Plural Component Paint Equipment

A decade of changes for the better!

Definitions pertaining to Plural Components

- Plural components
- Mix Ratio
- Pot life
- Preconditioning of material
  - solid content of paint
- Hose bundles
  - Reason for hose bundle
  - Bare hoses or Heated
- Mixer manifold
- Static mixers

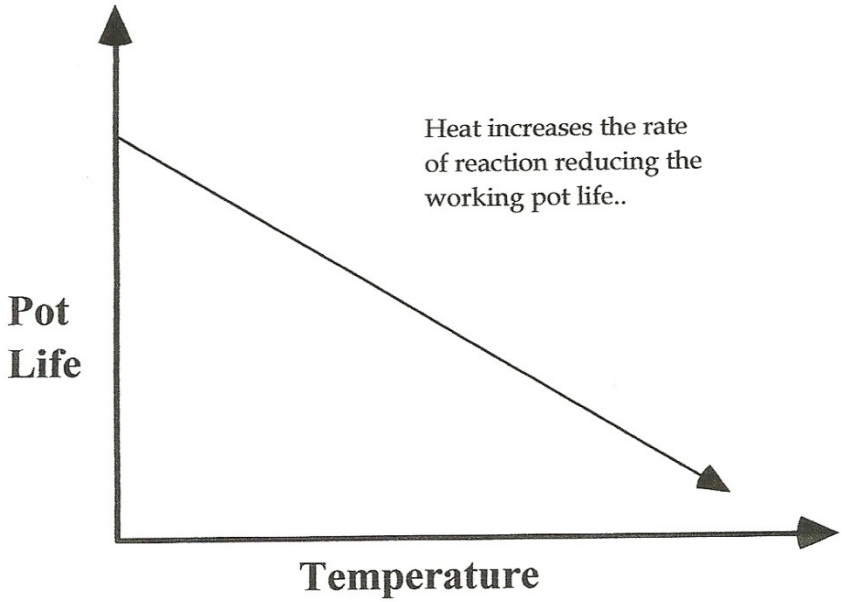
Definition: Plural component paint equipment

- Paint equipment that uses multiple positive displacement pumps to achieve a desired mix ratio and mixes that ratio to a single homogenous blend.

Definition: Mix Ratio

What is mix ratio?

- *Mix Ratio* is the ratio of Component A to Component B that yields the best characteristics of the end product.
- Mix ratio is specified by the material supplier as a function of weight and/or volume.
- The material supplier will specify the mix ratio and a margin of error called *Ratio Tolerance*.
- Ratio tolerance tells you how far off the prescribed mix ratio you can be before you are off-ratio.
- Mix ratio is the most critical factor that determines the physical properties of the end product.
- Too much catalyst may cause problems.
- Too little catalyst may cause different problems.
- Mix ratio affects pot life.
- Off-ratio materials may not cure properly.
- Applying heat will often shorten pot life or speed curing.



Why plural component equipment is used.

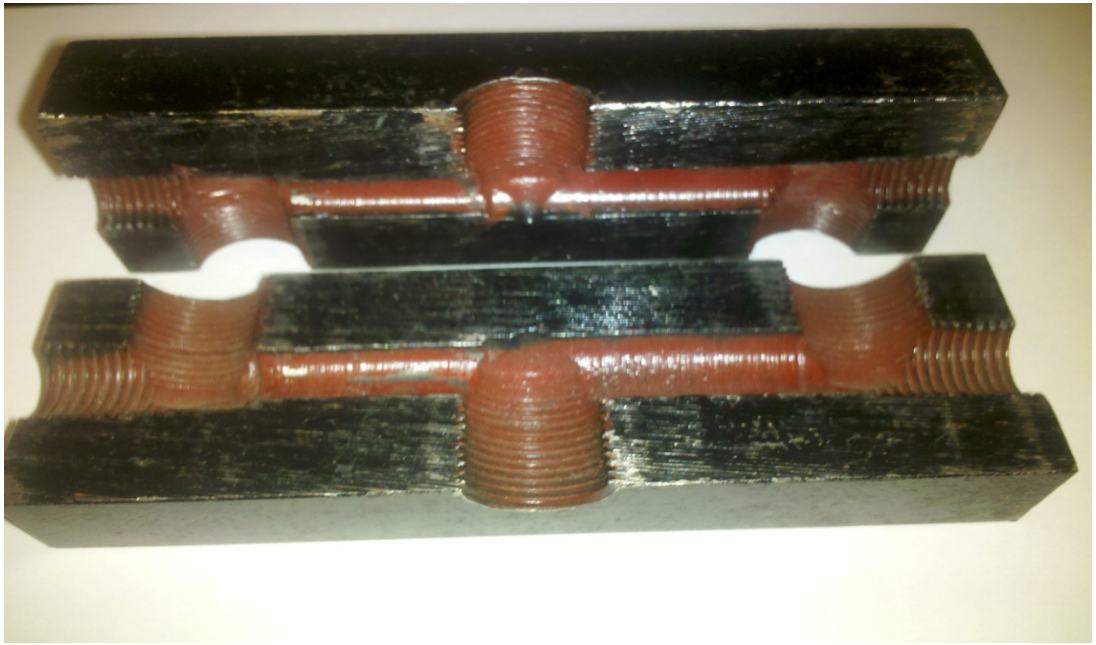
- Pot Life
  - Starts when the component chemicals are mixed and ends when hardening occurs
- Conventional spray methods take to long to move the mixed materials from the source to the spray gun
  - Examples
    - Pressure pot with 30 – 50 ft of hose to the spray gun
    - Standard airless spray pump with 50 ft. hose and gun
- Paint Viscosity
    - Thickness or centipoises of the coating

Definition: Hose Bundle

- A set of hoses used to pump or convey Component A & B separately to the mixer manifold
- Reasons:
  - The applicator may have to move the coatings long distances away from the Plural Component unit for that application
    - Example: paint kitchen in the rail shop is 200ft ft from the spray booth or area
- Types: bare hoses, insulated, or heated lines

Definition: Mixer Manifold

- The mixer manifold is a block that consists of two separate ports for Component A & B on the entry side. This block is ported to allow these separate streams of material to come together and exit the manifold as one.



Definition: Static Mixer

- A static mixer is a tube device used to mix two or more fluids to a homogenous blend. The blend is produced by pushing the fluid thru a serious of twisted elements or Helixes to create a blending process.

Types of Plural Equipment

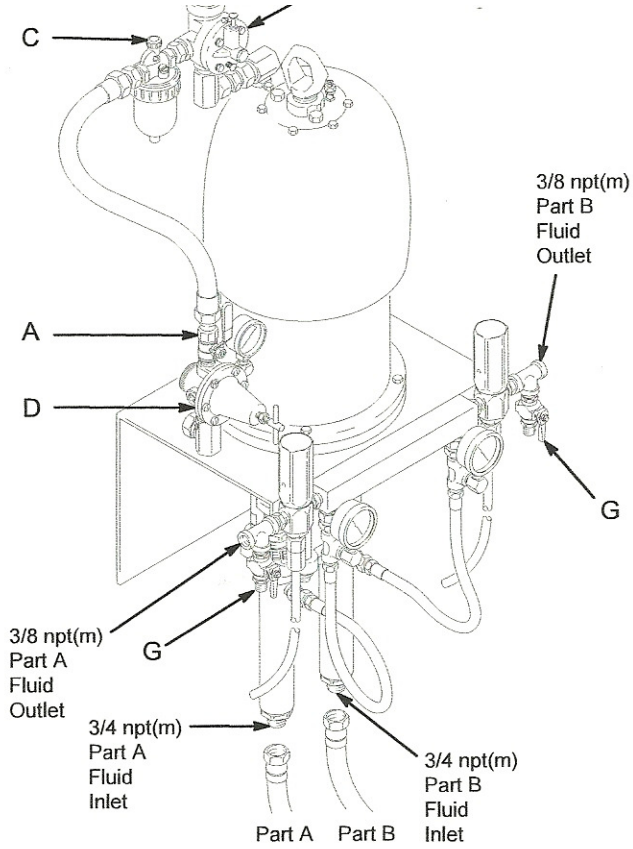
Old style mechanical to the New Electronic age

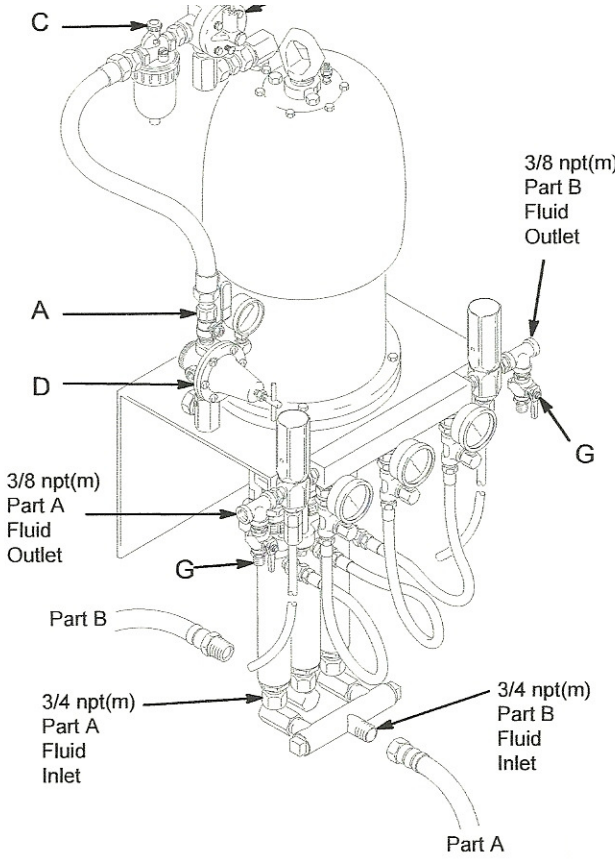
Three types of Plural Units

- Mechanical
- Electronic Dosing
- Electronic Injection

Mechanical Proportioning
First units of their kind

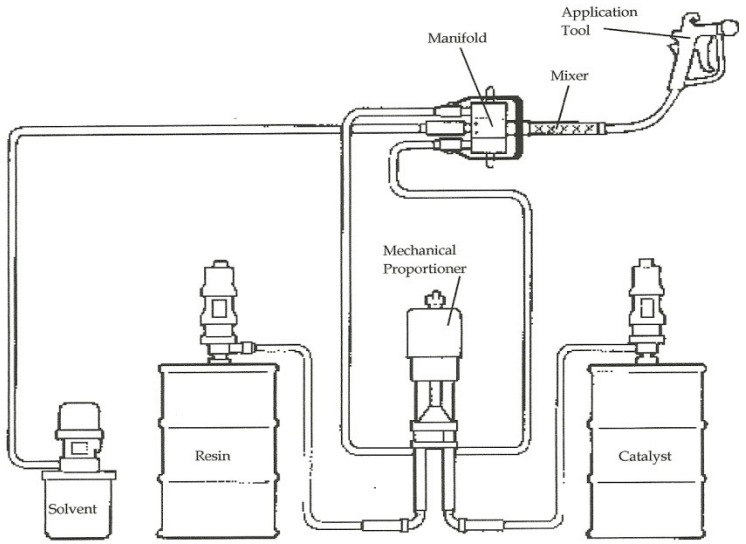
Mechanical Proportioner used a series of different size volume output pump to achieve the mix ratio.





Typical set up for the old style mechanical proportioner

How are plural component materials mixed?(continued)



How Mechanical Proportioning Works
Two or more pumps or pressure tanks supply a simultaneous flow of fluid to the proportioner. Mechanical proportioners use two or more displacement pumps to measure the component chemicals. The pump strokes are synchronized by a mechanical connection. As the pumps operate, they meter out component chemicals in ratios determined by the displacement of the pumps. Fluid is directed from the pumps to a mixing mechanism, then applied to the end product.

Mechanical Proportioner Contributions to the Industries

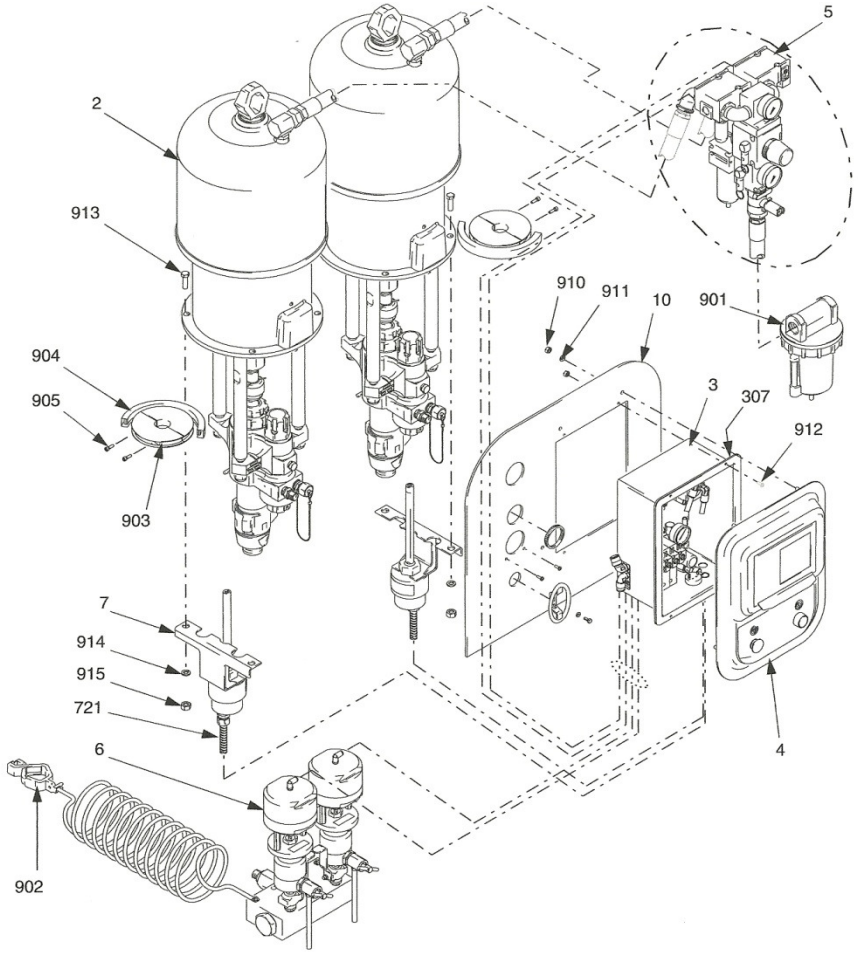
- This equipment opened the door for new advances in coatings and applications
  - Coatings manufacturing now had a piece of equipment to apply faster pot life material with the ability of various mix ratios
- Allowed the applicator to cut down manual labor in mixing paint in a pail first before his application.
  - Also minimized amount of waist in the premixed material that was not used after the spray was completed.

Mechanical Proportioner Limitations

- Mix ratios offered by pump manufactures were limited to about 6 configurations.
  - 1:1, 1.5:1, 2:1, 2.5:1, 3:1, 4:1
- Ratio Assurance
  - The Mechanical proportioner is based on a positive feed of the materials. Any variations in that feed can effect the mix ratio and materials sprayed on the sub straight without warning the operator.
    - Some pressure devices were offered in the market place to manage these limitations. On occasion the monitoring devices still allowed some off ratio circumstances.

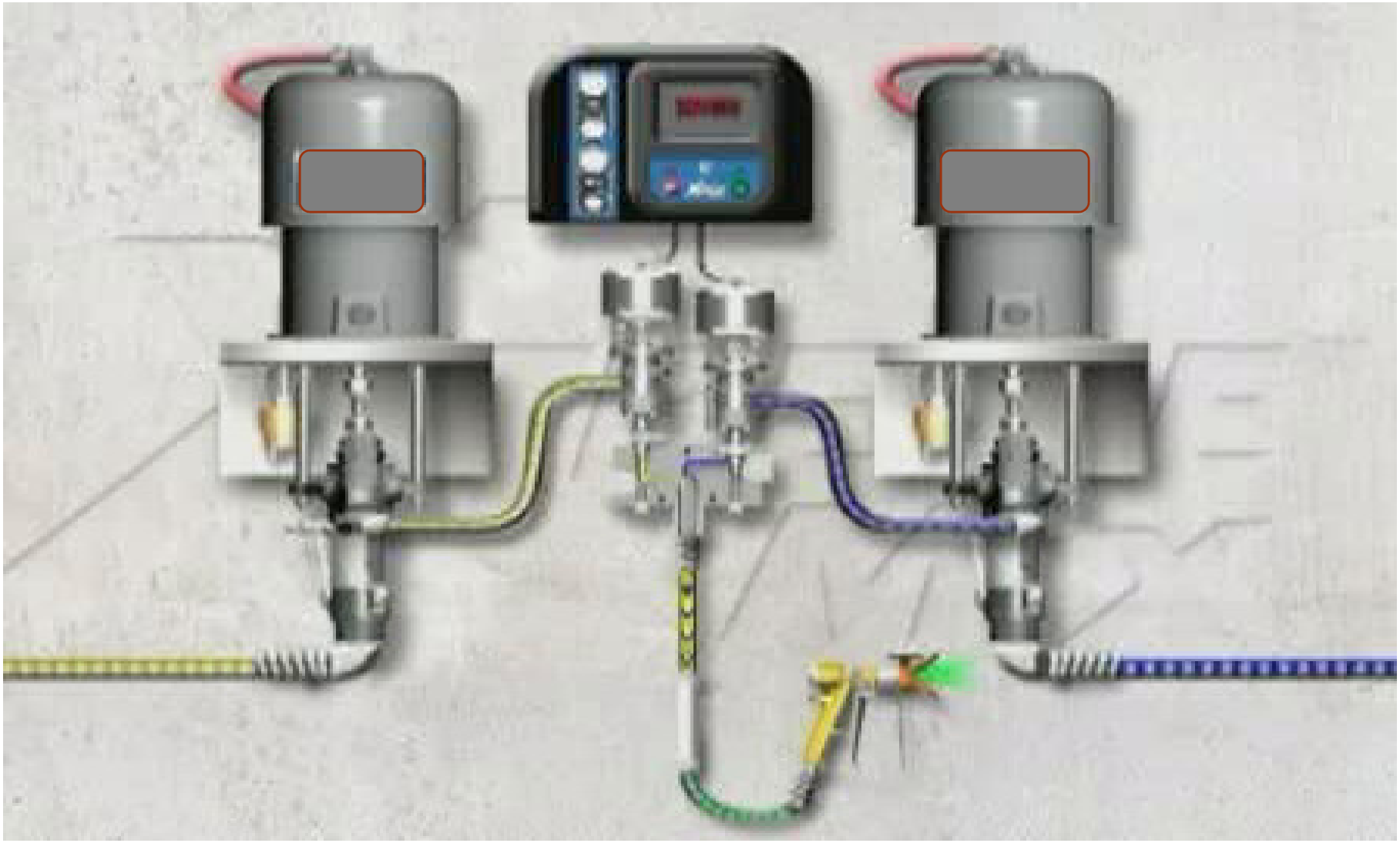
Electronic Dosing System
Stepping up to the next generation

Electronic Dosing System
Released in late 1990's early 2000's



Typical Set- up for the Dosing Style Proportioner

Dosing Process Animation



Dosing Proportioner contributions to the Industry

- First unit to have some "SMART" functions via computer technologies
- Allows the Plural unit to monitor any deviations in supply of material, pressure drops on Component A & B, and shuts down when off ratio situations occur.
- End user has ratio assurance within +/- 5 % tolerance
- Units has some data down load capabilities for monitoring unit functions
- Computer technology allowed the operator to switch mix ratios with one unit by programming.
  - Ratios can be set from 1:1 to 10:1.

Dosing Proportioner Limitations

- A true dosing system has to alternate from A component to B component while dispensing the proportioned amounts.
  - Metering valves can only operate so fast before an error occurs
  - Large GPM (gallon per minute) demands or large tips can cause shut downs
- Heavy viscosity materials used in the standard units from the manufacturers could sometimes cause alarms with the processors
- Dosing system set-ups do not allow for faster pot life materials because of the mixing process
  - Integration style mix process

Customization components that have improved Plural Component Equipment

- Heated tanks
  - Some companies offer heated tanks to precondition paint viscosities with heat.
    - The tank is double walled with a water jacket for heating a glycol –water solution. This in return heats the inner tank that contains the paint. The two materials are in separate vessels much like a home double boiler you would put on a stove.
- Heat traced hose bundles engineered for specific hoses for different applications
  - Urethane coatings would need special moisture lock hose
  - Epoxy coating may require different hose sizes between the A & B components do to viscosity differences
  - Custom lengths ranging from 50 ft to 300 ft in length

Customization continued

- Companies also design special units set-ups according to the customers needs.
  - Examples
    - Plural component unit with heated tanks
    - Unit mounted on a skid with forklift slots
    - Unit mounted on four wheel cart with heated tanks
    - Custom installations inside of paint kitchens
- Electrical controls that meet Class I Div I and II hazardous area requirement

Plural Component injection system with the latest technology

Electronic Injection System Released in 2nd quarter 2010

Component Identification

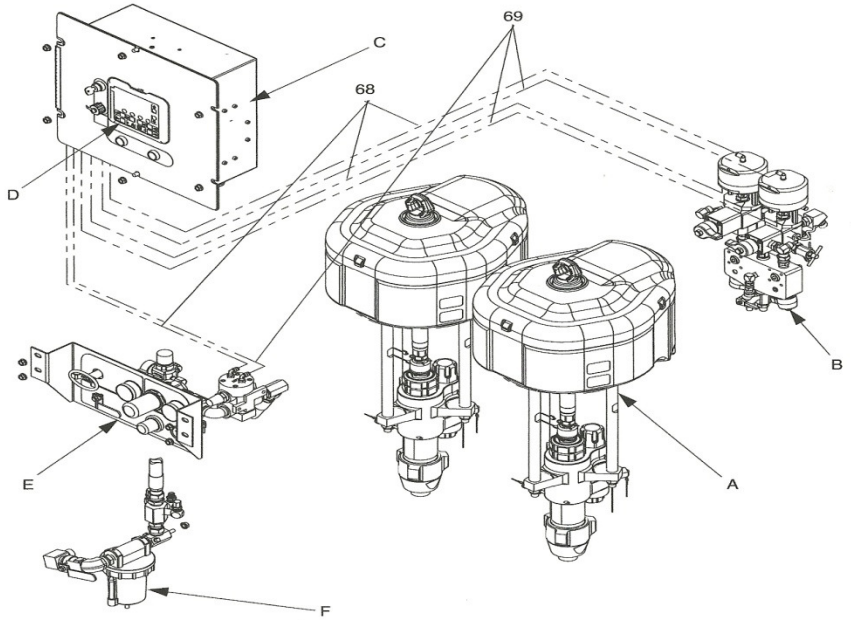


FIG. 1: Typical OEM Sprayer Components

Key:

A Pump Assembly
B Fluid Control Assembly (see **Fluid Control Assembly**, page 10)
C Control Box
D User Interface Display (see **User Interface Display**, page 13)
E Air Controls (see **Air Controls**, page 11)
F Air Inlet Manifold Assembly
68 Air Line
69 Air Line

Typical Setup for Injection Style

New Features of the Injection style Proportioner

- Uses constant flow of "A" component while injecting "B" component into the "A" stream
  - Theory – The "A" component pump pressure is set at a lower pressure than the "B" pump. This allows the "B" fluid pressure to inject into the "A" fluid stream without deviations in mix ratio.
  - Advantages
    - Allow the machine to produce higher GPM (gallons per minute) without flow interruption from the metering valve
    - Faster pot life materials can be used with shorter integration hoses


A
B
Fluid Flow Theory

- Smart Processor Controls
  - The injection processor allows the operator to set parameters or conditions to apply the coatings. The operator may choose the following settings:
    - Temperature of daily operation
      - Tolerances can be set with a +/- factor for warning and shut down alarms
    - Operating pressures
      - Tolerances can be set with a +/- factor for warning and shut down alarms
    - Frequency of logging information into memory storage
    - Maintenance schedule by number of gallons usage
    - Gallons sprayed or usage counter on main screen
    - High injection rates for coatings with a 5:1 mix ratio or higher

- Pot life timer warnings
  - Operator has the ability to input about of spray hose and material curing time as a warning. If the processor recognizes no fluid movement an alarm will sound to alert the sprayer.
- Testing Modes
  - Processors allows operator to run diagnostic tests for the following:
    - Ratio test
      - Dispense “A” and “B” component into separate beakers for volumetric confirmation
    - Pump test
      - Processor runs self diagnostics to ensure proper function
    - Valve test
      - Processor will pressure system to test for leaks in valves or fittings

Controls User Interface

Mode key switch

•Switch between command and setup modes

•Remove key to lock settings

USB port

•Download spray data with USB drive.

•4GB flash drive is included with each machine.

Trouble shooting/ Error alarms

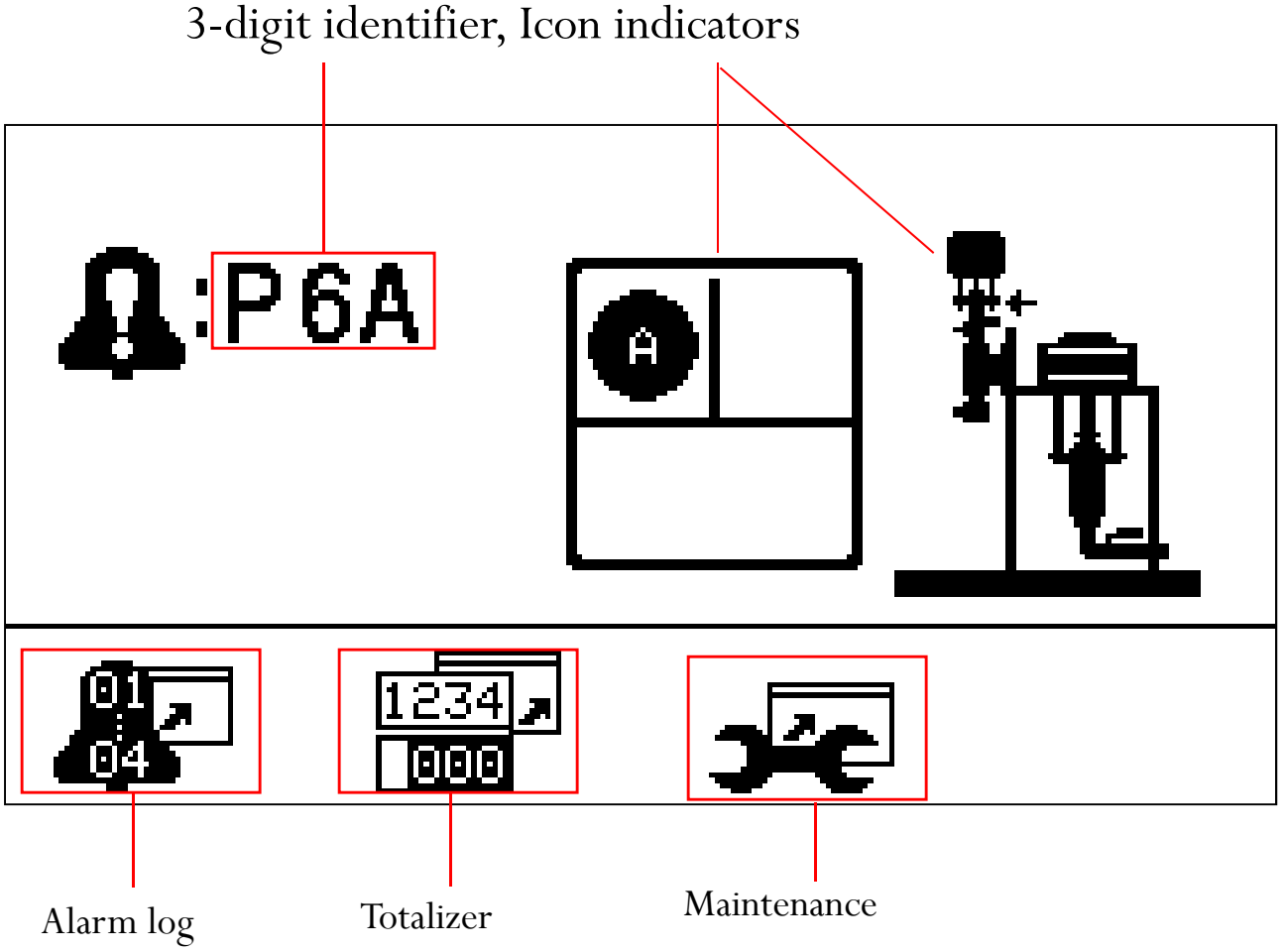
- New processor has the ability thru the electronics to pin point exactly where the mechanical failure occurred.
- The processor uses a three digit system to advise the operator where the problem occurred.
- Display screen provides a picture as a reference

Alarm Codes

P: Pressure

6: Sensor/connection

A: Material A



ALARM CODES

WHAT?		ALERT		WHERE?	
F	FLOW	1	LOW	A	MATERIAL A
N	TIME	2	DEVIATION	B	MATERIAL B
P	PRESSURE	4	HIGH	C	CONTROLLER
R	RATIO	5	LIMIT WARNING	D	DOSING/POT LIFE
T	TEMPERATURE	6	SENSOR OR CONNECTION FAILURE	M	POWER OR AIR SUPPLY
V	VOLTAGE			R	RECIRCULATION
D	PUMP	A	PUMP RUNAWAY		
		D	PUMP DIVING/CAVITATION		
		E	PUMP TIME-OUT		
		F	PUMP FAILED TO STALL UP		
		G	PUMP FAILED TO STALL DOWN		
		H	PUMP FAILED TO STALL		
		J	LINEAR SENSOR FAILURE		
		K	DIRECTIONAL SWITCH FAILURE		
M	MAINTENANCE DUE	A	PUMP		
		E	DOSING VALVE		
		G	FILTER		

Spray Log

- Acts as on board "inspector"
  - Set how often data will record and download depth
    - 60 second increments and 30 day depth is default, overwrites oldest data
  - Date
  - Time
  - Machine number
  - Temperature A & B
  - Pressure A & B
  - Ratio Actual & Set point
  - Restriction balance indicator
  - Flow
  - Alarms

Spray Log 1
USB SN 09000117
Software PN 15W201
Software Rev 1.04.004
3/31/2009 7:36

Date	Time	Machine No	Temp A	Temp B	Press A	Press B	Ratio Actual	Ratio Setpoint	Restrictor
3/13/2009	16:55:37	1001	92	88	1949	2187	3.987	4	< - - - - I - - - - >
3/13/2009	16:55:38	1001	92	88	1949	2187	3.989	4	< - - - - I - - - - >

Closing: How does this effect the industry

- The ability to spray with accurate mix ratios
- One machine can spray multiple guns with higher GPM (gallons per minute) outputs
- Higher solids paints can be applied with heated system set up
  - Results in lower VOC materials being applied
  - Reduction in VOC emissions
  - Increase in the amount of production (per gallons sprayed)
- Data logging
  - Down load all pump operations for the exact job to place in a file for future reference