Table Of Contents

7. MEGASPENSE PUMP MODULE

7.1 DESCRIPTION (FIGURE 7.1)

The MegaSpense Pump Module, hereafter referred to as Pump Module, is comprised of a ceramic piston and cylinder set and a case assembly. The Pump Module has been designed to be easily disassembled and detached from the Motor/Base Module for ease of cleaning, decontamination, and sterilization. The Pump Module measures 86mm (3.4") wide, 182.9mm (7.2") long and 82.8mm (3.3") high and weighs approximately 2.3 kilograms (5 Pounds).

The Pump Module's piston/cylinder set provides positive liquid displacement. Piston/cylinder sets are matched, and the piston and cylinder should stay together as a set.

WARNING

Never remove a guard while the motor is running. Moving parts are located under these covers. Physical harm to individuals is possible.

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). The displacement adjustment is easily made and recorded as a setting taken from the Motor/Base Module's vernier scale. Repeatability of 0.1% is obtainable once the stroke length is established.

On each rotation of the piston, the ports are opened alternately and exclusively, first to the inlet and then to the outlet. During the rotation, the limited piston flat creates the void allowing the flow from only one port at a time, positively displacing the liquid. The piston flat acts as a rotary valve, completing one pressure stroke and one suction stroke per revolution as the pump rotates and reciprocates synchronously.

The end of the piston is never drawn back beyond the inlet and outlet ports in normal operation. The piston flat allows

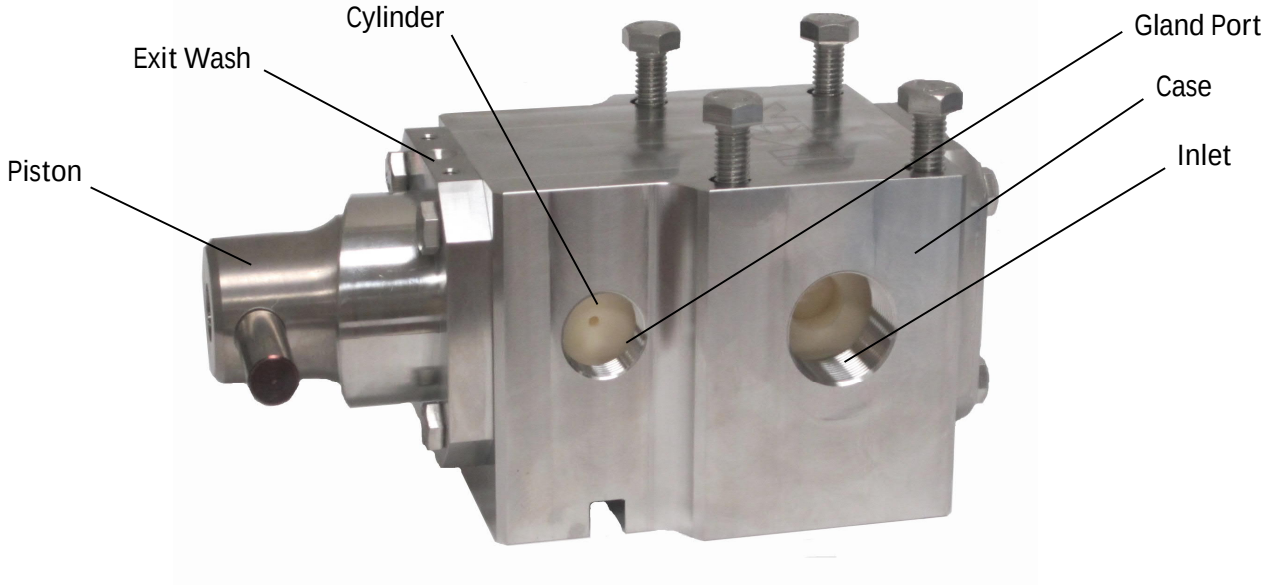

Figure 7.1 MegaSpense Pump Module

only one port to communicate with the interior chamber of the pump cylinder at any one time. The effect is positive mechanical valving, eliminating the need for check valves under normal operations.

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

The Pump Module can easily and accurately be set over the full displacement range. By changing the stroke length through the angular adjustment of the metering head, displacement is changed from zero to the maximum. Once the displacement is set, Pump Module maintenance can be performed without affecting the displacement.

7.2.1 Piston/Cylinder Set

The piston/cylinder set is constructed of high-density alumina ceramic. The ceramics are compatible with most acids and bases.

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 ceramics display zero porosity ensuring zero retention and carryover of one liquid to the next.

The combination of the ceramic material's mechanical and thermal stability allows it to be machined and operated with a close running clearance. This means no compliant dynamic seals are needed, eliminating parts requiring frequent replacement in traditional pump designs.

7.2.2 Case

The case design provides ease of disassembly for cleaning and maintenance. The ceramics, end cap seal, and fitting sets are all serviceable parts. The ceramics are easily accessed by removing them from the case.

7.3 INSTALLATION

Installing the Pump Module into the Motor/Base Module involves the following: (refer to Figure 7.3) Refer to Section 7.5.4.1 for removal procedure.

CAUTION

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

Lubricate the drive pin with IVEK Spindle Bearing Lubricant (IVEK part number 052046) prior to assembly. Failure to lubricate the drive pin may result in damage to the Pump Module and Motor/Base Module.

1. Remove three screws (15) securing top cover (16) to the Motor/Base Module.
2. Remove two hex bolts (18) securing spindle balancer (17) to spindle (19).
3. Rotate spindle (19) on the Motor/Base Module so spherical bearing (20) is at the 3 O'clock position.
4. Extend piston fabrication (5), which is housed in the Pump Module, approximately 2/3 of the way out of cylinder (6).
5. Slide drive pin (4), which is pressed into piston fabrication (5), into the spherical bearing (20).
6. Position the Pump Module on swing plate (23) with the slot on the Pump Module positioned over the two locating pins (21).
7. Slide the Pump Module up against locating screw (22).
8. Secure the Pump Module to the Motor/base Module with four bolts (8). Torque four bolts (8) to 10Nm (88.5 in lb)
9. Position spindle balancer (17) onto spindle (19) and secure with two screws (18). Torque two screws (18) to 3.4Nm (30 in lb).
10. Position cover (16) on the Motor Base and secure with three screws (15).

NOTE

Figure 7.2 shows the inlet orientation of the Pump Module on both the Single Ended and Double Ended Motor/Base Modules.

7.4 OPTIONS

IVEK Corporation offers a variety of options to best meet the customers' needs. Following is a list and description of available options for the Pump Module. Refer to the Title Section of this manual for the list of options provided.

7.4.1 Special Piston/Cylinder Bore Clearances or Modifications

For certain applications, special clearances are required for the piston/cylinder bore. IVEK Corporation determines these clearances by performing application tests using the application fluid. Contact IVEK Corporation for additional information.

For certain applications, special machined modifications are required for the piston/cylinder. IVEK Corporation determines these modifications by performing application tests using the application fluid. Contact IVEK Corporation for additional information.

7.4.2 Rinse Gland

This option provides for rinsing the rear portion of the piston with a liquid passing at a low flow rate through the annular gland. This precludes migration of the metered liquid beyond this groove, preventing it from reaching the rear of the pump. This also reduces the chance of the piston binding in the cylinder.

7.4.3 Fittings

Fittings are available with the Pump Module. Chapter 9 Table 9.14 - MegaSpense Fittings and Tools lists the IVEK part numbers and descriptions for the available fittings, associated seals and sleeves when required.

7.4.4 Case Material

The case material can be either 316 Stainless Steel or 6061-T6 Aluminum.

7.5 MAINTENANCE

CAUTION

Never connect or disconnect the cable from the Motor/Base Module connector while power is on. Damage to the equipment may result.

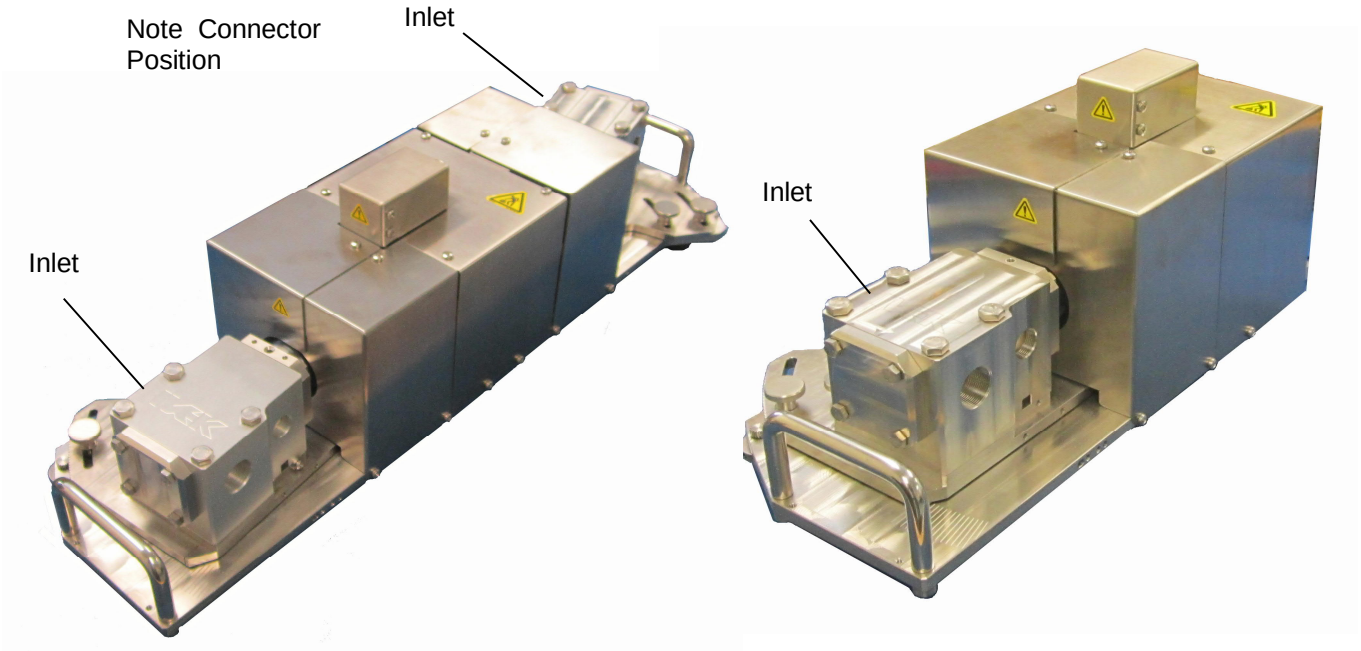

Figure 7.2 MegaSpense Pump Module Orientation

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 should include careful handling of the piston and cylinder when they have been removed from the Pump Module. Always take great care when removing the piston from the cylinder and replacing the piston into the cylinder. Never clean ceramic parts in such a way that they can vibrate against each other. This could cause chipping.

The piston and cylinder are a matched set and should always be kept together. Each piston and cylinder are identified with a number which match the parts as a set.

CAUTION

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

7.5.1.1 General Applications; Routine Cleaning Procedure.

1. Disconnect inlet tubing from process liquid supply container.
2. Cycle pump in continuous mode until remaining process liquid has been purged from the Pump Module liquid path.
3. Connect the inlet tubing to an appropriate cleaning solution supply container.
4. Cycle pump in continuous mode at a high volume and rate to flush cleaning solution through the entire liquid path.

NOTE

Routine flushing with a compatible solution after shutdown may provide sufficient cleaning for many applications.

7.5.2 Storage Options

Storage refers to any extended time that the system remains idle. The main concern is liquid drying in the piston/cylinder area, causing the piston to freeze in the cylinder. The duration of idle time requiring storage procedures is based on the liquid being pumped, the Pump Module configuration, and the operating environment. The system can either remain wetted with cleaning liquid, disassembled, or a liquid loop can be created.

7.5.2.1 Wetting With Cleaning Liquid

This option involves leaving the liquid circuit and Pump Module assembled in place. Load the liquid circuit with a compatible cleaning liquid and leave the system wet until the next use when the stored liquid can be purged during setup for operations.

7.5.2.2 Disassembling

If it is desired not to leave cleaning liquid in the system, after rinsing with cleaning liquid as described in Section 7.5.1.1, empty the system of cleaning liquid as described in Chapter 3.

Disassemble the liquid circuit and Pump Module, remove the piston from the cylinder and store the component parts disassembled until the pump is again required. The instructions for disassembling the Pump Module are found in Section 7.5.4 of this chapter.

NOTE

If applicable, the disassembled liquid circuit and Pump Module components may be immersed and soaked or further cleaned in an ultrasonic cleaning device using a compatible cleaning solution.

7.5.2.3 Liquid Loop

Fill a loop of flexible tubing with a compatible cleaning liquid or other chemical that will thin or neutralize the last liquid pumped. Connect one end of the tube to the pump inlet port and the other to the outlet port. Cycle the pump a few times

in any operational mode to ensure the piston and cylinder are wetted by the cleaning liquid. With this loop positioned above the pump head, the ceramic surfaces and seal areas will stay moist and mobile for extended idle periods.

7.5.3 Extended Storage

If a pump is to be stored assembled for an extended period, it is recommended that after cleaning, the piston and cylinder be dried before reassembly or stored separately in protective packaging. Wet components will have a tendency to bind after materials have evaporated, leaving residue.

7.5.4 Assembly/Disassembly Procedures (Refer to Figure 7.3)

The Pump Module can be fully disassembled to replace any component.

CAUTION

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

7.5.4.1 Pump Module Removal

Removing the Pump Module from the Motor/Base Module involves the following. Refer to Section 7.3 for the installation procedure.

1. Remove three screws (15) securing top cover (16) to the Motor/Base Module.
2. Remove two screws (18) securing spindle balancer (17) to spindle (19).
3. Rotate spindle (19) on the Motor/Base Module so spherical bearing (20) is at the 3 O'clock position.
4. Remove four bolts (8) securing the Pump Module to the Motor/Base Module.
5. Move the Pump Module laterally until drive pin (4) in piston fabrication (5) slides out of spherical bearing (20).

7.5.4.2 Pump Module Disassembly

1. Remove the Pump Module from the Motor/Base Module. Refer to section 7.5.4.1
2. Remove four bolts (3) securing the piston entry cap (2) to case (7).
3. Remove piston fabrication (5) with piston entry cap (2), spacer (14) and O-ring (13).
4. Slide piston entry cap (2), spacer (14) and O-ring (13) off piston fabrication (5).
5. Remove four bolts (10) securing end cap (9) to case (7).
6. Remove end cap (9), sealing insert (11) and O-ring (12).
7. Remove cylinder (6) from case (7).

7.5.4.3 Pump Module Assembly

1. Install end cap (9) onto case (7) using four bolts (10). Torque bolts to 5.6Nm (50 in lb).
2. Position case (7) with end cap (9) down.
3. Install O-ring (12) into sealing insert (11) and drop into case (7) with O-ring (12) facing up. Make sure the O-Ring stays in place.
4. Carefully place cylinder (6) into case (7) ensuring slot on cylinder (6) is aligned with the pin on case (7).
5. Install O-ring (13) into spacer (14).
6. Place Spacer (14) with O-ring (13) installed on top of Cylinder (6) with O-Ring (13) facing down the cylinder.
7. Slide piston entry cap (2) onto piston fabrication (5) flat side last.
8. Slide piston fabrication (5) into cylinder (6).
9. Secure piston entry cap (2) onto case (7) with barb fitting (1) facing down using four bolts (3). Make sure the piston rotates freely.
10. Install the Pump Module on the Motor/Base Module as described in section 7.3.

7.6 PROBLEM GUIDE

7.6.1 Piston Frozen In The Cylinder

If the piston gets frozen in the cylinder perform the following steps.

CAUTION

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

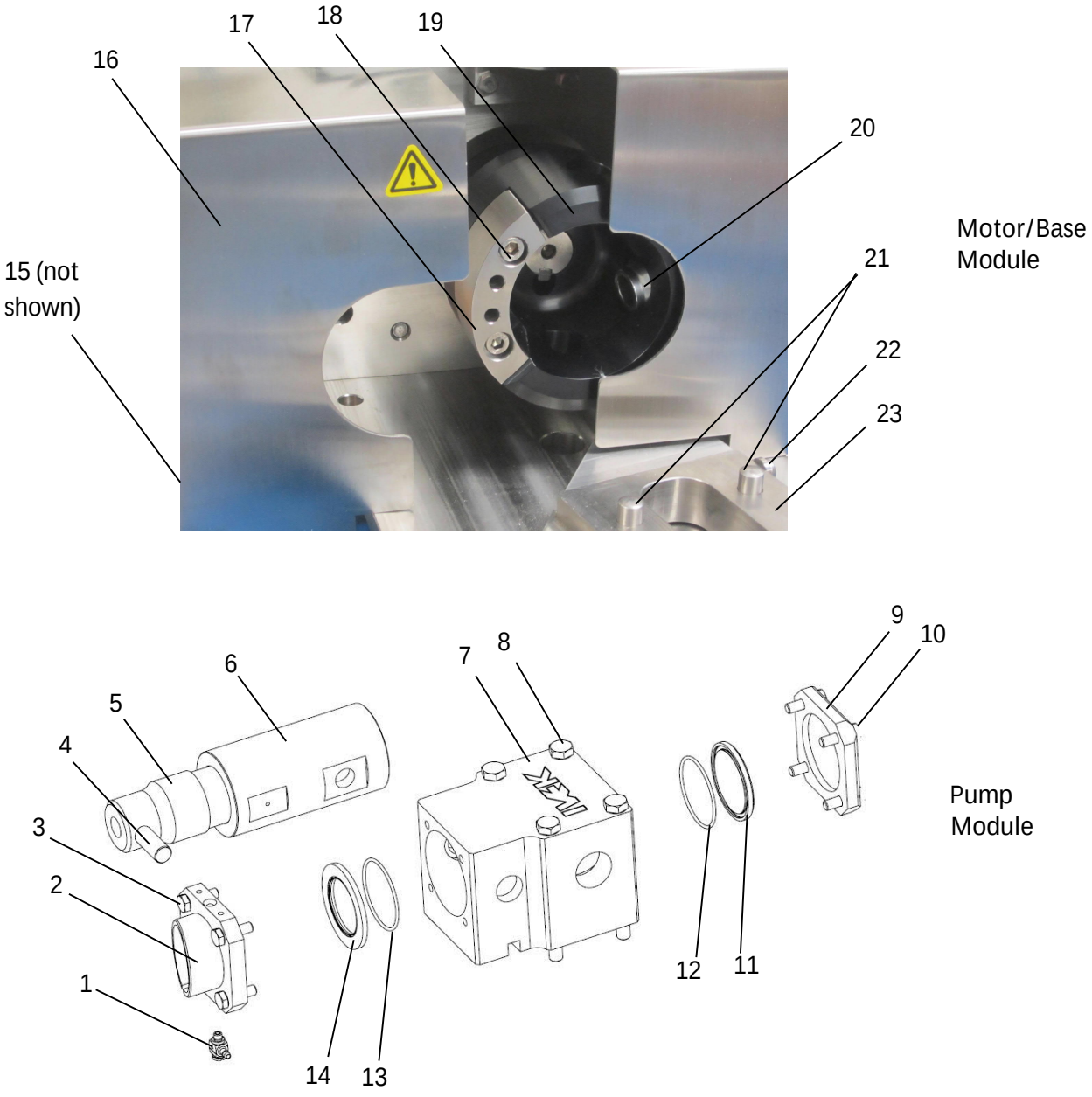

Figure 7.3 MegaSpense Pump Module Disassembly/Assembly

1. Carefully remove the Pump Module from the Motor/Base Module. Refer to Section 7.5.4.1. Remove the piston and cylinder from the case then soak in a compatible solvent.
2. If the Pump Module is not conveniently removable, the tube loop described in section 7.5.2.3 of this chapter may permit solvent to dissolve the “frozen” residue in reasonable time.
3. If the aforementioned procedures fail, contact IVEK for technical help. It may be necessary to ship the Pump Module back to the factory. Provide a note describing, in detail, what conditions caused the seizure and what liquids are being pumped.

It may also be necessary to return the Controller and Motor/Base Modules along with the Pump Module should readjustment of the pump drive components be required to free the pump.

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

Table 7.1 Common Operational Problems And Solutions

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
Power is on, Controller Module accepts trigger, motor spindle rotates, but Pump Module does not move any fluid.	Loose fittings or seals.	Check port seals and front cap seal.
	Broken piston or loose piston cap.	Remove and inspect piston/cylinder set.
Fluid is leaking from front of pump.	Leaky seals.	Inspect for scratches or grit. (clean or replace if necessary)
End cap will not tighten smoothly.	Grit in threads.	Clean end cap and case.
Ceramic cylinder will not seat in case.	Misalignment	Make sure the slot on the ceramic cylinder aligns with the cylinder locating pin.
		Make sure the cylinder locating pin is not damaged.
Piston does not rotate or rotates slowly.	Piston seized	Clean by soaking.
	Port fittings are too tight	Loosen castellated sleeve and recheck piston.
If none of the above solves the problem, contact IVEK technical support for assistance.		

7.7 SPECIFICATIONS

7.7.1 Volume

The volume represents the liquid displaced for a single revolution of the motor. If this system is used for dispensing, the dispenser’s VOLUME STROKES setting will determine the total volume for each dispense cycle. Table 7.2 list the recommended minimum and maximum displacement per stroke for the Pump Module.

Table 7.2 Pump Module Displacement Specifications

Size	Max Displacement Per Stroke	Recommended Min Displacement Per Stroke
G	15 ml	0.75 ml

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.

082218 - # # # ## ##

Size
- **0** – G

Gland
- **0** – No Gland
- **1** – With Gland

Future Option
- **0**

Case Material
- **00** – 316 SST
- **02** – Aluminum

O-Ring Material
- **01** – Buna-N
- **02** – EPDM
- **03** – FFKM
- **04** – Polyurethane
- **05** – Silicone
- **08** – FKM

An example of a Pump Module model number would be **082218-0100205**. This would be a MegaSpense Pump Module with Size G ceramics, Rinse Gland, Aluminum Case and Silicone O-Ring.

7.9 ILLUSTRATED PARTS BREAKDOWN

The illustrated parts breakdown (Figure 7.4) contains the information required for identifying and ordering parts for the Pump Module.

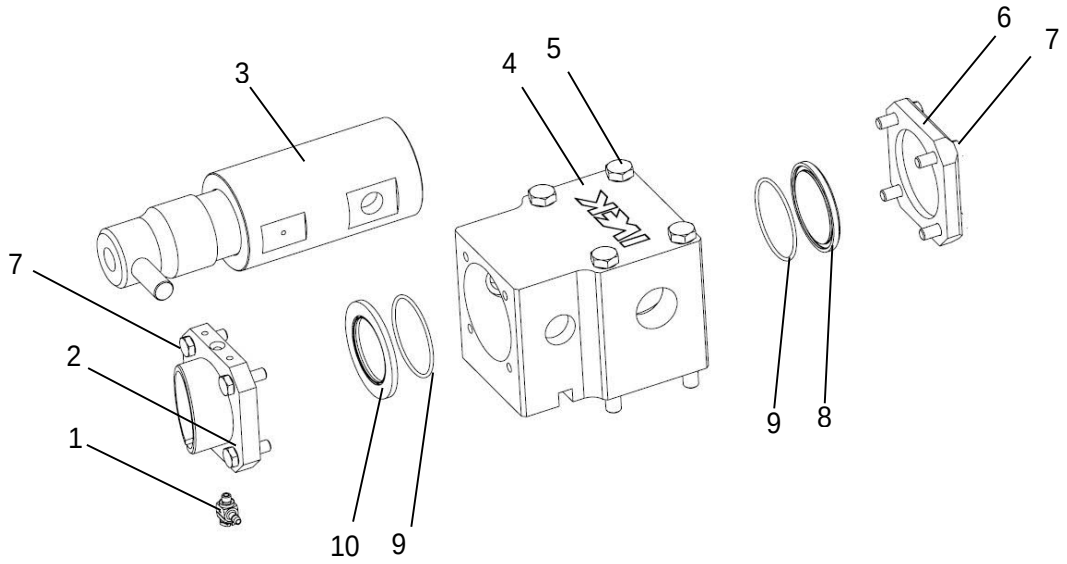

Figure 7.5 MegaSpense Pump Module (Sheet 1 of 2)

	PART NUMBER	DESCRIPTION	UNITS PER ASSY
	082218-#######	**MegaSpense Pump Module**	**1**
Model # Tab	**Dwg Index #**	**Part #**	**Description**	**Qty**
	1	082213-005	Fitting, Male Thd Barb Elbow, Adj, SS, Metric; Char 005	1
	5	182047-0890	Screw, Hex Hd Cap, 18-8, Metric; M8 X 90	4
	7	182047-0620	Screw, Hex Hd Cap, 18-8, Metric; M6 X 20	8
	8	082189-03	Sealing Insert, Endcap, E/F/G Pump; G SIZE	1
	10	082223-003	Spacer, Seal Alternative, E/F/G Pump; G Size	1
082218 - ## # ## ## SIZE/GLAND Contains 1 of the Following:				
00	3	022427-06	Piston/Cylinder Set, Rotary, E/F/G; G Size, No Gland	1
01	3	022427-03	Piston/Cylinder Set, Rotary, E/F/G; G Size, W/ Gland	1
082218 - ## # ## ## CASE MATERIAL:				
00	4	082220-001	Case Fab, Solid, E/F/G Pump; 316SS W/ Gland	1
02	4	082220-005	Case Fab, Solid, E/F/G Pump; 6061-T6 Alum W/ Gland	1
00	2	082222-002	Cap, Piston Entry, E/F/G Pump; G W/Flush, 316SS	1
02	2	082222-202	Cap, Piston Entry, E/F/G Pump; G W/Flush, 6061-T6 Alum	1
00	6	082178-001	End Cap, E/F/G Pump; 316SS	1
02	6	082178-003	End Cap, E/F/G Pump; 6061-T6 Alum	1
082218 - # # # ## ## O-RING MATERIAL Contains 1 of the Following:				
01	9	142294-03001	O-Ring, AS568; 030, Buna-N	2
02	9	142294-03002	O-Ring, AS568; 030, EPDM	2
03	9	142294-03003	O-Ring, AS568; 030, FFKM	2
04	9	142294-03004	O-Ring, AS568; 030, Polyurethane	2
05	9	142294-03005	O-Ring, AS568; 030, Silicone	2
08	9	142294-03008	O-Ring, AS568; 030, FKM	2

Figure 7.5 MegaSpense Pump Module (Sheet 2 of 2)

CHAPTER REVISIONS

B	11/29/22	Per DCR/N 21252 – Added 316 SS options to piston entry cap and end cap. Updated figure and table number.
A	10/30/19	Per DCR/N 19472 - Added SS Case to model number and parts list and options
-	5/26/17	Original release