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7. A-SERIES ROTARY W/LIP SEAL PUMP MODULE

7.1 DESCRIPTION (Figure 7.1)

The A-Series Rotary W/Lip Seal Pump Module, hereafter referred to as the Pump Module, is comprised of the following major components; a ceramic piston fabrication and a cylinder pressed into a case having intake and discharge ports. The Pump Module is within the liquid path and is designed to be easily detached from the Motor/Base Module and disassembled for ease of cleaning, decontamination and sterilization. Depending on the model number ordered, the intake and discharge ports accept either 1/4-28 or 5/16-24 male threaded fittings. The Pump Module is designed to be used in conjunction with the Microspense AP and the Rotary Adjust Motor/ Base Modules.

7.2 OPERATION

When the Pump Module is mounted on the Motor/Base Module, the piston is driven by a spherical bearing mounted within a rotating spindle. This drive arrangement imparts both reciprocating and rotary motion to the piston. The magnitude of the piston's stroke is adjustable by varying the angle of the axis of the pump head relative to the axis of the motor drive shaft. This displacement range is infinitely adjustable within the pump specifications (refer to Table 7.2). Repeatability of 0.1% is obtainable once the stroke length is established.

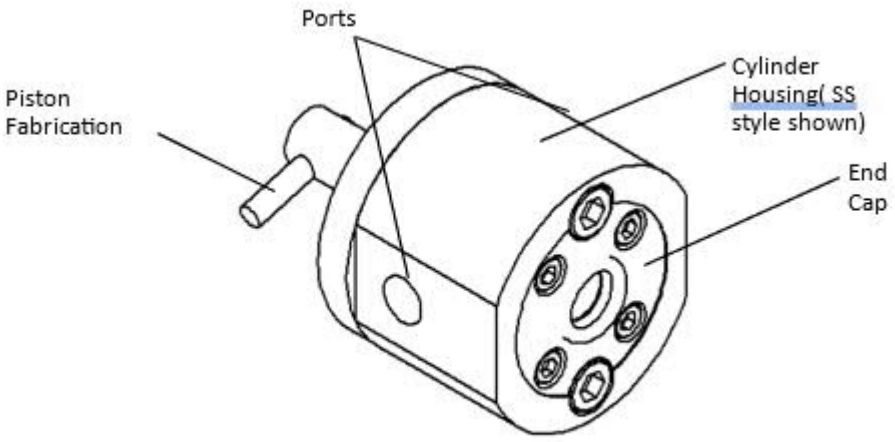


Figure 7.1 Pump Module

The end of the piston is never drawn back beyond the intake and discharge ports in normal operation. The piston flat allows only one port to communicate with the interior of the pump cylinder at any time. The effect of this is positive mechanical valving, eliminating the need for check valves under normal operations.

The pump, which cannot be driven by liquid pressure, essentially acts as a closed valve when the unit is not in operation.

7.2.1 Piston/Cylinder Set

The piston/cylinder set is constructed from a variety of ceramic materials. The ceramics are compatible with most acids and bases. The piston/cylinder set has a clearance between the piston and cylinder wall of approximately .00005" which minimizes fluid slip.

The ceramic piston operates within the ceramic cylinder with no lubrication other than the liquid being dispensed or metered. The natural crystalline structure of the ceramic displays zero porosity ensuring zero retention and carry over of one liquid to the next.

The ceramic material's mechanical and thermal stability allows the Pump Module to be sealed by virtue of a close running clearance between the piston and the cylinder bore. This means that no compliant dynamic seals are used eliminating a part requiring frequent replacement in traditional pump designs.

7.3 INSTALLATION

No installation of the Pump Module is required. Refer to System Setup information in Chapter 2. Refer to section 7.5.3.1 for assembly and disassembly of the Pump Module to the Motor/Base Module.

7.4 OPTIONS

7.4.1 Internal Pump Modification

Modifications to the piston or cylinder can be made to provide improved pumping performance for certain liquids.

7.4.2 Teflon End Cap/Seal

The Teflon end cap/seal replaces the sight glass end cap and the inner O-ring. The Teflon provides the seal for the head end of the pump cylinder. The assembly disassembly procedures contain separate *italicized* instructions for this option and an illustrated parts breakdown provides a listing of the parts.

7.5 MAINTENANCE (Figure 7.2)

CAUTION

Never forcibly remove or install the piston into the cylinder housed within the Pump Module. Damage to the equipment may result.

7.5.1 Preventative Maintenance

The ceramic components for the Pump Module have been designed to last for millions of repetitions without wear. Preventative maintenance includes careful handling of the piston fabrication and cylinder housing when they have been removed from the Pump Module. Always take great care when removing the piston fabrication from the cylinder and replacing the piston fabrication into the cylinder. If the cleaning procedure includes removing the Pump Module and individually cleaning separate parts, always keep the Pump Module parts together, each piston fabrication with the cylinder housing to which it was originally mated. The number on the piston fabrication should match the number on the cylinder housing. To avoid damage or chipping, never clean in such a way that the ceramics can vibrate against each other.

CAUTION

Ceramic piston/cylinder sets are particularly sensitive to neglect and may seize if allowed to dry out without adequate cleaning.

7.5.1.1 General Applications; Routine Cleaning Procedure.

1. Disconnect intake tubing from process liquid supply container.
2. Cycle pump in continuous mode until liquid supply liquid path.
3. Connect intake tubing to the cleaning container.
4. Cycle pump in continuous mode at a high prime rate to flush the cleaning liquid through the entire liquid path. Remaining process liquid has been purged from the Pump Module.

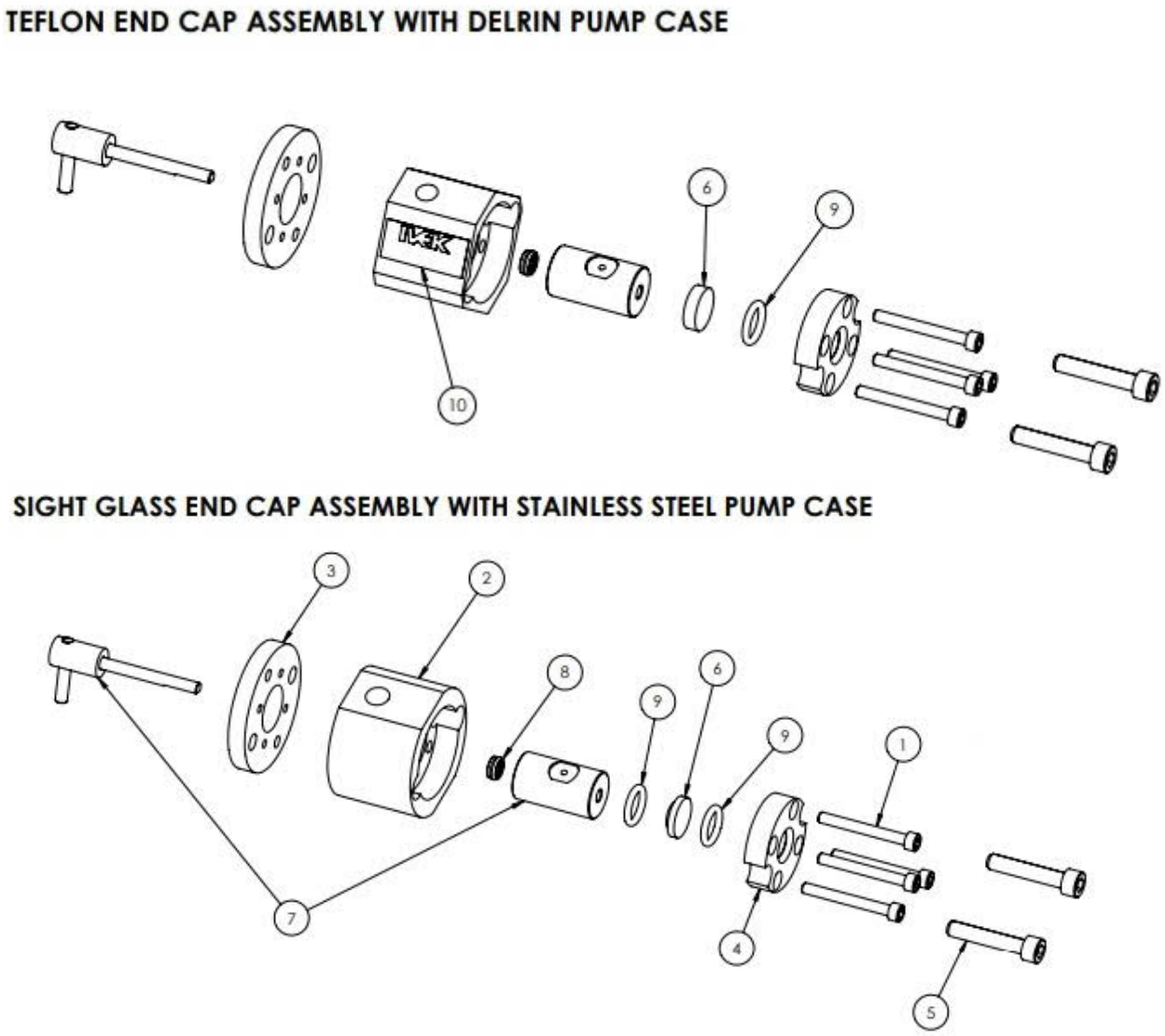


Figure 7.2 Pump Module Components Assembly/Disassembly

NOTE

Routine flushing with a compatible liquid after shutdown may suffice for most applications.

7.5.2 O-Rings (Figure 7.2)

The inner O-ring (6A) serves to seal the head end of the pumping chamber.

Over time, O-rings may lose elasticity and become deformed. Periodic replacement of these O-rings is required. The replacement cycle is dependent on handling during assembly and disassembly in addition to the liquids being pumped.

Please contact technical support at IVEK Corporation with any questions or concerns you may have regarding the operation or maintenance of this module.

7.5.3 Assembly/Disassembly Procedures (Figure 7.2)

The Pump Module contains the following replaceable parts. Also contained in this section are the procedures for assembling and disassembling the Pump Module from the Motor/ Base Module.

- Cylinder, Case and Piston Assembly (2 and 7)
- Base (3)
- Lip Seal (8)
- O-Ring(s) (9)
- Sight Glass/*Teflon* End Cap (6)
- End Cap Retainer (4)

WARNING

Make sure the power is OFF and all hazardous liquids have been flushed from the system prior to performing any disassembly or assembly procedures.

7.5.3.1 Pump Module (Figures 7.2 & 7.3)

IVEK systems are shipped with the Pump Module assembled onto the Motor/Base Module. The following procedures are only necessary if you received a new Pump Module or for assembly after removing the Pump Module for cleaning, maintenance or repair

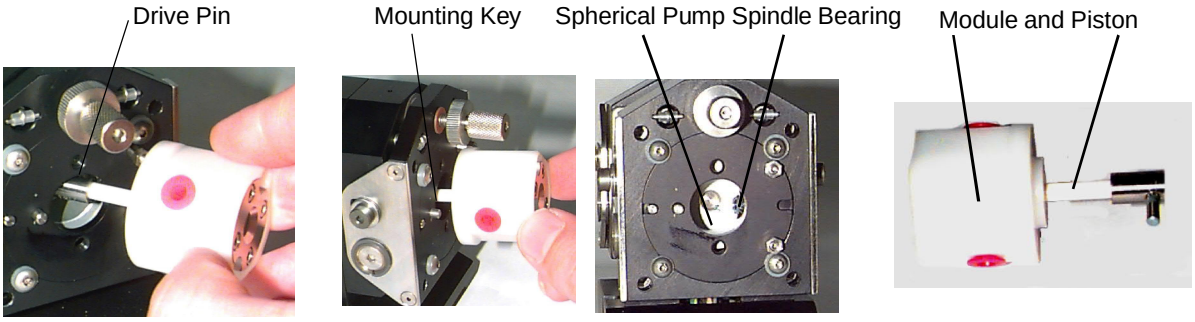
Disassembly:

1. Loosen the two #8-32 socket head cap screws (10) securing the Pump Module to the face plate.
2. Pull the Pump Module away from the face plate until the piston fabrication is approximately 2/3 of the way out of the cylinder.
3. Determine the location of the spherical bearing and move the Pump Module laterally away from it until the pin in the piston fabrication slides out.

Assembly:

CAUTION

Lubricate the drive pin with Aqualube prior to assembly. Failure to lubricate the drive pin may result in damage to the Pump Module and Motor/Base Module.



1. (Image 1) Rotate the spindle on the Motor/Base Module so the spherical bearing is at the 3 O'clock position.
2. (Image 2) Extend the piston, which is housed in the Pump Module, approximately 2/3 of the way out of the cylinder.
3. (Image 3) Slide the drive pin, which is pressed into the piston end cap, into the center bore of the spherical bearing.
4. (Image 4) Position the Pump Module on the face plate aligning over the mounting key.
5. Secure the Pump Module to the swing plate by installing and tightening the two #8-32 socket head cap screws (10).

7.5.3.2 End Cap Retainer, Sight Glass/*Teflon* End Cap, End Cap O-rings, Base and Lip Seal (Figure 7.2 items 4, 6, 9, 3, 8)

Disassembly

1. Remove the Pump Module (Refer to section 7.5.3.1).
2. Remove four #4-40 socket head cap screws (1) securing end cap retainer (4) to cylinder housing (2).
3. Remove end cap retainer (4).
4. Remove inner o-ring (9), sight glass end cap (6) and outer O-ring (9). *Remove inner o-ring (9), and Teflon end cap (6) for Teflon End Cap option.*
5. Pull Base (3) from cylinder housing (2).
6. Carefully remove lip seal (8), as shown below, from cylinder (7).

NOTE

Clean and inspect o-rings and lip seal (8 and 9) prior to assembly. (Replace if necessary)

Assembly

1. Carefully install lip seal (8) with exposed spring towards cylinder (7) into cylinder (7).
2. Place base (3) on cylinder housing (2).
3. Position outer o-ring (9), sight glass or *teflon* end cap (6) and inner o-ring (9) into the recessed diameter of end cap retainer (4). Note: Inner o-ring only applicable on sight glass end cap option.

NOTE

Install sight glass end cap with the reduced diameter facing towards the cylinder housing.

4. Position end cap retainer (4), with installed components into the recessed diameter of cylinder housing (2).
5. Align holes on end cap retainer, cylinder housing (2) and base (3) and secure with four #4-40 socket head cap screws (1) and torque to 0.565Nm (5 in. lbs).
6. Install the Pump Module (Refer to section 7.5.3.1).

7.6 PROBLEM GUIDE

7.6.1 Piston Seized In The Cylinder (Figure 7.3)

7.6.1.1 Tool Required

Pump Extractor Tool Kit IVEK Part Number 072087
9/64" Allen Wrench
3/32" Allen Wrench

7.6.1.2 Procedure (Figures 7.2 & 7.3)

If the piston seizes in the cylinder perform the following steps.

CAUTION

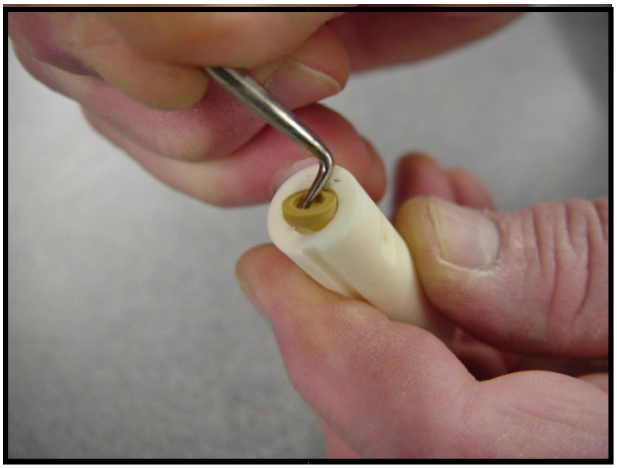
DO NOT TRY TO FORCE THE PISTON FREE! Damage to the piston/cylinder set or Motor/Base Module may occur.

1. Remove four #4-40 socket head cap screws (1).
2. Remove end cap retainer, sight glass/*teflon* end cap, and o-rings (4, 6, 9).
3. Remove two #8-32 socket head cap screws (5).
4. Install end cap extractor with countersink out using the four #4-40 socket head cap screws (1).
5. Insert correct size extractor tip into the thumb screw knob.
6. Turn (by hand) the thumb screw knob (clockwise) into the end cap extractor until cylinder housing (2) becomes loose from piston fabrication (7).
7. Remove cylinder housing (2).

If Step 7 cannot be performed, move the cylinder housing (2) laterally until the pin in the piston fabrication slides out of the spherical bearing, then perform steps 8 and 9.

8. Soak the whole assembly in a liquid compatible with the materials and process liquids.
9. After soaking, try removing the piston from the cylinder by applying a light torque to the piston using only your fingers (no tools).

If the aforementioned procedures fail, contact IVEK Technical Support Department. It may be necessary to ship the Pump and Motor/Base Modules back to the factory. Provide a note describing, in detail, what conditions caused the seizure.



Lip Seal Removal

7.6.2 Additional Problems

Table 7.1 contains a list of possible problems, causes and solutions for the Pump Module.

7.7 SPECIFICATIONS

Table 7.2 lists the volumetric output of the different size Pump Modules. Refer to the Title Page section of this manual for the Pump Module size provided with your system.

Table 7.2 Maximum Volumetric Output Per Rotation Of Micro Rotary Pump Modules

Size	Max Displacement Per Stroke (Pl)	Recommended Min Displacement Per Stroke (Pl)
3A	25	1
2A	50	5
1A	100	10

7.8 MODEL NUMBER

The model number provides important information about the specifics of your Pump Module. Refer to this number when calling IVEK Technical support. The model number for your Pump Module is located in the Title Page section of this manual.

102263- # # # # # # # #

Pump Case Ports
1- White Delrin 1/4-28
2- Tefzel 1/4-28
3- White Delrin 5/16-24
4- Tefzel 5/16-24
5- Stainless Steel 1/4-28
6- Stainless Steel 5/16-24

End Cap Retainer
1- White Delrin
2- Tefzel
3- Stainless Steel (303)
4- Stainless Steel (316L)

Base, Pump Base
1- 3A
2- 2A
3- 1A

Ceramic Set

11- 1A Mag Zirc/Mag Zirc	12- 1A Mag Zirc/Alumina
13- 1A Alumina/Mag Zirc	14- 1A Alumina/Alumina
21- 2A Mag Zirc/Mag Zirc	22- 2A Mag Zirc/Alumina
23- 2A Alumina/Mag Zirc	24- 2A Alumina/Alumina
31- 3A HIP YTZP/Mag Zirc	32- 3A HIP YTZP/Alumina
33- 3A Mag Zirc/Mag Zirc	34- 3A Mag Zirc/Alumina

Lip Seal
1- PTFE/Stainless Steel Spring; 3A
2- UHMW/Elgilov; 3A
3- PTFE/Stainless Steel Spring; 2A
4- UHMW/Elgilov; 2A
5- PTFE/Stainless Steel Spring; 1A
6- UHMW/Elgilov; 1A

O-ring Material

1- Buna-N	2- Ethylene Propylene	3- Kalrez	4- Polyurethane	5- Silicone
6- Teflon	7- Teflon Encapsulated Silicone			
8- Viton	9- Teflon Encapsulated Viton			

Cylinder End Cap
1- Teflon 2- Sight Glass

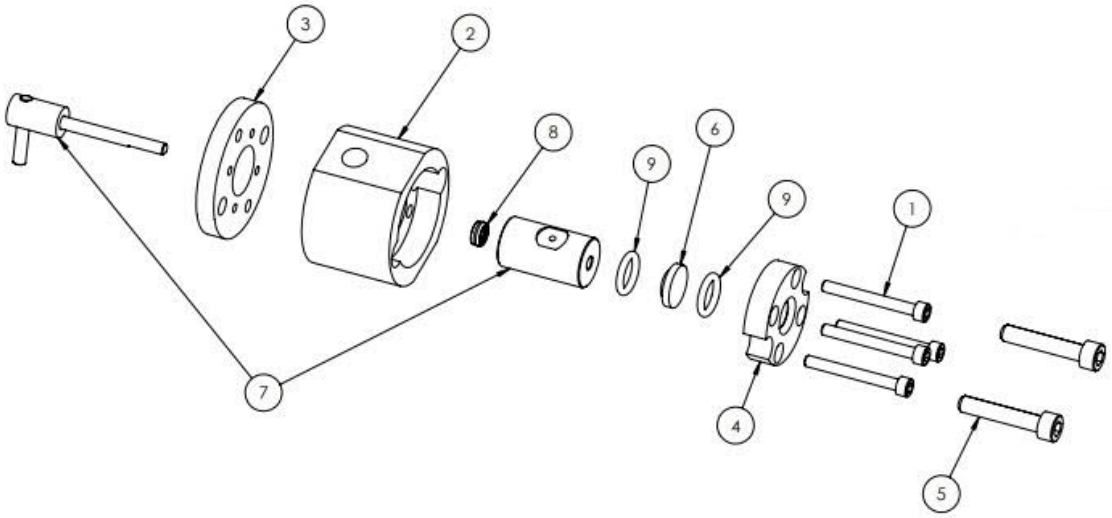
7.9 ILLUSTRATED PARTS BREAKDOWN

The illustrated parts breakdown (Figures 7.4) contains replacement parts for the Micro Rotary Pump Module.

Table 7.1 Common Operational Problems And Solutions

Problem	Probable Cause	Possible Solution
Air evident in discharge line.	Loose/Damaged Ferrules	Tighten/Replace Ferrules
	Loose or Damaged intake tubing	Tighten/Replace intake tubing
	Loose/Damaged End Cap Seals	Clean, inspect and replace if necessary
	Cavitation	Increase feed pressure, inlet tubing size or reduce Pump Module speed
Piston seizing	Particulate materials entrapped between piston and cylinder or liquid has polymerized	Disassemble Pump Module and clean all wetted surfaces
Fluid leaks	Improperly seated or worn end cap retainer, sight glass, end cap or o-ring	Disassembly Pump Module and clean all wetted surfaces, inspect all components and replace if necessary
	Loose/damaged ferrule or tubing	Inspect and replace ferrule or tubing if necessary

SIGHT GLASS END CAP ASSEMBLY WITH STAINLESS STEEL PUMP CASE



TEFLON END CAP ASSEMBLY WITH DELRIN PUMP CASE

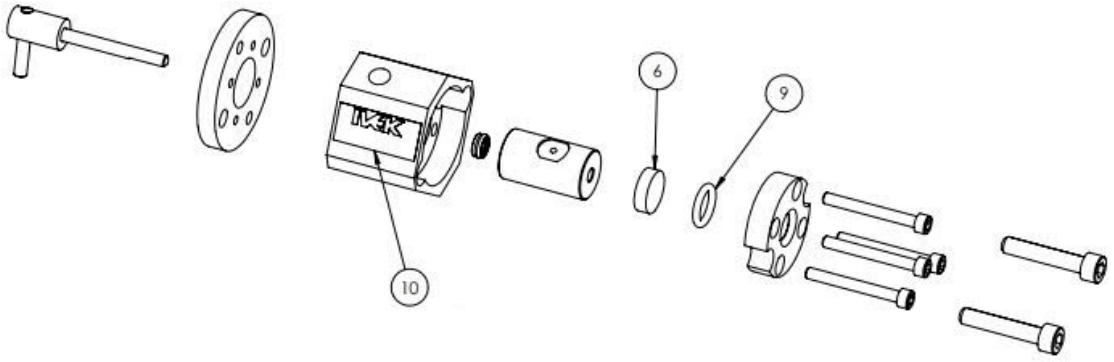


Figure 7.4 Pump Module (Sheet 1 of 3)

	PART NUMBER	DESCRIPTION	UNITS PER ASSY
	102263- ########	A-Series Rotary W/Lip Seal Pump Module	1

Model # Tab	Dwg Index #	Part #	Description	Qty
	5	182011-C08088	Scr, Soc Hd Cap, 18-8; 8-32 x 0.88	2
	1	182011-C04100	Scr, Soc Hd Cap, 18-8; 4-40 x 1.0	4
102263-(#)# # ## # # # PUMP CASE Contains 1 of the Following:				
1	2	072141-001	Pump Case, A-Series, For Lip Seal; White Delrin, 1/4-28 Ports	1
2	2	072141-002	" ; Tefzel, 1/4-28 Ports	1
3	2	072141-003	" ; White Delrin, 5/16-24 Ports	1
4	2	072141-004	" ; Tefzel, 5/16-24 Ports	1
5	2	102264-01	" ; Stainless Steel, 1/4-28	1
6	2	102264-02	" ; Stainless Steel, 5/16-24	1
102263- #(#)# ## # # # END CAP RETAINER Contains 1 of the Following:				
1	4	102171-001	Retainer, End Cap; White Delrin	1
2	4	102171-002	" ; Tefzel	1
3	4	102171-003	" ; Stainless Steel 303	1
3	4	102171-004	" ; Stainless Steel 316L	1
102263- # #(#)## # # # BASE, PUMP CASE Contains 1 of the Following:				
1	3	032147-002	Base, Micro Pump Case, Lip Seal; 3A	1
2	3	032147-003	" ; 2A	1
3	3	032147-004	" ; 1A	1
102263- # # #(##) # # # PISTON/CYLINDER SET Contains 1 of the Following:				
11	7	022383-12112	Piston/Cyl Set, A-Series, W/Lip Seal C'Bore; 1A, Mag Zirc/Mag Zirc	1
12	7	022383-12113	" ; 1A, Mag Zirc/Alumina	1
13	7	022383-13112	" ; 1A, Alumina/Mag Zirc	1
14	7	022383-13113	" ; 1A, Alumina/Alumina	1
21	7	022383-12222	" ; 2A, Mag Zirc/Mag Zirc	1
22	7	022383-12223	" ; 2A, Mag Zirc/Alumina	1
23	7	022383-13222	" ; 2A, Alumina/Mag Zirc	1
24	7	022383-13223	" ; 2A, Alumina/Alumina	1
31	7	022383-11332	" ; 3A, HIP YTZP/Mag Zirc	1
32	7	022383-11333	" ; 3A, HIP YTZP/Alumina	1
33	7	022383-12332	" ; 3A, Mag Zirc/Mag Zirc	1
34	7	022383-12333	" ; 3A, Mag Zirc/Alumina	1

Figure 7.4 Pump Module (Sheet 2 of 3)

	PART NUMBER	DESCRIPTION	UNITS PER ASSY
	102263- ########	A-Series Rotary W/Lip Seal Pump Module	1

Model # Tab	Dwg Index #	Part #	Description	Qty
102263- # # # ##(#)# # LIP SEAL Contains 1 of the Following:				
1	8	142378-006	Lip Seal, Spring Energized PTFE/Stainless Steel Spring; 3A	1
2	8	142669-006	Lip Seal, Spring Energized UHMW/Elgiloy Spring; 3A	1
3	8	142378-001	Lip Seal, Spring Energized PTFE/Stainless Steel Spring; 2A	1
4	8	142669-001	Lip Seal, Spring Energized UHMW/Elgiloy Spring; 2A	1
5	8	142378-007	Lip Seal, Spring Energized PTFE/Stainless Steel Spring; 1A	1
6	8	142669-007	Lip Seal, Spring Energized UHMW/Elgiloy Spring; 1A	1
102263- # # # ## #(#) # O-RING MATERIAL Contains 1 of the Following:				
1	9	142294-01101	O-Ring; -011 Buna-N	2
2	9	142294-01102	" ; -011 Ethylene Propylene	2
3	9	142294-01103	" ; -011 Kalrez	2
4	9	142294-01104	" ; -011 Polyurethane	2
5	9	142294-01105	" ; -011 Silicone	2
6	9	142294-01106	" ; -011 Teflon	2
7	9	142294-01107	" ; -011 Teflon Encapsulated Silicone	2
8	9	142294-01108	" ; -011 Viton	2
9	9	142294-01109	" ; -011 Teflon Encapsulated Viton	2
102263- # # # ## # #(#) CYLINDER END CAP Contains 1 of the Following:				
1	6	102104	Teflon End Cap	1
2	6	022044	End Cap, Sight Glass	2

Figure 7.4 Pump Module (Sheet 3 of 3)