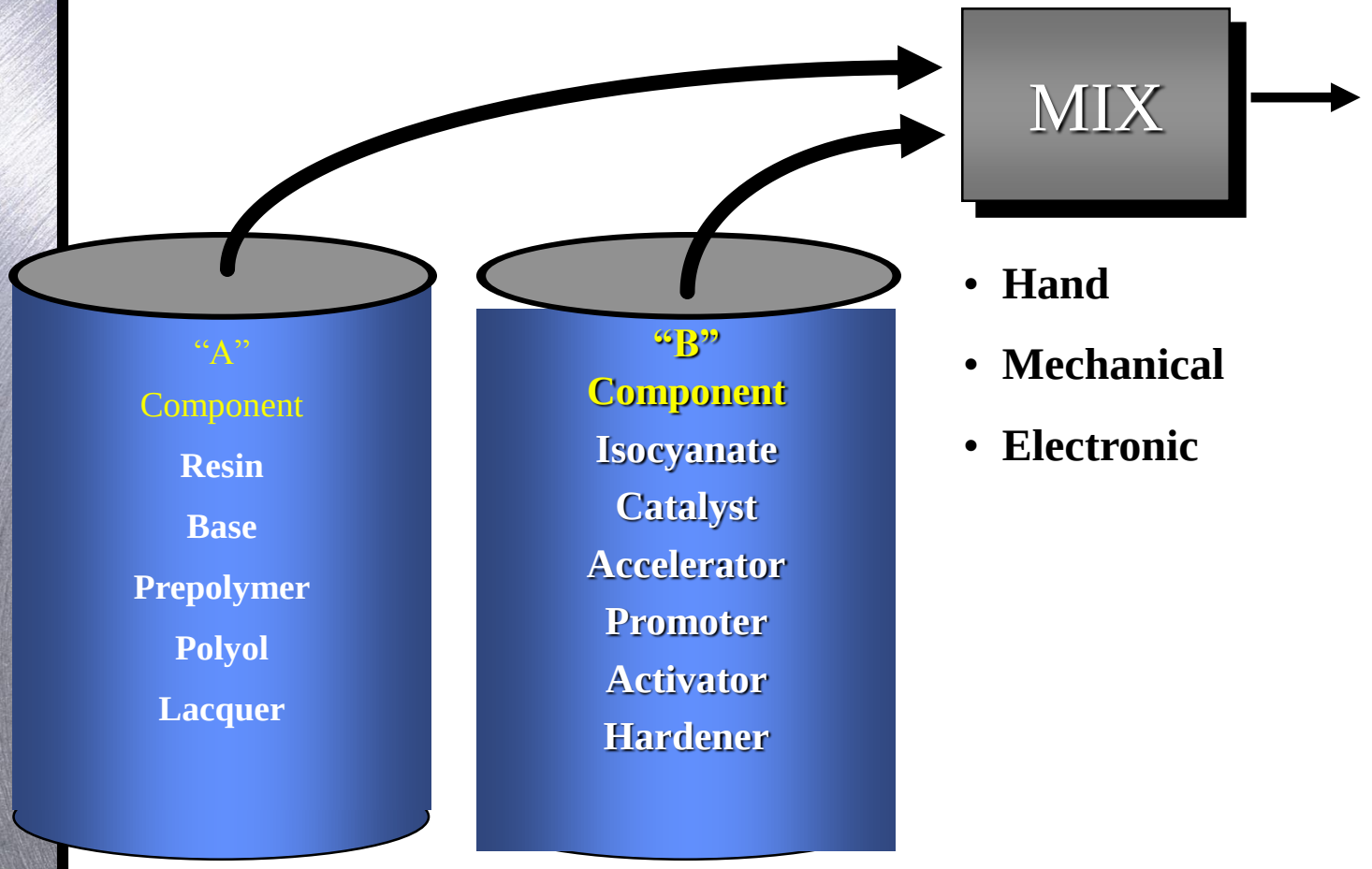
Air Assisted Airless Electrostatic Applications

- Structural Steel
- Tubing
- Ornamental Iron, metal tubing, trim work
- Engg Equip. Manufacturing
- Handrails
- Aircraft and Ground Support Equipment
- Farm Equipment

Definition of Plural Component Materials

Two materials,
blended in specific proportions
to produce a new usable product.

Plural Component Materials Names

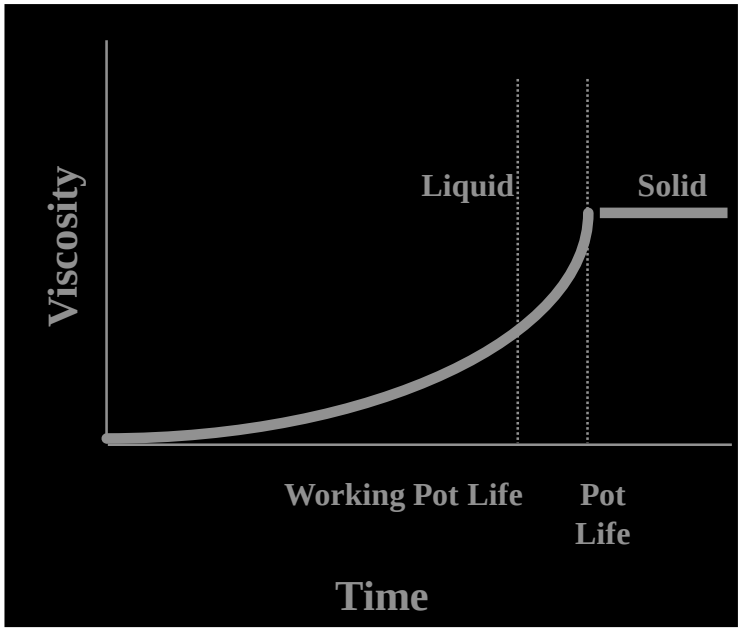


- Hand
- Mechanical
- Electronic

- Atomization (Spray)
- Dispensing
- Extrusion

Working Pot Life / Pot Life

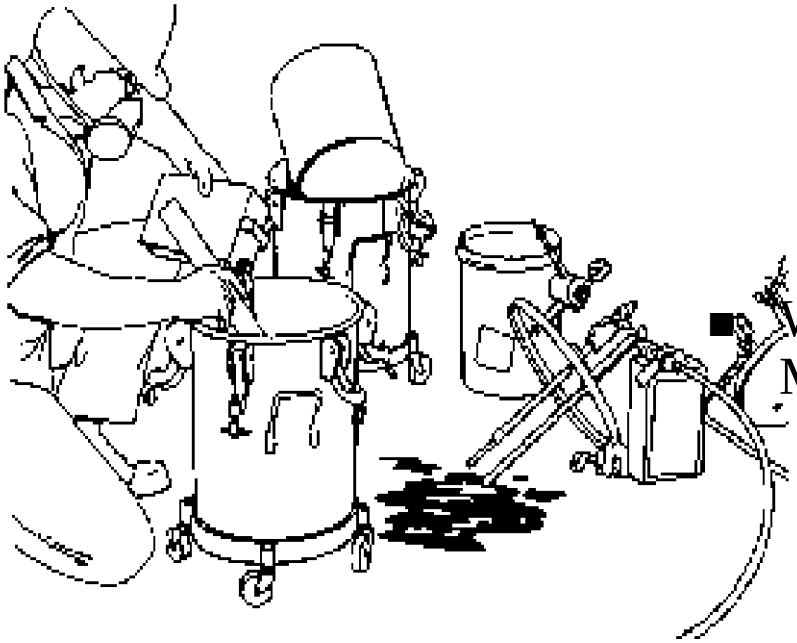
- Working Pot Life
  - The period of time after mixing that the material provides *Good Application Characteristics.*
    - a.k.a.; Spray Life for coatings,
- Pot Life
  - the period of time prior to the material hardening



Plural Component Materials Challenges

- Maintaining proper ratio
- Application prior to curing (spray life/work time)
- Off-ratio blending results in costly failures for manufacturers:
  - Lost Production
  - Rework
  - Scrap
  - Warranty
- Maintaining finish quality

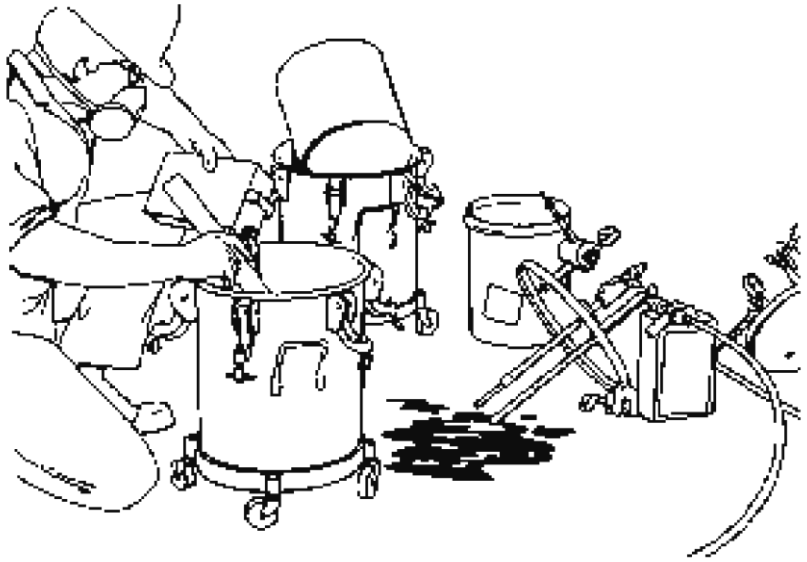
Manual or Hand Mixing Issues



- Why Manual or Hand Mixing?
  - Not capital $ intensive
  - Some materials ratios are not that critical
  - Low production volumes/rates
- What are the issues with Hand Mixing?
  - Operator related measuring and mixing quality issues
  - Disposal of cans
  - Large quantities of clean-up solvent
  - Labor intensive
  - “Quality of life” for employees

Hand Mixing.

- Hand measured and mixed often referred to as Hot Potting.
  - least accurate
  - generates the most waste
  - labor intensive
  - inaccurate mixing of material
  - more exposure to chemicals
  - no expensive equipment needed



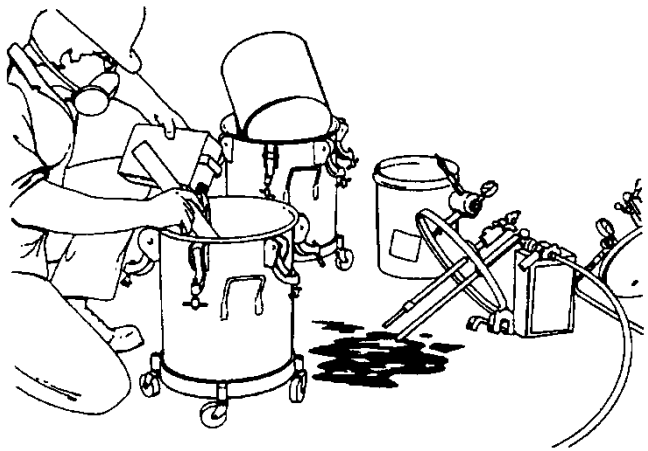
Benefits of 2 K application Equipment

- Data collection and reports
  - Batch Reports
    - ISO conformance
  - Material / recipe usage reports
    - Environmental reports
  - Inventory reports

- **Sample Batch Report**

Batch Report

Date	11/04/96			Started at 22:36
Recipe ID:	39684285		Job:	A 0357
Name:	Star Blue		Batch:	000865
Unit Measure:	Gallons		Operator:	A0357
COMPONENT	TARGET	ACTUAL	ERROR	TOLERANCE
03 Resin	1.000	0.992 gal.	-0.80%	+/- 1.50%
05 Catalyst	1.000	0.995 gal.	-0.50%	+/- 2.00%
Solvent	0.250	0.248 gal.	-0.80%	+/- 2.00%
Total Batch	2.250	2.235 gal.	-0.70%	
				Completed at 22:41

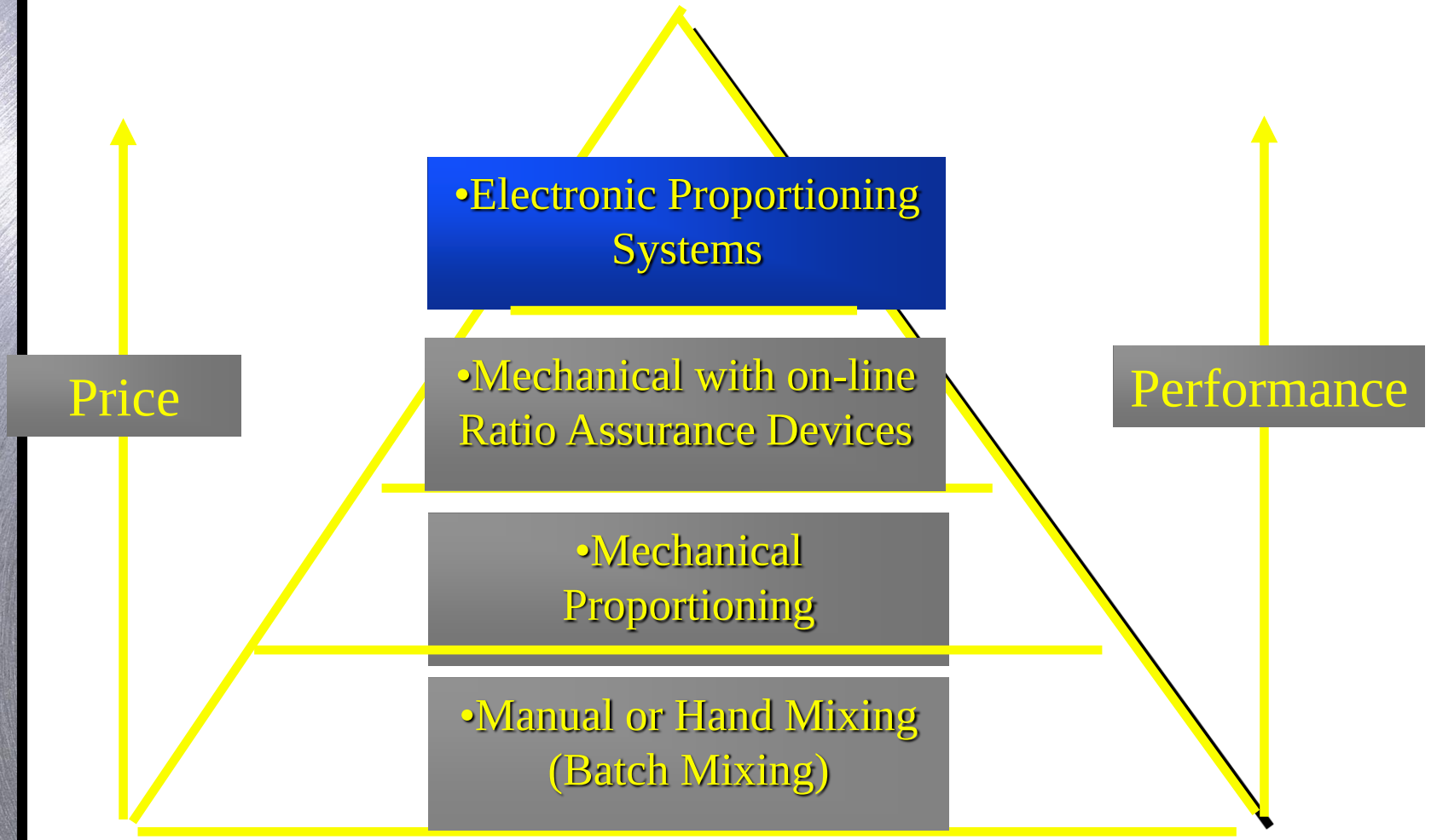


- Reduced operator exposure to hazardous materials
- Accurate Mixing

Application Equipment Solutions

- Batch Mixing
  - Pressure Pots
  - Airless Spray Package
- Mechanical Proportioners
  - Fixed & Variable Ratio HydraCat
- Electronic Proportioners
  - Xtreme Mix

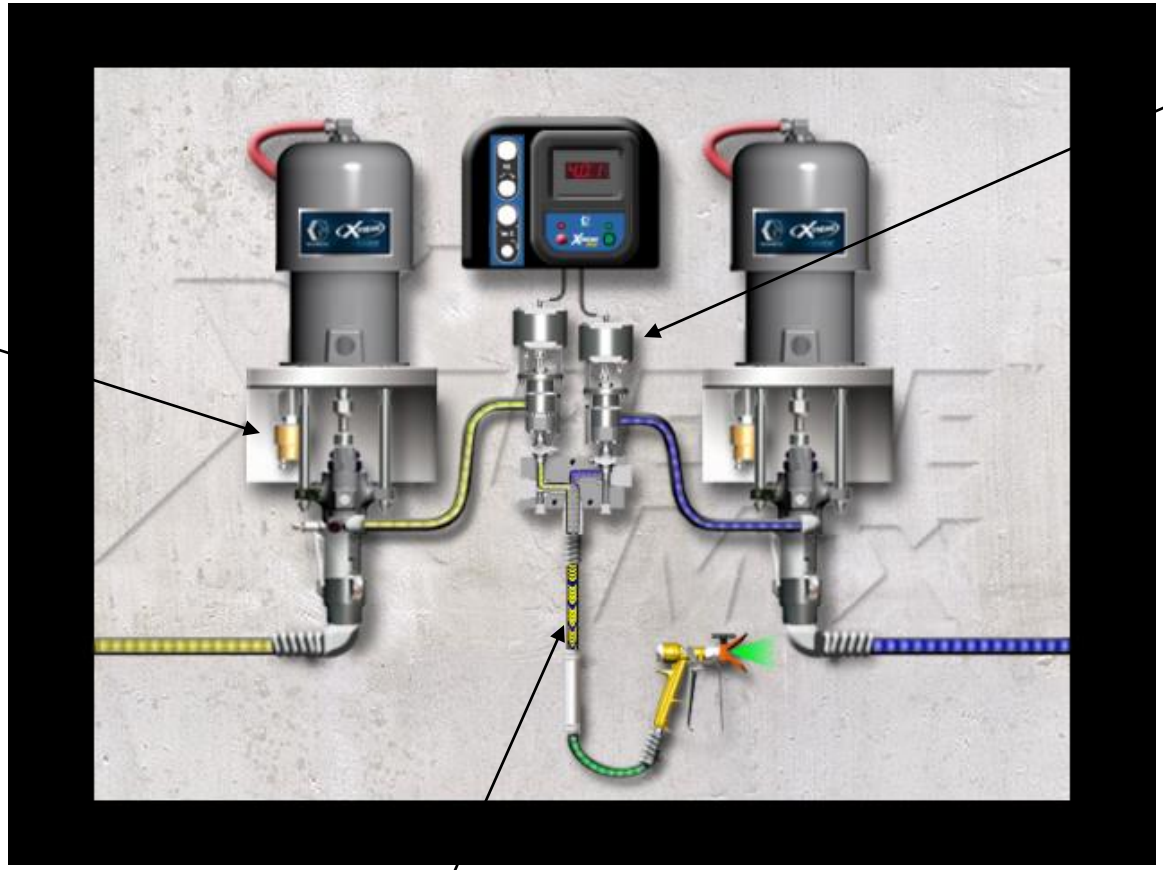
Handling Plural Component Materials



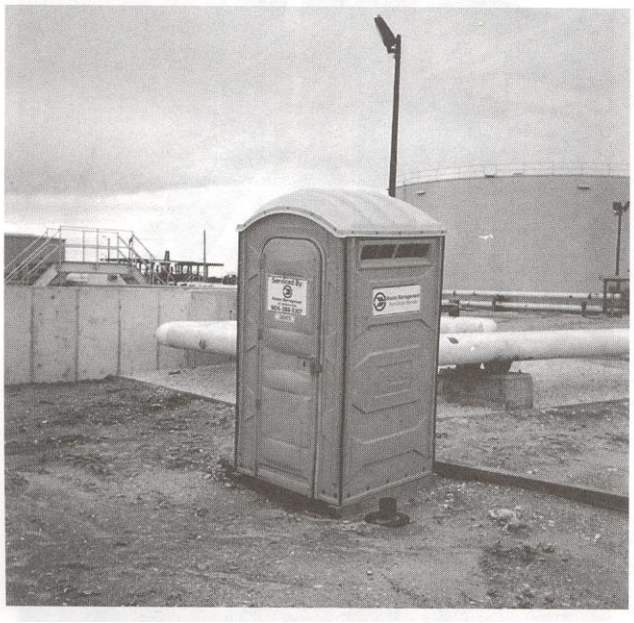
Mechanical Proportioners

- Supports Multiple Mix Ratios
  - Common Ratios: 1:1 to 12:1
- Performance Characteristics:
  - Fluid pressures: 100 - 7500 psi
  - Flow Rates Range: up to 30 Ltrs/m
- System Benefits:
  - Delivers mixed and proportioned material on demand
  - Stand-mount, Wall-mount, or Bare Proportioner

Operation

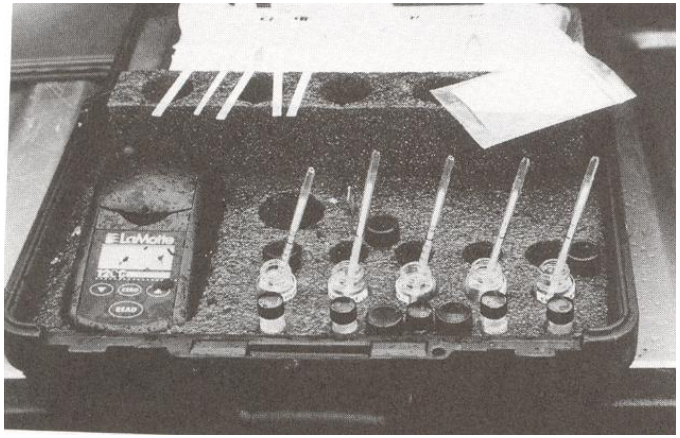


Contractor's Equipments required at job site



Portable toilet at job site

Hand wash unit



Soluble salt Test Key