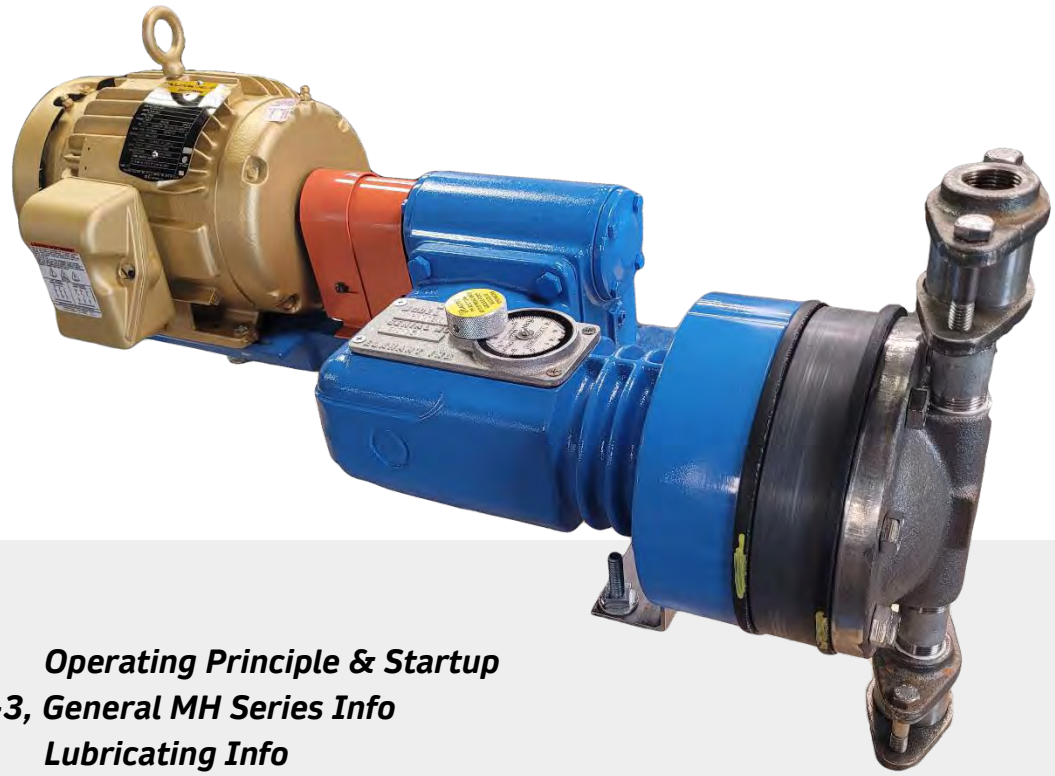
MADDEN PUMP

MH SERIES

DIAPHRAGM METERING PUMPS



OPERATING MANUAL & PARTS LIST

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The MADDEN MH Series Pump has been designed for the movement of chemical solutions and slurries of all kinds plus the additional advantage of a controlled volume discharge. It is built for heavy duty, continuous service. When operated according to the simple directions contained herein, it will require minimum attention.

Although the pump is simple in both design and structure, it embodies several features not encountered in other pumps. To obtain the best results it is important that the user fully understands the principle of operation and the function of the several parts.

THE OPERATING PRINCIPLE

Our heavy duty, flexible diaphragm, which is mechanically actuated by a large 4-1/2 inch diameter piston, operates with an extremely short maximum stroke from .274" up to .380" depending on the model. This provides industry leading service life.

The diaphragm, 1/4" thick and reinforced with plies of Nylon, has been placed between the pump body and the chemical solution head to act as a tough, durable dividing wall between the pumping mechanism and the chemical solution to be transferred. A wide variety of construction materials are available to handle almost all chemical or abrasive solutions.

Simplicity of design; rugged construction; total, self- contained lubrication . . . all are built into the MADDEN MH Series Pump to give the longest possible service with the least amount of maintenance.

A short study of the cover photograph will help to quickly familiarize the operator with the MH Series pump and special attention is called the "Micro-Control" stroke adjusting knob.

Screw is advanced by rotating the Adjustment Knob clockwise. Further advancement progressively reduces the "lost motion" space, thus transmitting an increasing portion of the Connecting Rod movement to the Piston. Advancement to 100% on the dial will close the gap completely and the Piston will then travel full stroke and deliver the maximum discharge volume.

It should be remembered that at any point above zero on the dial scale the Piston will always be fully returned on the back stroke by the action of the Connecting Rod against the heads of the two Slide Bolts, while the amount of forward movement will be governed by the position of the Stroke Adjustment Screw. Increased forward movement likewise increases volume of discharge up to the maximum capacity of the pump.

WARNING!

To prevent pump damage, the operator should be cautioned that when complete forward advancement of the Stroke Adjustment Screw has been attained, further excessive rotation of the Stroke Adjustment Knob could result in damage to the Flexible Shaft. When changing stroke adjustment, the Adjustment Knob should be turned SLOWLY and ONLY when pump is operating. Always watch dial scale to avoid "overturning" in either direction. Turning the Adjustment Knob when pump is not operating could result in damage to the Flexible Shaft.

STARTING AND PRIMING

Each MADDEN MH Series Pump and Gear Case shipped from the factory is filled with the right amount and kind of lubricating oil and is ready for service when piping and power connections are completed. The dial scale has one hundred calibrations with reference numbers at every ten for quick, accurate capacity control. (See Pump Curves on Page 3.) It is directly geared to the Stroke Adjustment Knob. This knob also controls the Stroke Adjustment Screw through a Flexible Shaft.

This simplified control mechanism of the MADDEN MH Series Pump is practically free of wear because there is no movement except when a change in capacity is made. The "Micrometer" precision should last indefinitely.

With each revolution of the Eccentric, the Connecting Rod travels the full, maximum stroke along the two Slide Bolts.

"Lost Motion" space has been allowed between the forward end of the Connecting Rod and the Trunnion with the result that the movement of the Connecting Rod is not transmitted to the Piston until the Stroke Adjustment

When starting the pump, it should be remembered that a few moments operation will be required to fill the solution section with fluid and displace all air present before the pump will become fully primed. When first put into service, or if allowed to operate without liquid entering the solution chamber, the air contained therein will tend to compress and expand with the movement of the piston and thus hinders the flow and displacement of liquid.

If the suction side conditions assure gravity flow to the pump, the liquid entering the inlet valve will quickly displace the air and after a few moments of operation, the discharge volume should be at full capacity according to the piston stroke adjustment. If complete clearance of air is hindered due to excessive back pressure at the discharge valve, the priming process may be expedited by relieving the pressure for a few strokes of the pump. Whenever possible, it is desirable to install the pump and solution source in such relative position to assure gravity flow to the inlet valve. Inlet head pressure of several feet or pounds will not interfere with the action of the valves or pump provided the discharge pressure, or back pressure at the discharge valve, is in excess of the inlet pressure. In any instance where the inlet pressure is equal to, or in excess of, back pressure at the discharge valve, or where the supply source is at an elevation of one or more floors above the pump, it may be necessary to install a back pressure check valve to compensate for the unbalanced condition.

SUCTION LIFT

In some instances, individual conditions may make it necessary to install the pump at a point above, rather than below the solution supply, thus requiring a "suction lift." Although the MADDEN MH Series Pump is not intended for high vacuum service, it should be possible to obtain a lift of 6' to 10' when pump is in good working order.

In all instances where a suction lift is employed, it will be necessary to arrange means for priming the solution chamber in order to start the pumping process. This is easily accomplished by adding a tee to the intake line with a pipe spud of at least 6” extending vertically upward. This will expel the air in the chamber, avoid the churning due to compression and expansion and thereby enable the suction stroke to become effective.

In any service where “lift” rather than gravity flow is necessary, it is desirable to install a foot valve at the lowest point in the intake pipe to avoid losing the prime whenever the pump is out of service.

VOLUME CONTROL - See Pump Curves on page 3

The volume of fluid displaced is in proportion to the length of piston stroke. The length of stroke may be easily adjusted by turning the Stroke Adjustment Knob (on top of the pump). Turn clockwise to increase stroke (for greater volume) and counterclockwise to decrease.

The one hundred calibrations offer a high degree of adjusting accuracy plus simple operation and good visibility. Any change of stroke adjustment should be made slowly and always while pump is running. The operator should always watch the dial scale while making adjustment to avoid excessive “over-turning” at either end of scale which could result in damage to the flexible shaft connecting the Stroke Adjustment Knob with the Stroke Adjustment Screw.

AUTOMATIC VOLUME CONTROL

The pump output volume can be controlled automatically by using a variable speed drive. The variable speed drive controller will respond to a 4-20 mA signal generated by a process monitoring instrument to increase and decrease the pump motor speed. Changing the motor speed has a linear impact on the pump output volume. The minimum effective stroking rate for the pump is 15 strokes per minute, which results in a turndown ratio of from 7.5:1 to 11.5:1, depending on the initial stroke speed of the pump. A number of AC and DC variable speed motors and controllers are available to meet the specific needs of the pump user. Contact the factory or the local sales representative for more information.

MOTOR

Most MH Series pumps have the motor installed connected to the drive shaft with a flexible coupling at the factory. Standard motors are 56 frame 1,725 rpm, with either 1/60/115-230 or 3/60/230-460 electrical power, TEFC (totally enclosed fan cooled) enclosure. Optional motors are available in washdown duty, chemical plant duty and explosion proof enclosures, and in other electrical power specifications. 50 Hz motors will operate at 1,425 rpm, and the slower speed will reduce the pump output by a factor of .833. Either clockwise or counterclockwise rotation is acceptable. The wiring connection diagram is on the name plate for each motor. Make sure a qualified electrician installs the wiring with a proper switch and fuse to the plant power system.

TYPE DDB DOUBLE DIAPHRAGM

We recommend the installation of the type DDB double diaphragm when the liquid being pumped is corrosive or hazardous. This feature will protect the inside workings of the pump from the liquid should a leak develop in the diaphragm. The double diaphragm construction places a second backup diaphragm, part no. MP360, between the liquid and the inside of the pump. The MP362 adapter ring placed between the two diaphragms has a tapped connection, 1/4” NPT, for the installation of a leak detector switch, part no. MP138, or relief piping for visual leak inspection. When a leak occurs remove and replace the damaged diaphragm and any other damaged parts.

DIAPHRAGM

The MADDEN MH Series pump is designed to transfer almost every chemical/fluid under many different conditions of volume, pH value, concentration, temperature, etc. Since there is no single substance for diaphragm use which will withstand every service, it is necessary to select materials according to the work to be performed. Within the limitation of availability, we endeavor to furnish diaphragms which will not only resist chemical attack but will also have the required physical properties to assure long periods of service. Contact the factory for assistance in selecting the best pumping materials for your application.

No matter what material is employed, it must be remembered that diaphragms will eventually reach a point of fatigue when failure will occur. For example, with the motor driven units operating at 172 RPM the diaphragm flexes 10,320 times each hour or a total of 247,680 times for each 24-hour period. Although the diaphragm is supported by the contoured face of the piston, and the amount of flex or movement is distributed over a large area, the best materials will ultimately reach a point of fatigue. The useful life of a diaphragm will, of course, depend upon many different factors such as, the material used, chemical or physical attack, temperature of fluid, volume pumped, etc. It will be apparent that with full piston stroke the flex or movement of the diaphragm will be greater than for lesser loads and the life thereof will be reduced accordingly.

DIAPHRAGM - Replacement

When it becomes necessary to replace a diaphragm, first disconnect both the inlet and discharge lines. Next remove the solution head screws. The old diaphragm may now be rotated counterclockwise until the screw mounting it to the piston has been disengaged.

Reverse this procedure when installing the new diaphragm, making sure to rotate it clockwise until screw has pulled the diaphragm snugly to the face of the piston, but with outer bolt holes matching those on the pump body.

The solution head can then be remounted, being sure to tighten the 8 hex head cap screws a little at a time progressively around the circle. These screws are to be tightened until solution head is firmly snugged up against the diaphragm which, due to its resiliency, will budge outward slightly. Do not greatly overtighten as pump capacity could be changed and diaphragm life could be lessened.

If valves have been loosened or removed, remount valves, being sure to tighten the two bolts alternately a little at a time so as to pull valve caps down evenly.

Tighten only enough to prevent leaking and if gaskets have been badly compressed, replace with new ones.

PIPE CONNECTIONS - Inlet and Outlet

The caps which hold the valves in place are tapped for 3/4" NPT vertical pipe connections.

VALVE STRUCTURE and ACTION

Ball valves are supplied as standard equipment with the MADDEN MH Series pump. The inlet and discharge valves are identical in size and structure and may be interchanged as desired. The caps incorporate the piping connection and replacement or cleaning is quickly done by simply removing the two valve cap screws. (Some installations may require disconnecting inlet and discharge lines.) When replacing screws, be sure to tighten alternately a little at a time so that caps remain parallel.

To insure a leakproof seal, gaskets are inserted at both top and bottom of valve body. These gaskets are made of a GortexTM expanded Teflon material which resists the action of almost every known substance. Whenever valves are disassembled, examine gaskets. If they have been substantially compressed replace with new ones rather than overtighten the two valve cap screws.

Thousands of these valves are in service on MADDEN equipment pumping from heavy abrasive slurries to extremely corrosive fluids. Note the simplicity of this unique design. The removable seat has a conical shape and is made from glass filled Teflon. The seat cushions the ball check and grips it to assure a positive seal. A sleeve encases and supports this seat. Valve action governs the ability of a metering pump to perform at the level of accuracy required.

LUBRICATING OIL

After a break-in period of 300 - 500 hours, REPLACE OIL. Afterwards, it is suggested that the oil be changed approximately every 3,000 - 4,000 hours of normal operation. REPLACEMENT OIL: ISO 460 Grade Lubricating Oil, viscosity 2300 SSU at 100 F, paraffin base. The oil drain plug is located near the bottom of the gear case at the rear, while the oil level plug is directly above it. With the OIL LEVEL PLUG removed, oil can be added or replaced until level reaches this hole, after which, the plug is replaced.

NEVER FILL COMPLETELY WITH OIL!

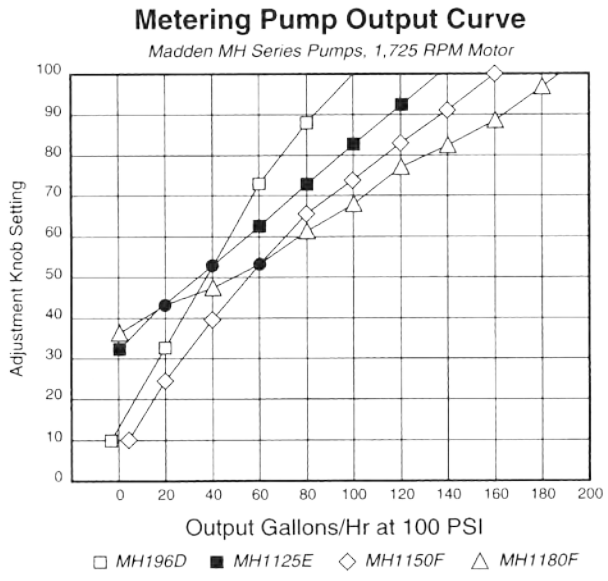
For easy access to the pump cavity for oil fill or inspection, remove the four screws holding the cover plate. Lift cover plate upward slightly and rotate 90 degrees, being careful not to damage the gasket.

Continuous operation at low oil level or with contaminated oil will result in increased bearing wear and early failure.

NOTE: If oil level is unusually high or low, turn off pump immediately. See paragraphs "D" and "E" on the last page.

BACK PRESSURE REQUIREMENTS

Your MH Series pump requires a small amount of back pressure in the discharge line to quickly seat the check valve balls for accurate metering. If the discharge line does not have adequate back pressure, install a check valve in the discharge line that will create 25 to 50 psi of back pressure.



PUMP REPAIRS

Complete repair service is available at the factory and at some local distributors. Repair instructions for your in- house repairs can be obtained from the factory.

CALIBRATION

The output of your pump is sensitive to several factors which require you to calibrate your pump to determine the expected output at each dial setting. The viscosity of the fluid being pumped, back pressure on the discharge line, suction pressure or suction lift effect pump output. To calibrate the pump; 1) measure the amount of flow from either the suction end, or at the end of the discharge line, 2) measure the time it takes to pump the measured flow, 3) convert the output for all expected dial settings.

PARTS LIST

(See Figures 1, 2, & 3 on following pages)

Item	Part No.	Qty Req'd	Description
1	MP010	1	Gear case
2	MP011	1	Side flange, for gear case
3	MP012	1	Bushing for side flange (also used in pump body)
4	MP013	2	Gasket, gear case
5	MP073	4	Screws, pump body to gear case, HH 7/16"-14 X 7/8"
6	MP014B	4	Screws, side flange to gear case, HH 7/16"-14 X 3/4"
7	MP015	1	Bearing cap, blind
8	MP016	1	Bearing cap, open
9	MP017	1	Oil seal
10	MP018	2	Oil feed tube
11	MP019	2	Tapered roller bearing
12	MP020A	2	Gasket set, bearing cap
13	MP021	8	Screws, bearing cap, HH 1/4"-20 X 5/8"
14	MP022	2	Oil plug for gear case
15	MP023__	1	Worm gear, "A" = 5 & 10 GPH, "C" = 9 & 18 GPH, "D" = 36 & 96 GPH, "E" = all other pump model flow rates.
16	MP024	1	Set screw, worm gear, SH 5/16"-18 X 5/16"
17	MP025__	1	Worm drive shaft, "A" = 5 & 10 GPH, "C" = 9 & 18 GPH, "D" = 36 & 96 GPH, "E" = all other pump model flow rates.
18	MP026	1	Woodruff key, worm drive shaft for coupling
19	MP027__	1	Pump drive shaft, "A" = simplex, "B" = duplex, "C" = triplex, "D" = quad
20	MP028	2	Woodruff key, pump drive shaft
21	MP029__	1	Pump body, "A" = left hand (standard), "B" = right hand
22	MP012	3	Bushing for drive shaft, installed in pump body
23	MP031	1	Expansion plug
24	MP032_	1	Eccentric, "A" = 5 & 9 GPH, "B" = 10, 18, 36, 54 & 60 GPH, "C" = 90, 96 & 150 GPH, "D" = 180 GPH, "E" = 125 GPH
25	MP024	1 OR 2	Set screw, eccentric, SH 5/16"-18 X 5/16"
26	MP034__	1	Connecting rod, "1" = standard, "2" = 9 & 18 GPH, "3" = 180 GPH
27	MP034__	1	Connecting rod assembly, "A" = standard, includes parts M-34, 35, 36, 37, 41, 42, 43, & 44, "B" = 5 & 9 GPH, "C" = 180 GPH
28	MP035	1	Bushing, connecting rod
29	MP036__	1	Screw, stroke adjusting, "A"= 5 & 9 GPH, "B" = standard, "C" = 180 GPH
30	MP037	1	Set screw, stroke adjusting screw, SH 10-32 X 1/4"
31	MP136	1	Primary Piston, MH Series, (9/16"). This part is also used for MF series pumps w/ type DDB double diaphragm set up.
32	MP038	1	Primary Piston, MF Series, (5/16"), for single/simplex diaphragm set up.
33	MP039	1	Wrist pin
34	MP040	1	Set screw, wrist pin, SH 1/4"-20 X 1/4"
35	MP041	1	Trunnion
36	MP042	1	Bushing, trunnion
37	MP043	2	Slide screw
38	MP024	4	Set screw, for slide screw, SH 5/16"-18 X 5/16"
39	MP045	1	Dial cover screw, fillister head 6-32 X 3/4"
40	MP047	1	Dial gear with M-56 dial scale, specify pump model
41	MP048	1	Flexible shaft
42	MP049	1	Name plate
43	MP049A	1	Name plate assembly, incl all parts M-45 to M-58, except M-48
44	MP050	4	Screw, name plate, oval head 10-32 X 1/2"
45	MP051	1	Gasket, name plate
46	MP052	1	Adjustment knob
47	MP052A	1	O-ring for Adjustment knob
48	MP053	2	Set screw, adjustment knob, SH 10-32 X 1/2"
49	MP054	1	Retaining ring, adjustment knob
50	MP055	1	Dial cover
51	MP056	1	Dial scale
52	MP057	1	Drag spring
53	MP058	1	Drag spring ball
54	MP070	1	Motor mounting bracket, *add "C" if 140 series motor frame
55	MP071	1	Support screw, motor mounting bracket, 5/16"-18 X 2.5"
56	MP072	1	Lock nut for support screw MP071, 5/16"-18
57	MP073	3	Screw, hex head, MP070 to MP010, HH 7/16"-14 X 7/8"
58	MP0802A	1	Coupling, flex, 5/8" X 5/8", L075, 56 frame motor, MH Series
59	MP0802B	1	Coupling, flex, 5/8" X 5/8", L070 for 56 frame motor, MF Series
60	MP0802C	1	Coupling, flex, 5/8" X 7/8", L075, 145 frame motor, MH Series

61	MP0812A	1	Spider, rubber, for L070 (4 prongs)
62	MP0812B	1	Spider, rubber, for L075 (6 prongs)
63	MP082D	1	Coupling Guard, Complete Assembly
64	MP083	2	Screw for coupling guard, SH 1/4"-20 X 3/8"
65	MP104_	4	Valve gasket, "A" = Garlock 3000, Buna, "B" = Gortex, Teflon, "G" = EPDM
66	MP136	1	MH series primary piston (9/16" - 12 thread)
67	MP300__	1	Diaphragm, "A" = Neoprene, "C" = Hypalon, "D" = Viton, "E" = Teflon faced Neoprene
68	MP302__	2	Valve connector, "B" = PVC, 3/4" NPT, "C" = Teflon, 3/4" NPT
69	MP303__	2	Valve body, "A" = 316 stainless steel, "B" = PVC, "C" = Kynar
70	MP304__	2	Valve ball, "A" = 316 stainless steel, "B" = Hast C, "C" = Carpenter 20, "D" = Viton, "E" = Teflon
71	MP305	2	Ball cushion, Teflon
72	MP306	2	Valve seat, Teflon (Rhulon glass filled Teflon)
73	MP307	4	Valve gasket, Gortex Teflon
74	MP308__	2	Valve nipple/bushing, "A" = 316 stainless steel, "B" = PVC, "C" = Kynar, "E" = Polypropylene
75	MP309__	4	Valve cap flange screw, "A" = HH 3/8"-16 X 2.5", "B" = HH 3/8"-16 X 14"
76	MP314__	1	Solution head, "A" = 316 stainless steel, "D" = PVC, "E" = Teflon
77	MP315A	8	Screw - "A" = 1.5", "B" = 3.5", "C" = 5"
78	MP316	1	Face flange for plastic solution head
79	MP317__	1	Secondary piston, "A" = standard, "B" = type DDB set up
80	MP318	1	Piston extension, required for DDB set up
81	MP320	1	Valve flange, top, plastic solution head
82	MP321	1	Valve flange, bottom, plastic solution head
83	MP325	1	Footplate, solution head support, SS
84	MP326	2	Screw, hex head, HH 1/2"-13 X 3/4"
85	MP360__	1	Backup diaphragm, "A" = Neoprene, "C" = Hypalon, "D" = Viton
86	MP362B	1	Spacer, DDB double diaphragm, PVC
87	MP370__	1	Pump body, "A" = left hand (standard), "B" = right hand
88	MP0665A	2	Valve Cap Outlet, 316SS, ¾" NPT
89	MP0675A	2	Valve Cap Inlet, 316SS, ¾" NPT

MH SERIES WETTED ENDS

Figure # 1 – 316SS

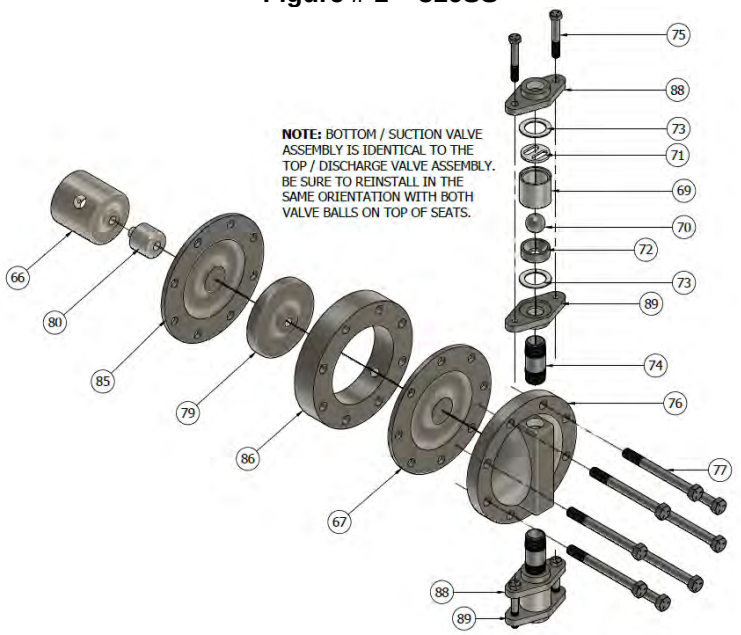
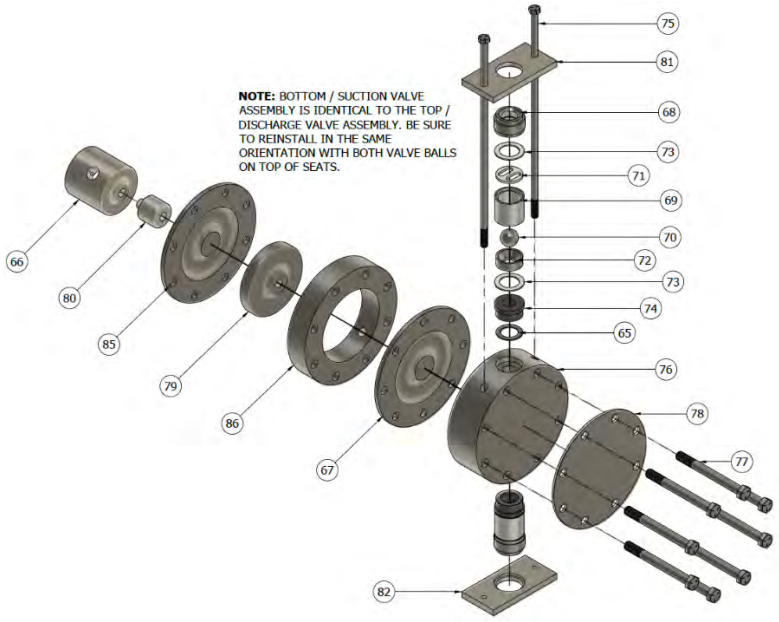
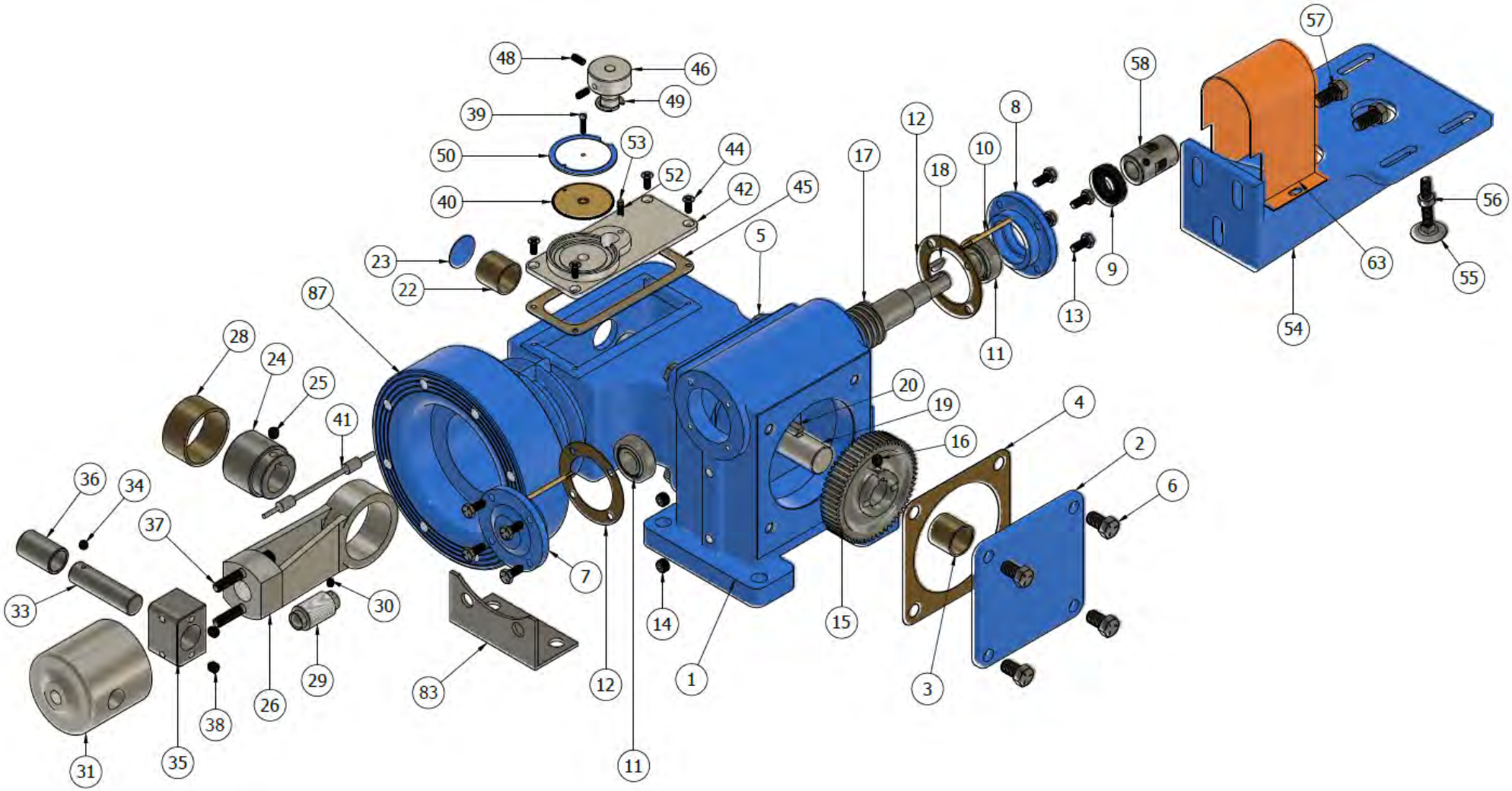


Figure # 2 – Plastic



PARTS LIST – FIGURE # 3



TROUBLE SHOOTING GUIDE	
ISSUE	**RESOLUTIONS**
Discharge from pump has stopped, reduced or become intermittent.	1. Supply line valve has been closed, or Adjustment Knob has been moved. 2. Adjustment Knob flexible shaft is broken. This allows knob to spin free and stroke adjusting screw to back off reducing output. Replace MP048 Flexible Shaft. 3. Supply or discharge line has become completely or partially clogged. 4. Obstruction in pump valves. Remove valve caps and clean valve seats of trash. Check for damage. Replace damaged parts. See valve diagram page 4. 5. Supply tank empty. 6. Possible air entrainment in supply line or pump. Bleed trapped air out. 7. Leak in supply line. 8. Lift of solution is in excess of pump vacuum capacity. 9. Ruptured diaphragm or broken diaphragm screw. Be sure to check for contamination of solution by pump lubricating oil - likewise for contamination of oil by solution. Replace diaphragm. A new diaphragm will require 24 - 48 hours of break-in time until full rated output volume can be pumped. Continuous operation of pump under these conditions could lead to increased diaphragm or valve wear. In the case of No. 1,3 or 8, the pump may have been operating under excessive vacuum conditions and the diaphragm should be inspected for wear or possible rupture.
Discharge volume greater than rated capacity.	1. If a new diaphragm has been recently installed, overtightening of the six solution head screws could result in excessive compression of the diaphragm. This distortion of the “working area” could give a slight capacity increase and might result in excessive diaphragm wear. 2. Back pressure on the discharge line is too low. See page 3.
Pump drive motor has stopped although switch is on. NOTE: turn electrical current off immediately!	1. If a valve in the discharge line is shut off or discharge line should become clogged while pump is running, it will result in the suction stroke operating up to full capacity without a compensating discharge. The result will be excess pressure created during the power stroke of the piston. Overloading or “stalling” of the drive motor will quickly follow. If not properly fused, motor could burn out, excessive strain will be put on all working parts and the diaphragm could be badly weakened or ruptured. 2. Check for “normal” motor failure causes, ie: faulty switches or wiring, blown fuses, etc.
Overflow of lubricating oil around Stroke Adjustment Knob and through air vent hold.	1. Pump body and gear case cavity is normally half filled with lubricating oil and overflow through the top of pump would be impossible. Check immediately for ruptured or leaking diaphragm. Contamination of oil by solution, solution by oil or both would follow. If oil is contaminated by a solution that is either abrasive or corrosive, serious damage to pump, gear case and all working parts of both could result.
Drop in lubricating oil level.	1. Same as item “D”. 2. Leakage at oil plugs or oil seals.

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