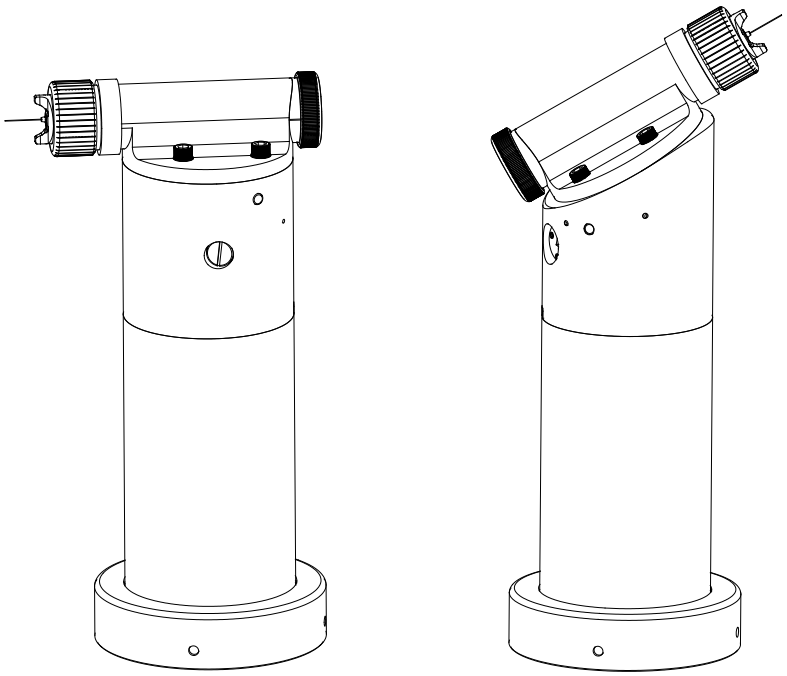
Ransburg

SERVICE MANUAL
AA-03-01.1
(Replaces AA-03-01)
January - 2013

ROBOT WATERBASE APPLICATOR



MODEL: 78863-90, 78863-60

IMPORTANT: Before using this equipment, carefully read SAFETY PRECAUTIONS, starting on page 1, and all instructions in this manual. Keep this Service Manual for future reference.

Service Manual Price: $30.00

CONTENTS

(Maintenance Cont. Next Page)

SAFETY

SAFETY PRECAUTIONS

Before operating, maintaining or servicing any Ransburg electrostatic coating system, read and understand all of the technical and safety literature for your Ransburg products. This manual contains information that is important for you to know and understand. This information relates to USER SAFETY and PREVENTING EQUIPMENT PROBLEMS. To help you recognize this information, we use the following symbols. Please pay particular attention to these sections.

A WARNING! states information to alert you to a situation that might cause serious injury if instructions are not followed.

A CAUTION! states information that tells how to prevent damage to equipment or how to avoid a situation that might cause minor injury.

A NOTE is information relevant to the procedure in progress.

While this manual lists standard specifications and service procedures, some minor deviations may be found between this literature and your equipment. Differences in local codes and plant requirements, material delivery requirements, etc., make such variations inevitable. Compare this manual with your system installation drawings and appropriate Ransburg equipment manuals to reconcile such differences.

Careful study and continued use of this manual will provide a better understanding of the equipment and process, resulting in more efficient operation, longer trouble-free service and faster, easier troubleshooting. If you do not have the manuals and safety literature for your Ransburg system, contact your local Ransburg representative or Ransburg.

⚠ WARNING

> The user MUST read and be familiar with the Safety Section in this manual and the Ransburg safety literature therein identified.

> This manual MUST be read and thoroughly understood by ALL personnel who operate, clean or maintain this equipment! Special care should be taken to ensure that the WARNINGS and safety requirements for operating and servicing the equipment are followed. The user should be aware of and adhere to ALL local building and fire codes and ordinances as well as NFPA 33 SAFETY STANDARD, 1995 EDITION, prior to installing, operating, and/or servicing this equipment.

⚠ WARNING

> The hazards shown on the following page may occur during the normal use of this equipment. Please read the hazard chart beginning on page 2.

AREA Tells where hazards may occur.	HAZARD Tells what the hazard is.	SAFEGUARDS Tells how to avoid the hazard.
Spray Area 	Fire Hazard Improper or inadequate operation and maintenance procedures will cause a fire hazard. Protection against inadvertent arcing that is capable of causing fire or explosion is lost if any safety interlocks are disabled during operation. Frequent power supply shutdown indicates a problem in the system requiring correction.	Fire extinguishing equipment must be present in the spray area and tested periodically. Spray areas must be kept clean to prevent the accumulation of combustible residues. Smoking must never be allowed in the spray area. The high voltage supplied to the atomizer must be turned off prior to cleaning, flushing or maintenance. When using solvents for cleaning: Those used for equipment flushing should have flash points equal to or higher than those of the coating material. Those used for general cleaning must have flash points above 100°F (37.8°C). Spray booth ventilation must be kept at the rates required by NFPA 33, 1995 Edition, OSHA and local codes. In addition, ventilation must be maintained during cleaning operations using flammable or combustible solvents. Electrostatic arcing must be prevented. Test only in areas free of combustible material. Testing may require high voltage to be on, but only as instructed. Non-factory replacement parts or unauthorized equipment modifications may cause fire or injury. If used, the key switch by-pass is intended for use only during set-up operations. Production should never be done with safety interlocks disabled. Never use equipment intended for use in waterborne installations to spray solvent based materials.
General Use and Maintenance	Improper operation or maintenance may create a hazard. Personnel must be properly trained in the use of this equipment.	Personnel must be given training in accordance with the requirements of NFPA-33, Chapter 16, 1995 edition. Instructions and safety precautions must be read and understood prior to using this equipment. Comply with appropriate local, state, and national codes governing ventilation, fire protection, operation maintenance, and housekeeping. OSHA references are Sections 1910.94 and 1910.107. Also refer to NFPA-33, 1995 edition and your insurance company requirements.

AREA Tells where hazards may occur.	HAZARD Tells what the hazard is.	SAFEGUARDS Tells how to avoid the hazard.
Electrical Equipment 	High voltage equipment is utilized. Arcing in areas of flammable or combustible materials may occur. Personnel are exposed to high voltage during operation and maintenance. Protection against inadvertent arcing that may cause a fire or explosion is lost if safety circuits are disabled during operation. Frequent power supply shut-down indicates a problem in the system which requires correction. An electrical arc can ignite coating materials and cause a fire or explosion.	The power supply, optional remote control cabinet, and all other electrical equipment must be located outside Class I or II, Division 1 and 2 hazardous areas. Refer to NFPA No. 33, 1995 Edition. Turn the power supply OFF before working on the equipment. Test only in areas free of flammable or combustible material. Testing may require high voltage to be on, but only as instructed. Production should never be done with the safety circuits disabled. Before turning the high voltage on, make sure no objects are within the sparking distance.
Explosion Hazard / Incompatible Materials 	Halogenated hydrocarbon solvents for example: methylene chloride and 1,1,1,-Trichloroethane are not chemically compatible with the aluminum that might be used in many system components. The chemical reaction caused by these solvents reacting with aluminum can become violent and lead to an equipment explosion.	Aluminum is widely used in other spray application equipment - such as material pumps, regulators, triggering valves, etc. Halogenated hydrocarbon solvents must never be used with aluminum equipment during spraying, flushing, or cleaning. Read the label or data sheet for the material you intend to spray. If in doubt as to whether or not a coating or cleaning material is compatible, contact your material supplier. Any other type of solvent may be used with aluminum equipment.
Toxic Substances 	Certain material may be harmful if inhaled, or if there is contact with the skin.	Follow the requirements of the Material Safety Data Sheet supplied by coating material manufacturer. Adequate exhaust must be provided to keep the air free of accumulations of toxic materials. Use a mask or respirator whenever there is a chance of inhaling sprayed materials. The mask must be compatible with the material being spray-ed and its concentration. Equipment must be as prescribed by an industrial hygienist or safety expert, and be NIOSH approved.

AREA Tells where hazards may occur.	HAZARD Tells what the hazard is.	SAFEGUARDS Tells how to avoid the hazard.
Spray Area / High Voltage Equipment 	There is a high voltage device that can induce an electrical charge on ungrounded objects which is capable of igniting coating materials. Inadequate grounding will cause a spark hazard. A spark can ignite many coating materials and cause a fire or explosion.	Parts being sprayed must be supported on conveyors or hangers and be grounded. The resistance between the part and ground must not exceed 1 megohm. All electrically conductive objects in the spray area, with the exception of those objects required by the process to be at high voltage, must be grounded. Any person working in the spray area must be grounded. Unless specifically approved for use in hazardous locations, the power supply and other electrical control equipment must not be used in Class 1, Division 1 or 2 locations.
Robot Work Area - General Use and Maintenance	Improper use or maintenance can lead to hazardous conditions, particularly from unexpected robot manipulator movement.	Applicator adjustments or maintenance should be done after the robot is taken out of service. Do not adjust or repair the applicator if the robot is operating or standing ready to start. Refer to robot operating instructions for the procedures to take the robot out of service.
Personnel Safety	Skin puncturing by sharp electrode.	Take precautions to see that flesh is not punctured by sharp electrode.

Notes:

INTRODUCTION

DESCRIPTION

The Ransburg Robot Waterbase Applicator RWA-EFM Series Spray Applicators for highly conductive coatings are air atomizing, fan pattern 100 kV automatic electrostatic spray guns. The waterbase or solvent-base paint is charged by the resistive electrode in the spray head of the gun. These guns have been developed for use on today's robots. These guns were designed to be used with a voltage block system such as the AquaBlock or isolated paint tanks. A separate manifold assembly includes single low voltage cable and the hosing required to operate the spray gun. The guns are manufactured in either 60° or 90° head configurations.

RWA-EFM ELECTROSTATIC SPRAY GUNS FOR HIGHLY CONDUCTIVE COATINGS

There are two models of the RWA-EFM Spray Guns for highly conductive coatings. (See Figure 1) All internal gun componenets are basically the same; the only apparent differences is the head angle, either 60° or 90°.

The spray gun has three major parts: the spray head assembly, the valve manifold section, and the valve housing section. (See Figure 1) The gun body is fabricated with the fluid, air, and dump passages. There is a removable check valve to allow air to blow down the dump line while paint is spraying. This prevents grounding out of the applicator when spraying highly conductive materials.

EFM SPRAY GUN MODELS	
Model #	Description
78863-60	60° Single Spray Head Assembly
78863-90	90° Single Spray Head Assembly

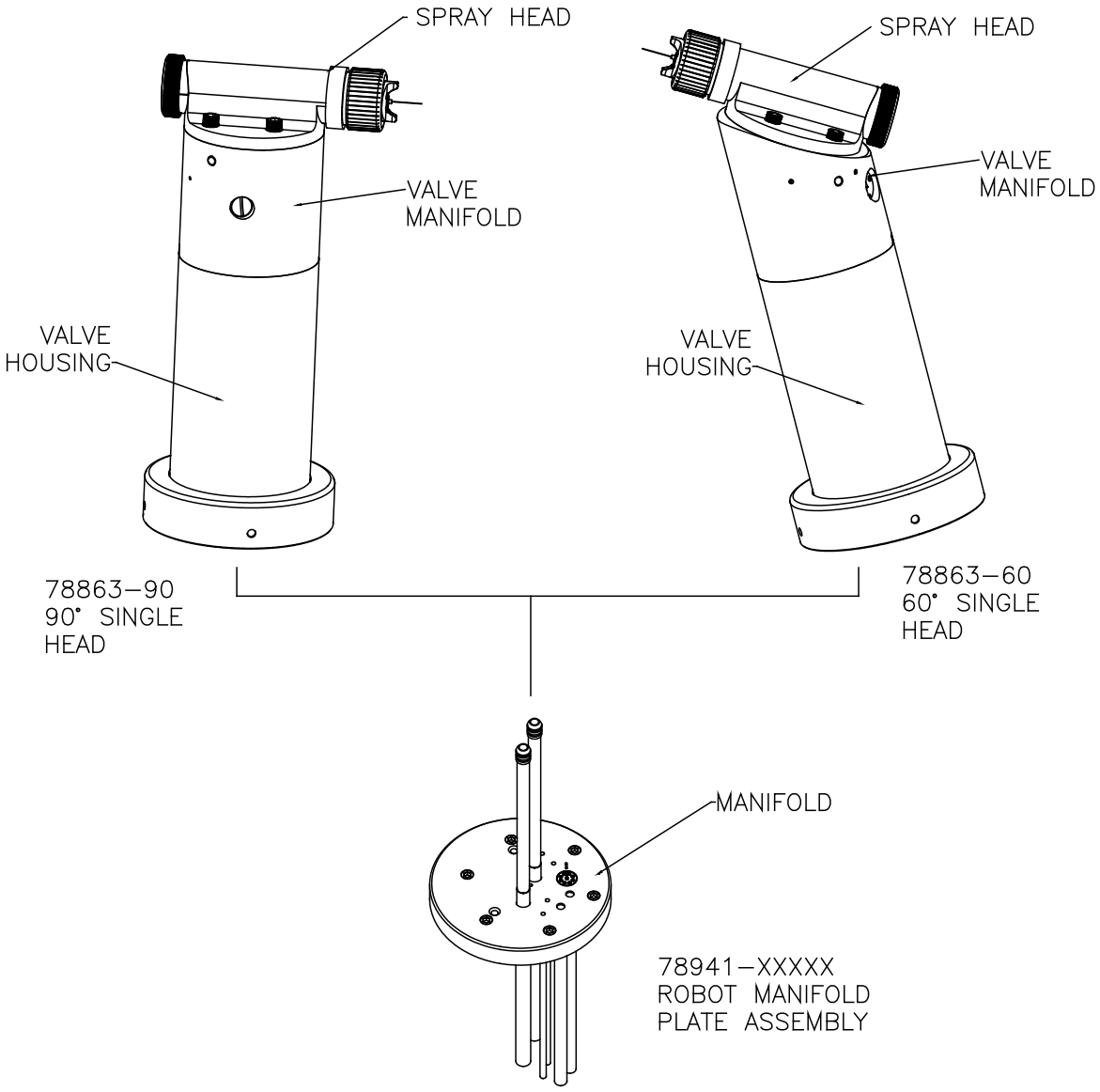


Figure 1: RWA-EFM Series Spray Guns and 78941-XXXXX Robot Manifold Assembly

FEATURES

The features of the RWA-EFM series guns include:

- Standard Ransburg air cap (76131-01), tip (76132- 00), and nozzle (EMF-195).
- Integral dump valve and dump air purge.
- Fluid dump valve is located adjacent to the fluid passages.
- HP-404 Internal Cascade
- Waterbase or solventbase compatible
- Screw on robot mount plate quick disconnect.

The EFM spray gun system consists of two major components: the gun assembly (78863-XX) and the robot manifold assembly (78941-XXXXX).

78941-XXXXX Robot Manifold Assembly

78941-XXXXX is designed to connect the 78863-60 or 78863-90 spray gun to the Fanuc or ABB robots. A 50 ft. low voltage control cable (76496-50) is supplied with the robot manifold to connect the cascade to the MicroPak power supply.

The fluid hose and dump line hose is shielded to prevent voltage from charging or bleeding voltage to items the hose comes in contact with.

The "Paint In" line is 3/16" I.D. (standard) and is 1/4" I.D. for the dump line (standard).

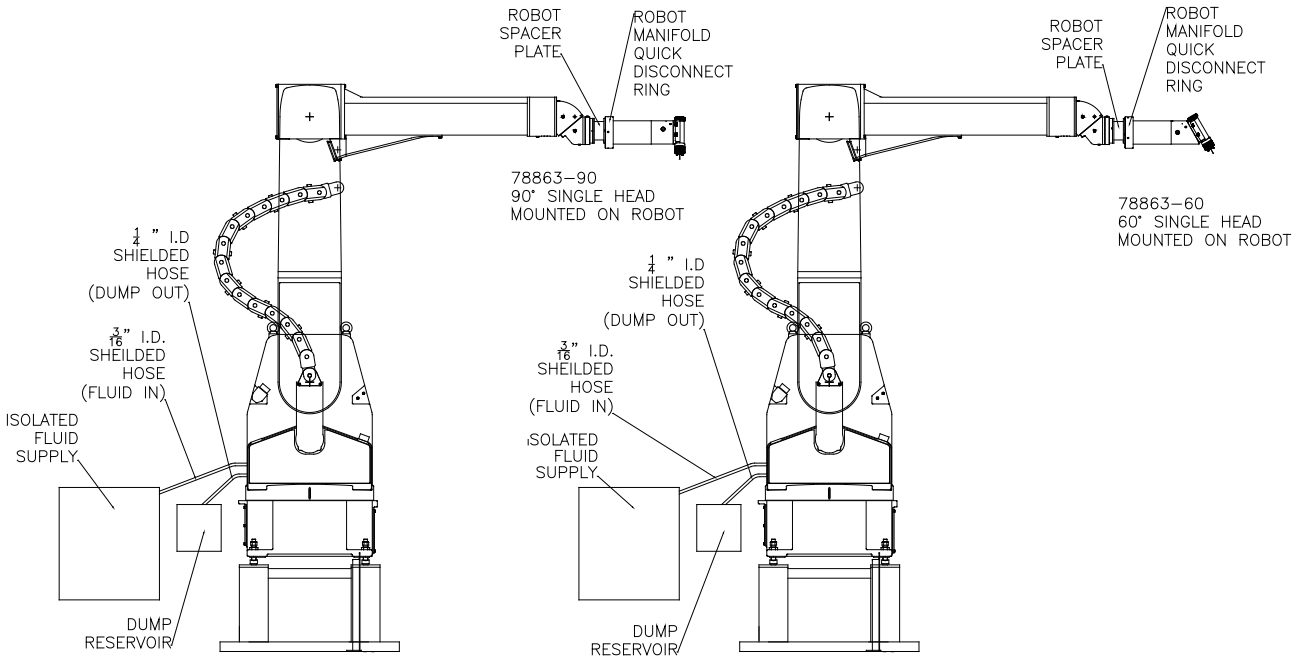


Figure 2: Typical Robotic Applicator Mounting

Power Supply

Figure 2 shows the optional isolated fluid supply system in line with the RWA-EFM applicators. This supply is required to create a voltage block which is necesary to keep the voltage from passing throughout the entire fluid supply system when highly conductive materials are used. Voltage is supplied to the fluid through contact with the resistive electrode in the gun. The resistive electrode in the gun passes back to the voltage block where it is "blocked" or "isolated" from traveling any further through the fluid supply system. The fluid tube enters an opening in the end of the robot arm. The fluid tube passes through the robot arm to the robot manifold where the spray gun attaches to the robot.

The RWA-EFM series spray guns operate from any MicroPak power supply.

Tool Center Point

Figure 3 shows the tool center-point information on both guns. Both are based upon a 10" (254mm) target distance.

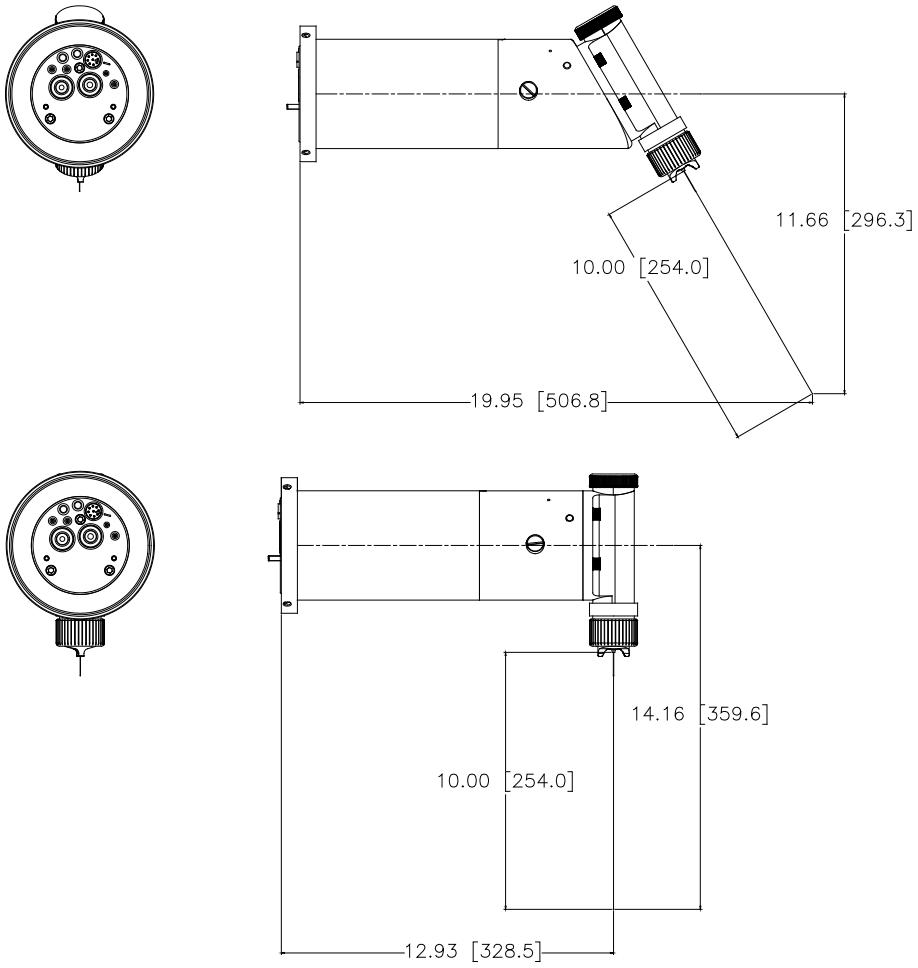


Figure 3: Gun Tool Center-Point Representation

SPECIFICATIONS

RWA-EFM Series Electrostatic Spray Guns for Highly Conductive Coatings

Weight

78863-60:	10.2 lbs. (4.6Kg)
78863-90:	10.1 lbs. (4.6Kg)

Length

78863-60:	14.93" (379mm) (See Figure 3)
78863-90:	12.93" (328mm) (See Figure 3)

Operating Air Pressures

Atomizing Air:	100 psig max. (6.9 bar)
Fan Air:	100 psig max. (6.9 bar)
Trigger Air:	150 psig max./70 psig min. (10.3 bar / 4.8 bar)
Purge Air:	200 psig max. (13.8 bar)
Dump Pilot:	150 psig max./70 psig min. (10.3 bar/4.8 bar)

Fluid Pressure

Max Fluid Pressure:	250 psig (17.2 bar)

Air Flow Rates/Pressures
(Recommended start point for fan and atomizing pressures.)
Note: Pressure taken at the cap

Atomizer Air:	27 psig (1.8 bar)
Fan Air:	30 psig (2.1 bar)
Total Air Flow:	17.50 SCFM (496 SLPM)
Air Purge:	35 psig

Robot Manifold Tubing Requirements

Atomizing Air:	3/8" O.D. Nylon (Natural color)
Pattern Air:	3/8" O.D. Nylon (Black color)
Paint In:	3/16" I.D. Shielded
Dump Out:	1/4" I.D. Shielded
Trigger Air:	3/16" O.D. Nylon (Green color)
Dump Pilot:	3/16" O.D. Nylon (Red color)
Air Purge:	3/16" O.D. Nylon (Blue color)

Electrical

Operating Voltage:	0-100 kV 0-125 µA

Applicator Nomenclature/Hose Identification:

A	Atomization Air (Natural)
F	Fan Air (Black)
T	Trigger (Green)
DP	Dump Pilot (Red)
AP	Purge Air (Blue)
TB	Trigger Bleed
P	Paint In
D	Dump Out

INSTALLATION

⚠ WARNING

> If improperly located, certain electrical equipment will become a source of ignition and may cause fire or explosion. Any power supply must be located outside Class I or Class II, Division 1 and 2 hazardous areas. (Reference NFPA #33 or National Electrical Code, article 516).

POWER SUPPLY

Refer to the Ransburg Service Instruction for the power supply being used for complete information. (Reference the current MicroPak Service Manual.)

A low voltage cable, 76496-XX (See Figure 4), connects from an output connection in the MicroPak to the robot manifold plate. (Refer to Figure 4 for connection diagram.)

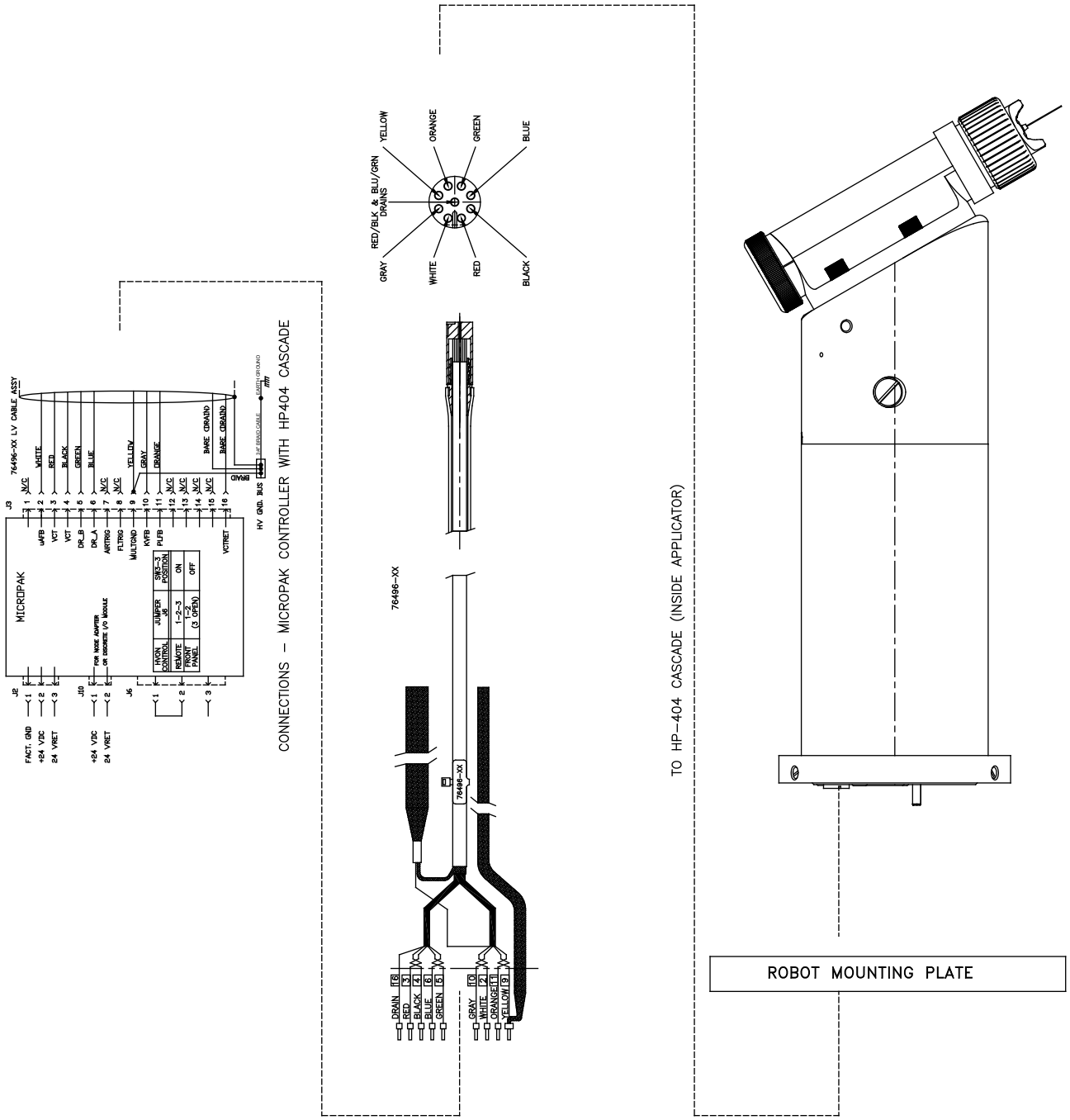


Figure 4: Power Supply, Manifold, and Gun Wiring

ROBOT MANIFOLD ASSEMBLY

The tubing, hose, and low voltage cable come bundled from the factory. Pull the bundle through the robot spacer plate and robot wrist carefully to prevent any cuts on the cable or hoses. Connect each signal line as required per signal legend:

AP	Air Purge (Blue color)
DP	Dump Pilot (Red color)
TP	Trigger Pilot (Green color)
A	Atomizer Air (Natural color)
F	Fan Air (Black color)

Connect "Paint In" and "Dump Out" line (shielded hose) to their proper respective connections. Improper connection of these lines could cause damage to the applicator.

NOTE

> "Paint In" line is 3/16" I.D., "Dump Out" line is 1/4" I.D.

Once all connections have been verified, install the robot spacer plate to the robot wrist using 6 screws (not provided).

Insure the shielded hose for the paint in line has stripped back the outer jacket and conductive sheath at least 12" from the exit of the voltage block devise. (See Figure 5)

⚠ CAUTION

> Do Not nick or cut the inner paint line hose. This will cause premature failure of the hose.

NOTE

> Failure to strip back the shielded hose will increase current draw and lower tip voltage reducing efficiency of the applicator.

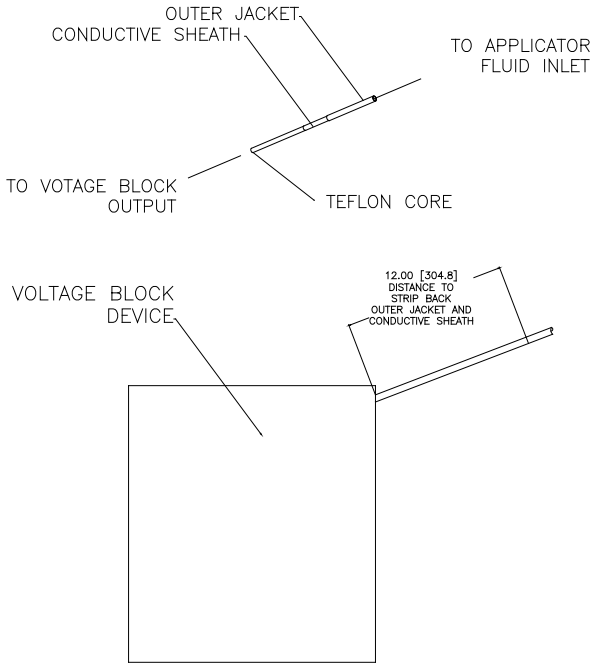


Figure 5: Shielded Hose Stripbacks Diagram

NOTE

> Try to keep the shielded 3/16" I.D. "Paint In" line and the 1/4" I.D. "Dump Out" line as long as possible. If these hoses should pinhole, this will allow a cut-off of the pinhole section. Strip back and re-assemble rather than replacing the entire hose.

Robot Spacer Plate

The robot spacer plate is included with the robot manifold assembly to increase life of the tubing bundle. The extra spacing it provides, increases the bend radius of the tubes and decreases the hose or cable stress at the connector.

There is only one way the spacer plate may be assembled to the mounting plate. The spacer plate has an alignment pin that may only engage in one hole position in the robot mount plate.

TABLE 2 - SPACER PLATES	
Part #	Description
79107-00	ABB Robots
78983-00	Fanuc P155, 145 Robots
79131-00	Fanuc P200 Robot

Three spacer plates are available for this product, one for ABB robots and two for Fanuc robots as shown in Table 2.

Robot Spacer Plate Mounting

Mount the spacer plate to the tube bundle assembly with scews [6] (7959-24C). Locate the spacer plate with the robot locating pin away from the robot mount plate. (See Figure 6)

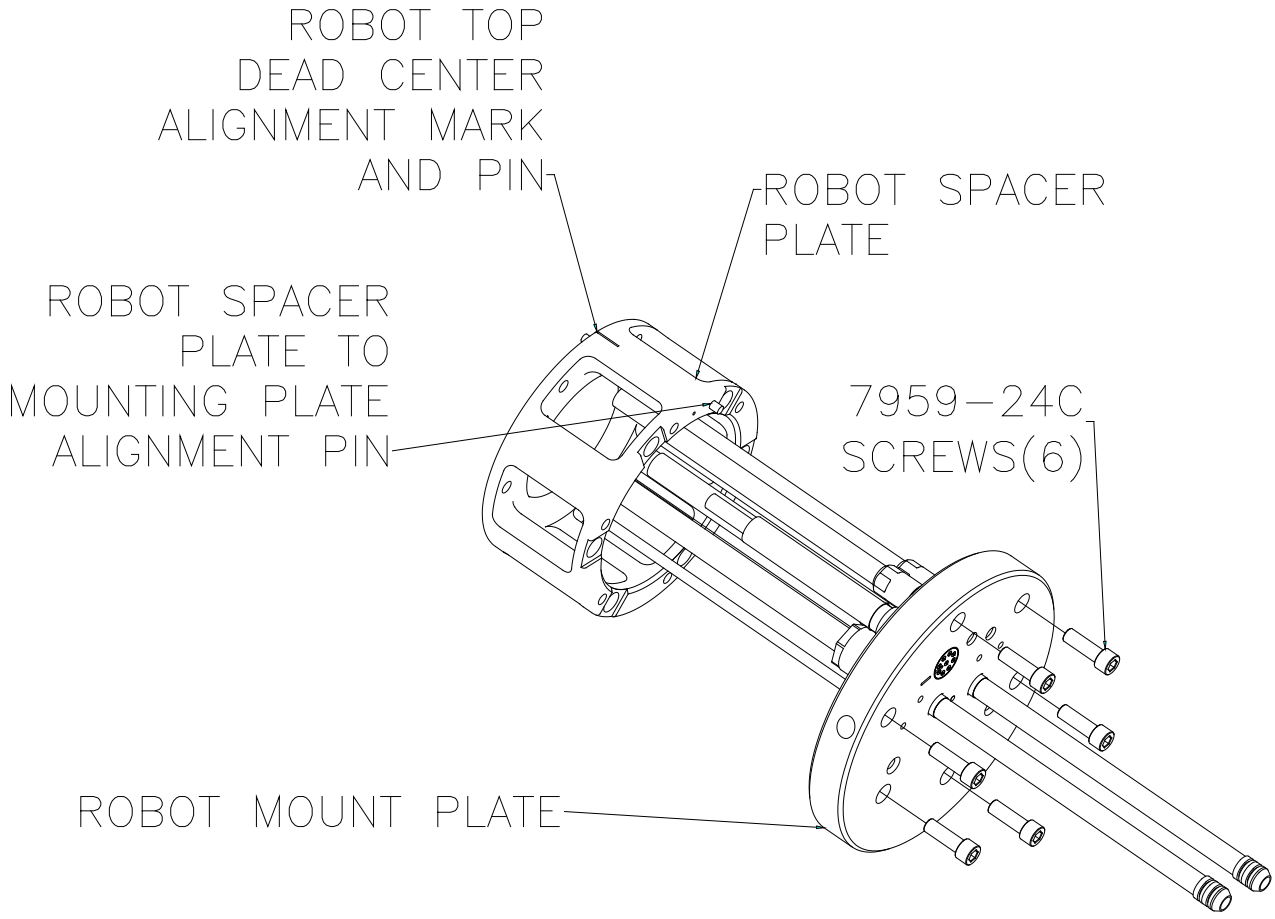


Figure 6: Mounting Spacer Plate Tube Bundle Assembly

OPERATION

SPRAY GUN CONTROLS

Atom (A) / Fan Air (F)

The RWA-EFM gun fluid On/Off is controlled by a trigger line where a signal comes from either the robot or a PLC. This signal must be a minimum of 70 psig. The atomization and fan air are always on and should be controlled by the solenoid valves either at the robot arm or as close as possible to the gun.

Air cap pressures should be set using air cap test kit. This provides a consistent measurement, so initial settings may be duplicated at any time. (See "Parts Identification" section for air cap test kit part numbers.)

NOTE

> Insure that the fan and atomization air are on and flowing prior to triggering the fluid. Failure to follow this sequence will cause spits and defects on the part being painted.

Dump Pilot (DP)

When the target part is finished and a color change is desired, insure voltage is turned Off.

⚠ WARNING

> Failure to turn voltage OFF during color change sequence could cause a fire or explosion.

Actuate the dump pilot (DP) signal and properly clean the line using an appropriate solvent for the material being sprayed.

When the cleaning cycle with solvent is complete, an air purge for several seconds is recomended to clean and dry the I.D. of the dump line hose.

⚠ WARNING

> Never apply voltage to robotic spray gun system when not in use. When electrostatically spraying a waterborne material, the entire paint column, from the spray gun to the fluid tank or pump system, is charged at high voltage. Insure proper protection from voltage discharge. Not providing protection may cause damage to equipment, serious injury to personnel, or death.

⚠ CAUTION

> Failure to properly clean and blow down the walls of the dump line tube may cause a voltage drain when spraying the target. This voltage drain will cause a lower voltage at the gun tip, lowering transfer efficiency, possibly causing paint defects.

Air Purge (AP)

After the dump line has been properly cleaned and blown down, turn the air purge (AP) line on. This air flow should remain on during the spray cycle. Recomended air pressure for air purge (AP) is 45 psig. This may be adjusted up or down, depending upon performance.

Paint Viscosity

This applicator is capable of atomizing paint of most any desired viscosity. It is recomended to keep the material viscosity as low as possible. This allows spraying at lower fan and atomization air pressures which results in less overspray and higher transfer efficiency.

⚠ WARNING

> Most paints and solvents are toxic to a certain degree and flammable or combustible. Use them only in a well ventilated atmosphere. Use protective equipment as required in the material safety data sheet supplied with the paint, coating, or solvent.

Fluid Flow Rate

Keep the fluid flow rate as low as possible, consistent with the conveyer or robot arm speed. For an isolated paint system, fluid flow is adjusted through the robot PLC by varying the pilot pressure to a fluid regulator within the paint equipment system. Fluid pressures from the circulating system may be as high as 250 psig.

Target Distance

The distance between the gun tip and the article being painted should be between 10-14". Excessive distance causes a waste of coating material and wrap back (paint particles being deposited on the gun body or the robot arm). At close distances, the voltage at the tip of the gun will be reduced, which decreases the charging effect of the gun.

Electrostatic Voltage

The maximum voltage limit for these spray guns is 100 kV. Some painting operations may require different voltage settings to obtain optimum transfer efficiencies. If Faraday cage areas are predominant on the item being painted, a lower voltage setting would aid in coating these areas.

When not spraying, it is recomended to set back voltage to 30-40 kV or off.

NOTE

> If a 0 kV command is sent to the MicroPak, a feedback fault will occur.

Sometimes, depending upon target carrier spacing, higher setback voltages may be required. The ramp-up time for the HP-404 cascade (0-100 kV) is approximately 3 seconds. This may be slightly longer with waterbase applications due to the charge capacity of the fluid system.

The MicroPak voltage ramp-down works at a rate of 33 kV/sec. However, in waterbase applications, this may be longer.

MAINTENANCE

PREVENTIVE MAINTENANCE

⚠ WARNING

> An electrical discharge or spark may create an electrical and/or fire hazard during maintenance. Do not clean or service the spray gun with the power supply on. Verify that the power supply has been turned OFF to ground.

> Unexpected robot movement can be hazardous. Do not adjust or repair the spray gun when the robot is operating or waiting to start. The robot must be taken out of service.

> Follow all Lockout/Tagout procedures prior to entering to service the applicator. OSHA 29 C CFR 1910.147.

⚠ WARNING

> Solvents used for equipment flushing must have flash point ratings equal to or greater than the flash point rating of the coating material. Solvents used for general cleaning must have flash point ratings higher than 100°F (37.8°C).

Internal Cleaning and Flushing

Preventive maintenance on the RWA-EMF spray guns is basically limited to the cleaning and flushing of the guns. Cleaning includes wiping the excess paint from the exterior of the gun and the spray head. Flushing the gun will keep the fluid passages clear. Flushing may be accomplished through the spray nozzles or dump valve. In any method, after using a solvent to flush the gun, the fluid passages should then be flushed with heated DI-water [130°F to 140°F (54°C to 60°C)] and amine mixture.

DI-water should only be used with waterbase materials.

NOTE

> Due to the design of this applicator, if spraying with solvent based materials, use the appropriate solvent recommended by the material supplier.

External Cleaning

NOTE

> Solvents used for external cleaning should be non-polar. Non-polar solvents leave the surface being cleaned non-conductive and will not cause voltage tracking to ground along cleaned surfaces.

POLAR AND NON-POLAR SOLVENTS		
Non-Conductive (Non-Polar)	Moderately Conductive	Extremely Conductive (Polar)
Amyl Acetate Methyl Amyl Acetate Toluene Xylene High Flash Naptha Mineral Spirits	Methyl Isobutyl Ketone Ethyl Acetate Methyl Ethyl Ketone Butyl Carbitol	Methanol Carbitol Diacetone Butyl Alcohol Acetone Butyl Cellosolve

It is always best if the gun is covered with a non-conductive gun cover. This cover speeds up the cleaning process of the exterior of the applicator. The covers should be replaced as required. As the gun covers fill with overspray material, they must be replaced because they become a path to ground, lowering kV ouput and increasing current draw.

Applicator Disassembly

⚠ WARNING

> An electrical discharge or spark may create an electrical and/or fire hazard during maintenance. Do not clean or service the spray gun with the power supply On. Verify that the power supply has been turned OFF to ground.

> Unexpected robot movement can be hazardous. Do not adjust or repair the spray gun when the robot is operating or waiting to start. The robot must be taken out of service.

> Follow all Lockout/Tagout procedures prior to entering to service the applicator, OSHA 29 CFR 1910.147.

Head Removal/Repair

1. Relieve all pressures, flush out paint lines, and blow all lines dry. Remove gun from robot by turning the retaining ring counter clockwise from the robot mount plate (See Figure 7.)

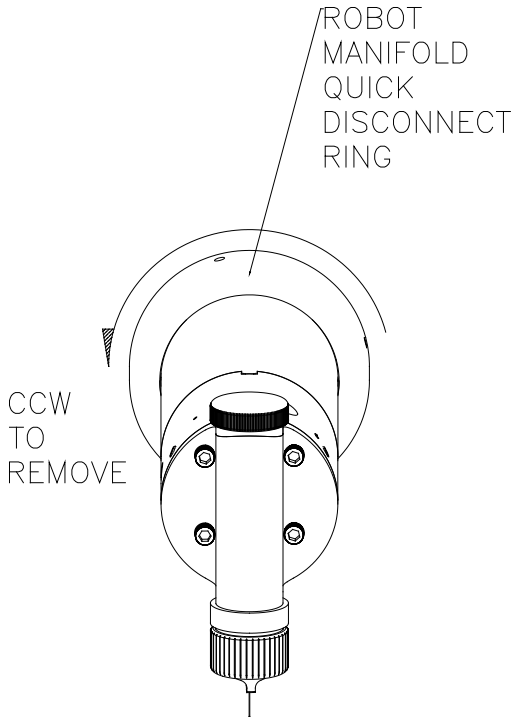


Figure 7: Removal of Applicator

2. Take applicator to a clean area outside the spray area, preferably to a designated maintenance area.

3. Remove head retaining screws [4] as shown in Figure 8 using a 1/4" wrench. This removes the head from the manifold.

NOTE

> Be sure to contain all o-rings between the head and manifold.

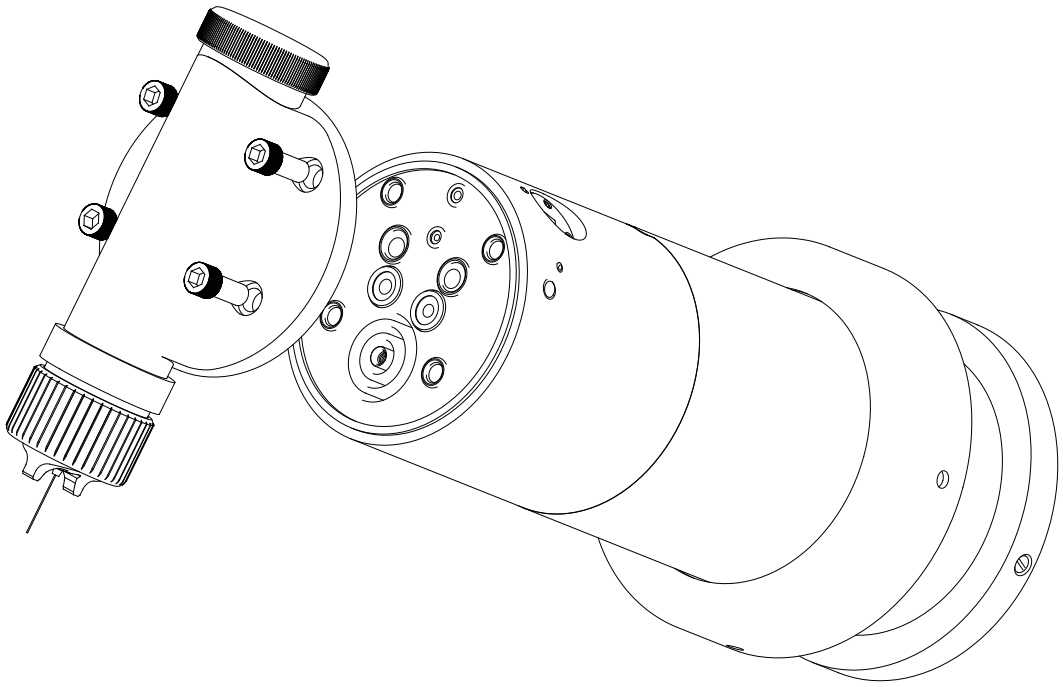
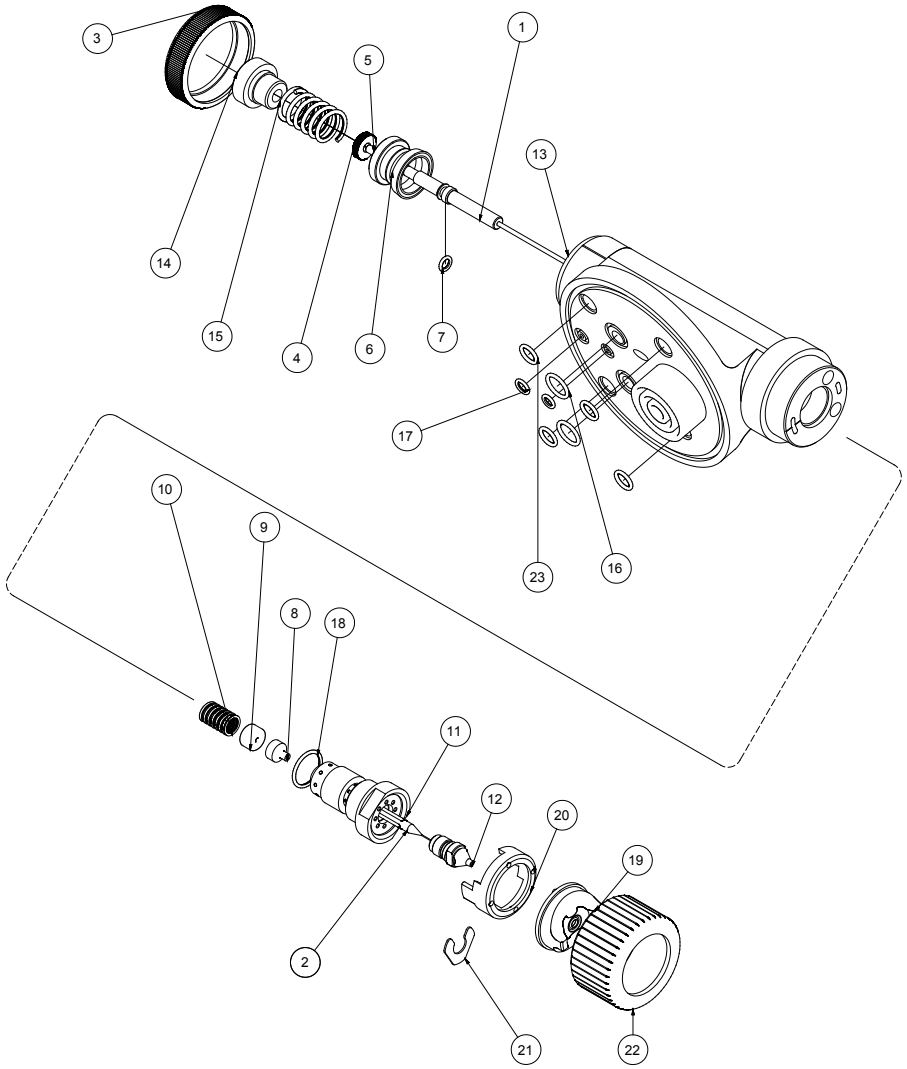


Figure 8: Head Removal

NOTE

> These head retention screws are designed and manufactured specifically for this product so that if an impact occurs, the screws break away. Use of any other screws may cause damage to more expensive components in the applicator.

Note: Refer to Figure 9 for parts.



Item #	Description	Qty.	Item #	Description	Qty.
1	Needle Shaft Assembly	1	13	Gun Barrel Assembly, Resistive	1
2	Electrode, High Wear	1	14	Backup, Piston	1
3	Cap, End	1	15	Spring, Return	1
4	Piston Nut	1	16	O-Ring, Solvent Proof	2
5	Piston	1	17	O-Ring, Solvent Proof	1
6	Seal Piston	1	18	O-Ring, Solvent Proof	1
7	O-Ring, Solvent Proof	2	19	Air Cap	1
8	Seal	1	20	Air Cap Locator	1
9	Seal, Washer	1	21	Clip, Air Cap	1
10	Spring, Seal	1	22	Ring, Retaining	1
11	Fluid Nozzle, High Flow	1	23	O-Ring, Solvent Proof	4
12	Nozzle, Fluid	1			

Figure 9: Head Assembly

4. Remove end caps [3] by turning CCW by hand. Remove backup piston [14] and spring return [15].

5. Remove retaining ring [22] by turning CCW. Remove air cap [19], air cap locator [20], and air cap clip [21]. Remove fluid nozzle [12] using appropriate wrench by turning CCW.

6. Remove electrode [2] by turning CCW. A drift pin may be inserted into the provided hole in needle shaft [1].

7. Pull needle shaft [1] straight out of the housing. Remove fluid nozzle [11] by turning CCW. Remove o-ring [18], packing [8], and washer seal [9], from inside house bore [10].

Piston Removal/Replacement

8. Remove piston nut [4] from shaft [1]. Unscrew CCW from the shaft piston [5]. Carefully pry the piston seal [6] off the piston. Replace the seal as required.

9. To install the seal, push the piston seal [6] onto the piston [5] with the spring side of the seal facing towards the smaller diameter of the piston [5].

Head Rebuild

10. To rebuild, follow steps 1 to 8 in reverse order.

NOTE

> A drop of purple loctite may be required on the needle shaft [1] end threads where electrode is assembled.

Valve Body Removal / Repair

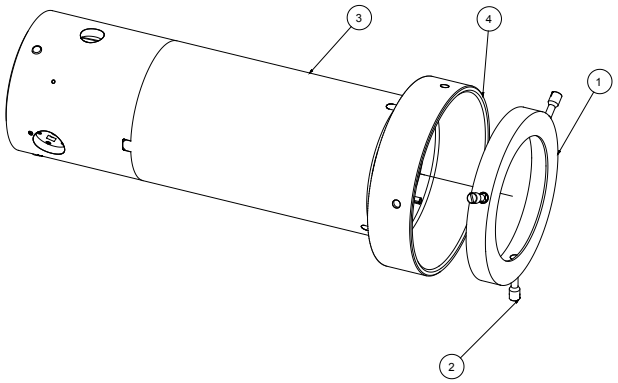
1. Remove the gun from the robot by turning the retaining ring counter clockwise from the robot mount plate. (See Figure 7.)

⚠ WARNING

> Be sure voltage is OFF, all lines de-pressurized, clean, and dry.

2. Take applicator to a clean area outside the spray area, preferably to a designated maintenance area.

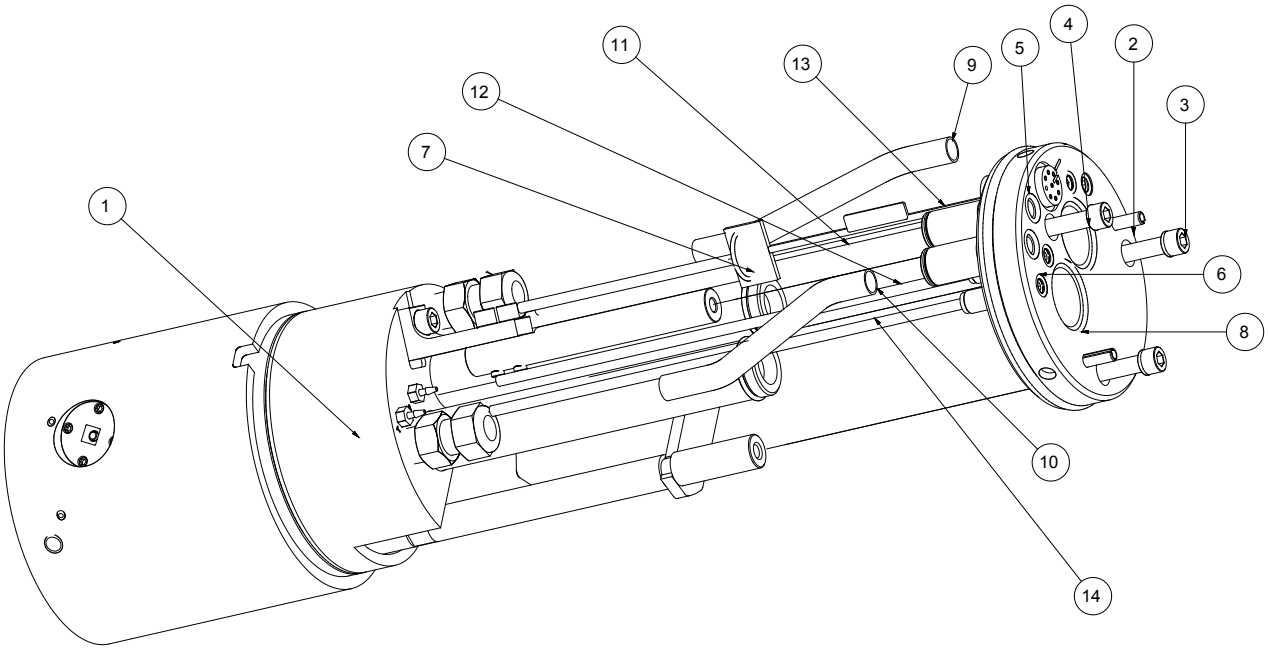
3. Remove the head of the gun. (See Figure 8.)



Item #	Description	Qty.
1	Flange, RWA-EFM	1
2	Locating Pin	3
3	Shroud	1
4	Retaining Ring	1

Figure 10: Flange Removal

4. Referring to Figure 10, remove (3) locating pins [2]. Remove flange [1] from end of gun. Remove the retaining ring [4] and shroud [3].



Item #	Description	Qty.
1	Valve Manifold	1
2	Assembly, Gun Manifold Plate RWA-EFM	1
3	SHCS 1/4-20 X 1.0 Long	3
4	O-Ring	3
5	O-Ring, Solvent Proof	2
6	O-Ring, Solvent Proof	4
7	Cascade Harness Connector	1
8	O-Ring, Solvent Proof	2
9	Tube, Formed	1
10	Tube, Formed	1
11	Tubing, 5/32 OD X .106 ID, Blue (AP)	1
12	Tubing, 5/32 OD X .106 ID, Red (DP)	1
13	Tubing, 5/32 OD X .106 ID, Green (T)	1
14	Tubing, 5/32 OD X .106 ID, Natural (TB)	1

Figure 11: Rear Plate Removal

5. Referring to Figure 11, remove the (3) socket head cap screws [3] and o-rings [4] from the rear of the gun.

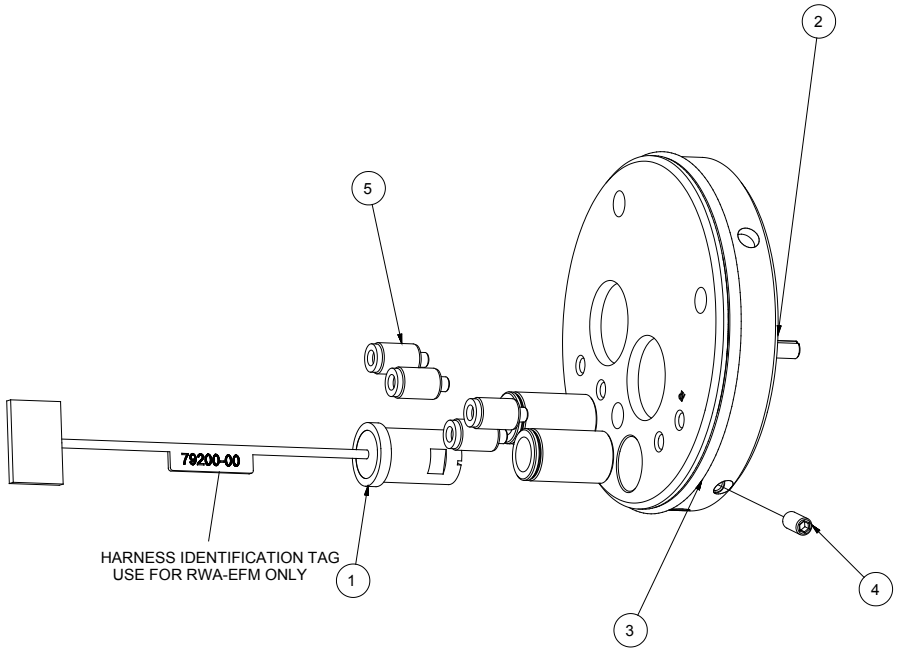
6. Remove the 3/6" OD tubes [11], [12], [13], and [14] from the barb fittings on the manifold or from the push-to-lock fittings on the plate assembly [2].

7. Remove the formed tubes [9] and [10] by releasing them from the push-to-lock fittings on the plate assembly [2]. Disconnect the cascade harness [7] from the cascade. The plate assembly [2] may now be removed by pulling the edges away from the valve manifold.

8. Refer to Figure 12 to remove the cascade harness [1] from the plate. Using a 3/32" wrench, remove the set screw [4] from the plate assembly [2]. Pull the harness straight out. Repair/replace as necessary.

CAUTION

> The cascade harness in the RWA-EFM and the EFM applicators are not interchangeable. Use only the harness with the tag (79200-00) for the RWA-EFM applicators. (Reference Figure 12.)



Item #	Description	Qty.
1	Wiring Harness, Cascade EFM	1
2	Plate, Read RWA-EFM	1
3	O-Ring, Encapsulated	1
4	Set Screw, 3/8" Long X 10-24	1
5	Fitting, Push-To-Lock, 3/16" OD	4

Figure 12: Harness Removal

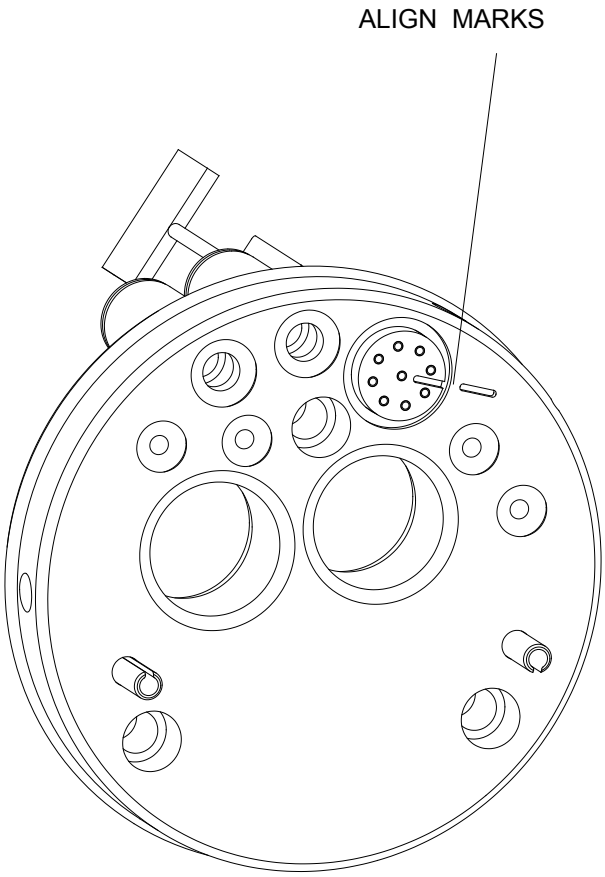
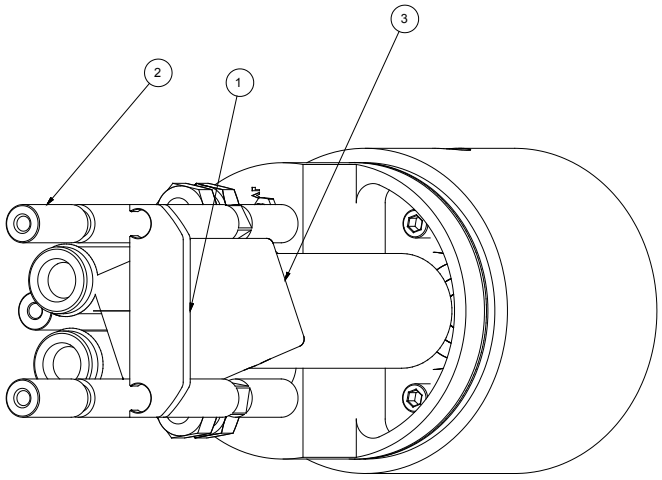


Figure 13: Mark Alignment

9. To re-install the harness, align the timing mark on plug with timing mark on plate and tighten set screw in place. (See Figure 13.)

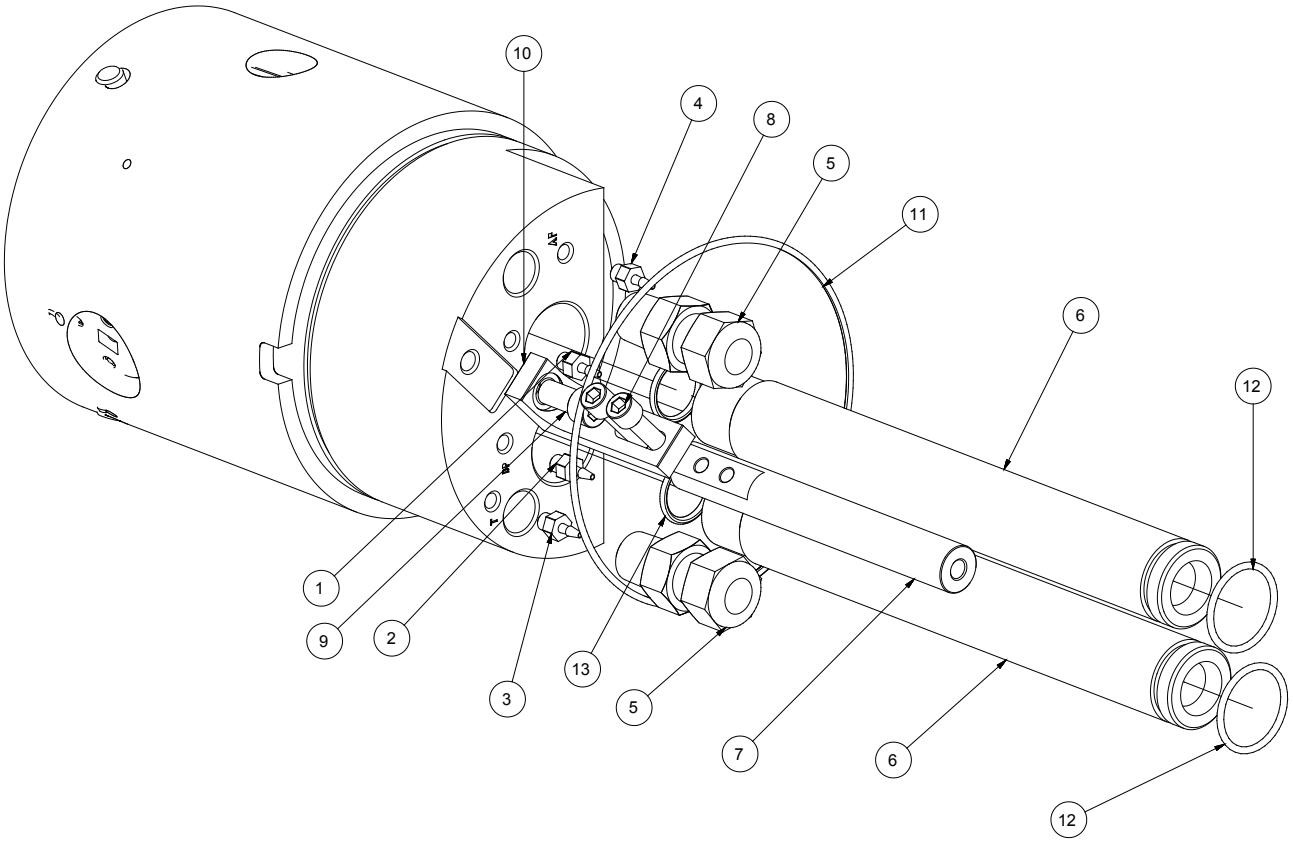


Item #	Description	Qty.
1	Bracket, Cascade Mounting	1
2	Tie Rod, Long	2
3	Cascade Assembly, HP-404	1

Figure 14: Cascade / Tie Rod Removal

10. Refer to Figure 14 for cascade removal. With a 3/8" open-end wrench, on the flats, turn the tie rod [2] counter-clockwise. Pull the bracket [1] out of the slots in the tie rods. Completely remove these parts. Pull the cascade [3] completely out of the valve manifold.

11. To re-install the cascade [3], apply a generous amount of di-electric grease to the labrynth end of the cascade. Insert the cascade into the valve manifold. Turn the tie rods [2] in by hand to within 1/2" of bottoming out in the valve manifold pocket. Install the bracket [1] into the grooves. Using the 3/8" open-end wrench, begin tightening the tie rods down, sequencing from side to side until the tie rods have bottomed out against the valve body.



Item #	Description	Qty.
1	Fitting, Barb, Natural Color	1
2	Fitting, Barb, Red Color	1
3	Fitting, Barb. Green Color	1
4	Fitting, Barbed, Black Color	1
5	Fitting, 1/4" NPT X 3/8" ODT, Nylon	2
6	Tube, Fluid Isolation	2
7	Tie Rod, Short	1
8	SHC 10-24 X .75 Long	2
9	SHCS 1/4-20 X .5 Long	1
10	Bracket, Tie Rod	1
11	O-Ring, Encapsulated	1
12	O-Ring, Solvent Proof	2
13	O-Ring, Solvent Proof	2

Figure 15: Isolation Tube Removal

12. Refer to Figure 15 to remove the isolation tubes, fittings, and short tie rod (Steps 12, 13, 14, 15, and 16.) Remove the isolation tube [6] by screwing the tube counter-clockwise out of the valve maifold by hand. Remove the (2) o-rings from each end [12] and [13].

NOTE

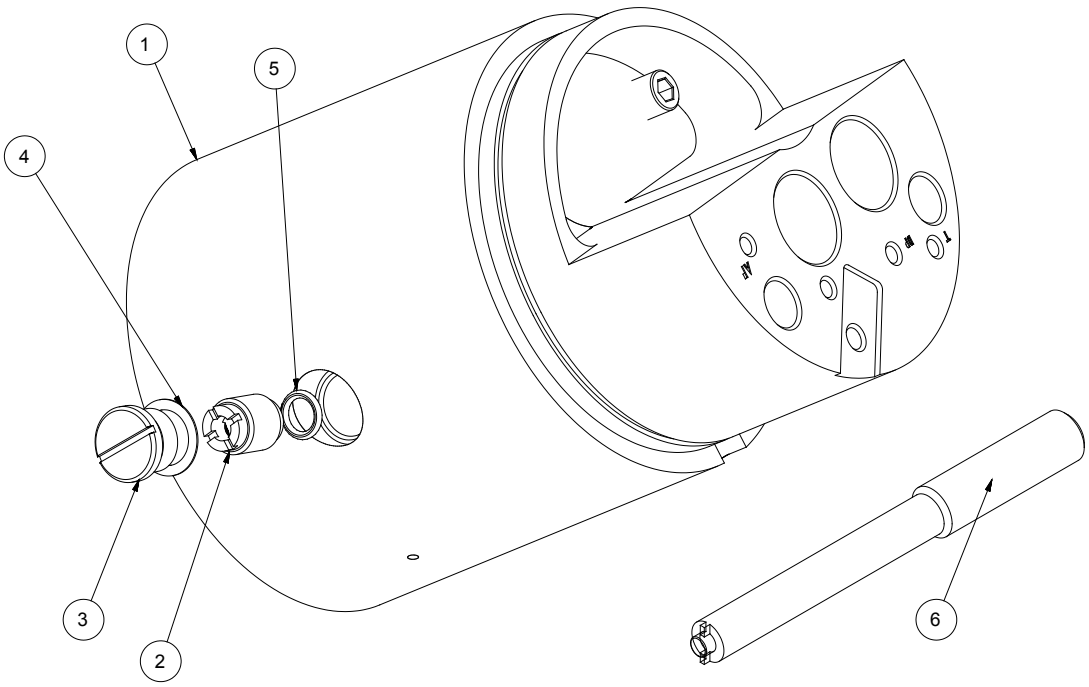
> This tube should be cleaned with the appropriate solvent to clean off the material being sprayed. Then this tube must be cleaned with a non-polar solvent.

13. Inspect the ID of the tubes for carbon tracking. If any carbon tracking is seen, the tube must be replaced. If no tracks are seen, install a generous amount of LSCH-0009 di-electric grease on the ID of the tube.

14. Remove the air fittings [5] and barbed fittings [1], [2], [3], and [4]. When re-installing these fittings, use a non-conductive pipe thread sealant on the threads.

15. Remove short tie rod [7] by removing two screws [8]. Remove tie rod bracket [10] by removing socket head cap screw [9].

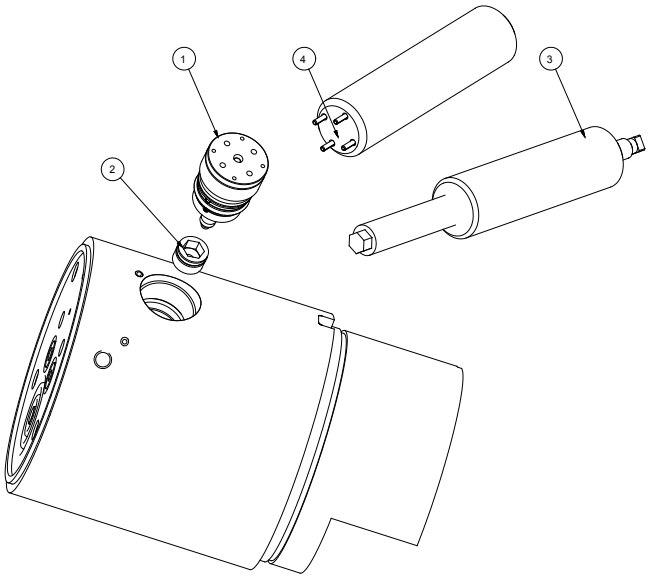
16. Remove shroud o-ring [11] by prying out of groove.



Item #	Description	Qty.
1	Valve Manifold	1
2	Check Valve Assembly	1
3	Plug, Check Valve	1
4	Seal	1
5	O-Ring, Solvent Proof	1
6	Valve Removal Tool	1

Figure 16: Check Valve Removal

17. Refer to Figure 16 to remove the air purge check valve. Remove the check valve plug [3]. Remove the-seal [4]. Using check valve removal tool (79000-00) [6], remove the check valve assembly [2]. Remove the o-ring [5].

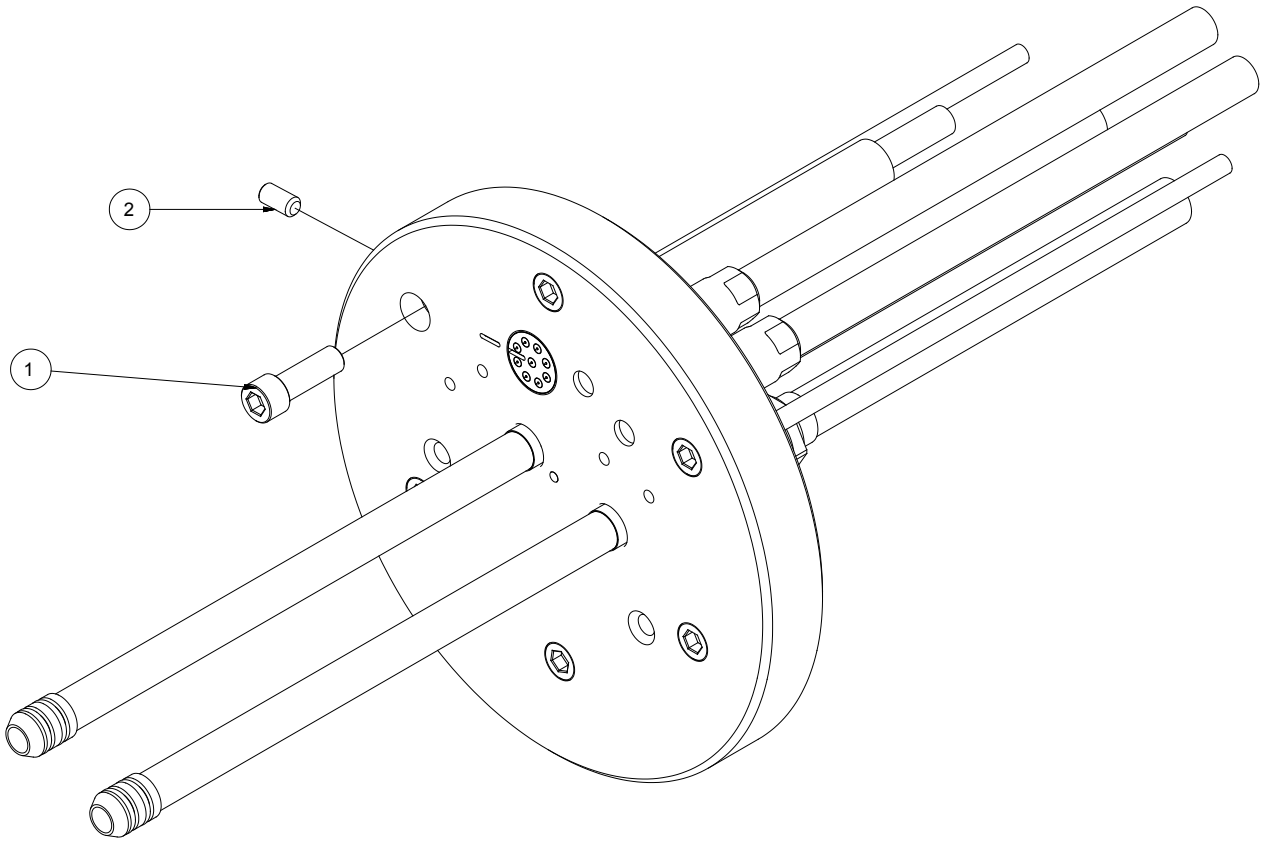


Item #	Description	Qty.
1	Valve Assembly	1
2	Valve Seat Assembly	1
3	Valve Seat Removal Tool	1
4	Valve Removal Tool	1

Figure 17: Dump Valve Removal

18. Refer to Figure 17 to remove the dump valve. Using the valve removal tool (78985-00) [4], re-move the valve assembly [1] by turning counter-clockwise. Using the valve seat removal tool (77872-00) [2], remove the seat. Replace parts as required. Torque seats [2] to 20 lbs•in torque. Tighten valves down till they are tight in the valve body.

Cable Removal



Item #	Description	Qty.
1	Screw, 1/4 - 20 X 3/4 Lg. SHCS	6
2	Set Screw, 3/8" Lg. X 10-24	1

Figure 18: Low Voltage Cable Removal

1. To remove and replace low voltage cable, refer to Figure 18. Remove applicator from robot wrist. (See Figure 7.)

2. Remove screw [1] from position shown. Insert 3/16" wrench to remove set screw [2]. The cable may now be removed.

3. To re-install, pull the cable through the robot arm. Install in the low voltage cable hole. Align the timing marks as shown in Figure 19.

4. Tighten the set screw [2] until tight. Re-install the screw into position shown.

Fluid Tube Repair / Replace

1. Remove the atomizer from the robot. (Refer to Figure 7.)

⚠ WARNING

> Depressurize, clean, and blow all fluid lines dry.

> Insure voltage is turned OFF.

> Insure robot is locked-out.

2. Remove (6) screws that retain the tubing bundle to the robot wrist.

3. Disconnect all cable and tubing connections.

4. Clamp the robot plate in a soft jawed vice to prevent any scratching or defacing of the plate.

5. Remove all pilot lines around the fluid dump line.

6. Remove the nut from the paint and dump line fittings.

7. Cut off the end of the tube where the barbed fittings are located and discard the barbed fittings

8. Pull out the tube straight out of the fitting, being carefull not to break the ferrules.

9. Carefully slide the ferrules and nuts off the old fluid lines for re-use.

10. Cut the existing tube a minimum of 2 ft. back from the end where the barbed fittings were located.

11. Cut away the jacket and coductive sheath according to Figure 19.

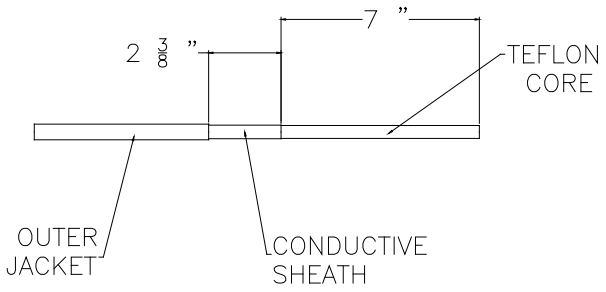


Figure 19: Fluid Hose Cutback Diagram

⚠ WARNING

> If the inner of the fluid line is nicked in any way, you must start over at Step 10. Any nicks will cause premature failure or high voltage pin holing after installation.

Fluid Tube Reassembly

12. Apply a thin film of SSL-11 petroleum jelly on the conductive sheath to aid installlation of ferrule.

13. Slide nut over the tube. Carefully, slide the ferrule over the conductive sheath, leaving no raised edges. Insure the outer jacket of the tube bottoms out inside the ferrule.

14. Apply anti sieze to the fitting threads. Slide the tube inside the fitting, until the ferrule shoulders against the back of the fitting. Carefully slide the nut over the ferrule and tighten.

NOTE

> Dump line is 1/4" I.D. and paint line is 3/16" I.D.

15. Insure the distance from the face of the robot plate to the end of the core is per Figure 20.

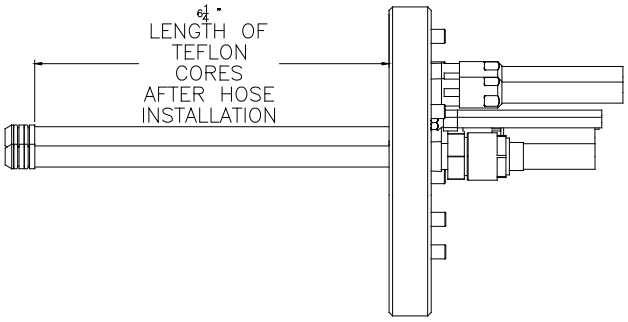


Figure 20: Assembled Hose Length

16. Apply a thin film of SSL-11 petroleum jelly to barbed end of the fittings. Press the appropriate fitting into the end of the tube by holding the tube by hand and push in straight with the other hand.

17. Install o-rings on barbed fittings per Figure 21.

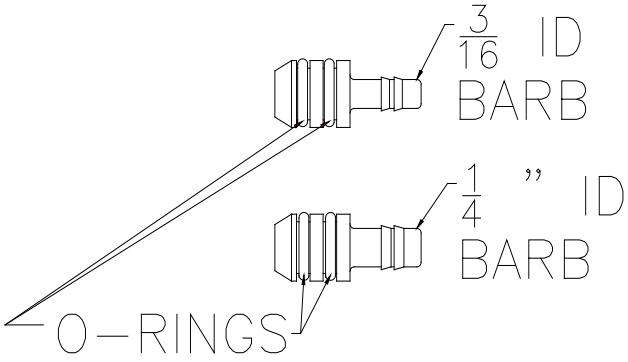


Figure 21: Barbed Fittings

18. Re-connect all pilot lines to appropriate fittings.

Color Code Table

• Pattern / Fan Air	Black, 3/8" OD, Nylon
• Atom Air	Natural, 3/8" OD, Nylon
• Trigger Air	Green, 3/16" OD, Nylon
• Dump Pilot	Red, 3/16" OD, Nylon
• Air Purge	Blue, 3/16" OD, Nylon

19. Re-install tubing bundle and robot plate assembly back into the robot arm. Re-connect all fluid air and low voltage connections.

20. Before re-installing atomizer to the robot plate, apply a film of LSCH0009 di-electic lubricant over entire length of exposed paint and dump line.

TROUBLESHOOTING GUIDE

General Problem	Possible Causes	Corrective Action
Fluid Does Not Turn On	1. Trigger pilot regulator has not been set to a minimum of 70 psig.	1. Increase to 70 psig minimum.
	2. Four nylon socket head cap screws holding the spray head are loose.	2. Tighten all screws.
	3. The green air tube possibly left disconnected during re-assembly.	3. Reconnect tubing.
	4. Green tube leading from the source to the gun mounting plate is pinched or broken.	4. Check the tubing for kinks or damage. Replace if worn or damaged.
	5. Piston seal within the gun spray head is not in place or there is an extremely tight fit between the seal and the cylinder wall.	5. Make sure that the seal is in the proper position and/or lubricate with a small amount of petroleum jelly.
No Fan or Atomization Air Pressure At the Air Cap	1. Low trigger pilot air pressure (70 psi min. required).	1. Increase pressure.
	2. Four nylon socket head screws holding the spray head are loose.	2. Tighten all screws.
	3. Air tubes EMF-102, 103 are not installed properly.	3. Re-install and tighten as required.
	4. Black or natural 3/8" OD tube is cut or pinched.	4. Examine, repair as required.

Note: A test station to bench test the applicator off line will speed the Troubleshooting process.

Fluid System

Fluid and Isolation Tube

General Problem	Possible Causes	Corrective Action
Excessive Current or Loss of High Voltage	1. Fluid tube leak inside fluid isolation tube, charged paint grounds out at robot arm manifold.	1. Replace any worn or damaged o-rings on EMFD-29-1 barbed fittings. 2. Replace any worn or damaged o-rings on fluid isolation tube. 3. Fluid tube too short. Check for correct length of fluid tube. Refer to Figure 21, Robot Manifold Assembly.
	2. Tubing or conductive sheath nicked or cut.	1. Replace tubing or conductive sheath.
	3. Internal end of fluid tube not seated properly into valve manifold assembly.	1. Ensure fluid tube is seated tightly into valve manifold assembly.
	4. Contaminated dump line.	1. Clean or replace
	5. Exterior of gun contaminat-	2. Clean with non-polar solvent

Note: To check for fluid leaks, it is easiest to first remove the gun from the test station and remove the shroud from the gun. The aluminum flange can be reattached to the gun manifold plate by using the three stainless steel screws. Then the gun can be remounted to the test station. Leak detector may be used at all appropriate sources. Be certain to wipe off all residual solution using a non-conductive solvent such as Naphtha.

Electrical

General Problem	Possible Causes	Corrective Action
No Electrostics	1. Cascade not functioning.	1. Check connection between cascade and harness (79200-00). 2. Check low voltage cable and harness timing. Correct as required. 3. Isolation tubes contaminated. Clean and re-install as required. 4. Fluid hose has pinholled. Replace as required. 5. Cascade bad. Replace as required. 6. Low voltage cable connections wrong at MicroPak. 7. Low voltage cable bad. Replace as required.
Low Kv , High µA Output	1. Exterior of gun contaminated with conductive material.	1. Replace gun cover. 2. Clean exterior with a non-polar solvent.
Low Kv, Low µA Output	1. Cascade failure.	1. Replace as required.

PARTS IDENTIFICATION

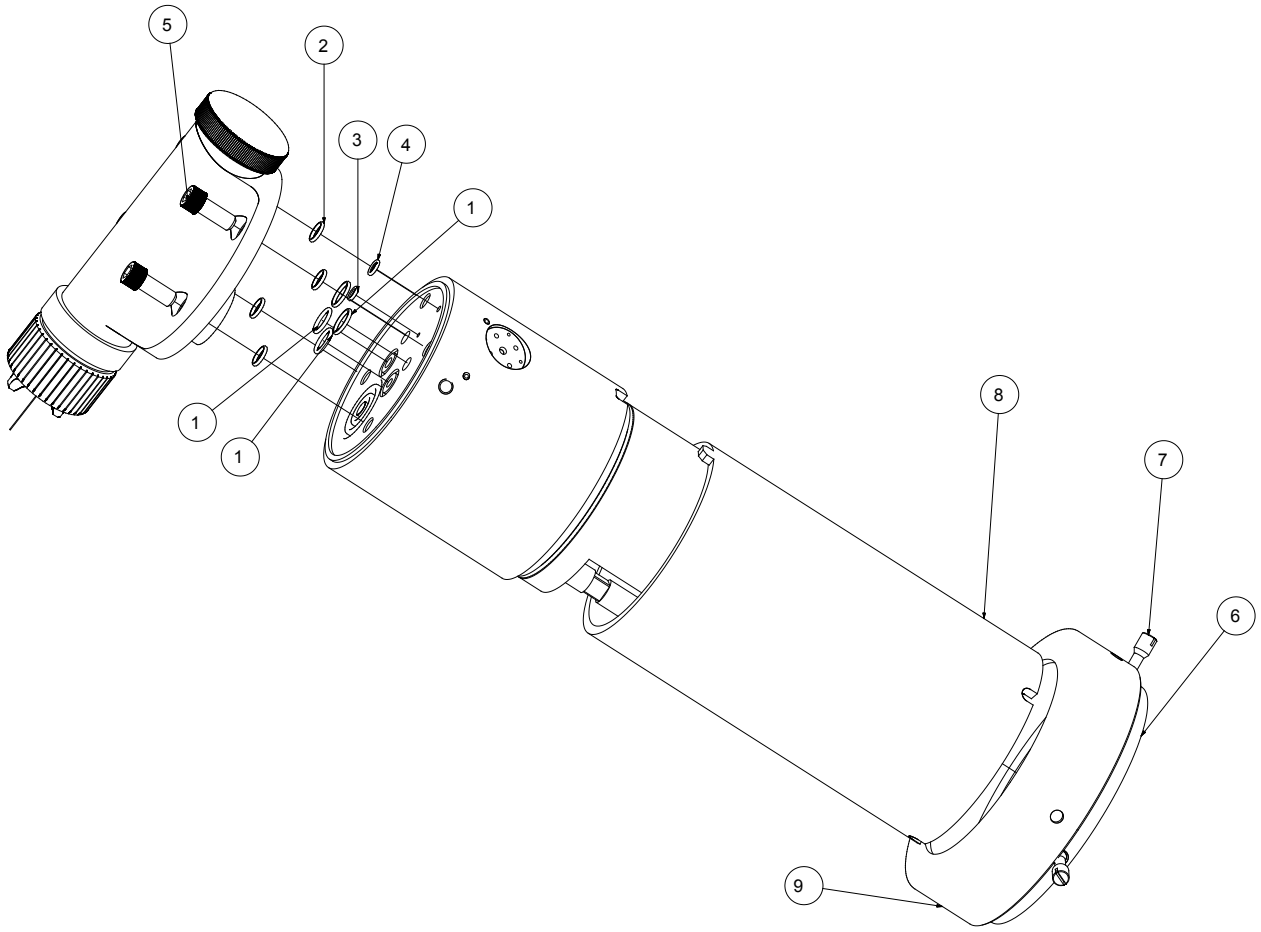


Figure 22: 78863-XX RWA-EFM Applicator

78863-XX RWA-EFM APPLICATOR - PARTS LIST (Figure 22)			
Item #	Part #	Description	Qty.
1	79001-07	O-Ring, Solvent Proof	4
2	79001-06	O-Ring, Solvent Proof	7
3	79001-04	O-Ring, Solvent Proof	2
4	79001-14	O-Ring, Solvent Proof	5
5	SSF-3125	Screw, SHCS, 5/16-18 Breakaway	4
6	78946-00	Flange, RWA-EFM	1
7	EMF-97	Locating Pin	3
8	EMF-96	Shroud	1
9	78942-00	Retaining Ring, RWA-EFM	1

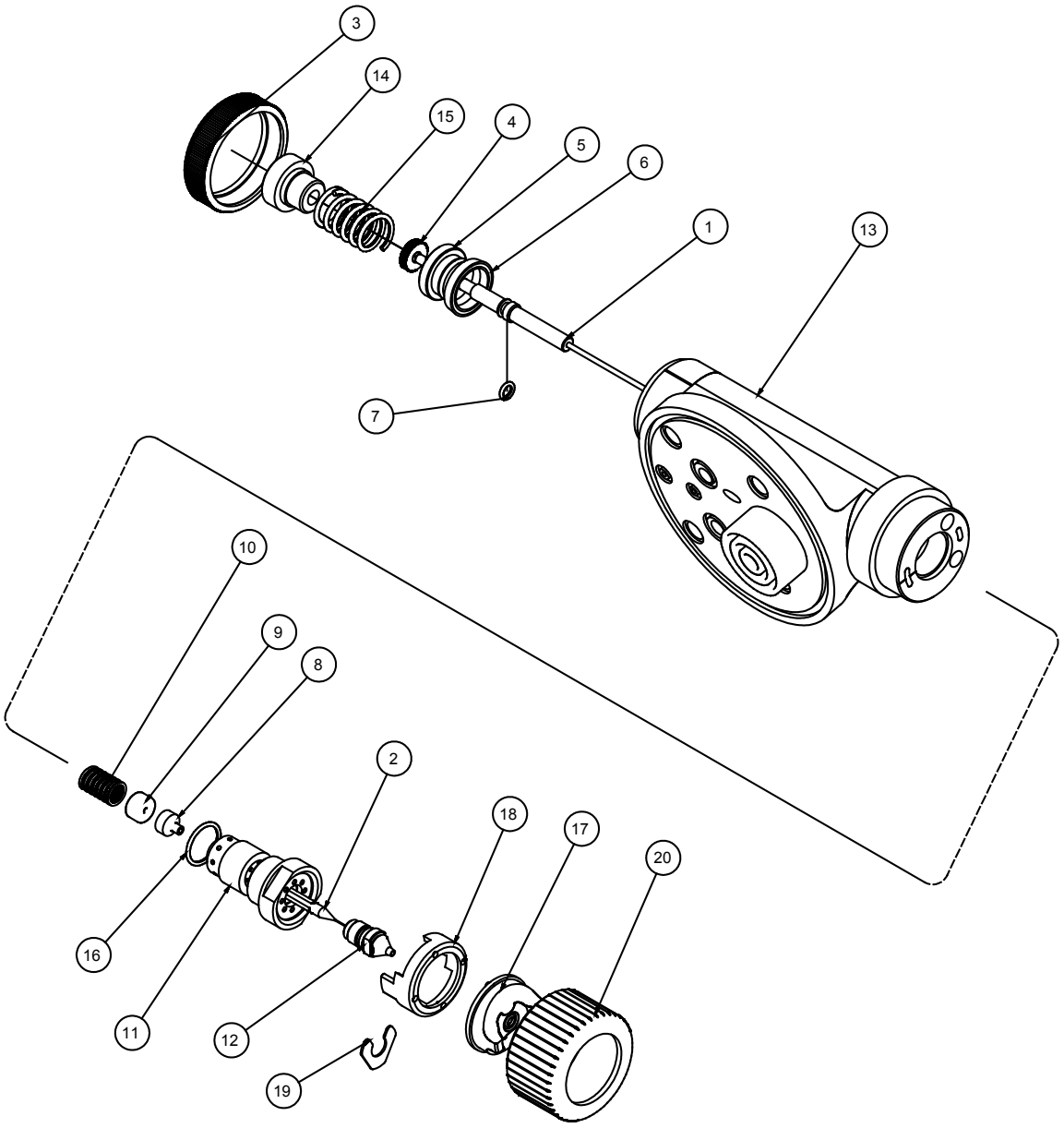


Figure 23: 76479-01 Head Assembly

76479-01 HEAD ASSEMBLY - PARTS LIST (Figure 23)			
Item #	Part #	Description	Qty.
1	78218-00	Needle Shaft Assembly	1
2	70430-01	Electrode, High Wear	1
3	EMF-13	Cap, End	1
4	RME-66	Piston Nut	1
5	RME-69	Piston	1
6	SST-7714	Seal, Piston	1
7	79001-04	O-Ring, Solvent Proof	2
8	RME-32	Seal	1
9	EMF-7	Seal, Washer	1
10	RME-38	Spring, Seal	1
11	EMF-195	Fluid Nozzle, High Flow (8) Holes (Std.)	1
	EMF-194	Nozzle, Fluid, Medium Flow (4) Holes	1
	EMF-43-1	Nozzle, Fluid, Low Flow (1) Hole	1
12	76132-00	Nozzle, Fluid, .055" Orifice (Std.)	1
	76132-01	Nozzle, Fluid, .043" Orifice	1
	76132-03	Nozzle, Fluid, .070" Orifice	1
13	76497-00	Gun Barrel Assembly, Resistive	1
14	EMF-22	Backup, Piston	1
15	RME-36	Spring, Return	1
16	79001-01	O-Ring, Solvent Proof	1
17	76131-00	Air Cap	1
18	EMF-192	Air Cap Locator	1
19	EFX-10	Clip, Air Cap	1
20	EFX-8	Ring, Retaining	1
21	74035-16	Air Cap Test Kit	1

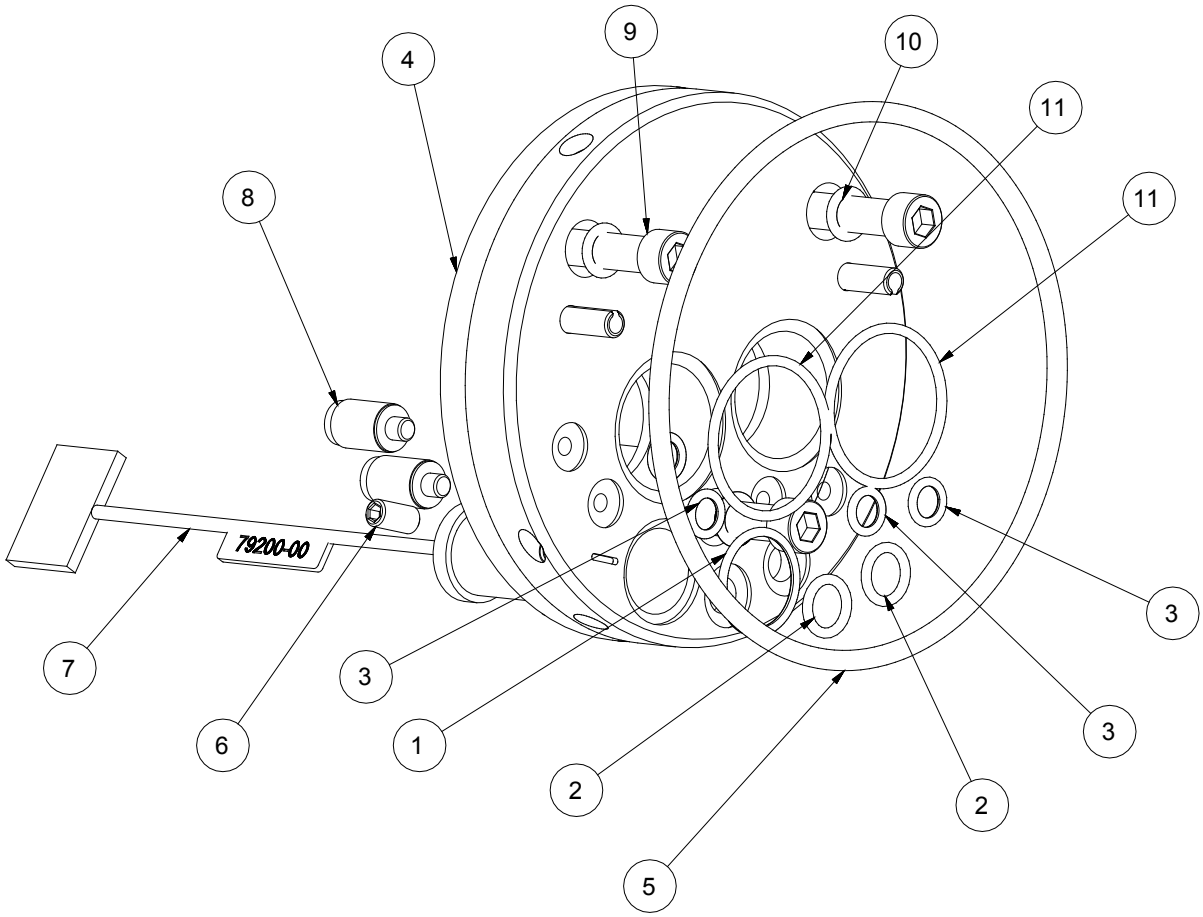


Figure 24: Rear Plate

REAR PLATE - PARTS LIST (Figure 23)			
Item #	Part #	Description	Qty.
1	79001-01	O-Ring, Solvent Proof	1
2	79001-06	O-Ring, Solvent Proof	2
3	79001-13	O-Ring, Solvent Proof	3
4	78938-00	Plate, Rear RWA-EFM	1
5	LSOR0005-07	O-Ring, Encapsulated	1
6	SSF-2052	Set Screw, 3/8" Lg. X 10-24	1
7	79200-00	Wiring Harness	1
8	41-FPP-1023	Fitting, 3/16" OD, Push-To-Lock	4
9	SS-7942-CD	SHCS 1/4"-20 X 1.0 Long	3
10	13076-10	O-Ring	3
11	EMFD-34	O-Ring, Solvent Proof, .926 ID X .07 CS #021	2

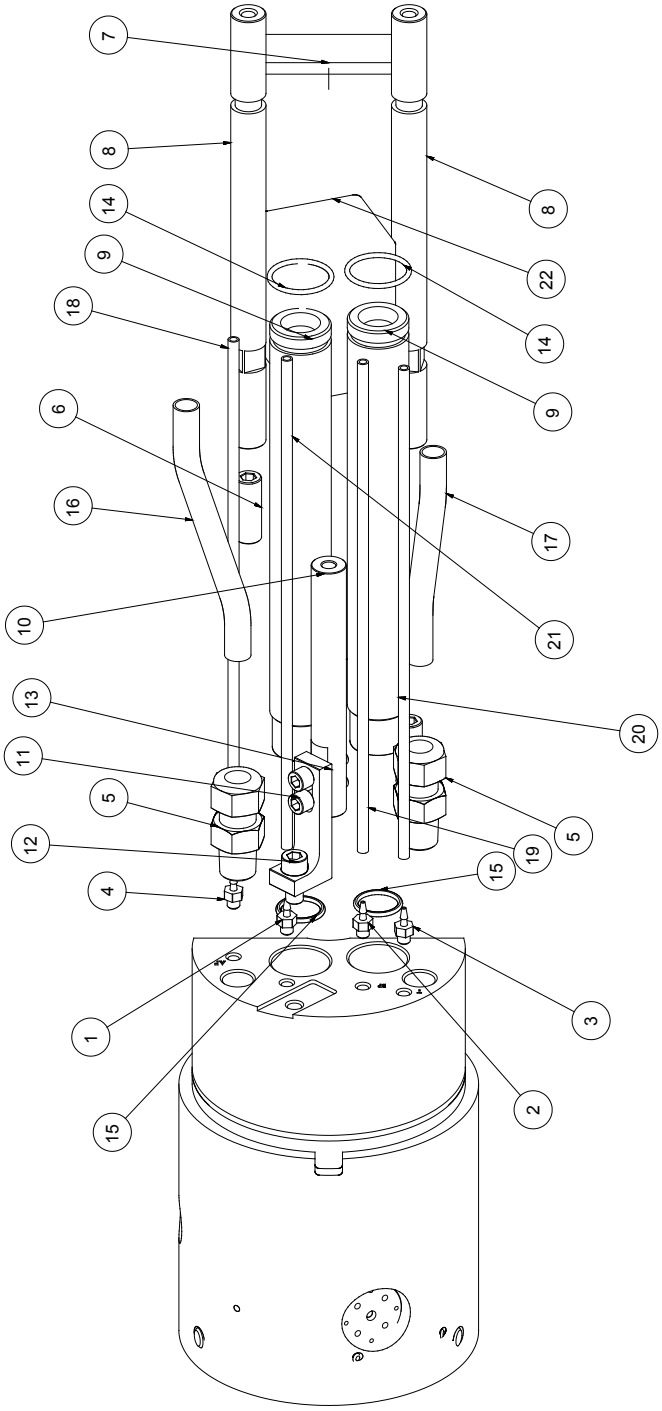


Figure 25: Air, Voltage, Material, and Tie Rod Components

AIR, VOLTAGE, MATERIAL, AND TIE ROD COMPONENTS - PARTS LIST (Figure 25)			
Item #	Part #	Description	Qty.
1	77546-04	Fitting, Barbed, Natural Color	1
2	77546-05	Fitting, Barbed, Red Color	1
3	77546-03	Fitting, Barbed, Green Color	1
4	77546-01	Fitting, Barbed, Blue Color	1
5	LSFI-0025-21	Fitting, 1/4" NPT X 3/8" ODT, Nylon	2
6	LSMM0067-32	Threaded Insert	2
7	76529-00	Bracket, Cascade Mounting	1
8	76530-00	Tie Rod, Long	2
9	78937-00	Tube, Fluid Isolation	2
10	EMF-74	Tie Rod, Short	1
11	SSF-3134	SHCS 10-24 X .75 Long	2
12	SSF-3135	SHCS 1/4-20 X .5 Long	1
13	EMF-72	Bracket, Tie Rod	1
14	79001-02	O-Ring, Solvent Proof	2
15	79001-08	O-Ring, .439 ID, Solvent Proof	2
16	EMF-102	Tube, Formed	1
17	EMF-103	Tube, Formed	1
18	77536-04	Tubing, 5/32" OD X .106 ID, Blue	1
19	77536-02	Tubing, 5/32" OD X .106 ID, Red	1
20	77536-03	Tubing, 5/32" OD X .106 ID, Green	1
21	77536-05	Tubing, 5/32" OD X .106 ID, Natural	1
22	75933-00	Cascade - HP-404	1

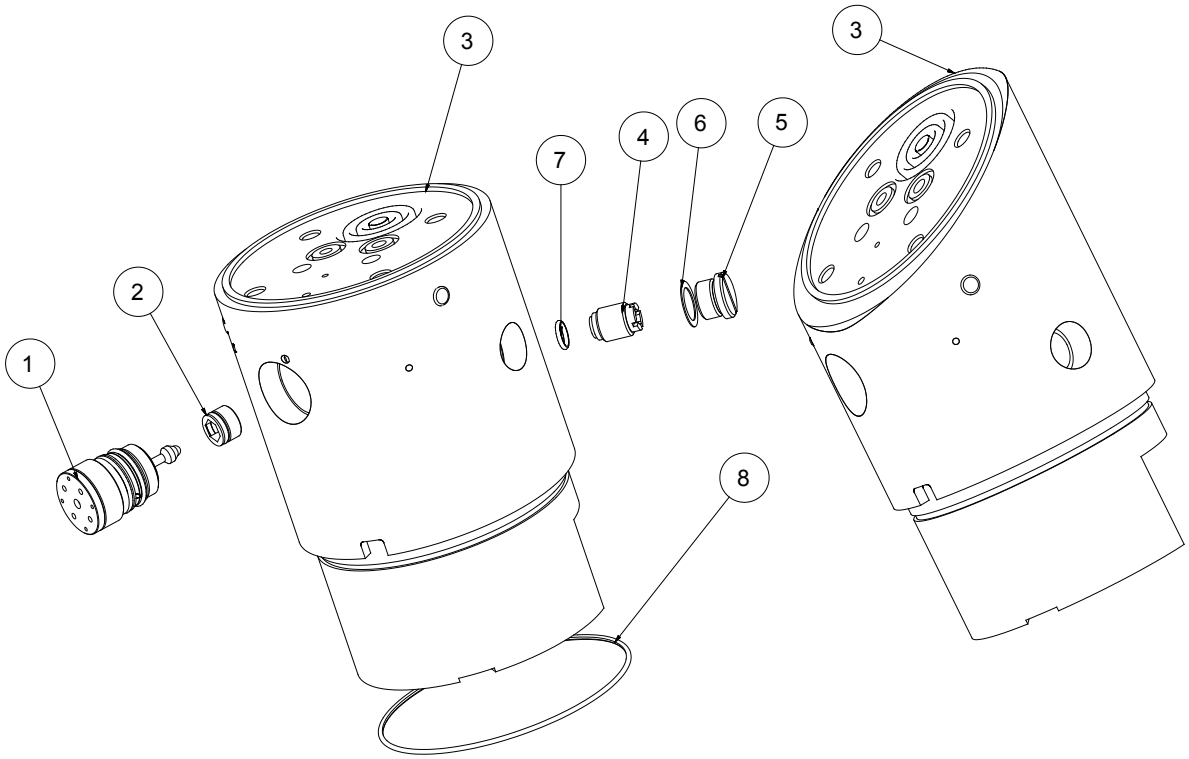


Figure 26: RWA-EFM Valve Manifold Assemblies

RWA-EFM VALVE MANIFOLD ASSEMBLIES - PARTS LIST (Figure 26)			
Item #	Part #	Description	Qty
1	78949-00	Valve Assembly	1
2	77367-00	Seat Assembly	1
3	78933-00	Assembly, Valve Body, RWA-EFM 90°	1
	79020-00	Assembly, Valve Body, RWA-EFM 60°	1
4	78944-00	Assembly, Check Valve RWA-EFM	1
5	78945-00	Plug, Check Valve	1
6	78947-00	Seal	1
7	79001-06	O-Ring, Solvent Proof	1
8	LSOR0005-06	O-Ring, Encapsulated	1

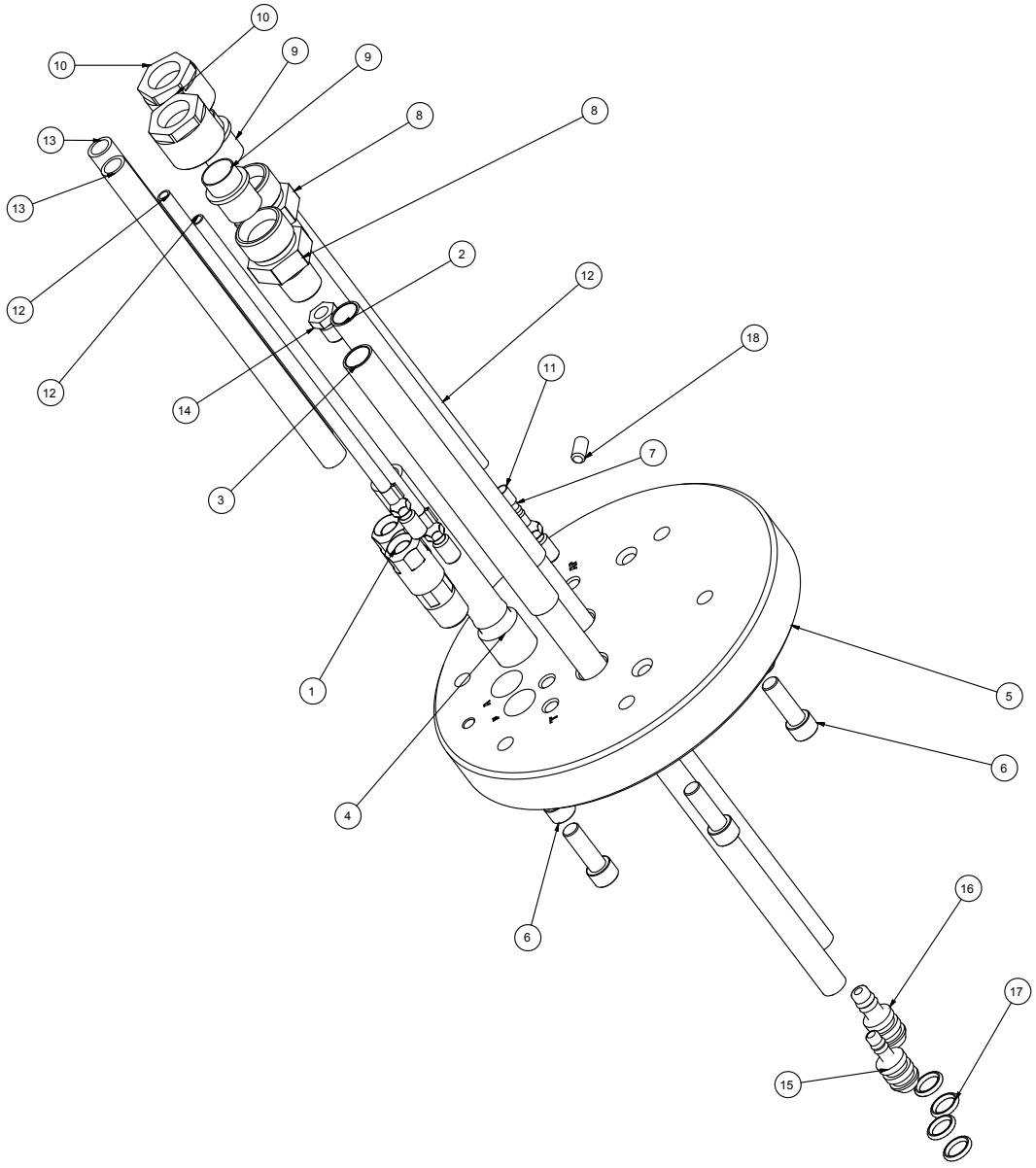


Figure 27: Robot Manifold Assembly

ROBOT MANIFOLD ASSEMBLY - PARTS LIST (Figure 27)

Item #	Part #	Description	Qty.
1	77947-00	Fitting, Air Modified	2
2	74178-01	Hose, Shielded, 3/8" OD X 1/4" ID	1
3	74178-02	Hose, Shielded, 3/8" OD x 3/16" ID, (Paint In Line)	1
4	76496-XX	Cable Assembly, EFM LV	1
5	78940-00	Robot Manifold Plate RWA-EFM	1
6	7959-24C	Screw, 1/4-20 x 3/4" Long Shcs.	6
7	EMF-82-1	Fitting,Air Pilot	3
8	EMFD-50	Fitting, Waterbase Inlet	2
9	EMFD-48	Conductive Ferrule, 2 Step	2
10	EMFD-49	Ferrule Nut, Fluit Fitting	2
11	77848-00	Clamp, Retaining	3
12	79121-02	Tubing, 3/16" OD, Red Color (DP)	1
	79121-04	Tubing, 3/16" OD, Green Color (T)	1
	79121-05	Tubing, 3/16" OD, Blue Color (AP)	1
13	7113-04	Tubing, 3/8" OD, Natural Color (ATOM)	1
	79120-02	Tubing, 3/8" OD, Black Color (FAN)	1
14	EMFD-428-1	Check Valve, Cartridge	1
15	EMFD-29-1	Barb Fitting, 3/16" ID	1
16	EMFD-29	Barb Fitting, 1/4" ID Tube	1
17	79001-06	O-Ring, Solvent Proof	4
18	SSF-2052	Set Screw, 3/8" Long x 10-24	1

WARRANTY POLICIES

LIMITED WARRANTY

Ransburg will replace or repair without charge any part and/or equipment that fails within the specified time (see below) because of faulty workmanship or material, provided that the equipment has been used and maintained in accordance with Ransburg's written safety and operating instructions, and has been used under normal operating conditions. Normal wear items are excluded.

THE USE OF OTHER THAN RANSBURG APPROVED PARTS VOIDS ALL WARRANTIES.

SPARE PARTS: One hundred and eighty (180) days from date of purchase, except for rebuilt parts (any part number ending in "R") for which the warranty period is ninety (90) days.

EQUIPMENT: When purchased as a complete unit, (example: guns, power supplies, control units, etc.), is one (1) year from date of purchase. WRAPPING THE APPLICATOR IN PLASTIC, SHRINK-WRAP, ETC., WILL VOID THIS WARRANTY.

FLUID HANDLING: One (1) year from date of purchase (example: Totalizer, CCV Valves, etc.).

AIR BEARING ROTATORS: Fifteen thousand (15,000) hours or three (3) years, whichever occurs first. Warranty period begins on the date of purchase.

RANSBURG'S ONLY OBLIGATION UNDER THIS WARRANTY IS TO REPLACE PARTS THAT HAVE FAILED BECAUSE OF FAULTY WORKMANSHIP OR MATERIALS. THERE ARE NO IMPLIED WARRANTIES NOR WARRANTIES OF EITHER MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. RANSBURG ASSUMES NO LIABILITY FOR INJURY, DAMAGE TO PROPERTY OR FOR CONSEQUENTIAL DAMAGES FOR LOSS OF GOODWILL OR PRODUCTION OR INCOME, WHICH RESULT FROM USE OR MISUSE OF THE EQUIPMENT BY PURCHASER OR OTHERS.

EXCLUSIONS: If, in Ransburg's opinion the warranty item in question, or other items damaged by this part was improperly installed, operated or maintained, Ransburg will assume no responsibility for repair or replacement of the item or items. The purchaser, therefore will assume all responsibility for any cost of repair or replacement and service related costs if applicable.

APPENDIX

PAINT AND SOLVENT SPECIFICATIONS

	REA™ / EFM™	REM™ / M90™	NO. 2 HAND GUN	TURBODISK™	AEROBELL® II*** AEROBELL® AEROBELL® 33 RMA-101™
RECOMMENDED VISCOSITY USING A ZAHN NO. 2	18 TO 30 SEC	18 TO 30 SEC	20 TO 60 SEC	20 TO 60 SEC	20 TO 60 SEC
PAINT ELECTRICAL RESISTANCE**	.1 MΩ TO ∞	.1 MΩ TO ∞	.1 TO 1 MΩ	.1 MΩ TO ∞	.1 MΩ TO ∞
RECOMMENDED DELIVERY (UP TO)	1000 cc/min	1500 cc/min	180 cc/min	1000 cc/min	500 cc/min

GUIDE TO USABLE SOLVENT SELECTION

Chemical Name	Common Name	Category	Flash Point†† (TCC)	*CAS Number	Evap. Rate†		Elec. Res.**
DICHLOROMETHANE	Methylene Chloride	Chlorinated Solvents		75-09-2	14.5	⇑	HIGH
VM & P NAPHTHA	Naptha	Aliphatic Hydrocarbons	65°F	8030-30-6	10		HIGH
ACETONE		Ketones	-18°F	67-64-1	5.6		LOW
METHYL ACETATE		Esters	90°F	79-20-9	5.3	F	LOW
BENZENE		Aromatic Hydrocarbons	12°F	71-43-2	5.1		HIGH
ETHYL ACETATE		Esters	24°F	141-78-6	3.9	A	MEDIUM
2-BUTANONE	MEK	Ketones	16°F	78-93-3	3.8		MEDIUM
ISO-PROPYL ACETATE		Esters	35°F	108-21-4	3.4	S	LOW
ISOPROPYL ALCOHOL	IPA	Alcohols	53°F	67-63-0	2.5		LOW
2-PENTANONE	MPK	Ketones	104°F	107-87-9	2.5	T	MEDIUM
METHANOL	Methyl Alcohol	Alcohols	50°F	67-56-1	2.1		LOW
PROPYL ACETATE	n-Propyl Acetate	Esters	55°F	109-60-4	2.1	E	LOW
TOLUOL	Toluene	Aromatic Hydrocarbons	48°F	108-88-3	1.9		HIGH
METHYL ISOBUTYL KETONE	MIBK	Ketones	60°F	108-10-1	1.6	R	MEDIUM
ISOBUTYL ACETATE		Esters	69°F	110-19-0	1.5		LOW
ETHANOL	Ethyl Alcohol	Alcohols		64-17-5	1.4		LOW
BUTYL ACETATE		Esters	78°F	123-86-4	1.0		LOW
ETHYLBENZENE		Aromatic Hydrocarbons	64°F	100-41-4	.89		HIGH
1-PROPANOL	n-Propyl Alcohol	Alcohols	74°F	71-23-8	.86		LOW
2-BUTANOL	sec.-Butyl Alcohol	Alcohols	72°F	78-92-2	.81		LOW
XYLOL	Xylene	Aromatic Hydrocarbons	79°F	1330-02-07	.80		HIGH
AMYL ACETATE		Esters	106°F	628-63-7	.67		MEDIUM
2-METHYLPROPANOL	iso-Butyl Alcohol	Alcohols	82°F	78-83-1	.62	S	LOW
METHYL AMYL ACETATE		Esters	96°F	108-84-9	.50		LOW
5-METHYL-2-HEXANONE	MIAK	Ketones	96°F	110-12-3	.50	L	MEDIUM
1-BUTANOL	n-Butyl Alcohol	Alcohols	95°F	71-36-3	.43		LOW
2-ETHOXYETHANOL		Glycol Ethers	164°F	110-80-5	.38	O	LOW
2-HEPTANONE	MAK	Ketones	102°F	110-43-0	.40		MEDIUM
CYCLOHEXANONE		Ketones	111°F	108-94-1	.29	W	MEDIUM
AROMATIC-100	SC#100	Aromatic Hydrocarbons	111°F		.20		HIGH
DIISOBUTYL KETONE	DIBK	Ketones	120°F	108-83-8	.19	E	MEDIUM
1-PENTANOL	Amyl Alcohol	Alcohols		71-41-0	.15		LOW
DIACETONE ALCOHOL		Ketones	133°F	123-42-2	.12	R	LOW
2-BUTOXYETHANOL	Butyl Cellosolve	Glycol Ethers	154°F	111-76-2	.07		LOW
CYCLOHEXANOL		Alcohols	111°F	108-93-0	.05		LOW
AROMATIC-150	SC#150	Aromatic Hydrocarbons	149°F		.004	⇓	HIGH
AROMATIC-200		Aromatic Hydrocarbons	203°F		.003		HIGH

* CAS Number: Chemical Abstract Service Number.
** Electrical Resistance using the Ransburg Meter.
*** Solvent Base Configuration Only.
† Information Obtained From: http://solvdb.ncms.org
†† The lowest temperature at which a volatile fluid will ignite.
Evaporation Rate is Based Upon Butyl Acetate Having a Rate of 1.0

NOTE: Chart provides resistance and control information that we feel is necessary when using Ransburg equipment.

VISCOSITY CONVERSION CHART

Poise	Centipoise	Parlin 7	Parlin 10	Fisher 1	Fisher 2	Ford Cup 3	Ford Cup 4	Gardner - Holdt Bubble	Gardner - Lithographic	Krebs Unit KU	Saybolt Universal SSU	Zahn 1	Zahn 2	Zahn 3	Zahn 4	Zahn 5	Sears Craftsman Cup	Din Cup 4
.1	10	27	11	20			5	A-4			60	30	16					10
.15	15	30	12	25			8	A-3			80	34	17					11
.2	20	32	13	30	15	12	10				100	37	18					12
.25	25	37	14	35	17	15	12	A-2			130	41	19					13
.3	30	43	15	39	18	19	14	A-1			160	44	20					14
.4	40	50	16	50	21	25	18	A			210	52	22				19	15
.5	50	57	17		24	29	22			30	260	60	24				20	16
.6	60	64	18		29	33	25	B		33	320	68	27				21	18
.7	70		20		33	36	28			35	370		30				23	21
.8	80		22		39	41	31	C		37	430		34				24	23
.9	90		23		44	45	32			38	480		37	10			26	25
1.0	100		25		50	50	34	D		40	530		41	12	10		27	27
1.2	120		30		62	58	41	E		43	580		49	14	11		31	31
1.4	140		32			66	45	F		46	690		58	16	13		34	34
1.6	160		37				50	G		48	790		66	18	14		38	38
1.8	180		41				54		000	50	900		74	20	16		40	43
2.0	200		45				58	H		52	1000		82	23	17	10	44	46
2.2	220						62	I		54	1100			25	18	11		51
2.4	240						65	J		56	1200			27	20	12		55
2.6	260						68			58	1280			30	21	13		58
2.8	280						70	K		59	1380			32	22	14		63
3.0	300						74	L		60	1475			34	24	15		68
3.2	320							M			1530			36	25	16		72
3.4	340							N			1630			39	26	17		76
3.6	360							O		62	1730			41	28	18		82
3.8	380										1850			43	29	19		86
4.0	400							P		64	1950			46	30	20		90
4.2	420										2050			48	32	21		95
4.4	440							Q			2160			50	33	22		100
4.6	460							R		66	2270			52	34	23		104
4.8	480								00	67	2380			54	36	24		109
5.0	500							S		68	2480			57	37	25		112
5.5	550							T		69	2660			63	40	27		124
6.0	600							U		71	2900			68	44	30		135
7.0	700									74	3375				51	35		160
8.0	800								0	77	3380				58	40		172
9.0	900							V		81	4300				64	45		195
10.0	1000							W		85	4600					49		218
11.0	1100									88	5200					55		
12.0	1200									92	5620					59		

VISCOSITY CONVERSION CHART (Continued)

Poise	Centipoise	Parlin 7	Parlin 10	Fisher 1	Fisher 2	Ford Cup 3	Ford Cup 4	Gardner - Holdt Bubble	Gardner - Lithographic	Krebs Unit KU	Saybolt Universal SSU	Zahn 1	Zahn 2	Zahn 3	Zahn 4	Zahn 5	Sears Craftsman Cup	Din Cup 4
13.0	1300							X		95	6100					64		
14.0	1400								1	96	6480							
15.0	1500									98	7000							
16.0	1600									100	7500							
17.0	1700									101	8000							
18.0	1800							Y			8500							
19.0	1900										9000							
20.0	2000									103	9400							
21.0	2100										9850							
22.0	2200										10300							
23.0	2300							Z	2	105	10750							
24.0	2400									109	11200							
25.0	2500							Z-1		114	11600							
30.0	3000									121	14500							
35.0	3500							Z-2	3	129	16500							
40.0	4000									133	18500							
45.0	4500							Z-3		136	21000							
50.0	5000										23500							
55.0	5500										26000							
60.0	6000							Z-4	4		2800							
65.0	6500										30000							
70.0	7000										32500							
75.0	7500										35000							
80.0	8000										37000							
85.0	8500										39500							
90.0	9000										41000							
95.0	9500										43000							
100.0	10000							Z-5	5		46500							
110.0	11000										51000							
120.0	12000										55005							
130.0	13000										60000							
140.0	14000										65000							
150.0	15000							Z-6			67500							
160.0	16000										74000							
170.0	17000										83500							
180.0	18000										83500							
190.0	19000										88000							
200.0	20000										93000							
300.0	30000										140000							

Note: All viscosity comparisons are as accurate as possible with existing information.
Comparisons are made with a material having a specific gravity of 1.0.

VOLUMETRIC CONTENT OF HOSE OR TUBE (English Units)							
I.D (in)	cc/ft	Cross Section (in^2)	Length				
			5ft. (60")	10ft. (120")	15ft. (180")	25ft. (300")	50ft. (600")
1/8	2.4	.012	.003 gal. .4 fl. oz.	.005 gal. .8 fl. oz.	.009 gal. 1.2 fl. oz.	.015 gal. 2.0 fl. oz.	.03 gal. 4.0 fl. oz.
3/16	5.4	.027	.007 gal. .9 fl. oz.	.014 gal. 1.8 fl. oz.	.021 gal. 2.7 fl. oz.	.035 gal. 4.5 fl. oz.	.07 gal. 9.0 fl. oz.
1/4	9.6	.049	.012 gal. 1.6 fl. oz.	.024 gal. 3.2 fl. oz.	.035 gal. 4.8 fl. oz.	.050 gal. 8.0 fl. oz.	.125 gal. 16.0 fl. oz.
5/16	13.8	.070	.018 gal. 2.3 fl. oz.	.036 gal. 4.6 fl. oz.	.054 gal. 6.9 fl. oz.	.090 gal. 11.5 fl. oz.	.180 gal. 23.0 fl. oz.
3/8	43.8	.110	.028 gal. 3.65 fl. oz.	.056 gal. 7.3 fl. oz.	.084 gal. 10.95 fl. oz.	.140 gal. 18.25 fl. oz.	.250 gal. 36.5 fl. oz.
1/2	78.04	.196	.052 gal. 6.5 fl. oz.	.104 gal. 13.0 fl. oz.	.156 gal. 19.5 fl. oz.	.260 gal. 32.5 fl. oz.	.520 gal. 65.0 fl. oz.

VOLUMETRIC CONTENT OF HOSE OR TUBE (Metric Units)							
I.D (mm)	cc/m	Cross Section (mm^2)	Length				
			1.5m	3.0m	4.5m	6.0m	7.5m
3.6	102	10.2	153 cc	306 cc	459 cc	612 cc	765 cc
5.6	246	24.6	369 cc	738 cc	1.1 Liters	1.5 Liters	1.8 Liters
6.8	363	36.3	544 cc	1.1 Liters	1.6 Liters	2.2 Liters	2.7 Liters
8.8	608	60.8	912 cc	1.8 Liters	2.7 Liters	3.6 Liters	4.6 Liters

Service Manual Price: $30.00

Automotive Systems*
Automotive Finishing Group
48152 West Road
Wixom, Michigan 48393
Telephone: 248 / 668-8900
Fax: 248 / 668-2160
E-Mail: marketing@autofinish.com
Order Desk: Telephone: 800/726-8097 Fax: 800/359-2341
Technical/Service Assistance: Telephone: 800/ 626-3565 Fax: 877/ 852-7796

Industrial Systems
Ransburg Electrostatic Systems
320 Phillips Avenue
Toledo, Ohio 43612
Telephone: 419/ 470-2000
Fax: 419/ 470-2270
Website: www.ransburg.com
E-Mail: marketing@ransburg.com
Order Desk: Telephone: 800/ 726-8097 Fax: 800/ 359-2341
Technical/Service Assistance: Telephone: 800/ 233-3366 Fax: 419/ 470-2071

*Ransburg Industrial Systems is an ISO 9001 compliant company registered with Factory Mutual.
Models and specifications subject to change without notice.

Form No. AA-03-01.1
Litho in U.S.A.
01/13