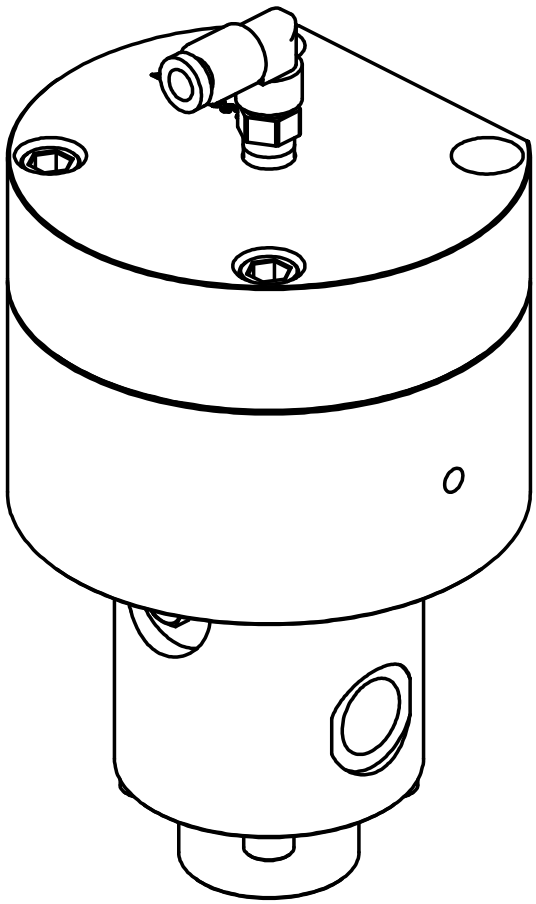
ITW Ransburg
Electrostatic Systems

SERVICE MANUAL
LN-9112-00

WEEPING MVR ASSEMBLY



MODEL: TR-SSMM-147, 148, and 225

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: $20.00

CONTENTS

SAFETY

SAFETY PRECAUTIONS

Before operating, maintaining or servicing any ITW Ransburg 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 ITW 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 ITW Ransburg system, contact your local ITW Ransburg representative or ITW Ransburg.

⚠ WARNING

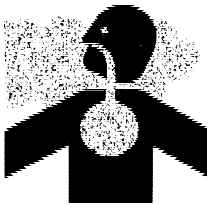
➤ The user **MUST** read and be familiar with the Safety Section in this manual and the ITW Ransburg safety literature therein identified.

➤ 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.	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. 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. Test only in areas free of combustible material. Non-factory replacement parts or unauthorized equipment modifications may cause fire or injury. If used, the key switch bypass is intended for use only during setup 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.
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 sprayed and its concentration. Equipment must be as prescribed by an industrial hygienist or safety expert, and be NIOSH approved.

INTRODUCTION

TR-SSMM-147, 148 & 225 WEEPING MVR ASSEMBLY

The material regulator valve is an air-operated sliding valve. It has a tapered needle and specially designed fluid ports that permit precise regulation and rapid response to air command signals. These characteristics are maintained over the full operating range of the regulator valve.

Control of the MVR is achieved through an air pressure control signal generated from the transducer panel. Air pressure against a solvent resistant diaphragm moves the needle up and down across the fluid ports. The tapered seat on the needle, combined with the fluid port configuration, allows fluid flow through the MVR to directly reflect the air pressure control signal. An increase in air pressure results in an increase in fluid flow through the regulator.

The flow rate of the material depends on the position of the shaft taper within the valve body.

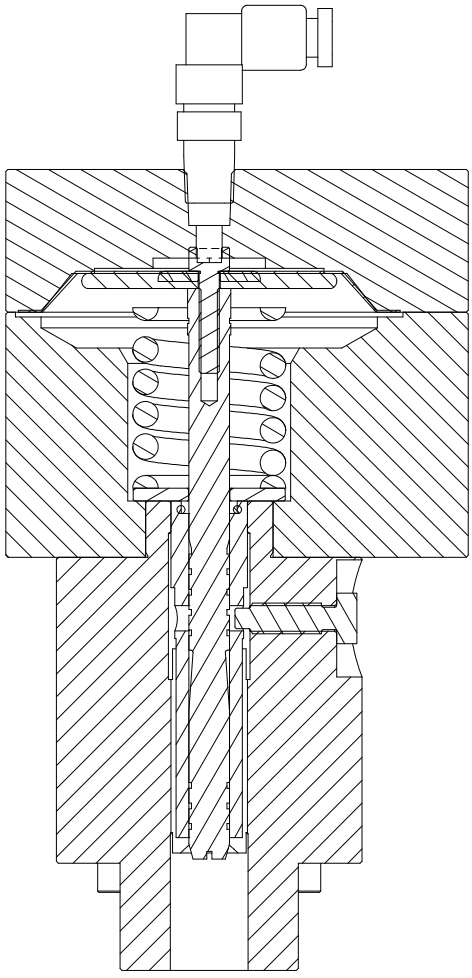


Figure 1: TR-SSMM-147 Weeping MVR Assembly

SPECIFICATIONS

Technical

Maximum Air Pressure: 100 psig (6.9 bar)

Maximum fluid Pressure: 300 psig (207 bar)

Flow Rate: ***(Dependent upon material viscosity and needle used.)***

#2 Needle	Low Flow	(TR-SSMM-149)
#3 Needle	Medium Flow	(TR-SSMM-150)
#4 Needle	High Flow	(TR-SSMM-226)

Ports:

Top and Side Air Ports:	1/8-27 NPT (F)
Fluid Inlet & Oulet Ports:	3/8 BSP Threads
Bottom Weep Port:	3/8-18 NPT (F)
Mounting Holes:	5/16-18

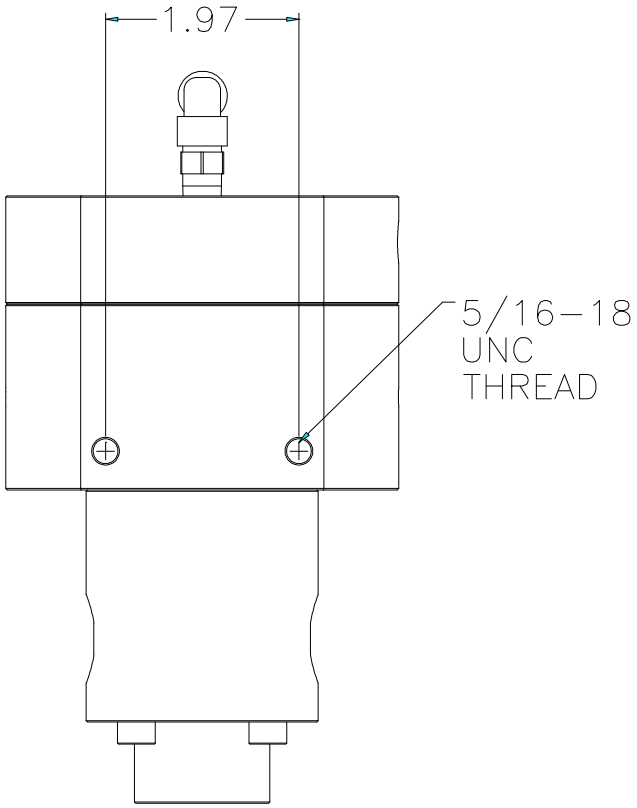


Figure 2: Mounting Footprint

MAINTENANCE

POSSIBLE CAUSES OF MVR PROBLEMS

1. Most problems with the material regulator are caused by improperly filtered fluid. Particulates and residue in the material regulator can cause plugging of the fluid ports and sluggish valve operation. If repeated disassembly and cleaning for removal of solids and residue occurs, inspect the entire fluid supply system. A 100 mesh filter is recomended for proper filtration.

2. Fluid backup, i.e. reverse flow, can cause reacted/catalyzed material to enter the material regulator. Reverse flow will be detected by the 2-K and the system will shut down, however, the material regulator should be cleaned or flushed immediately to prevent the fluid from setting-up.

If repeated cleaning is required, inspect the check valves and adjust the REV FLOW parameter accordingly.

3. Kinks or tight bends in the control air line may restrict air flow to the material regulator. Inspect the condition of exposed tubing periodically and check the fitting connection at the material regulator.

4. Check the leakage weep port for any signs of coagulated material. Excessive buildup will cause the valve to operate improperly. Buildup can also indicate that the valve needle and valve body should be replaced.

PREVENTIVE MAINTENANCE

Daily

1. Check the leakage weep ports for fluid leakage. If fluid leakage is evident, repair at earliest opportunity.

2. Inspect the exposed fluid and air tubing for kinks, tight bends, leaks, etc.

Weekly

Flush the coating material from the system.

2500 Hours of Operation

Rebuild the valve:

1. Inspect the fluid section and fluid needle. Replace both if excessive leakage is evident.

2. Replace the air diaphragms.

3. Replace the compression spring.

4. Replace the seal SSG-8125 Teflon o-ring.

GENERAL

1. Work from a clean, dry bench.

2. Always install new o-rings, gaskets and diaphragms when the material regulator is reassembled.

3. Use only lint-free wipers/cloths for cleaning.

4. Refer to the model number of the material regulator when ordering replacement parts.

PRELIMINARY PROCEDURES

Prior to removing the material regulator for service or repair, perform the following:

1. Flush the material regulator with the system purge.

2. Remove all pressure from the affected fluid line.

3. Close the shut-off valves on either side of the material regulator.

4. Clean the exterior of the material regulator before loosening any fittings.

5. Disconnect the control air line from the material regulator. Cover the exposed hose end to prevent contamination.

6. Remove the material regulator from the fluid line.

7. If the fluid lines will be left open during the repair, cover them to prevent contaminants from entering the fluid system.

DISASSEMBLY PROCEDURES

Material Regulator Disassembly

1. Clamp the regulator in a bench vise with padded jaws.

2. Loosen the top (4) housing bolts [4] equally and alternately.
3. Lift off the upper housing and remove the diaphragm and needle assembly.

NOTE

► As the bolts are loosened the load spring will force the housing halves apart. Keep equal tension on the housing bolts to avoid damaging the internal components.

Diaphragm Removal

1. Remove the allen screw from the diaphragm end of the needle assembly and lift off the flat washer.

2. Remove the diaphragm flat washers and regulator spring. The diaphragm is constructed of (3) layers of Teflon material. It should be replaced if fluid has leaked into the air pressure chamber or the diaphragm shows signs of wear.

Fluid Section Disassembly Procedures

1. Loosen the bottom (4) housing bolts [16] to remove the TR-SHC-149, fluid housing.

VALVE BODY SERVICING

Remove the fittings/adapters from the inlet and outlet ports of the valve and clean out any coating buildup.

ASSEMBLY PROCEDURES

Needle Preassembly

1. Assemble the TR-SSF-506 small washer [10], onto the TR-SSF-031 screw [9]. The radius side of the washer should be facing away from the screw head.

2. Now assemble the (3) TR-SSMM-151 diaphragms [8], onto the TR-SSF-031 cap screw [9], and then place the TR-SSF-505 large washer, on top of the diaphragms.

NOTE

► It is highly recomended that the diaphragm [7] be replaced each time the housing is opened or unit is rebuilt.

3. Apply a small drop of 7969-031, loctite (blue), onto the cap screw and assemble onto the TR-SSMM-XXX, needle. Tighten the needle using the appropriate Allen wrenches. For exact assembly detail, see Figure 4.

TR-SSMM-147, 148, and 225 MVR ASSEMBLY

Assemble Bolt in Housing

Locate TR-SSHC-149 housing and TR-SSF-508 bolt; assemble bolt loosely into body with nose of bolt slightly inside of diameter to provide needed alignment of bushing when being pressed into place.

Press Bushing Into Body (If Previously Removed)

Locate item TR-SSHC-149 housing with bolt assembled into it and apply petroleum jelly to the inside diameter of bushing sparingly. Place the housing onto the arbor, press with the longest "neck" side down on the table.

Now locate TR-SSHC-153 bushing and sparingly apply Vaseline to the outside diameter of the bushing. Carefully align the bushing into the housing with one of the slot sides of the bushing aligned with the bolt inside the housing.

NOTE

➤ The "screwdriver" slot in the bushing should be facing downwards during the press operation.

Now carefully bring down the arbor press tongue onto the bushing and press it into place slowly and steady, do not stop. Make sure to keep a steady press motion during the press operation to assure bushing does not gull the body during the press operation. Press the bushing in until it is flush with the top of the housing.

Assemble Fluid Housing Onto Lower Piston Housing

Locate fluid housing assembly with pressed in bushing and insert SSF-8125 [15] Teflon o-ring into the counter bore of bushing as shown in Figure 4. Once installed, lubricate Teflon o-ring with petroleum jelly.

Turn TR-SSHC-150 lower housing upside down on the table with threaded holes facing up. Take TR-SSHC-149 fluid housing and assemble it into the lower housing. Now rotate the housing until the TR-SSF-508 bolt is 90 degrees away from the mounting hole in TR-SSHC-150 lower housing.

Pull TR-SSF-509 SHCS screw and apple (blue) loctite 7969-03 onto the four screws. Proceed to assemble the screws into the fluid housing and lower housing. Tighten the screws securely.

Assemble Needle Assembly Into the Piston and Fluid Housing

Locate TR-SSF-504 Support washer and place into lower housing as shown in Figure 4. Next place the A10231-00 spring into lower housing as shown in Figure 4.

Apply petroleum jelly onto the outside diameter of needle assembly sparingly. Now align needle assembly into bushing and carefully slide needle into the bushing until the lower diaphragm support rests onto the top of the spring.

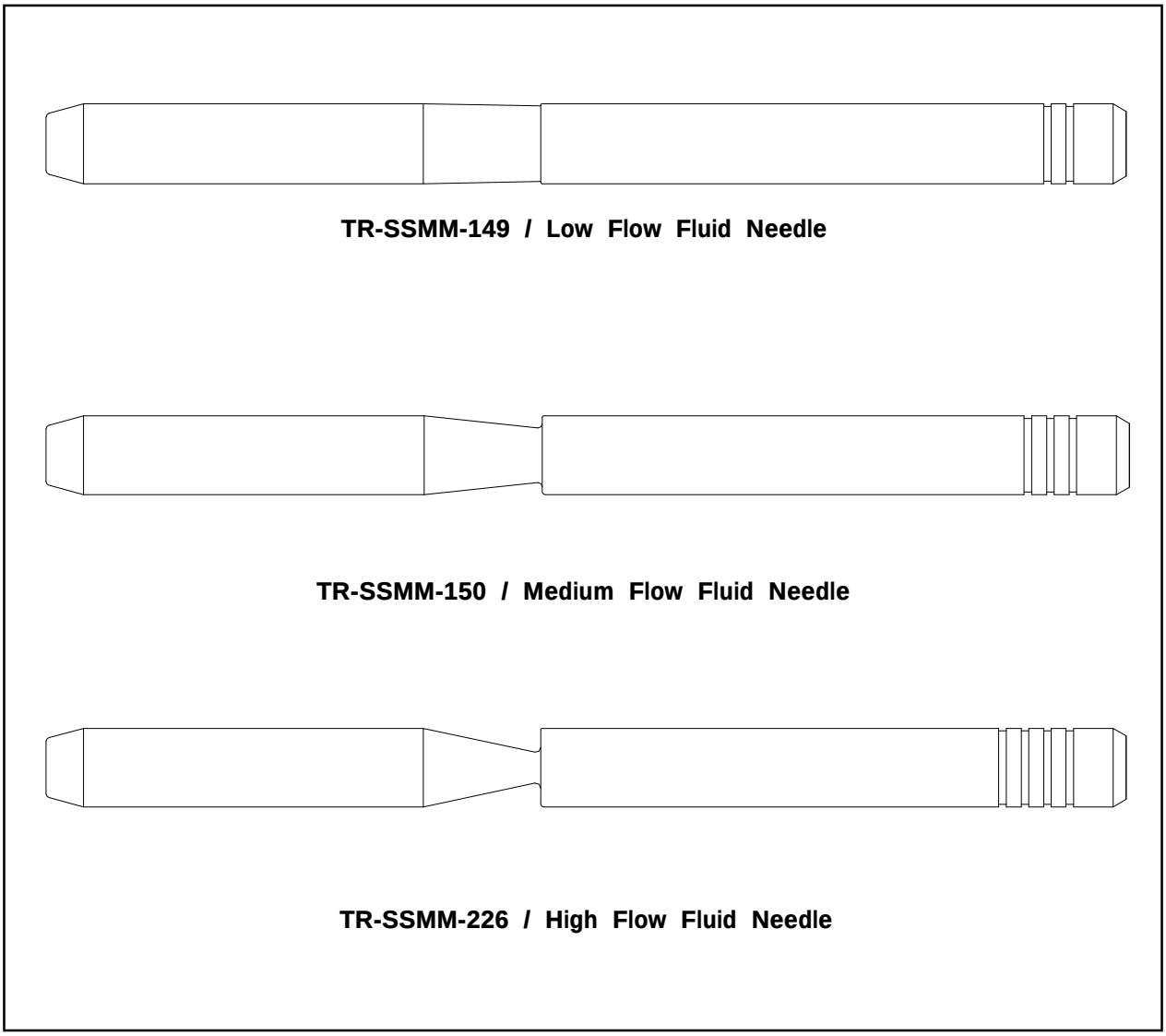
Assemble Upper Housing

Pull TR-SSHC-151 upper housing onto the lower piston assembly. Once the upper housing is oriented to its correct position, locate four screws TR-SSF-100 and assemble into the counter bore of the upper housing. Carefully take down the screws evely using an "X" pattern to avoid stripping out the threaded holes in the lower housing, tighten securely.

FLUID NEEDLE REPLACEMENT

NOTE

➤ When replacing MVR fluid needles, use Figure 3 below to determine the correct size and part number. The number of grooves at the top of the needle correlates to the dash number of the part number.



TR-SSMM-149 / Low Flow Fluid Needle

TR-SSMM-150 / Medium Flow Fluid Needle

TR-SSMM-226 / High Flow Fluid Needle

Figure 3: Weeping MVR Fluid Needles

PARTS IDENTIFICATION

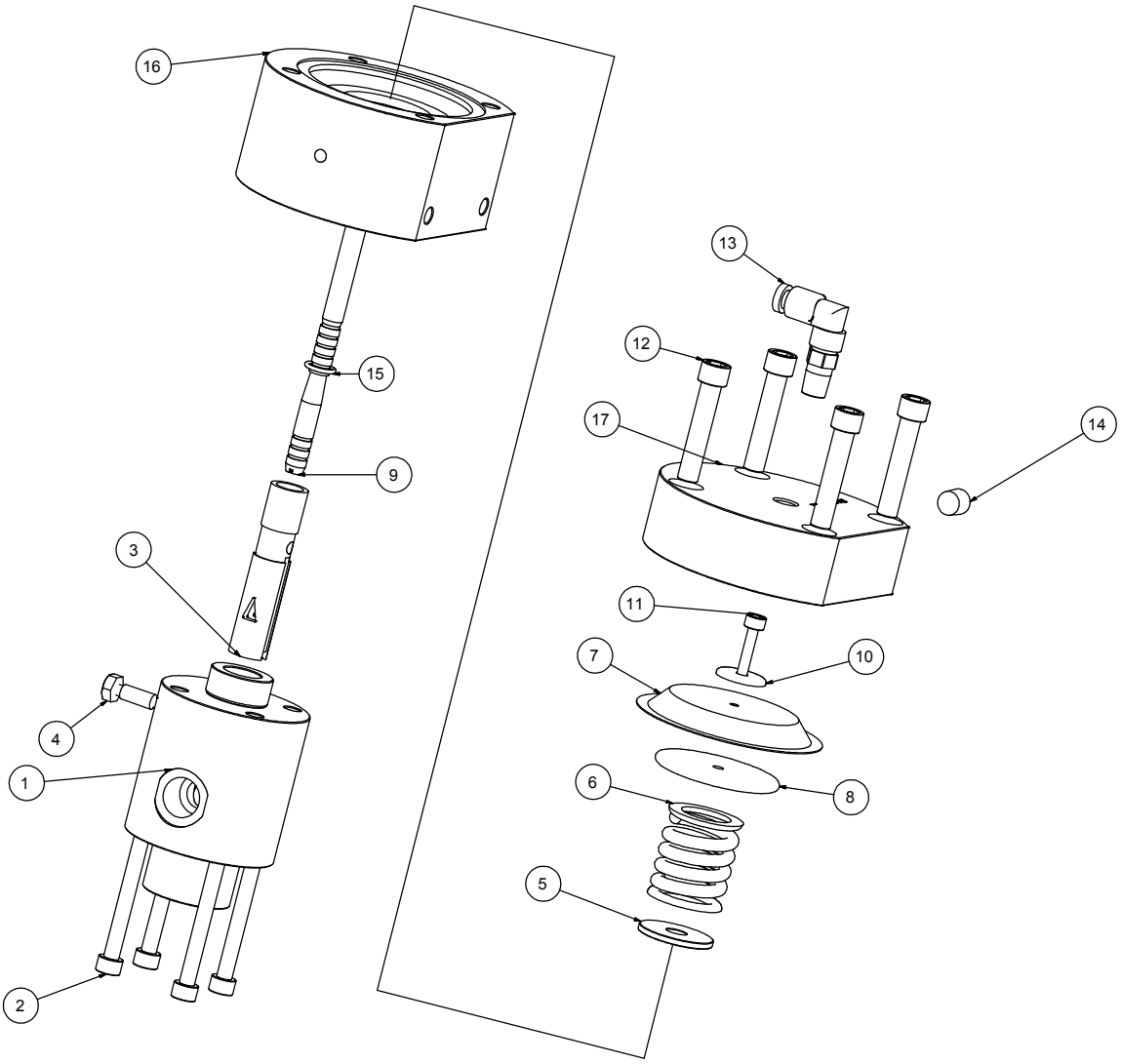


Figure 4: Weeping MVR Assembly

WEEPING MVR ASSEMBLY - PARTS LIST (Figure 4)

Item #	Part #	Description	Qty
1	TR-SSHC-149	Fluid Housing	1
2	TR-SSF-509	Screw, Socket Head Cap, M6 X 75	4
3	TR-SSHC-153	Bushing	1
4	TR-SSF-508	Bolt	1
5	TR-SSF-504	Support Washer	1
6	78783-00	Spring	1
7	TR-SSMM-151	Air Diaphragm	3
8	TR-SSF-505	Lower Diameter Support	1
9	**See Table "A"**	Needle	1
10	TR-SSF-506	Upper Diaphragm, Support	1
11	TR-SSF-031	Screw, Socket Head Cap, M4 X 20	1 ▷3
12	TR-SSF-100	Screw, Socket Head Cap, M8 X 40	4
13	SSP-6427	Fitting, Elbow, 1/8 NPT X 5/32 ODT	1
14	41-FP-1006	Plug	1 ▷4
15	SSG-8125	O-Ring, Teflon	1 ▷2
16	A10509-00	Lower Housing (After 12/03)	1
	TR-SSHC-150	Lower Housing (Prior to 12/03)	1
17	A10508-00	Upper Housing (After 12/03)	1
	TR-SSHC-151	Upper Housing (Prior to 12/03)	1

PARTS LIST BULLET DEFINITION TABLE

▷4 Apply thread sealant 7969-10.

▷3 Apply blue loctite 7969-03.

▷2 Apply petroleum jelly on o-rings before installation.

* All dimensions are in millimeters. unless otherwise specified.

TABLE "A"

MVR Assy.	Description	Needle Part #
TR-SSMM-147	#2 Needle	TR-SSMM-149
TR-SSMM-148	#3 Needle	TR-SSMM-150
TR-SSMM-225	#4 Needle	TR-SSMM-226

RECOMMENDED SPARE PARTS

Part #	Description	Qty
TR-SSMM-151	Air Diaphragm, MVR Assembly	3
78783-00	Compression Spring, MVR	1
SSG-8125	O-Ring, Teflon	1

WARRANTY POLICIES

LIMITED WARRANTY

ITW Ransburg will replace or repair without charge any part and/or equipment that falls within the specified time (see below) because of faulty workmanship or material, provided that the equipment has been used and maintained in accordance with ITW 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 WAR-RANTIES.

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, (i.e., 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 (i.e., 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.

ITW 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 WAR-RANTIES OF EITHER MERCHANT-ABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ITW RANSBURG ASSUMES NO LIABILITY FOR INJURY, DAMAGE TO PRO-PERTY OR FOR CONSEQUENTIAL DAMAGES FOR LOSS OF GOODWILL OR PRODUCTION OR INCOME, WHICH RESULT FROM USE OR MISUSE OF THE EQUIPMENT BY PUR-CHASER OR OTHERS.

EXCLUSIONS:

If, in ITW Ransburg's opinion the warranty item in question, or other items damaged by this part was improperly installed, operated or maintained, ITW 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	65ºF	8030-30-6	**10**	HIGH
ACETONE		Ketones	-18ºF	67-64-1	**5.6**	LOW
METHYL ACETATE		Esters	90ºF	79-20-9	**5.3**	LOW
BENZENE		Aromatic Hydrocarbons	12ºF	71-43-2	**5.1**	HIGH
ETHYL ACETATE		Esters	24ºF	141-78-6	**3.9**	MEDIUM
2-BUTANONE	MEK	Ketones	16ºF	78-93-3	**3.8**	MEDIUM
ISO-PROPYL ACETATE		Esters	35ºF	108-21-4	**3.4**	LOW
ISOPROPYL ALCOHOL	IPA	Alcohols	53ºF	67-63-0	**2.5**	LOW
2-PENTANONE	MPK	Ketones	104ºF	107-87-9	**2.5**	MEDIUM
METHANOL	Methyl Alcohol	Alcohols	50ºF	67-56-1	**2.1**	LOW
PROPYL ACETATE	n-Propyl Acetate	Esters	55ºF	109-60-4	**2.1**	LOW
TOLUOL	Toluene	Aromatic Hydrocarbons	48ºF	108-88-3	**1.9**	HIGH
METHYL ISOBUTYL KETONE	MIBK	Ketones	60ºF	108-10-1	**1.6**	MEDIUM
ISOBUTYL ACETATE		Esters	69ºF	110-19-0	**1.5**	LOW
ETHANOL	Ethyl Alcohol	Alcohols		64-17-5	**1.4**	LOW
BUTYL ACETATE		***Esters***	**78ºF**	***123-86-4***	***1.0***	***LOW***
ETHYLBENZENE		Aromatic Hydrocarbons	64ºF	100-41-4	**.89**	HIGH
1-PROPANOL	n-Propyl Alcohol	Alcohols	74ºF	71-23-8	**.86**	LOW
2-BUTANOL	sec.-Butyl Alcohol	Alcohols	72ºF	78-92-2	**.81**	LOW
XYLOL	Xylene	Aromatic Hydrocarbons	79ºF	1330-02-07	**.80**	HIGH
AMYL ACETATE		Esters	106ºF	628-63-7	**.67**	MEDIUM
2-METHYLPROPANOL	iso-Butyl Alcohol	Alcohols	82ºF	78-83-1	**.62**	LOW
METHYL AMYL ACETATE		Esters	96ºF	108-84-9	**.50**	LOW
5-METHYL-2-HEXANONE	MIAK	Ketones	96ºF	110-12-3	**.50**	MEDIUM
1-BUTANOL	n-Butyl Alcohol	Alcohols	95ºF	71-36-3	**.43**	LOW
2-ETHOXYETHANOL		Glycol Ethers	164ºF	110-80-5	**.38**	LOW
2-HEPTANONE	MAK	Ketones	102ºF	110-43-0	**.40**	MEDIUM
CYCLOHEXANONE		Ketones	111ºF	108-94-1	**.29**	MEDIUM
AROMATIC-100	SC#100	Aromatic Hydrocarbons	111ºF		**.20**	HIGH
DIISOBUTYL KETONE	DIBK	Ketones	120ºF	108-83-8	**.19**	MEDIUM
1-PENTANOL	Amyl Alcohol	Alcohols		71-41-0	**.15**	LOW
DIACETONE ALCOHOL		Ketones	133ºF	123-42-2	**.12**	LOW
2-BUTOXYETHANOL	Butyl Cellosolve	Glycol Ethers	154ºF	111-76-2	**.07**	LOW
CYCLOHEXANOL		Alcohols	111ºF	108-93-0	**.05**	LOW
AROMATIC-150	SC#150	Aromatic Hydrocarbons	149ºF		**.004**	HIGH
AROMATIC-200		Aromatic Hydrocarbons	203ºF		**.003**	HIGH

FASTER SLOWER

***** CAS Number: Chemical Abstract Service Number.

****** Electrical Resistance using the ITW 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 ITW Ransburg/ITW Automotive equipment.

VISCOSITY CONVERSION CHART

Poise	Centipoise	DuPont Parlin 7	DuPont 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	DuPont Parlin 7	DuPont 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. (inches)	cc/ft.	Cross Section (sq. in.)	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: $20.00

Manufacturing
1910 North Wayne Street
Angola, Indiana 46703-9100
Telephone: 260/665-8800
Fax: 260/665-8516

Technical/Service Assistance

Automotive Assembly and Tier I	Telephone: 800/ 626-3565	Fax: 419/ 470-2040
Industrial Systems	Telephone: 800/ 233-3366	Fax: 419/ 470-2071
Ransburg Guns	Telephone: 800/ 233-3366	Fax: 419/ 470-2071

Technical Support Representative will direct you to the appropriate telephone number for ordering Spare Parts.

Form No. LN-9112-00
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