CARLISLE
FLUID TECHNOLOGIES

FINISHING EDUCATION UNIVERSITY

Automating The Color Change Process

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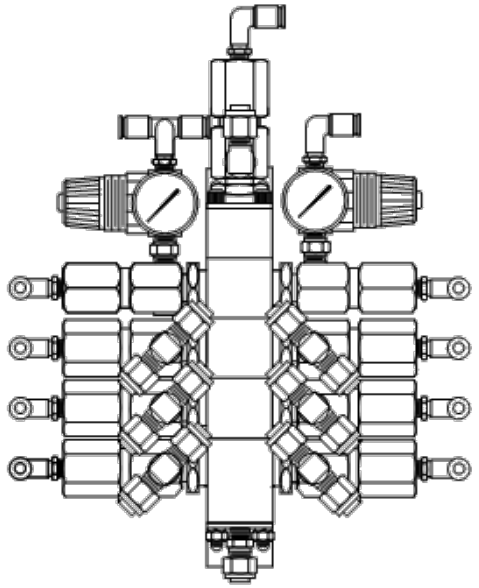
Automating The Color Change Process

Presentation Overview:

- Why Automate the Color Change Process
- Color Change Hardware
- Color Change Terminology
- Color Change Sequence & Examples
- Dual Purge Color Change
- Other Solutions
- Questions



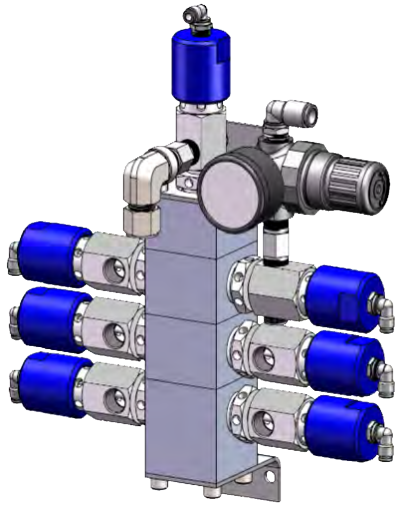
Color Change – Benefit of Automating

- Automating the color change process provides many benefits
  - ✓Increases Productivity
  - ✓Eliminates contamination from poor flushing
  - ✓Minimizes amount of paint wasted
  - ✓Minimizes the amount of solvent used and waste created during the flush process (35 – 55% decrease).

- Color change time; “Fast” is a relative term
  - ✓Automotive OEM: 8 – 12 Seconds
  - ✓Tier 1 Automotive: 30 – 60 seconds
  - ✓Industrial application: 45 sec – 10min

Color Change - Hardware

- The heart of a “color change” system is the color valve manifold assembly.
  - ✓ Termination point for multiple colors.
  - ✓ Flush media (water or solvent).
  - ✓ Air for purging
- Pneumatically operated
  - ✓ Manually or automatically
  - ✓ Can be located in spray booth or process arm
  - ✓ Should be as close to applicator as possible
- Modular Design
  - ✓ Solvent and Air at top
  - ✓ Select number of colors



Color Change - Hardware

A wide variety of color stack configurations available

SERVICE MANUAL EN

BINKS

CCV-503-SS
COLOR CHANGE VALVE

SPECIFICATIONS

Maximum air inlet pressure:	7 bar [105 psi]
Air requirements (operating pressure):	4.8-6.9 bar [70-100 psi]
Air inlet connection:	1/8" NPT (f)
Maximum fluid pressure:	20.7 bar [300 psi]
Fluid inlet connections (2x):	1/4" NPT (f)
Valve actuation speed (ON/OFF cycles):	55 cycles/min
Wetted Parts:	300 series Stainless Steel, PTFE

SERVICE MANUAL EN

Ransburg

CCV-403-SS & CCV-403-SS-E
COLOR CHANGE VALVES

SPECIFICATIONS

Maximum air inlet pressure:	7 bar [105 psi]
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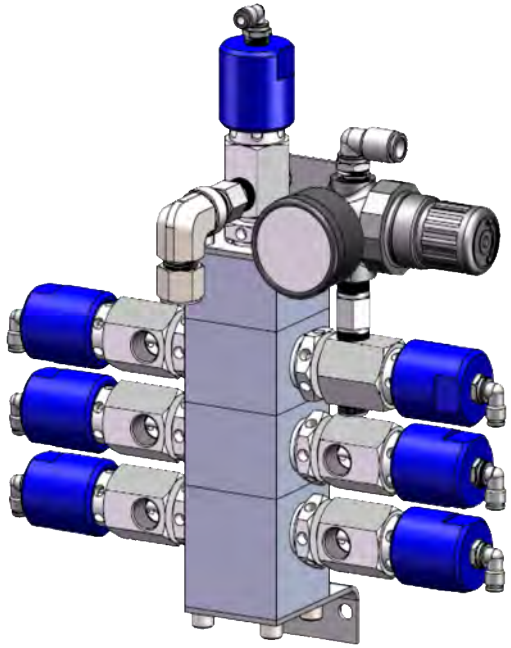
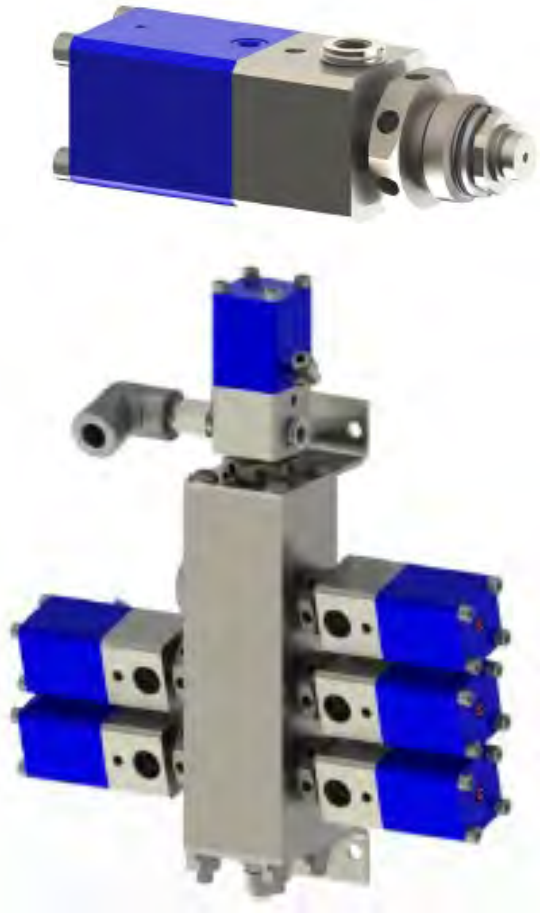


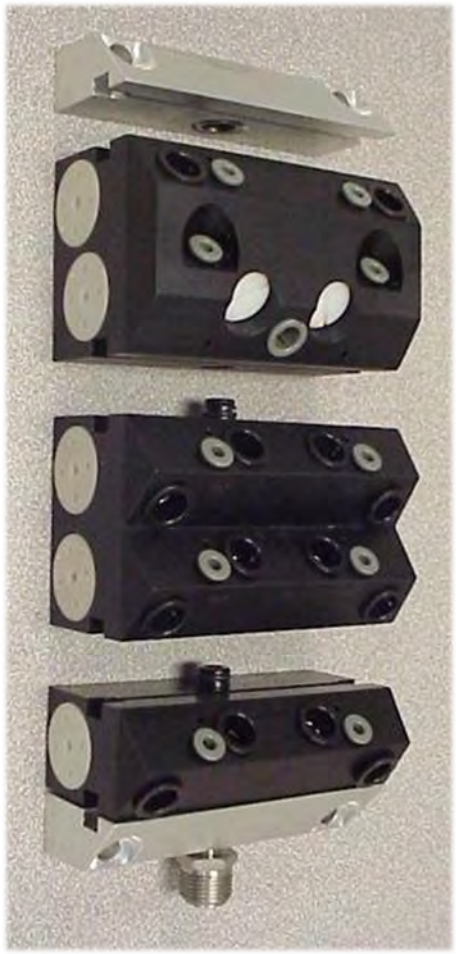


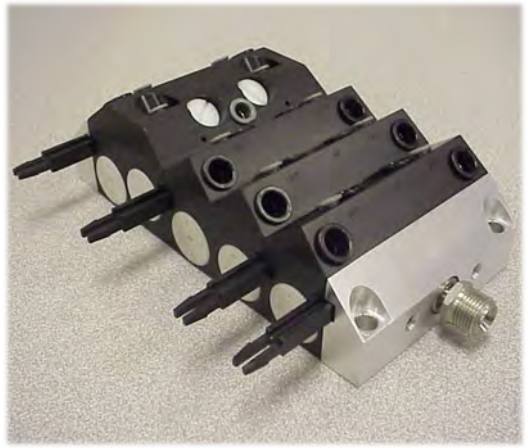
CCV: Low Pressure up to 300psi

CCV MP: Medium Pressure up to 1000psi

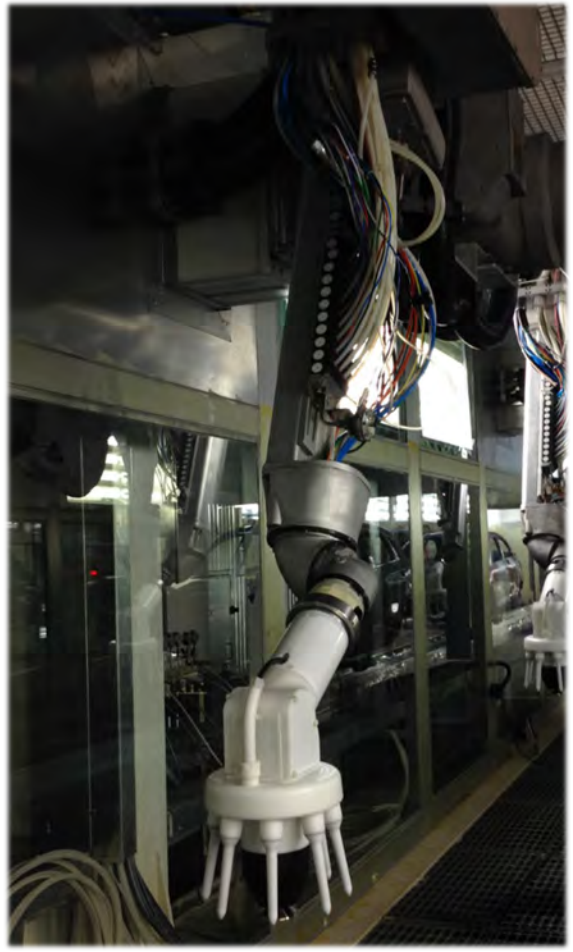
Color Change - Hardware

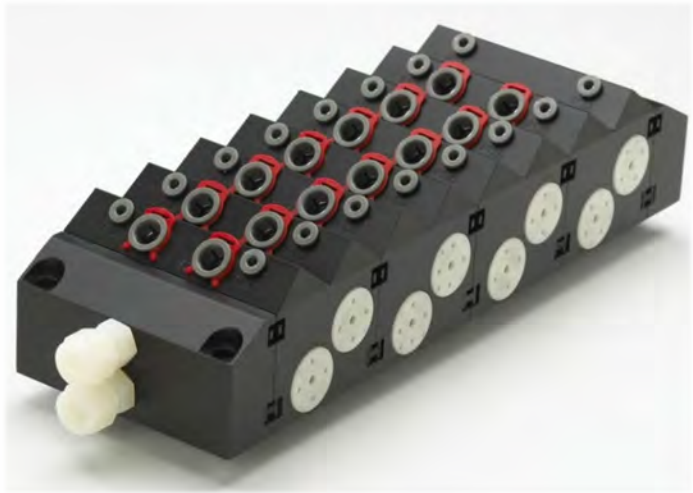
A wide variety of color stack configurations available

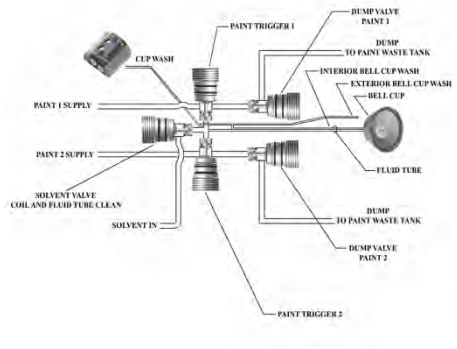




MCV2: Light Weight Modular Design



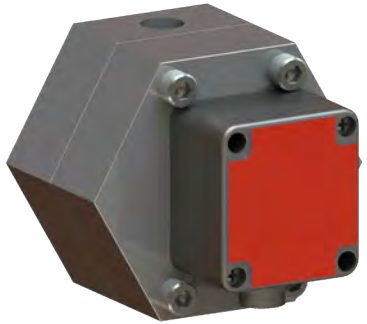


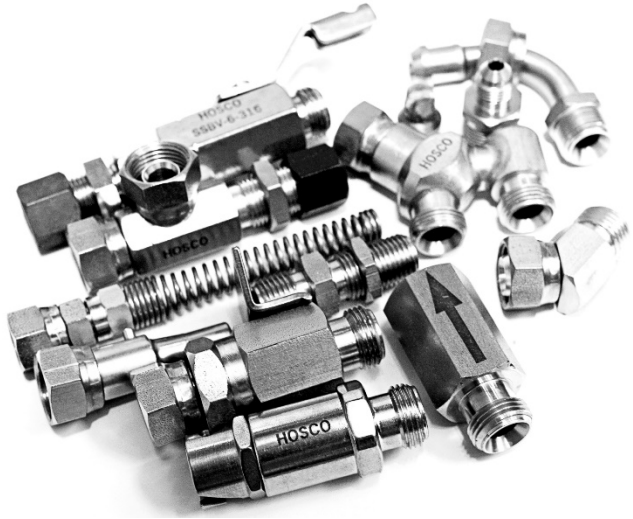


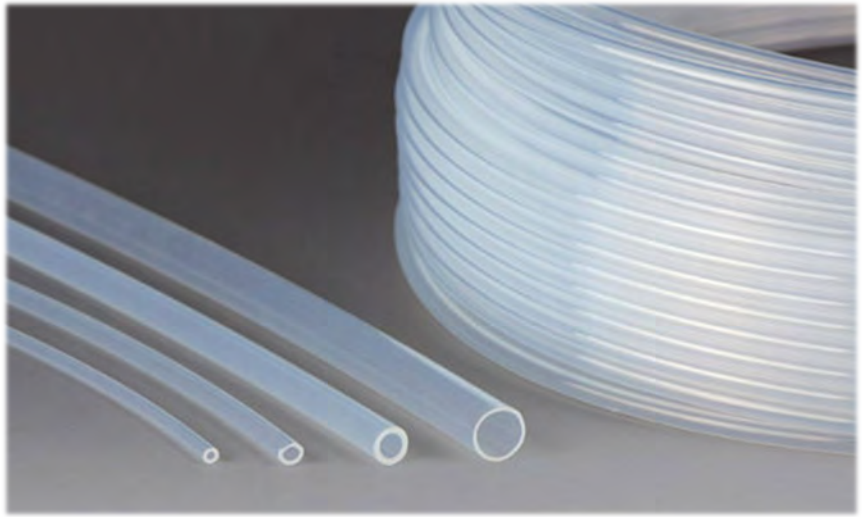
MCV2D: Dual Purge, Light Weight Modular Design

Color Change - Hardware

- Downstream hardware from the color stack includes:
  - ✓ Flow Meters
  - ✓ Fluid Regulators
  - ✓ Application Equipment
  - ✓ Dump Valves
  - ✓ Fluid Tubing
  - ✓ Fluid Fittings

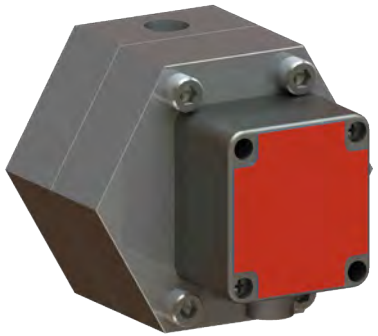


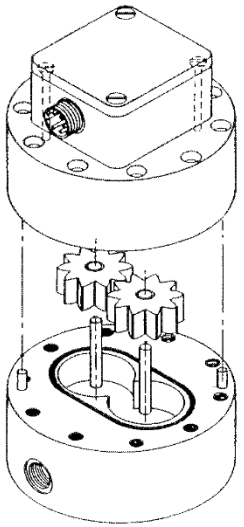




Color Change - Hardware

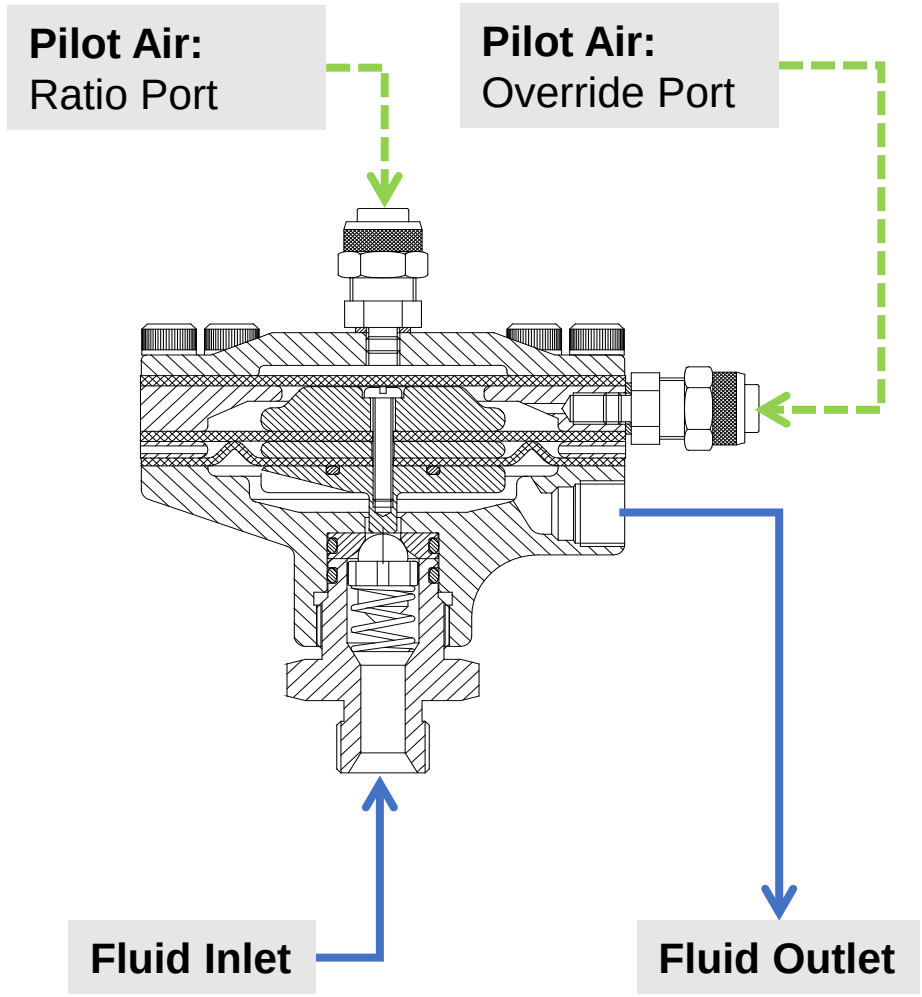
- Flow Meters
  - ✓Gear Type, fluid drives gears which generate pulses though pick-up assembly.
  - ✓Coriolis, straight or bent tube which detects flow based on vibration.
  - ✓Typically located at outlet of color stack.
  - ✓ With closed loop flow control, may have one dedicated per applicator.





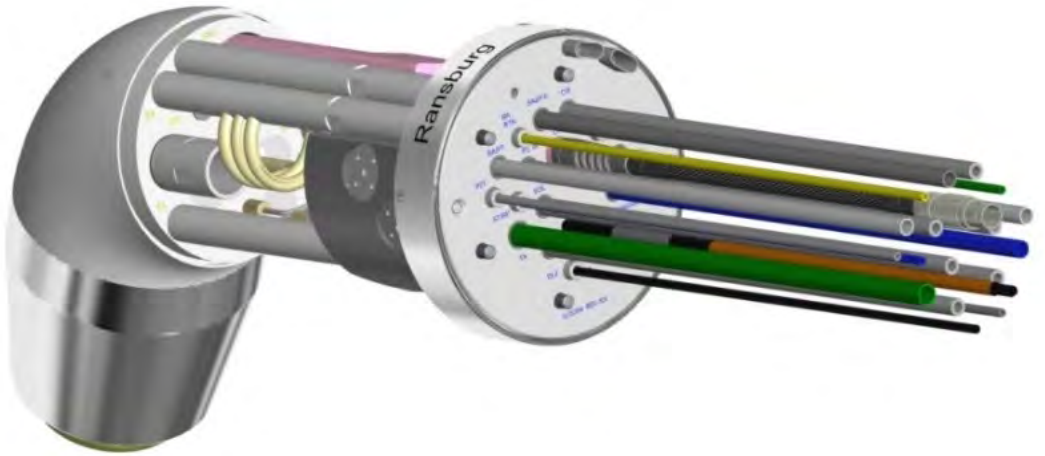
Color Change - Hardware

- Fluid Regulators
  - ✓Used to regulate flow rate:
    - Line pressure from fluid forces regulator closed.
    - Remote air signal is used to oppose fluid pressure and allow fluid flow.
  - ✓Internal machining and passages should be evaluated.
  - ✓Regulator volume should be considered.
  - ✓May be integrated into applicator or color stack.



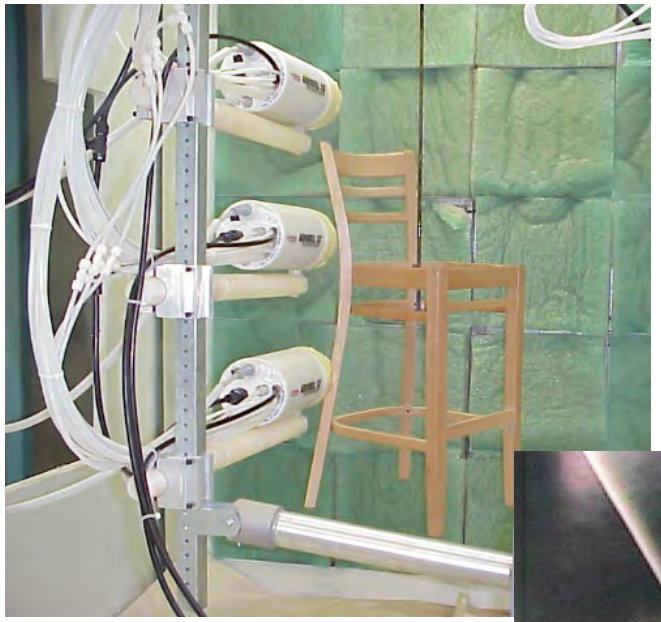
Color Change - Hardware

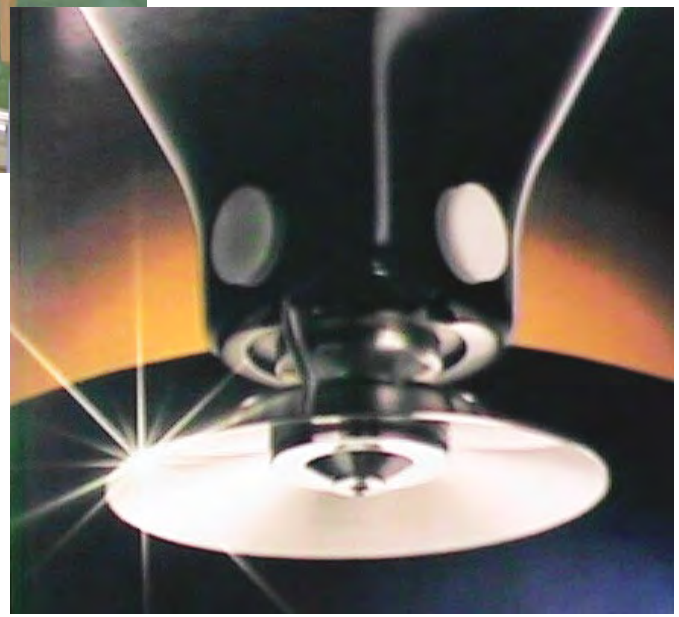
- Dump Valves
  - ✓Typically located at or in applicator.
  - ✓Used to allow flushing through larger orifice in dump valve as opposed to restriction in applicator (.042, .055, .070).
  - ✓Outlet of dump valve plumbed to reclaim system.
  - ✓In some cases dump valve is not used, coating is purged into booth for reclaim.



Color Change - Hardware

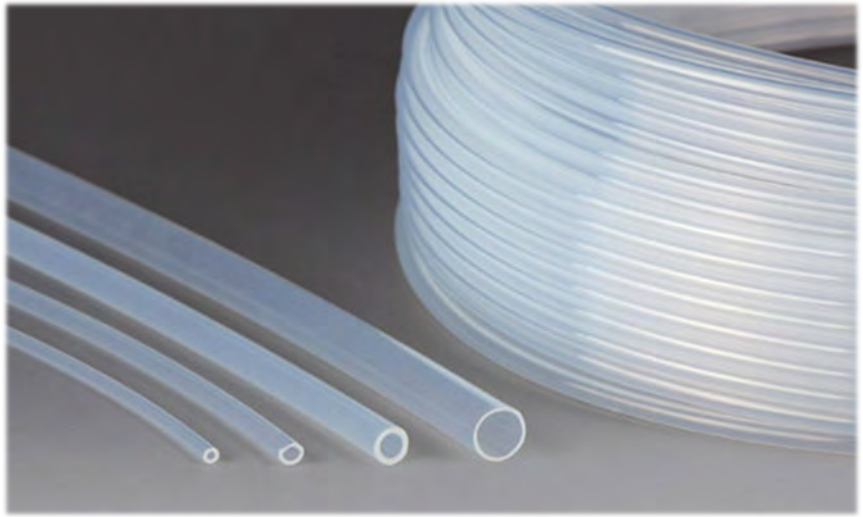
- Application Equipment

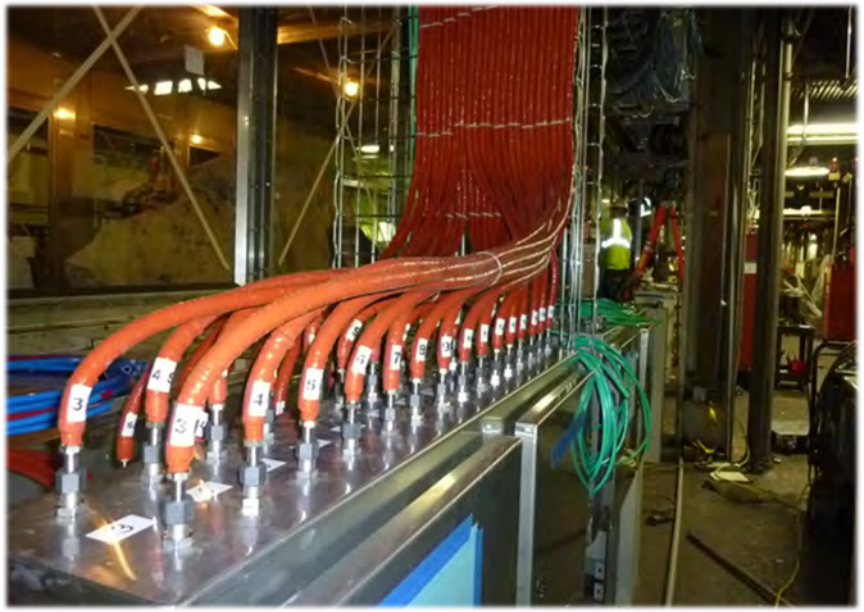




Color Change - Hardware

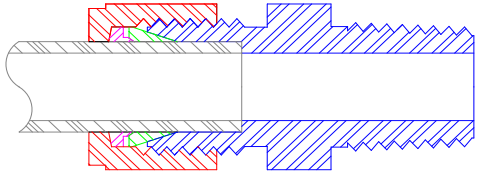
- Fluid Tubing
  - ✓ Teflon tubing is recommended
  - ✓ FEP or PFA (PFA is a high temp version of FEP)
    - Clear, easy to see level of cleanliness
    - Smooth with low coefficient of friction
    - High DI-electric strength (electrostatics)
  - ✓ Minimize length and inside diameter “ID” of tubing
    - 1/8” (.125) = 2.41 ml / 300 mm (0.08 oz)
    - 1/4” (.250) = 9.65 ml / 300 mm (0.33 oz)
    - 3/8” (.375) = 21.72 ml / 300 mm (0.73 oz)
    - 1/2” (.500) = 38.60 ml / 300 mm (1.30 oz)
    - Evaluate flow restriction



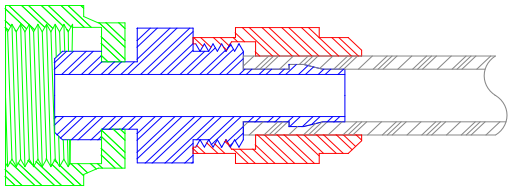


Color Change - Hardware

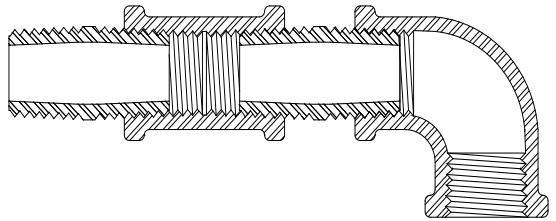
- Fluid Fittings
  - ✓ Use Nylon or stainless-steel fittings.
  - ✓ Use fittings without internal restriction
  - ✓ Use “AN” style fittings
  - ✓ Do not use pipe fittings
    - ✓ Exposed internal threads trap paint and increase color change time.
    - ✓ Rough interior surfaces cause contamination (dirt) and resistance.
    - ✓ Prone to rusting and scaling.



No internal restrictions



Internal restrictions

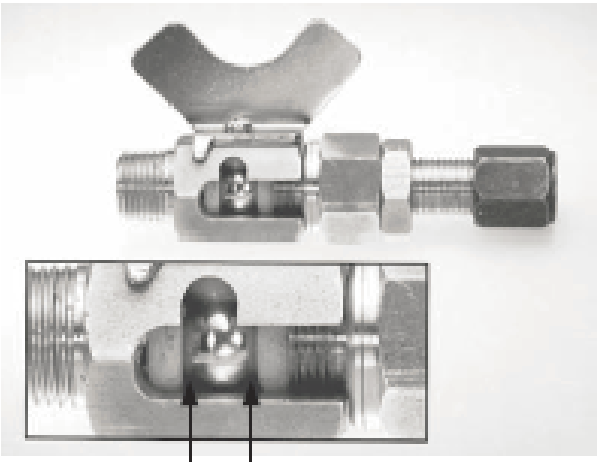


Avoid pipe style fittings

Color Change - Hardware

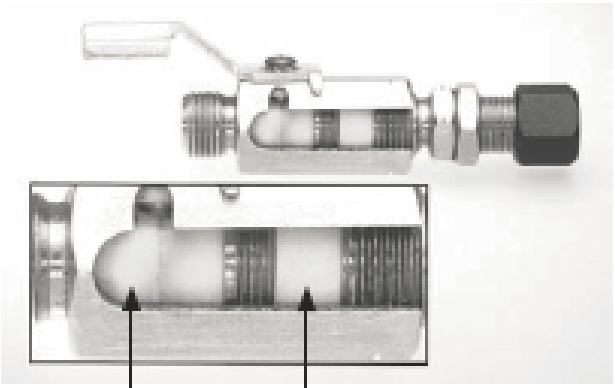
- Fluid Fittings

Conventional Ball Valve
(cut-a-way)



Dirt Traps

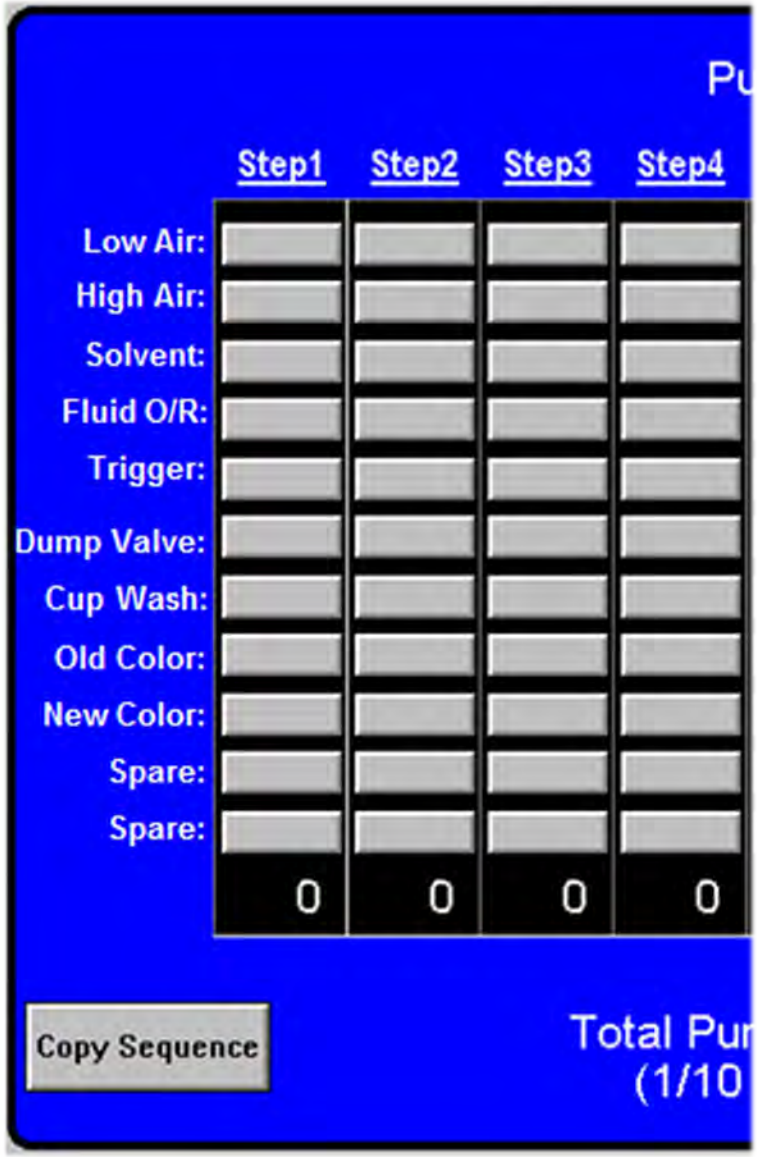
Encapsulated Ball "Ball Valve"
(cut-a-way)



No Dirt Traps

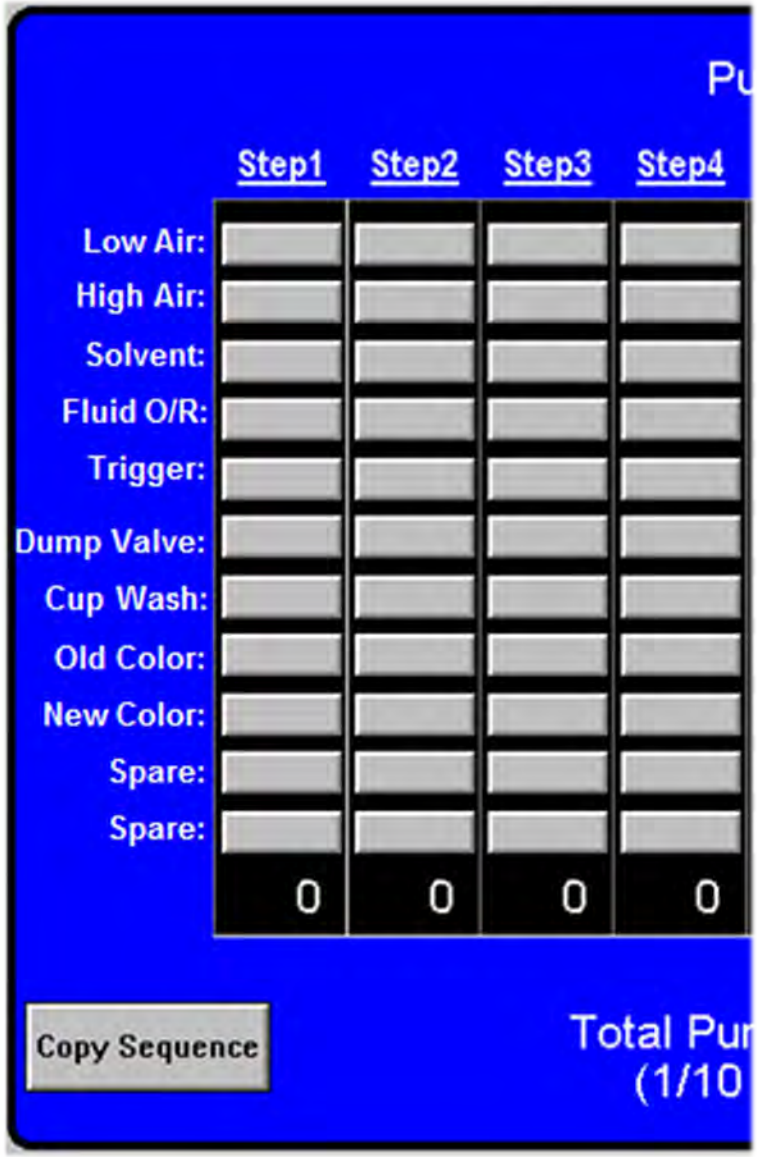
Color Change - Terminology

- **Low Air**: Air pressure used to match fluid pressure and push residual paint out of the system while still painting.
- **High Air**: Air pressure used during cleaning of fluid lines and hardware.
- **Solvent**: Air signal is used to actuate flow of solvent or other flush media.
- **Fluid O/R** (override): Air signal sent to fluid regulator to fully open and facilitate faster cleaning cycle.
- **Trigger**: Air signal sent to actuate paint applicator(s).
- **Dump Valve**: Air signal sent to open dump valve which facilitates faster flush.



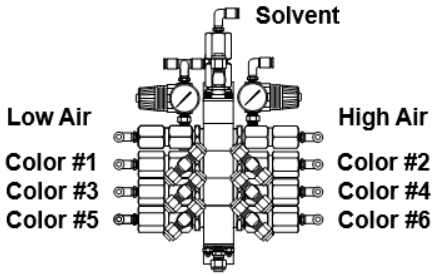
Color Change - Terminology

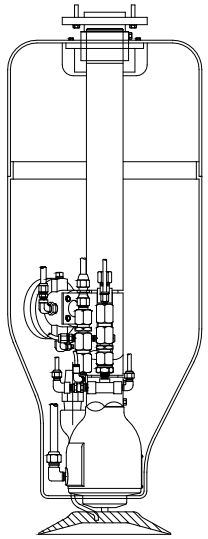
- **Cup Wash**: Specific to rotary atomizers, air signal is used to actuate solvent supply which flushes bell cup only.
- **Old Color**: Refers to previous color used.
- **New Color**: Refers to next color selected
- Helpful information when setting up color change sequence:
  - **System Capacity**: Volume of material within the fluid delivery system from the color stack to the applicator
  - **Fill Time**: Time required to “fill” the system when empty



Color Change - Sequence

- The color change sequence is typically broken down into two sections:
  - ✓ Purge or Flush
  - ✓ Load or Fill





Station: Clear Bell 1

Color Change Sequence

Color: 1

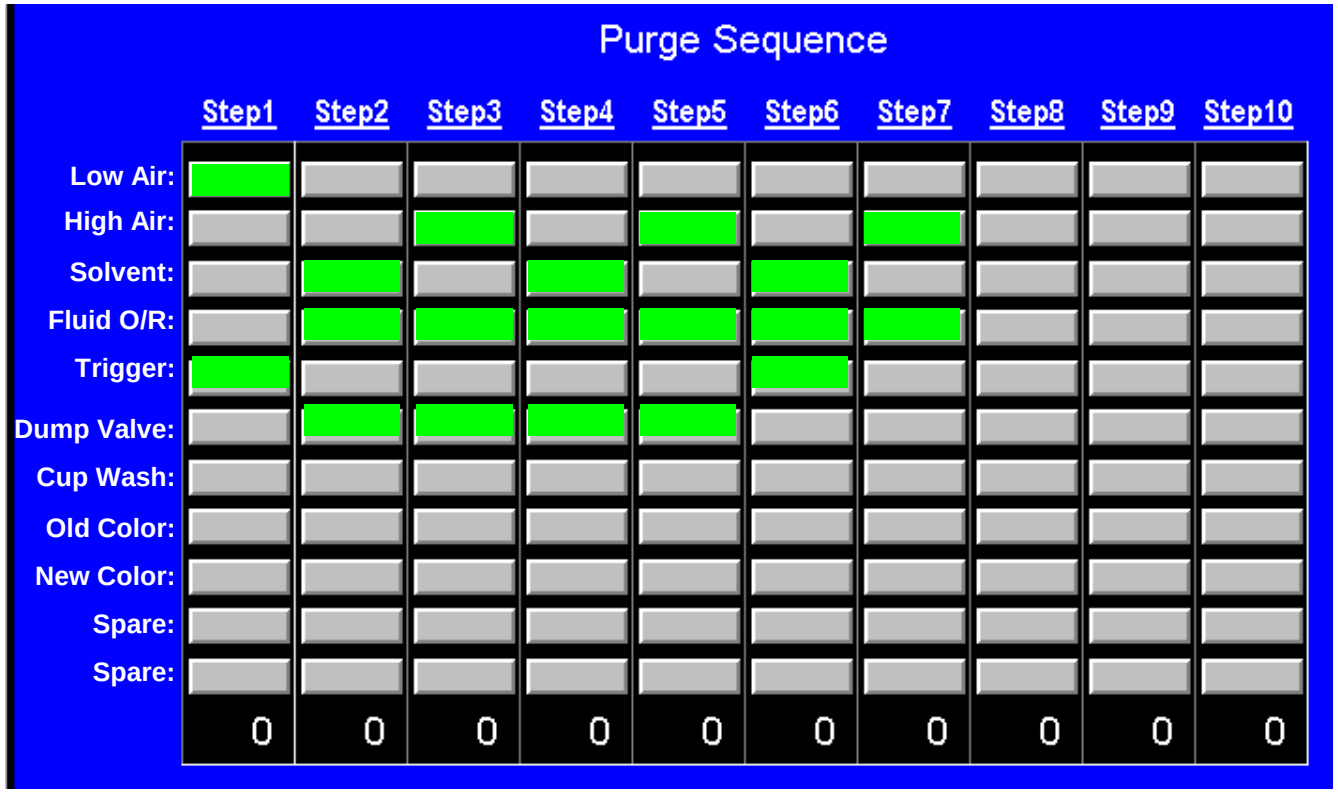
	Purge Sequence										Color Load Sequence				
	Step1	Step2	Step3	Step4	Step5	Step6	Step7	Step8	Step9	Step10	Step1	Step2	Step3	Step4	Step5
Low Air:															
High Air:															
Solvent:															
Fluid O/R:															
Trigger:															
Dump Valve:															
Cup Wash:															
Old Color:															
New Color:															
Spare:															
Spare:															
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

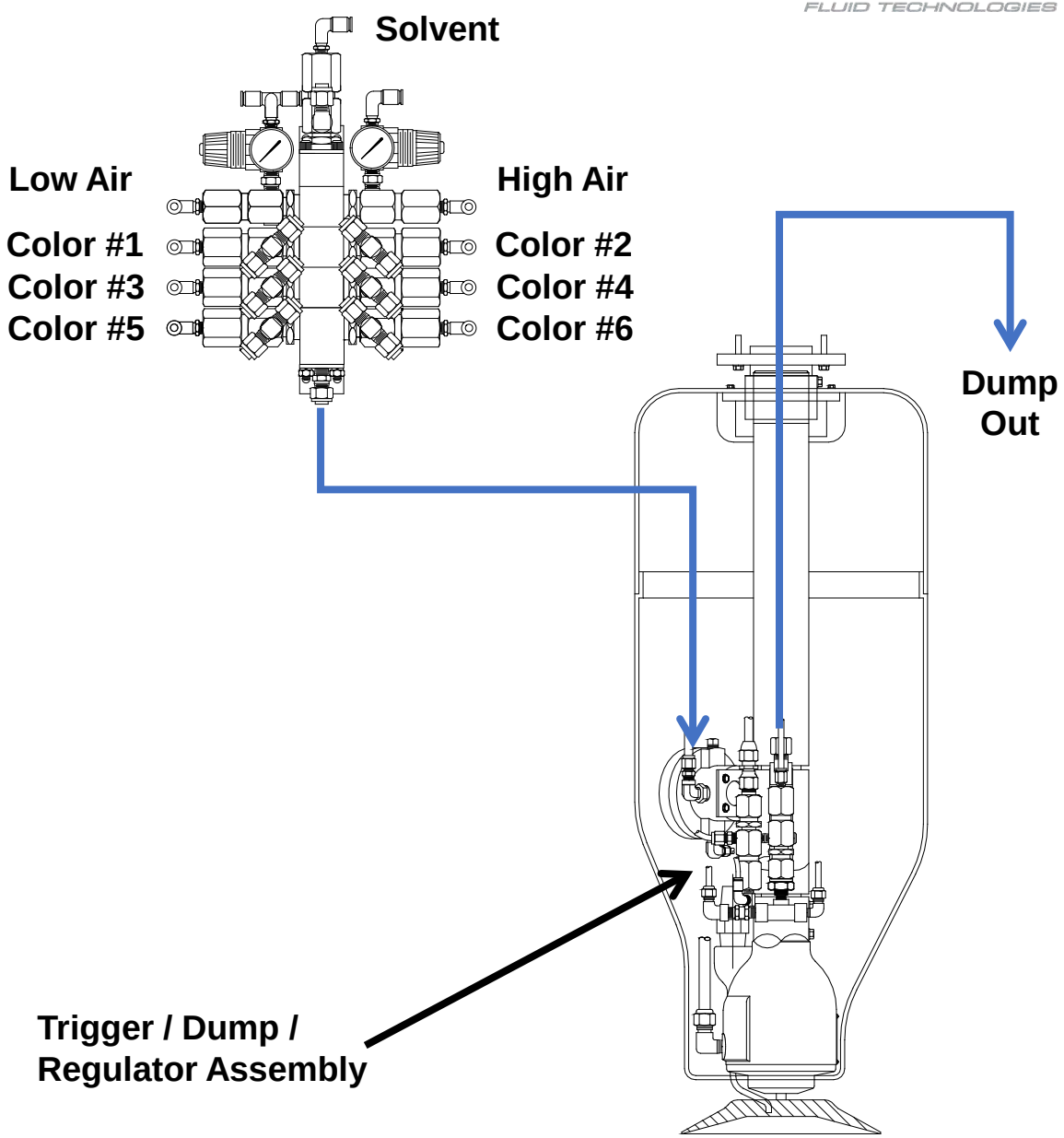
Copy Sequence

Total Purge Time: 0
(1/10 Second)

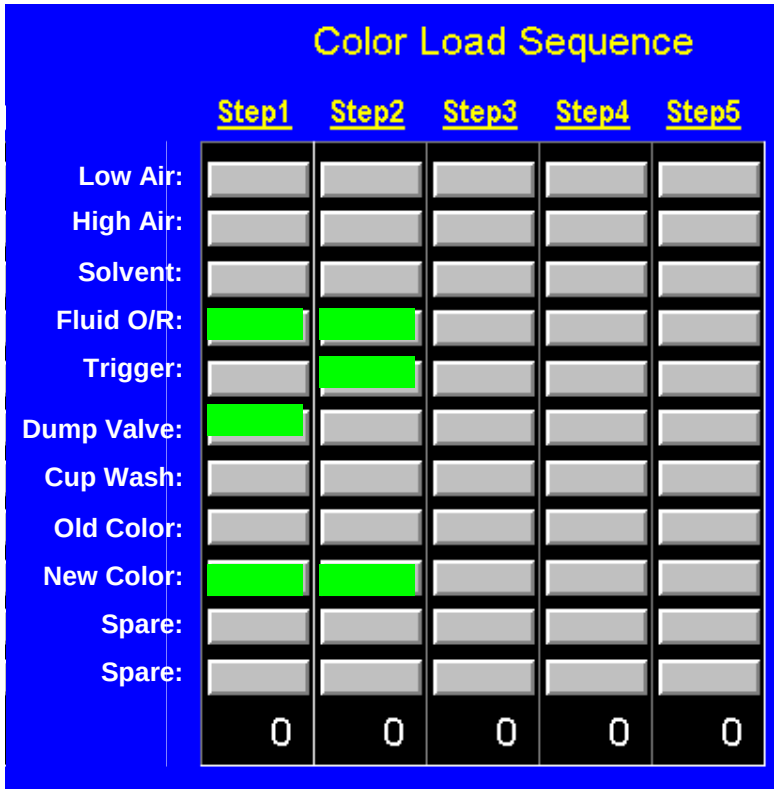
Total Load Time: 0
(1/10 Second)

Color Change – Sequence: Purge / Flush

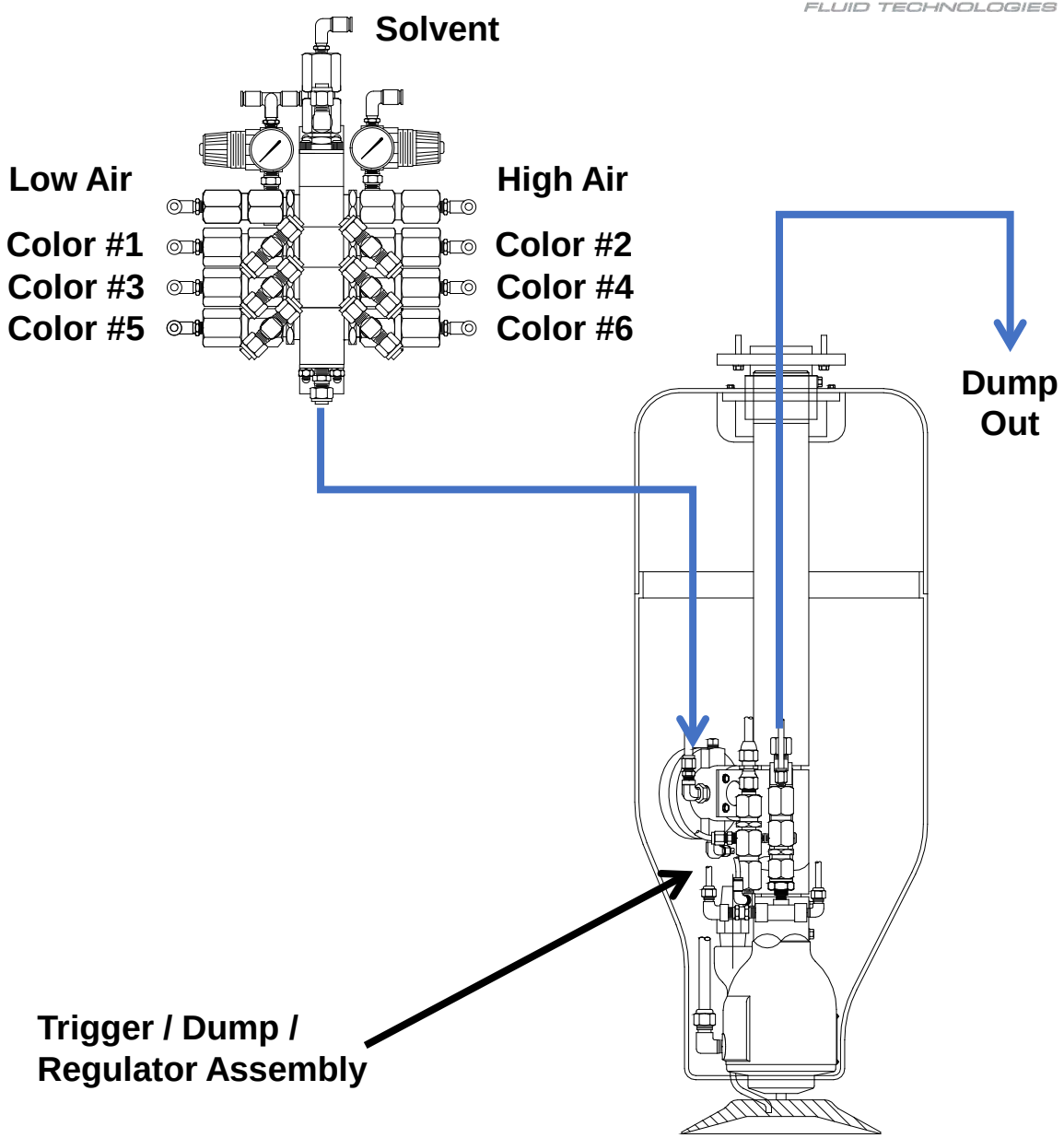




Color Change – Sequence: Load / Fill

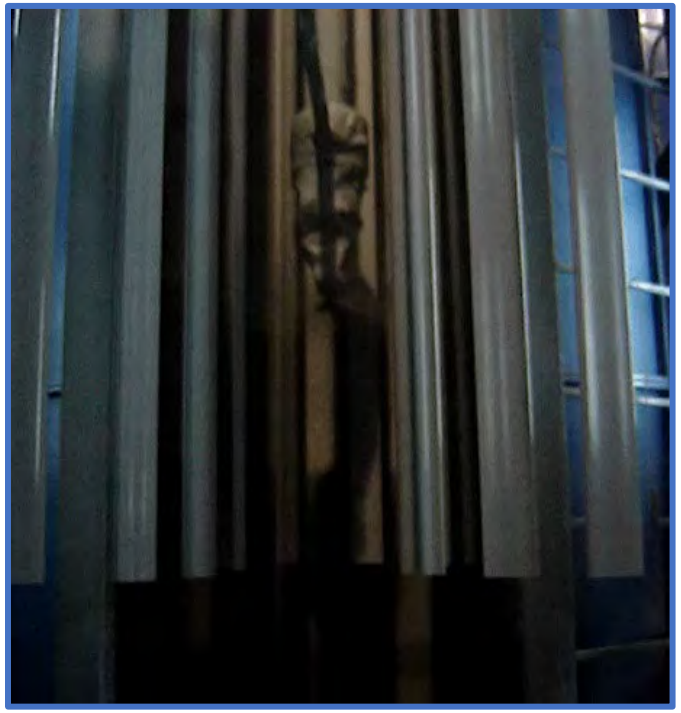


Timing typically 40 - 120 seconds

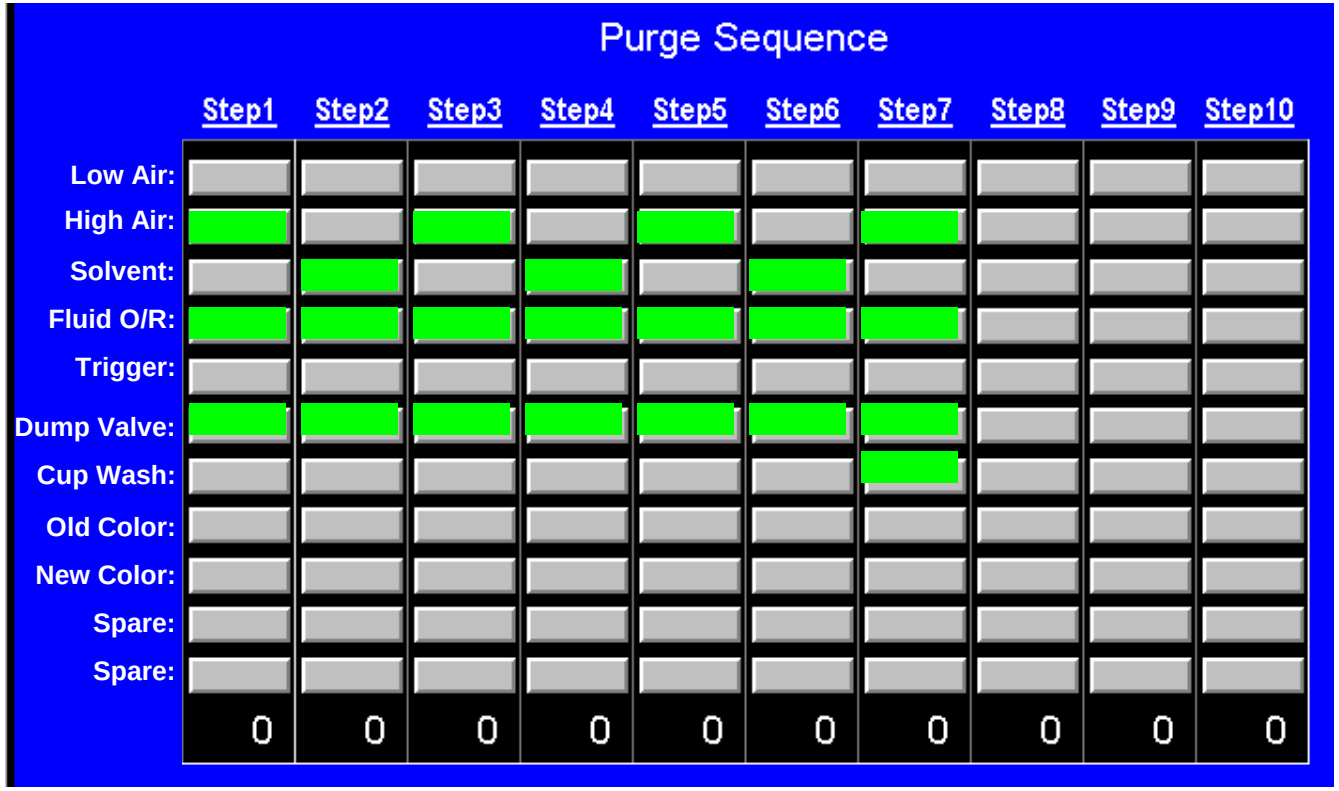


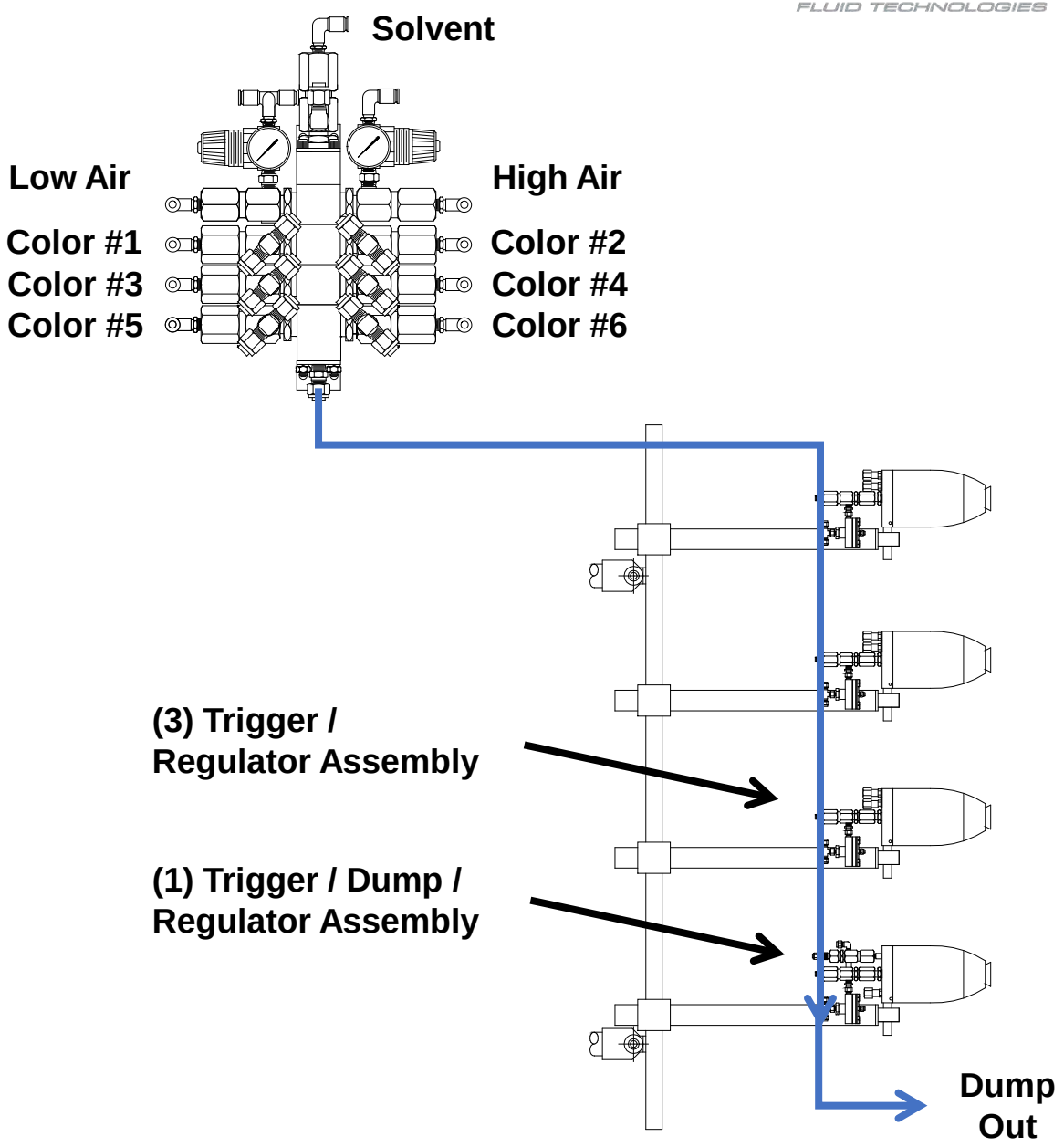
Color Change – Sequence: Load / Fill

	Previous Configuration	Modified Configuration	Savings Per Day
Fluid Supply Line Length:	45 Feet	27 Feet	
Fluid Supply Line "ID":	5/8"	1/4"	
Fluid Line Capacity:	2700	270	
System Capacity:	2850	320	
Color Change Time:	10 Minutes	40 Sec (2 Min)	
Color Changes Per Shift:	8	8	
Color Change Time Per Shift:	80 Minutes	16 Minutes	64 Minutes
Solvent Used Per Color Change:	9462 cc	365 cc	
Solvent Used Per Shift:	20 Gallons	.75 Gallons	19.25 Gallons

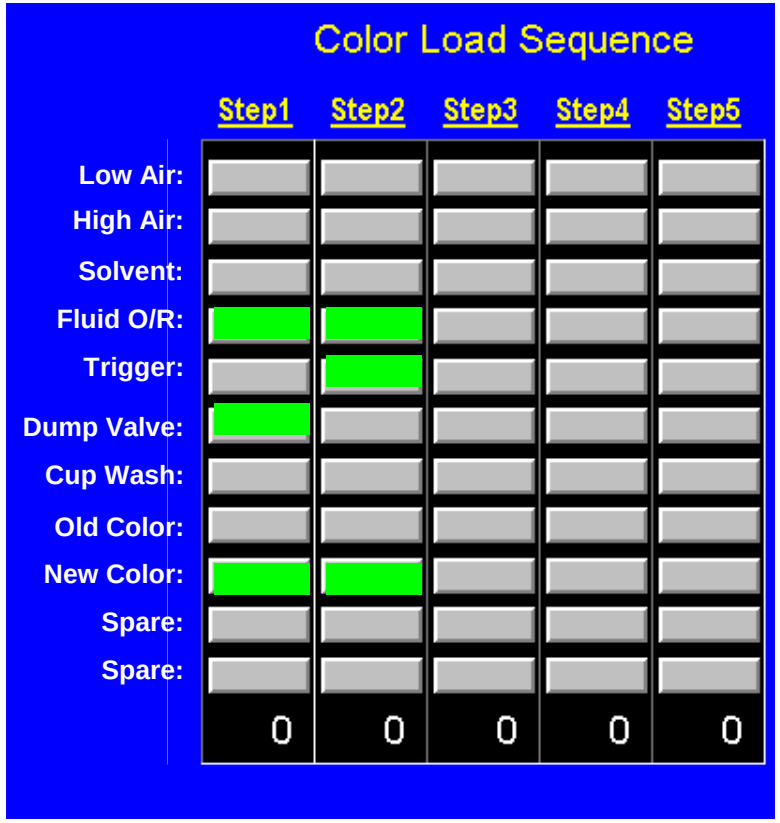


Color Change – Sequence: Purge / Flush

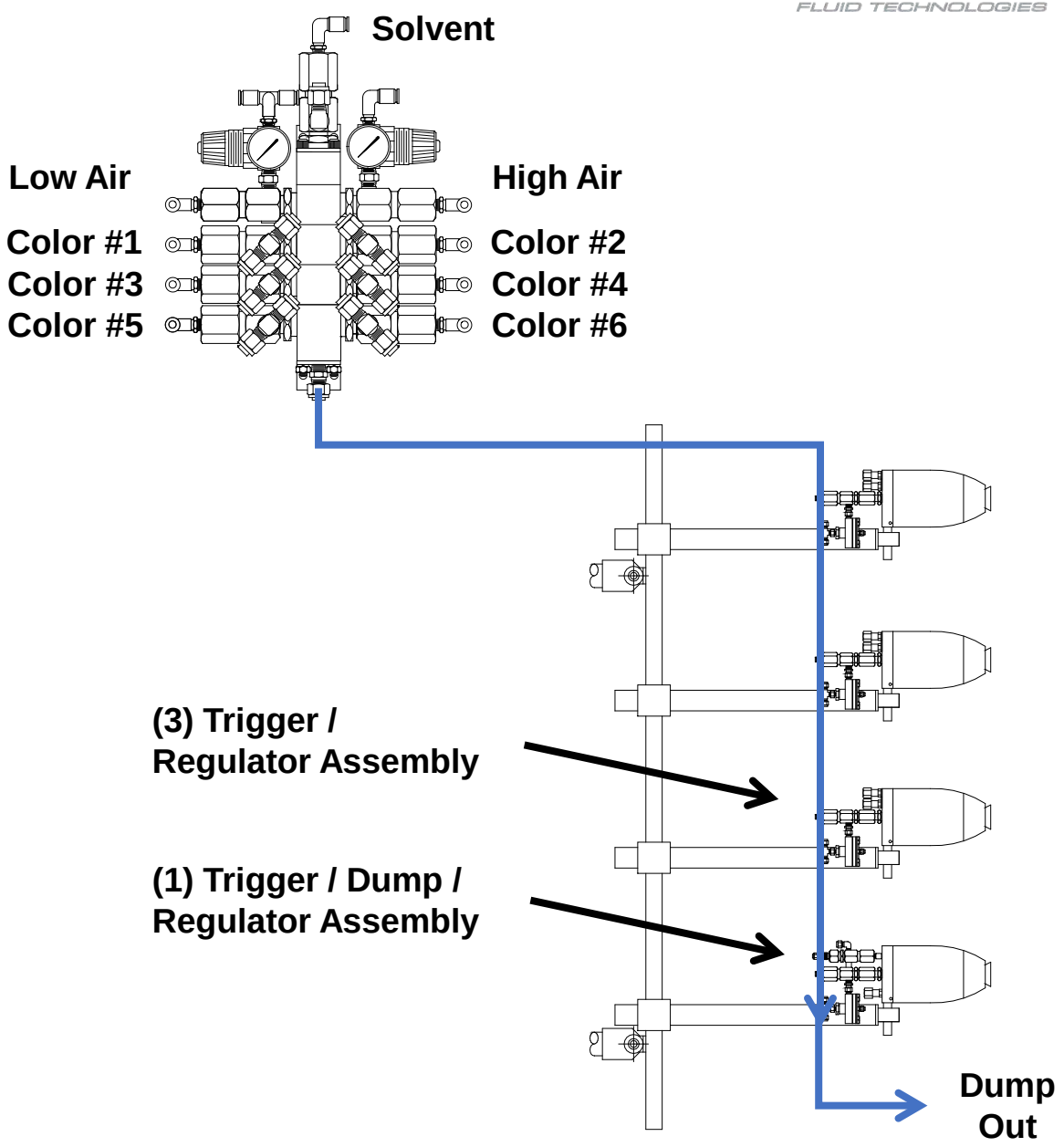




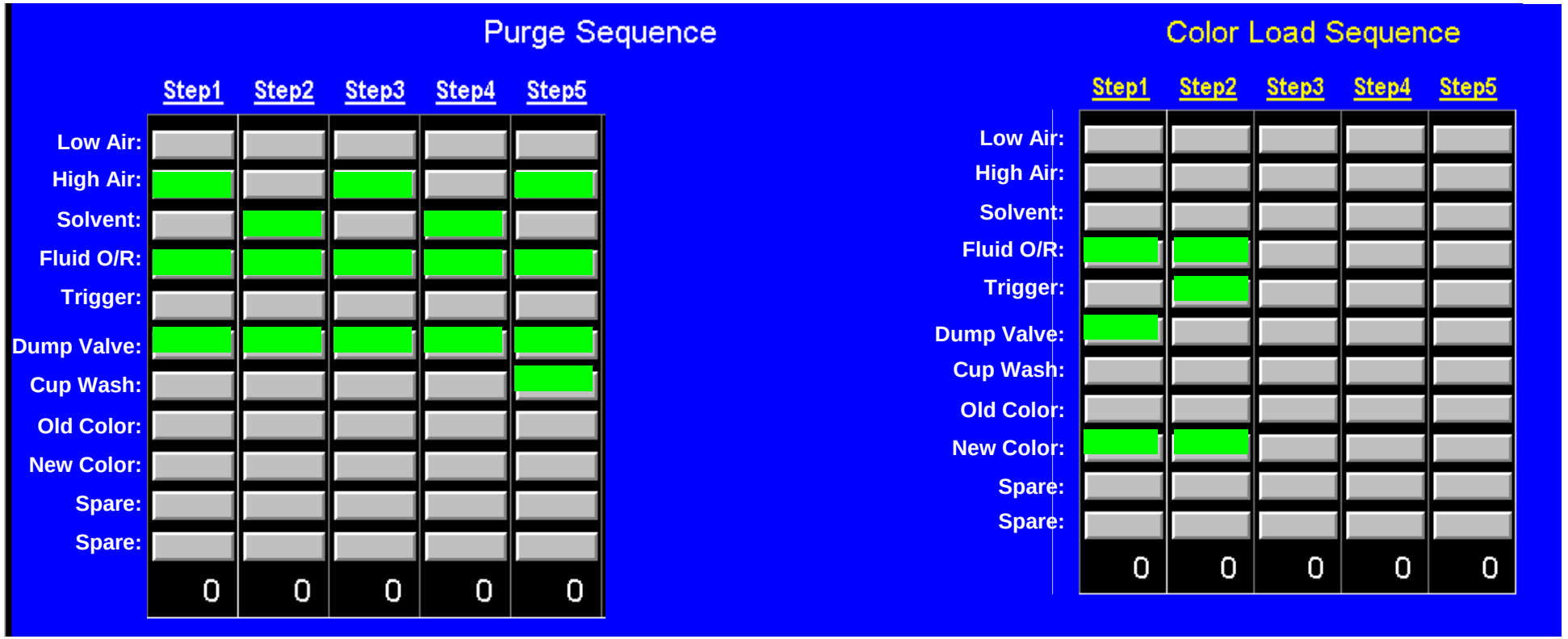
Color Change – Sequence: Load / Fill

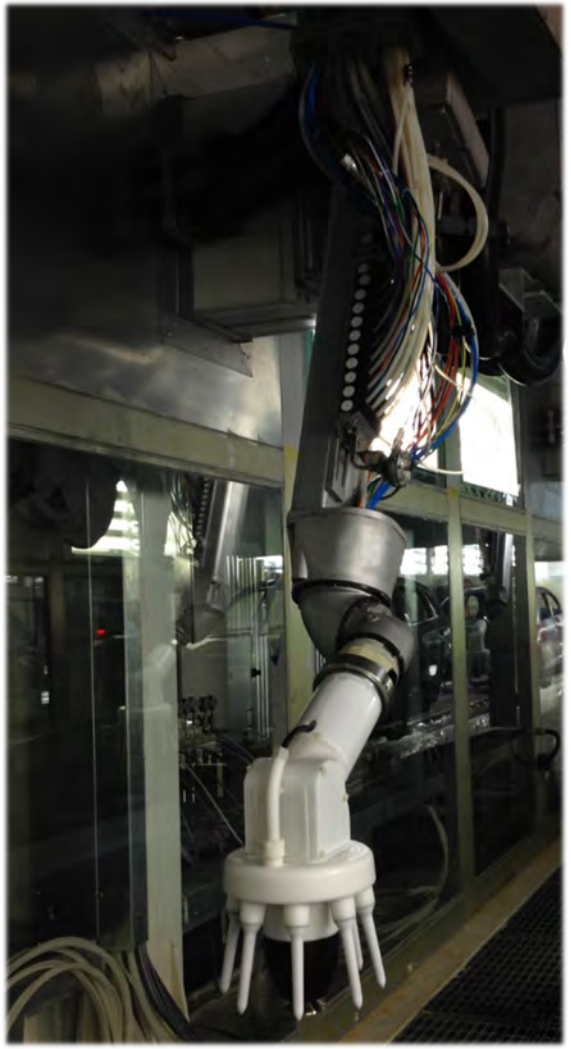


Timing typically 30 - 60 seconds



Color Change – Sequence: Flush / Load

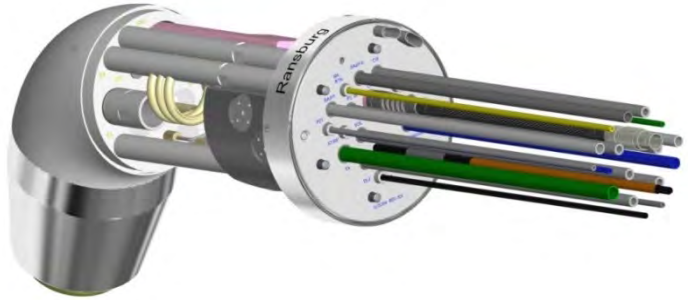




Timing typically 8 - 12 seconds

Color Change – Dual Purge Applicators

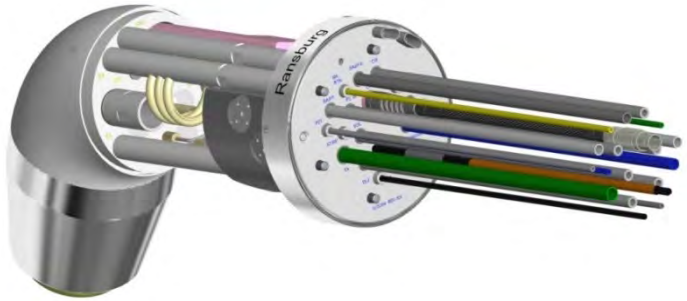
- The RMA and Evolver applicators have an optional dual purge feature.
  - ✓The dual purge feature utilizes a 5-valve manifold block assembly.
  - ✓Two fluid sources are available to the applicator at all times.
  - ✓While one color is being applied with voltage activated, the second color can be flushed and loaded.
  - ✓During the color change process, an integrated solvent valve is used to quickly flush out the coiled fluid tube and spray head.
  - ✓Color change times of 7 – 10 seconds can be achieved since both materials are at the applicator.



5 Valves
- (2) Paint Valves
- (2) Dump Valves
- (1) Solvent Flush

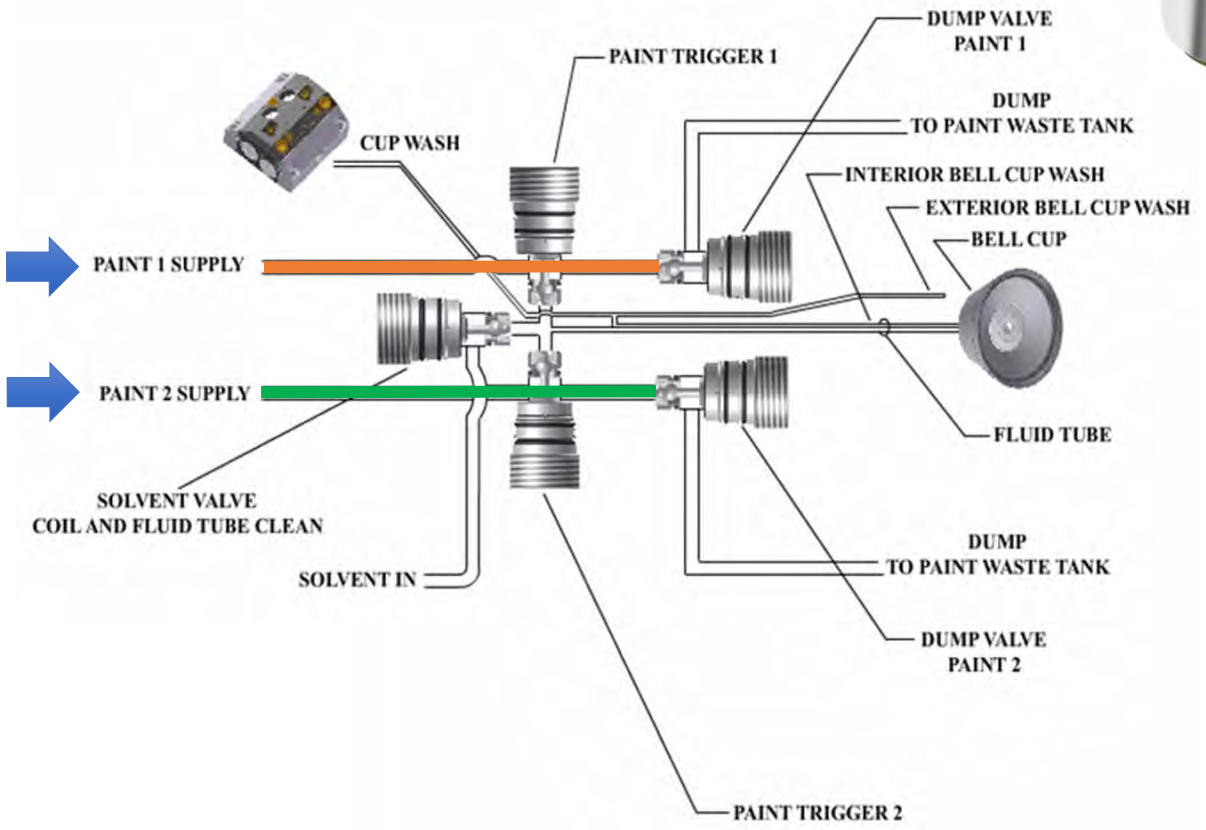
Color Change – Dual Purge Applicators

RMA and Evolver Series of Atomizers



Dual Purge Sequence

- C1 & C2 loaded



5 Valves

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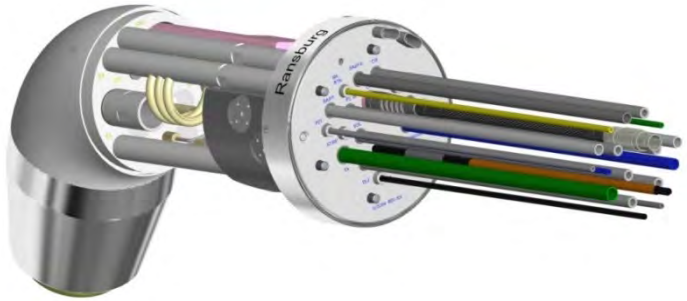
Color Change – Dual Purge Applicators

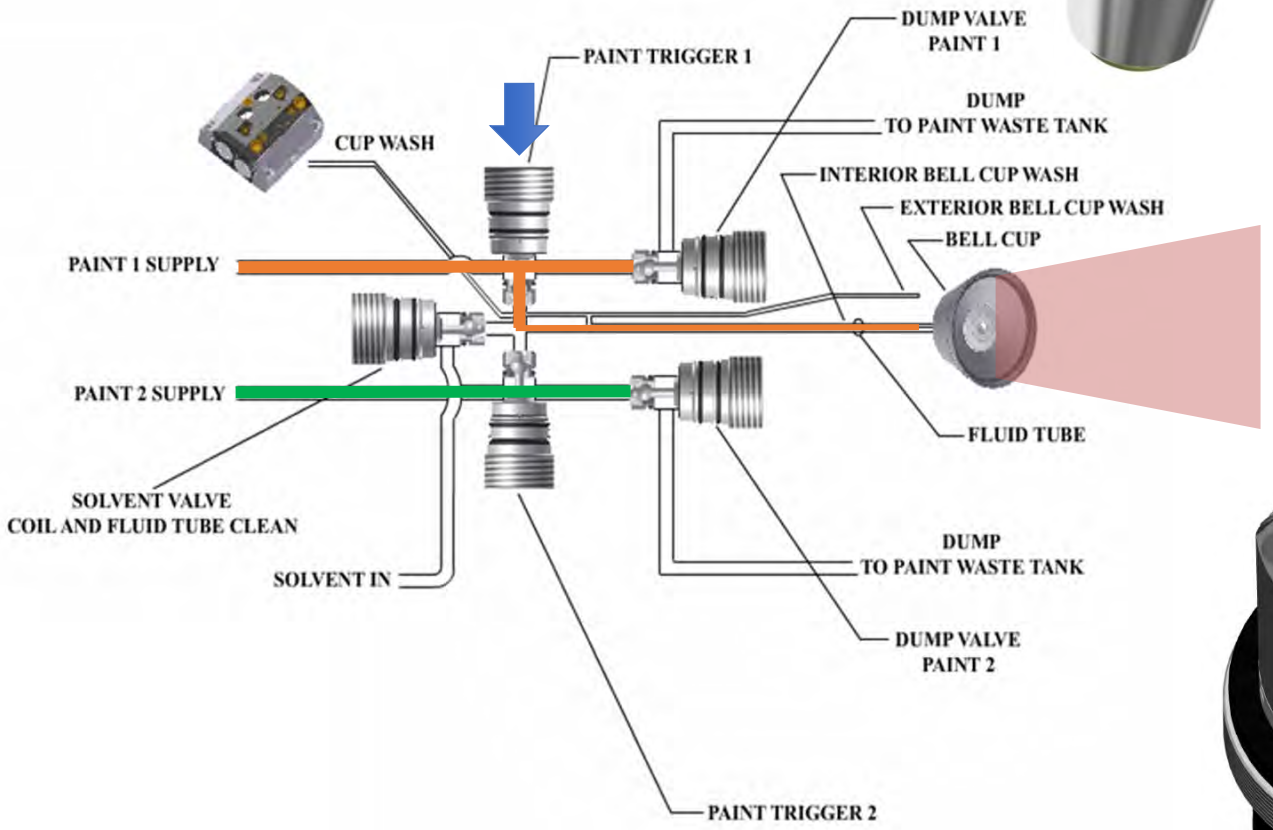
RMA and Evolver Series of Atomizers



Dual Purge Sequence

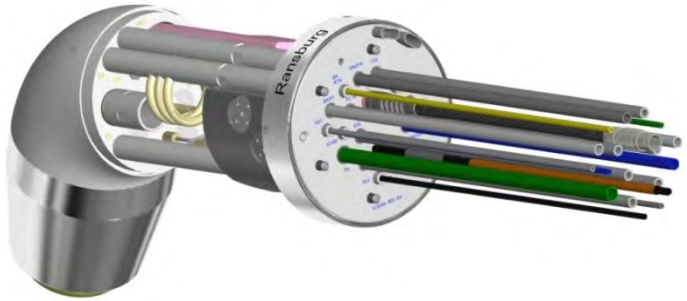
C1 & C2 loaded

➡ Spray with C1



Color Change – Dual Purge Applicators

RMA and Evolver Series of Atomizers

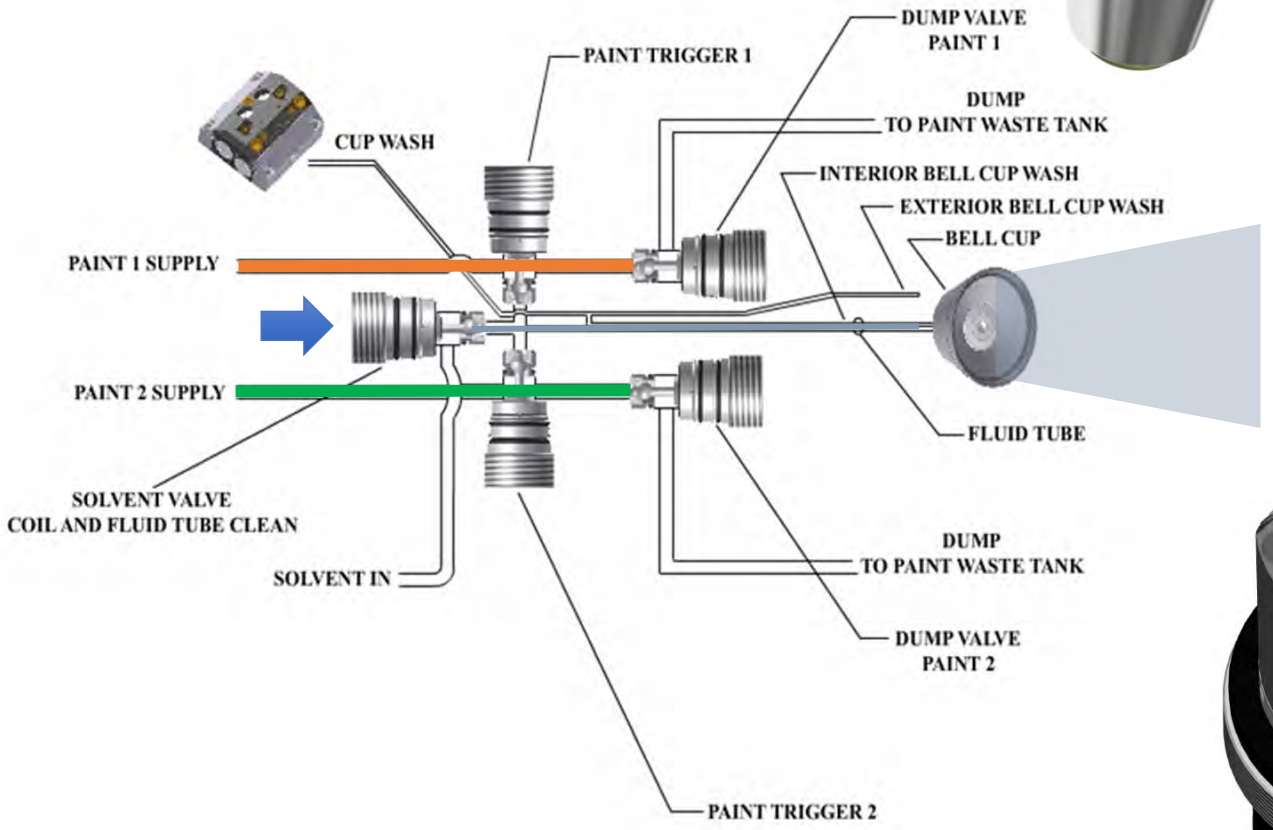


Dual Purge Sequence

C1 & C2 loaded

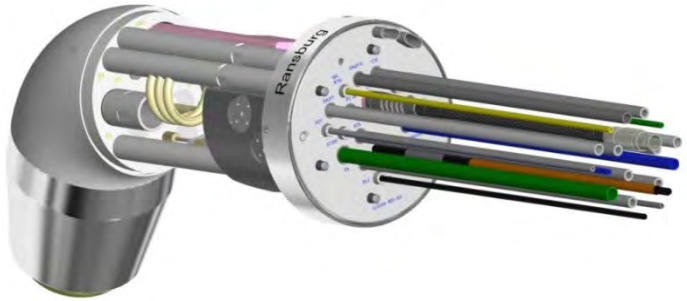
Spray with C1

➡ Clean fluid tube



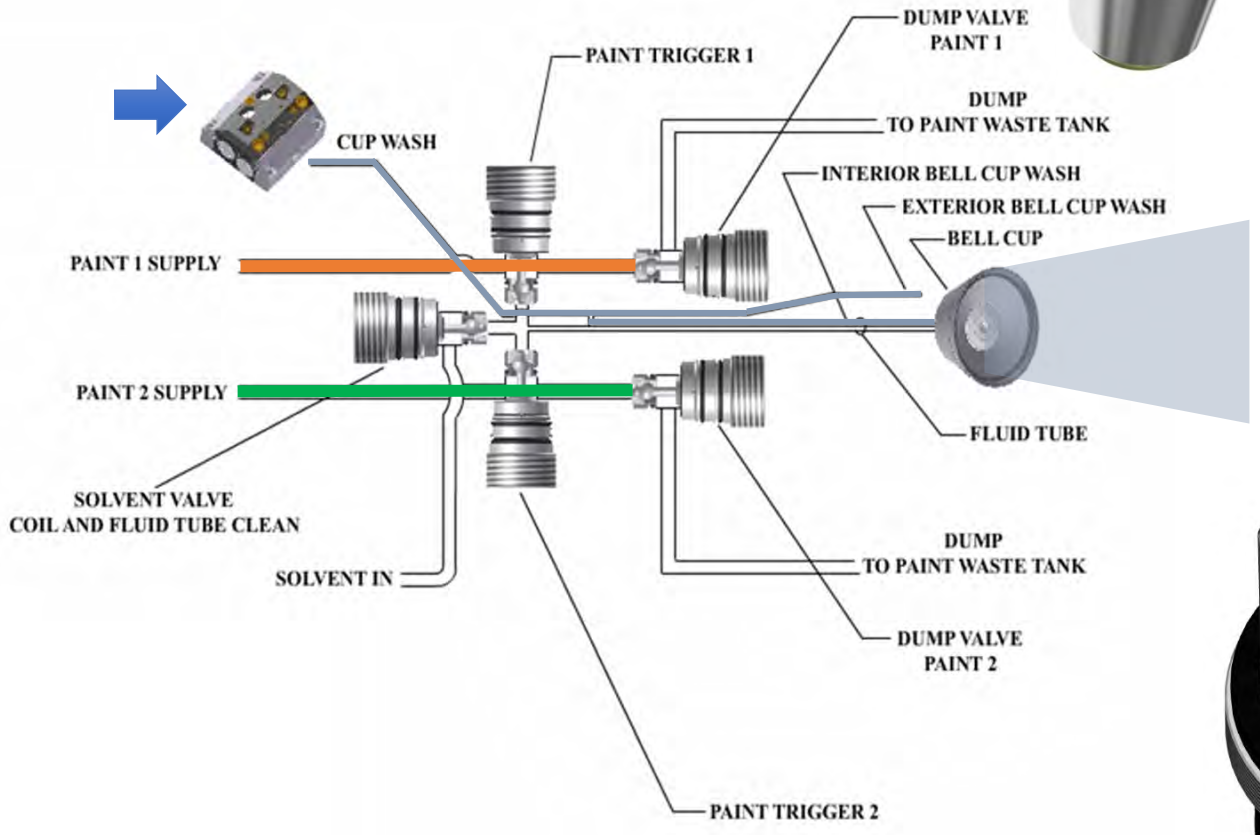
Color Change – Dual Purge Applicators

RMA and Evolver Series of Atomizers



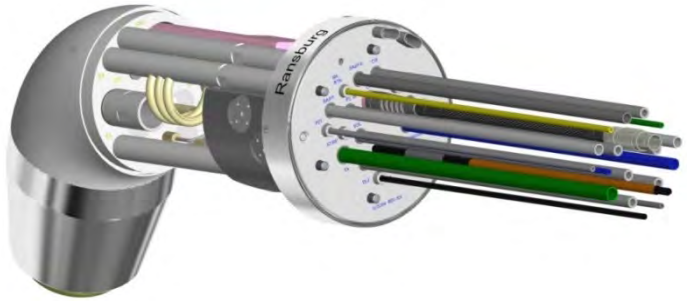
Dual Purge Sequence

- C1 & C2 loaded
- Spray with C1
- Clean fluid tube
- **➡** Wash bell cup



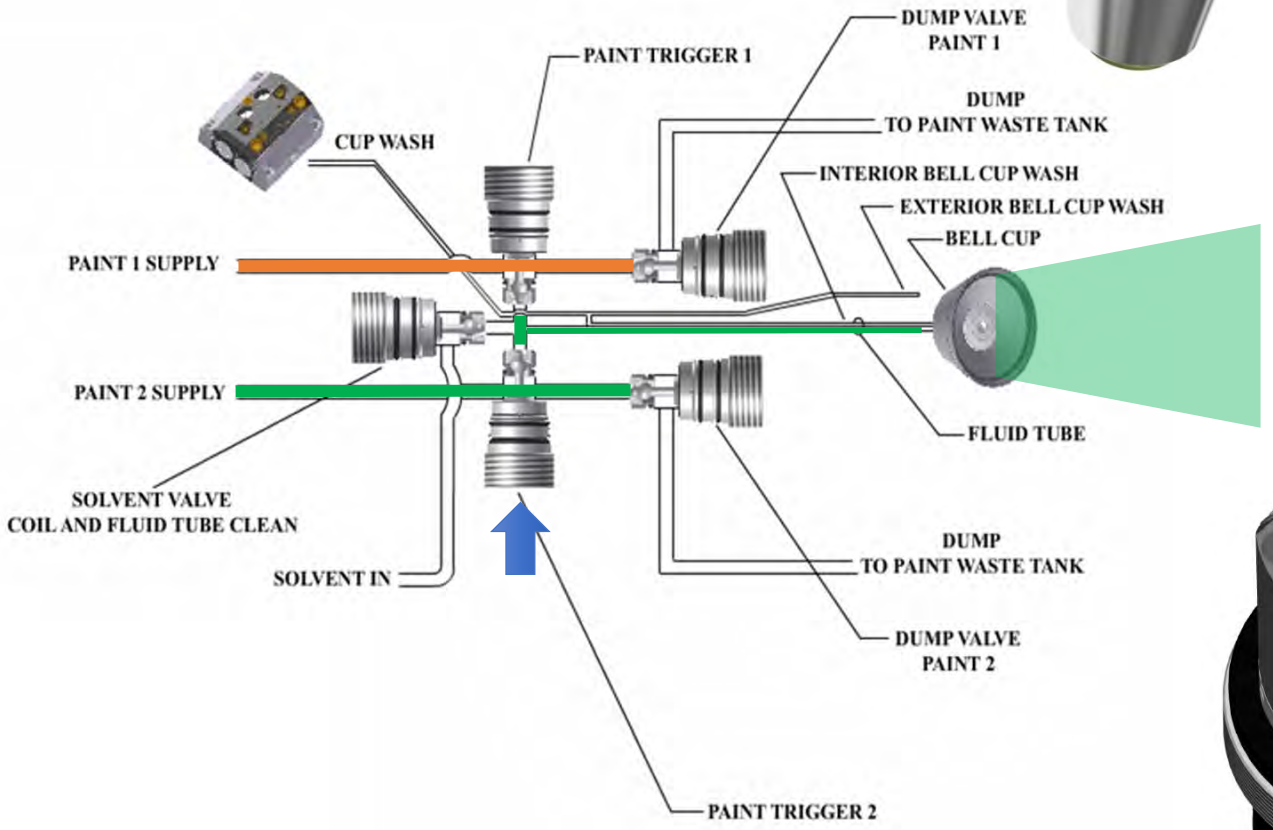
Color Change – Dual Purge Applicators

RMA and Evolver Series of Atomizers



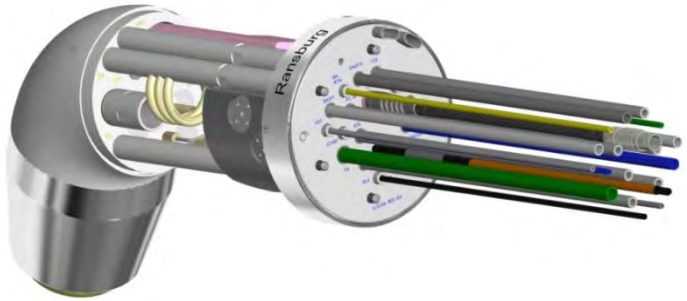
Dual Purge Sequence

- C1 & C2 loaded
- Spray with C1
- Clean fluid tube
- Wash bell cup
- ➡ Spray with C2



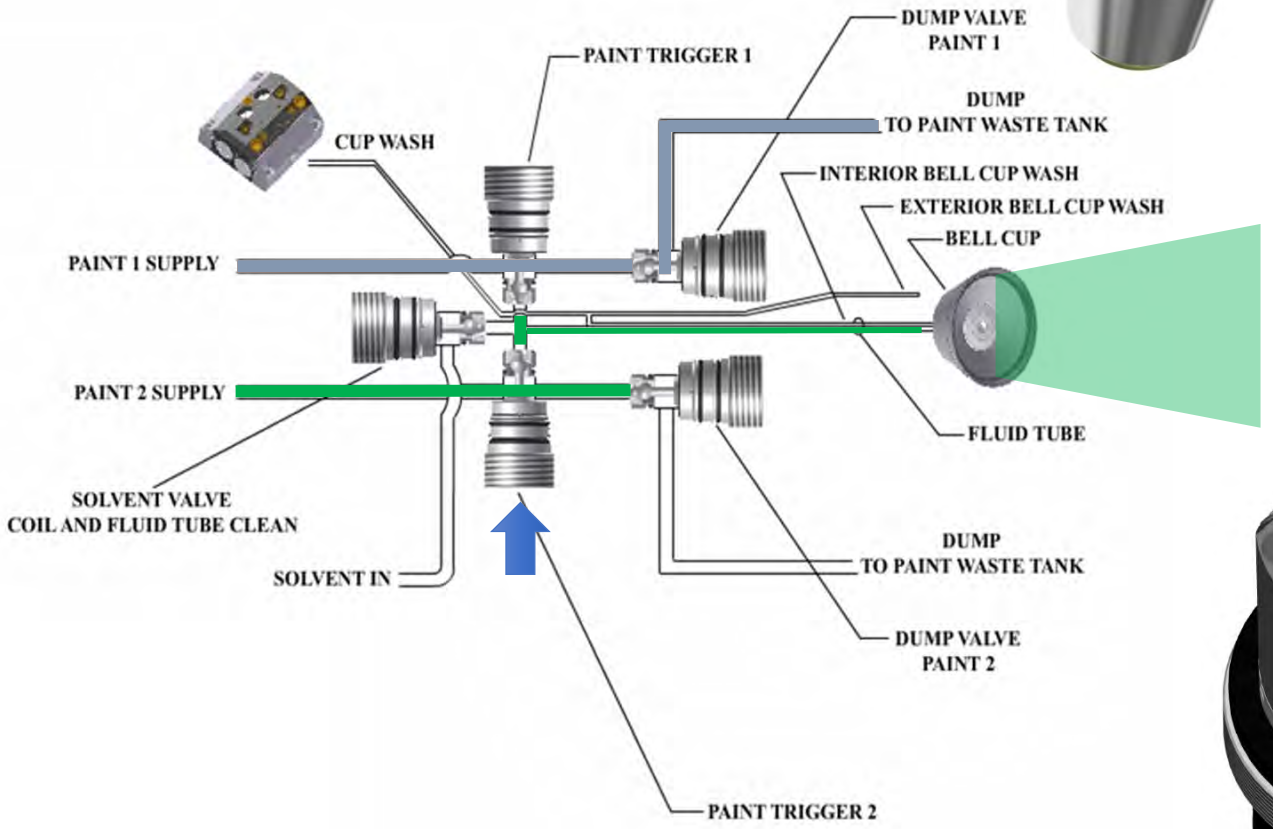
Color Change – Dual Purge Applicators

RMA and Evolver Series of Atomizers



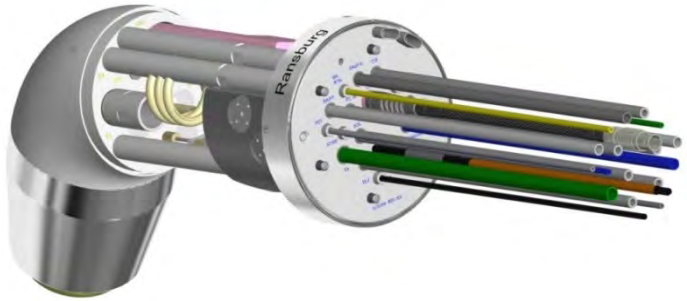
Dual Purge Sequence

- C1 & C2 loaded
- Spray with C1
- Clean fluid tube
- Wash bell cup
- ➡ Spray with C2
- ➡ Flush C1



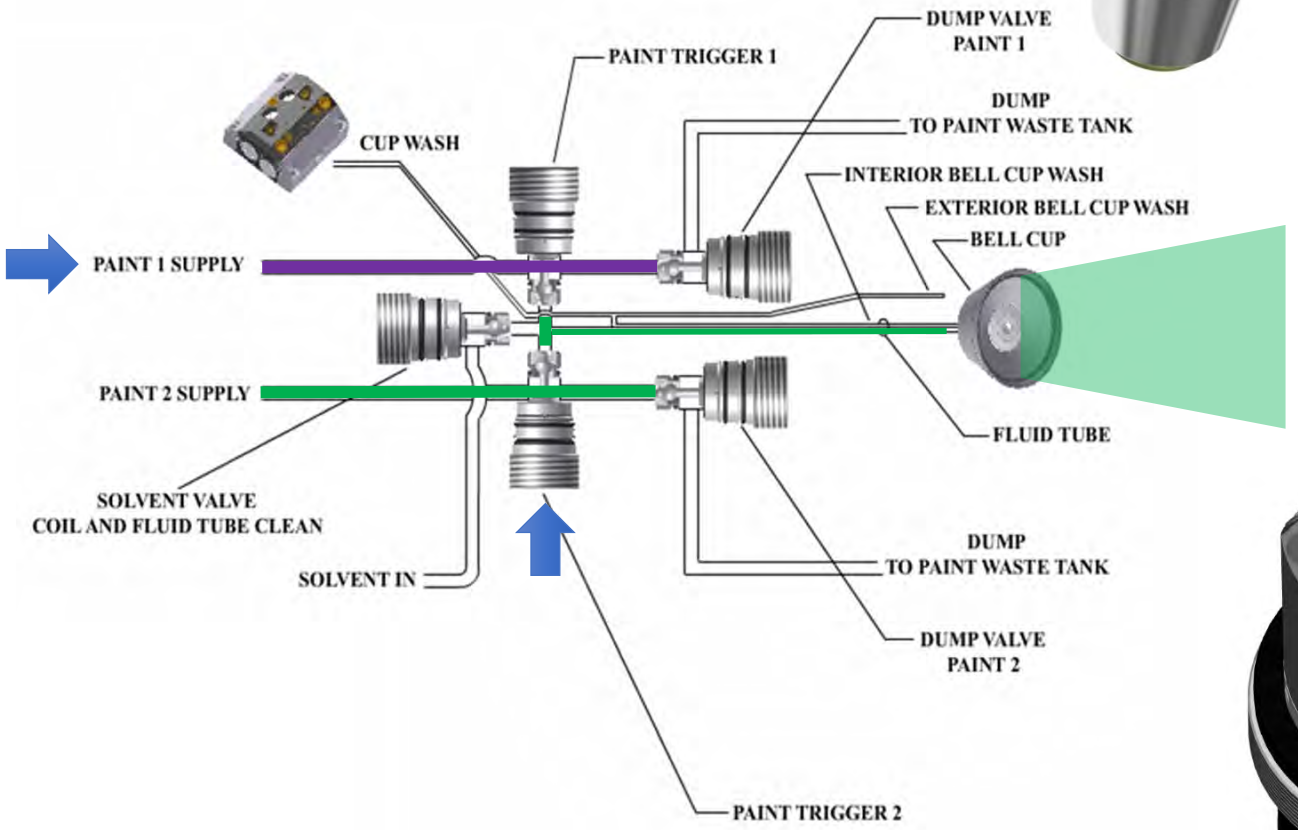
Color Change – Dual Purge Applicators

RMA and Evolver Series of Atomizers

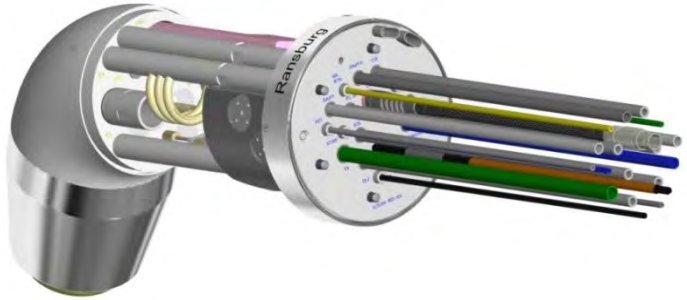


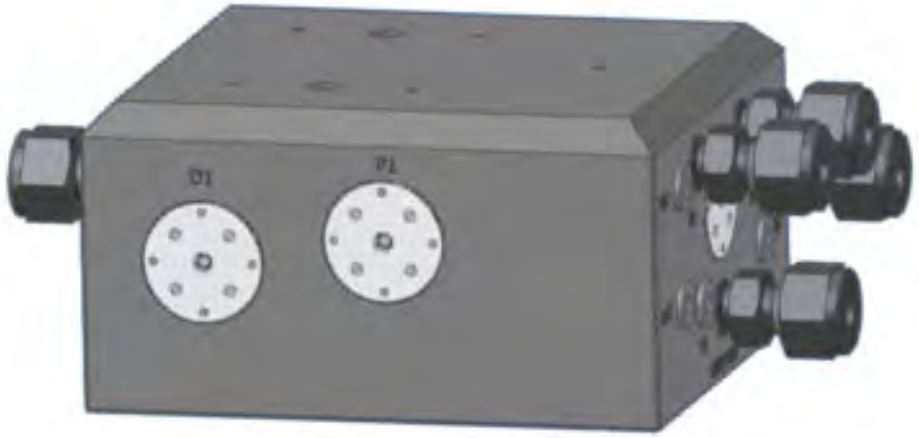
Dual Purge Sequence

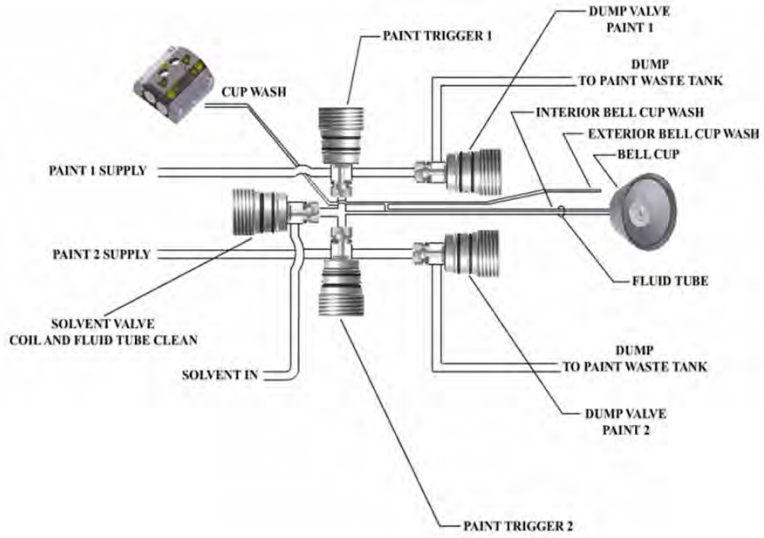
- C1 & C2 loaded
- Spray with C1
- Clean fluid tube
- Wash bell cup
- ➡ Spray with C2
- Flush C1
- ➡ Load C3



Color Change – Dual Purge Adapter Manifold

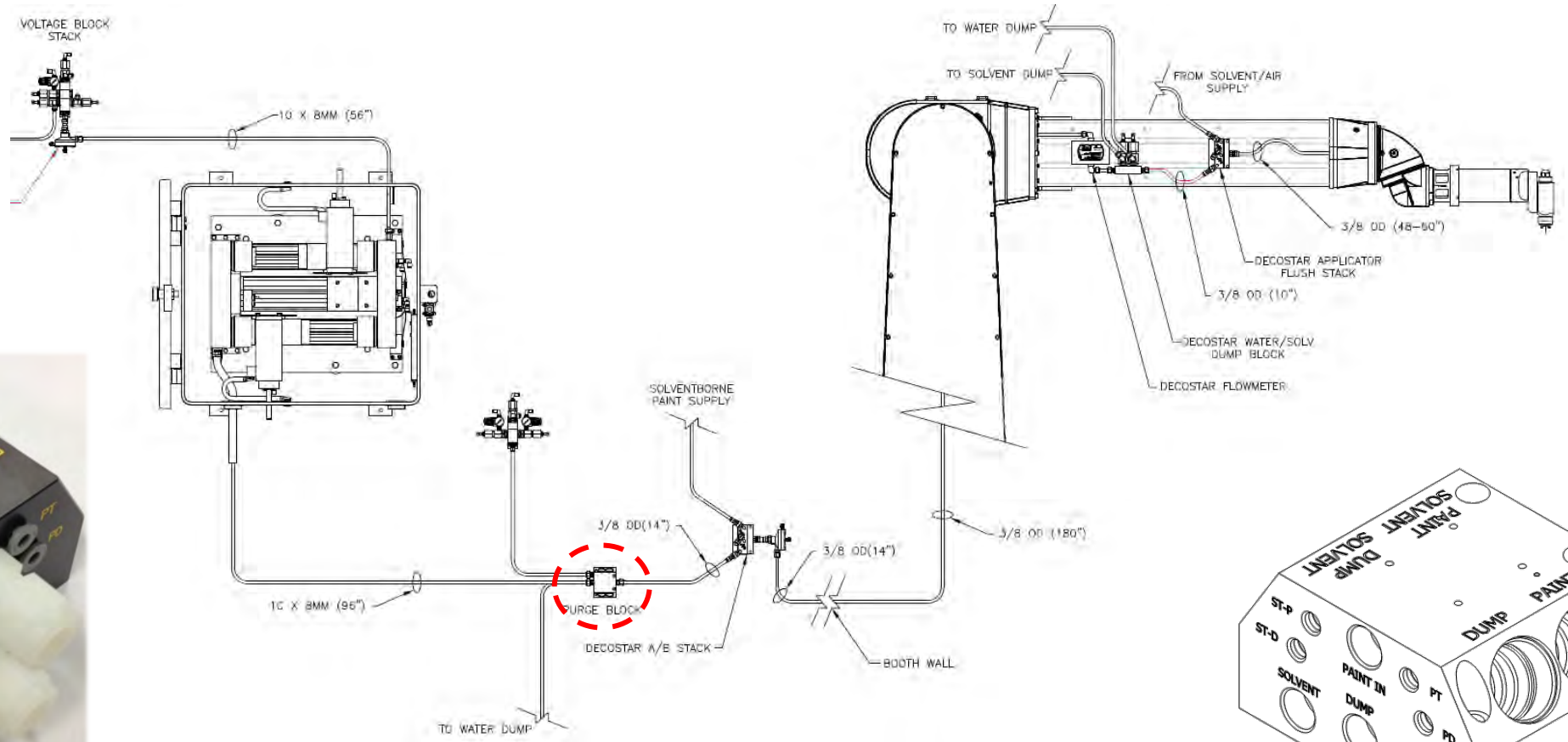


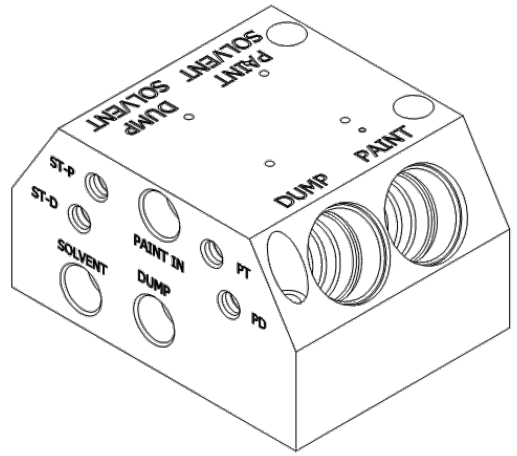




Color Change – Other Solutions

Flush Assist Manifolds

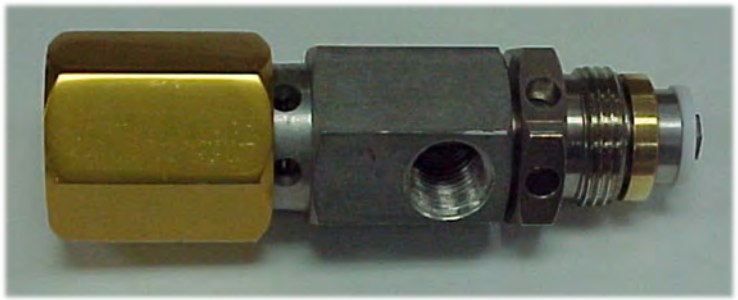


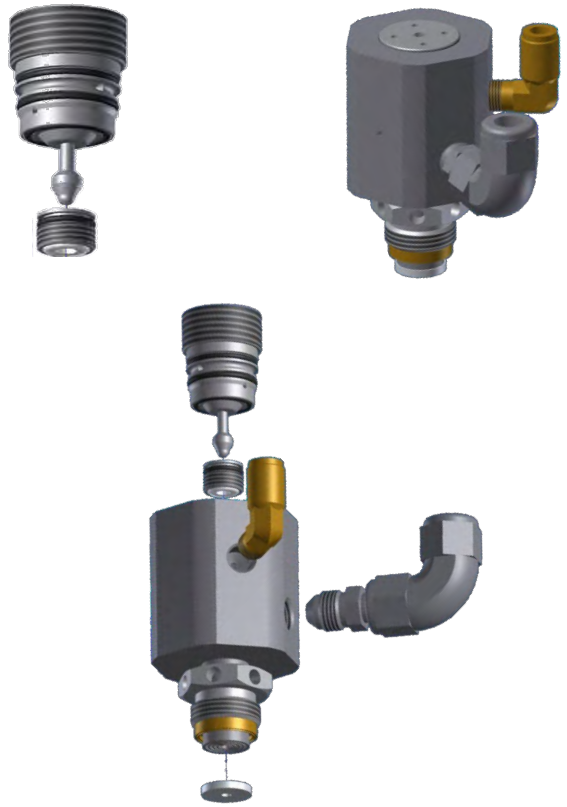


Color Change – Other Solutions

CCV - MCV Adapter

- Moisture sensitive catalyst was drying on the shaft of CCV and damaging the seals resulting in leakage or stuck valves.





Color Change – Other Solutions

SPECIFICATIONS

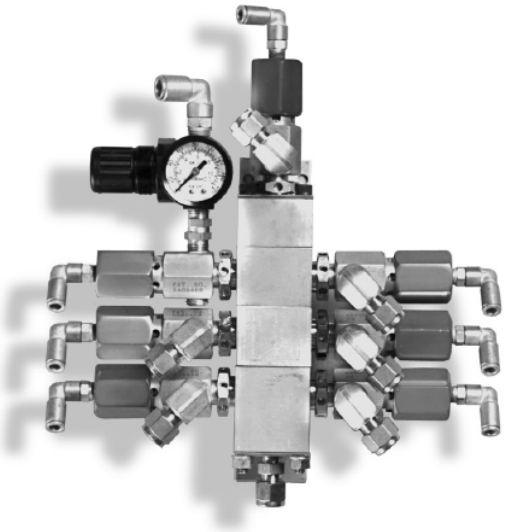
Environmental/Physical

Nominal Dimensions:	See "Color Valve Stack Figure" in the "Parts Identification" section.

Mechanical

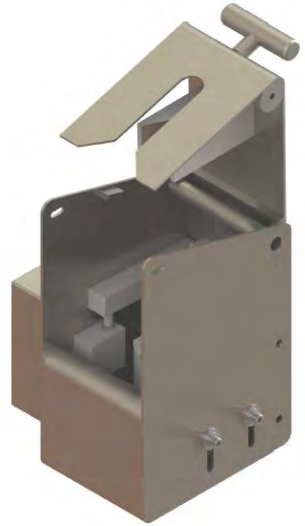
Air Requirements:	70-100 psig (4.8-6.9 bar) Operating Pressure
Air Inlet/Outlet Connections:	1/4-inch OD Tubing
Fluid Pressure:	300 psig (20.6 bar) maximum
Fluid Inlet:	1/4-inch NPT(F) X 2 port (Fitting installed 3/8-inch OD tubing)
Fluid Outlet:	1/4-inch NPT(F) X 1 port (Fitting installed 3/8-inchOD tubing)
Fluid Flow Capacity:	3800 cc/min @ 47 psi pressure drop (Paint viscosity @ 700 entipoise) Varies according to material pressure and viscosity.
Valve Actuation Speed, On-Off Cyle:	55 cycles/min
Colors:	Up to and including 30 colors total.

Color Select System



Gun Flush Boxes

- Automatically flush handguns during color changes
- Avoid messes and simplify cleanup
- Increase production speed



Automating The Color Change Process:

- Fast is a “relative” term when it come to color change time, how much does customer want to invest?
- Return on Investment can be determined based on:
  - ✓ Increased productivity
  - ✓ Reduced coating and solvent usage
  - ✓ Recued waste disposal
- Standard hardware can be configured to meet customers specific needs

Thank you!

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