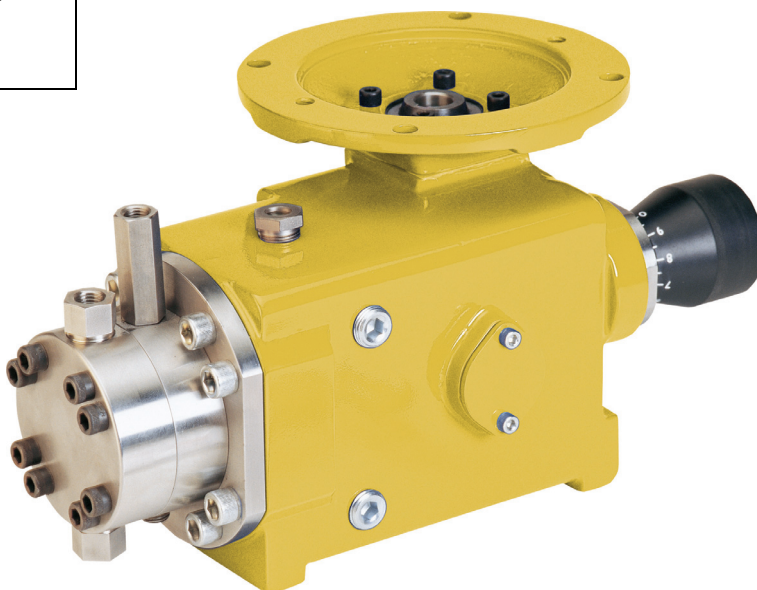




EVA-Series Metering Pump

INSTALLATION, OPERATION, AND- MAINTENACE MANUAL

THIS MANUAL SUPERSEDES MANUAL
OM/EVA, REV B, 7/17/03. USE THIS
MANUAL FOR SERIAL NUMBERS
2410603 AND ABOVE.



Please record the following data for file reference

Tag Number(s): _____

Model Number: _____

Serial Number: _____

Installation Date: _____

Installation Location: _____

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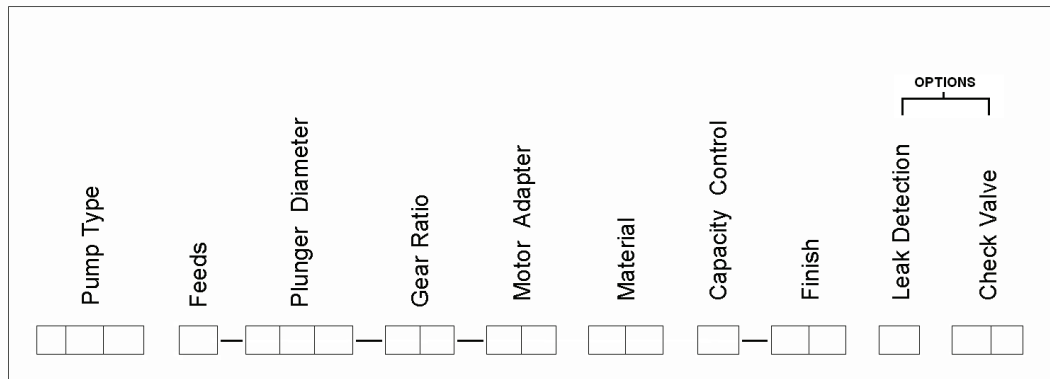
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EVA PUMP MODEL NUMBER AND OPTIONS



Pump Type

Code	Description
EVA	Type

Feeds

Code	Description
1	Simplex

Plunger Diameter

Code	Description
03D	3/16" Dia., Size A Head
04D	1/4" Dia., Size A Head
06D	3/8" Dia., Size A Head
10D	5/8" Dia., Size B Head
14D	7/8" Dia., Size B Head
20D	1-1/4 Dia., Size B Head

Gear Ratio

Code	Description
15	15:1
20	20:1
30	30:1
60	60:1

Motor

Code	Description
56	NEMA 56C
71	IEC 71 Frame (85)

Material

Code	Description
SS	316L Stainless Steel
A2	Alloy 20
HC	Hastalloy C
PV	PVC
KN	PVDF

Capacity Control

Code	Description
M	Manual
E	Electric

Finish

Code	Description
EP	TGIC Powder Coating

Leak Detector

Code	Description
G	Gauge Only
P	Pressure Switch & Gauge
S	Optical Sensor & Gauge

Check Valve *

Code	Description
DB	Double Ball Check Valve *
SC	Slurry Check Valve (Size B, Single Ball Only)
AF	ANSI Flange (Size B Only)

* All A Size and B Size Metallic are Double Ball.
B Size Non-Metallic is Single or Double Ball.

SECTION 1 DESCRIPTION

1.1 GENERAL INFORMATION

The Milton Roy EVA pump is a compact product designed for low flow ranges. Additionally the EVA is based on a modular design. The metering pump has four independent assemblies as illustrated in Figure 1.

1.2 DRIVECASE ASSEMBLY

The heavy-duty construction furnishes strength and durability. The drivecase accept NEMA 56C and IEC71 motor frames. Flow is manually adjustable while pump is stationary or running or can be easily upgraded to an electronic stroke adjuster. The drivecase is fully sealed to prevent contamination.

1.3 LIQUID END ASSEMBLY

The liquid end uses a single diaphragm design, without a process side contour plate. Positive sealing ball check valves create the pumping action. Check valves can be easily replaced or rebuilt in the field. Standard wet end materials include 316L stainless steel, Alloy 20, Hastalloy C, PVC, and PVDF.

1.4 PLUNGER BODY ASSEMBLY

Milton Roy provides a reciprocating plunger design that features a 3/4 inch (19 mm) stroke length and six interchangeable plunger sizes (See Model/Product code located prior to Section one).

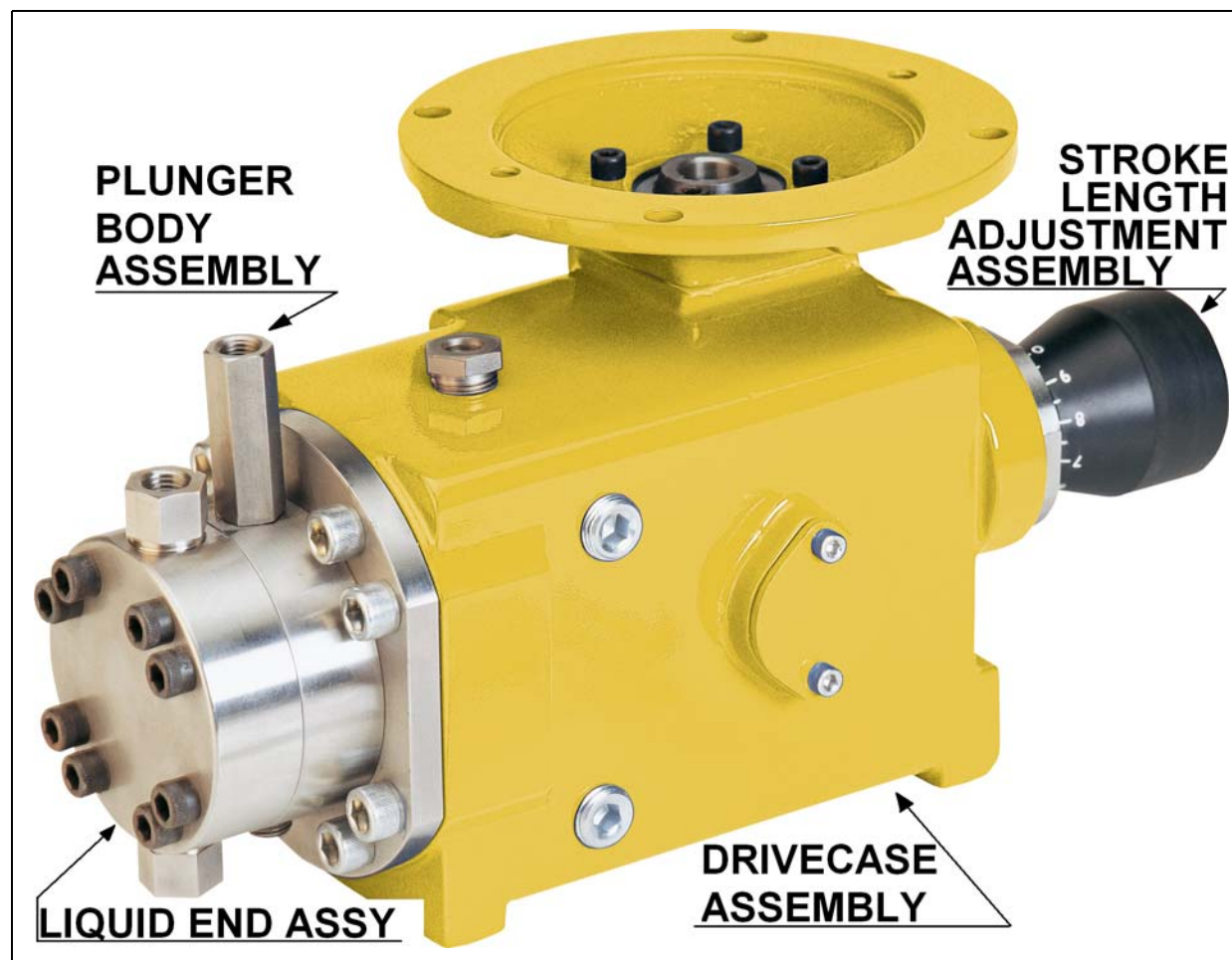


Figure 1. EVA Modular Metering Pump

A field replaceable, three-part plunger seal provides the wear surface between the plunger assembly and the plunger.

A filter eliminates any contaminants from entering the pump's plunger system.

Air from the pressurized plunger system is vented through an externally adjustable relief valve poppet located at the high point of the plunger system.

A replenishment valve/replenishment check work together to insure excellent suction lift.

1.5 STROKE LENGTH ADJUSTMENT ASSEMBLY

The stroke length is fully adjustable from 0% to 100% in 1% increments. The adjuster is fully sealed to prevent contamination or oil leakage. Also the stroke adjuster can be easily converted to an electronic stroke adjuster.

1.6 GENERAL SPECIFICATIONS

Flow Rate:

0.049 GPH (0.18 L/H) to 23 GPH (88.5 L/H)

Pressure:

Up to 3500 PSIG (241 BAR)

Turn Down Ratio:

10:1 (optional 100:1)

Steady State Accuracy:

±0.5% of flow setting

Repeatability:

± 2% of full flow

Linearity:

± 1% of full flow

Maximum Temperature:

Metallic to 250° F (121° C)

Non-metallic to 150° F (66° C)

Paint:

Powder Coating

SECTION 2 INSTALLATION

2.1 UNPACKING

Pumps are shipped f.o.b. factory or representative warehouse and the title passes to the customer when the carrier signs for receipt of the pump. In the event that damages occur during shipment, it is the responsibility of the customer to notify the carrier immediately and to file a damage claim. Carefully examine the shipping crate upon receipt from the carrier to be sure there is no obvious damage to the contents. Open the crate carefully so accessory items fastened to the inside of the crate will not be damaged or lost. Examine all material inside the crate and check against packing list to be sure that all items are accounted for and intact.

2.2 STORAGE

Short Term Storage (Less than 6 Months)

It is preferable to store the material under a shelter in its original package to protect it from adverse weather conditions. In condensing atmospheres, follow the long term storage procedure.

Long Term Storage (Longer than 6 Months)

The primary consideration in storage of pump equipment is to prevent corrosion of external and internal components. This corrosion is caused by natural circulation of air as temperature of the surroundings change from day to night, day to day, and from season to season. It is not practical to prevent this circulation which carries water vapor and other corrosive gasses, so it is necessary to protect internal and external surfaces from their effects to the greatest extent possible.

When the instructions given in this section are completed, the equipment is to be stored in a shelter; protected from direct exposure to weather. The prepared equipment should be covered with a plastic sheet or a tarpaulin, but in a manner which will allow air circulation and prevent capture of moisture. Equipment should be stored 12 inches or more above the ground.

If equipment is to be shipped directly from Milton Roy into long term storage, contact Milton Roy to arrange for factory preparation.

Pump Drive and Gearbox

1. Flood the gearbox compartment with a high grade lubricating oil/rust preventative such as Mobile Oil Corporation product Mobilarma 524. Fill the compartment completely to minimize air space and water vapor condensation. After storage, drain this material and refill the equipment with the recommended operating lubricant for equipment commissioning.

2. Remove drive motors and mounting adapters, and brush all unpainted metal surfaces with multi-purpose grease (NLGI grade 2 or 3). Store these unattached.

Pump Liquid Ends

1. Flood the front compartment of the pump housing with a high grade Lubricating Oil/Rust Preventative such as Mobil Oil Corporation product "Mobilarma 527". Fill the pump-housing compartment all the way to minimize airspace and water vapor condensation.

2. Most of the liquid ends are constructed of inherently corrosion resistant materials and require no applied corrosion inhibitor. If they are NOT naturally resistant (test the threaded or flanged inlet and outlet connections - if they have little or no magnetic property, they are resistant) they should be flush filled with a corrosion inhibiting and non-freezing liquid which is compatible with the final pumped process chemical. Flush and fill with inhibitors such as "Mobilarma 524" or with a commercial automotive antifreeze coolant. The pump head contains one way check valves, so flush in a direction into the suction (bottom) connection, and out the discharge (to) connection.

3. Cap or plug all openings to capture the inhibiting fluid, and to prevent animals and insects from building nests.

Pneumatic, Electrical and Electronic Equipment

1. Motors should be prepared in the manner prescribed by their manufacturer. If information is not available, dismount and store motors as indicated in step 3 below.

2. Dismount electrical equipment (including motors) from the pump.

3. For all pneumatic and electrical equipment, place packets of Vapor Phase Corrosion Inhibitor (VPCI) inside of the enclosure, then place the entire enclosure, with additional packets, inside a plastic bag. Seal the bag tightly closed. Contact Milton Roy Service Department for recommended VPCI materials.

2.3 SAFETY PRECAUTIONS

WARNING

WHEN INSTALLING, OPERATING, AND MAINTAINING THIS EVA PUMP, KEEP SAFETY CONSIDERATIONS FOREMOST. USE PROPER TOOLS, PROTECTIVE CLOTHING, AND EYE PROTECTION WHEN WORKING ON THE EQUIPMENT AND INSTALL THE EQUIPMENT WITH A VIEW TOWARD ENSURING SAFE OPERATION. FOLLOW THE INSTRUCTIONS IN THIS MANUAL AND TAKE ADDITIONAL SAFETY MEASURES APPROPRIATE TO THE LIQUID BEING PUMPED. BE EXTREMELY CAREFUL IN THE PRESENCE OF HAZARDOUS SUBSTANCES (E.G., CORROSIVES, TOXINS, SOLVENTS, ACIDS, CAUSTICS, FLAMMABLES, ETC.).

CAUTION

THE PERSONNEL RESPONSIBLE FOR INSTALLATION, OPERATION AND MAINTENANCE OF THIS EQUIPMENT MUST BECOME FULLY ACQUAINTED WITH THE CONTENTS OF THIS MANUAL.

ANY SERVICING OF THIS EQUIPMENT MUST BE CARRIED OUT WHEN THE UNIT IS STOPPED AND ALL PRESSURE HAS BEEN BLED FROM THE LIQUID END. SHUT-OFF VALVES IN SUCTION AND DISCHARGE SIDES OF THE LIQUID END SHOULD BE CLOSED WHILE THE UNIT IS BEING SER-

VICED. ACTIONS SHOULD BE TAKEN TO ELIMINATE THE POSSIBILITY OF ACCIDENTAL START-UP WHILE SERVICING IS TAKING PLACE. A NOTICE SHOULD BE POSTED BY THE POWER SWITCH TO WARN THAT SERVICING IS BEING CARRIED OUT ON THE EQUIPMENT. SWITCH OFF THE POWER SUPPLY AS SOON AS ANY FAULT IS DETECTED DURING OPERATION (EXAMPLES: ABNORMALLY HIGH DRIVE TEMPERATURE, UNUSUAL NOISE, DIAPHRAGM FAILURE).

2.4 MOUNTING

Milton Roy metering pumps are designed to operate in harsh indoor and outdoor services. Areas of service, however, may affect motor or accessory specifications, unless properly selected. Therefore, Milton Roy recommends that pumps installed outdoors be protected by a shelter.

Support the pump firmly in a level position using 4, grade 5 bolts on a solid, vibration-free foundation. The pump should preferably be positioned with the base above floor level to protect the pump from wash downs and to provide easier access for service. Be sure to allow enough space around the pump for easy access during maintenance operations and pump adjustments.

The wiring of drive motors, actuators, or variable speed controllers should be performed by qualified personnel and should be performed in compliance with manufacturer's instructions and all local codes. Consult your representative if information is missing or any questions exist.

2.5 DRIP COLLECTION

In the event of a failure of the diaphragm or oil seal, provisions need to be made to contain the process fluid or pump oil. This is particularly important when handling fluids which may be harmful to plant personnel.

To collect fluid in the event of a diaphragm or oil seal rupture, position a tray under the liquid end assembly.

2.6 PIPING

2.6.1 GENERAL PIPING CONSIDERATIONS

Use extreme care in piping to plastic liquid end pumps with rigid pipe such as PVC. If excessive pipe stress or vibration is unavoidable, flexible connections are recommended.

Use piping materials that will resist corrosion by the liquid being pumped. Use care in selecting materials to avoid galvanic corrosion at pump liquid end connections.

Use piping heavy enough to withstand maximum pressures. Remove burrs, sharp edges, and debris from inside piping. Blow out all pipelines before making final connections to pump.

Because vapor in the liquid end will cause inaccurate pump delivery, piping should be sloped up from pump suction check to the supply tank to prevent formation of vapor pockets.

When pumping suspended solids (such as slurries), install plugged crosses at all 90° line turns to permit line cleaning without dismantling piping.

See Figure 2 for a typical recommended pump installation scheme.

2.6.2 SUCTION PIPING CONSIDERATIONS

It is preferable to have the suction of the pump flooded by locating the liquid end below the lowest level of the liquid in the supply tank.

To minimize the chances of a loss-of-prime condition, the pump should be installed as close as possible to the supply vessel.

Avoid negative suction pressure conditions (suction lift), as such conditions adversely affect metering accuracy. A lift of 6.6 feet (2 meters) of water column is the maximum permissible suction lift.

EVA pumps are designed to operate with process liquid supplied at or above atmospheric pressure. Although these pumps can move liquids supplied at less than atmospheric pressure (suction lift), in these negative pressure applications it is important that all connections be absolutely drip free and vacuum tight.

When pumping a liquid near its boiling point, provide enough suction head to prevent the liquid from “flashing” into vapor when it enters the pump liquid end on the suction stroke.

If possible, use metal or plastic tubing for the suction line because tubing has a smooth inner surface and can be formed into long, sweeping bends to minimize frictional flow losses.

A strainer should be used in the suction line to prevent foreign particles from entering the liquid end. This and any other measures which prevent debris from entering and fouling the liquid end check valves will give increased maintenance-free service. Check strainer frequently to prevent blockage which could lead to cavitation. Keep suction piping as short and straight as possible.

Piping size should be larger than the liquid end suction fitting to prevent pump starvation.

If long suction lines are unavoidable, install a stand pipe near the pump in the suction line.

Suction piping must be absolutely airtight to ensure accurate pumping. After installation, test suction piping for leaks with air and soap solution.

2.6.3 DISCHARGE PIPING CONSIDERATIONS

Install pipe large enough to prevent excessive pressure losses on the discharge stroke of the pump. Maximum pressure at the discharge fitting on the liquid end must be kept at or below the rated pressure (shown on the pump nameplate).

The pump will not deliver a controlled flow unless the discharge line pressure is 10 psi greater than the suction line pressure. One way to create an artificial pressure is the installation of a back pressure valve. (Please contact your Milton Roy representative for recommendations to increase back pressure in slurry applications).

When pumping water treatment chemicals directly into boiler drums, use one liquid end assembly for each boiler drum. Discharging into a manifold having the slightest pressure difference between its several discharge connections can diminish metering accuracy as the outlet with the lowest pressure will receive more liquid than the other outlets.

2.7 VALVES

2.7.1 Back Pressure Valves

All metering pumps are prone to over pumping (excessive output) at low discharge pressures. To

prevent this condition from occurring, it is necessary to maintain approximately 10 psi (0.7 bar) back pressure against the pump. This can be accomplished through the installation of a back pressure valve in the discharge line. Typically, the valve should be located near the pump. However, back pressure valves for large pumps with long and extremely small discharge lines may have to be installed near the point of discharge into the process (to minimize siphoning tendencies).

2.7.2 Pulsation Dampeners

An accumulator, surge chamber, surge suppressor, or pulsation dampener should be used with the back pressure valve in the discharge line to absorb the flow peaks between the pump and the back pressure valve. Without the pulsation dampener the valve mechanism will snap open and close with the surge from each pump stroke. The pulsation dampener will allow the back pressure valve to oscillate about a partly-closed position, thus minimizing wear on the valve. Discharge line pulsation dampeners offer the further advantage of limiting the flow and pressure variations characteristic of this kind of pump. Installing a properly sized pulsation dampener will improve pump performance and may reduce system costs dramatically by permitting the substitution of smaller piping. Please contact Milton Roy Company for further information on pulsation dampeners.

2.7.3 Safety Valves and Priming Valves

Motor-driven positive displacement pumps can develop excessive discharge pressures long

before thermal overload devices interrupt the motor electrical circuit. To prevent a blocked discharge line from causing damage to the pump, piping, or process equipment, install a safety valve in the pump discharge line. This valve is designed and sized to handle system flow rates and pressures safely while resisting corrosion by the process liquid.

To aid in pump start-up, it is advisable to install a priming valve on the discharge side of the liquid end.

2.7.4 Shut-off Valves

Provide shut-off valves in both suction and discharge lines next to the pump. Locate discharge line shut-off valve downstream from the inlet connection of the safety valve. Figure 2 shows recommended valve locations.

2.8 ELECTRICAL CONNECTIONS

Do not forget to connect the earth terminal on the motor to the equipment earth conductor.

Ensure that the electrical supply matches the pump motor nameplate characteristics. Connect the motor in accordance with the instructions and connection diagrams on the motor (or in the motor terminal box).

The electrical protection installed for the motor (fuse or thermal protection) must be suitable for the motor's rated current.

SECTION 3 OPERATION

3.1 RECOMMENDED LUBRICATION

The EVA drivecase will hold approximately 2 quarts of oil. When filled from empty, the quantity of oil will differ slightly with plunger size. Fill to Level Indicator Plug on drivecase.

Since the oil used in the EVA metering pump is used as plunger, vacuum, and gear lubricant oil, it is important to use oil supplied by Milton Roy or a recommended equivalent. For recommended lubricants and equivalents see data page, at end of this manual.

The EVA pump has a highly refined plunger system. It is critical oil replacement guidelines are followed per the recommended service intervals found in maintenance Section 4.

To drain drivecase oil, remove lower socket head set screw. Allow complete drainage, then replace plug, using an anti-galling thread sealant. The filter assembly should be replaced as recommended in the maintenance chart. Instructions for this procedure are found in Paragraph 4.6, Plunger Body.

Refill the drivecase as recommended above.

3.2 START-UP CHECKS

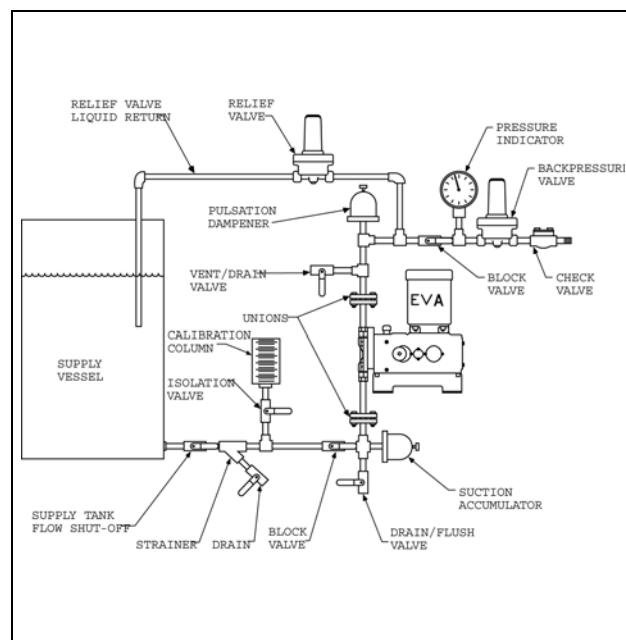


Figure 2. Typical Piping Diagram.

Make sure all isolation valves installed on the suction and discharge lines are open. If the discharge line is equipped with an injection nozzle or a back-pressure valve, open the priming valve for discharge (if there is no priming valve, disconnect the discharge pipe). This allows for verification that liquid is present in the liquid end when the pump is installed in flooded suction condition. If the pump is installed in a suction lift condition, this allows for priming of the pump during start-up.

Make sure that pump is set at 0% capacity.

3.3 NPSH

The proper operation of a metering pump depends on many factors. Prior to the start-up of a new pump, the NPSHA (Net Positive Suction Head Available) of the system must be calculated. The NPSHR (Net Positive Suction Head Required) must be exceeded in all of the worst case conditions.

3.4 BACK PRESSURE

Metering pumps require at least 10-15 PSI differential pressure to operate properly. The discharge pressure must exceed the suction pressure at all times to ensure proper check valve operation and to prevent siphoning. If the pump is not discharging at a sufficient and consistent pressure, then a back pressure valve must be installed. See Figure 2 for the recommended location.

3.5 START-UP

Once all the checks and procedures described above have been carried out, start the pump.

Conduct a visual and audio check of the pump (in particular, listen for the presence of any "suspicious" noises).

Make sure that the stroke adjustment knob is unlocked.

Gradually increase the capacity until liquid can be seen flowing from the priming valve. If no priming valve is in place, when the liquid end is primed, the discharge check valves can be heard to be operating (should hear a clicking noise caused by move-

ment of check valve balls). When liquid end is primed, stop the pump and close the priming valve.

Adjust the pump to the desired capacity.

3.6 FLOW RATE ADJUSTMENT

The EVA flow rate is fully adjustable from 100% of rated capacity (see name-plate for rated capacity) to 0% flow rate. However, the pump will only be accurate from 100% to 10% of rated capacity. Flow is varied by turning stroke control knob. Turned fully counterclockwise is 100% setting or maximum flow. The calibration of stroke length is via the vernier scale created by the 10 increments on the stroke adjuster knob and 10 increments on the sleeve.

NOTE

The stroke length scale is a reference of adjuster setting, NOT flow rate. A calibration curve must be developed to determine flow rate at various settings.

3.7 CALIBRATION

To determine the relationship between the stroke adjuster setting and flow rate, a calibration curve must be developed. This is easily done by checking capacities at various stroke adjuster settings and plotting points on a graph.

NOTE

The results should approach a straight line, but compressibility, tolerances, and check valve losses may yield slight variations. Sample points that are within 3% of the maximum flow rate of the unit at 100% stroke setting are deemed acceptable.

3.8 HYDRAULIC PRIMING

The priming of the hydraulics is necessary whenever the liquid head has been removed. After re-assembly, remove pressure relief valve components as mentioned in Paragraph 4.4, Plunger Body. Be sure to note the turns needed to remove the adjustment screw, or measure from the top of the nut to top of the tower, to remember your relief valve setting.

Set the stroke adjuster to approximately 30%. For fast stroking pumps and those with the larger plunger size of 1-1/4 in. stroke adjuster should be set lower.

Start the pump motor while adding the proper oil into the plunger stem (Relief Valve area). Run pump for several minutes to allow oil to enter the plunger chamber. Stop the pump and re-assemble the pressure relief valve, following the instructions from Paragraph 4.4, Plunger Body. Return the adjustment screw to its original setting.

Start the pump and operate against zero back pressure. Slowly increase to 1/2 the rated pressure and run for several minutes to allow the plunger to properly prime.

To set the pressure relief valve, follow the directions in paragraph below – Relief Valve Setting.

WARNING

THE HYDRAULIC RELIEF VALVE PROTECTS THE PUMP ONLY AND IS NOT DESIGNED TO BE USED AS A SYSTEM SAFETY RELIEF VALVE.

3.9 RELIEF VALVE SETTING

To properly set the relief valve certain system components are necessary.

An accurate liquid dampened gauge, a means of developing back pressure in excess of designed relief valve setting, and some means of measuring flow.

If these components are not available in the system, the pump should be removed and taken back to a test area. Run the pump with little or no back pressure. Slowly increase the back pressure and check the pump for delivery of the rated capacity at 10% over maximum pressure. If the relief valve is not set high enough, the flow will taper off, as pressure is increased. Slowly increase the relief valve adjustment screw and check the flow rate. If the flow does not increase as relief valve is tightened, another problem such as starved suction or a blocked discharge may exist. Immediately shut down the pump and find the problem. If the pump readily delivers the rated flow at maximum pressure, the relief valve may be set too high. Slowly

decrease the relief valve setting until the flow decreases. Tighten the adjuster until the rated flow is delivered at 10% over the rated pressure.

CAUTION

THE PLUNGER RELIEF VALVE PROTECTS PUMP GEARING ONLY AND IS NOT DESIGNED TO BE USED AS A SYSTEM SAFETY RELIEF VALVE.

3.10 TROUBLESHOOTING

The EVA is equipped with an air bleed relief sight tube. This offers a means of viewing the oil emitted from both the air bleed valve and relief valve. This tube also offers an external means of troubleshooting.

The sight tube is located under the sight glass on the top of the drive case located close to plunger body. If equipped, the pump may have an external bulls eye.

During normal operation the tube should emit a small amount of oil on every stroke. This results in a slight percolating action.

If the sight tube is dry, malfunction exists. Any of the following may cause this: starved suction, the plunger not primed, no oil in the drivecase, the oil filter is clogged or a dirty air bleed valve.

3.11 TOOLS & WORKING FACILITY

There are no special tools needed to perform routine maintenance on the EVA model pump. There are, however, some sub-assemblies that require special fixtures and are sold only as a complete assembly. Contact Milton Roy for identification of these components.

For replacement of common wear components, it should not be necessary to remove the entire pump. The EVA pump is modular in design and should require removal of damaged component only. Avoid contamination of pump components during maintenance.

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SECTION 4 MAINTENANCE

4.1 ROUTINE MAINTENANCE

During normal operation of the pump, replacement of common wear items will become necessary. These are found in the Liquid End Rebuild Kit. The kit contains recommended items that should be stocked in the customer's inventory. The frequency of maintenance on any pump depends on the severity of service and total hours of operation. Table 1 reflects recommended service intervals.

Table 1. Recommended Service Intervals.

Frequency of Service	Recommended Parts of Service
24 Hours	Visual check for gear box oil and product leakage
6 Months Convenience Service or 4500 Hours	Initial: Change gear box oil. Slurry Service: Inspect check valves, Rebuild as necessary.
12 Months Continuous Service 9000 Hours Note: This interval is a good time to develop frequency of needed repairs	Change gear box oil & filter. Check Valves: Inspect and replace as necessary. Diaphragm: Replace
36 Months	Inspect: Plunger housing, stroke adjuster, and drivecase for wear.

4.2 SPARE PARTS

The material code, found on the pump's nameplate and model number are required when ordering any parts.

Rebuild kits are available for the liquid head, plunger body, stroke adjuster, and drivecase. The kits include only the wear items recommended for routine maintenance.

The parts section contains cross sectional drawings to identify parts by item number. You must cross reference your particular list to find Milton Roy's part number.

When pumps of different size or material of construction are being serviced, use Milton Roy's part numbers taken from the corresponding parts list. A 316SS check ball has the same item number as a ceramic check ball. Milton Roy's part number, however, will reflect correct construction.

4.3 DRIVE MOTOR (FIGURE 3)

The EVA is designed to accept a 1/3 HP Nema 56C or 0.25 KW IEC71 Face Motor. Specific motor data can be found in the information package supplied with the pump. If the motor is replaced, it

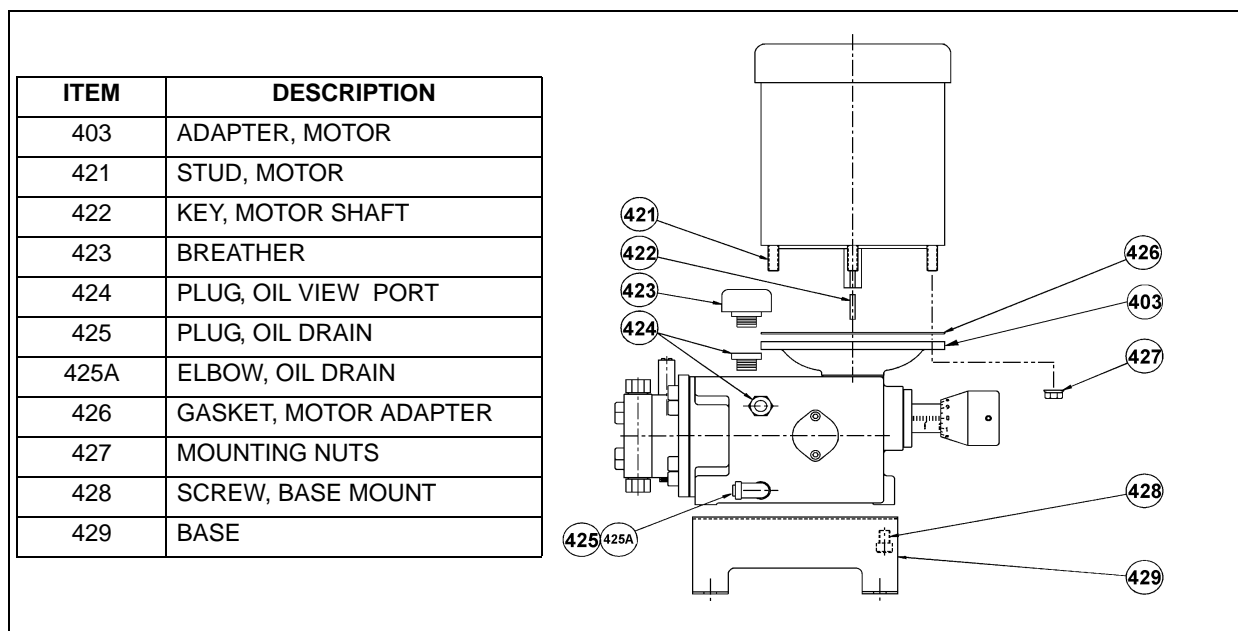


Figure 3. Drive Motor

must be identical to the original or a factory approved equivalent.

NOTE

Motor rotation will not affect pump performance or wear.

WARNING

ALWAYS DISCONNECT ELECTRICAL POWER FROM THE PUMP MOTOR BEFORE PERFORMING ANY MAINTENANCE. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN DEATH OR SERIOUS INJURY.

1. Before removing the drive motor, ensure that all power is removed and locked out.
2. Remove four (4) 3/8 in. (9.5 mm) attachment nuts from motor studs (421). Evenly lift motor out. The motor shaft is coupled to worm shaft with a 3/16 in. (7.8 mm) square 0.81 in. key (422). (Figure 3).
3. When motor is replaced transfer (4) studs (421) to new motor.
4. To reinstall drive motor apply a liberal amount of antiseize to shaft, then place 3/16 in. (7.8 mm) shaft key into worm shaft. Align motor shaft with worm, studs with motor adapter and carefully insert. The motor face should meet motor adapter.
5. Attach four (4) 3/8 in. (9.5 mm) mounting nuts to studs and tighten.

4.4 CHECK VALVES

The check valves are a very critical part of a metering pump. Proper maintenance is important to ensure accuracy. Size A, both metallic and non-metallic and size B metallic check valves are removed and replaced as an assembly. Size B non-metallic check valves are removed and replaced as the following individual parts: seat, O-ring, guide,

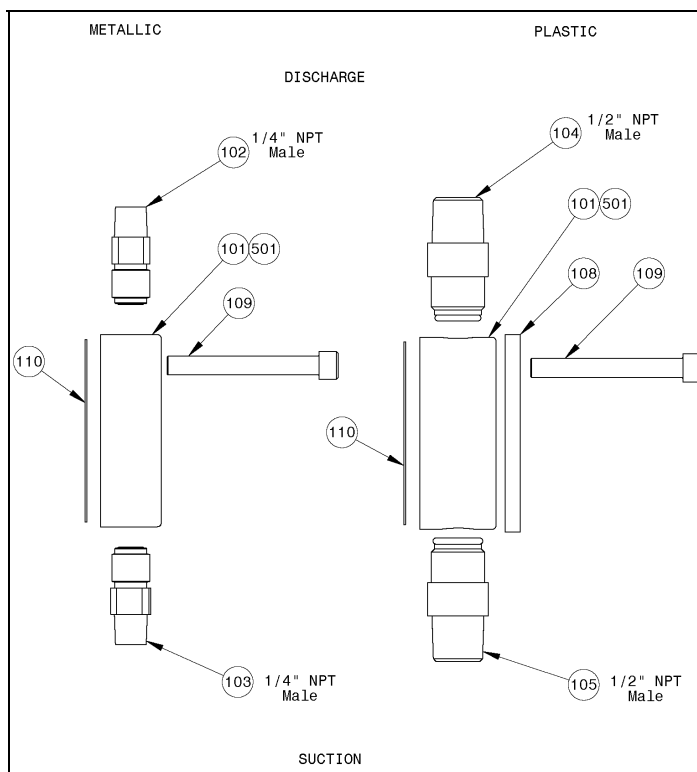


Figure 4. Metallic/Plastic Head Assembly, Size A.

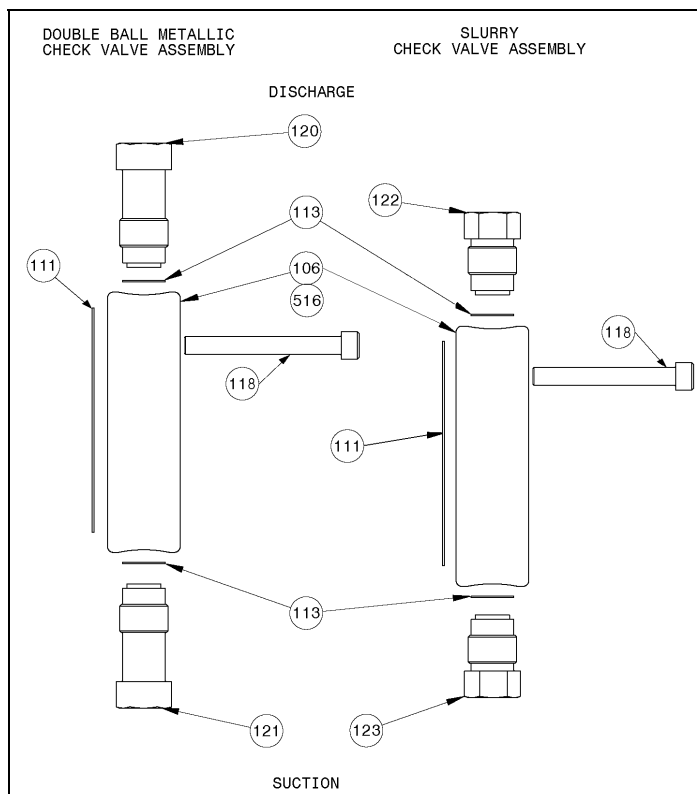


Figure 5. Metallic Head Assembly, Size B.

cap, seal, and ball (double ball check valve includes a transition piece). Some pumps come equipped with double ball check valves (Figures 5 & 6.) The maintenance is similar to that of the single ball.

1. Disconnect piping from union or flanged connections nearest pump.
2. Prior to removal of check valve caps, pumping cavity must be flushed to remove contaminants.
3. Remove suction and discharge check valve caps as shown in Figures 4 through 6. Be sure not to drop valve components as damage may occur.
4. Examine valve seats. The suction valve seat is located in valve cap, discharge valve seat is located in liquid head. Seat surface should be free of burrs or excessive wear. If seats are in need of replacement, liquid end must be removed per instruction located in Paragraph 4.5.
5. On pumps with non-metallic size heads plunger diameters of 5/8 in. (15.87 mm) to 1-1/4 in. (31.7 mm), discharge seat is pressed into liquid head, while suction seat is machined into check valve cap. Both caps are identical so a new suction valve seat is available by switching suction discharge valve caps. Before removal of discharge seat, liquid head must be removed per Paragraph 4.5. If seat area is corroded, it may be necessary to tap seat with a 5/16 in (8 mm) - 24 UNF thread. Use a 5/16 in (8 mm) - 24 screw and pry out evenly.
6. Replace TFE gaskets whenever valve caps are disturbed (size B only). Removal of gaskets is accomplished by using a soft tool. Do not scratch seal surface.
7. When installing a new gasket, be sure seal surface is clean and gasket is inserted completely into groove.
8. Replace check valve assemblies as shown in Figures 4 through 6. Torques on valve caps (size B only) are critical. Consult Table 2 for correct torque value. Tighten size A valve caps to compress o-ring.

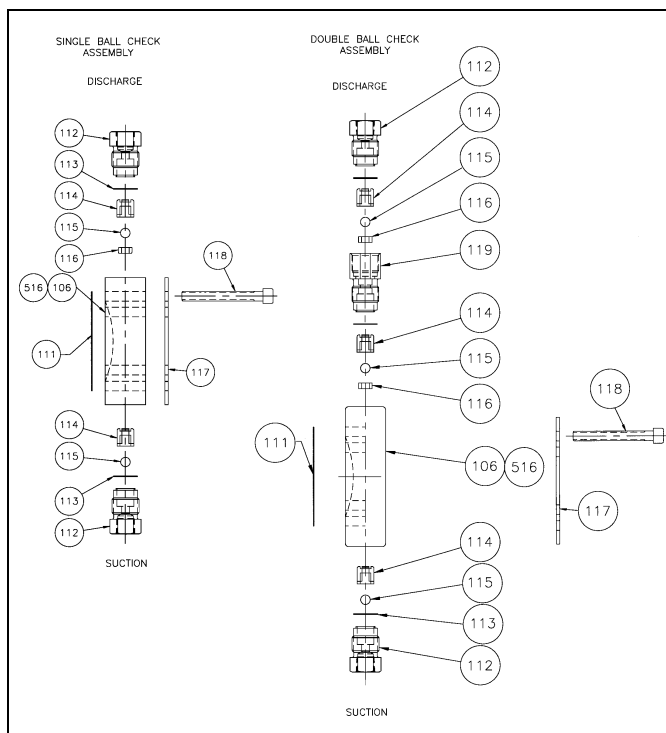


Figure 6. Plastic Head Assembly, Size B.

Table 2. Check Valve Caps

PLUNGER SIZE	SIZE B	
	5/8 in. (15.87 mm) 7/8 in. (22.2 mm) 1-1/4 in. (31.7 mm)	
Liquid Head Material	Metallic	Non-Metallic
Torque	15 ft/lbs (20 N•m)	8 ft/lbs (11 N•m)

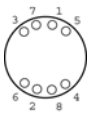
9. Reinstall piping. It is not recommended that threaded connections be wrapped with Teflon tape, this is a common cause of check valve clogging. A TFE based sealing compound is recommended.

4.5 LIQUID END ASSEMBLY

The liquid heads on the EVA are available in two sizes (A - 3/16, 1/4, 3/8 & B - 5/8, 7/8, 1-1/4). With the exception of torque specifications and the metal support ring on plastic heads, non metallic sizes are similar, and should be addressed in the same fashion.

1. To remove the liquid head, remove the attaching cap screws (109).
2. The diaphragm may be adhered to plunger housing. To remove diaphragm, use a soft pry tool. Do not scratch the sealing surface. Since the diaphragm will contain hydraulic oil, place a catch pan under the head.
3. Check operation of replenishment valve. When valve button is depressed, then released, valve should snap back to forward position. (Figures 9 & 14). If a problem is noted and further disassembly is required, proceed to Step 4.
4. A new replacement diaphragm is required whenever the liquid head is removed. Refer to Table 3 for torque specifications for a diaphragm.

Table 3. Liquid Head Bolt Torque

SEQUENCE	SIZE A		SIZE B	
	Metallic	Non-Metallic	Metallic	Non-Metallic
	18 ft/lbs (24 N•m)	72 in/lbs (8.1 N•m)	40 ft/lbs (54 N•m)	15 ft/lbs (20 N•m)

5. Install the liquid head oriented so the flow arrow points up on the face, and insert eight (8) attaching screws. Tighten the liquid head bolts in sequence to the maximum torque ratings as indicated Table 3.
6. With the replacement of a diaphragm it is necessary to re-prime the hydraulic chamber. The procedure for re-priming is found in Section 3, Operation.
7. Replace check valve assemblies, Paragraph 4.4.

4.6 PLUNGER BODY ASSEMBLY

The function of the plunger body (Figure 9) is to control the hydraulic system. This is the most intricate portion of the pump and should be carefully serviced in a clean environment.

NOTE

Prior to plunger body removal, the gear box oil must be drained and the liquid head and stroke adjuster removed. The motor must be rotated to place the plunger at the bottom, dead center (full suction stroke). The screws must be removed slowly to allow the plunger return spring to decompress. Be sure the plunger housing is moving forward as the attaching screws are loosened so there is no compression remaining on the spring.

WARNING

FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN A SUDDEN RELEASE OF THE SPRING COMPRESSION, LEADING TO SERIOUS INJURY.

1. To remove plunger body, attaching screws must be removed.
 - (1) Removing eight (8) 3/8 in (9.5 mm) - 16 cap screws.
 - (2) Remove pump head.
 - (3) Remove diaphragm.
 - (4) Remove two (2) 1/4 in (6.4 mm) - 20 cap screws.
2. Remove filter assembly from drivecase and inspect. If replacement is necessary, filter may be removed from magnet by cutting plastic tie. Renew tube if it is damaged or does not fit snugly onto filter or connector.
3. Clean drivecase carefully. Magnet is designed to attract metal particles. This area will need special attention.
4. Carefully slide plunger and spring from plunger bore. Examine plunger for any signs of wear or damage. Configurations differ by plunger sizes. All sizes, however, are functionally similar.
5. The plunger seal is a 3 piece T-type seal. This utilizes an elastomer T-shaped seal with 2

plastic support rings (Figure 7). If no wear is evident and plunger fits snugly into seal, renewal is not necessary. Seal may NOT be reused if it is removed from plunger body.

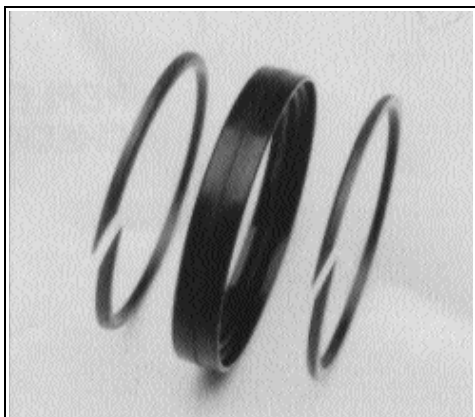


Figure 7. Plunger Seal.

6. To remove plunger seal, both plastic retaining rings must be removed first. Using a small angled tool, carefully pry out all three seal components.
7. To replace seal, insert first plastic ring into bore. Note orientation of beveled ends. (See Figure 7).
8. Install a well lubricated seal into groove in plunger body.
9. Slide retaining ring from bore into far side of plunger seal.
10. Install second ring into near side of plunger seal, noting position of beveled end and radius, where applicable. Be sure all seal components are aligned properly.
11. To remove replenishment check (Figure 8 & 9), remove protection plug item number (234/260) and back out of plunger body using a 1/4 Allen Wrench. Note location in Figure 8.
12. Examine o-rings for any damage. Check ball should move freely inside body.
13. If repair of replenishment check is necessary, entire sub-assembly should be replaced (Figure 8).

ITEM	SIZE	DESCRIPTION
231	A	REPL CHECK VALVE
232	A	REPL GASKET
233	A	REPL RETAINER
234	A	REPL PLUG, 1/4 NPT
258	B	BALL, 3/16" DIA.
259	B	REPL CHECK ROLL PIN
260	B	REPL CHECK BODY
261	B	REPL CHECK O-RING
262	B	REPL CHECK O-RING

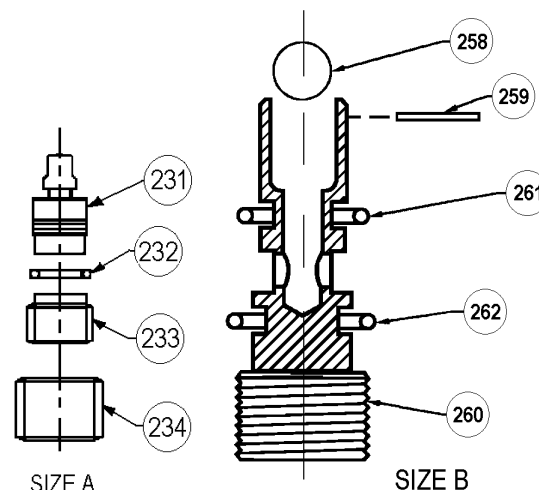
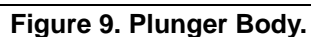
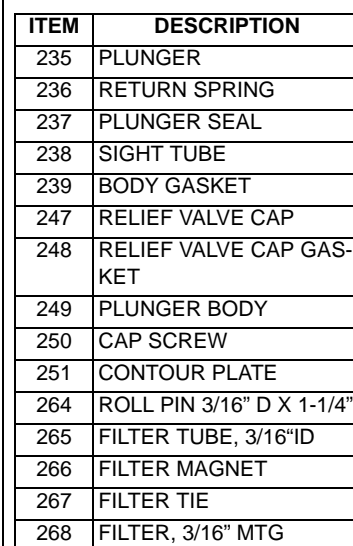


FIGURE 8. Replenishment Check Assembly.

14. To reinstall replenishment check, generously lubricate o-rings and insert. Use a gentle turning force until threads catch. Tighten firmly.
15. Insert protection plug, Item (234/260). Replace when necessary.
16. The air bleed and pressure relief valve (Figure 9 & 10) are removed by backing out large slotted screw from stem of plunger housing. (Count number of turns needed to remove screw and record). Note the orientation of the components as shown.
17. The poppet and air bleed assembly are housed in the square body. The air bleed ball (Size A) should move freely inside the body. If no movement of the air bleed ball is evidence, assembly may be flushed with a solvent. If a defect is found, assembly is to be replaced with a factory assembled unit.



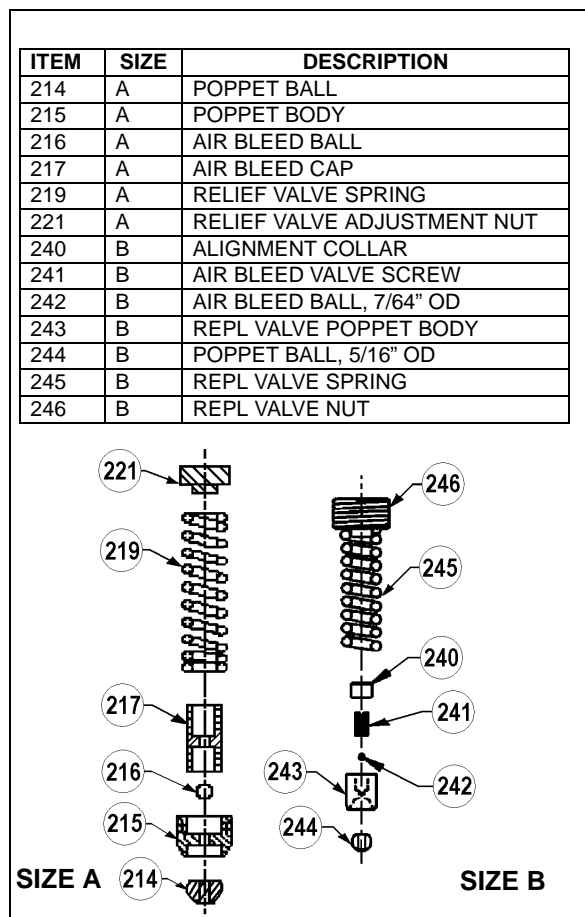


FIGURE 10. Pressure Relief/Air Bleed Assembly.

18. The relief spring in each pump head is specific for each application (Under no circumstances should any other spring be used in this assembly).
19. To re-assemble pressure relief valve, insert poppet/air bleed assembly into stem. Be sure it is centered and properly located onto seat. Insert spring and screw, making sure to return the screw to its original location. As noted earlier the final setting of the pressure relief valve is covered in Operation, Section 3. Be sure to install protection cap, item 222/247 prior to installation.
20. To access replenishment valve (Figure 9 & 11), remove rear support plate, item 251 (size B only). To remove valve, tap lightly with a soft rod through plunger bore on back side of valve.

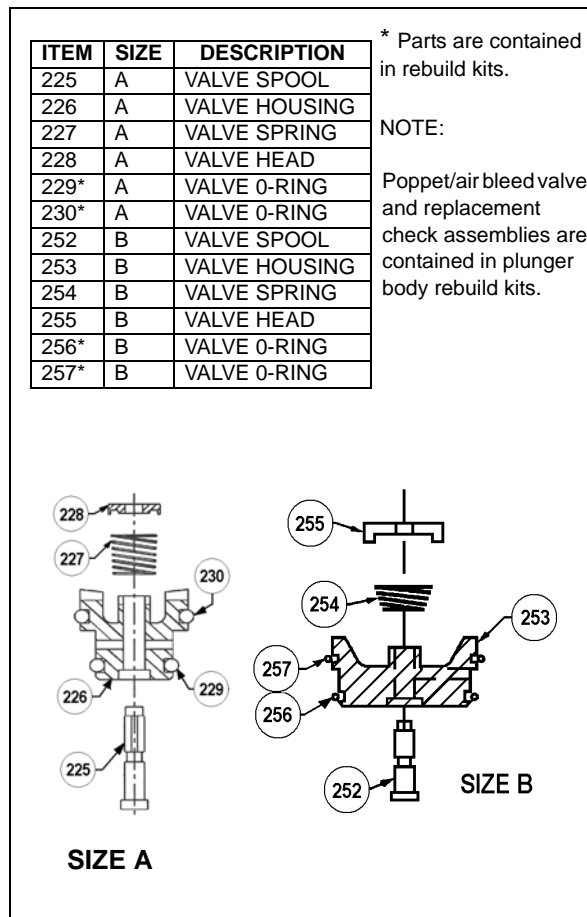


Figure 11. Replenishment Valve Assembly.

21. The face of the valve, item 228/255 should be secured to the spool (item 225/252) via a press fit. The spool should move freely in the valve and easily return to forward position via a conical spring (item 227/254). See Figure 11.
22. When action of valve is not smooth, replacement of entire assembly is necessary.
23. O-rings should not be reused. Remove old o-rings carefully. Ensure there are no sharp edges on exterior of valve body.
24. Lubricate new o-rings with hydraulic oil and carefully install. Place plunger housing face up on firm table. Generously lubricate valve bore and set valve squarely into opening. Rotate valve until one hole in valve body (Figure 12) is aligned with hole in plunger body (Figure 13) and press valve into plunger housing.

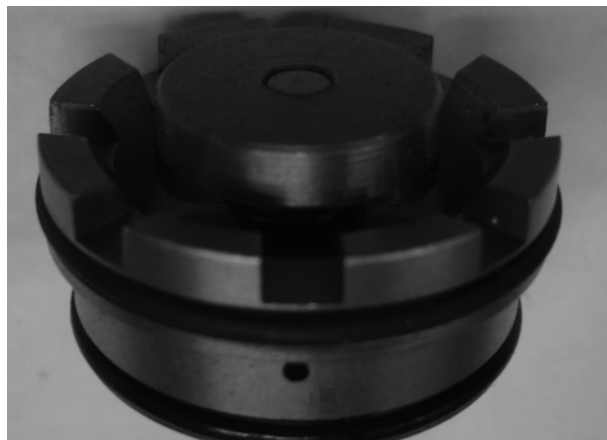


Figure 12. Replenishment Valve Hole.

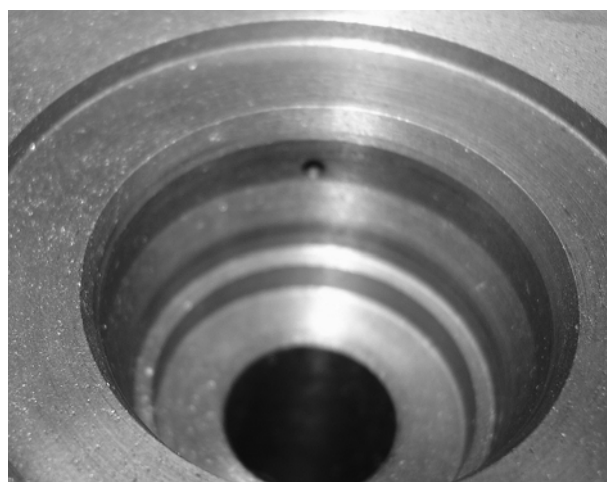


Figure 13. Plunger Body Hole.

25. To ensure that replenishment valve is installed completely, place rear contour plate Item 251 (Figure 9) onto plunger body (Size B only). The plate should fit tightly to the body without any rocking action (Figure 14).



Figure 14. Plunger With Replenishment Valve and Rear Contour Plate Installed.

26. The plunger and return spring may now be installed. Lubricate bore and plunger generously. Using an even rotational force on back of plunger, press plunger into bore.
27. Insert filter magnet assembly into drivecase. Ensure tube is securely fastened to pin, Item 264 (Figure 9) and filter. The tube must not come in contact with the eccentric or the plunger return spring.
28. Before installing the plunger body, be sure the stroke adjuster is set at 100% and the motor is rotated until the eccentric is at its lowest point in relation to plunger contact (full suction stroke).
29. Position gasket so all required holes are aligned. Be sure replenishment and hydraulic relief valve holes are in proper orientation. The larger hole is for the hydraulic relief valve port.
30. Insert plunger body so that stem is pointing up. The two different positions available are found when pump motor is mounted in either horizontal or vertical positions.
31. Evenly draw up body with attaching bolts. See Table 4 for proper torque settings.

Table 4. Plunger Housing Bolt Size

BOLT SIZE	1/4 IN. (6.4 MM)
3/16 in. (4.76 mm)	100 in/lb (11 N•m)
1/4 in. (6.35 mm)	
3/8 in. (9.525 mm)	
5/8 in. (15.87 mm)	
7/8 in. (22.2 mm)	
1-1/4 in. (31.7 mm)	

32. Re-assemble liquid head as described in Paragraph 4.5.
33. Before restarting pump, make sure drivecase is properly refilled with oil. The relief valve setting also must be verified. See Section 3, Operations.

4.7 STROKE LENGTH ADJUSTMENT ASSEMBLY

The stroke adjuster cartridge is a graduated plunger stop which allows the pump to have a variable stroke length at a fixed frequency. Due to the complexity of this component, we recommend a

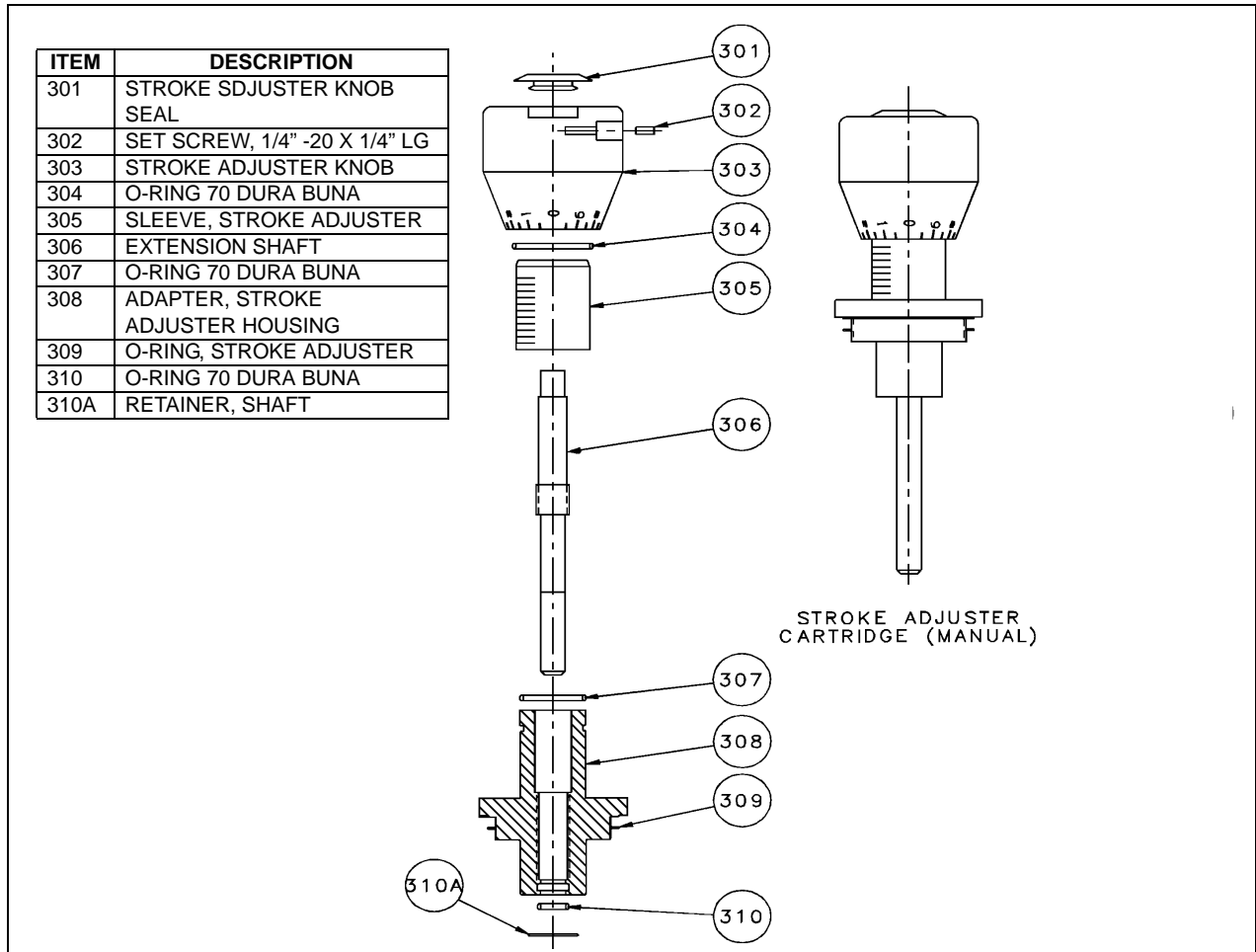


FIGURE 15. Manual Stroke Adjuster.

new assembly be purchased if major rework is necessary.

1. Prior to disassembly set stroke adjuster at 100%. This will allow plunger spring to relax and ease housing removal. On pumps with vertical motors, gear box oil must be drained.
2. Detach housing (308) using an adjustable wrench and remove assembly. See breakdown of the assembly in Figure 15.
3. Both knob and sleeve utilize locating o-rings. It is not necessary to replace o-rings unless they are damaged.
4. The knob o-ring, item 304, is located inside, at the end of bore. Remove with small angled tool. If replacement is necessary, lubricate with light oil.
5. Sleeve o-ring, Item 307, is located on outside of adjuster housing (308). If replacement is necessary, do not lubricate.
6. Install o-ring on outside of housing stem and press on calibrated sleeve. Use no lubricant. Calibration marks should face top of pump.
7. Install o-ring, Item 304, into stroke adjuster knob.
8. Place adjusting knob on shaft and dial in, clockwise, until adjustment bottoms. Back out 1/2 turn. Be sure "zero" mark on knob aligns with "zero" on calibrated sleeve, when pump flow is zero.
9. Check for proper operation. Turn calibrated sleeve to align zero mark.
10. Install assembly using new o-ring.

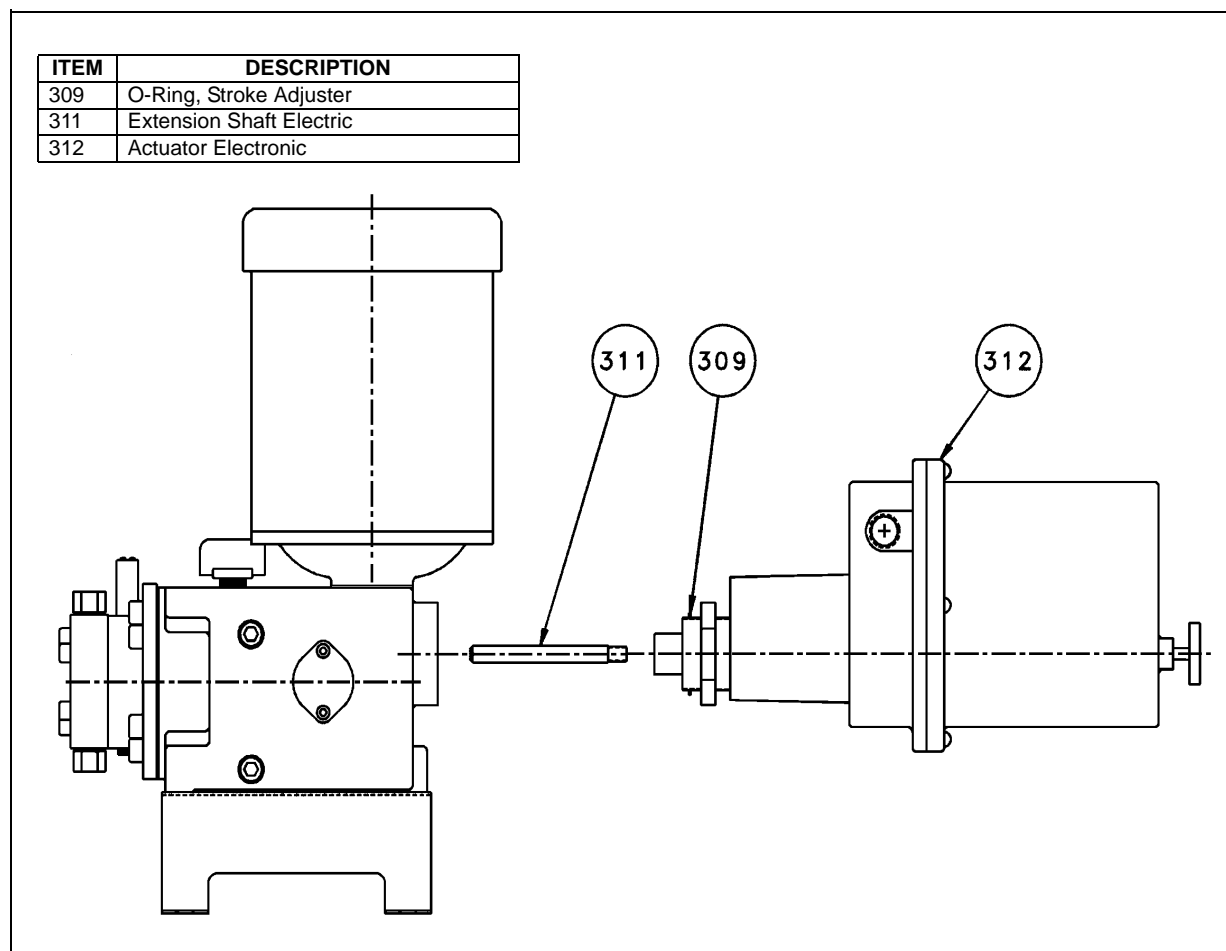


Figure 16. Electric Stroke Adjuster Assembly (Optional).

11. It is necessary to verify plunger stop adjustment whenever the stroke adjuster has been removed. To check, dial stroke adjuster to 0%. There must be NO plunger movement present while the pump is operating.

12. Use a lab calibrated vessel (ml) to determine pump flow.

4.8 ELECTRONIC ACTUATOR (OPTIONAL)

The operation of the stroke adjuster can be automated with the installation of an electronic actuator. See Electronic Actuator Instruction Manual.

Actuator:

Jordan Control Multiturn Actuator Model SM1010

WARNING

**ACTUATOR MUST NOT BE POWERED
UNLESS PUMP MOTOR IS OPERATING.**

CAUTION

**BE SURE PROPER SAFETY PRECAUTIONS
ARE TAKEN WHEN ADJUSTING
THE JORDAN ACTUATOR.**

NOTE

The pump motor must be operating to perform any actuator adjustments.

1. Wire the actuator per installation wiring in the MV1000 instruction manual.

2. Determine the voltage and set SW1 for either 120 Vac or 240 Vac.
3. Set the dip switches 1 through 8 for proper operation.
4. (Down position activates switch) See MV1000 instruction manual.

4.9 DRIVE CASE ASSEMBLY

The drivecase (Figure 17) is cast iron, and is built for durability and precision. It may be easily disassembled with the exception of the eccentric shaft, hub, and gear, which are inserted into the gear box using special tooling. When gearing needs to be changed, consult the factory for special instructions.

Eccentric shaft retainers, item 412, are used to center the shaft by providing a bearing surface for 3/8 in. (9.5 mm) balls. Gaskets used under these shaft retainers are of various thicknesses and are picked to provide the proper end play. Different colors have been selected for each available thickness. When ordering new gaskets be sure to specify the needed colors, as originally supplied with the pump.

The drivecase is powder coated with a polyester TGIC to aid in chemical resistance. If power coat becomes chipped or corroded, it should be powder coated to prevent damage to drivecase.

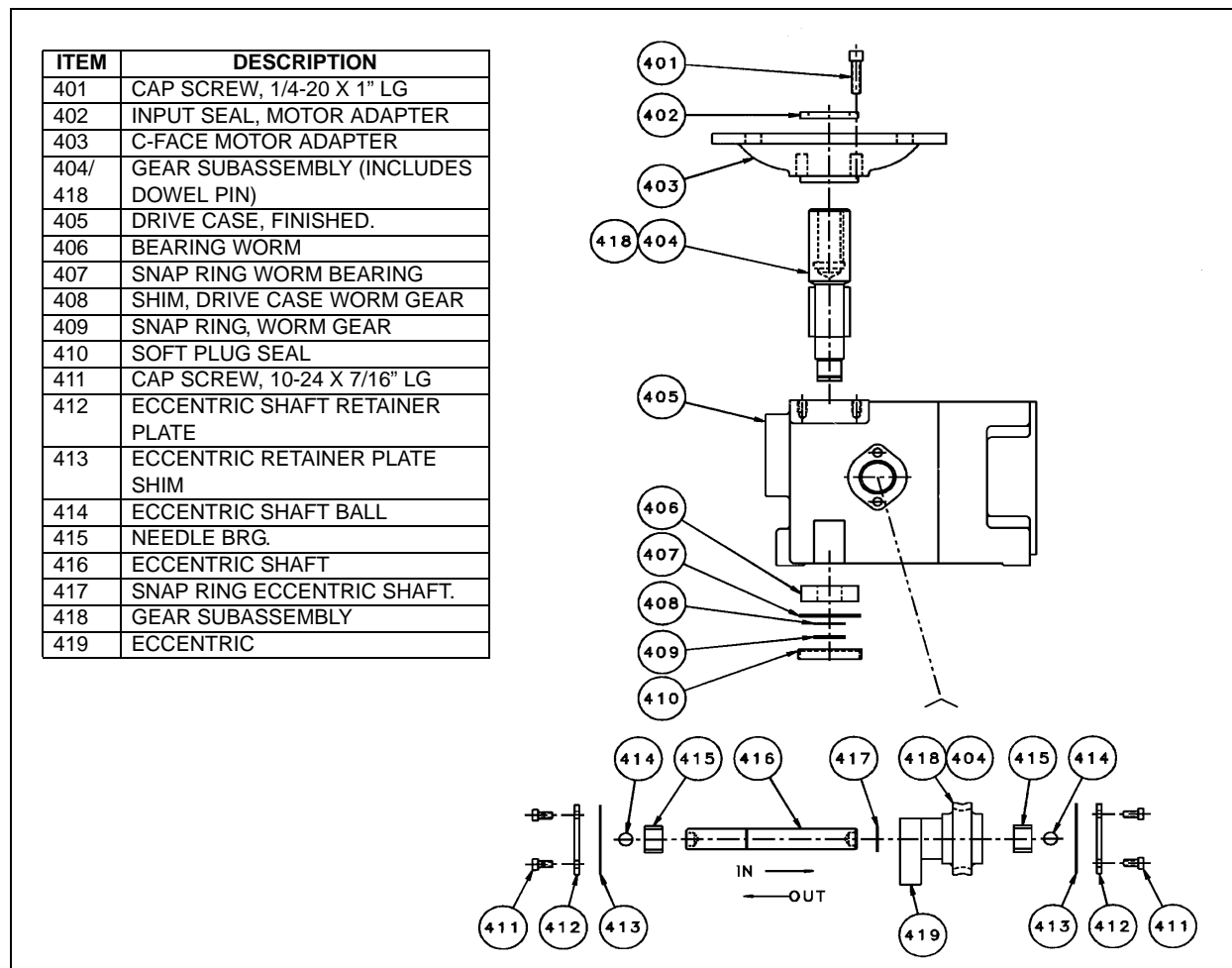


Figure 17. Drivecase Assembly.

CAUTION

IF A BREATHER IS NOT INSTALLED, PRESSURE IN THE DRIVECASE MAY DESTROY SEALS AND GASKETS CAUSING OIL LEAKAGE OR PUMP FAILURE.

All EVA drive cases must have a breather installed before start-up operation. Pumps are shipped with 3/8 in. (9.5 mm) NPT plastic plug to prevent oil leakage. The plastic plug must be replaced with breather, which is shipped with the pump.

The drivecase has the following components mounted outside the case: liquid end assembly, motor adapter, flow control (stroke adjuster), and base.

Inside the drive case the following components are mounted: pumping device and oil pump.

The pumping device includes the worm gear (404) which is connected to the motor shaft. The wheel gear (418) is pressed on to the eccentric (419) and then pressed on to the eccentric shaft (418).

The oil pump includes the following components:

- Plunger piston is driven by the eccentric into the plunger body (pump cylinder).
- Replenishing (refill) valve includes an oil suction valve and oil filter.
- Diaphragm protection valve prevents damage to the diaphragm.
- Relief valve controls oil pressure. Never exceeding the pump's working pressure. The relief valve also bleeds air at pump start-up.

4.10 LEAK DETECTION (OPTIONAL)

4.10.1 Introduction

This is intended to aid in the operation, maintenance and troubleshooting of the metering pump leak detection system. It also provides information on conversion procedures and gives a logical course of action and diagnosis should service be required.

SYSTEM DESCRIPTIONS

A. Gauge Type

This option offers a visual response using a pressure gauge to indicate a diaphragm failure. If a diaphragm fails the vacuum between the double diaphragm is lost and an increase in pressure will occur.

B. Pressure Switch

This option offers an electrical interface by providing an N/O or N/C relay. The switch is plumbed to the center of the diaphragm assembly and senses the presence of fluid. In the event of a diaphragm failure the relay will activate.

C. Fiber Optic

This option offers a visual and electrical interface through an N/O or N/C relay. The optic probe is plumbed to the center of the diaphragm assembly and senses the presence of fluid. In the event of a diaphragm failure the relay will activate.

All units come from the factory fully assembled, tested and mounted to the pump.

4.10.2 Specifications

A. Gauge Type

Type: Dual Purpose (Vacuum/Pressure)

Range: 30 In Hg - 300 PSIG

B. Pressure Switch

Furnished with specific orders: available in NEMA 4 or NEMA 7

C. Optic Probe (NEMA 4)

SENSOR	POWER BLOCK MODULE
Supply Voltage	Construction
24-250/1/50-60 Vac 24-36 Vdc	Valox thermoplastic polyester housing; Lexan transparent cover
Supply Current	Available Enclosures
Maximum 45 mA	NEMA 4: Explosion Proof
Internal Sensing Indication	Weight
Red LED Activation	Approximately 1.0 lb.

C. Optic Probe (NEMA 4)**External Sensing
Indication**

Relay Interface

Operation Temperature

0° to +50° C

+32° to +122° F

RELAY INTERFACE**Output Configu-
ration**Internal form
"C" Relay (SPDT)**Output Rating**Max. switching power = 150W,
600 VAMax. switching voltage = 250
Vac or 30 Vdc

Max. switching current = 5A

Min. voltage/current = 5 Vdc,
0.1 A**Power Supply Cable****Material:** PVC**Length:** Six (6)**Gauge:** Five (5) Wire 20 Gauge**Fiber Optic Cable****Type:** Flexible Optic Cable**Material:** Stainless Steel**4.10.3 PRESSURE SWITCH**

Sub-Mini-Hermet pressure switches (Figure 18) are factory preset (tamper proof). These field mounted instruments are suited for compact areas and hostile environments. A UL Listed and CSA Certified hermetically sealed explosion proof steel switch capsule is provided in a rugged cast housing. The housing and switch capsule are standard 316SS. See specifications.

Table 5. Pressure Switch

Range		Typical Dead Band		Overrange		Proof	
psi	bar	psi	bar	psi	bar	psi	bar
6-8	0.4-1.2	3	0.2	1500	103.4	2500	172.4

NOTE

- Dead band values are expressed as typical expected at mid-range.
- Metric bar values are conservative.

- They are practical equivalents of the reference English values; not exact mathematical conversions.

**Figure 18. Pressure Switch.****Order Number**

6AT-EF19-M4-CIA-TT

Comes with SS oversized
tag, permanently attached.**Overrange**

The maximum input pressure that can be continuously applied to the pressure switch without causing permanent change of set point, leakage, or material failure.

Proof Pressure

The maximum input pressure that can be continuously applied to the pressure switch without causing leakage or catastrophic material failure. permanent change of set points may occur, or the device may be rendered inoperative.

SPECIFICATIONS**Housing**

Type

- Contains explosion-proof hermetically sealed switching element. See electrical service. class I, Groups A, B, C, D; class II, groups E, F, G; Divisions 1 & 2.
- Weather tight, NEMA 4, 4X, IP65

Material

- 316SS

Wetted Materials (Note 1)

- Primary Diaphragm: 316SS
- O-ring: Viton

- Pressure Port: 1/4 NPT (F) 316SS

Electrical Connection

- 1/2 NPT(M); 18 in. (458 mm) stranded wire leads, 18-AWG color-coded and marked.

Temperature Limits

- Process: 32° to 400° F (0° to 204° C)
- Ambient: -40° to 167° F (-40° to 75° C)

Electrical Service (Notes 2 and 3)

- For DPDT contact form, replace EF in model number with EG. Multiply typical dead band by 2.
- 250 VAC - 5 amp
- 30 VDC - 5 amp
- 125 VDC - 0.5 amp

Shipping Weight

- Approximate 1 lb (0.5 kg)

Notes:

1. Other wetted materials and pressure port sizes are available. Consult your representative or the SOR representative in your area for more information.
2. The DC electrical ratings are for resistive loads only. DC ratings are not agency approved or listed but have been verified by testing or experience.
3. The hermetically sealed switching element capsule is UL Listed, CSA Certified and SSA Approved as an explosion proof snap switch per the following table DIMENSIONS:.

Table 6. Agency Approvals

Agency	Hazardous Location Conditions
UL Listed	Class I, Group A, B, C, & D
CSA Certified	Class II, Group E, F, & G Division 1 & 2
SAA Approved	Ex s IIC T6 for Class I, Zone 1 DIP Type B 80° C for Class II, Div. 1 & 2

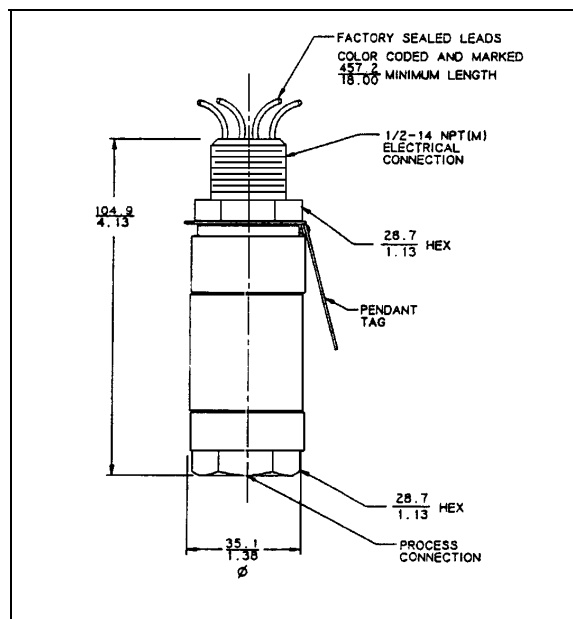


Figure 19. Pressure Switch Dimensions.

DIMENSIONS:

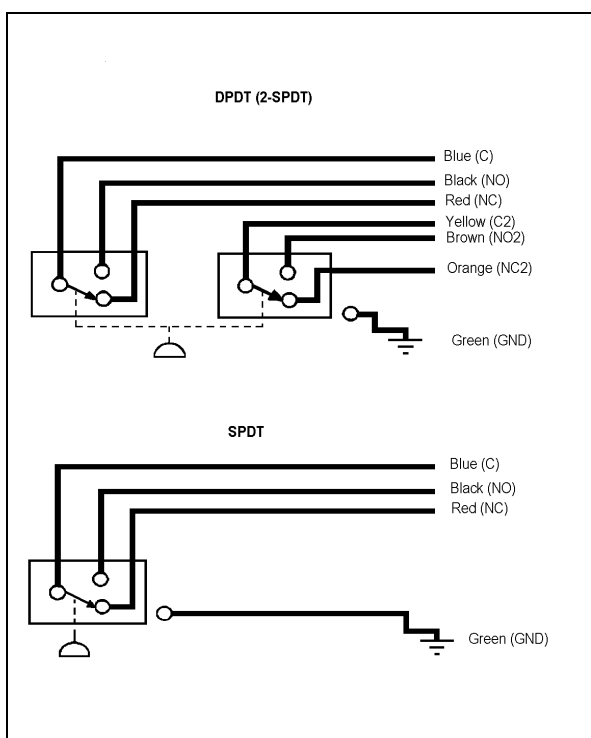
Linear = $\frac{\text{MM}}{\text{IN}}$

Dimensions (Figure 19) are for reference only. Contact the factory for certified drawings for a particular model number.

ELECTRICAL CONNECTION

Use a 1-1/8 in (29 mm) open-end wrench to hold the hex on the electrical connection while conduit or conduit fitting is being tightened.

The electrical switch element capsule assembly contains UL Listed and CSA Certified factory-sealed leads. A conduit seal is not required to preserve explosion proof integrity. Electrical leads are marked NC (normally Closed), NO (Normally Open) and C (Common). Electrical switching elements are snap-action and are either SPDT or DPDT (2-SPDT) set to actuate simultaneously (See diagram next page).



CAUTION

DO NOT USE A PIPE WRENCH OR STRAP WRENCH ON THE ROUND BODY OR AN OPEN-END WRENCH ON THE HEX PRESSURE PORT WHILE TIGHTENING THE CONDUIT CONNECTION, BECAUSE THE HERMETICALLY SEALED SWITCHING ELEMENT CAPSULE HAS BEEN PRECISELY POSITIONED AND LOCKED DURING MANUFACTURE. EXCESSIVE FORCE COULD OVERCOME THE LOCK AND CAUSE MOVEMENT WHICH WILL ADVERSELY AFFECT OPERATION OR RENDER THE PRESSURE SWITCH INOPERATIVE. SHOULD MOVEMENT OCCUR, FACTORY CALIBRATION MUST BE PERFORMED IN ORDER TO RESTORE NORMAL OPERATION.

4.10.4 Wiring, Optic Probe (Figure 20)

NEMA 4 Optic Probe Wiring Diagrams

Supplemental wiring diagrams issued for NEMA 7 applications:

Wire Color	Connection
Brown (L1)	Power input
Black (N/O)	Normally open relay connection
Yellow (C)	Relay common
White (N/C)	Normally closed relay connection
Blue (L2)	Power input

The use of black and yellow results in a normally opened contact and when tripped will close the circuit.

The use of white and yellow results in a normally closed contact and when tripped will open the circuit.

DC hookup is without regard to power supply polarity.

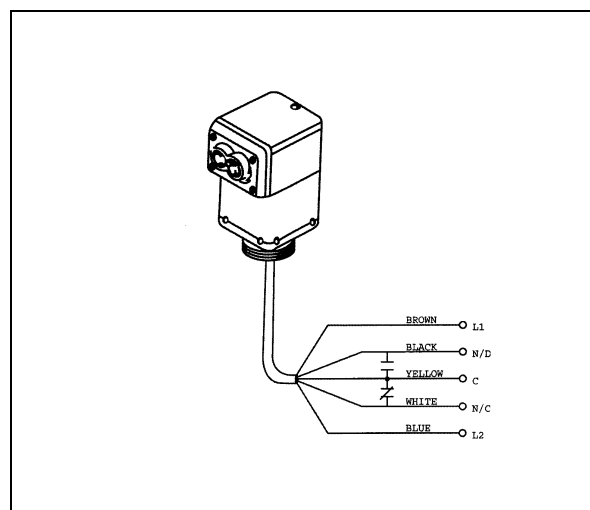


Figure 20. Optic Probe.

4.10.5 Operation

The Evolution Series metering pump leak detection package is designed to sense and indicate a diaphragm rupture. The standard package offers three means of indication.

The diaphragm cartridge is a double diaphragm configuration in which the diaphragms are phased together by evacuating all of the air between them.

A. Gauge Type

The first form of rupture indication is a visual reading of the supplied vacuum/pressure gauge. During normal operation the gauge indicates a vacuum of 20 inch HG to 0 psi. In the event of a diaphragm failure this gauge will indicate a positive pressure approximately equal to line pressure.

B. Pressure Switch

The second form of rupture indications is achieved through the use of a pressure switch. In the event of a diaphragm failure, process pressure will act on the pressure switch. The switch will then activate offering electrical interface per the specific switch specifications. The application of the pressure switch option must be reviewed to insure proper operation. The performance of the switch is improved as the process pressure increases. It is recommended a back-pressure valve be installed if the process pressure is less than 50 PSI. See the REACTION TIME vs. PRESSURE graph below.

C. Optic Probe

This third form of rupture indication is achieved through the use of an optic probe. The probe is inserted into a TEE which is mounted directly to the pump head. In the event of a diaphragm failure fluid will be forced into the TEE. The Optic probe will then be activated. Two forms of notification are standard with the optics package. The red LED on the sensor body and the relay interface will both activate upon diaphragm failure. The optics package is the quickest form of diaphragm rupture detection available. This option is especially useful for low pressure applications. See the REACTION TIME vs. PRESSURE graph below.

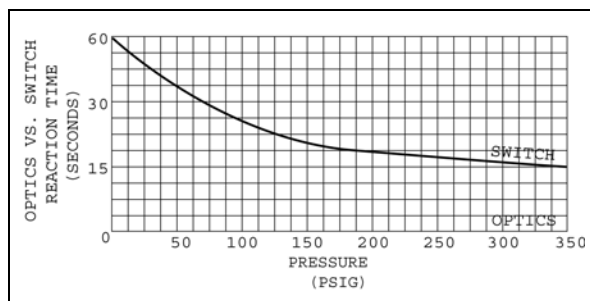


Figure 21. Reaction Time VS Pressure.

4.10.6 Start Up

EV pumps equipped with leak detection come from the factory fully assembled and tested. However, certain pre-start up steps are necessary to ensure proper operation.

1. Disconnect all power supplies to the pump.
2. If equipped with either pressure switch or optics probe, wire per appropriate wiring diagram.
3. Loosen the bleeder located on the face of the liquid head. See Figures 23 & 24.
4. Draw a 20-30 inch Hg vacuum on the bleeder with a vacuum pump. Retighten the bleeder to maintain the vacuum. A hand type vacuum pump works adequately.

NOTE

The vacuum will decay to 0 PSIG over time. Diaphragm failure is indicated by pressures greater than 0 PSIG.

5. Refer to Section 3, Operation for standard pump start up procedures.

4.10.7 Conversion

The instructions below cover all the necessary steps require to convert a single diaphragm EV to a double diaphragm pump with leak detection.

The double diaphragm assembly is available for all liquid head and plunger body configurations. Conversion assembly and operation is similar for all types.

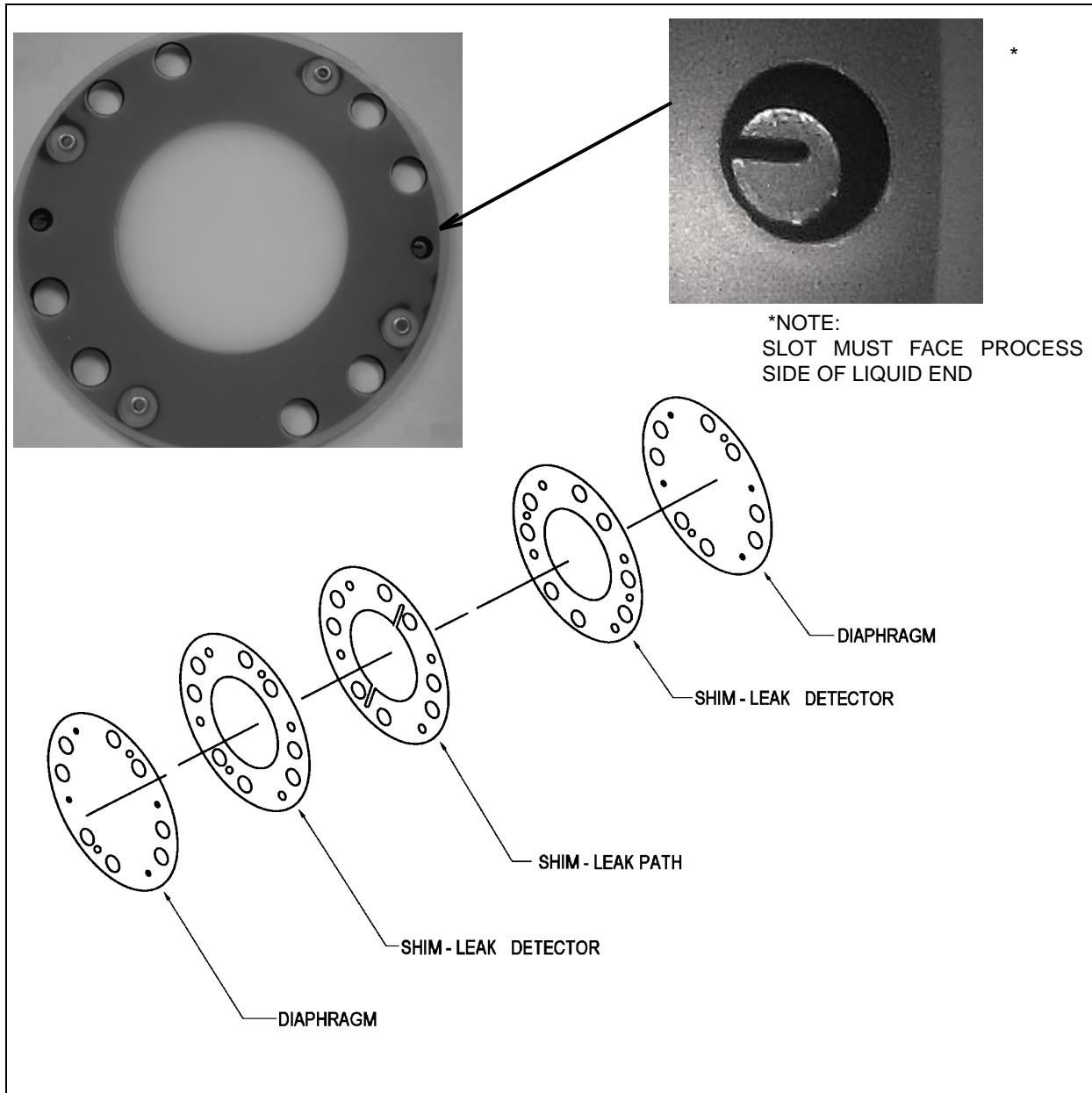
NOTE

To properly install a leak detection package on a pump the liquid head must contain the drilled porting to accept the bleeder and TEE assembly and utilize a full face diaphragm. (The diaphragm will contain holes for liquid head retaining bolts).

If your pump is not configured in this fashion, consult your representative for a list of parts required for the conversion.

A. Liquid Head and Diaphragm

1. Remove power to the drive motor and ensure that all line pressure has dissipated. Flush the pump thoroughly and remove all process piping to the pump.
2. Remove the liquid head by removing eight (8) cap screws. Place a catch pan under the plunger body to catch any hydraulic oil retained in the plunger body.
3. Remove the diaphragm. If adhered to plunger body, use a soft pry tool to remove. Do not scratch the sealing surface.
4. Install the double diaphragm cartridge. See Figure 22 for proper alignment.

**Figure 22. Diaphragm Assembly.**

WARNING

IF THE DIAPHRAGM IS NOT INSTALLED PROPERLY THEN A FAILURE WILL NOT BE DETECTED. DAMAGE TO THE PUMP AND INJURY TO PERSONNEL MAY OCCUR.

5. Install the liquid head and diaphragm cartridge to the plunger body, arrow on face pointing

upward, and torque the cap screws to rating as indicated Table 3.

B. Piping

1. Assemble components as shown in Figures 23 & 24. Be sure all connections are adequately tightened to prevent leaks. Use TFE based pipe sealant for best results.

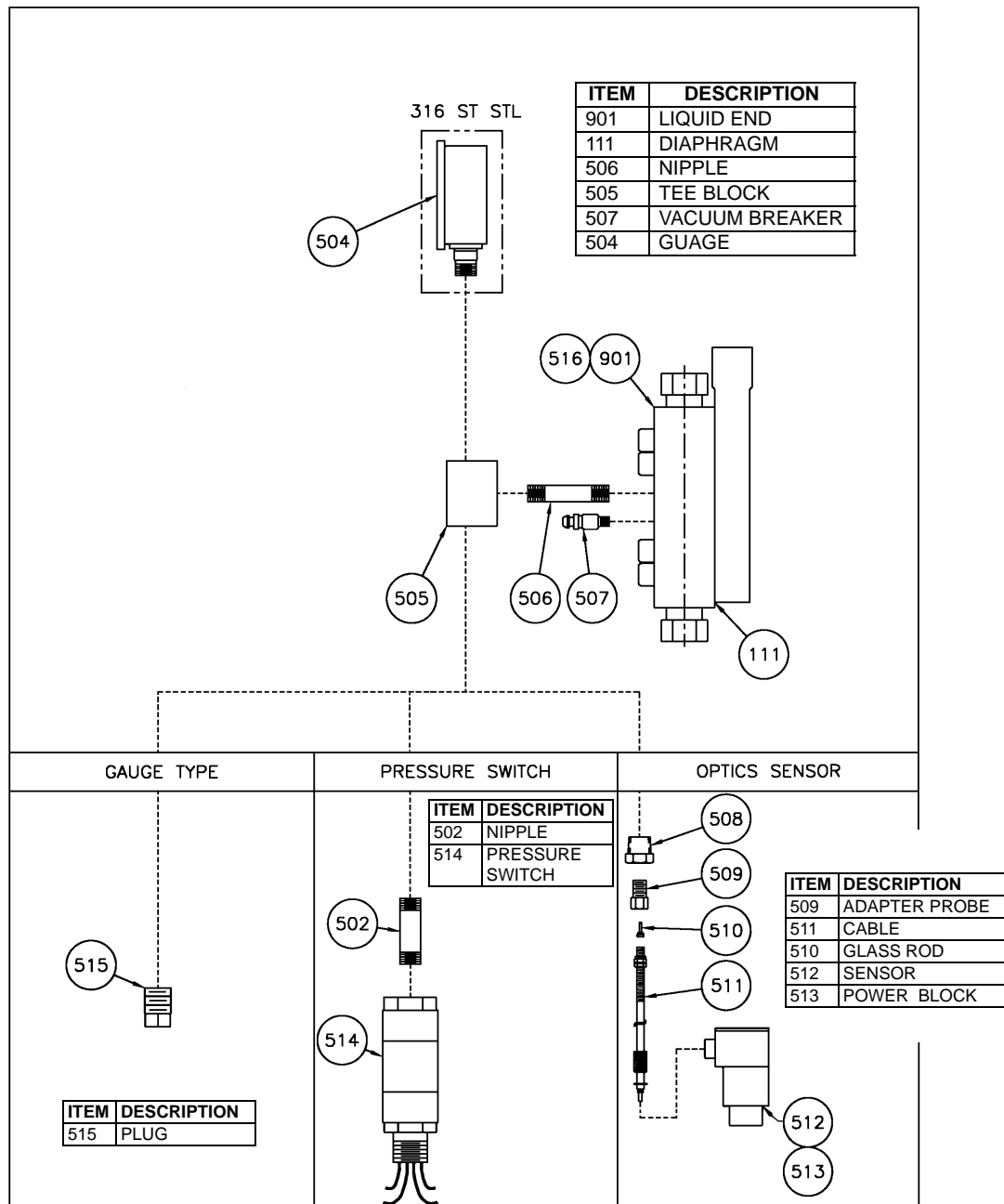


Figure 23. Metallic Leak Detection.

2. Attach assembled parts and vacuum bleeder to head.

C. Fiber Optic Cable

1. Install o-ring over glass probe and insert into probe adapter. See Figures 23 & 24.
2. Place jam nuts and gasket on probe end of cable.

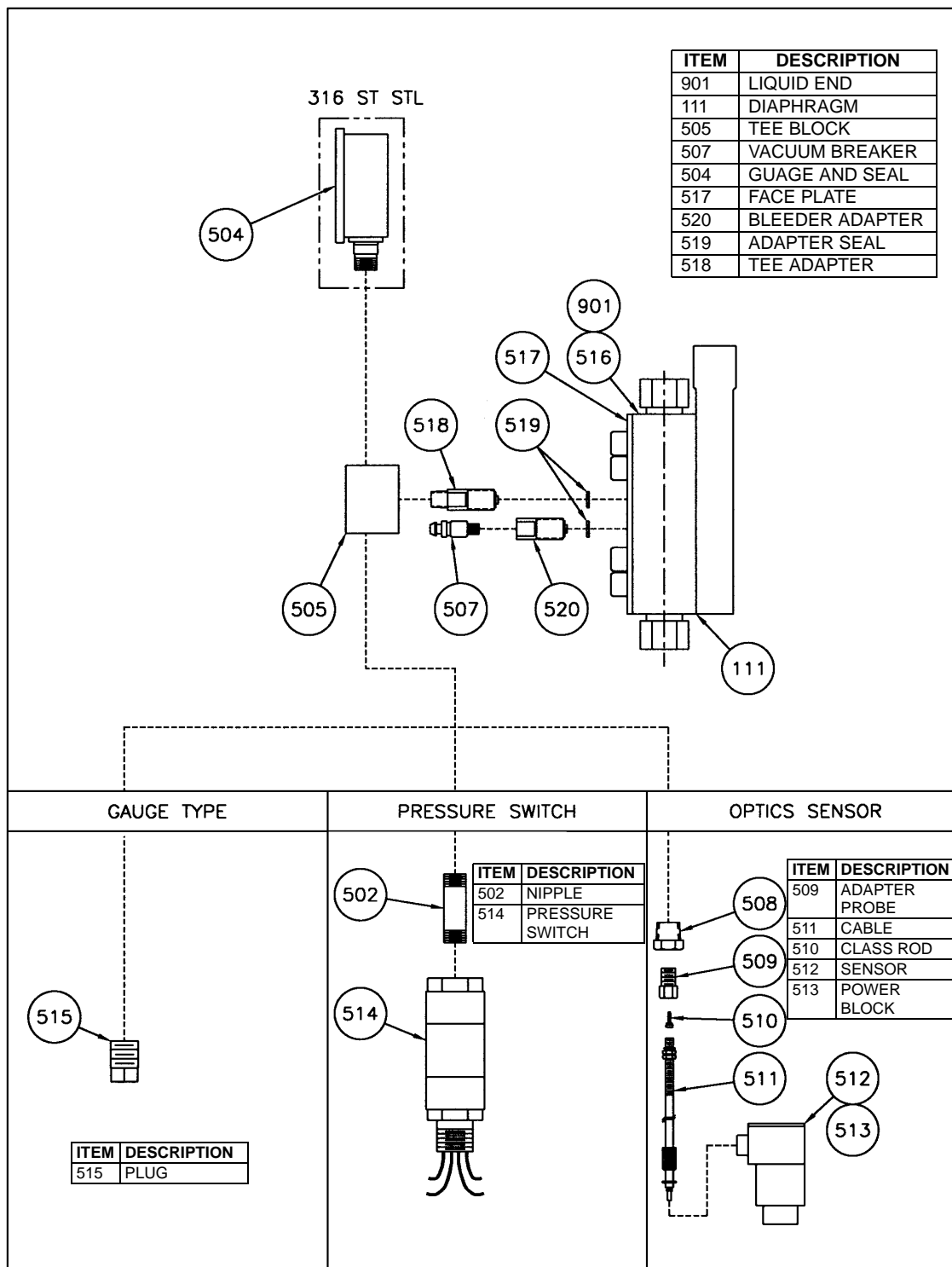


Figure 24. Non-Metallic Leak Detection.

3. Thread adapter onto cable to compress o-ring. Secure with jam nuts.
4. Install fiber bolts, c-rings and o-rings to both sensor ends of cable.

D. Sensor

1. Plug sensor into power block. Be sure to properly align four (4) connecting pins. Secure with four (4) flat head screws.
2. Mount sensor, utilizing sensor bracket to side of pump.

E. Final Assembly

1. Attach sensor end of cable into "TEE". Allow cable to rotate freely while threading adapter. Tighten securely.
2. Route cable. Be sure not to force cable into any sharp bends.
3. Install both cable connections into sensor. Secure with fiber bolts.
4. Wire sensor per Figure 20.

4.10.8 Calibration

The only calibration necessary for the Leak Detection System is the adjustment of the sensitivity pot on the optics type leak detection options.

1. Remove sensor ends of cable. Carefully' unthread probe end from TEE.
2. Remove sensor cover by unthreading flat head screw to access sensitivity pot.
3. Energize unit with proper supply voltage.
4. While probe is exposed to air, red LED indicator should be lit. Adjust pot clockwise to reduce sensitivity until LED is illuminated.
5. To properly adjust sensitivity and test operation, immerse probe into small amount of liquid. When probe contacts liquid, sensor should light and relay activate. if liquid is not sensed by probe, adjust pot counterclockwise to increase sensitivity.
6. Repeat test operation until liquid is sensed as soon as probe contacts liquid.

NOTE

Be sure to thoroughly dry probe between tests.

To increase sensitivity - adjust pot counterclockwise.

To decrease sensitivity - adjust pot clockwise.

SECTION 5 TROUBLESHOOTING

No Flow	<ul style="list-style-type: none"> • Motor not operating - 1. Check motor wiring 2. Check for power. • Suction or discharge valve not open completely - Ensure valves are completely open. • Velocity too low with slurries - Decrease pipe ID. • Vapor lock in suction line or liquid head - 1. Bleed vapor out of pipe and/or pump. 2. Check NPSH. • Line, strainer, or check valves clogged - 1. Ensure lines, fittings, and strainers are clean. 2. Flush slurries and increase filter maintenance on precipitating products. • Hydraulics not primed - Re-prime hydraulics. • Improper action of pressure relief - Inspect and adjust relief valve.
Low Flow	<ul style="list-style-type: none"> • Motor speed wrong - Check motor tag vs. pump tag. • Motor operating at wrong frequency - Check motor tag vs. pump tag. • Velocity too low with slurries - Decrease pipe ID. • Suction line leak - Ensure tight connections. • High velocity in suction or discharge line - 1. Increase pipe ID. 2. Calculate NPSH • Line, strainer, or check valves clogged - 1. Ensure lines, fittings, and strainers are clean. 2. Flush slurries and increase filter maintenance on precipitating products. • Hydraulics not primed - Re-prime hydraulics. • Piston seal worn - Renew seal. • Punctured Diaphragm - 1. DISASSEMBLE PUMP 2. Replace Diaphragm. 3. Thoroughly check for gear box contamination or damage. • Insufficient NPSH (Starved Suction) - Calculate NPSH. • Gear box oil contaminated - 1. Change oil. 2. Replace filter. 3. Find possible contamination path. • Improper action of pressure relief - Inspect and adjust relief valve. • Improper action of replenishment valve - Inspect, repair, or replace valve. • Improper assembly of stroke adjuster - Inspect and realign.
Erratic Flow	<ul style="list-style-type: none"> • Erratic motor speed - 1. Check motor wiring 2. Check supply power. • Velocity too low with slurries - Decrease pipe ID. • Suction line leak - Ensure tight connections. • Pump not mounted level (Airbound) - Shim base plate. • Pressure on suction varying - Ensure stable suction conditions for accurate pumping. • High velocity in suction or discharge line - 1. Increase pipe ID. 2. Calculate NPSH • Line, strainer, or check valves clogged - 1. Ensure lines, fittings, and strainers are clean. 2. Flush slurries and increase filter maintenance on precipitating products. • Hydraulics not primed - Re-prime hydraulics. • Piston seal worn - Renew seal. • Punctured Diaphragm - 1. DISASSEMBLE PUMP 2. Replace Diaphragm. 3. Thoroughly check for gear box contamination or damage. • Insufficient NPSH (Starved Suction) - Calculate NPSH. • Insufficient differential pressure - Install back pressure valve. • Gear box oil contaminated - 1. Change oil. 2. Replace filter. 3. Find possible contamination path. • Improper action of pressure relief - Inspect and adjust relief valve. • Improper action of replenishment valve - Inspect, repair, or replace valve.

Flow Gradually Drops	<ul style="list-style-type: none"> • Velocity too low with slurries - Decrease pipe ID. • Suction line leak - Ensure tight connections. • Vapor lock in suction line or liquid head - 1. Bleed vapor out of pipe and/or pump. 2. Check NPSH. • Pump not mounted level (Airbound) - Shim base plate. • Line, strainer, or check valves clogged - 1. Ensure lines, fittings, and strainers are clean. 2. Flush slurries and increase filter maintenance on precipitating products. • Piston seal worn - Renew seal. • Low oil level - Fill gear box and find leak path. • Gear box oil contaminated - 1. Change oil. 2. Replace filter. 3. Find possible contamination path. • Hydraulics air bound - Clean or replace air bleed valve. • Improper action of replenishment valve - Inspect, repair, or replace valve.
Uncontrollable Flow	<ul style="list-style-type: none"> • Erratic motor speed - 1. Check motor wiring 2. Check supply power. • Velocity too low with slurries - Decrease pipe ID • Pressure on suction varying - Ensure stable suction conditions for accurate pumping. • High velocity in suction or discharge line - 1. Increase pipe ID. 2. Calculate NPSH • Line, strainer, or check valves clogged - 1. Ensure lines, fittings, and strainers are clean. 2. Flush slurries and increase filter maintenance on precipitating products. • Piston seal worn - Renew seal. • Insufficient differential pressure - Install back pressure valve. • Improper action of replenishment valve - Inspect, repair, or replace valve. • Improper assembly of stroke adjuster - Inspect and realign.
High Flow	<ul style="list-style-type: none"> • Motor speed wrong - Check motor tag vs. pump tag. • Motor operating at wrong frequency - Check motor tag vs. pump tag. • Pressure on suction varying - Ensure stable suction conditions for accurate pumping. • High velocity in suction or discharge line - 1. Increase pipe ID. 2. Calculate NPSH • Insufficient differential pressure - Install back pressure valve.
Check Valve Chatter	<ul style="list-style-type: none"> • Suction or discharge valve not open completely - Ensure valves are completely open. • Pump not mounted level (Airbound) - Shim base plate. • Pressure on suction varying - Ensure stable suction conditions for accurate pumping. • High velocity in suction or discharge line - 1. Increase pipe ID. 2. Calculate NPSH • Line, strainer, or check valves clogged - 1. Ensure lines, fittings, and strainers are clean. 2. Flush slurries and increase filter maintenance on precipitating products. • Insufficient NPSH (Starved Suction) - Calculate NPSH. • Insufficient differential pressure - Install back pressure valve.
Excessive Gear Box Noise	<ul style="list-style-type: none"> • Motor speed wrong - Check motor tag vs. pump tag. • Punctured Diaphragm - 1. DISASSEMBLE PUMP 2. Replace Diaphragm. 3. Thoroughly check for gear box contamination or damage. • Low oil level - Fill gear box and find leak path. • Gear box oil contaminated - 1. Change oil. 2. Replace filter. 3. Find possible contamination path. • Worn gearing or bearings. - 1. Replace gears or bearings. 2. Locate cause of possible damage. • Leaking gaskets on gear box - 1. Replace gaskets. 2. Look for possible damage.

Pipe Hammer	<ul style="list-style-type: none"> • Suction or discharge valve not open completely - Ensure valves are completely open. • High velocity in suction or discharge line - 1. Increase pipe ID. 2. Calculate NPSH • Insufficient NPSH (Starved Suction) - Calculate NPSH.
Motor Over-heating or Noisy	<ul style="list-style-type: none"> • Motor speed wrong - Check motor tag vs. pump tag. • Motor operating at wrong frequency - Check motor tag vs. pump tag. • Punctured Diaphragm - 1. DISASSEMBLE PUMP 2. Replace Diaphragm. 3. Thoroughly check for gear box contamination or damage. • Low oil level - Fill gear box and find leak path. • Gear box oil contaminated - 1. Change oil. 2. Replace filter. 3. Find possible contamination path. • Worn gearing or bearings. - 1. Replace gears or bearings. 2. Locate cause of possible damage. • Leaking gaskets on gear box - 1. Replace gaskets. 2. Look for possible damage.
Oil Level Drops	<ul style="list-style-type: none"> • Punctured Diaphragm - 1. DISASSEMBLE PUMP 2. Replace Diaphragm. 3. Thoroughly check for gear box contamination or damage. • Leaking gaskets on gear box - 1. Replace gaskets. 2. Look for possible damage.

SECTION 6 PARTS LIST

6.1 GENERAL

1. This section gives information regarding replaceable components. The parts lists begin with A size heads followed with B size heads and ending with parts common to both heads.

6.2 ILLUSTRATED PARTS LIST

1. Figure and Item Number Column

- a) The item numbers shown in the detailed parts list correspond to the item numbers appearing on the exploded view illustration. To find an unknown part number, locate the part on the illustration and note the item number. Look for the item number on the detailed parts list. The part number is on the same line. A dash (-) precedes non-illustrated item numbers.

2. Description Column

- a) The name of the item is in the description column.

3. Part Number Column

- a) The supplier's part number is listed in the part number column.

4. Quantity Column

- a) The numbers appearing in the quantity column are the total quantity of the listed part required in its immediate assembly.

5. Reference Code Column

- a) This column is used to denote plunger size variations among similar components (models) covered by this publication. When the symbol "03D", "10D", "20D" etc. is entered in this column, the part is used only in the model at which the symbol appears. If the column lists ALL, the part is used in all models.

SIZE A HEADS

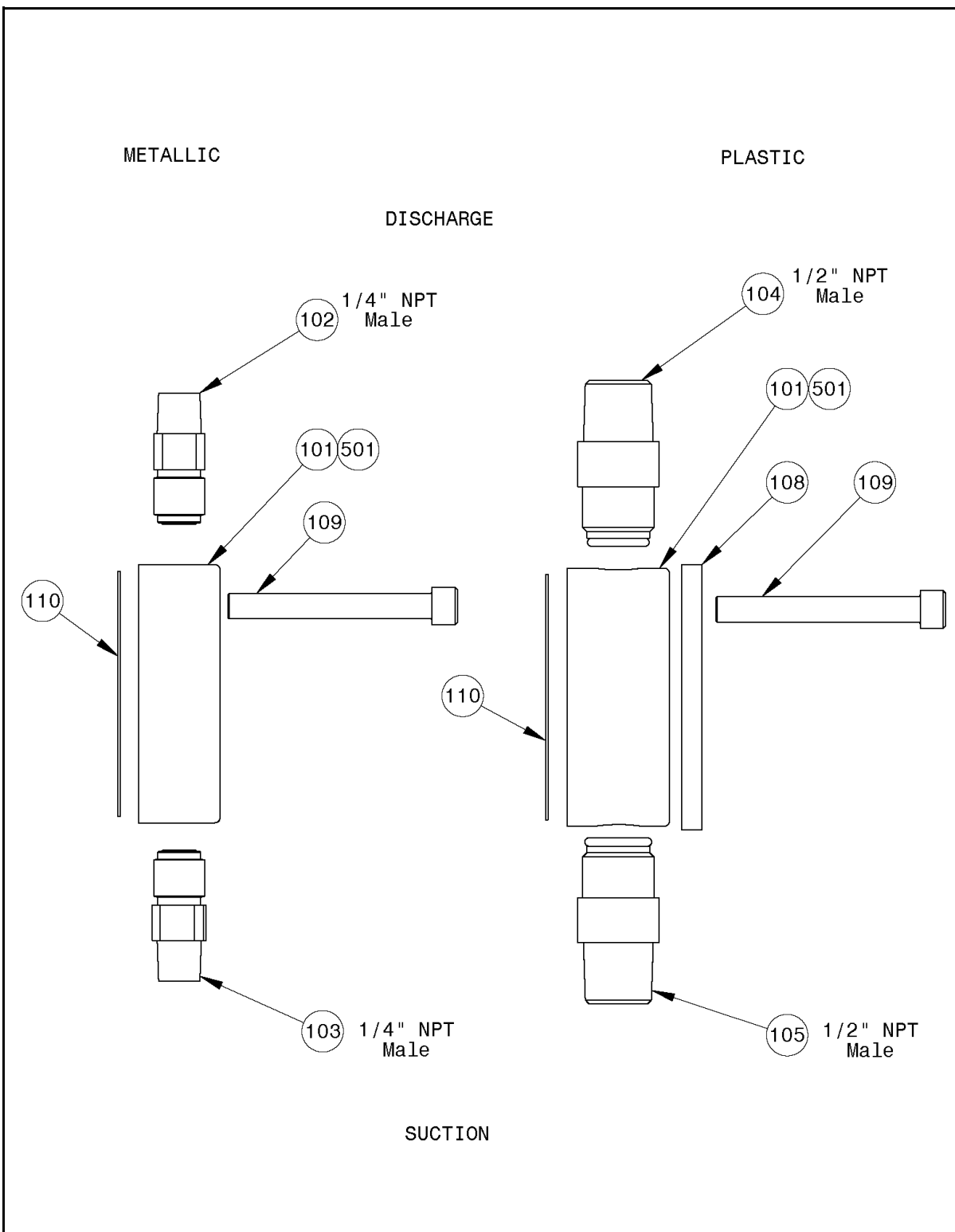


Figure 25. Liquid End Assembly, Size A.

6.3 LIQUID END ASSEMBLY COMPONENTS, SIZE A (316SS, Alloy 20, Hast C & PVC) (FIGURE 25)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
LIQUID END				
101	Liquid Head Size A, 316SS	6022A-SS	1	03D,04D,06D
	Liquid Head Size A, Alloy 20	6022A-A2	1	03D,04D,06D
	Liquid Head Size A, Hast C	6022A-HC	1	03D,04D,06D
	Liquid Head Size A, PVC	22400	1	03D,04D,06D
	Liquid Head Size A, Kynar	22418	1	03D,04D,06D
501	Liquid Head Size A, Leak Detection, 316SS	6022AL-SS	1	03D,04D,06D
	Liquid Head Size A, Leak Detection, Alloy 20	6022AL-A2	1	03D,04D,06D
	Liquid Head Size A, Leak Detection, Hast C	6022AL-HC	1	03D,04D,06D
	Liquid Head Size A, Leak Detection, PVC	22417	1	03D,04D,06D
	Liquid Head Size A, Leak Detection, Kynar	22419	1	03D,04D,06D
NON-METALLIC LIQUID END SUPPORT RING				
108	Stiffner Plate Size A	60220600	1	03D,04D,06D
DIAPHRAGM				
110	Diaphragm Size A, Gylon	60330200	1	03D,04D,06D
	Diaphragm Assy Size A, Leak Detection, Gylon	60330400	1	03D,04D,06D
METALLIC CHECK VALVE, DISCHARGE (DOUBLE BALL ONLY)				
102	Metallic Check Valve Assy (316SS), Discharge	30734	1	03D,04D,06D
	Metallic Check Valve Assy (CA-20), Discharge	30723	1	03D,04D,06D
	Metallic Check Valve Assy (HC-22), Discharge	30736	1	03D,04D,06D
METALLIC CHECK VALVE, SUCTION (DOUBLE BALL ONLY)				
103	Metallic Check Valve Assy (316SS), Suction	30733	1	03D,04D,06D
	Metallic Check Valve Assy (CA-20), Suction	30722	1	03D,04D,06D
	Metallic Check Valve Assy (HC-22), Suction	30735	1	03D,04D,06D
PLASTIC CHECK VALVE, DISCHARGE (DOUBLE BALL ONLY)				
104	Plastic Check Valve Assy (PVC), Discharge	22421	1	03D,04D,06D
	Plastic Check Valve Assy (Kynar), Discharge	22423	1	03D,04D,06D
PLASTIC CHECK VALVE, SUCTION (DOUBLE BALL ONLY)				
105	Plastic Check Valve Assy (PVC), Suction	22420	1	03D,04D,06D
	Plastic Check Valve Assy (Kynar), Suction	22422	1	03D,04D,06D
LIQUID END BOLT				
109	Liquid Head Bolt (Metallic)	90223508HT	8	03D,04D,06D
	Liquid Head Bolt (Plastic)	41491	8	03D,04D,06D

- Items not shown.

6.4 LIQUID END ASSEMBLY, SIZE A (FIGURE 25)

	DESCRIPTION	PART NUMBER	PLUNGER CODE
COMPLETE LIQUID END ASSEMBLY			
SIZE A: 3/16, 1/4, & 3/8 PLUNGER			
	L. E. Assembly, 316SS	6071-A-SS-SS	03D,04D,06D
	L. E. Assembly, 316SS/Leak Detection/Gage Type	6071-A-SS-SS-G	03D,04D,06D
	L. E. Assembly, 316SS/Leak Detection/Pressure Switch	6071-A-SS-SS-P	03D,04D,06D
	L. E. Assembly, 316SS/Leak Detection/Optic Sensor	6071-A-SS-SS-S	03D,04D,06D
	L. E. Assembly, Alloy 20	6071-A-A2-CR	03D,04D,06D
	L. E. Assembly, Alloy 20/Leak Detection/Gage Type	6071-A-A2-CR-G	03D,04D,06D
	L. E. Assembly, Alloy 20/Leak Detection/Pressure Switch	6071-A-A2-CR-P	03D,04D,06D
	L. E. Assembly, Alloy 20/Leak Detection/Optic Sensor	6071-A-A2-CR-S	03D,04D,06D
	L. E. Assembly, Hast C	6071-A-HC-HC	03D,04D,06D
	L. E. Assembly, Hast C/Leak Detection/Gage Type	6071-A-HC-HC-G	03D,04D,06D
	L. E. Assembly, Hast C/Leak Detection/Pressure Switch	6071-A-HC-HC-P	03D,04D,06D
	L. E. Assembly, Hast C/Leak Detection/Optic Sensor	6071-A-HC-HC-S	03D,04D,06D
	L. E. Assembly, PVC	6071-A-PV-CR	03D,04D,06D
	L. E. Assembly, PVC/Leak Detection/Gage Type	6071-A-PV-CR-G	03D,04D,06D
	L. E. Assembly, PVC/Leak Detection/Pressure Switch	6071-A-PV-CR-P	03D,04D,06D
	L. E. Assembly, PVC/Leak Detection/Optic Sensor	6071-A-PV-CR-S	03D,04D,06D
	L. E. Assembly, Kynar	6071-A-KN-CR	03D,04D,06D
	L. E. Assembly, Kynar/Leak Detection/Gage Type	6071-A-KN-CR-G	03D,04D,06D
	L. E. Assembly, Kynar/Leak Detection/Pressure Switch	6071-A-KN-CR-P	03D,04D,06D
	L. E. Assembly, Kynar/Leak Detection/Optic Sensor	6071-A-KN-CR-S	03D,04D,06D

- Items not shown.

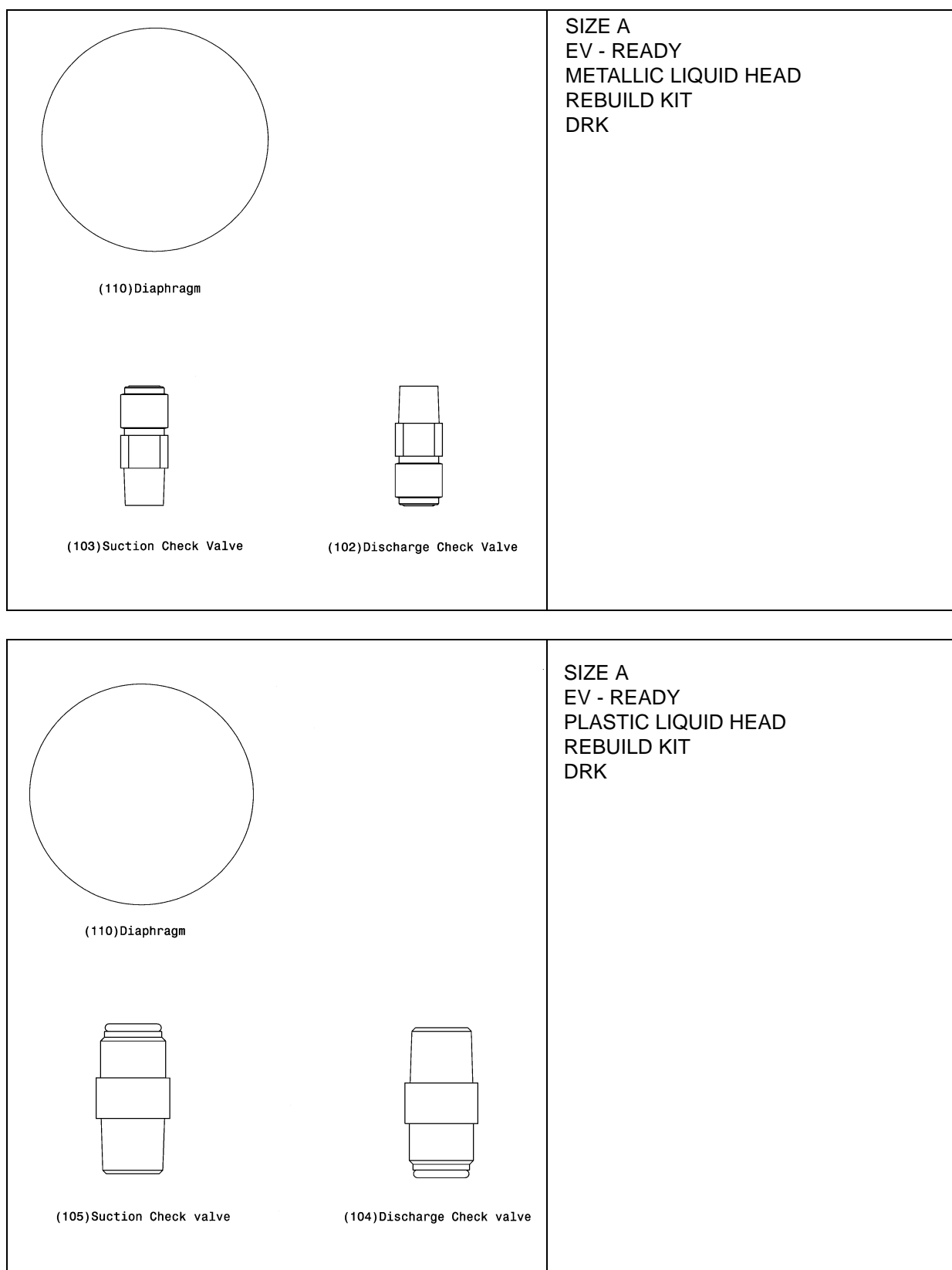


Figure 26. Metallic/Plastic Rebuild Kit, Size A.

6.5 METALLIC/PLASTIC REBUILD KIT, SIZE A (FIGURE 26)

DESCRIPTION	PART NUMBER	PLUNGER CODE
LIQUID END REBUILD KITS SIZE A		
Rebuild Kit, 316SS	DRK100	03D,04D,06D
Rebuild Kit, 316SS, Leak Detection	DRK101	03D,04D,06D
Rebuild Kit, Hast C	DRK102	03D,04D,06D
Rebuild Kit, Hast C, Leak Detection	DRK103	03D,04D,06D
Rebuild Kit, Alloy 20	DRK104	03D,04D,06D
Rebuild Kit, Alloy 20, Leak Detection	DRK105	03D,04D,06D
Rebuild Kit, PVC	DRK106	03D,04D,06D
Rebuild Kit, PVC, Leak Detection	DRK107	03D,04D,06D
Rebuild Kit, Kynar	DRK108	03D,04D,06D
Rebuild Kit, Kynar, Leak Detection	DRK109	03D,04D,06D
PLUNGER BODY REBUILD KITS EVA SIZE A		
3/16 Rebuild Kit	60766300	03D
1/4 Rebuild Kit	60760200	04D
3/8 Rebuild Kit	60760300	06D
3/16 Rebuild Kit, Leak Detection	60766300LD	03D
1/4 Rebuild Kit, Leak Detection	60760200LD	04D
3/8 Rebuild Kit, Leak Detection	60760300LD	06D
STROKE ADJUSTER REBUILD KIT		
Manual stroke adjuster rebuild kit	6076MN01	ALL

- Items not shown.

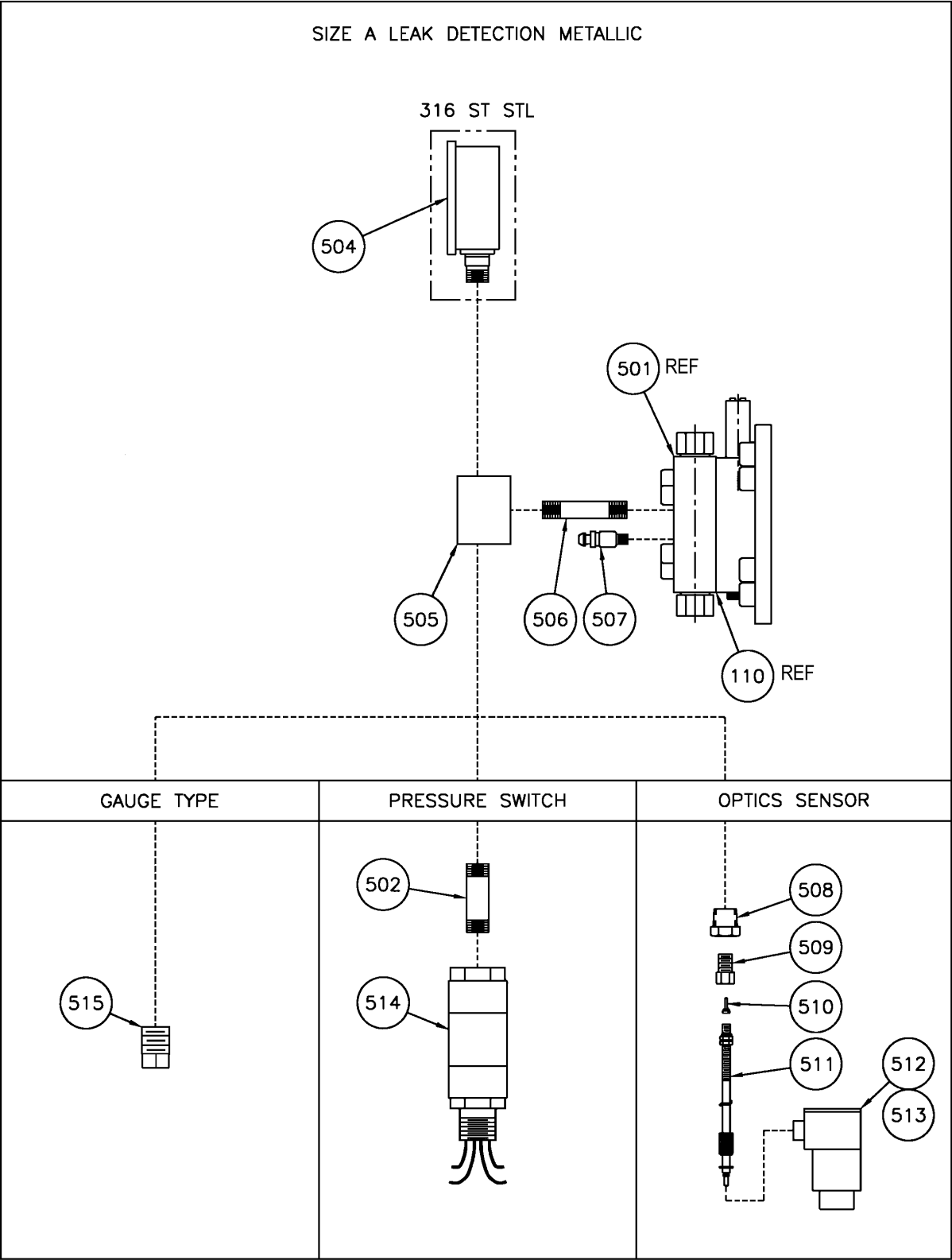


Figure 27. Metallic Leak Detection, Size A.

6.6 METALLIC LEAK DETECTION, SIZE A (316SS, ALLOY 20 & HAST C) (FIGURE 27)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
GAUGE STYLE				
504	Leak Detection Gauge, 30" HG - 300 PSI	9MG2201010	1	03D,04D,06D
505	Leak Detection Tee Block, 316SS	61230400008	1	03D,04D,06D
506	Leak Detection Nipple, 1/8" X 2" Long, 316SS	9702106010	1	03D,04D,06D
507	Leak Detection Vacuum Breaker, 316SS	61230200008	1	03D,04D,06D
515	Hex Head Plug 1/4" NPT, 316SS (Gauge Style Only)	9702204010	1	03D,04D,06D
PRESSURE SWITCH (WITH GAUGE STYLE ITEMS)				
502	Leak Detection Nipple, 1/4" X 2" Long, 316SS	9702107010	1	03D,04D,06D
514	Leak Detection Pressure Switch, 316SS	9842214010	1	03D,04D,06D
OPTICS SENSOR (WITH GAUGE STYLE ITEMS)				
508	Reducer Bushing, 1/4" X 1/8", 316SS	9702205010	1	03D,04D,06D
509	Leak Detection Adapter Probe, 316SS	61230300008	1	03D,04D,06D
510	Leak Detection Glass Rod	9842003000	1	03D,04D,06D
511	Leak Detection Cable	9842002000	1	03D,04D,06D
512	Leak Detection Sensor	9842001000	1	03D,04D,06D
513	Leak Detection Power Block	9842004000	1	03D,04D,06D

- Items not shown.

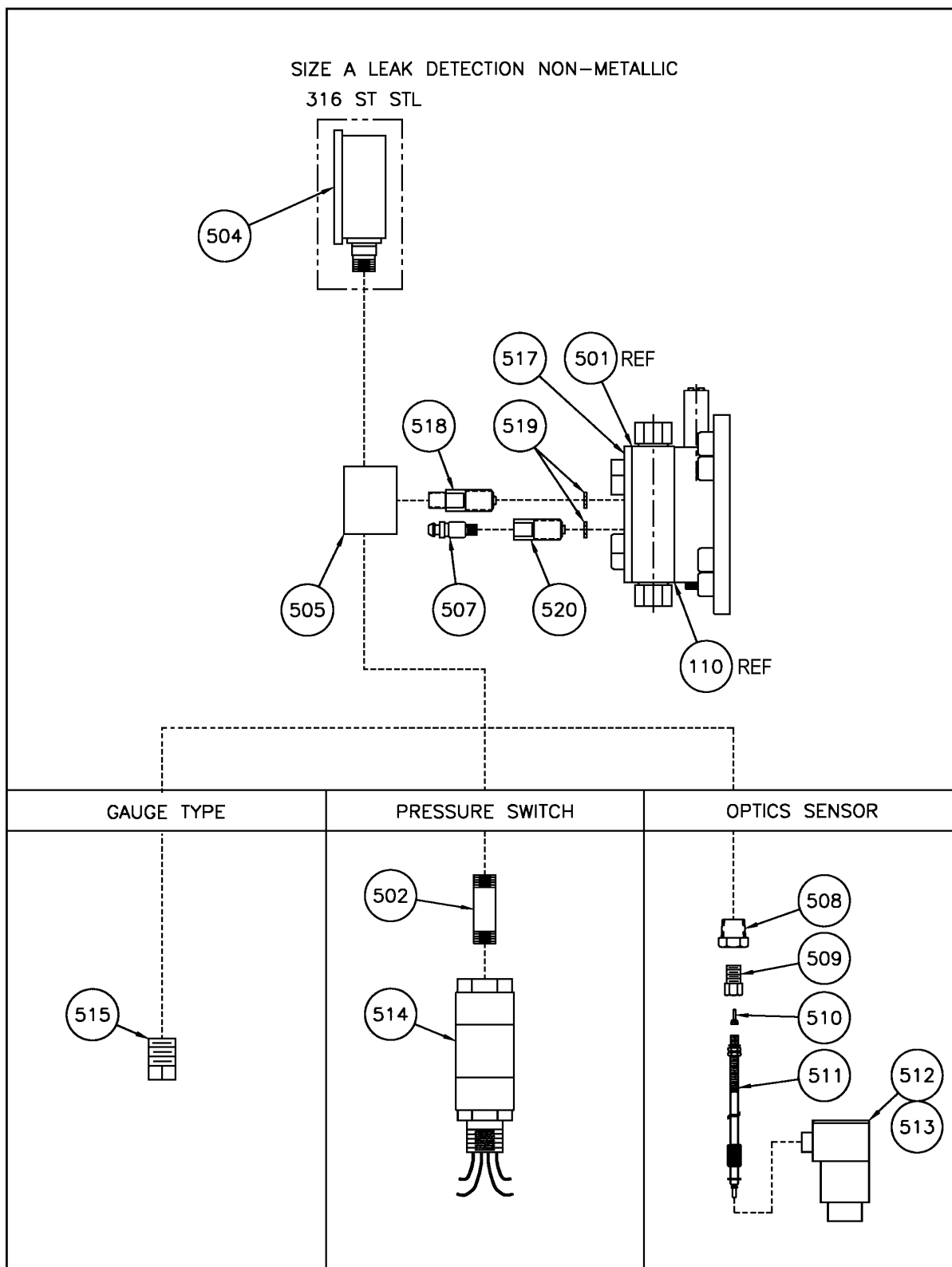


Figure 28. Non-Metallic Leak Detection, Size A.

6.7 NON-METALLIC LEAK DETECTION, SIZE A (PVC & KYNAR) (FIGURE 28)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
GAUGE STYLE				
504	Leak Detection Gauge, 30 HG - 300 PSI	9MG2201010	1	03D,04D,06D
505	Leak Detection Tee Block, 316SS	61230400008	1	03D,04D,06D
507	Leak Detection Vacuum Breaker, 316SS	61230200008	1	03D,04D,06D
515	Hex Head Plug 1/4" NPT, 316SS (Gauge Style Only)	9702102010	1	03D,04D,06D
517	Leak Detection Face Plate Size A, SS	60220600	1	03D,04D,06D
518	Leak Detection Tee Adapter, 316SS	61232000008	1	03D,04D,06D
519	Leak Detection Adapter Seal, Teflon	61435200	1	03D,04D,06D
520	Leak Detection Bleeder Adapter, 316SS	61232100008	1	03D,04D,06D
PRESSURE SWITCH (WITH GAUGE STYLE ITEMS)				
502	Leak Detection Nipple, 1/4" X 2" Long, 316SS	9702107010	1	03D,04D,06D
514	Leak Detection Pressure Switch, 316SS	9842214010	1	03D,04D,06D
OPTICS SENSOR (WITH GAUGE STYLE ITEMS)				
508	Leak Detection Adapter Probe, 316SS	9702205010	1	03D,04D,06D
509	Leak Detection Gauge,	61230300008	1	03D,04D,06D
510	Leak Detection Glass Rod	9842003000	1	03D,04D,06D
511	Leak Detection Cable	9842002000	1	03D,04D,06D
512	Leak Detection Sensor	9842001000	1	03D,04D,06D
513	Leak Detection Power Block	9842004000	1	03D,04D,06D

- Items not shown.

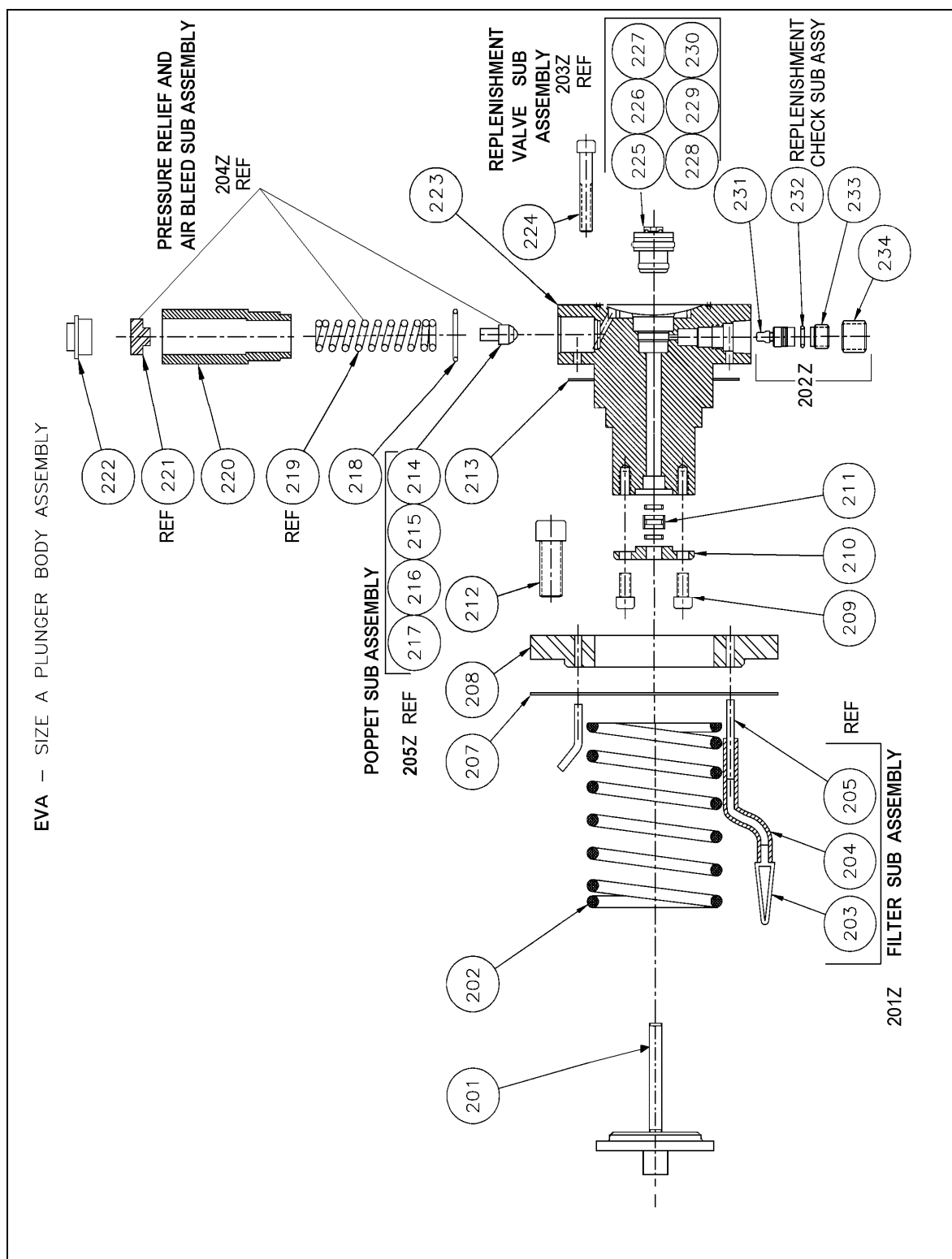


Figure 29. Plunger Body Assembly, Size A.

6.8 PLUNGER BODY ASSEMBLY COMPONENTS, SIZE A (FIGURE 29)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
PLUNGER				
201	3/16" Plunger	6001-03	1	03D
	1/4" Plunger	6001-04	1	04D
	3/8" Plunger	6001-06	1	06D
202	Return Spring	9372901740	1	03D,04D,06D
206	Sight Tube	60890100	1	03D,04D,06D
207	Plunger Body Adaptor Gasket	61430600	1	03D,04D,06D
208	Adaptor Plate	60230300	1	03D,04D,06D
209	Cap Screw, 10-24 x 0.5 LG	90222011CX	4	03D,04D,06D
SEAL CAP				
210	3/16" Seal Cap	6010-03	1	03D
	1/4" Seal Cap	6010-04	1	04D
	3/8" Seal Cap	6010-06	1	06D
211	3/16" Plunger Seal	9552217000	1	03D
	1/4" Plunger Seal	9552216000	1	04D
	3/8" Plunger Seal	9552303000	1	06D
212	Cap Screw, 3/8-16 X 1" LG	902230103	8	03D,04D,06D
213	Plunger Body Gasket	60430200	1	03D,04D,06D
218	Relief Valve Tower O-Ring	9520905410	1	03D,04D,06D
220	Relief Valve Tower	60230100	1	03D,04D,06D
222	Relief Valve Cap Plug	9102502560	1	03D,04D,06D
PLUNGER BODY				
223	3/16" Plunger Body	6002-03		03D
	1/4" Plunger Body	6002-04		04D
	3/8" Plunger Body	6002-06		06D

- Items not shown.

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
224	Cap Screw, 3/8-16 X 1" LG	90222171CX		03D,04D,06D
231	Replenishment Check VALVE	9MV2105000		03D,04D,06D
232	Replenishment Check VALVE Gasket	60430400		03D,04D,06D
233	Replenishment Check RETAINER	60170200		03D,04D,06D
234	Plug, 1/4" NPT	9702211010		03D,04D,06D

- Items not shown.

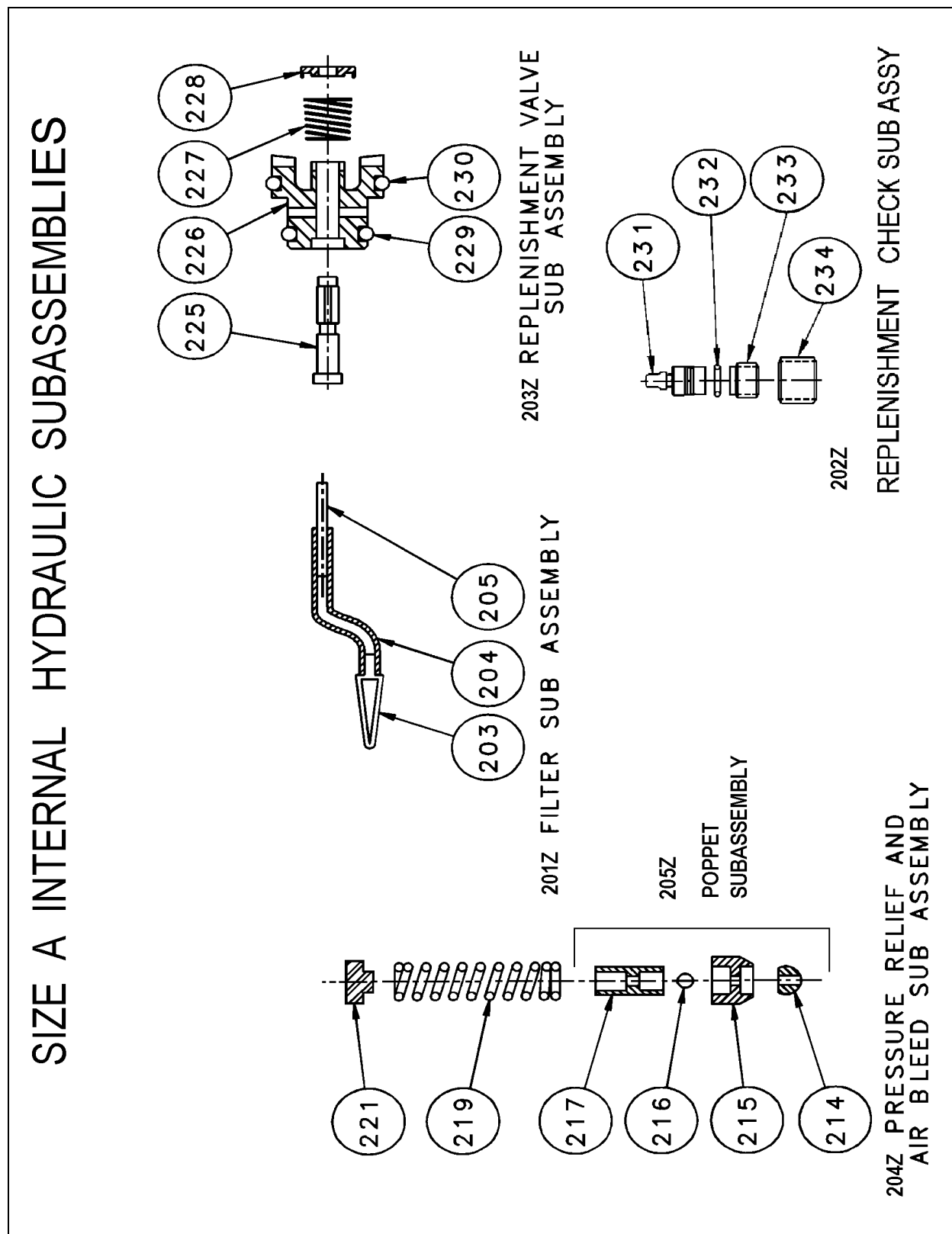


Figure 30. Internal Hydraulic Subassembly, Size A.

6.9 INTERNAL HYDRAULIC SUBASSEMBLIES, SIZE A (FIGURE 30)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
FILTER SUBASSEMBLY				
201Z	Filter Subassembly Contains Items: 203, 204, 205	60660100	1	03D,04D,06D
203	Filter	These Parts are Included in the Above Subassembly		03D,04D,06D
204	Tubing, 3/16" Dia.			03D,04D,06D
205	Roll Pin 3/16" Dia X 1-1/4" LG			03D,04D,06D
REPLENISHMENT CHECK SUBASSEMBLY				
202Z	Replenishment Valve Subassembly Contains Items: 231, 232, 233, 234	22607	1	03D,04D,06D
231	Check Valve	These Parts are Included in the Above Subassembly		03D,04D,06D
232	Check Valve Gasket			03D,04D,06D
233	Check Retainer			03D,04D,06D
234	Plug, 1/4" NPT			03D,04D,06D
REPLENISHMENT VALVE SUBASSEMBLY				
203Z	Replenishment Valve Subassembly Contains Items: 225, 226, 227, 228, 229, 230	60752000	1	03D,04D,06D
225	Valve Spool	These Parts are Included in the Above Subassembly		03D,04D,06D
226	Replenishment Valve Housing			03D,04D,06D
227	Replenishment Valve Spring			03D,04D,06D
228	Replenishment Valve Head			03D,04D,06D
229	Replenishment Valve O-Ring #12			03D,04D,06D
230	Replenishment Valve O-Ring #15			03D,04D,06D
PRESSURE RELIEF AND AIR BLEED SUBASSEMBLY				
204Z	Pressure Relief and Air Bleed Assembly Contains Items: 214, 215, 216, 217, 219, & 221	These Parts are Included in the Subassembly Ordered by Spring Number		03D,04D,06D
214	Poppet Ball			03D,04D,06D
215	poppet Body			03D,04D,06D
216	Air Bleed Ball			03D,04D,06D
217	Air Bleed Cap			03D,04D,06D
219	Relief Valve Spring			03D,04D,06D
	250 PSI Spring (P/N 9372301740)	60750100	1	03D,04D,06D
	251-900 PSI Spring (P/N 9372302740)	60750101	1	03D,04D,06D
	901-1300 PSI Spring (P/N 9372303740)	60750102	1	03D,04D,06D
	1301-1800 PSI Spring (P/N 9372304740)	60750103	1	03D,04D,06D
	1801-2300 PSI Spring (P/N 9372305740)	60750104	1	03D,04D,06D
	2301-3500 PSI Spring (P/N 9372306740)	60750105	1	03D,04D,06D
221	Relief Valve Adjusting Nut	These Parts are Included in the Subassembly Ordered by Spring Number		03D,04D,06D

- Items not shown.

EVA

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
POPPET SUBASSEMBLY				
205Z	Poppet Subassembly Contains Items: 214, 215, 216, & 217 listed above	60751000	1	03D,04D,06D

- Items not shown.

6.10 PLUNGER BODY ASSEMBLY, SIZE A (FIGURE 29 & 30)

ITEM	DESCRIPTION	PART NUMBER	PLUNGER CODE
	* Complete Plunger Body Assembly Contains All Plunger Body Assembly Components (Figure 29) and 5 Subassemblies (Figure 30).		
	3/16 Size A	6073-A-03-ES	03D
	1/4 Size A	6073-A-04-ES	04D
	3/8 Size A	6073-A-06-ES	06D

RELIEF VALVE SPRING

219	250 PSI Spring	9372301740	03D,04D,06D
	251-900 PSI Spring	9372302740	03D,04D,06D
	901-1300 PSI Spring	9372303740	03D,04D,06D
	1301-1800 PSI Spring	9372304740	03D,04D,06D
	1801-2300 PSI Spring	9372305740	03D,04D,06D
	2301-3500 PSI Spring	9372306740	03D,04D,06D

* WHEN ORDERING PLUNGER BODY ASSEMBLY, ORDER RELIEF VALVE SPRING ALSO. SPRING RANGES ARE RELIEF SET PRESSURE.

- Items not shown.

EVA

SIZE B HEADS

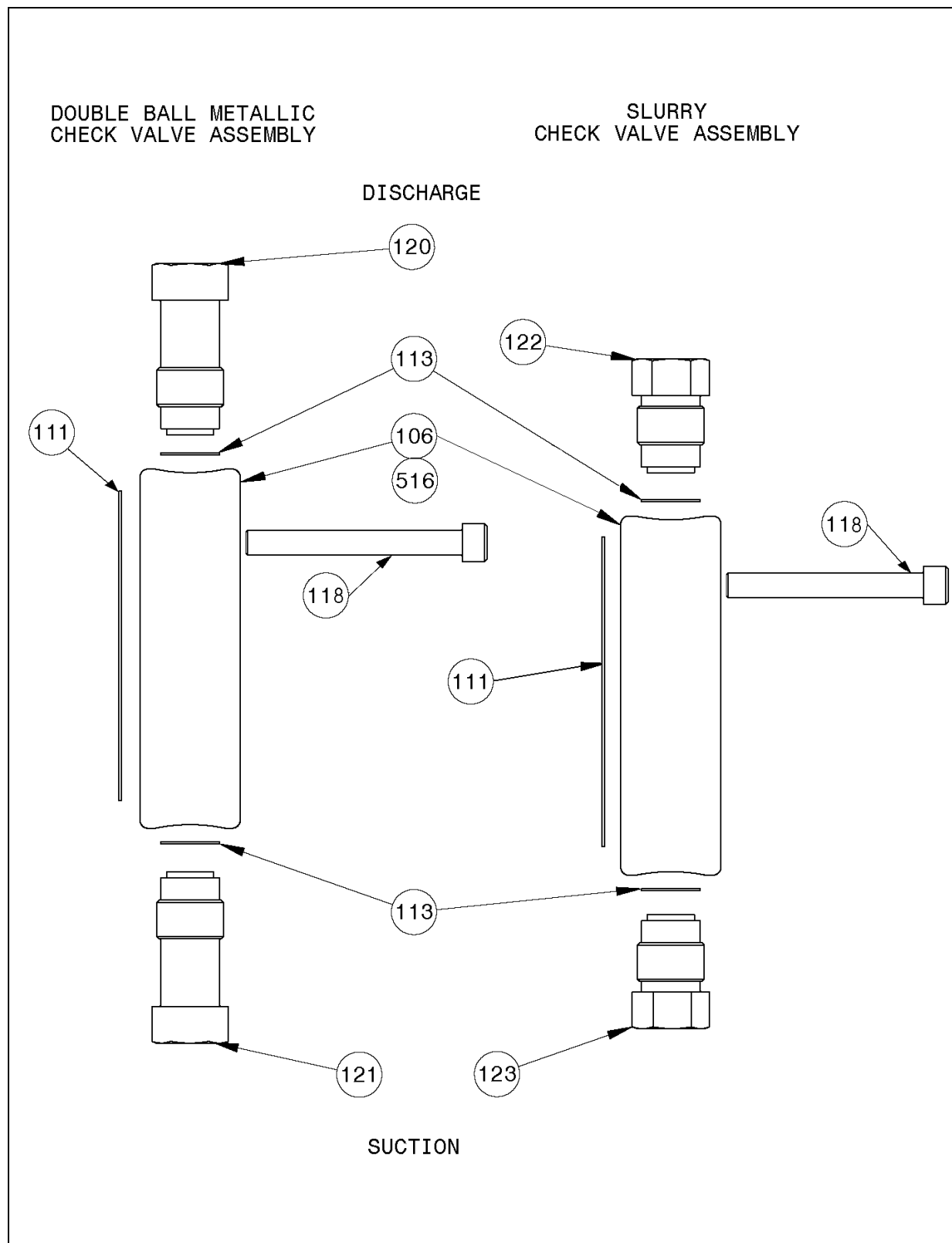


Figure 31. Liquid End Assembly, Size B, Metallic.

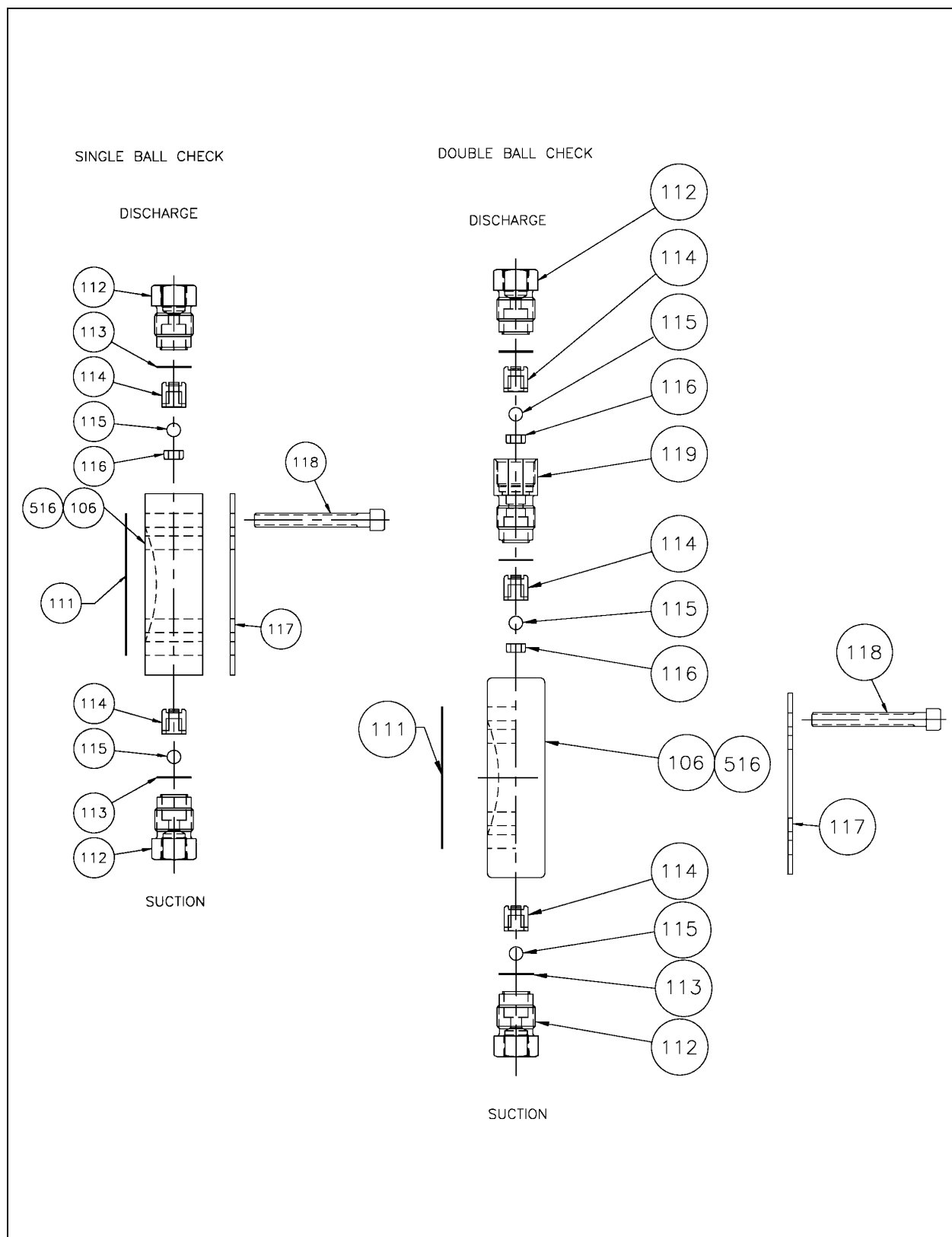


Figure 32. Liquid End Assembly, Size B, Non-Metallic.

**6.11 LIQUID END ASSEMBLY COMPONENTS, SIZE B (316SS, Alloy 20, Hast C, PVC, & KYNAR)
(FIGURES 31 & 32)**

ITEM	DESCRIPTION	PART NUMBER	QTY	QTY DOUBLE BALL	PLUNGER CODE
LIQUID END					
106	Liquid Head Size B, 316SS	21898	1		10D,14D,20D
	Liquid Head Size B, Alloy 20	21900	1		10D,14D,20D
	Liquid Head Size B, Hast C	21937	1		10D,14D,20D
	Liquid Head Size B, PVC	21939	1		10D,14D,20D
	Liquid Head Size B, Kynar	21941	1		10D,14D,20D
516	Liquid Head Size B, Leak Detection, 316SS	21899	1		10D,14D,20D
	Liquid Head Size B, Leak Detection, Alloy 20	21936	1		10D,14D,20D
	Liquid Head Size B, Leak Detection, Hast C	21938	1		10D,14D,20D
	Liquid Head Size B, Leak Detection, PVC	21940	1		10D,14D,20D
	Liquid Head Size B, Leak Detection, Kynar	21942	1		10D,14D,20D
DIAPHRAGM					
111	Diaphragm Size B, Gylon	21999	1		10D,14D,20D
	Diaphragm Assy Size B, Leak Detection, Gylon	61332400	1		10D,14D,20D
CHECK VALVE SEAL					
113	Check valve Seal, Size B, TFE	61431200	2		10D,14D,20D
METALLIC CHECK VALVE, DISCHARGE (DOUBLE BALL ONLY)					
120	Metallic Check Valve (316SS), Discharge	22425	1		10D,14D,20D
	Metallic Check Valve (CA-20), Discharge	22429	1		10D,14D,20D
	Metallic Check Valve (HC-22), Discharge	22427	1		10D,14D,20D
METALLIC CHECK VALVE, DISCHARGE (SINGLE BALL ONLY)					
122	SLURRY CK VALVE (316SS), DISCHARGE	22431	1		10D,14D,20D
METALLIC CHECK VALVE, SUCTION (DOUBLE BALL ONLY)					
121	Metallic Check Valve (316SS), Suction	22424	2		10D,14D,20D
	Metallic Check Valve (CA-20), Suction	22428	2		10D,14D,20D
	Metallic Check Valve (HC-22), Suction	22426	1		10D,14D,20D
METALLIC CHECK VALVE, DISCHARGE (SINGLE BALL ONLY)					
123	SLURRY CK VALVE (316SS), SUCTION	22430	1		10D,14D,20D
NON-METALIC LIQUID END SUPPORT RING					
117	Face Plate, Size B	61221200	1		10D,14D,20D
	Leak Detection Face Plate, Size B	61224901	1		10D,14D,20D
LIQUID END BOLT					
118	Liquid Head Bolt (Metallic)	90223031C4	8		10D,14D,20D
	Liquid Head Bolt (Plastic)	90223031C4	8		10D,14D,20D

- Items not shown.

ITEM	DESCRIPTION	PART NUMBER	QTY	QTY DOUBLE BALL	PLUNGER CODE
PLASTIC CHECK VALVE COMPONENTS (SINGLE OR DOUBLE BALL)					
PLASTIC CHECK VALVE CAP					
112	Check Valve Cap Size B, PVC	6140PB-PV	2	2	10D,14D,20D
	Check Valve Cap Size B, Kynar	6140PB-KN	2	2	10D,14D,20D
113	Check valve Seal, Size B, TFE	61431200	2	3	10D,14D,20D
PLASTIC CHECK VALVE GUIDE					
114	Ball Guide Size B, PVC	6139PB-PV	2	3	10D,14D,20D
	Ball Guide Size B, Kynar	6139PB-KN	2	3	10D,14D,20D
CHECK VALVE BALL, 3/8 OD					
115	Check Valve Ball Size B, 316SS	4070014112	2	3	10D,14D,20D
	Check Valve Ball Size B, Ceramic	4070015111	2	3	10D,14D,20D
	Check Valve Ball Size B, Hast C	4070014116	2	3	10D,14D,20D
PLASTIC CHECK VALVE SEAT					
116	Check Valve Seat Size B, PVC	6137PB-PV	2	3	10D,14D,20D
	Check Valve Seat Size B, Kynar	6137PB-KN	2	3	10D,14D,20D
PLASTIC CHECK VALVE DOUBLE BALL BODY					
119	Double Ball Body Size B, PVC	6141PB-PV	N/A	1	10D,14D,20D
	Double Ball Body Size B, Kynar	6141PB-KN	N/A	1	10D,14D,20D

6.12 LIQUID END ASSEMBLY, SIZE B (FIGURE 31 & 32)

	DESCRIPTION	PART NUMBER	PLUNGER CODE
COMPLETE LIQUID END ASSEMBLY			
SIZE B: 5/8, 7/8, 1-1/4 PLUNGER			
	L. E. Assembly, 316SS	6171-B-SS-SS	03D,04D,06D
	L. E. Assembly, 316SS/Leak Detection/Gage Type	6171-B-SS-SS-G	03D,04D,06D
	L. E. Assembly, 316SS/Leak Detection/Pressure Switch	6171-B-SS-SS-P	03D,04D,06D
	L. E. Assembly, 316SS/Leak Detection/Optic Sensor	6171-B-SS-SS-S	03D,04D,06D
	L. E. Assembly, Alloy 20	6171-B-A2-CR	03D,04D,06D
	L. E. Assembly, Alloy 20/Leak Detection/Gage Type	6071-B-A2-CR-G	03D,04D,06D
	L. E. Assembly, Alloy 20/Leak Detection/Pressure Switch	6171-B-A2-CR-P	03D,04D,06D
	L. E. Assembly, Alloy 20/Leak Detection/Optic Sensor	6171-B-A2-CR-S	03D,04D,06D
	L. E. Assembly, Hast C	6171-B-HC-HC	03D,04D,06D
	L. E. Assembly, Hast C/Leak Detection/Gage Type	6171-B-HC-HC-G	03D,04D,06D
	L. E. Assembly, Hast C/Leak Detection/Pressure Switch	6171-B-HC-HC-P	03D,04D,06D
	L. E. Assembly, Hast C/Leak Detection/Optic Sensor	6171-B-HC-HC-S	03D,04D,06D
	L. E. Assembly, PVC	6171-B-PV-CR	03D,04D,06D
	L. E. Assembly, PVC/Leak Detection/Gage Type	6171-B-PV-CR-G	03D,04D,06D
	L. E. Assembly, PVC/Leak Detection/Pressure Switch	6171-B-PV-CR-P	03D,04D,06D
	L. E. Assembly, PVC/Leak Detection/Optic Sensor	6171-B-PV-CR-S	03D,04D,06D
	L. E. Assembly, Kynar	6171-B-KN-CR	03D,04D,06D
	L. E. Assembly, Kynar/Leak Detection/Gage Type	6171-B-KN-CR-G	03D,04D,06D
	L. E. Assembly, Kynar/Leak Detection/Pressure Switch	6171-B-KN-CR-P	03D,04D,06D
	L. E. Assembly, Kynar/Leak Detection/Optic Sensor	6171-B-KN-CR-S	03D,04D,06D
	L. E. Assembly, 316SS, SLURRY	6171-B-SS-TC-SC	

- Items not shown.

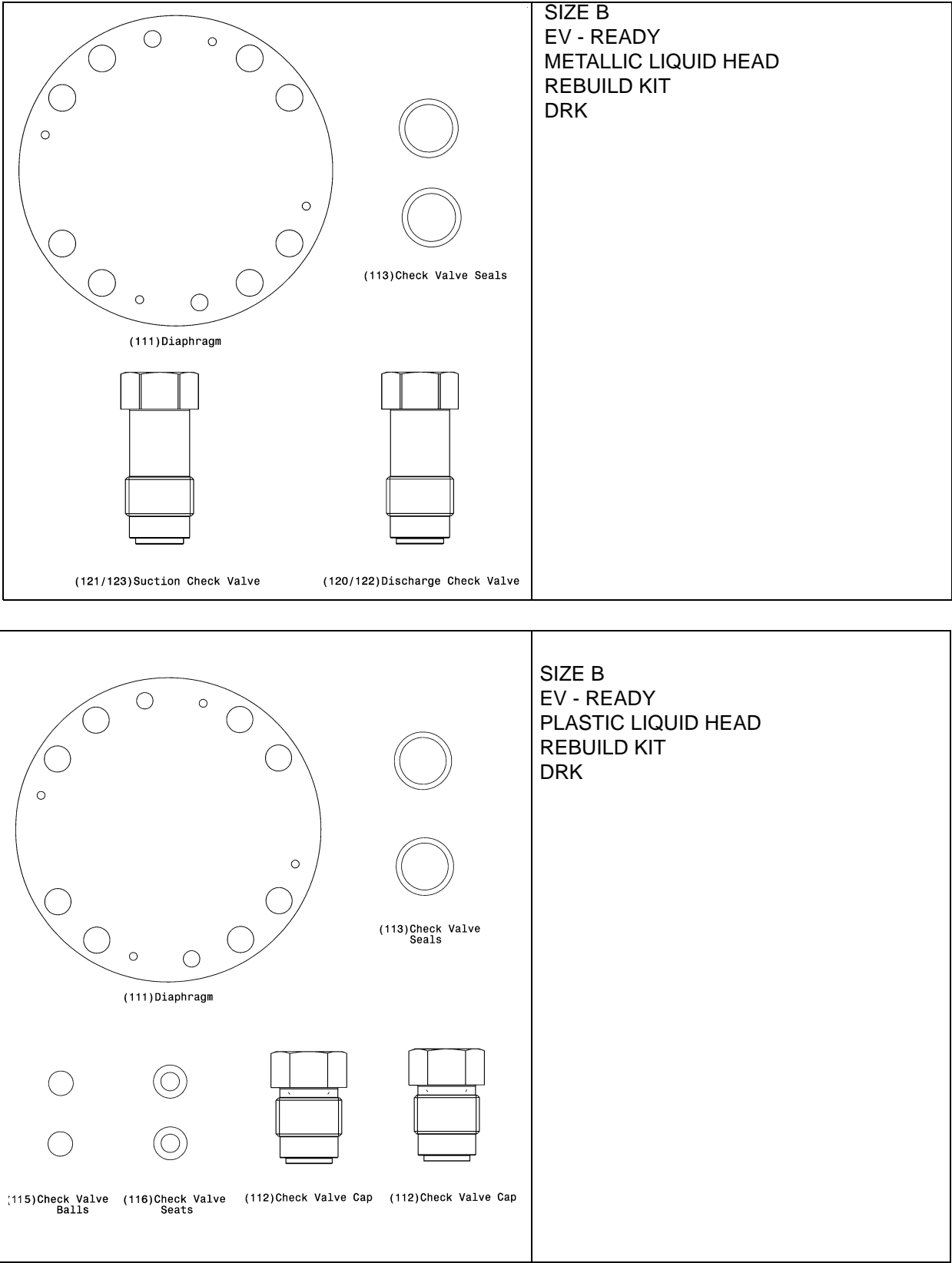


Figure 33. Metallic/Plastic Rebuild Kit, Size B.

6.13 METALLIC/PLASTIC REBUILD KIT, SIZE B (FIGURE 33)

DESCRIPTION	PART NUMBER	PLUNGER CODE
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LIQUID END REBUILD KITS SIZE B

Rebuild Kit, 316SS	DRK110	10D,14D,20D
Rebuild Kit, 316SS, Leak Detection	DRK111	10D,14D,20D
Rebuild Kit, Hast C	DRK112	10D,14D,20D
Rebuild Kit, Hast C, Leak Detection	DRK113	10D,14D,20D
Rebuild Kit, Alloy 20	DRK114	10D,14D,20D
Rebuild Kit, Alloy 20, Leak Detection	DRK115	10D,14D,20D
Rebuild Kit, Slurry	DRK116	
Rebuild Kit, Slurry, Leak Detection	DRK117	
Rebuild Kit, PVC	DRK118	10D,14D,20D
Rebuild Kit, PVC, Leak Detection	DRK119	10D,14D,20D
Rebuild Kit, Kynar	DRK120	10D,14D,20D
Rebuild Kit, Kynar, Leak Detection	DRK121	10D,14D,20D

PLUNGER BODY REBUILD KITS EVA SIZE B

5/8 Rebuild Kit	61760010	10D
7/8 Rebuild Kit	61760700	14D
1-1/4 Rebuild Kit	61760120	20D
5/8 Rebuild Kit, Leak Detection	61760010LD	10D
7/8 Rebuild Kit, Leak Detection	61760700LD	14D
1-1/4 Rebuild Kit, Leak Detection	61760120LD	20D

STROKE ADJUSTER REBUILD KIT

Manual stroke adjuster rebuild kit	6076MN01	ALL
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- Items not shown.

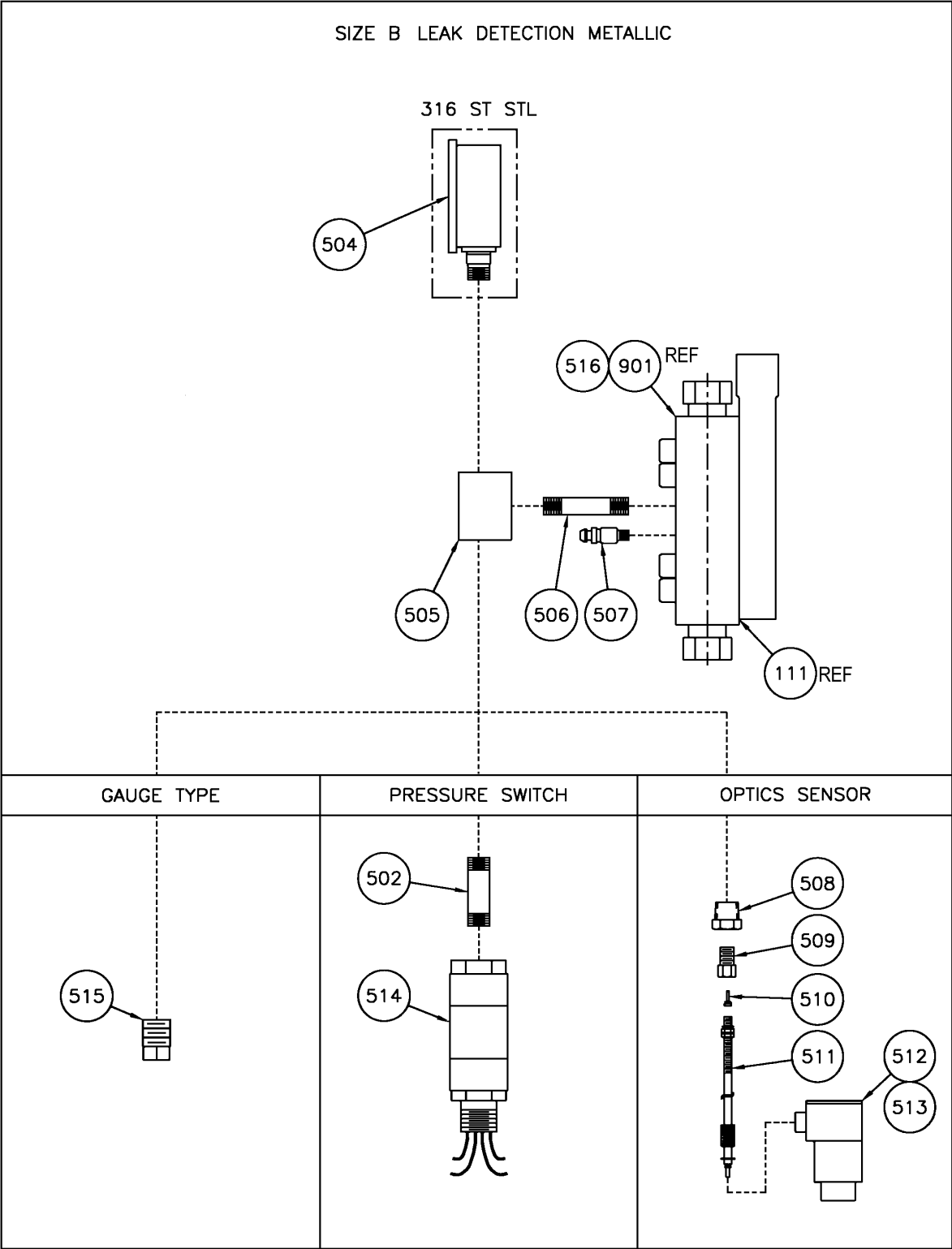


Figure 34. Metallic Leak Detection, Size B.

6.14 METALLIC LEAK DETECTION, SIZE B (316SS, ALLOY 20 & HAST C) (FIGURE 34)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
GAUGE STYLE				
504	Leak Detection Gauge, 30" HG - 300 PSI	9MG2201010	1	10D,14D,20D
505	Leak Detection Tee Block, 316SS	61230400008	1	10D,14D,20D
506	Leak Detection Nipple, 1/8" X 2" Long, 316SS	9702106010	1	10D,14D,20D
507	Leak Detection Vacuum Breaker, 316SS	61230200008	1	10D,14D,20D
515	Hex Head Plug 1/4" NPT, 316SS (Gauge Style Only)	9702204010	1	10D,14D,20D
PRESSURE SWITCH (WITH GAUGE STYLE ITEMS)				
502	Leak Detection Nipple, 1/4" X 2" Long, 316SS	9702107010	1	10D,14D,20D
514	Leak Detection Pressure Switch, 316SS	9842214010	1	10D,14D,20D
OPTICS SENSOR (WITH GAUGE STYLE ITEMS)				
508	Reducer Bushing, 1/4" X 1/8", 316SS	9702205010	1	10D,14D,20D
509	Leak Detection Adapter Probe, 316SS	61230300008	1	10D,14D,20D
510	Leak Detection Glass Rod	9842003000	1	10D,14D,20D
511	Leak Detection Cable	9842002000	1	10D,14D,20D
512	Leak Detection Sensor	9842001000	1	10D,14D,20D
513	Leak Detection Power Block	9842004000	1	10D,14D,20D

- Items not shown.

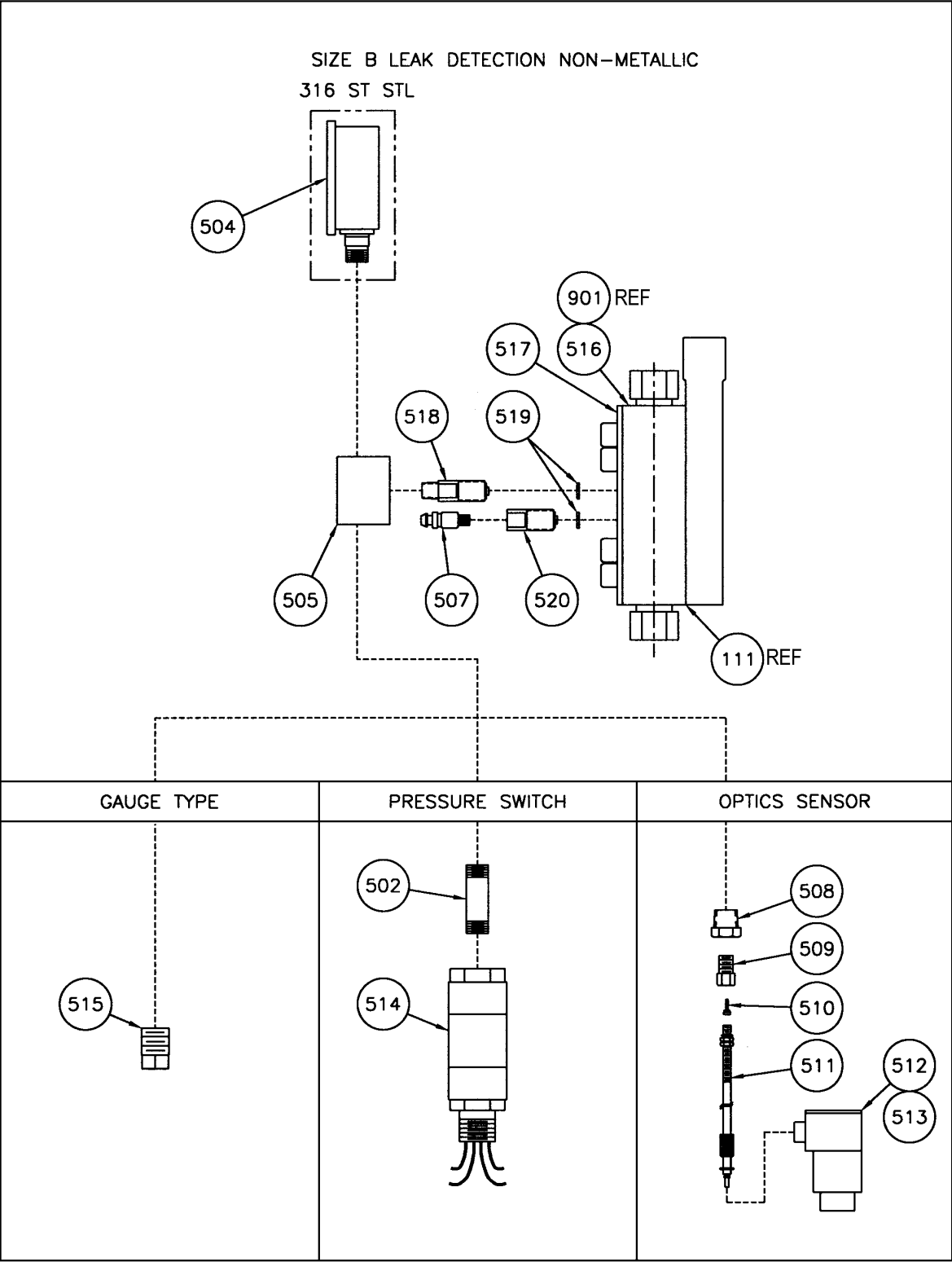


Figure 35. Non-Metallic Leak Detection, Size B.

6.15 NON-METALLIC LEAK DETECTION, SIZE B (PVC & KYNAR) (FIGURE 35)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
GAUGE STYLE				
505	Leak Detection Tee Block, 316SS	61230400008	1	10D,14D,20D
507	Leak Detection Vacuum Breaker, 316SS	61230200008	1	10D,14D,20D
515	Hex Head Plug 1/4" NPT, 316SS (Gauge Style Only)	9702102010	1	10D,14D,20D
517	Leak Detection Face Plate Size B, PVC & Kynar	61224901	1	10D,14D,20D
517	Leak Detection Face Plate Size C, PVC & Kynar	61224702	1	28D, 34D
518	Leak Detection Tee Adapter, 316SS	61232000008	1	10D,14D,20D
519	Leak Detection Adapter Seal, Teflon	61435200	1	10D,14D,20D
520	Leak Detection Bleeder Adapter, PVC	61232100008	1	10D,14D,20D
PRESSURE SWITCH (WITH GAUGE STYLE ITEMS)				
502	Leak Detection Nipple, 1/4" X 2" Long, 316SS	9702107010	1	10D,14D,20D
514	Leak Detection Pressure Switch, 316SS	9842214010	1	10D,14D,20D
OPTICS SENSOR (WITH GAUGE STYLE ITEMS)				
508	Reducer Bushing, 1/4" X 1/8", 316SS	9702205010	1	10D,14D,20D
509	Leak Detection Adapter Probe, 316SS	61230300008	1	10D,14D,20D
510	Leak Detection Glass Rod	9842003000	1	10D,14D,20D
511	Leak Detection Cable	9842002000	1	10D,14D,20D
512	Leak Detection Sensor	9842001000	1	10D,14D,20D
513	Leak Detection Power Block	9842004000	1	10D,14D,20D

- Items not shown.

EVA – SIZE B PLUNGER BODY ASSEMBLY

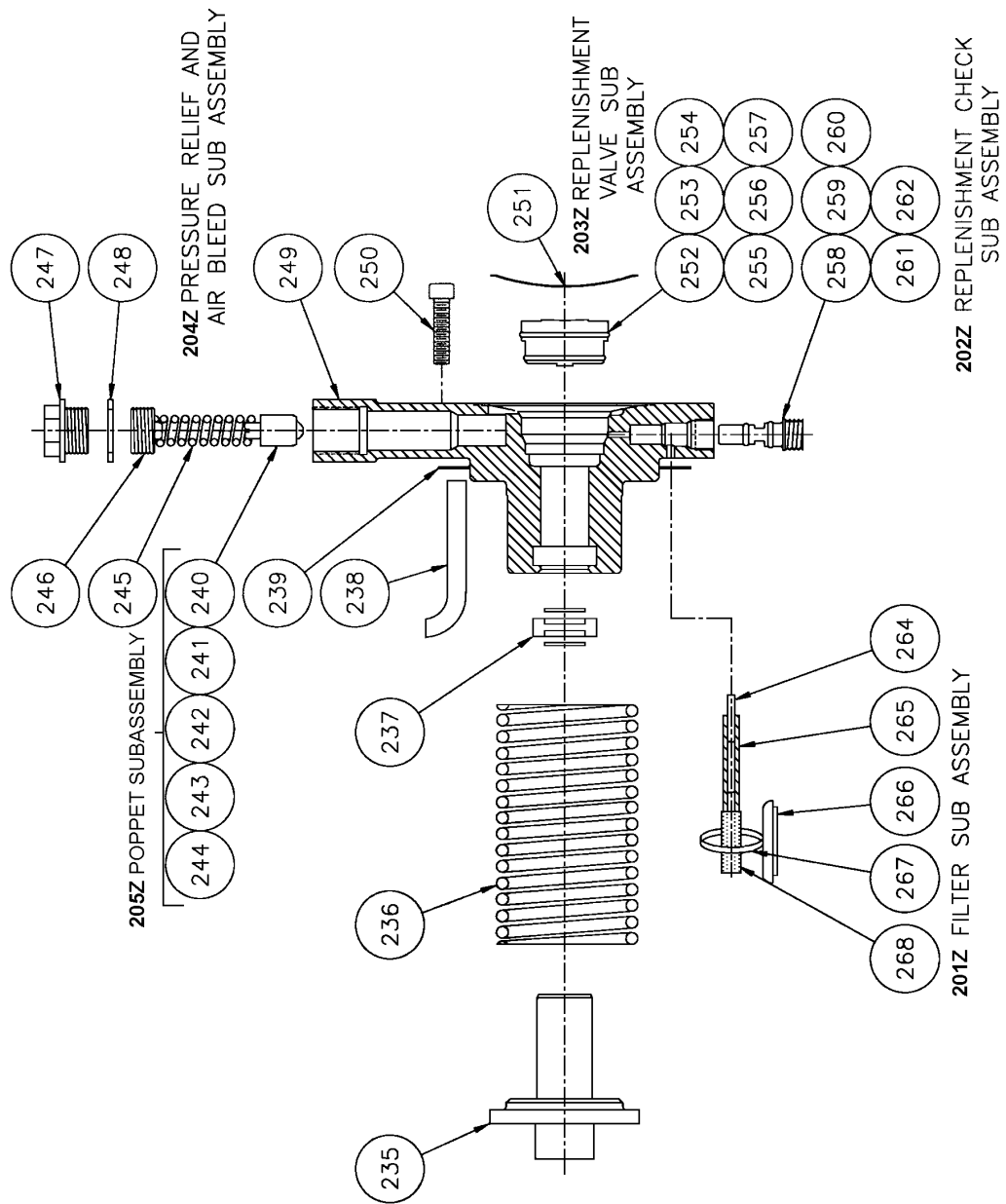


Figure 36. Plunger Body Assembly, Size B.

6.16 PLUNGER BODY ASSEMBLY COMPONENTS, SIZE B (FIGURE 36)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
PLUNGER				
235	5/8" Plunger	6001-10	1	10D
	7/8" Plunger	6001-14	1	14D
	1-1/4" Plunger	6001-20	1	20D
RETURN SPRING				
236	Plunger Return Spring	60420400	1	10D,14D,20D,
PLUNGER BODY SEAL				
237	5/8" Plunger Seal	9552502000	1	10D
	7/8" Plunger Seal	9552601000	1	14D
	1-1/4" Plunger Seal	9552702000	1	20D
STANDARD SIGHT TUBE ASSEMBLY				
238	Sight Tube	61890100	1	ALL
239	Plunger Body Gasket	61430600	1	ALL
247	Relief Valve Cap Plug	9102501560	1	ALL
248	Relief Valve Cap Gasket	9562501000	1	ALL
PLUNGER BODY				
249	5/8" Plunger Body	22449	1	10D
	7/8" Plunger Body	22450	1	14D
	1-1/4" Plunger Body	22451	1	20D
250	Cap Screw, 1/4" - 20" X 1-1/2" Long	90222A61CX	2	10D,14D,20D
CONTOUR PLATE				
251	1-1/4" Contour Plate, Size B	61220312	1	10D,14D,20D

- Items not shown.

SIZE B INTERNAL HYDRAULIC ASSEMBLY

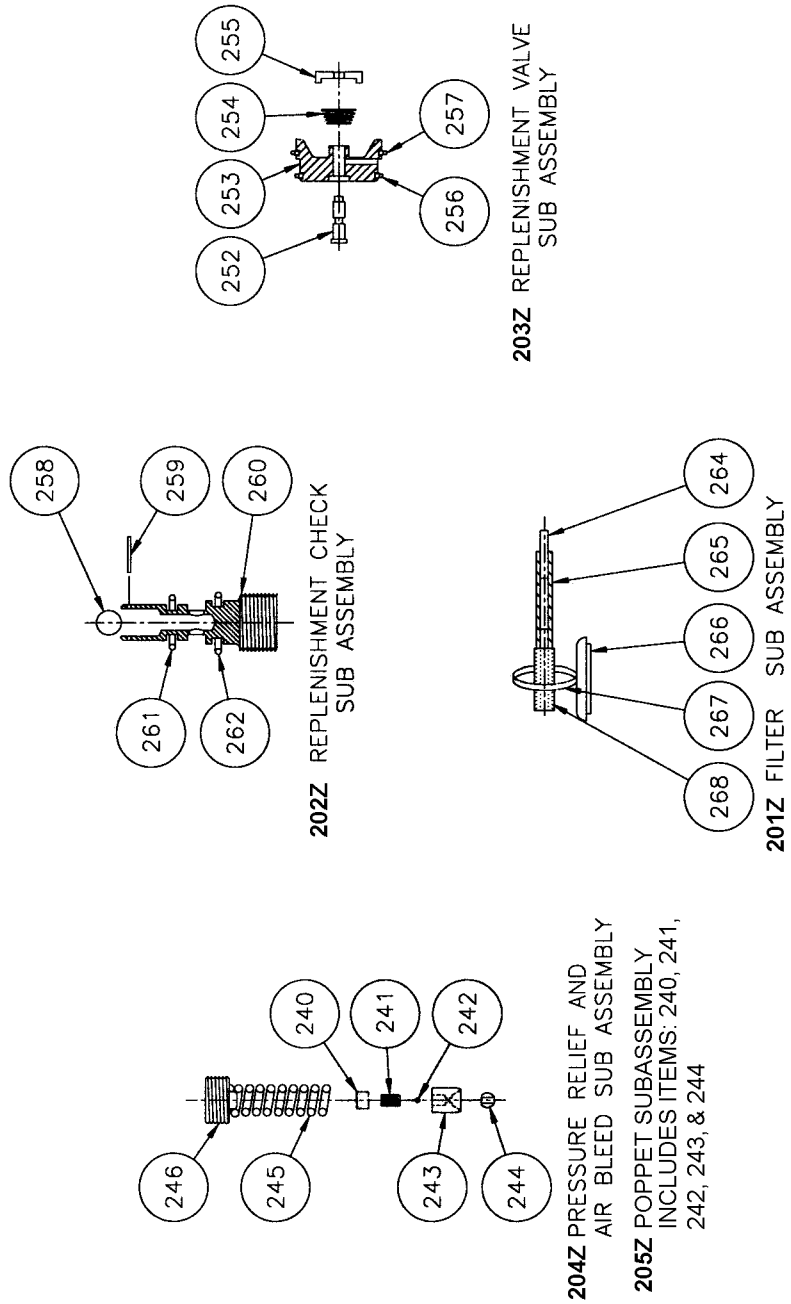


Figure 37. Plunger Body Internal Hydraulic SubAssembly, Size B.

6.17 PLUNGER BODY INTERNAL HYDRAULIC SUBASSEMBLY, SIZE B (FIGURE 37)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
FILTER SUBASSEMBLY				
201Z	Filter Subassembly Contains Items: 264, 265, 266, 267 & 268	61660100	1	10D,14D,20D
264	Roll Pin 3/16" Dia X 1-1/4" LG	These Parts are Included in the Above Subassembly		10D,14D,20D
265	Filter Tube, 3/16" ID			10D,14D,20D
266	Filter Magnet			10D,14D,20D
267	Filter Tie			10D,14D,20D
268	Filter, 3/16" MTG.			10D,14D,20D
REPLENISHMENT CHECK SUBASSEMBLY				
202Z	Replenishment Check Subassembly Contains Items: 258, 259, 260, 261, 262	61751300	1	10D,14D,20D
258	Ball, 3/16" DIA	These Parts are Included in the Above Subassembly		10D,14D,20D
259	Replenishment Check Roll Pin			10D,14D,20D
260	Replenishment Check Body			10D,14D,20D
261	Replenishment Check O-Ring			10D,14D,20D
262	Replenishment Check O-Ring			10D,14D,20D
REPLENISHMENT VALVE SUBASSEMBLY				
203Z	Replenishment Valve Subassembly Contains Items: 252, 253, 254, 255, 256, 257	61751800	1	10D,14D,20D
252	Replenishment Valve Spool	These Parts are Included in the Above Subassembly		10D,14D,20D
253	Replenishment Valve Head			10D,14D,20D
254	Replenishment Valve Housing			10D,14D,20D
255	Replenishment Valve Spring			10D,14D,20D
256	*Replenishment Valve O-Ring #24 Nitrile			10D,14D,20D
257	*Replenishment Valve O-Ring #26 Nitrile			10D,14D,20D
PRESSURE RELIEF AND AIR BLEED SUBASSEMBLY				
204Z	Pressure Relief and Air Bleed Subassembly Contains Items: 240, 241, 242, 243, 244, 245, & 246	These Parts are Included in the Subassembly Ordered by Spring Number		10D,14D,20D
240	Alignment Collar			10D,14D,20D
241	Air Bleed Valve Screw			10D,14D,20D
242	Air Bleed Ball, 7/64" OD			10D,14D,20D
243	Relief Valve Poppet Body			10D,14D,20D
244	Poppet Ball, 5/16" OD			10D,14D,20D
245	SPRINGS			10D,14D,20D
	Relief Valve Spring, 0-165 PSI Green (P/N 9372003000)	61750101Z	1	10D,14D,20D
	Relief Valve Spring, 166-330 PSI Orange (P/N 9372006000)	61750201Z	1	10D,14D,20D
	Relief Valve Spring, 331-790 PSI Blue (P/N 9372004000)	61750401Z	1	10D,14D,20D

- Items not shown.

EVA

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
	Relief Valve Spring, 791-1694 PSI Gold (P/N 9372002000)	61750301Z	1	10D,14D,20D
	Relief Valve Spring, 1695-2000 PSI Red (P/N 9372008000)	61750501Z	1	10D,14D,20D
246	Relief Valve Assembly Nut		1	10D,14D,20D

POPPET ASSEMBLY

205Z	Poppet Subassembly Contains Items: 240, 241,242, 243, & 244	61751600	1	ALL
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- Items not shown.

6.18 PLUNGER BODY ASSEMBLY, SIZE B (FIGURE 36 & 37)

ITEM	DESCRIPTION	PART NUMBER	PLUNGER CODE
200Z	* Complete Plunger Body Assembly (Less Relief Valve Spring) Contains All Plunger Body Assembly Components (Figure 36) and 5 Subassemblies (Figure (37)).		
	5/8" Plunger	6073-B-10-EN	10D
	7/8" Plunger	6073-B-14-EN	14D
	1-1/4" Plunger	6073-B-20-EN	20D

RELIEF VALVE SPRING

245	165 PSI Spring	9372003000	10D,14D,20D
	166-330 PSI Spring	9372006000	10D,14D,20D
	331-790 PSI Spring	9372004000	10D,14D,20D
	791-1694 PSI Spring	9372002000	10D,14D,20D
	1695-2000 PSI Spring	9372008000	10D,14D,20D

* WHEN ORDERING PLUNGER BODY ASSEMBLY, ORDER RELIEF VALVE SPRING ALSO. SPRING RANGES ARE RELIEF SET PRESSURE.

- Items not shown.

EVA

PARTS COMMON TO BOTH SIZE HEADS

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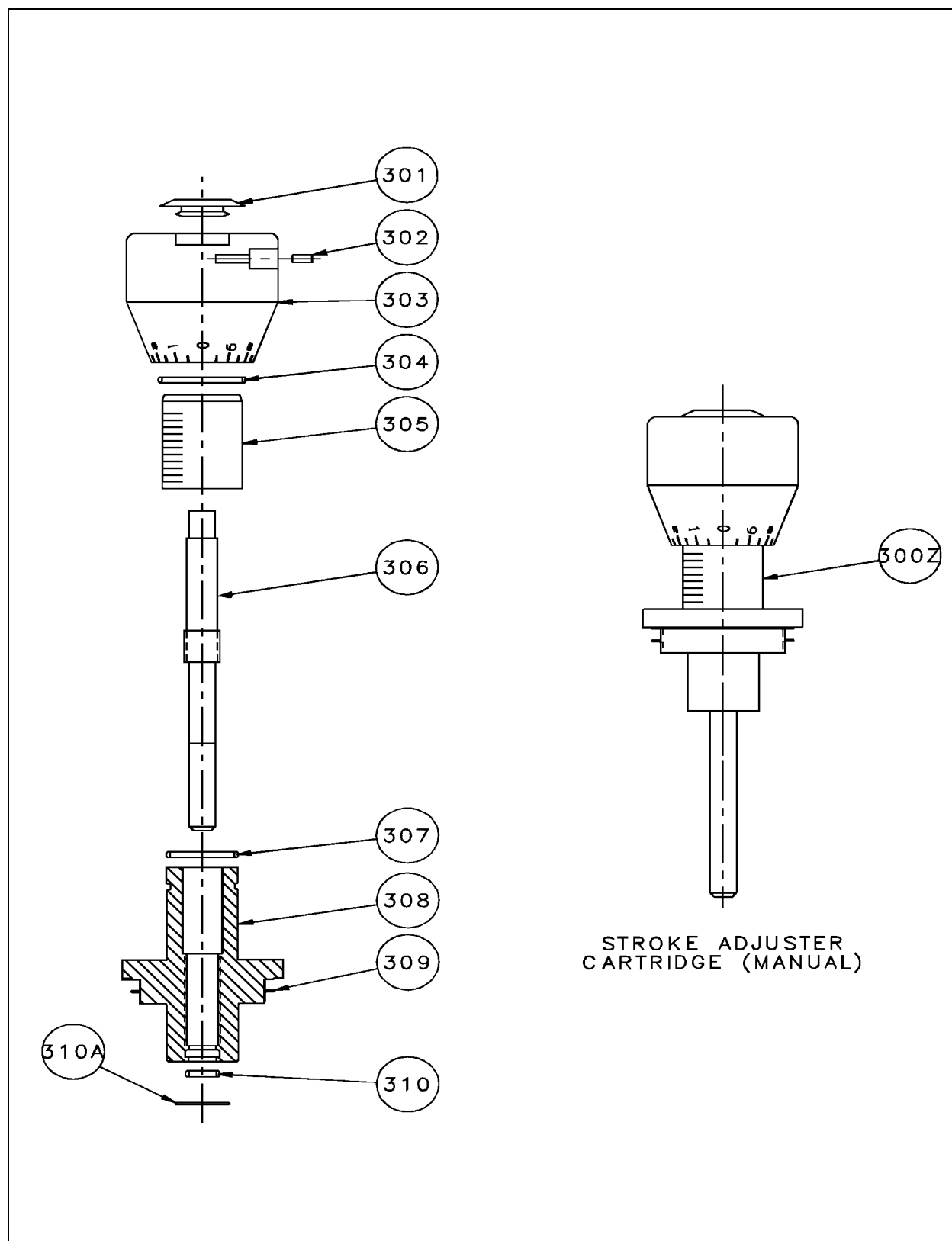


Figure 38. Manual Stroke Adjuster Assembly.

6.19 MANUAL STROKE ADJUSTER ASSEMBLY (FIGURE 38)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
301	Stroke Adjuster Knob Seal	9MT2202000	1	
302	Set Screw, 1/4"-20 X 1/4" LG	90322481CX	1	
303	Stroke Adjuster Knob	61340101	1	
304	O-Ring 70 Dura Buna	9520024410	1	
305	Sleeve, Stroke Adjuster	60090600	1	
306	Extension Shaft	60090301	1	
307	O-Ring 70 Dura Buna	9520120410	1	
308	Adapter, Stroke Adjuster Housing	60090101	1	
309	O-Ring, Stroke Adjuster	9520013410	1	
310	O-Ring 70 Dura Buna	9520012410	1	
310A	Retainer Shaft	938230374H	1	

MANUAL STROKE ADJUSTER ASSEMBLY

300Z	Complete Manual Stroke Adjuster Assembly, Contains Items: 301-310, 310A	6079MN01	1	
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- Items not shown.

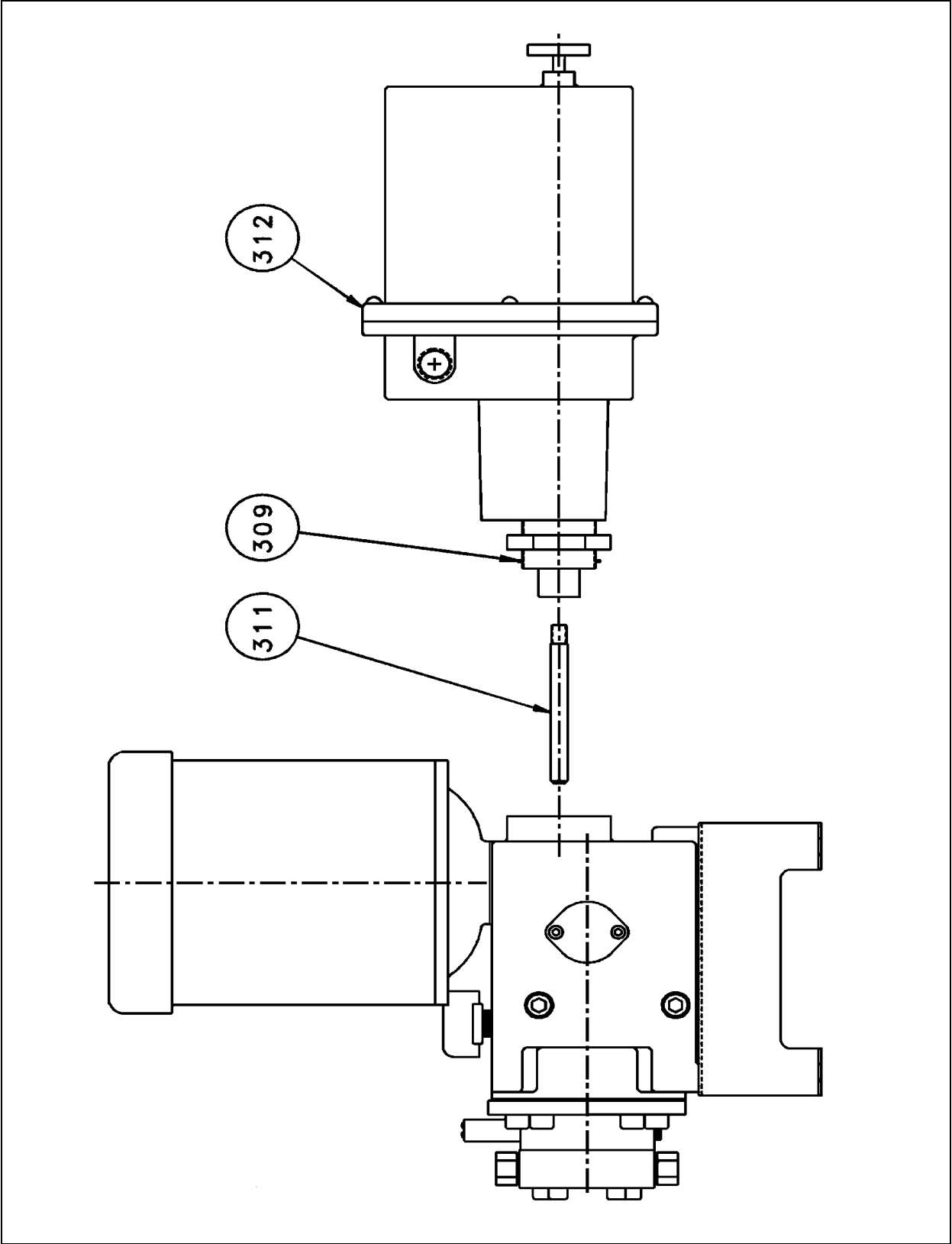


Figure 39. Electronic Stroke Adjuster Assembly.

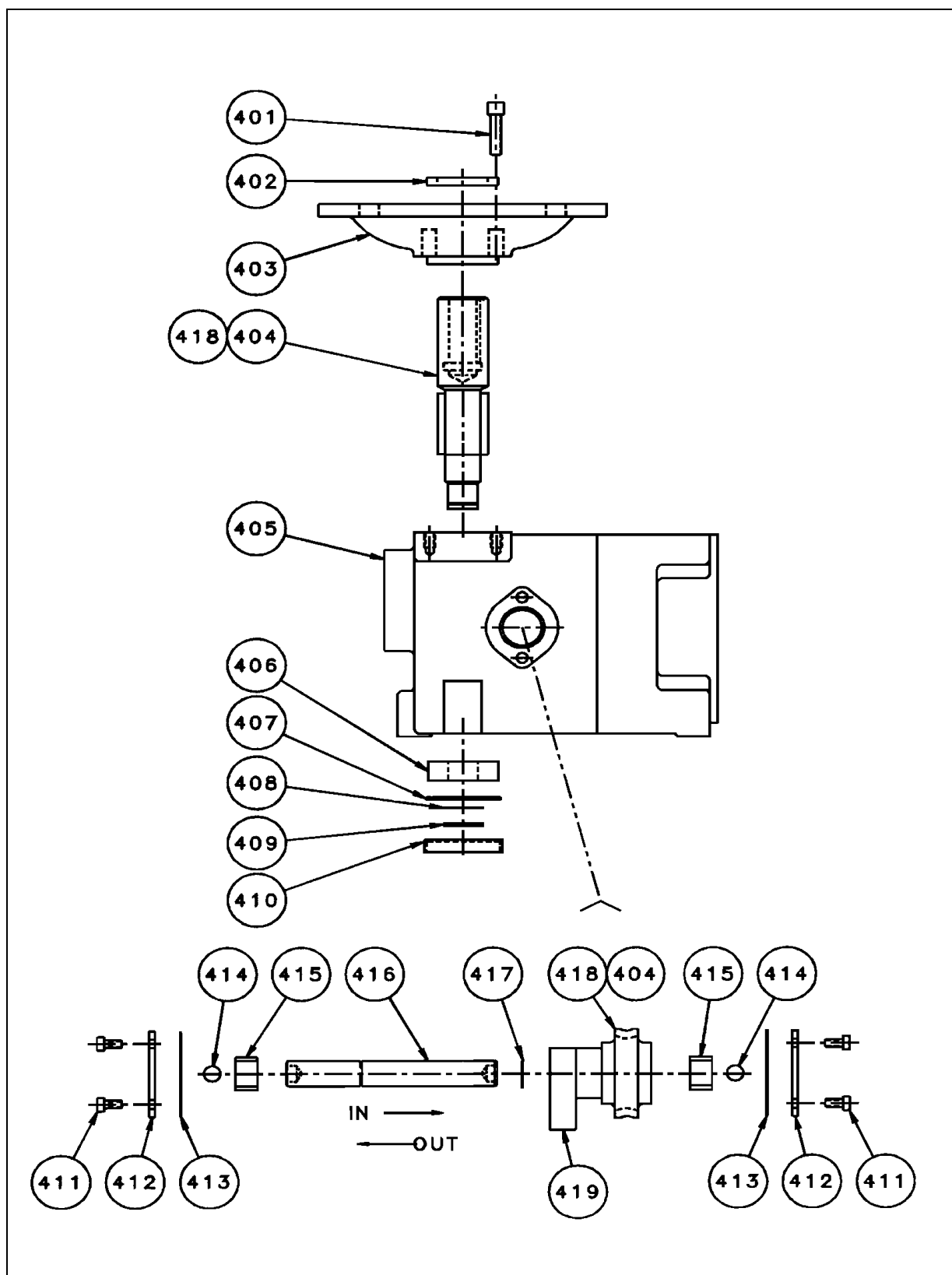
6.20 ELECTRONIC STROKE ADJUSTER ASSEMBLY (FIGURE 39)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
309	O-Ring, Stroke Adjuster	9520130410	1	
311	Extension Shaft Electric	60090300	1	
312	Actuator Electronic	9MA2008000	1	

ELECTRONIC STROKE ADJUSTER ASSEMBLY CONTAINS ITEMS: 309, 311, 312

300Z	Electric Stroke Adjuster Assembly	6079EL01	1	
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- Items not shown.



6.21 DRIVECASE AND ECCENTRIC SHAFT GEAR HUB ASSEMBLY (FIGURE 40)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
405	Drive Case, Finished	60070200	1	
416	Eccentric Shaft	60150100	1	

418/404 GEAR SET WITH HUB (Includes Dowel Pin)

	Gear Subassembly, 60:1	6068-60	1	
	Gear Subassembly, 30:1	6068-30	1	
	Gear Subassembly, 20:1	6068-20	1	
	Gear Subassembly, 15:1	6068-15	1	

411	Cap Screw, 10-24 X 7/16" LG	90122061C4	4	
412	Eccentric Shaft Retainer Plate	61190200	2	
413	Eccentric Retainer Plate Shim	61430200	2	
414	Eccentric Shaft Ball	96923011H0	2	
415	Needle Bearing	9742418000	2	
417	Snap Ring Eccentric Shaft	9592502740	1	
419	Eccentric	60160100	1	

MOTOR ADAPTER ASSEMBLY

401	Cap Screw, 1/4-20 X 1" LG	90222071CX	4	
402	Input Seal, Motor Adapter	9552703000	1	
403	C Face Motor Adapter	9795601000	1	
406	Bearing Worm	9742518000	1	
407	Snap Ring Worm Bearing	9592905740	1	
408	Shim, Drivecase Worm Gear	60430500	1	
409	Snap Ring, Worm Gear	9592503740	1	
410	Soft Plug Seal	9102901000	1	

DRIVECASE ASSEMBLY

400Z	Complete Drivecase Assembly, 56C, Contains Items: 401, 402, 403, 404 / 418, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, & 419			
	Drivecase Assembly, 60:1	6072-60-1-56-EP	1	
	Drivecase Assembly, 30:1	6072-30-1-56-EP	1	
	Drivecase Assembly, 20:1	6072-20-1-56-EP	1	
	Drivecase Assembly, 15:1	6072-15-1-56-EP	1	

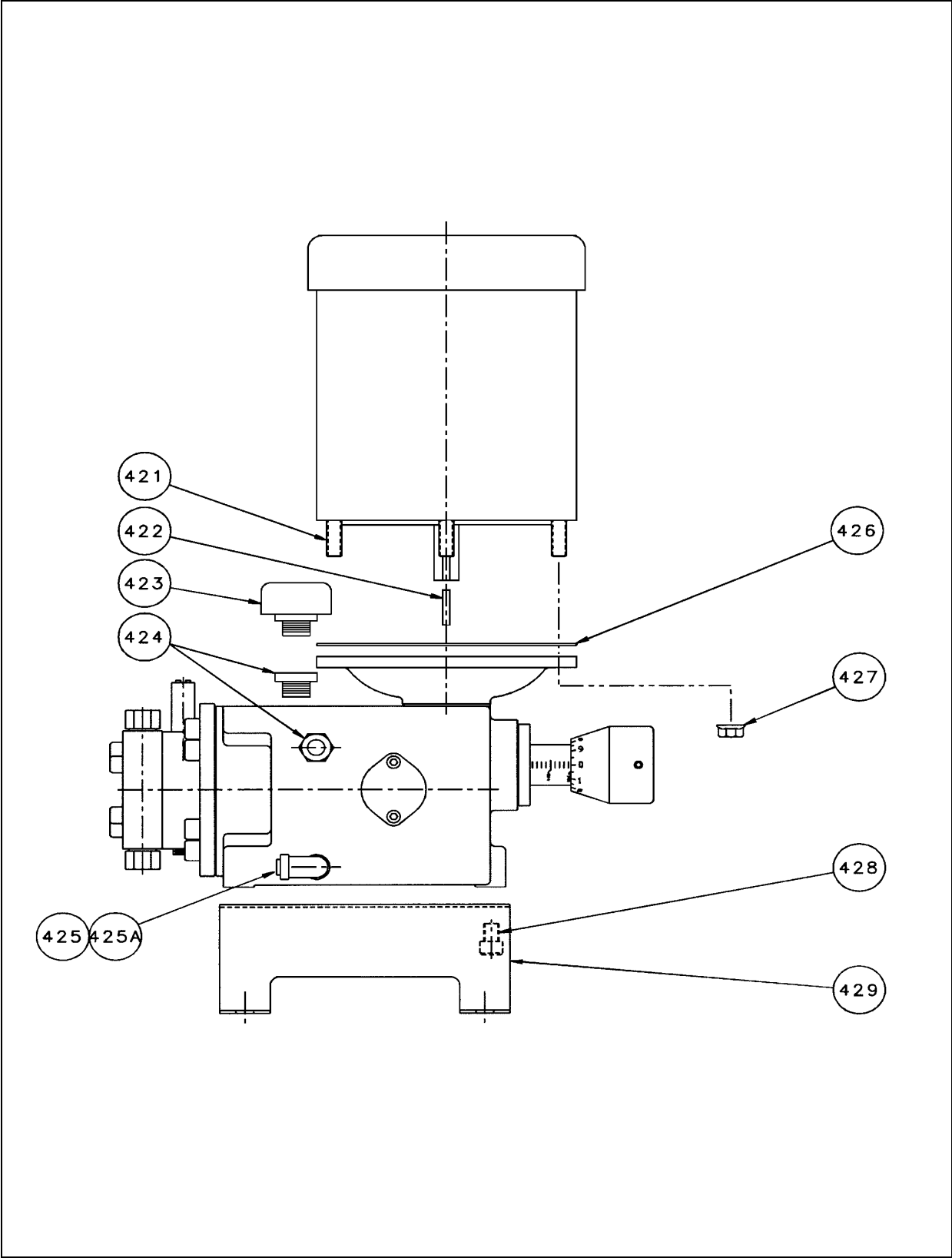


Figure 41. Miscellaneous.

6.22 MISCELLANEOUS (316SS, ALLOY 20, HAST C, PVC, & KYNAR) (FIGURE 41)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
421	Stud, 3/8" - 16" X 1-1/2" Long	9092301070	4	
422	Key 1/8" X 13/16" Long	9452109020	1	
423	Breather	9702323000	1	
424	Sight Glass	9702362000	2	
425	Pipe Plug 3/8"	970230402E	4	
425A	St. Elbow 3/8	970226202H	1	
426	C-Face Motor Gasket	61430400	1	
427	Flanged Nut 3/8" X 16"	92323011C4	4	
428	Screw, 3/8" - 16" X 1/2" Long	90223021CX	4	
429	Base, Pump	60060100	1	

- Items not shown.



EVA PUMP FACTS

PAGE 1 OF 2

Effective 10/08
Supersedes ALL

EVA

Minimum Temperature		- 20°F	(Below 40°F use synthetic oil)	
Maximum Temperature		Metallic	250°F	(Above 100°F use synthetic oil)
		Non-Metallic	150°F	(Above 100°F see Tech Tip TU096-09)
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¹ Registered trademark for Haynes International



EVA

Application Limitations:

NPSHR is 10 PSIA as calculated using NPSH worksheet or NPSH Tab in Durameter Sizing Program. NPSH calculations are for Newtonian fluids only. Consult Factory for non-Newtonian fluids.

Type: Hydraulically balanced single or double diaphragm.
Double ball check, lost motion drive.

Uses: Viscous Service (NPSH Calculation Required) Slurry Service
Controlled Volume Pumping Accurate Chemical Injection

Typical Markets:

Chemical Process	Refinery
Pulp and Paper	Food and Beverage
Pharmaceutical	Waste Water Treatment
Power Generation	Mining
Water Treatment	Manufacturing
Oil Exploration / Transmission / Recovery	Gas Exploration / Transmission / Recovery

Options: Diaphragm Rupture Leak Detection Systems Available at Three Levels
Electronic Stroke Control in Nema 4 or 7
Special Metallics and Non-Metallics

Features:

Modular Cartridge Design	Ease of Maintenance
Dependability	Compact Size
Durability	C-Face Motor Mount
Cost Effectiveness	No Process Side Contour Plate
Accuracy	Many Options Available
Parts Interchangeability	

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