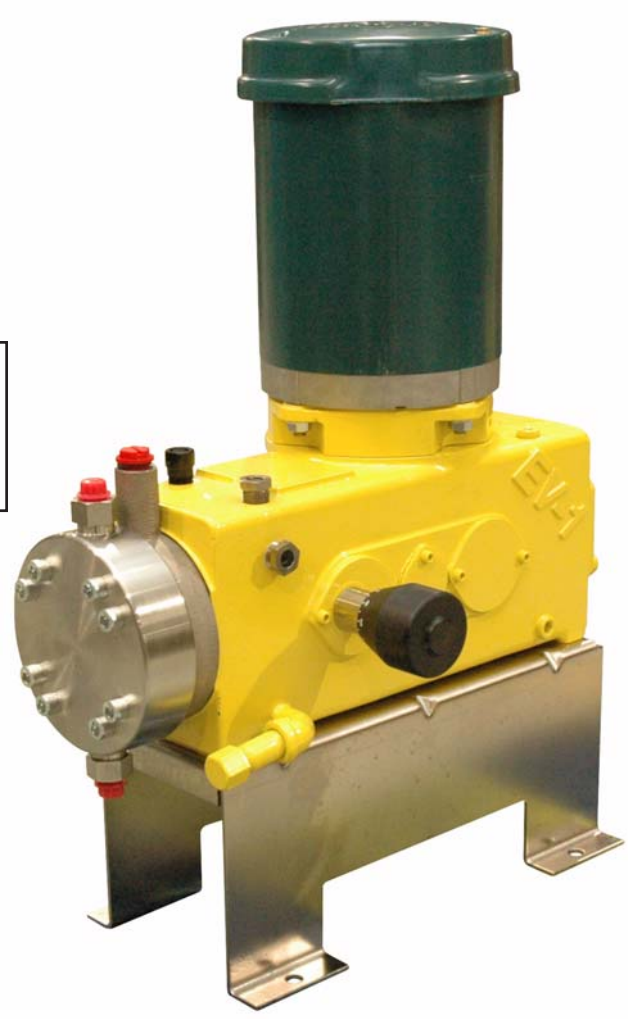
MILTON ROY

EV1-Series

Metering Pump

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

THIS MANUAL SUPERSEDES MANUAL OM/EV1 AND EV1 PARTS CATALOG DATED 11/2000. USE THIS MANUAL FOR SERIAL NUMBERS 2403816 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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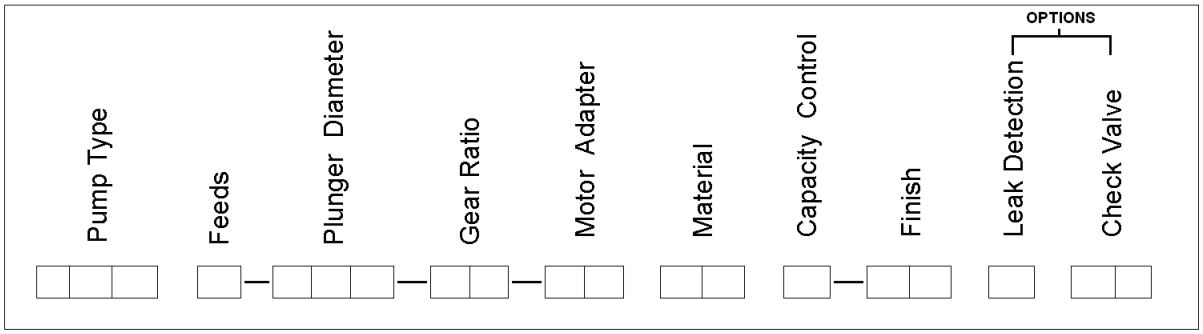
FIGURES

EV1/EVP PUMP MODEL NUMBER AND OPTIONS



Pump Type

Code	Description
EV1	Type
EVP	EV1 TYPE PULSE-LESS

Feeds

Code	Description
1	Simplex
2	Duplex

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
28D	1-3/4 Dia., Size C Head
38D	2-3/8 Dia., Size C Head

Gear Ratio

Code	Description
13	12.5:1
15	15:1
30	30:1
60	60:1

Motor Adapter

Code	Description
56	Direct Mount, NEMA 56C
71	Direct Mount, IEC 71 Frame (B5)
80	Direct Mount, IEC 80 Frame (B5)
5F	Flexible Coupling Mount, NEMA 56C
7F	Flexible Coupling Mount, IEC 71 Frame (B5)
8F	Flexible Coupling Mount, IEC 80 Frame (B5)

Material

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

Capacity Control

Code	Description
M	Manual
E	Electric
N	EVP Only

Finish

Code	Description
EP	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 Valves (Size B and C, Single Ball Only)
AF	ANSI Flange (Size B and C Only)

* All A Size and B Size Metallic are Double Ball. B & C Size Nonmetallic and C Size Metallic are Single or Double Ball.

MODEL/PRODUCT CODE

SECTION 1
DESCRIPTION

1.1 GENERAL INFORMATION

The Milton Roy EV1 pump is a product designed to fill most industries' metering application needs. This has been accomplished with proven technology used in new and innovative ways. Through our engineering program, we have optimized each component for safety, functionality, durability, and economy. These guidelines and the American Petroleum Institutes' API 675 Standards were used as a goal.

Fully encased check valve assemblies with captured PTFE seals and internal hydraulic relief system assures safe operation. Pump performance is enhanced by eliminating the liquid end contour plate. This is accomplished by using a demand type hydraulic system. The benefits of this design are superior slurry and viscous handling capabilities, increased diaphragm life, and greater lift capabilities. Accuracy is improved through the use of a finely calibrated stroke adjuster, integral hydraulic relief / air bleed system and aerospace quality plunger seal. Through the use of a cast iron drivecase, hardened steel wear surfaces, anti-friction bearing with high L-10 life, and gearing with AGMA service factors, the EV1 is designed for low maintenance, long life operation. By using rigid standards for quality, workmanship, and product design, the EV1 has proven to be an economical investment.

Additionally the EV1 is based on a modular design. The metering pump has four independent assemblies as illustrated in Figure 1.

1.2 DRIVECASE ASSEMBLY

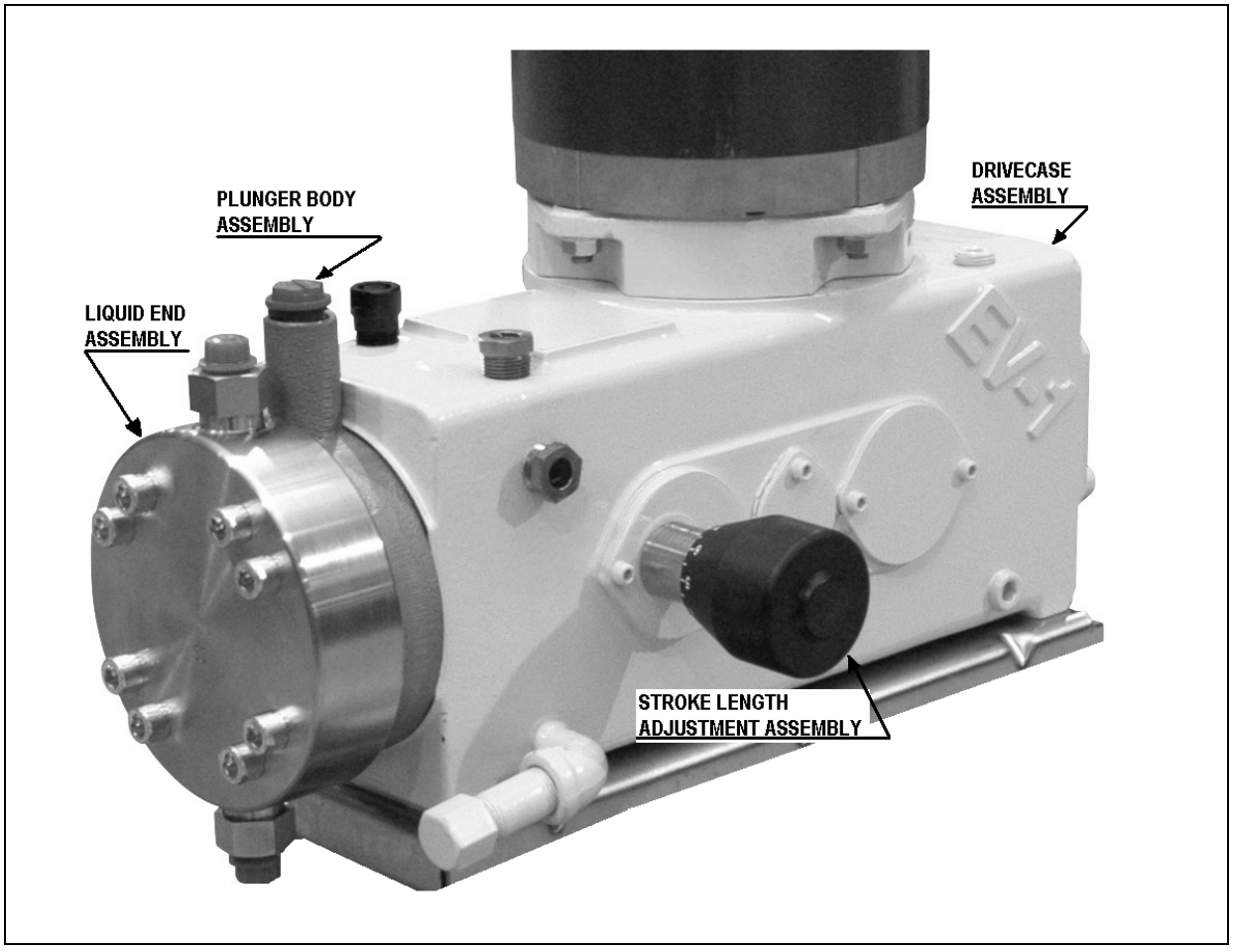


Figure 1. EV1 Modular Metering Pump.

The heavy-duty construction furnishes strength and durability. The symmetrical design permits one or two feeds as in our duplex pumps. And multi-plexing allows as many as 12 feeds with one motor. The drivecase accept NEMA 56C and IEC motor frames.

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 316 stainless steel, Alloy 20, Hastelloy 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 eight interchangeable plunger sizes (See Model/ Product code located prior to Section one).

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:

0.08 GPH (0.30 L/H) to 220 GPH (833 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:

Power 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 multipurpose 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 liquid end 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 EV1 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 SERVICED. 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.

EV1 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 EV1 drivecase will hold approximately 3.3 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 EV1 metering pump is used as hydraulic, 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 specification page 38.

NOTE

The EV1 pump has a highly refined hydraulic 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.

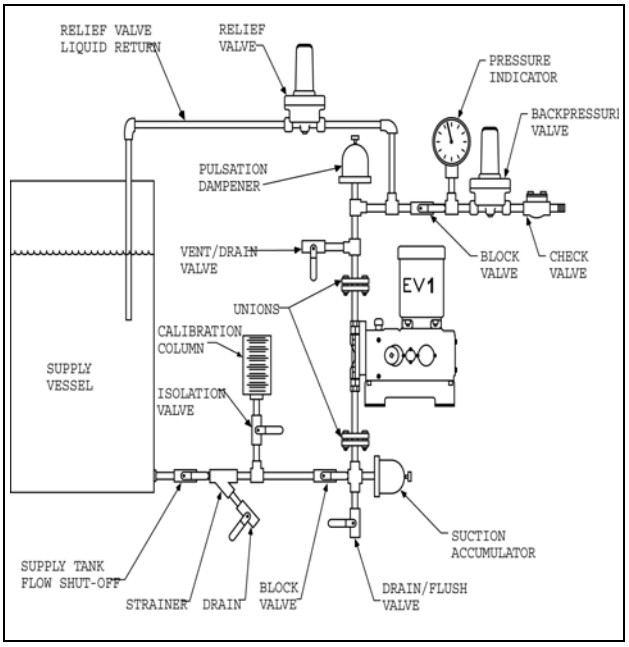


Figure 2. Typical Piping Diagram.

3.2 START-UP CHECKS

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 operat-

ing (should hear a clicking noise caused by movement 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 EV1 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 end has been removed. After reassembly, remove pressure relief valve components as mentioned in Paragraph 4.6, 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 1-3/4 in and 2-3/8 in stroke adjuster should be set lower.

Start the pump motor while adding the proper hydraulic oil into the plunger stem (Relief Valve area). Run pump for several minutes to allow oil to enter the hydraulic chamber. Stop the pump and re-assemble the pressure relief valve, following the instructions from Paragraph 4.6, 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 hydraulics 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 HYDRAULIC RELIEF VALVE PROTECTS PUMP GEARING ONLY AND IS NOT DESIGNED TO BE USED AS A SYSTEM SAFETY RELIEF VALVE.

3.10 TROUBLESHOOTING

The EV1 is equipped with an air bleed relief sight tube. This offers a means of viewing the hydraulic 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 hydraulics 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 EV1 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 EV1 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 end, 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 EV1 is designed to accept a Nema 56C, IEC71, or IEC80 Face Motor. Specific motor data can be found in the information package supplied with the pump. If the motor is replaced, it must be

ITEM	DESCRIPTION
102	ADAPTER, MOTOR
715	STUD
717	FLANGE NUT
725	KEY

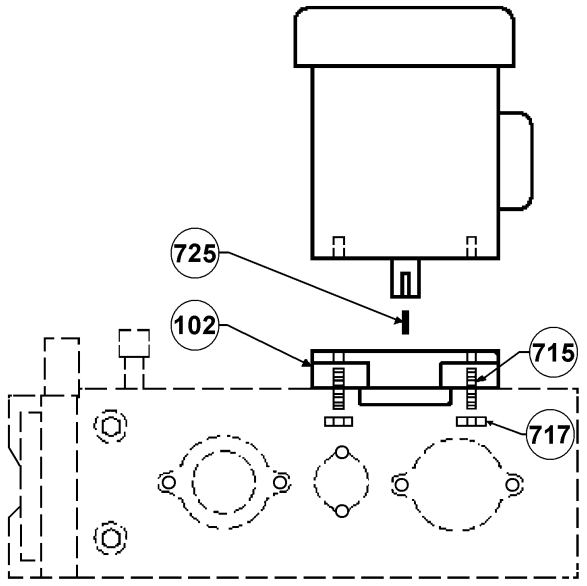


Figure 3. Drive Motor.

identical to the original or a factory approved equivalent.

NOTE

Motor rotation will not affect pump performance or wear, unless fitted for continuous flow option. (Model Designation Pulse-Less).

WARNING

ALWAYS DISCONNECT ELECTRICAL POWER FROM THE PUMP MOTOR BEFORE PERFORMING ANY MAINT-ENANCE. 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” (9.5mm) attachment nuts. Evenly lift motor out. The motor shaft is coupled to worm shaft with a 3/16” (7.8mm) square 0.81” key.

3. To reinstall drive motor apply a liberal amount of antiseize to shaft, then place 3/16” (7.8 mm) shaft key into worm shaft. Align motor shaft with worm and carefully insert. The motor face should meet motor adapter.

4. Evenly draw up four (4) 3/8” (9.5 mm) mounting nuts.

4.4 CHECK VALVES

The check valves are a 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 and size C metallic and non-metallic check valves are removed and replaced as the following individual parts: seat, O-ring, guide, cap, seal, and ball (double ball check valve includes a transition piece). Pumps equipped with double ball check valves (See Figures 6 & 7) maintenance is similar to that of the single ball.

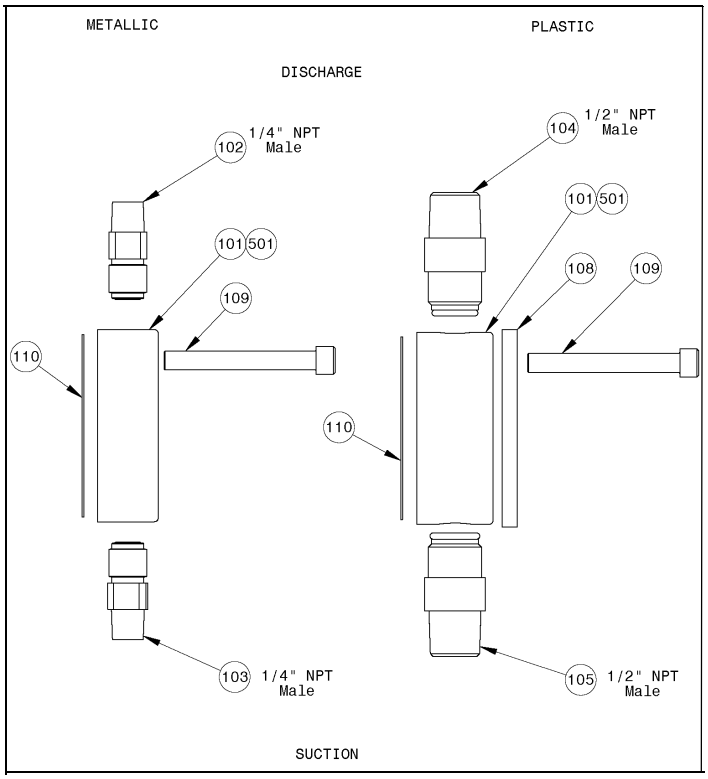


Figure 4. Metallic/Plastic, Head Assembly, Size A.

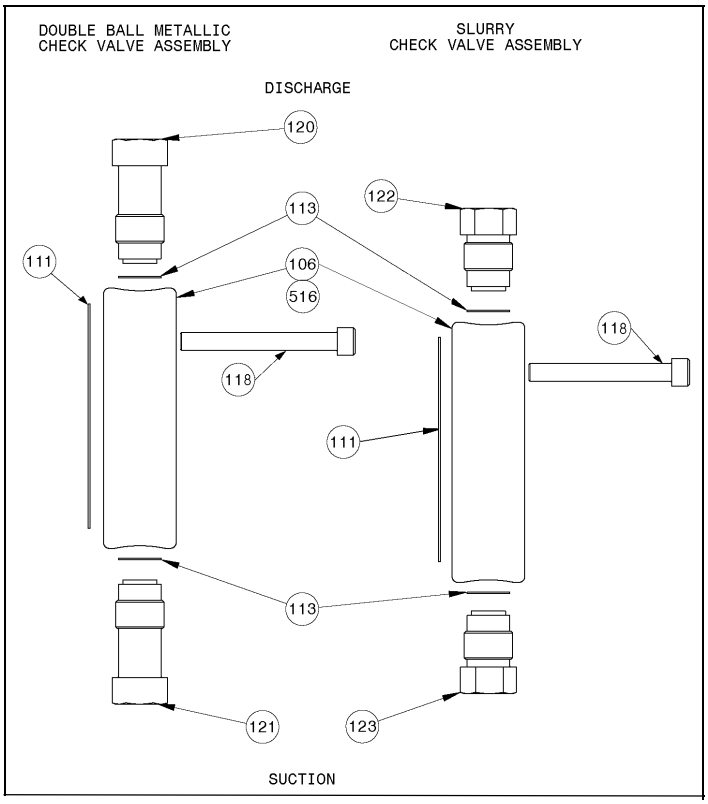


Figure 5. Metallic Head Assembly, Size B.

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 Figure 4. 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 end. Seat surface should be free of burrs or excessive wear. If seats are in need of replacement, liquid end must be removed per Paragraph 4.5.

5. On pumps with plunger diameters of 5/8 in. (15.87 mm) to 1-1/4 in. (31.7 mm), discharge seat is pressed into liquid end, 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 end must be removed per Paragraph 4.5. If seat area is corroded, it may be necessary to tap seat with 5/16 in (8 mm, 24 UNF thread). Use a 5/16 in (8 mm,24 screw and pry out evenly.

6. Pumps equipped with plunger diameters 1-3/4 in. (44.5 mm) and larger, have suction seat pressed into suction valve cap, and discharge seat is pressed into liquid end. Use a drift to remove both seats as in step 5. If needed, use a 5/8 in (15.9 mm) - 18 UNF tap and screw.

7. When new seats are installed, they must be coined. Place a check valve ball on ball seat. Using a brass drift on ball strike drift firmly with hammer. A small chamfer is formed on seat surface.

8. Replace TFE gaskets when valve caps are disturbed (size B & C only). Removal of gaskets is accomplished by using a soft tool. Do not scratch seal surface.

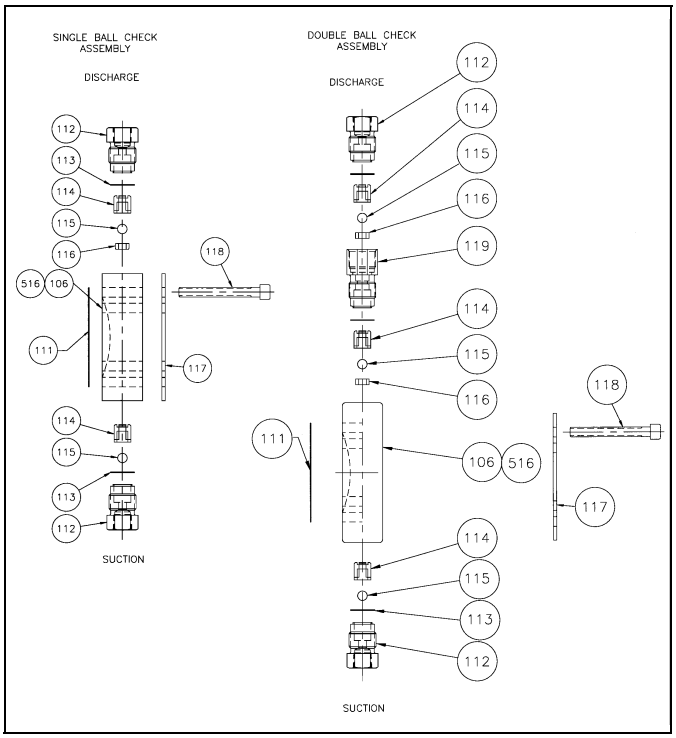


Figure 6. Plastic Head Assembly, Size B.

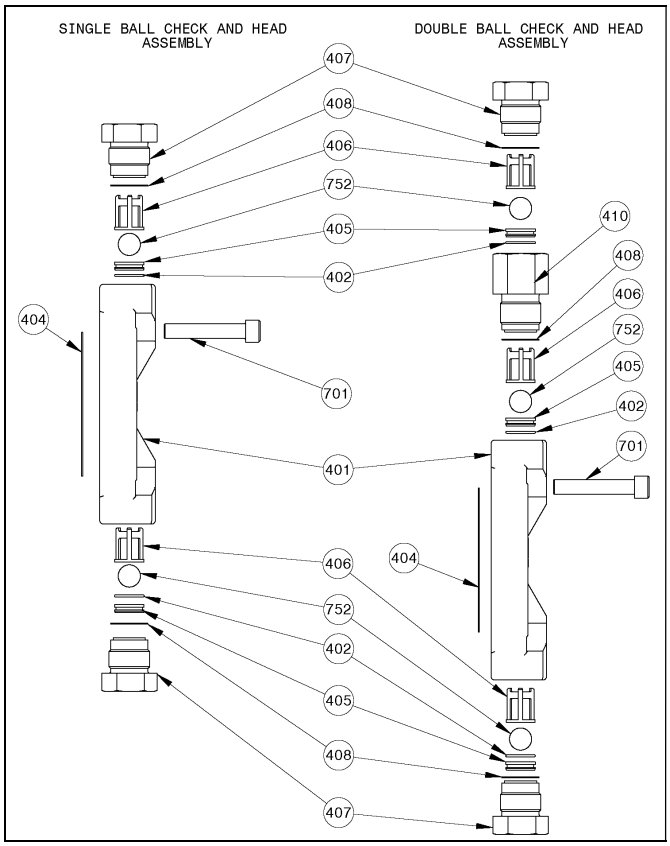


Figure 7. Metallic Head Assembly, Size C.

9. When installing a new gasket, be sure seal surface is clean and gasket is inserted completely into groove.

10. Replace check valve assemblies Figures 4 - 7. Torques on valve caps are critical (size B & C only). Consult Table 2 for correct torque value. Size A check valve caps are tightened to compress o-ring.

Table 2. Check Valve Caps

PLUNGER SIZE	SIZE B		SIZE C	
	5/8 in. (15.87 mm) 7/8 in. (22.2 mm) 1-1/4 in. (31.7 mm)		1-3/4 in. (44.5 mm) 2-3/8 in. (60.3 mm)	
Liquid End Material	Metallic	Non-Metallic	Metallic	Non-Metallic
Torque	15 ft/lbs (20 N•m)	8 ft/lbs (11 N•m)	15 ft/lbs (20 N•m)	8 ft/lbs (11 N•m)

11. 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.

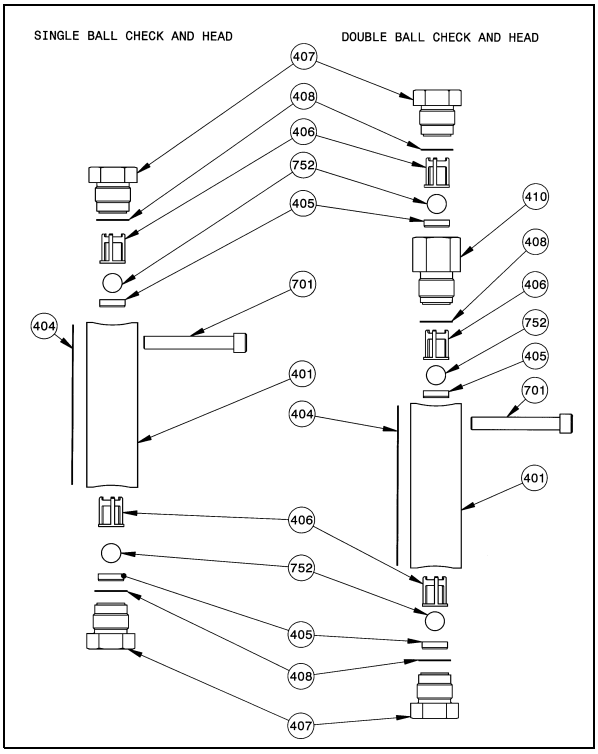


FIGURE 8. Plastic Head Assembly, Size C.

4.5 LIQUID END ASSEMBLY

The liquid ends (Fig. 9 & 10) on the EV1 are available in three sizes (A, B, & C). With the exception of torque specifications and the metal support ring on plastic liquid ends, non metallic sizes are similar, and should be addressed in the same fashion.

1. To remove the liquid end, remove the attaching cap screws.

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 liquid end.

3. Check operation of replenishment valve. When valve button is depressed, then released, valve should snap back to forward position (See Fig. 16C). If a problem is noted and further disassembly is required, proceed to Step 4.

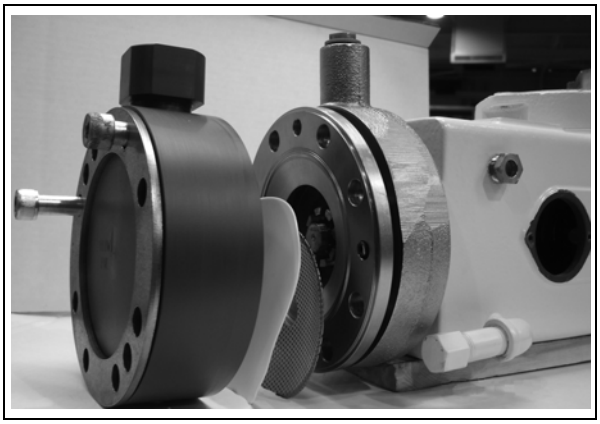


Figure 9. Breakaway of Size C Plastic Liquid End.

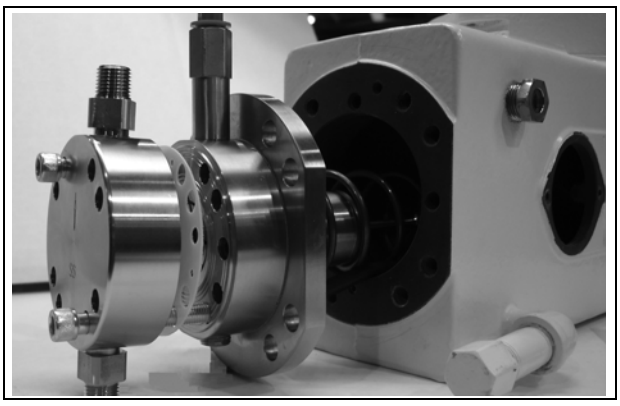


Figure 10. Breakaway of Size A Metallic Liquid End.

4. A new replacement diaphragm is required whenever the liquid end is removed. Refer to Table 5, Page 38 for torque specifications for a diaphragm.

5. Install the liquid end oriented so the flow arrow points up on the face, and insert eight (8) attaching screws. Tighten the liquid end bolts in sequence to the maximum torque ratings as indicated, Table 5, Page 38.

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 the check valve assemblies, Paragraph 4.4.

4.6 PLUNGER BODY ASSEMBLY

The function of the plunger body (Figure 12) 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 end 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) For small plunger body, remove two (2) 1/4 in (6.4 mm) - 20 cap screws.

   (2) For large plunger body, first remove two (2) 1/4 in (6.4 mm) - 20 cap screws that retain diaphragm support ring, Item 213. Plunger body may now be removed by removing eight (8) 3/8 in (9.5 mm) - 16 cap screws.

2. Remove plunger housing from drivecase, taking care plunger and spring do not fall free.

3. 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.

4. Clean drivecase carefully. Magnet is designed to attract metal particles. This area will need special attention.

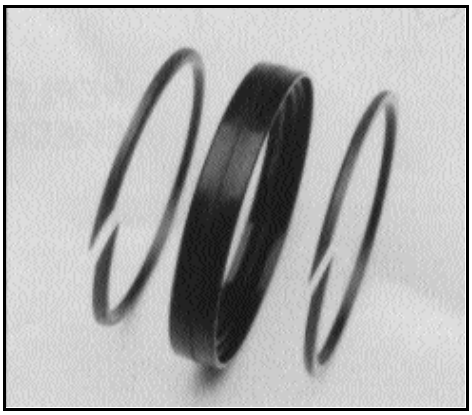
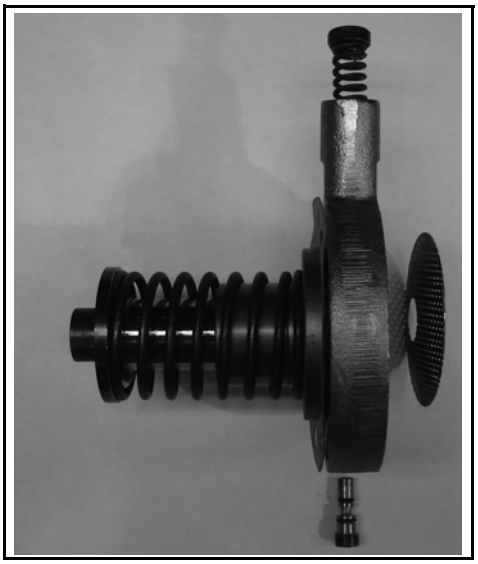
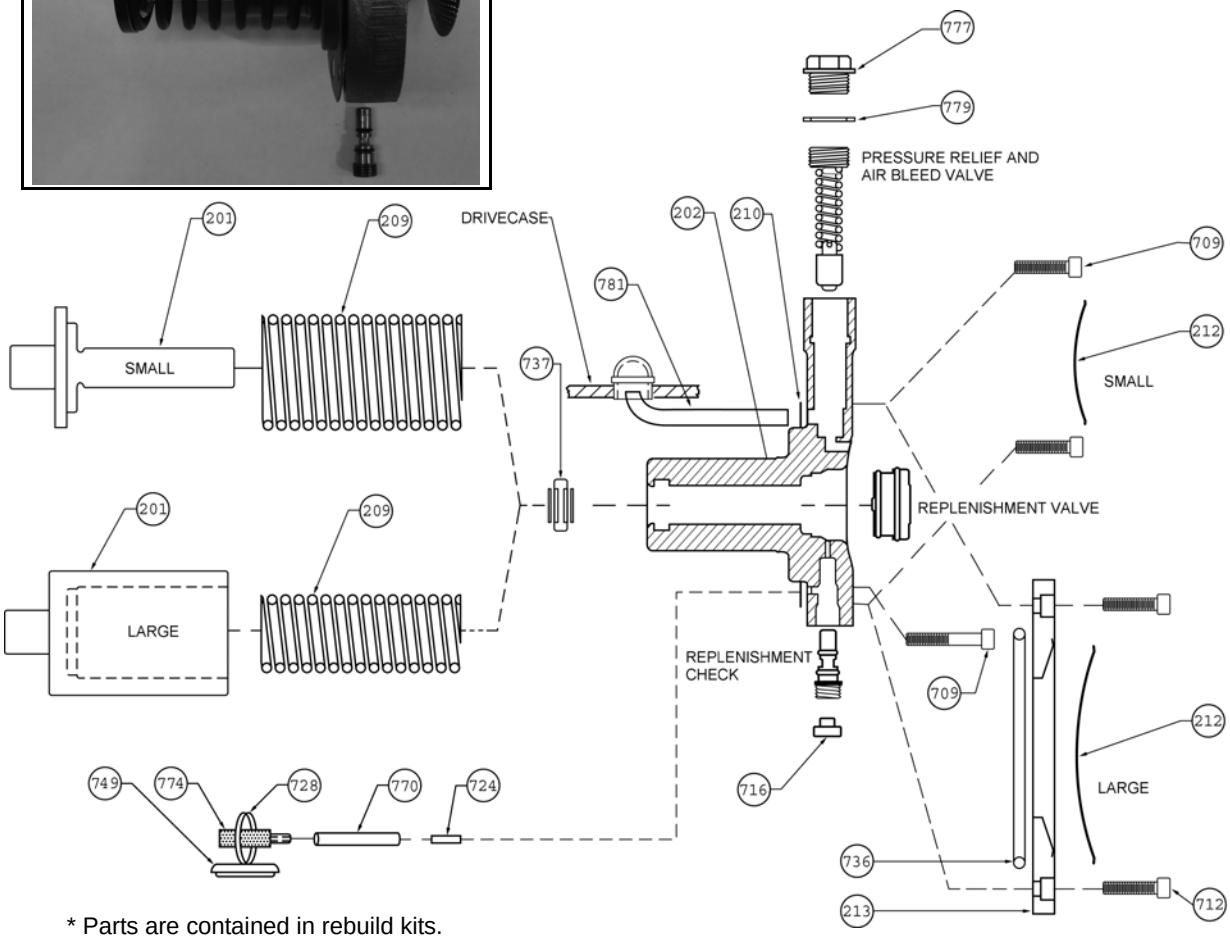


Figure 11. Plunger Seal.

5. 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.

   - Plunger sizes 5/8 in. (15.875 mm), 7/8 in (22.2 mm), 1-1/4 in (31.7 mm) have external return springs.
   - Plunger sizes 1-3/4 in (44.5 mm), 2-1/8 in (54 mm), 2-3/8 in (60.3 mm) have internal-return springs.





* Parts are contained in rebuild kits.
Note: Poppet/air bleed valve and replenishment check assemblies are contained in plunger body rebuild kits.

ITEM	DESCRIPTION
201	PLUNGER
202	PLUNGER BODY
209	SPRING
210*	PLUNGER BODY GASKET
212	CONTOUR PLATE
213	CONTOUR RING
709	CAP SCREW

ITEM	DESCRIPTION
712	CAP SCREW
716*	PLASTIC CAP
724	ROLL PIN
728*	FILTER TIE
736*	PLUNGER BODY O-RING
737*	PLUNGER SEAL

ITEM	DESCRIPTION
749	FILTER MAGNET
770*	FILTER TUBE
774*	FILTER
777	CAP PLUG
779*	R.V. CAP GASKET
781	SIGHT TUBE ASSY

Figure 12. Plunger Body Assembly (Size B and C).

6. The plunger seal is a 3 piece T-type seal. This utilizes an elastomer T-shaped seal with 2 plastic support rings (See Figure 11). 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.

7. To remove plunger seal, both plastic retaining rings must be removed first. Using a small angled tool, carefully pry out all three seal components.

8. To replace seal, insert first plastic ring into bore. Note orientation of beveled ends. (See Figure 11). Plunger seals 1-1/4 in (31.7 mm), 1-3/4 in (44.5 mm), 2-3/8 in (60.3 mm), plastic rings contain a machined radius. This radius must face center of seal.

9. Install a well lubricated seal into groove in plunger body.

ITEM	DESCRIPTION
206	REPL CHECK BODY
211	REPL CHECK ROLL PIN
729	REPL CHECK O-RING
730	REPL CHECK O-RING
751	BALL

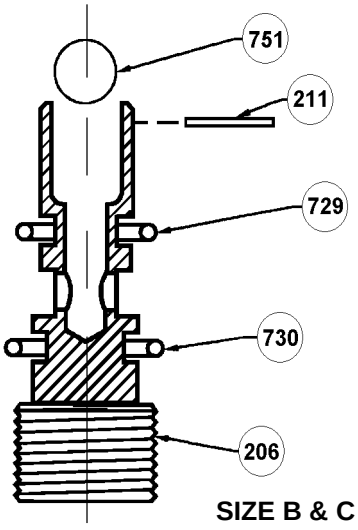


FIGURE 13. Replenishment Check Assembly.

10. Slide retaining ring from bore into far side of plunger seal.

11. 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.

12. To remove replenishment check, remove protection plug (item 716) and back out of plunger body using a 1/4 Allen Wrench. Note location in Figure 12.

13. Examine o-rings for any damage. Check ball should move freely inside body.

14. If repair of replenishment check is necessary, entire sub-assembly should be replaced (Figure 13).

15. To reinstall replenishment check, generously lubricate o-rings and insert. Use a gentle turning force until threads catch. Tighten firmly.

16. Insert protection plug, Item 716. Replace when necessary.

17. The air bleed and pressure relief valve 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 in Figure 14.

18. The poppet and air bleed assembly are housed in the square body. The small air bleed ball 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.

19. The relief spring in each liquid end is specific for each application (Under no circumstances should any other spring be used in this assembly).

20. 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 Section 3, Operation. Be sure to install protection cap, Item 777 prior to installation.

ITEM	DESCRIPTION
501	REPL VALVE NUT
502	REPL VALVE POPPET
503	AIR BLEED VALVE SCREW
504	REPL VALVE SPRING
750	AIR BLEED BALL
755	POPPET BALL
778	ALIGNMENT COLLAR

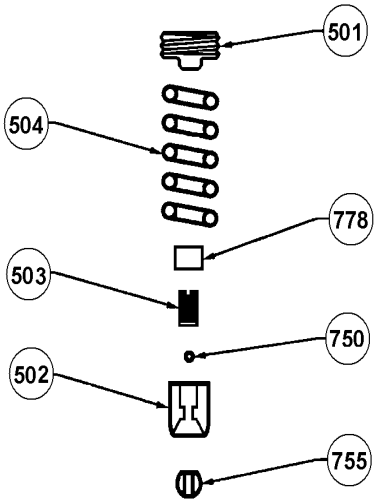


FIGURE 14. Pressure Relief/Air Bleed Assembly (Size B & C).

21. To access replenishment valve, remove rear support plate, Item 212 (size B & C only). To remove valve, tap lightly with a soft rod through plunger bore on back side of valve (See Figure 12).

22. The face of the valve should be secure to the spool via a press fit. The spool should move freely in the valve and easily return to forward position via a conical spring (See Figure 15).

23. When action of valve is not smooth, replacement of entire assembly is necessary.

24. O-rings should not be reused. Remove old o-rings carefully. Ensure there are no sharp edges on exterior of valve body.

25. 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 16A) is aligned with hole in plunger body (Figure 16B) and press valve into plunger housing.

* Parts are contained in rebuild kits.

ITEM	DESCRIPTION
203	REPL VALVE SPOOL
205	REPL VALVE HEAD
207	REPL VALVE HOUSING
208	REPL VALVE SPRING
732*	REPL VALVE O-RING
733*	REPL VALVE 0-RING
734*	REPL VALVE 0-RING

NOTE:

Poppet/air bleed valve and replacement check assemblies are contained in plunger body rebuild kits.

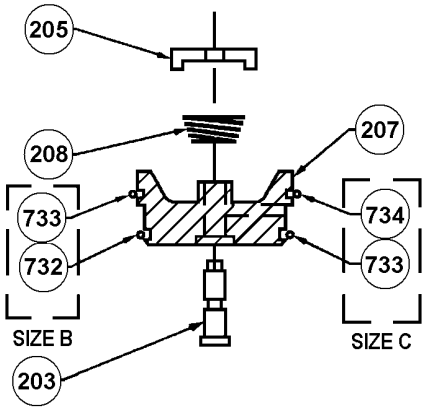


Figure 15. Replenishment Valve Assembly (Size B & C).

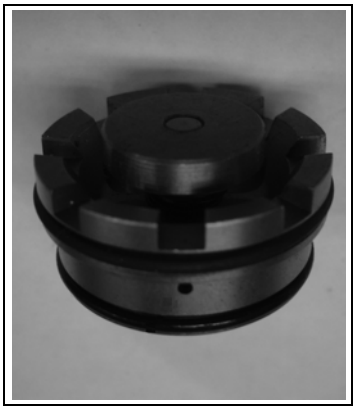


Figure 16A.

Replenishment Valve Hole.

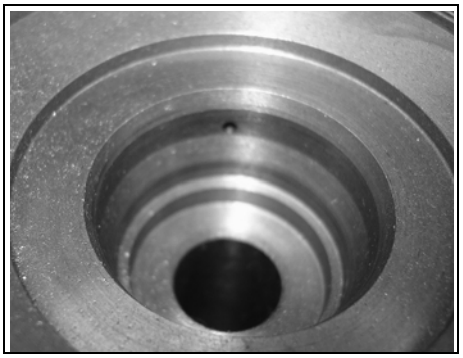


Figure 16B. Plunger Body Hole.

26. To ensure that replenishment valve is installed completely, place rear contour plate Item 212 (Figure 12) onto plunger body. The plate should fit tightly to the body without any rocking action (Figure 16C).

Figure 16C. Plunger With Replenishment Valve and Rear Contour Plate Installed.

27. 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. On 1-3/4 in. (44.5 mm) plunger, be sure to install spring support ring as shown in Figure 12.

28. Insert filter magnet assembly into drivecase. Ensure tube is securely fastened to pin, Item 724 (Figure 12) and filter. The tube must not come in contact with the eccentric or the plunger return spring.

29. 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).

30. 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.

Table 3. Plunger Housing Bolt Size

BOLT SIZE	1/4 IN. (6.4 MM)	3/8 IN. (9.5 MM)
5/8 in. (15.87 mm) 7/8 in. (22.2 mm) 1-1/4 in. (31.7 mm)	100 in/lb (11 N•m)	
1-3/4 in. (44.5 mm) 2-3/8 in. (60.3 mm)		40 ft/lb (54 N•m)

31. 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.

32. Evenly draw up body with attaching bolts. See Table 3 for proper torque settings.

33. Re-assemble liquid end as described in Paragraph 4.5.

34. Before restarting pump, make sure drivecase is properly refilled with oil. The relief valve setting also must be verified. See Section 3, Operation.

4.7 STROKE LENGTH ADJUSTMENT ASSEMBLY

The stroke length adjustment assembly 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 new assembly be purchased if major rework is necessary.

1. Prior to disassembly set the stroke adjuster at 100%. This will allow the plunger spring to relax and ease the housing removal. On pumps with vertical motors, the gear box oil must be drained.

2. Detach the housing by removing the two (2) cap screws and retract the assembly (See Figure 17). See the breakdown of the assembly in Figure 18.

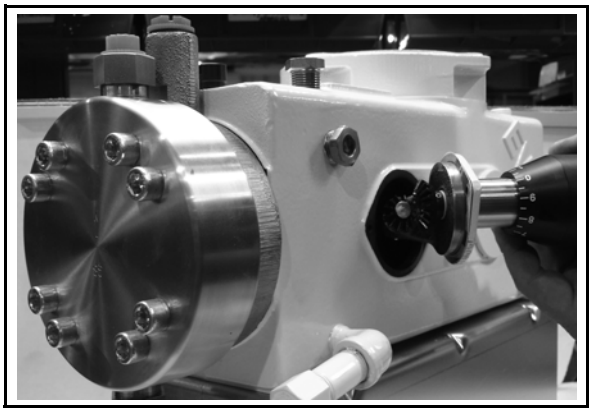


Figure 17. Stroke Adjuster Housing.

3. Remove the adjuster knob with a 9/64 in (3.6 mm) Allen Wrench on the set screw located at the collar.

ITEM	DESCRIPTION
*108	STROKE ADJUSTER COVER GASKET
*301	STROKE SDJUSTER HOUSING
*302	PLUNGER STOP
*303	STROKE ADJUSTER SLEEVE
*304	STROKE ADJUSTER GEARSHAFT
*305	STROKE ADJUSTER SHAFT SCREW
*306	STROKE ADJUSTER KNOB
*307	BEVELED GEAR WASHER
*308	BEVELED PIN
*309	BEVELED GEAR
*326	PLUNGER STOP BUSHING
702	SOCKET HEAD CAP SCREW
*714	SET SCREW
*718	SPRING WASHER
*723	ROLL PIN
*731	O-RING
*732	O-RING
*735	O-RING
*784	SET SCREW

* Parts are contained in rebuild kits.
Note: Poppet/air bleed valve and replacement check assemblies are contained in plunger body rebuild kits.

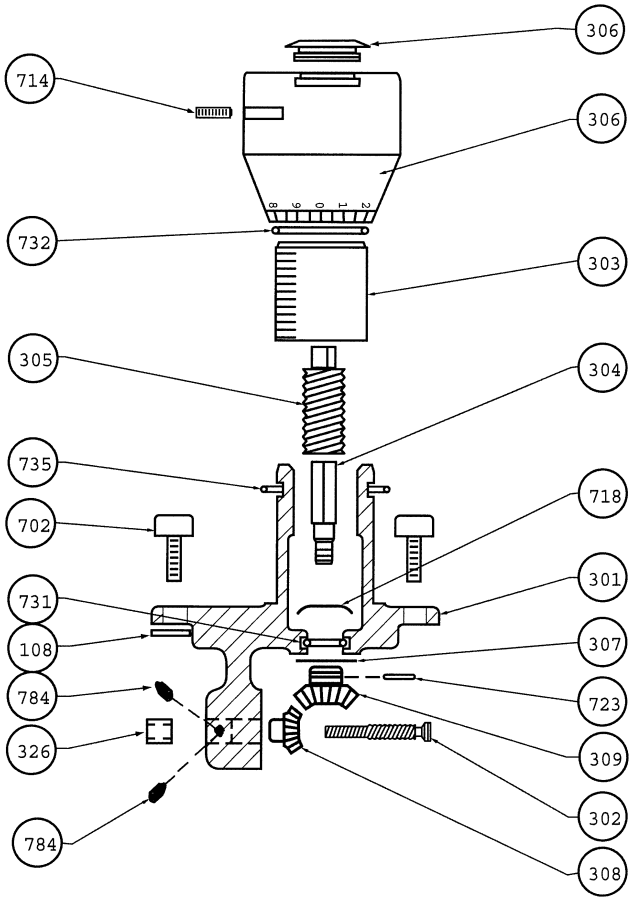


Figure 18. Manual Stroke Adjuster.

4. Remove the calibrated sleeve, Item 303.

5. Both the knob and sleeve utilize locating o-rings. It is not necessary to replace the o-rings unless they are damaged.

6. The knob o-ring, Item 732, is located inside, at the end of the bore. Remove with small angled tool. If replacement is necessary, lubricate with light oil.

7. The sleeve o-ring, Item 735, is located on the outside of the adjuster housing. If replacement is necessary, do not lubricate.

8. Adjust the plunger stop until there is 1-3/16 in. (30 mm) from end of screw to bottom of small gear (Figure 19).

NOTE

Be sure that stop screw and small gear are firmly pressed against ear of housing (See Figure 19).

FIGURE 19. Stroke Adjuster Assembly.

9. Insert the collar, Item 326, into housing ear. Install two (2) set screws Item 784. Double check distance in Step 8 and firmly secure the two (2) set screws.

10. Install O-ring on outside of housing stem and press on calibrated sleeve. Use no lubricant. Calibration marks should face top of pump.

11. Install the o-ring, Item 732, into stroke adjuster knob.

12. Place the adjusting knob on the shaft and dial in, clockwise, until the adjustment bottoms. Back out a 1/2 turn and affix with the set screw. Be sure that the “zero” mark on knob aligns with “zero” on the calibrated sleeve.

13. Check for proper operation.

14. Install assembly using a new gasket and two (2) cap screws.

15. 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.

16. If plunger movement is present, repeat the adjustment procedure from Step 8. Increase the measurement from 1-3/16 in (30 mm) gradually until Step 15 is met.

4.8 ELECTRONIC ACTUATOR ALIGNMENT PROCEDURE

The operation of the stroke adjuster can be automated with the installation of an electronic actuator.

Actuator:

Jordan Control Multiturn Actuator Model SM1010

WARNING

ACTUATOR MUST NOT BE POWERED UNLESS PUMP MOTOR IS OPERATING.

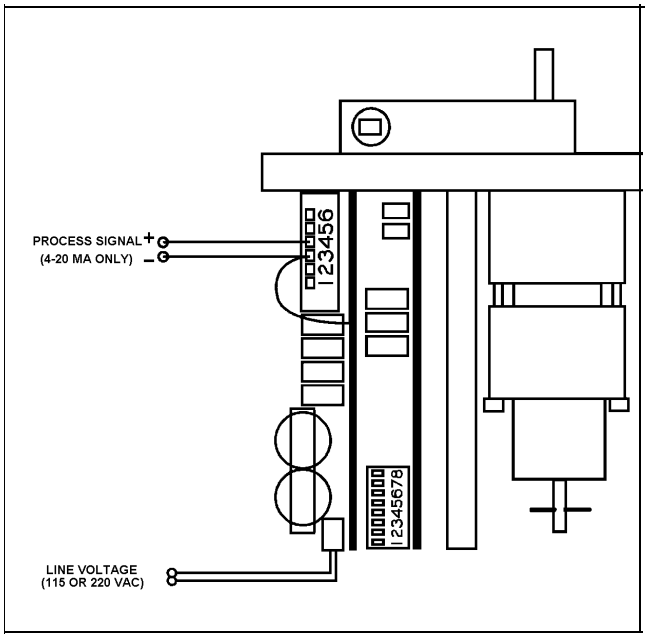


Figure 20. Wiring Diagram.

CAUTION

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

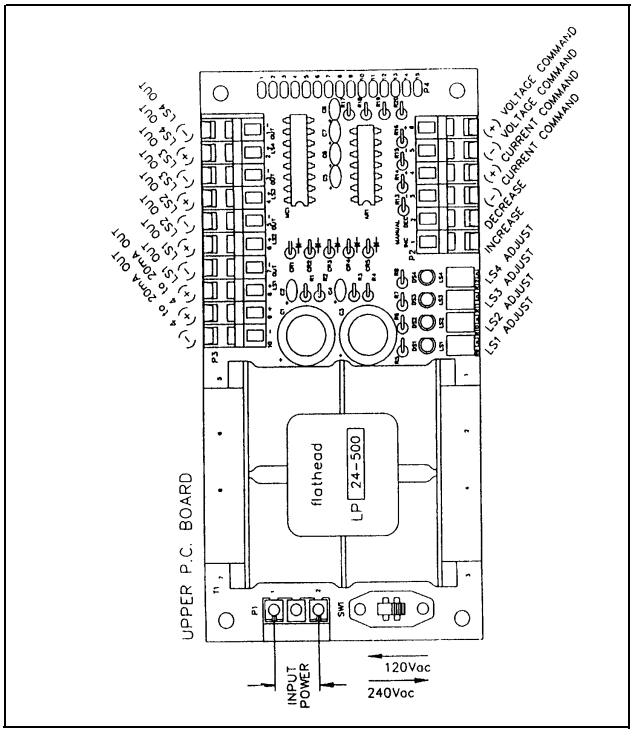


Figure 21. Upper PC Board.

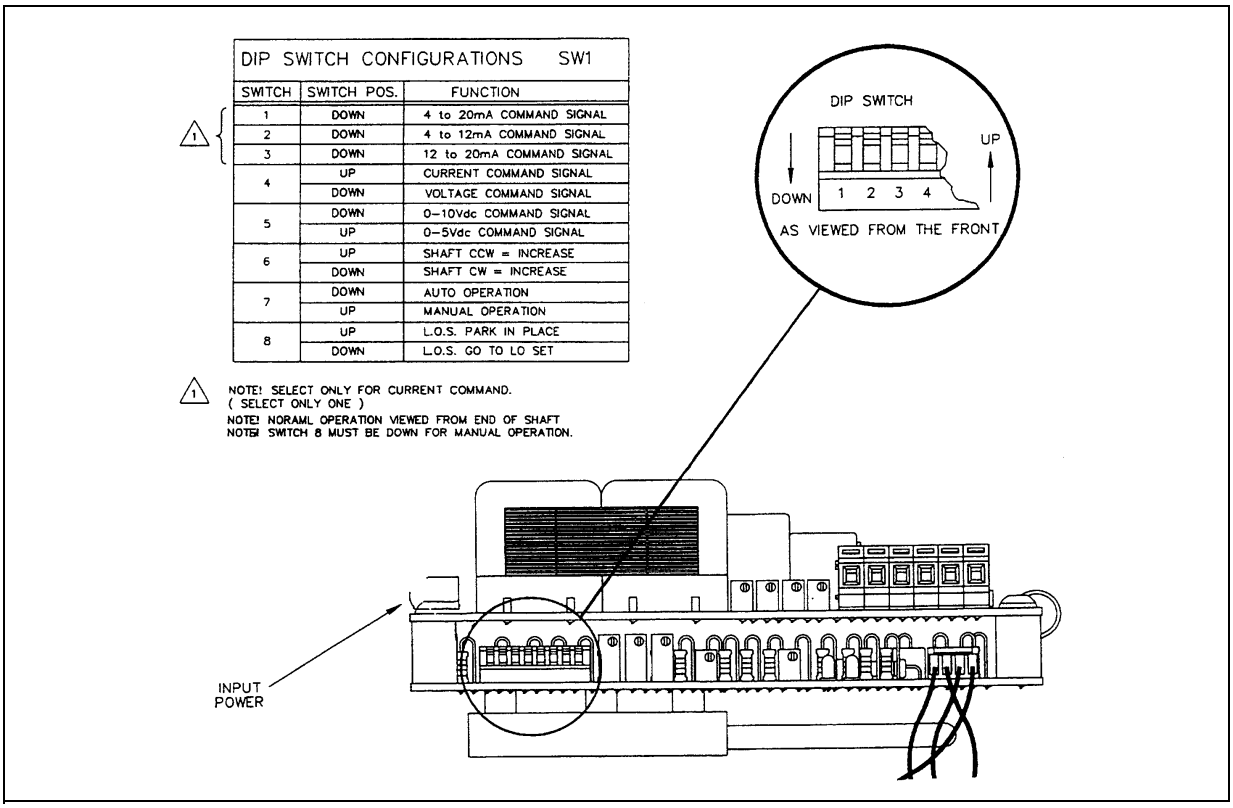


Figure 22. Dip Switch Configuration.

NOTE

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

1. Wire the actuator per Figure 20.

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: (Down position activates switch.) See Figure 22 for chart.

   (1) DOWN - provides 0-100% stroke for 4-20 MA process signal.

   (2) UP - for 4-12 MA process signal, place 2 up and 1 & 3 down.

   (3) UP - for 12-20 MA process signal, place 3 up 1 & 2 down.

   (4) UP - for STD 4-20 MA process signal.

   (5) UP - for STD signal.

   (6) DOWN - for use on Milton Roy's EV1 Metering Pumps. (sets rotation)

   (7) DOWN - STD operation.

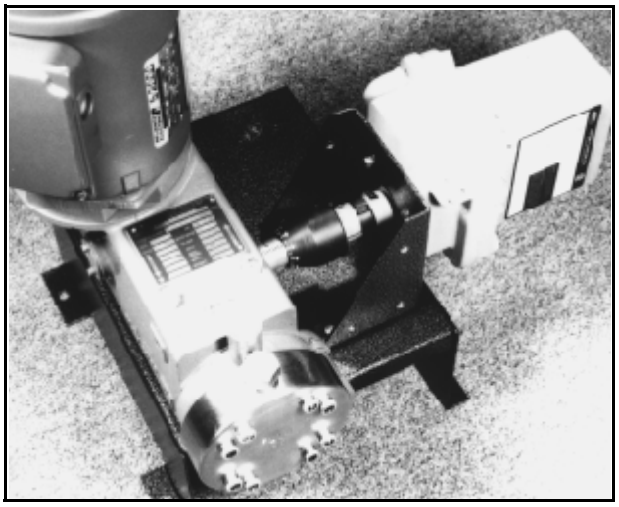


Figure 23. Pump View.

   (8) DOWN - Drives actuator to the low set point.

4. Leave pump side of coupling loose and actuator side tight.

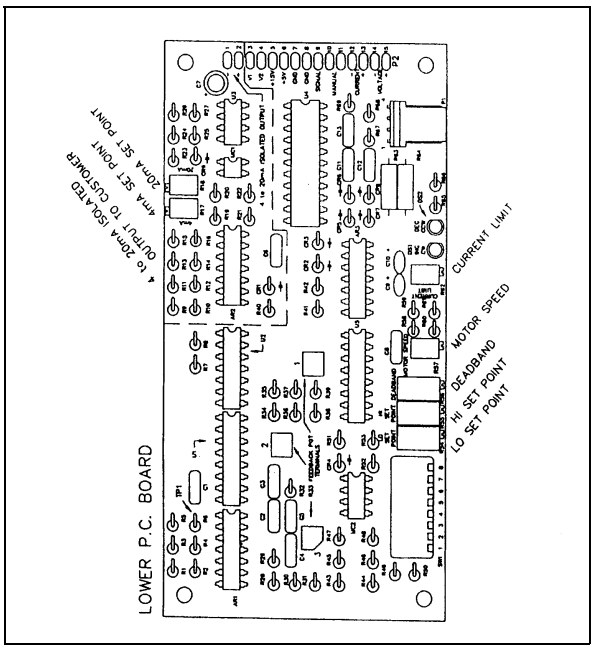


Figure 24. Lower PC Board.

5. Apply a 4 MA signal until LS1 LED (Red) is lit - adjust low set point to achieve this.

6. Adjust low set point until LED 1 (Yellow LED on lower board) just shuts off.

7. Tighten pump side coupling set screw.

8. Apply a 12 MA signal and adjust high set point (pot is located on lower board) so pump setting is 50%.

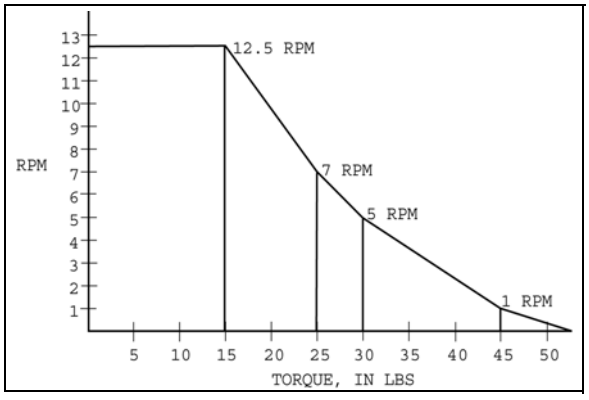


Figure 25. Speed/Torque Curve.

9. Apply a 20 MA signal and adjust LS2 so pump setting does not exceed 99%. LED 2 (Green) should be lit. (CCW reduces setting).

10. Adjust the high set point so LS2 LED (Red) just shuts off.

11. Set current limit pot located on lower board to full setting by turning full clockwise. This is noted by a slight click.

12. Set motor speed by adjusting motor speed pot on lower board. Set for approximately 10 RPM (Figure 25).

4.9 MOTOR ADAPTER/ECCENTRIC SHAFT ASSEMBLY

The motor adapter serves two functions in the pump. It provides a C-Face mounting for the drive motor and locates the worm shaft drive gear. The adapter is fabricated in cast iron for durability. The eccentric shaft assembly when coupled with worm shaft, provides the proper strokes per minute. The rotational motion of the worm shaft is converted to reciprocating motion through the use of a cam on the eccentric shaft.

With the motor removed, Paragraph 4.3, it is possible to remove the motor adapter. This assembly houses the worm shaft.

1. Remove four (4) mounting screws and lift out assembly.

2. Remove seal, item 740 and spirolox retaining ring, item 745. Invert motor adapter and press out worm shaft.

3. Remove snap ring, item 747. Support inner bearing race and press out worm shaft.

4. Press out needle bearing from inside of drive case. Allow bearing to push out plug, item 766. Multiplex units will have an oil seal, item 775, instead of a plug.

5. The new needle bearing needs to be pressed into place from inside the drive case. Use a press tool with an O. D. slightly smaller than the O. D. of the bearing to support the side wall of the bearing. Press in bearing until it is 3/32 in. below machined surface.

ITEM	DESCRIPTION
102	MOTOR ADAPTER
103	ECCENTRIC SHAFT
104	ECCENTRIC GEARHUB
*111	C-FACE MOTOR ADAPTER PINION GASKET
112	GEAR SUBASSEMBLY
112A	WORMSHAFT (SOLD WITH ITEM 112)
113	GEAR SUBASSEMBLY (MULTIPLEX)
113A	WORMSHAFT (SOLD WITH ITEM 113)
708	SCREW
715	STUD
717	FLANGE NUT
720	DOWEL PIN
*740	INPUT SHAFT SEAL
745	SNAP RING WORM BEARING
746	ECCENTRIC SHAFT SNAP RING
747	SNAP RING WORM SHAFT
748	ECCENTRIC BEARING SNAP RING
756	ECCENTRIC SHAFT BALL
763	NEEDLE BEARING STD.
764	NEEDLE BEARING OPEN
766	NEEDLE BRG.
768	BALL BEARING
769	BALL BRG.
775	OIL SEAL
776	DRIVE CASE PLUG

* Parts are contained in rebuild kits.
Note: Poppet/air bleed valve and replacement check assemblies are contained in plunger body rebuild kits.

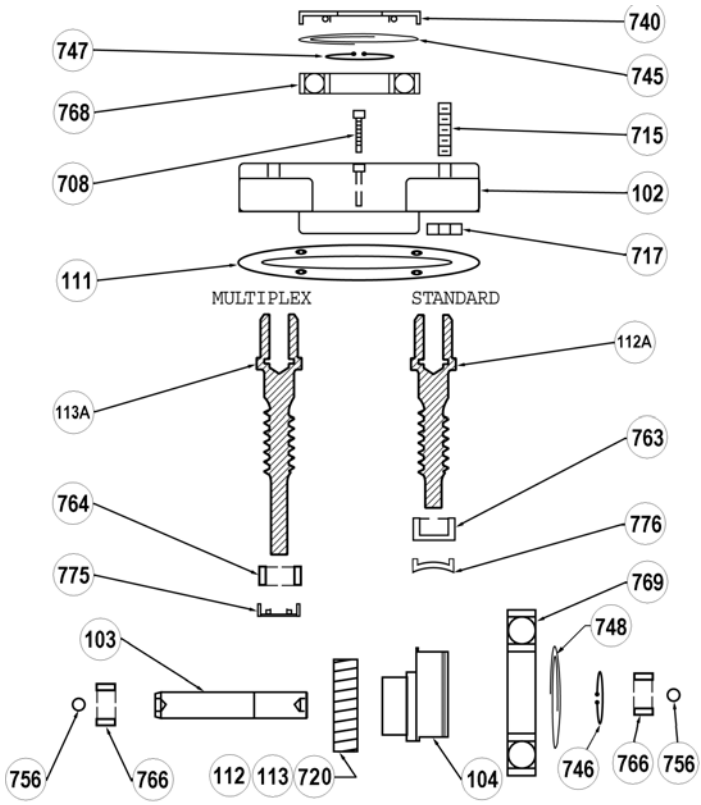


Figure 26. Motor Adapter/Eccentric Shaft Assembly.

6. Reinstall worm shaft plug, item 776, or new oil seal, item 775.

7. Press new bearing on to worm shaft until it bottoms on shoulder of shaft. Secure with a new snap ring, item 747.

8. Press shaft and bearing assembly into motor adapter. Secure with a new spirolox retainer, item 745.

9. Install new oil seal, with lip side towards gear box. Press into adapter until top of seal is below chamfer in adapter.

NOTE

To replace the oil seal, strike a small sharp tool to perforate the oil seal near the perimeter. Pry out the seal with a proper tool.

10. The eccentric shaft will generally require no service for the life of the pump. When a gear ratio change is required, consult the factory for special instructions. See Figure 26 for parts identification.

11. Place gasket, item 111 on drive case and install motor adapter/worm gear assembly.

12. Secure with four (4) screws. Draw up evenly and torque to approximately 50 in/lbs (6 N•m).

13. Reinstall motor - Paragraph 4.3.

4.10 DRIVE CASE ASSEMBLY

The drivecase (Figure 27) 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.

ITEM	DESCRIPTION
101	DRIVECASE
105	END COVER
106	ECCENTRIC SHAFT RETAINER PLATE COVER
107	STROKE ADJUSTER COVER
108	STROKE ADJUSTER GASKET COVER
*109	ECCENTRIC SHAFT RETAINER PLATE SHIM
110	END COVER GASKET
641	BASE
702	SCREW
703	SCREW
753	SIGHT PLUG
*760	BREATHER
761	PIPE PLUG
777	CAP PLUG
779	RV CAP GASKET

* Parts are contained in rebuild kits.
Note: Poppet/air bleed valve and replacement check assemblies are contained in plunger body rebuild kits.

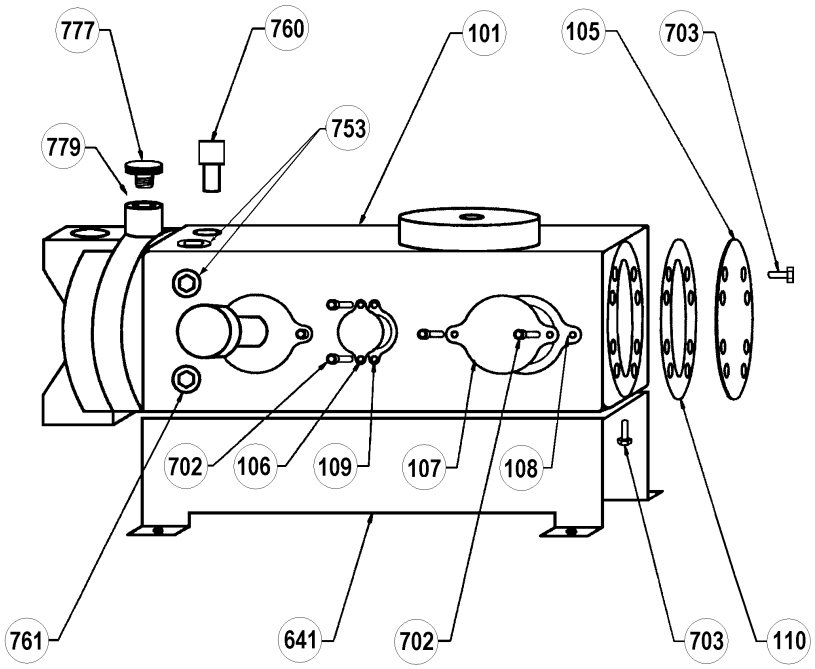


Figure 27. Drivecase.

Two (2) baseplate configurations, horizontal or vertical, are supplied for the EV1. The design is dependent upon motor orientation.

The second feed plunger housing and stroke adjuster's cover utilize a gasket. If a leak is detected or an assembly removed, a new gasket is needed. Directions for installing new components are found in their designated section.

Eccentric shaft retainers, item 106, 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.

All EV1 drive cases must have a breather.

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.

4.11 MULTIPLEX

Multiplex pumps utilize a single motor to power two or more pumps. Since most of the required HP of a motor is not needed throughout the entire stroke, a second pump will require only slightly more HP. Multiplexing, along with the dual feed design, offers unlimited options and unparalleled flexibility.

Multiplexing is accomplished by mounting a pump horizontally and retrofitting a new extended worm shaft. Note breakdown in Figure 28. Instructions are found in Paragraph 4.9 for installation of standard worm shaft.

Follow Step 6 in Paragraph 4.9, motor adapter, to press in new needle bearing, item 764.

1. Oil seal, Item 775, must be pressed until flush with face of gear case. Ensure keyway is cov-

ITEM	DESCRIPTION
101	DRIVECASE
105	END COVER
106	ECCENTRIC SHAFT RETAINER PLATE COVER
107	STROKE ADJUSTER COVER
108	STROKE ADJUSTER GASKET COVER
*109	ECCENTRIC SHAFT RETAINER PLATE SHIM
110	END COVER GASKET
601	BASE
702	SCREW
703	SCREW
*760	BREATHER
761	PIPE PLUG
777	CAP PLUG
779	RV CAP GASKET

* Parts are contained in rebuild kits.
Note: Poppet/air bleed valve and replacement check assemblies are contained in plunger body rebuild kits.

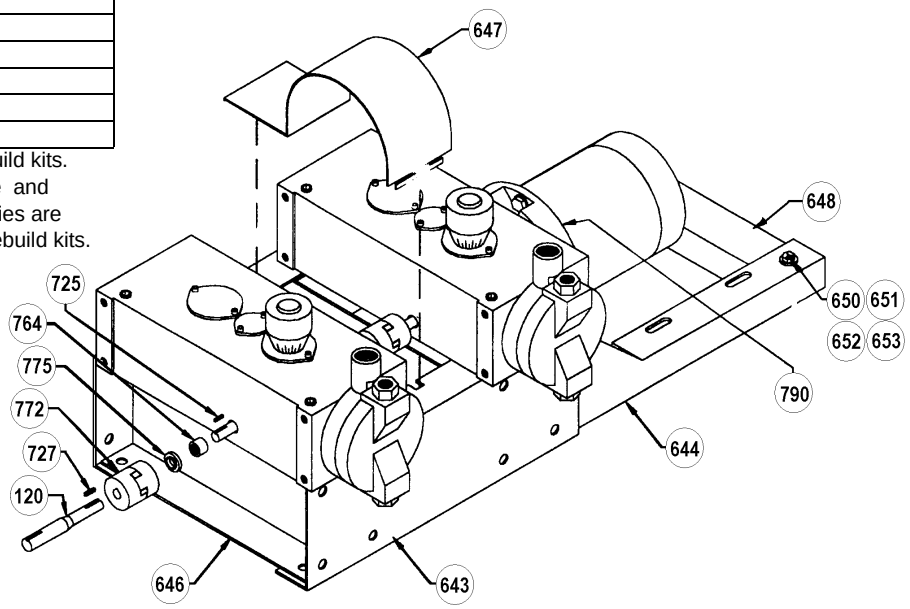


Figure 28. Multiplex.

ered to protect seal. TFE or electrical tape should provide satisfactory protection.

2. A lovejoy coupling, Item 772, will be secured to output shaft of drive base using a shaft key and coupling set screw.

3. Insert coupler shaft, Item 120, into coupling and secure with a set screw.

4. Before engaging pumps, be sure they are phased properly. Normal phasing for two similar pumps is 180 Degrees. That is, one pump plunger full forward, one full back. For multihead pumps or ganging of more than two pumps consult representative for proper phasing.

5. The coupler shaft fits into second pump's input shaft in motor adapter. This is a similar procedure to Step 3, paragraph 4.3 - Drive Motor.

6. The coupling shaft must be aligned within 0.005 in. (0.127 mm). The drivecase of either pump may need to be shimmed to achieve proper alignment.

4.12 LEAK DETECTION (OPTIONAL)

4.12.1 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.

4.12.2 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

C. Optic Probe (NEMA 4)

Internal Sensing Indication	Weight
Red LED Activation	Approximately 1.0 lb.
External Sensing Indication	**Operation Temperature**
Relay Interface	0° to +50° C +32° to +122° F

RELAY INTERFACE

Output Configuration	Output Rating
Internal form “C” Relay (SPDT)	Max.switching power = 150W, 600 VA Max. 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

4.12.3 Pressure Switch

Order Number
6AT-EF19-M4-CIA-TT
Comes with SS oversized tag, permanently attached.

Figure 29. Pressure Switch.

Sub-Mini-Hermet pressure switches (Figure 29) 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 4: 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.

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.Approved as an explosion proof snap

3. The hermetically sealed switching element capsule is UL Listed, CSA Certified and SSA approved as an explosion proof snap switch per table 5.

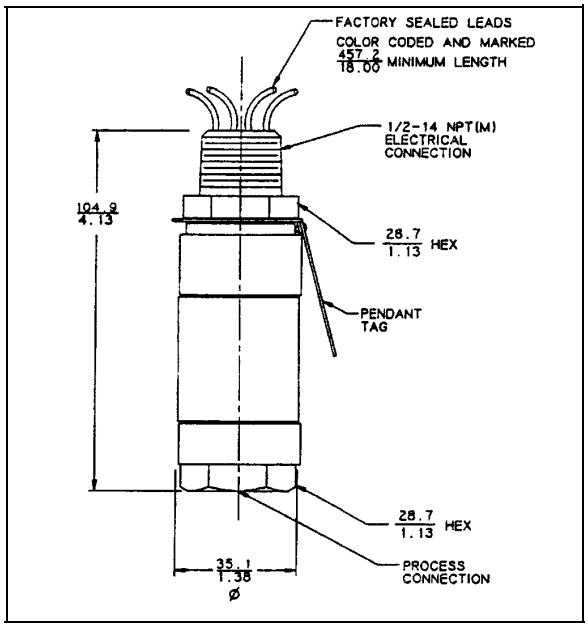


Figure 30. Pressure Switch Dimensions.

Table 5. Agency Approvals

Agency	Hazardous Location Conditions
UL Listed CSA Certified	Class I, Group A, B, C, & D 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

DIMENSIONS

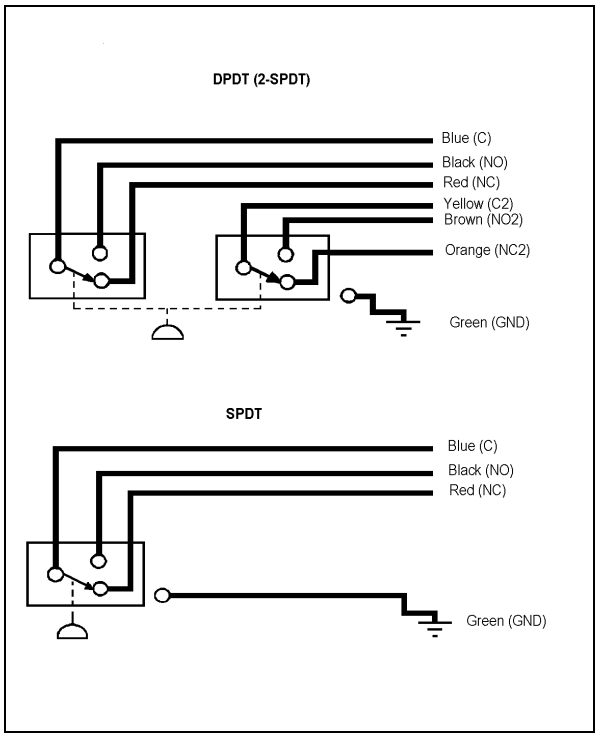
Linear = MM / IN

Dimensions (Figure 30) 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 below.



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.

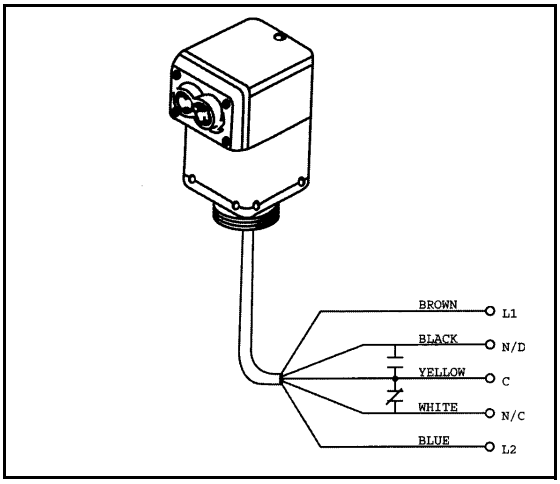


Figure 31. Optic Probe.

4.12.4 Wiring

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.

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

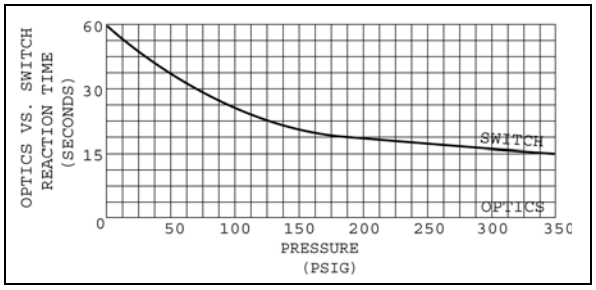


Figure 32. Reaction Time vs. Pressure.

'

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 above.

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 liquid end. 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 above.

4.12.6 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 end. See Figures 34 & 35.

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.

4.12.7 Conversion

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

The double diaphragm assembly is available for all liquid ends 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 end 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 end 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 End 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 end 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 assembly. See Figure 33 for proper alignment.

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 end and diaphragm assembly to the plunger body, arrow on face pointing upward, and torque the cap screws to rating as indicated Table 6.

B. Piping

1. Assemble components as shown in Figures 34 or 35. Be sure all connections are adequately tightened to prevent leaks. Use TFE based pipe sealant for best results.

2. Attach assembled parts and vacuum bleeder to liquid end.

C. Fiber Optic Cable

1. Install o-ring over glass probe and insert into probe adapter. Figures 34 or 35.

2. Place jam nuts and gasket on probe end of cable.

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 diagram, Figure 31.

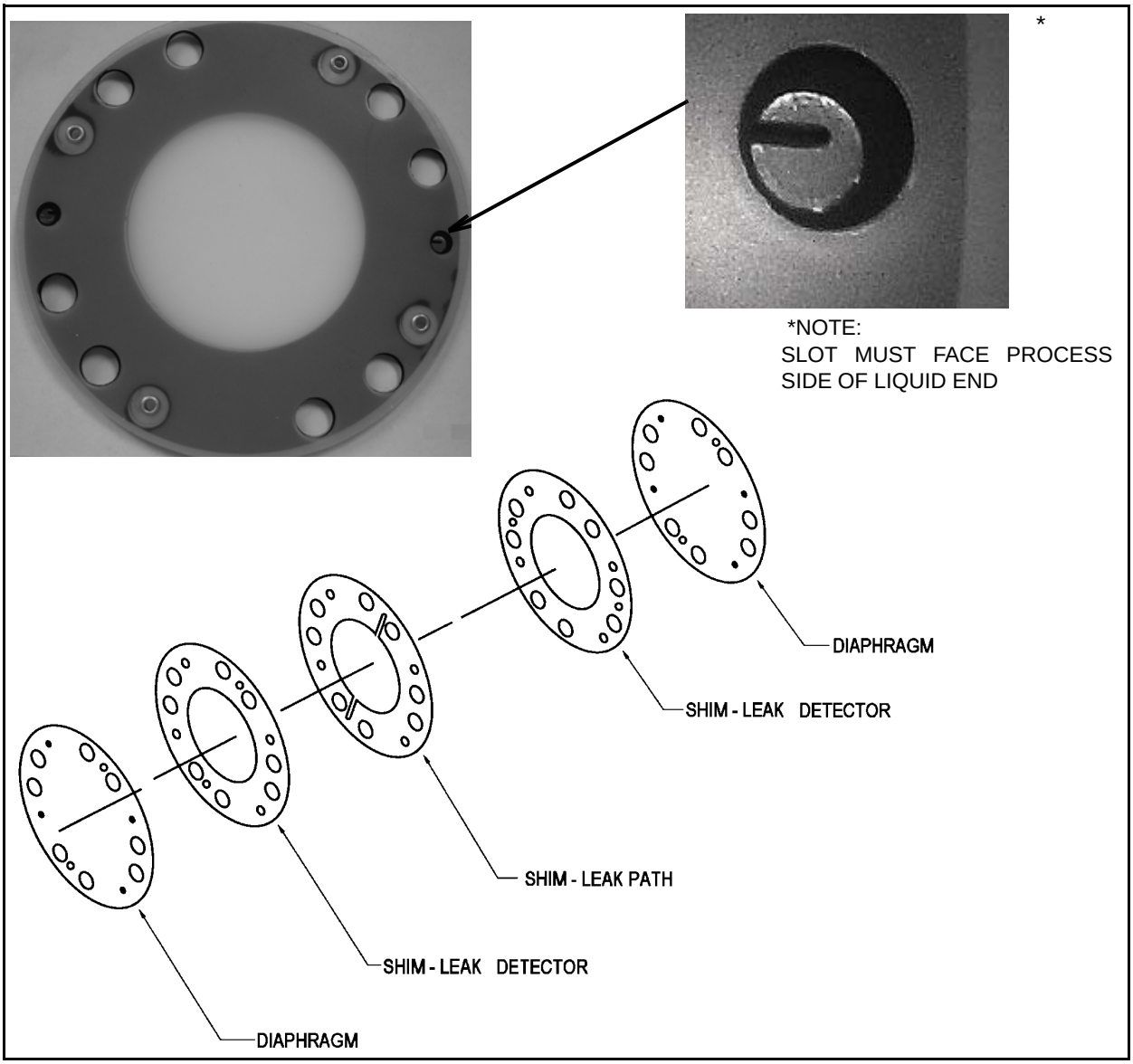


Figure 33. Diaphragm Assembly.

4.12.8 Calibration

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

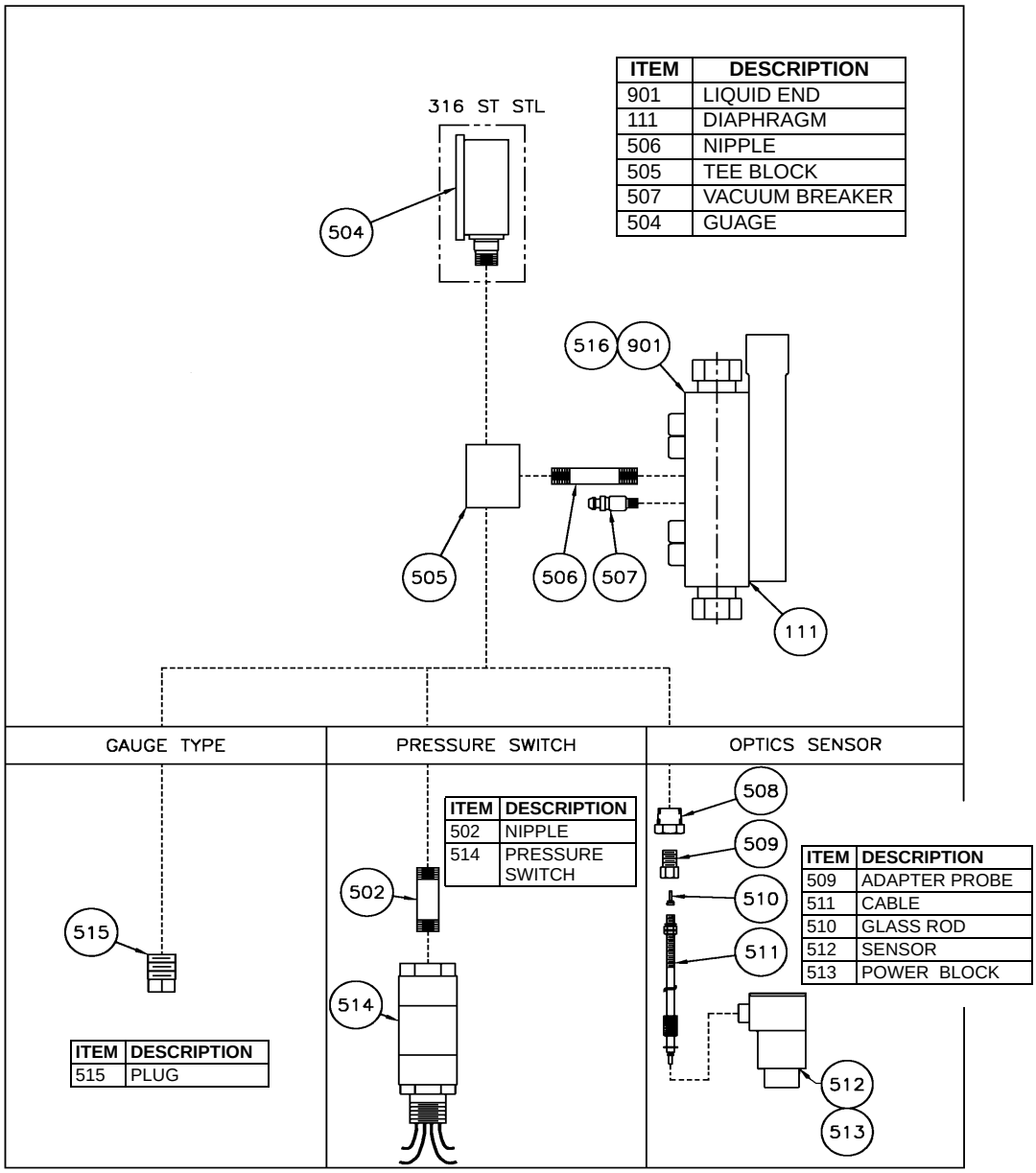
1. Remove sensor ends of cable. Carefully' un-thread probe end from TEE.

2. Remove sensor cover by un-threading 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.



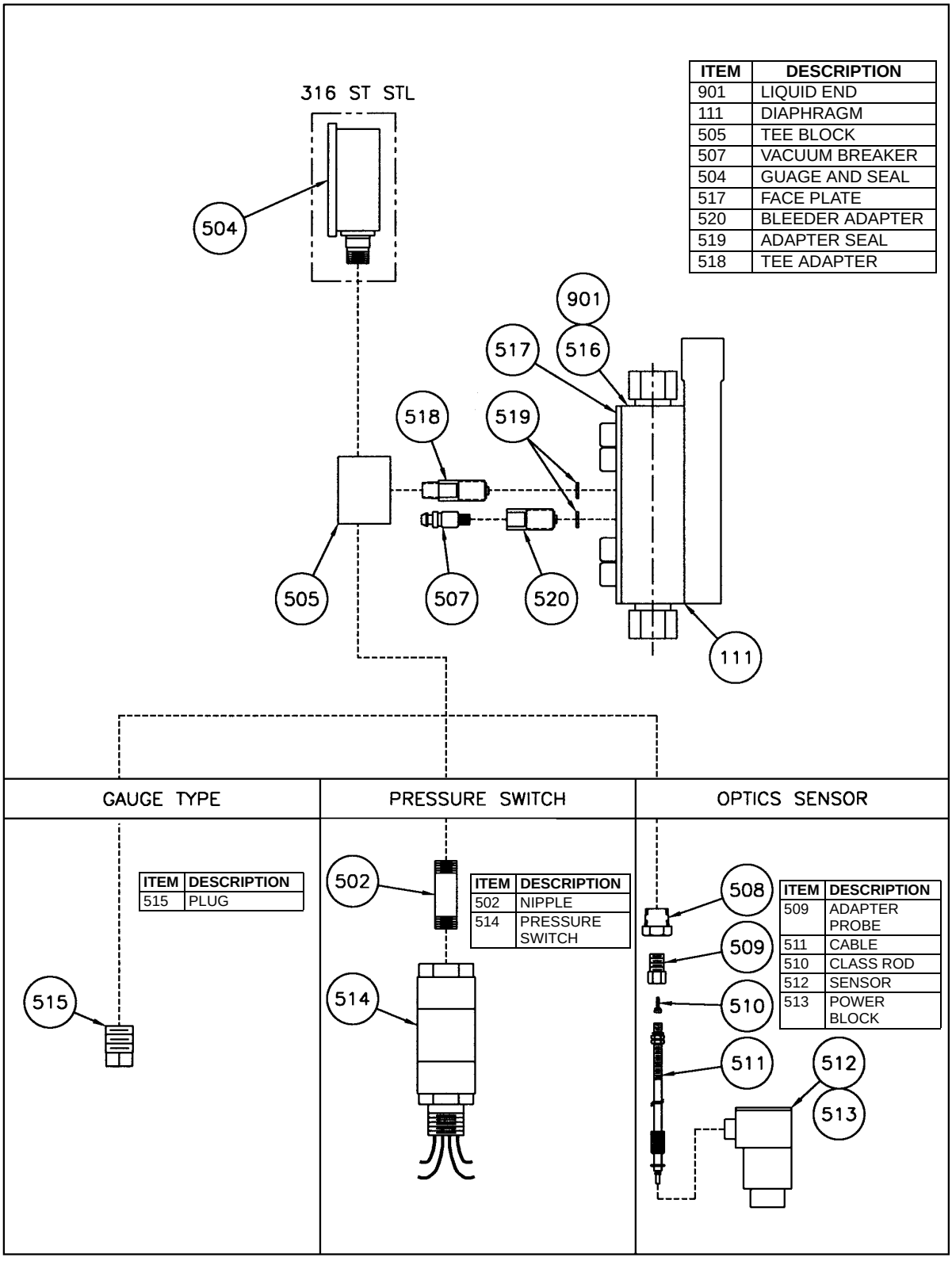
ITEM	DESCRIPTION
901	LIQUID END
111	DIAPHRAGM
506	NIPPLE
505	TEE BLOCK
507	VACUUM BREAKER
504	GUAGE

ITEM	DESCRIPTION
515	PLUG

ITEM	DESCRIPTION
502	NIPPLE
514	PRESSURE SWITCH

ITEM	DESCRIPTION
509	ADAPTER PROBE
511	CABLE
510	GLASS ROD
512	SENSOR
513	POWER BLOCK

Figure 34. Metallic Leak Detection.



ITEM	DESCRIPTION
901	LIQUID END
111	DIAPHRAGM
505	TEE BLOCK
507	VACUUM BREAKER
504	GUAGE AND SEAL
517	FACE PLATE
520	BLEEDER ADAPTER
519	ADAPTER SEAL
518	TEE ADAPTER

ITEM	DESCRIPTION
515	PLUG

ITEM	DESCRIPTION
502	NIPPLE
514	PRESSURE SWITCH

ITEM	DESCRIPTION
509	ADAPTER PROBE
511	CABLE
510	CLASS ROD
512	SENSOR
513	POWER BLOCK

Figure 35. Non-Metallic Leak Detection.

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.

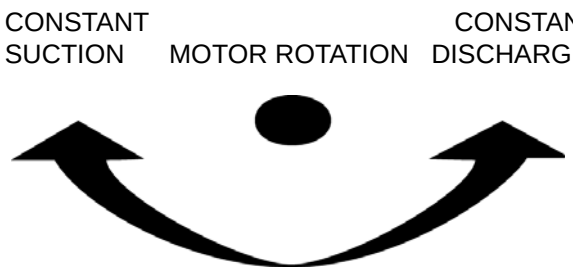
To decrease sensitivity - adjust pot clockwise.

4.13 EVP PULSE-LESS OPTION

4.13.1 Introduction

The EV1 metering pump fitted with the Pulse-Less cam option provides constant flow on suction, or discharge. This allows the EVP to handle many applications where other types of pumps are not well-suited.

The Pulse-Less option is available on the EVP pump with minor modifications. A duplex pump with a specially machined cam, replaces the eccentric/bearing assembly and the stroke adjuster assemblies are removed. The special plungers are



equipped with hardened cam rollers for an extended service life. See Figure 37.

4.13.2 Installation

For the pump to operate In a "constant" flow manner, both feeds of the pump must be manifolded. The most effective operation is accomplished by symmetrical piping connections.

The motor rotation determines the behavior of the pump. To operate in a constant suction mode the motor must be wired to rotate counter-clockwise when facing the input shaft. Clockwise rotation will provide constant discharge.

4.13.3 Operation

The flow is varied by adjusting the speed of the motor (AC or DC) by means of a variable speed drive controller. For proper operation of the pump, the stroke speed of the pumps should not go lower than 15 strokes per minute (19 SPM on 3/8 in. plunger).

NOTE

This limits the turndown to a maximum of 10:1 for the fastest stroking pump. If the 100% stroke speed is less than 138, then the turndown will be less. The flow curve however, is linear at all times.

Since the constant flow relies on each of the duplex liquid ends to provide the same flow characteristics, it is imperative that each feed is set up and operates identically. For example, if one relief valve Is relieving the totalized flow will not be constant. See the troubleshooting guide Section 5 of this manual for details on any problems encountered.

4.13.4 Maintenance

For standard maintenance issues concerning the liquid end assembly, the plunger assembly (less the plunger Item 201), see Figure 37.

4.13.5 Plunger Assembly

1. The plunger assembly differs slightly from the standard (Figure 37). Attached to the plunger, Item 201 is a hardened cam follower, Item 792. If excessive wear is evident, this may be replaced by removing the locknut, Item 793.

2. The plunger guide, Item 151 is attached to the plunger, Item 201 by two screws, Item 794. If the guide is worn, this may be replaced by removing the two screws. Replace the guide and reattach the screws.

3. When the plunger body is Installed into the drivecase, the plunger guide must be oriented in the vertical position. This will ensure that the cam roller is properly contacting the cam. The locknut, Item 793 should be facing the stroke adjuster covers.

4. See Paragraph 4.6 for more information regarding the plunger body assembly.

4.13.6 Cam Assembly

1. The cam, Item 150 is mounted onto hub, Item 154 by six screws, Item 790. To replace cam remove screws and washers, Item 791.
2. Slide cam off hub. Place new cam onto hub, making sure side marked with a "T" is on top.
3. Tighten all bolts.
4. See Paragraph 4.10 to reassemble drivecase.

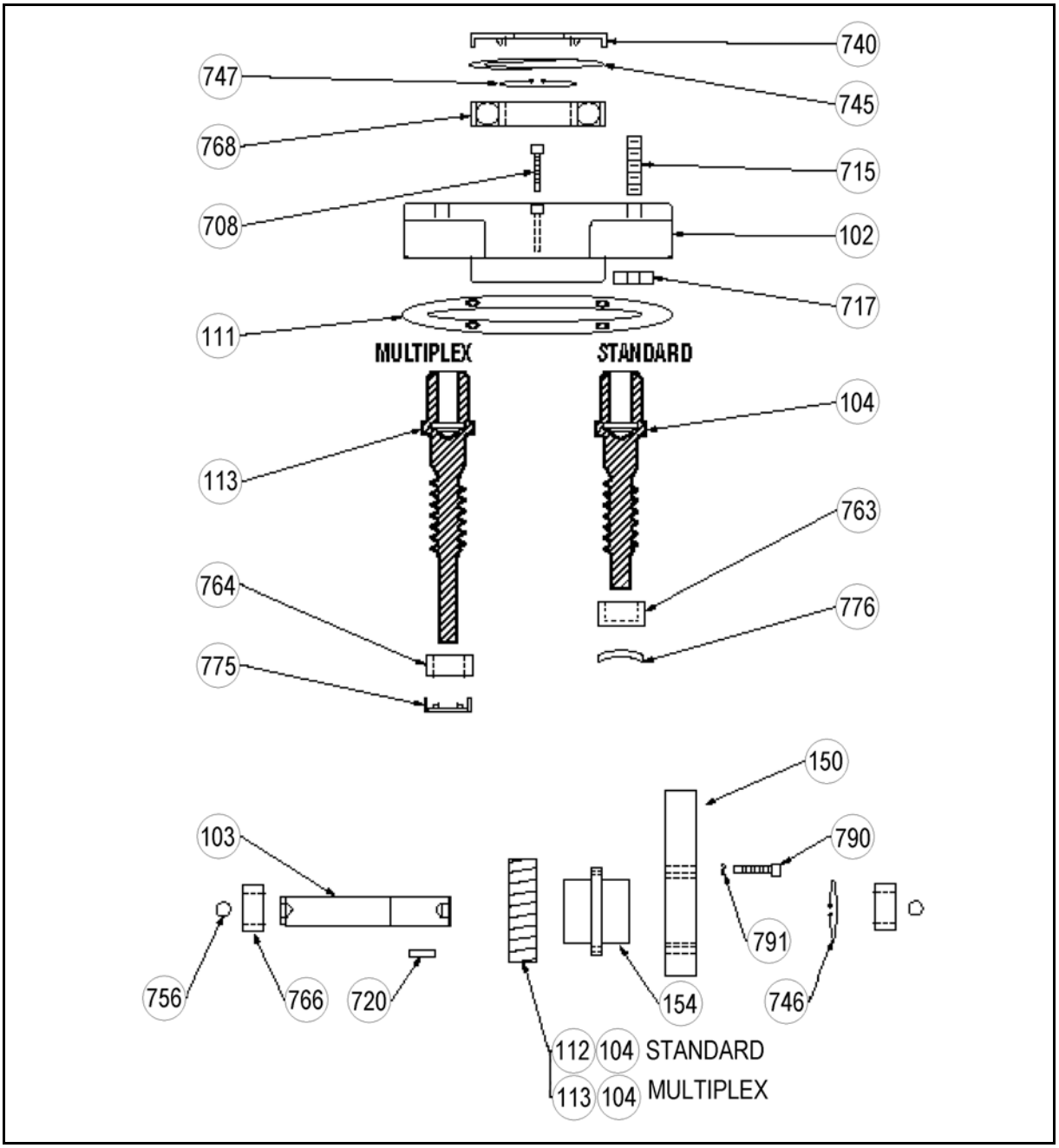
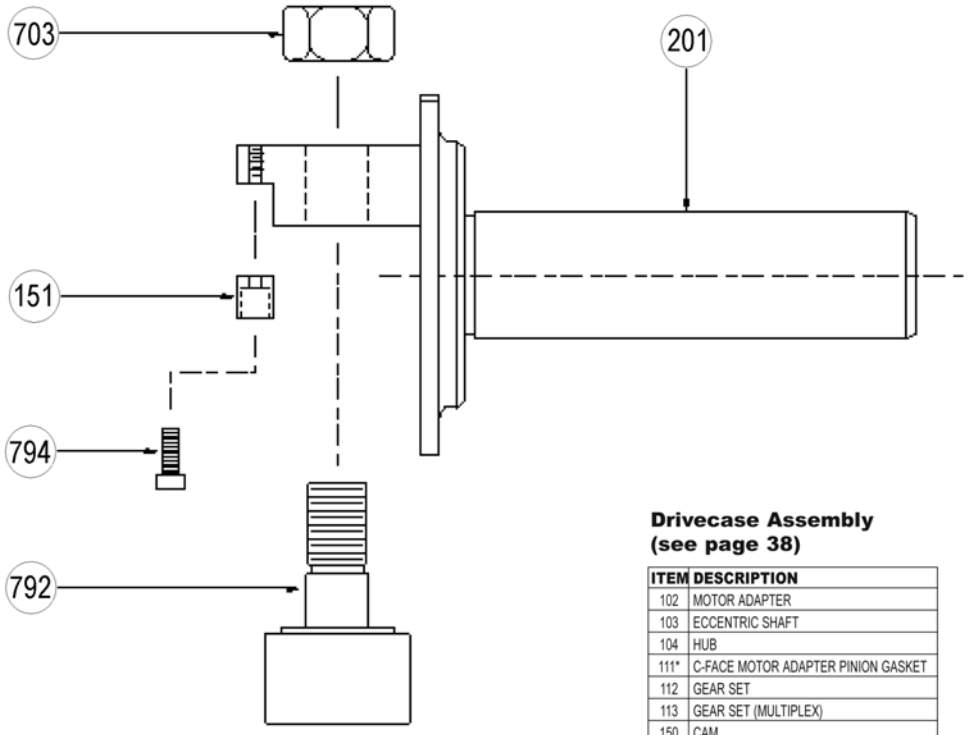


Figure 36. Drivecase Assembly/Pulseless Cam Assembly.



Pulse-Less Components

Part #	Description	Item #	#/Pump
61160200	Cam	150	1
61010500	Guide Block	151	2
61160300	Cam Support	154	1
6101P-06	Plunger, 3/8"	201	2
6101P-14	Plunger, 7/8"	201	2
6101P-20	Plunger, 1-1/4"	201	2
6101P-28	Plunger, 1-3/4"	201	2
6101P-38	Plunger, 2-3/8"	201	2
90222071CX	1/4" x 1" SHCS	790	6
93522011CE	Lock Washer	791	6
9742301100	Cam Follower	792	2
9222301740	Locknut 7/16-20	793	1
902213600	SHCS 4-4 x .375"	794	2
6101P-10	Plunger 5/8"	201	1
6101P-04	Plunger 1/4"	201	1
6101P-03	Plunger 3/16"	201	1

Drivecase Assembly (see page 38)

ITEM	DESCRIPTION
102	MOTOR ADAPTER
103	ECCENTRIC SHAFT
104	HUB
111*	C-FACE MOTOR ADAPTER PINION GASKET
112	GEAR SET
113	GEAR SET (MULTIPLEX)
150	CAM
708	SCREW
715	STUD
717	FLANGE NUT
720	DOWEL, .25D X 34
740	INPUT SHAFT SEAL
745	SNAP RING WORM BEARING
746	ECCENTRIC SHAFT SNAP RING
747	SNAP RING WORM SHAFT
756	ECCENTRIC SHAFT BALL
763*	NEEDLE BEARING STANDARD
764	NEEDLE BEARING OPEN
766*	NEEDLE BRG.
768	BALL BEARING
775*	OIL SEAL
776	DRIVECASE PLUG
790	SCREW, 1/4 X 1 SHCS
791	LOCK WASHER

*Parts are contained in rebuild kits.

Note: Poppet/air bleed valve and replenishment check assemblies are contained in plunger body rebuild kits.

Figure 37. Pulse-Less Plunger Assembly.

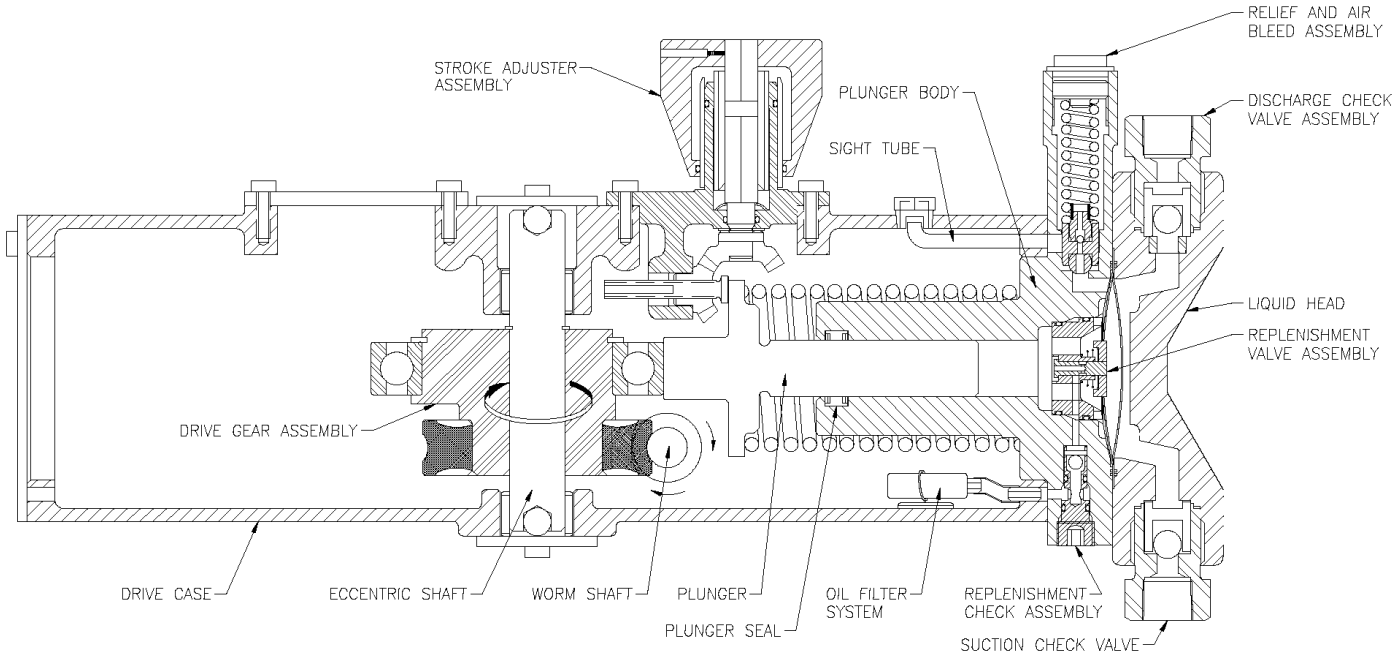


Figure 38. EV1 Cross Sectional.

Lubrication Requirement:

Mobil SHC 524 (Size A)
Mobil SHC 629 (Size B & C)

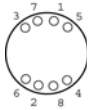
Torque Specifications:

Motor Adapter: 50 in/lbs

Table 7. Plunger Housing Torque:

Bolt Size	5/8" (15.87 mm) 7/8" (22 mm) 1-1/4" (31.7 mm)	1-3/4" (44.5 mm) 2-3/8" (60.3 mm)
1/4" (6.3 mm)	100 in/lbs (11.2 N·m)	100 in/lbs (11.2 N·m)
3/8" (9.5 mm)	---------	40 ft/lbs (54 N·m)

Table 6. Torque Specifications For Liquid Head Assembly

SEQUENCE	PLUNGER SIZE	SIZE A 3/16, 1/4, 3/8		SIZE B 5/8, 7/8, 1-1/4		SIZE C 1-3/4, 2-3/8	
	Liquid Head Material	Metallic	Non-Metallic	Metallic	Non-Metallic	Metallic	Non-Metallic
	Torque, ft lbs	18 ft lbs	72 in lbs	40 ft lbs	15 ft lbs	40 ft lbs	15 ft lbs
	Torque, Nm	24 Nm	8.1 Nm	54 Nm	20 Nm	54 Nm	20 Nm

SECTION 5
TROUBLESHOOTING

No Flow	• 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 end - 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	• 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	• 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	• Velocity too low with slurries - Decrease pipe ID. • Suction line leak - Ensure tight connections. • Vapor lock in suction line or liquid end - 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	• 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	• 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	• 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	• 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	• 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	• 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	• 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 liquid ends followed with B and C size liquid ends and ending with parts common to all size liquid ends.

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. Plunger Size 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", "28D" 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.

EV1 SIZE A

(PLUNGER CODES 03D-3/16 in., 04D-1/4 in., & 06D-3/8 in.)

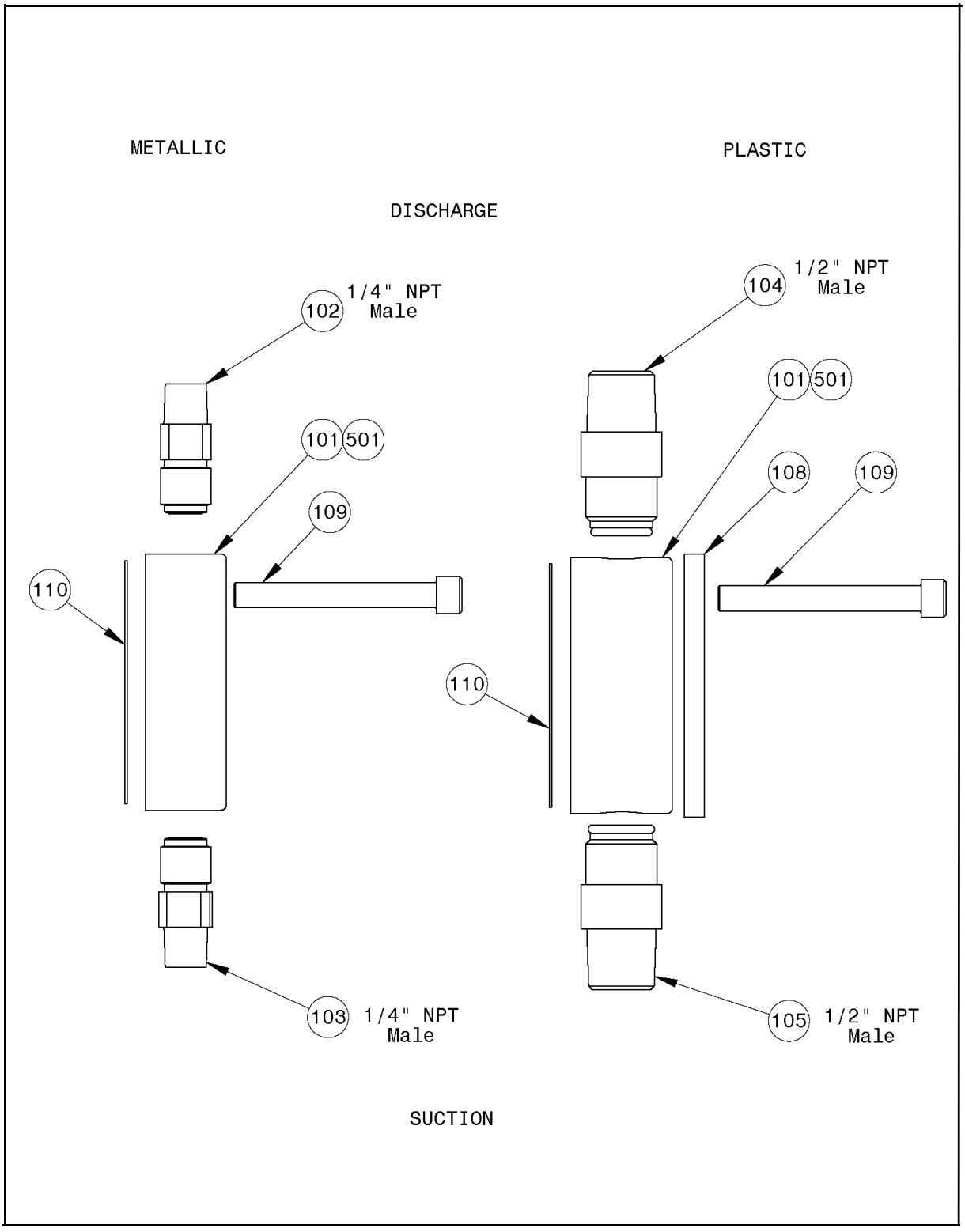


Figure 39. Liquid End Assembly, Size A.

6.3 LIQUID END ASSEMBLY COMPONENTS, SIZE A (316SS, Alloy 20, Hast C, PVC, & KYNAR) (FIGURE 39)

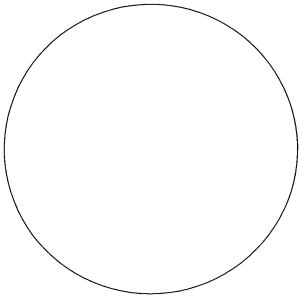
ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
	LIQUID END			
101	Liquid Head Size A, 316SS	6022A-SS	1	03D,04D,06D
	Liquid Head Size A, Alloy 20	6022A-A2	1	03D,04D,06D
	Liquid Head Size A, Hast C	6022A-HC	1	03D,04D,06D
	Liquid Head Size A, PVC	22400	1	03D,04D,06D
	Liquid Head Size A, Kynar	22418	1	03D,04D,06D
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.

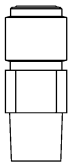
6.4 LIQUID END ASSEMBLY, SIZE A (FIGURE 39)

	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

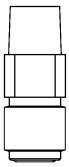
- Items not shown.



(110)Diaphragm

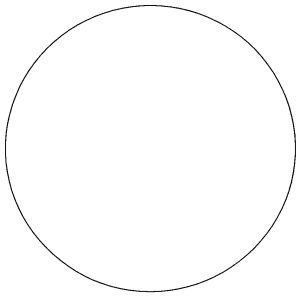


(103)Suction Check Valve

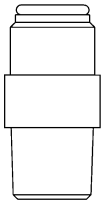


(102)Discharge Check Valve

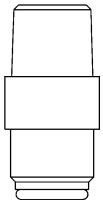
SIZE A
EV - READY
METALLIC LIQUID END
REBUILD KIT
DRK



(110)Diaphragm



(105)Suction Check valve



(104)Discharge Check valve

SIZE A
EV - READY
PLASTIC LIQUID END
REBUILD KIT
DRK

Figure 40. Metallic/Plastic Rebuild Kit, Size A.

6.5 METALLIC/PLASTIC REBUILD KITS, SIZE A

DESCRIPTION	PART NUMBER	PLUNGER CODE
LIQUID END REBUILD KITS SIZE A (SEE FIGURE 40)		
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 EV1 SIZE A (SEE FIGURES 39, 43, & 44) (Contains items: 110, Figure 39; 207, 211, 213, 218, 232, Figure 43 & 203Z, 203, 214, 215, 216, 217 Figure 44)		
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 (SEE FIGURE 56)		
Manual stroke adjuster rebuild kit (Contains items 302, 303, 304, 305, 307, 326, 714, 718, 723, 731, 732, 735, 784, & 789	61761001	ALL
Electric stroke adjuster rebuild kit - less actuator (Contains items 302, 303, 306, 307, 322, 323, 326, 714, 718, 723, 731, 732, 735, & 784	61761002	ALL
DRIVE CASE REBUILD KIT (SEE FIGURE 58)		
Drive case rebuild kit (1 Feed) (Contains items: 108, 109, 111, 210, 740, & 760	61763101	ALL
Deluxe drive case rebuild kit (Contains items: 108, 109, 111, 210, 725, 740, & 760, 763, 764, 766, 768, 769, 775, 776, & 779	61763102	ALL

- Items not shown.

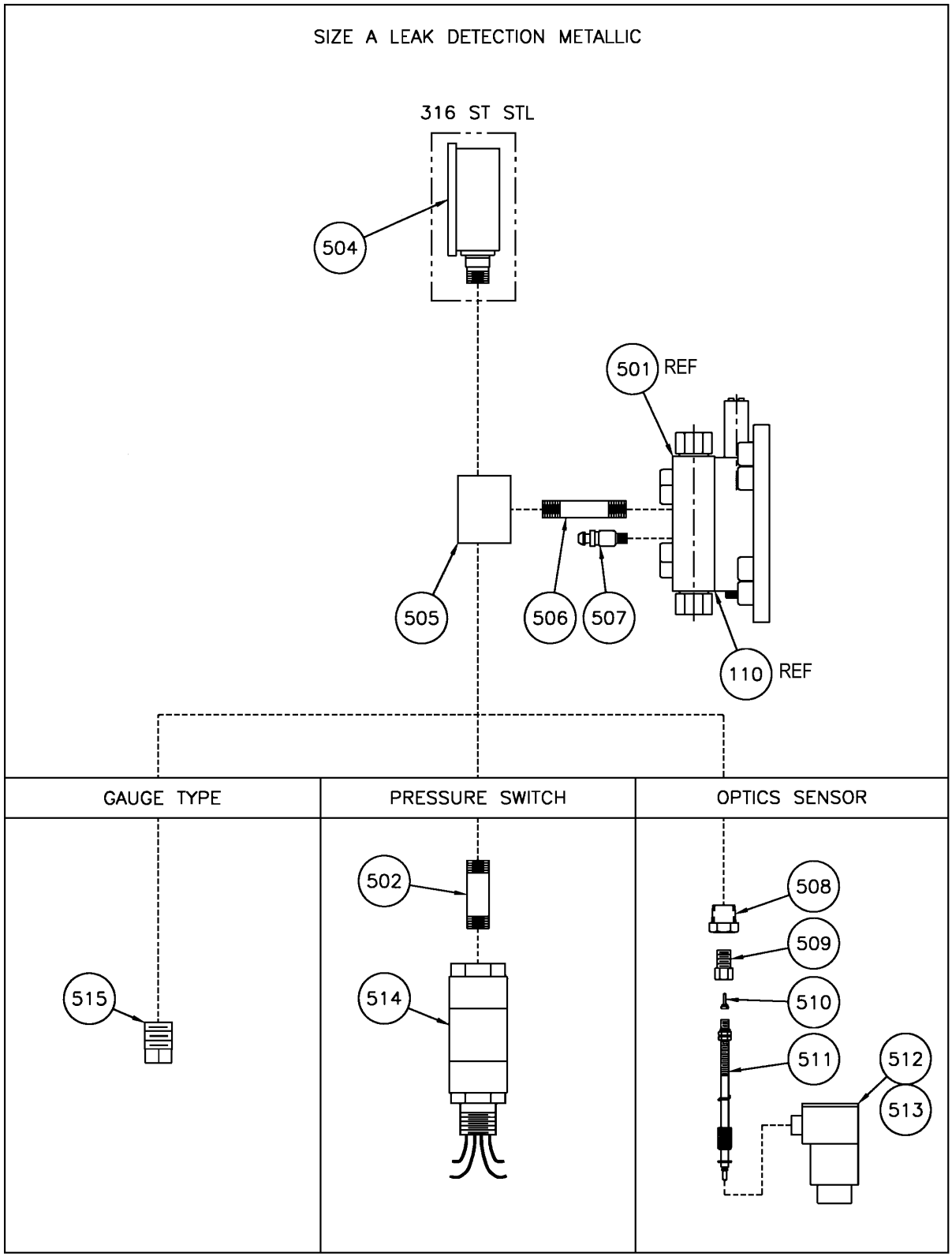


Figure 41. Metallic Leak Detection, Size A.

6.6 METALLIC LEAK DETECTION, SIZE A (316SS, ALLOY 20 & HAST C) (FIGURE 41)

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.

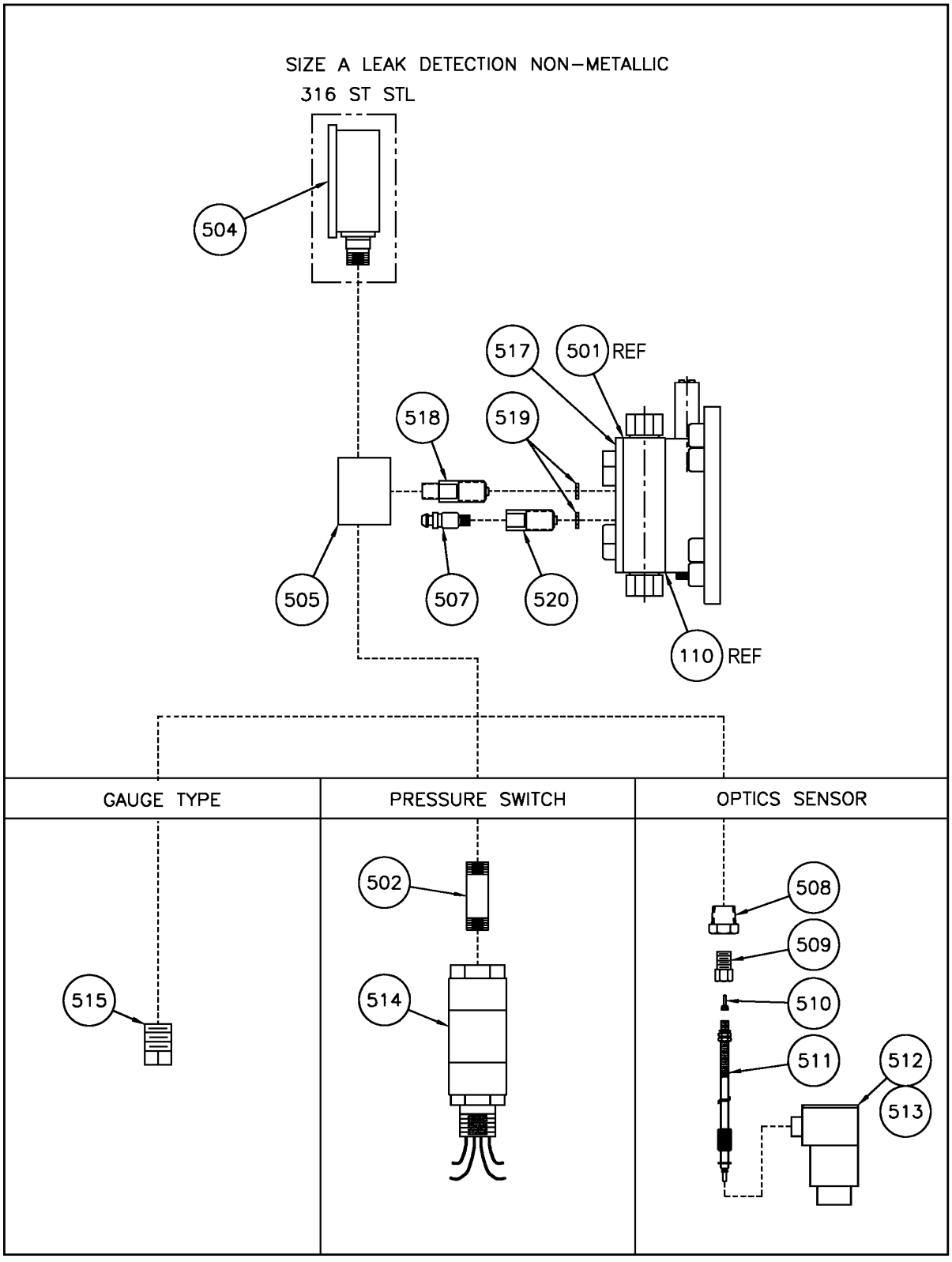


Figure 42. Non-Metallic Leak Detection, Size A.

6.7 NON-METALLIC LEAK DETECTION, SIZE A (PVC & KYNAR)(FIGURE 42)

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.

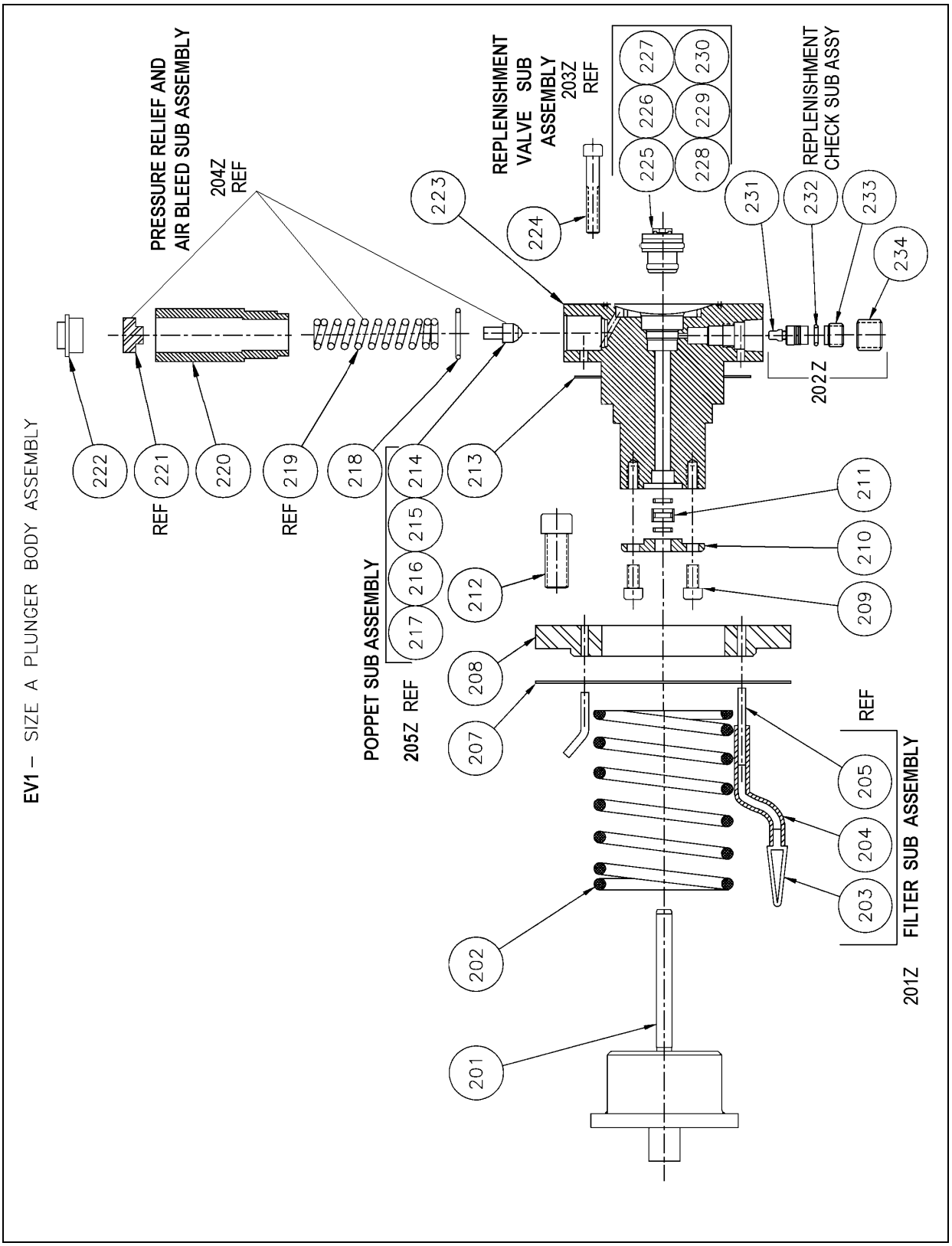


Figure 43. Plunger Body Assembly, Size A.

6.8 PLUNGER BODY ASSEMBLY COMPONENTS, SIZE A (FIGURE 43)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
	PLUNGER			
201	3/16” Plunger	6101-03	1	03D
	1/4” Plunger	6101-04	1	04D
	3/8” Plunger	6101-06	1	06D
	PLUNGER FOR EVP PULSLESS PUMP (NOT SHOWN)			
-	3/16” Plunger	6101P-03	1	03D
-	1/4” Plunger	6101P-04	1	04D
-	3/8” Plunger	6101P-06	1	06D
	FOR EVP PULSLESS PUMP (NOT SHOWN)			
-	Guide Block Cam Plunger	61010500	1	ALL
-	Cam Follower	9742301100	1	ALL
-	Socket Head Cap Screw 3/8” Long	9022136000	2	ALL
-	Locknut	9222301740	1	ALL
202	**Return Spring**	9372901740	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

- Items not shown.

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
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
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.

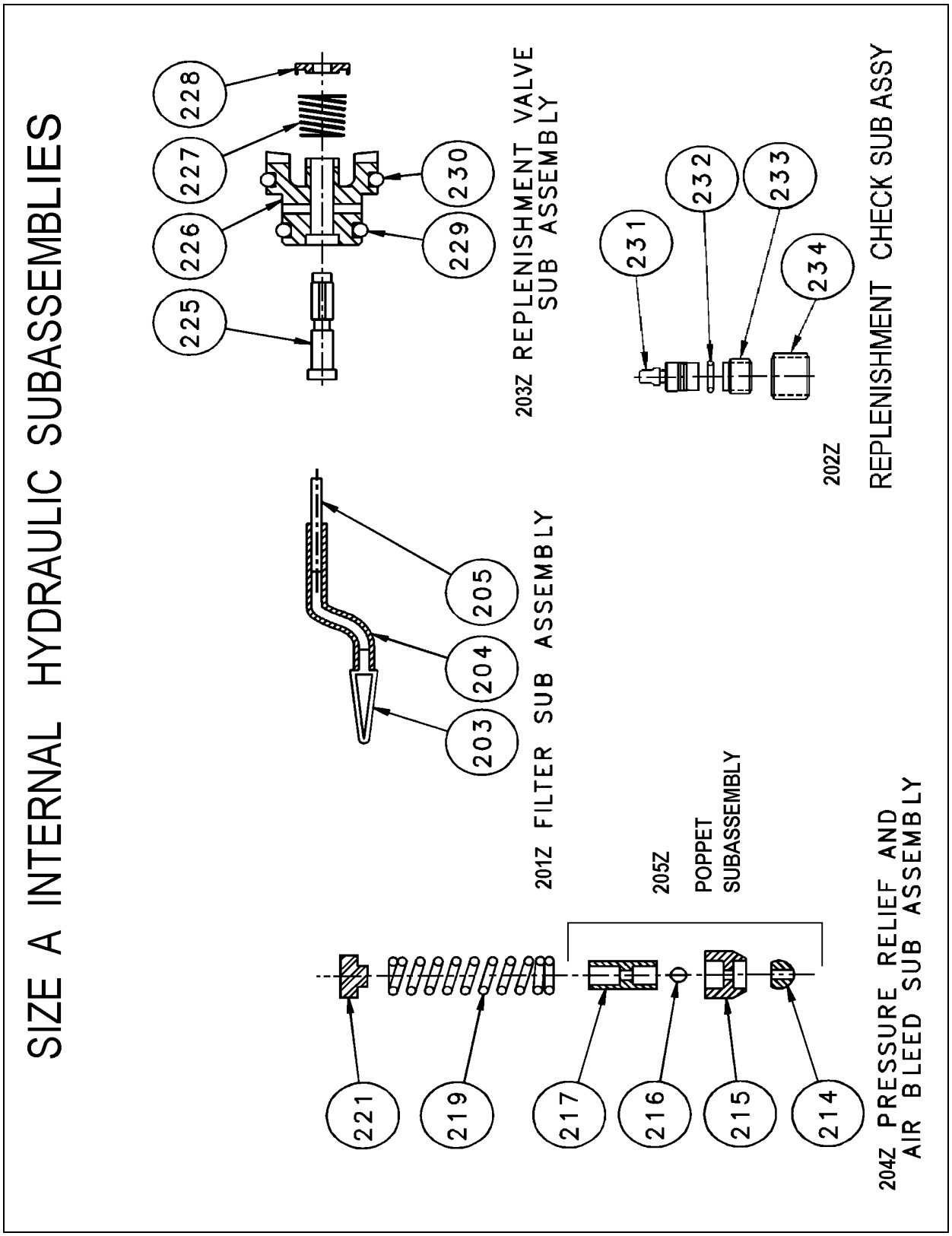


Figure 44. Internal Hydraulic Subassemblies, Size A.

6.9 INTERNAL HYDRAULIC SUBASSEMBLIES, SIZE A (FIGURE 44)

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.

EV1

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 43)

ITEM	DESCRIPTION	PART NUMBER	PLUNGER CODE
	*** Complete Plunger Body Assembly Contains 5 Subassemblies (Figure 44) and All Plunger Body Assembly Components (Figure 43).**		
	3/16 Size A	6173-A-03-ES	03D
	1/4 Size A	6173-A-04-ES	04D
	3/8 Size A	6173-A-06-ES	06D
	3/16 Size A, EVP Pulseless Pump	6173-A-03P-ES	03D
	1/4 Size A, EVP Pulseless Pump	6173-A-04P-ES	04D
	3/8 Size A, EVP Pulseless Pump	6173-A-06P-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.

EV1 SIZE B

(PLUNGER CODES 10D-5/8 in., 14D-7/8 in., & 20D-1 1/4 in.)

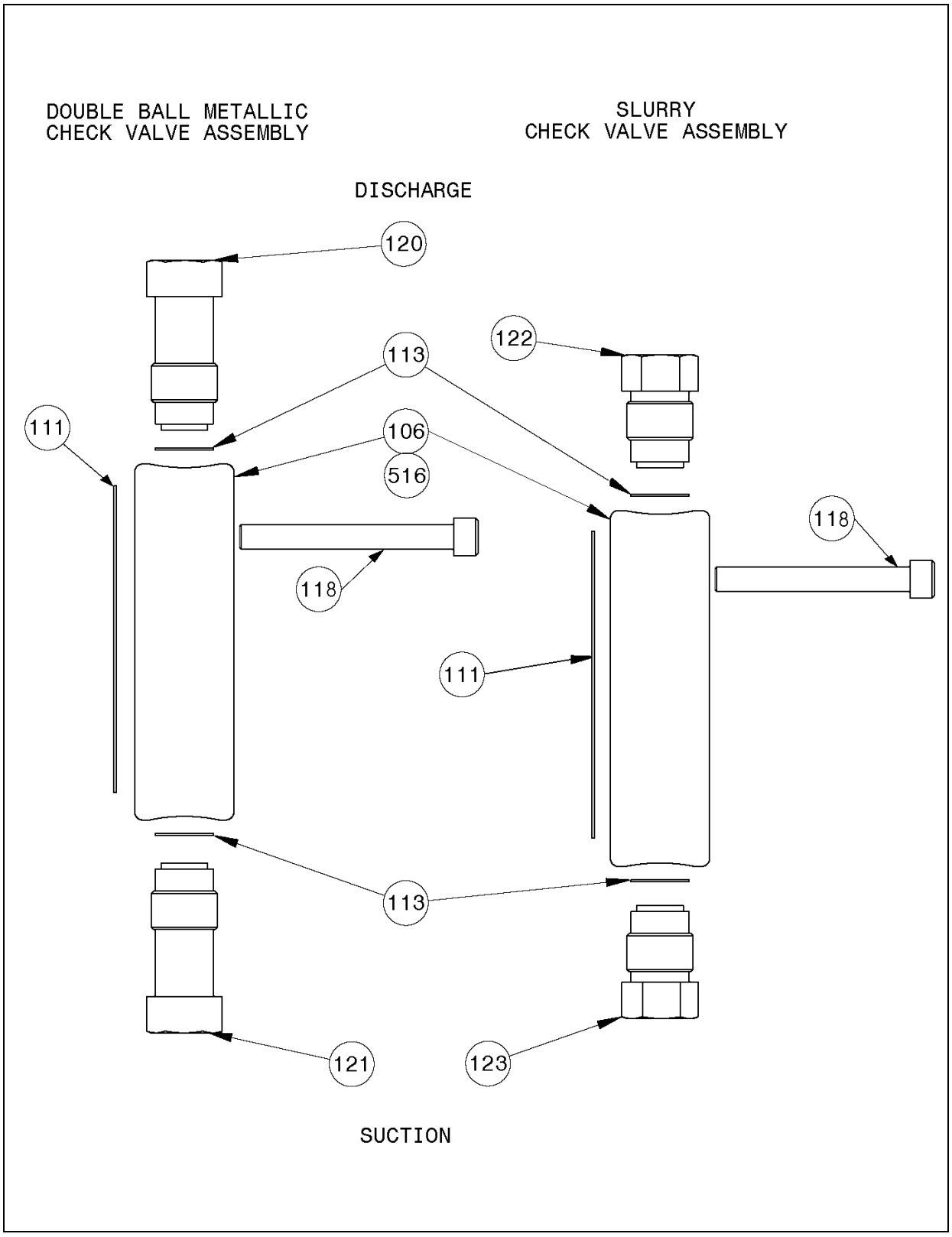


Figure 45. Liquid End Assembly, Size B, Metallic.

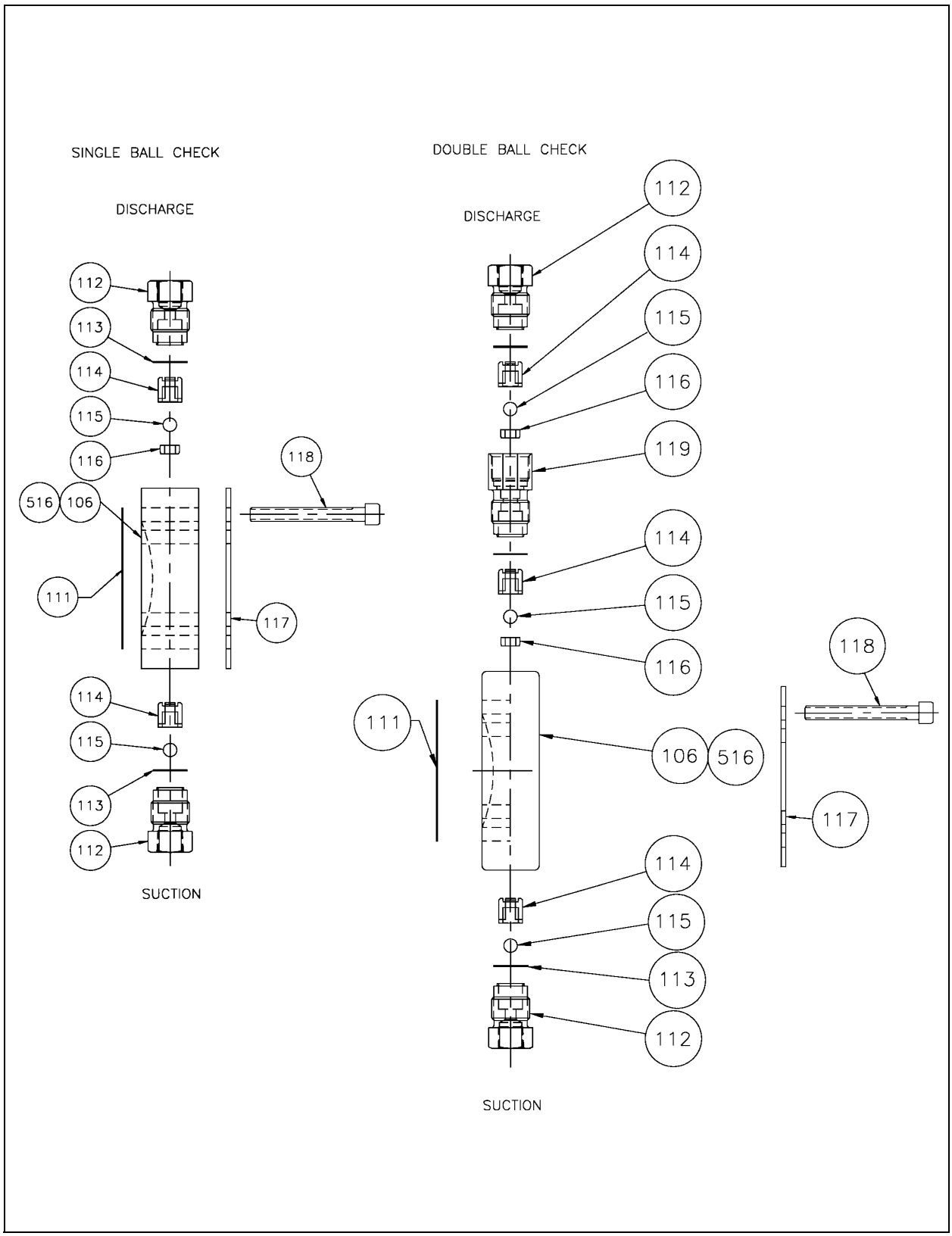


Figure 46. Liquid End Assembly, Size B, Non-Metallic.

6.11 LIQUID END ASSEMBLY COMPONENTS, SIZE B (316SS, Alloy 20, Hast C, PVC, & KYNAR) (FIGURE 45 & 46)

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, SUCTION (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.

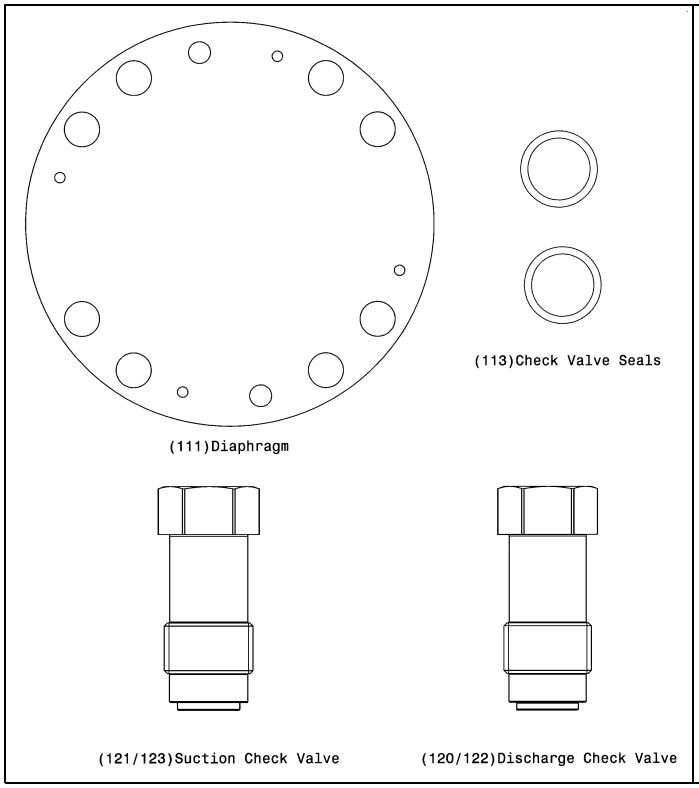
EV1

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

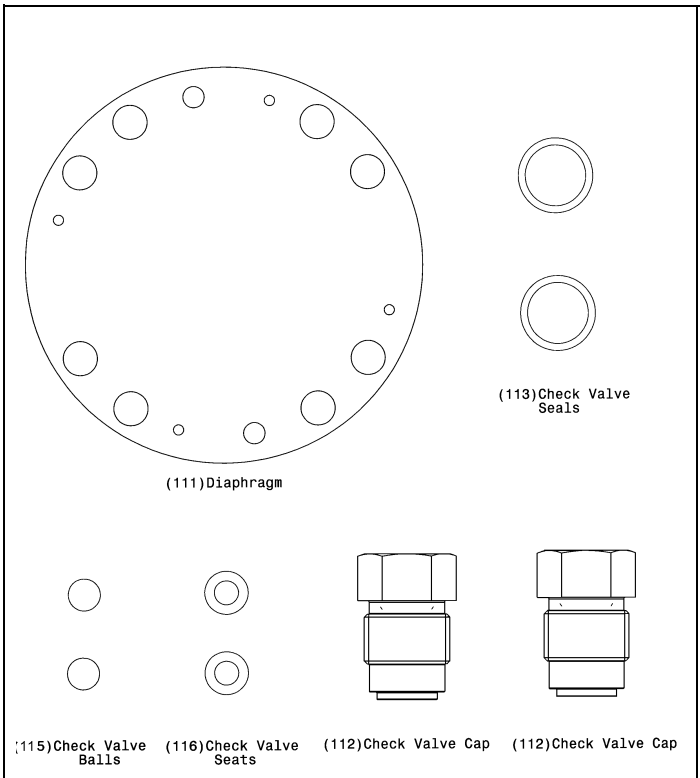
6.12 LIQUID END ASSEMBLY, SIZE B (FIGURE 45 & 46)

	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	10D,14D,20D
	L. E. Assembly, 316SS/Leak Detection/Gage Type	6171-B-SS-SS-G	10D,14D,20D
	L. E. Assembly, 316SS/Leak Detection/Pressure Switch	6171-B-SS-SS-P	10D,14D,20D
	L. E. Assembly, 316SS/Leak Detection/Optic Sensor	6171-B-SS-SS-S	10D,14D,20D
	L. E. Assembly, Alloy 20	6171-B-A2-CR	10D,14D,20D
	L. E. Assembly, Alloy 20/Leak Detection/Gage Type	6171-B-A2-CR-G	10D,14D,20D
	L. E. Assembly, Alloy 20/Leak Detection/Pressure Switch	6171-B-A2-CR-P	10D,14D,20D
	L. E. Assembly, Alloy 20/Leak Detection/Optic Sensor	6171-B-A2-CR-S	10D,14D,20D
	L. E. Assembly, Hast C	6171-B-HC-HC	10D,14D,20D
	L. E. Assembly, Hast C/Leak Detection/Gage Type	6171-B-HC-HC-G	10D,14D,20D
	L. E. Assembly, Hast C/Leak Detection/Pressure Switch	6171-B-HC-HC-P	10D,14D,20D
	L. E. Assembly, Hast C/Leak Detection/Optic Sensor	6171-B-HC-HC-S	10D,14D,20D
	L. E. Assembly, PVC	6171-B-PV-CR	10D,14D,20D
	L. E. Assembly, PVC/Leak Detection/Gage Type	6171-B-PV-CR-G	10D,14D,20D
	L. E. Assembly, PVC/Leak Detection/Pressure Switch	6171-B-PV-CR-P	10D,14D,20D
	L. E. Assembly, PVC/Leak Detection/Optic Sensor	6171-B-PV-CR-S	10D,14D,20D
	L. E. Assembly, Kynar	6171-B-KN-CR	10D,14D,20D
	L. E. Assembly, Kynar/Leak Detection/Gage Type	6171-B-KN-CR-G	10D,14D,20D
	L. E. Assembly, Kynar/Leak Detection/Pressure Switch	6171-B-KN-CR-P	10D,14D,20D
	L. E. Assembly, Kynar/Leak Detection/Optic Sensor	6171-B-KN-CR-S	10D,14D,20D
	L. E. Assembly, 316SS, SLURRY	6171-B-SS-TC-SC	10D,14D,20D

- Items not shown.



SIZE B
EV - READY
METALLIC LIQUID END
REBUILD KIT
DRK



SIZE B
EV - READY
PLASTIC LIQUID END
REBUILD KIT
DRK

Figure 47. Metallic/Plastic Rebuild Kit, Size B.

6.13 METALLIC/PLASTIC REBUILD KITS, SIZE B (FIGURE 47)

DESCRIPTION	PART NUMBER	PLUNGER CODE
LIQUID END REBUILD KITS SIZE B (SEE FIGURE 47)		
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	10D,14D,20D
Rebuild Kit, Slurry, Leak Detection	DRK117	10D,14D,20D
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 EV1 SIZE B (SEE FIGURE 47)(SEE FIGURES 45, 46, 53, & 54) **(**Contains items: 111, Figure 45 & 46; 210, 709, 737, 777, 779, Figure 53 & 201Z, 202Z, 203Z, 204Z, 205Z Figure 54)		
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 (SEE FIGURE 56)		
Manual stroke adjuster rebuild kit (Contains items 302, 303, 304, 305, 307, 326, 714, 718, 723, 731, 732, 735, & 784	61761001	ALL
Electric stroke adjuster rebuild kit - less actuator (Contains items 302, 303, 306, 307, 322, 323, 326, 714, 718, 723, 731, 732, 735, & 784	61761002	ALL
DRIVE CASE REBUILD KIT (SEE FIGURE 58)		
Drive case rebuild kit (1 Feed) (Contains items: 108, 109, 111, 210, 740, & 760	61763101	ALL
Deluxe drive case rebuild kit (Contains items: 108, 109, 111, 210, 725, 740, & 760, 763, 764, 766, 768, 769, 775, 776, & 779	61763102	ALL

- Items not shown.

EV1 SIZE C

(PLUNGER CODES 28D-1-3/4 in., 38D-2 3/8 in.)

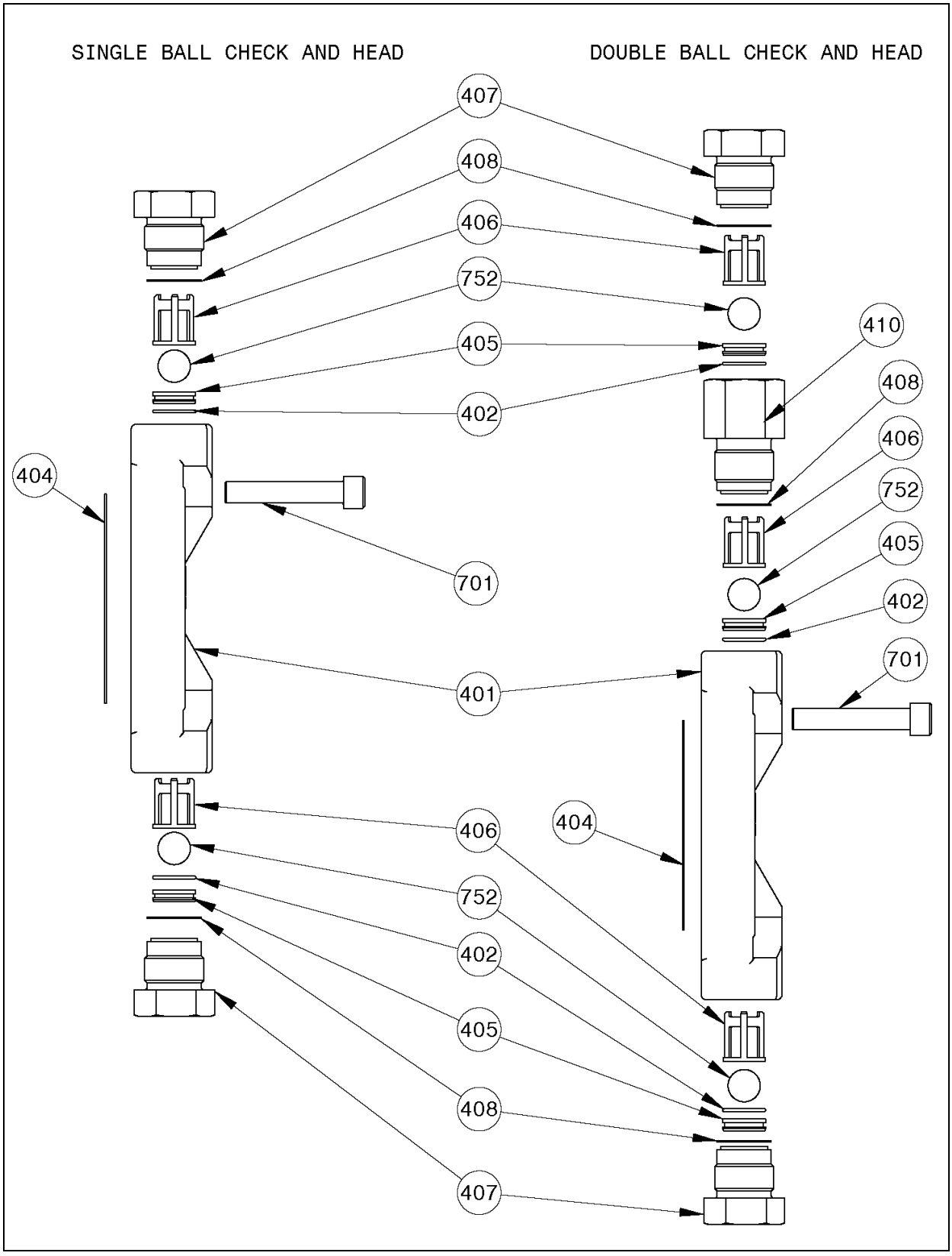


Figure 48. Liquid End Assembly, Size C, Metallic.

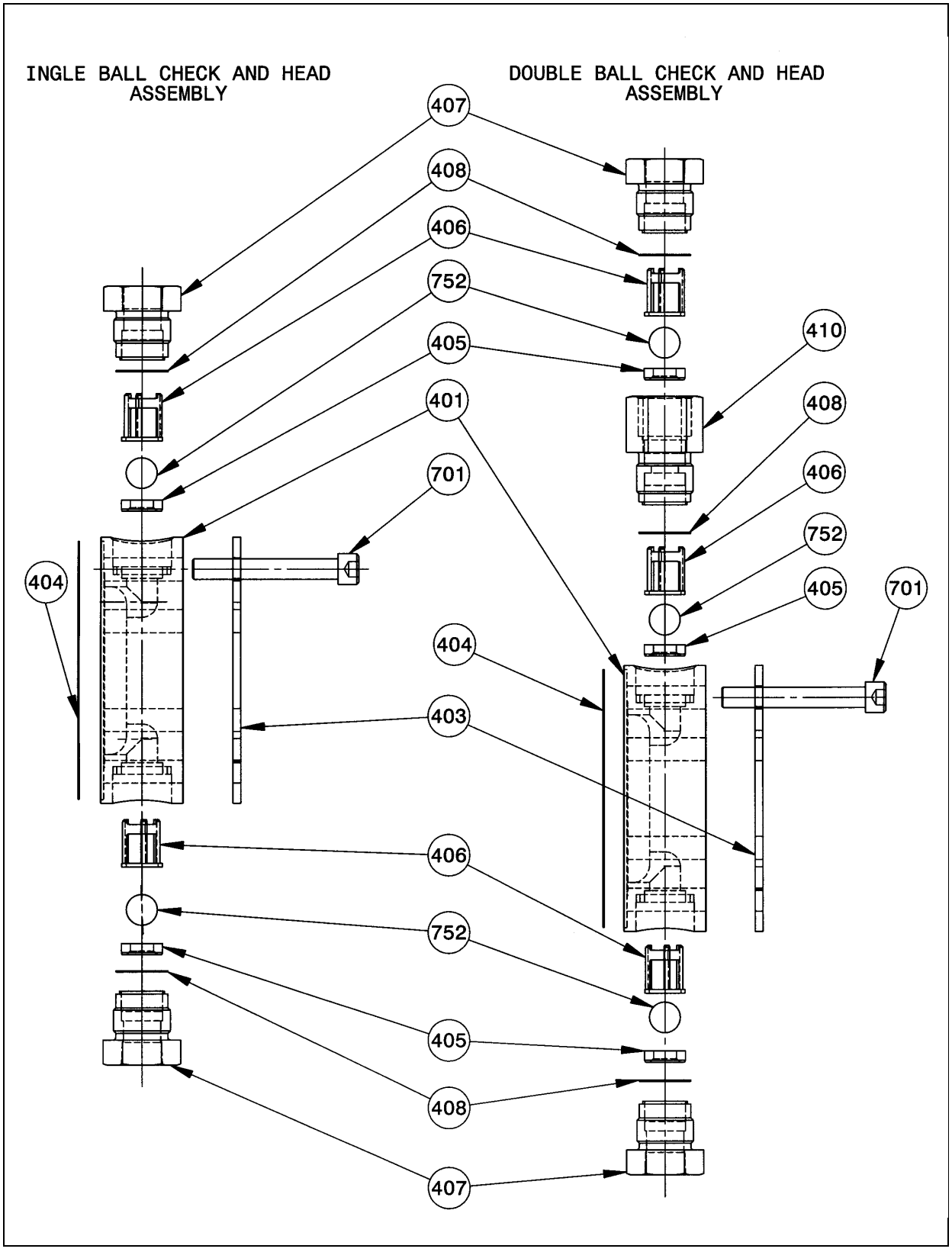


Figure 49. Liquid End Assembly, Size C, Non-Metallic.

6.14 LIQUID END ASSEMBLY COMPONENTS, SIZE C (FIGURE 48 & 49)

ITEM	DESCRIPTION	PART NUMBER	QTY	QTY DOUBLE BALL	PLUNGER CODE
	LIQUID END				
401	Liquid Head Size B, 316SS	21946	1		28D,38D
	Liquid Head Size B, Alloy 20	22391	1		28D,38D
	Liquid Head Size B, Hast C	22393	1		28D,38D
	Liquid Head Size B, PVC	22395	1		28D,38D
	Liquid Head Size B, Kynar	22397	1		28D,38D
901	Liquid Head Size B, Leak Detection, 316SS	22390	1		28D,38D
	Liquid Head Size B, Leak Detection, Alloy 20	22392	1		28D,38D
	Liquid Head Size B, Leak Detection, Hast C	22394	1		28D,38D
	Liquid Head Size B, Leak Detection, PVC	22396	1		28D,38D
	Liquid Head Size B, Leak Detection, Kynar	22398	1		28D,38D
	NON-METALLIC LIQUID END SUPPORT RING				
403	Stiffner Plate Size C	61221300	1		28D,38D
	Stiffner Plate Size C, Leak Detection	61224702	1		28D,38D
	DIAPHRAGM				
404	Diaphragm Size C, TFE (For Metallic Head)	61330200	1		28D,38D
	Diaphragm Size C, Full Face, TFE (For Plastic Head)	21501	1		28D,38D
	Diaphragm ASB Size C, Leak Detection, TFE (Metallic and Plastic Head)	61332200	1		28D,38D
	CHECK VALVE COMPONENTS (SIGLE OR DOUBLE BALL)				
	CHECK VALVE SEAT				
405	Check Valve Seat Size C, 316SS	22404	2	3	28D,38D
	Check Valve Seat Size C, Alloy 20	22406	2	3	28D,38D
	Check Valve Seat Size C, Hast C	22405	2	3	28D,38D
	Check Valve Seat Size C, PVC	6137PC-PV	2	3	28D,38D
	Check Valve Seat Size C, Kynar	6137PC-KN	2	3	28D,38D
	Hard Slurry Seat Size C, Tungsten Carbide (Single Ball Only)	6137C-TC	2		28D,38D
	Soft Slurry Seat Size C, Urethane (Single Ball Only)	61370606173	2		28D,38D
	Soft Slurry Seat Size C, Uhmwpe (Single Ball Only)	61370504-056	2		28D,38D
	O-RING				

- Item not shown.

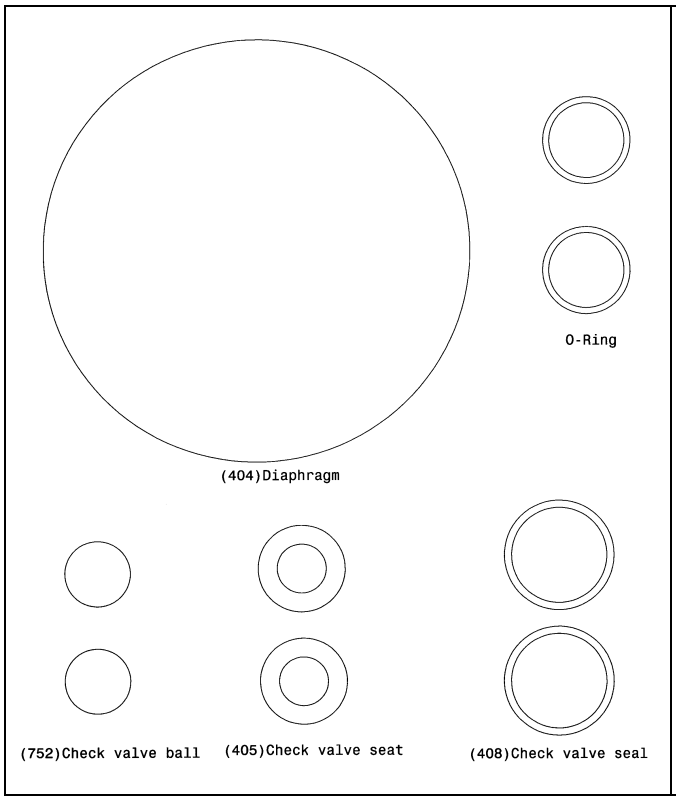
ITEM	DESCRIPTION	PART NUMBER	QTY	QTY DOUBLE BALL	PLUNGER CODE
402	O-Ring, TFE Encapsulated Viton (For Metallic Head Only)	41486	2	3	28D,38D
	CHECK VALVE GUIDE				
406	Ball Guide Size C, 316SS	6139C-SS	2	3	28D,38D
	Ball Guide Size C, Alloy 20	6139C-A2	2	3	28D,38D
	Ball Guide Size C, Hast C	6139C-HC	2	3	28D,38D
	Ball Guide Size C, PVC	6139PC-PV	2	3	28D,38D
	Ball Guide Size C, Kynar	6139PC-KN	2	3	28D,38D
	Slurry Guide Size C Hast C (Single Ball Only)	61390706019	2		28D,38D
	CHECK VALVE CAP				
407	Check Valve Cap, Size C, 316SS	6140C-SS	2	2	28D,38D
	Check Valve Cap, Size C, Alloy 20	6140C-A2	2	2	28D,38D
	Check Valve Cap, Size C, Hast C	6140C-HC	2	2	28D,38D
	Check Valve Cap, Size C, PVC	6140PC-PV	2	2	28D,38D
	Check Valve Cap, Size C, Kynar	6140PC-KN	2	2	28D,38D
	CHECK VALVE SEAL				
408	Check Valve Seal, TFE, Metallic Head	61430800	2	3	28D,38D
	Check Valve Seal, TFE, Non-Metallic Head	61431300	2	3	28D,38D
	DOUBLE BALL TRANSISTION PIECE				
410	Check Valve Cap, Size C, 316SS	22576	N/A	1	28D,38D
	Check Valve Cap, Size C, Alloy 20	22577	N/A	1	28D,38D
	Check Valve Cap, Size C, Hast C	22578	N/A	1	28D,38D
	Check Valve Cap, Size C, PVC	6141PC-PV	N/A	1	28D,38D
	Check Valve Cap, Size C, Kynar	6141PC-KN	N/A	1	28D,38D
	LIQUID HEAD BOLT				
701	Liquid Head Bolt, Cast Metallic Head	90224011CX	8	8	28D,38D
	Liquid Head Bolt, Non-Metallic Head	90224231C4		8	28D,38D
	CHECK VALVE BALL				
	Check Valve Ball Size C, 316SS	4070014192	2	3	28D,38D
	Check Valve Ball Size C, Ceramic	4070015191	2	3	28D,38D
	Check Valve Ball Size C, Hast c	4070014196	2	3	28D,38D
	Check Valve Ball Size C, Tungsten Carbide Ball)	9692508-TC	2		28D,38D

- Item not shown.

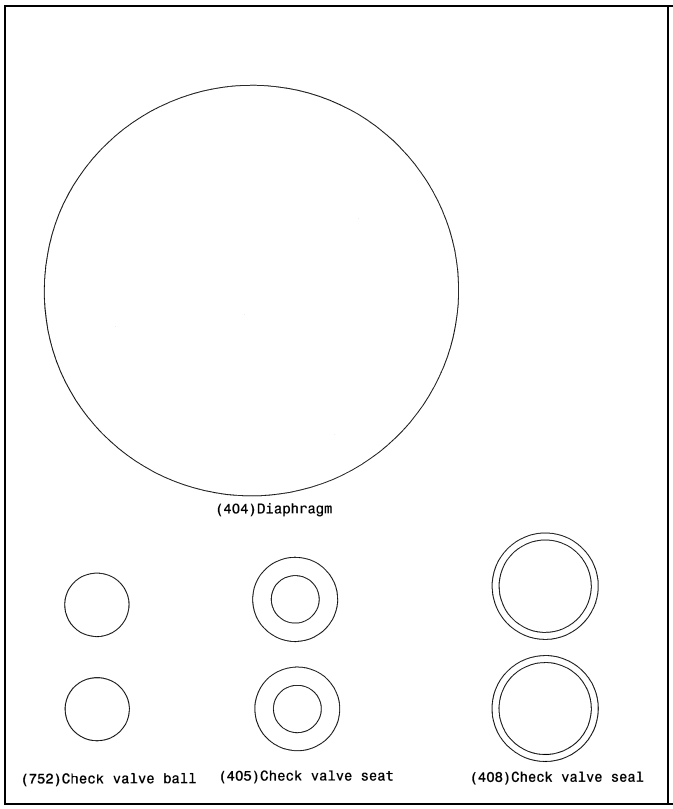
6.15 LIQUID END ASSEMBLY, SIZE C (FIGURE 48 & 49)

	DESCRIPTION	PART NUMBER	PLUNGER CODE
	COMPLETE LIQUID END ASSEMBLY		
	SIZE C: 1-3/4, 2-3/8 PLUNGER		
	L. E. Assembly, 316SS	6171-C-SS-SS	03D,04D,06D
	L. E. Assembly, 316SS/Leak Detection/Gage Type	6171-C-SS-SS-G	03D,04D,06D
	L. E. Assembly, 316SS/Leak Detection/Pressure Switch	6171-C-SS-SS-P	03D,04D,06D
	L. E. Assembly, 316SS/Leak Detection/Optic Sensor	6171-C-SS-SS-S	03D,04D,06D
	L. E. Assembly, Alloy 20	6171-C-A2-CR	03D,04D,06D
	L. E. Assembly, Alloy 20/Leak Detection/Gage Type	6171-C-A2-CR-G	03D,04D,06D
	L. E. Assembly, Alloy 20/Leak Detection/Pressure Switch	6171-C-A2-CR-P	03D,04D,06D
	L. E. Assembly, Alloy 20/Leak Detection/Optic Sensor	6171-C-A2-CR-S	03D,04D,06D
	L. E. Assembly, Hast C	6171-C-HC-HC	03D,04D,06D
	L. E. Assembly, Hast C/Leak Detection/Gage Type	6171-C-HC-HC-G	03D,04D,06D
	L. E. Assembly, Hast C/Leak Detection/Pressure Switch	6171-C-HC-HC-P	03D,04D,06D
	L. E. Assembly, Hast C/Leak Detection/Optic Sensor	6171-C-HC-HC-S	03D,04D,06D
	L. E. Assembly, PVC	6171-C-PV-CR	03D,04D,06D
	L. E. Assembly, PVC/Leak Detection/Gage Type	6171-C-PV-CR-G	03D,04D,06D
	L. E. Assembly, PVC/Leak Detection/Pressure Switch	6171-C-PV-CR-P	03D,04D,06D
	L. E. Assembly, PVC/Leak Detection/Optic Sensor	6171-C-PV-CR-S	03D,04D,06D
	L. E. Assembly, Kynar	6171-C-KN-CR	03D,04D,06D
	L. E. Assembly, Kynar/Leak Detection/Gage Type	6171-C-KN-CR-G	03D,04D,06D
	L. E. Assembly, Kynar/Leak Detection/Pressure Switch	6171-C-KN-CR-P	03D,04D,06D
	L. E. Assembly, Kynar/Leak Detection/Optic Sensor	6171-C-KN-CR-S	03D,04D,06D
	L. E. Assembly,316SS, Slurry	6171-C-SS-TC-SC	03D,04D,06D

- Items not shown.



SIZE C
EV - READY
METALLIC LIQUID END
REBUILD KIT
DRK



SIZE C
EV - READY
PLASTIC LIQUID END
REBUILD KIT
DRK

Figure 50. Metallic/Plastic Rebuild Kit, Size C.

6.16 METALLIC/PLASTIC REBUILD KITS, SIZE C (FIGURE 50)

DESCRIPTION	PART NUMBER	PLUNGER CODE
LIQUID END REBUILD KITS, SIZE C		
Rebuild Kit, 316SS, Single Ball	DRK122	28D, 38D
Rebuild Kit, 316SS, Single Ball, Leak Detection	DRK124	28D, 38D
Rebuild Kit, 316SS, Double Ball	DRK123	28D, 38D
Rebuild Kit, 316SS, Double Ball, Leak Detection	DRK125	28D, 38D
Rebuild Kit, Hast C, Single Ball	DRK126	28D, 38D
Rebuild Kit, Hast C, Single Ball, Leak Detection	DRK128	28D, 38D
Rebuild Kit, Hast C, Double Ball	DRK127	28D, 38D
Rebuild Kit, Hast C, Double Ball, Leak Detection	DRK129	28D, 38D
Rebuild Kit, Alloy 20, Single Ball	DRK130	28D, 38D
Rebuild Kit, Alloy 20, Single Ball, Leak Detection	DRK132	28D, 38D
Rebuild Kit, Alloy 20, Double Ball	DRK131	28D, 38D
Rebuild Kit, Alloy 20, Double Ball, Leak Detection	DRK133	28D, 38D
Rebuild Kit, Slurry	DRK134	28D, 38D
Rebuild Kit, Slurry, Leak Detection	DRK135	28D, 38D
Rebuild Kit, PVC	DRK136	28D, 38D
Rebuild Kit, PVC, Leak Detection	DRK137	28D, 38D
Rebuild Kit, Kynar	DRK138	28D, 38D
Rebuild Kit, Kynar, Leak Detection	DRK139	28D, 38D
PLUNGER BODY REBUILD KITS, SIZE C		
1-3/4 Rebuild Kit	61760160	28D
2-3/8 Rebuild Kit	61760230	38D
1-3/4 Rebuild Kit, Leak Detection	61760160LD	28D
2-3/8 Rebuild Kit, Leak Detection	61760230LD	38D
STROKE ADJUSTER REBUILD KIT (SEE FIGURE 56)		
Manual stroke adjuster rebuild kit (Contains items 302, 303, 304, 305, 307, 326, 714, 718, 723, 731, 732, 735, 784, & 789	61761001	ALL
Electric stroke adjuster rebuild kit - less actuator (Contains items 302, 303, 306, 307, 322, 323, 326, 714, 718, 723, 731, 732, 735, & 784	61761002	ALL
DRIVE CASE REBUILD KIT (SEE FIGURE 58)		
Drive case rebuild kit (1 Feed) (Contains items: 108, 109, 111, 210, 740, & 760	61763101	ALL
Deluxe drive case rebuild kit (Contains items: 108, 109, 111, 210, 725, 740, & 760, 763, 764, 766, 768, 769, 775, 776, 779	61763102	ALL

- Items not shown.

EV1 SIZE B AND C

(PLUNGER CODES 10D-5/8 in., 14D-7/8 in., & 20D-1 1/4 in.)
(PLUNGER CODES 28D-1-3/4 in., 38D-2 3/8 in.)

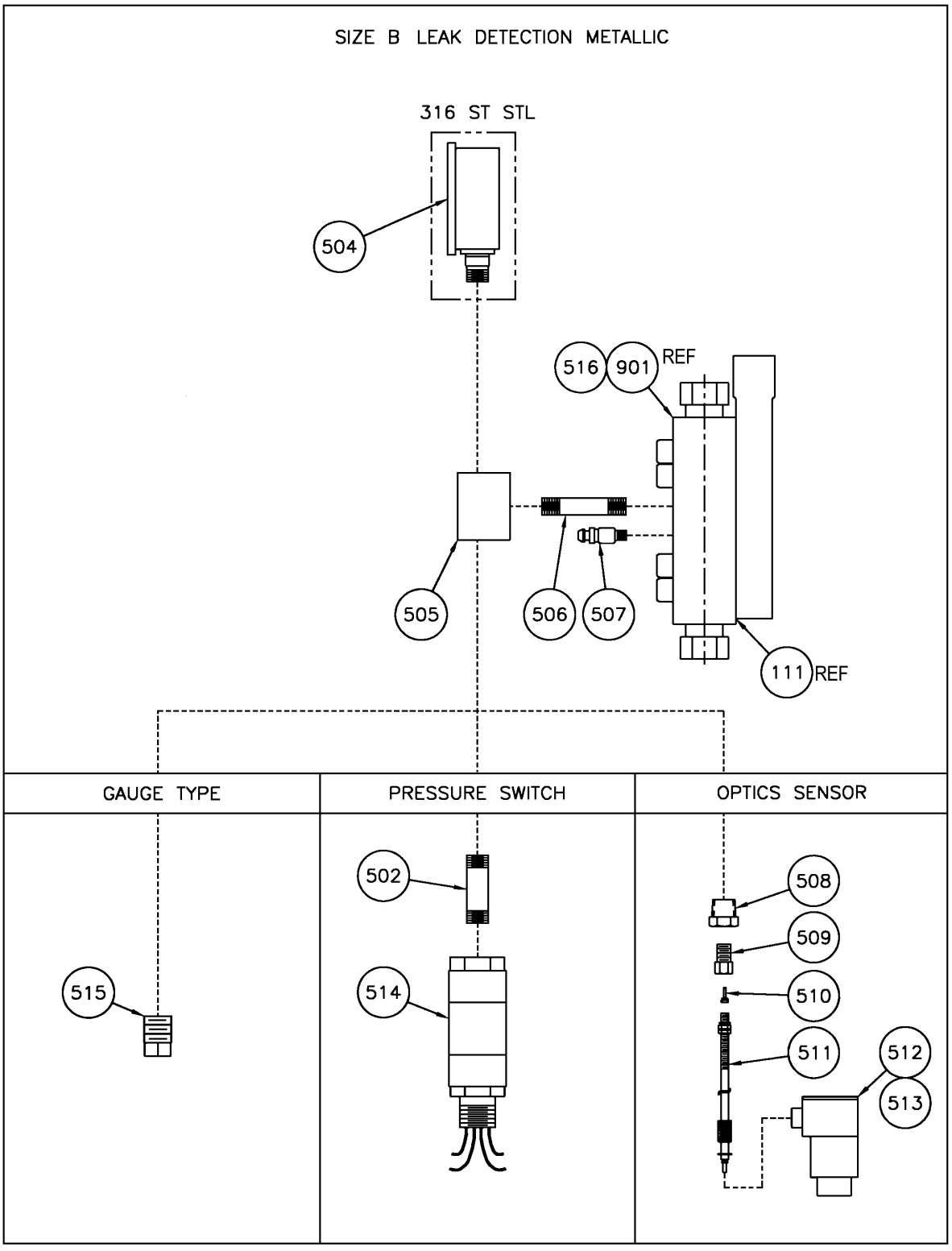


Figure 51. Metallic Leak Detection, Size B and C.

6.17 METALLIC LEAK DETECTION, SIZE B & C (316SS, ALLOY 20 & HAST C) (FIGURE 51)

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.

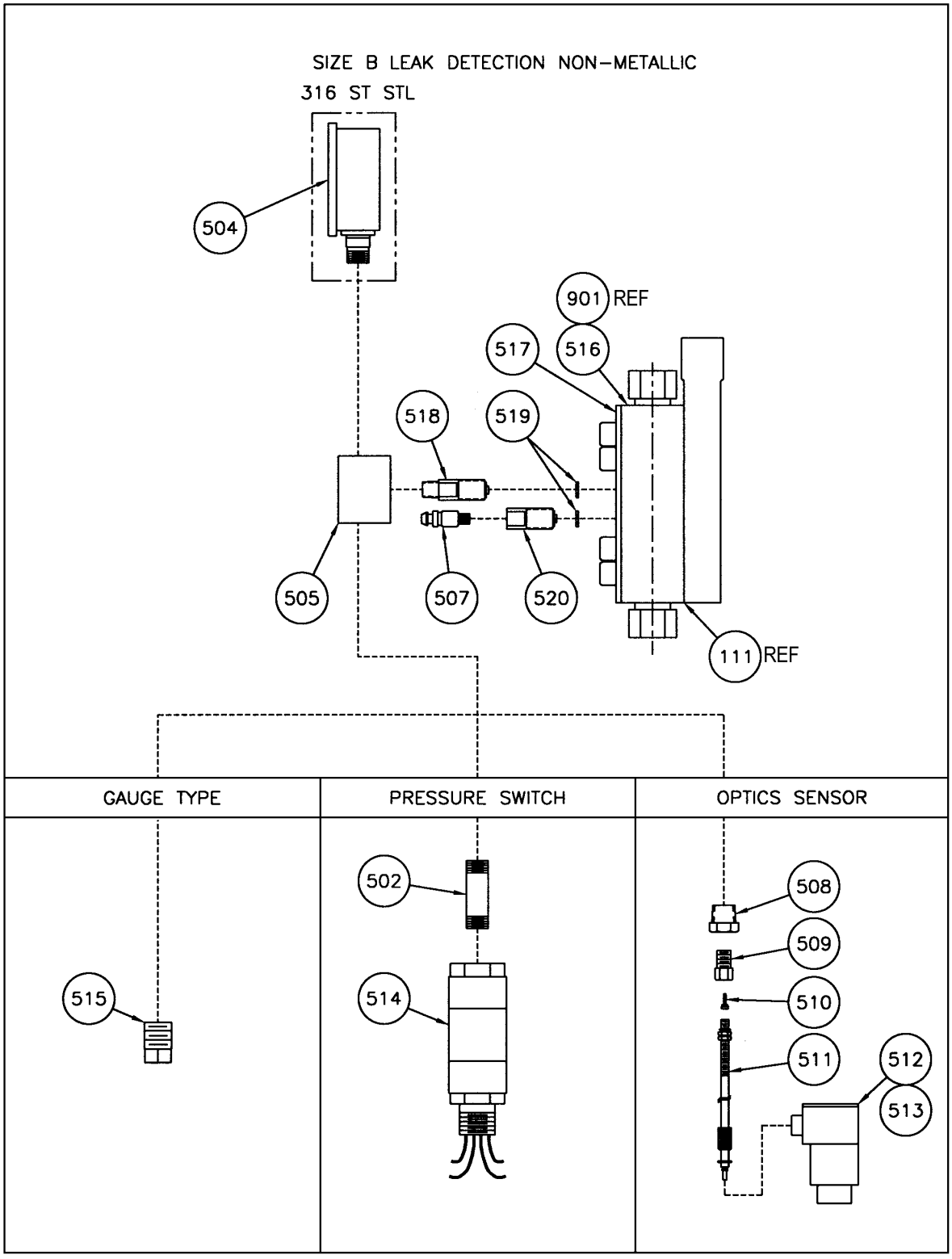


Figure 52. Non-Metallic Leak Detection, Size B and C.

6.18 NON-METALLIC LEAK DETECTION, SIZE B & C (FIGURE 52)

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.

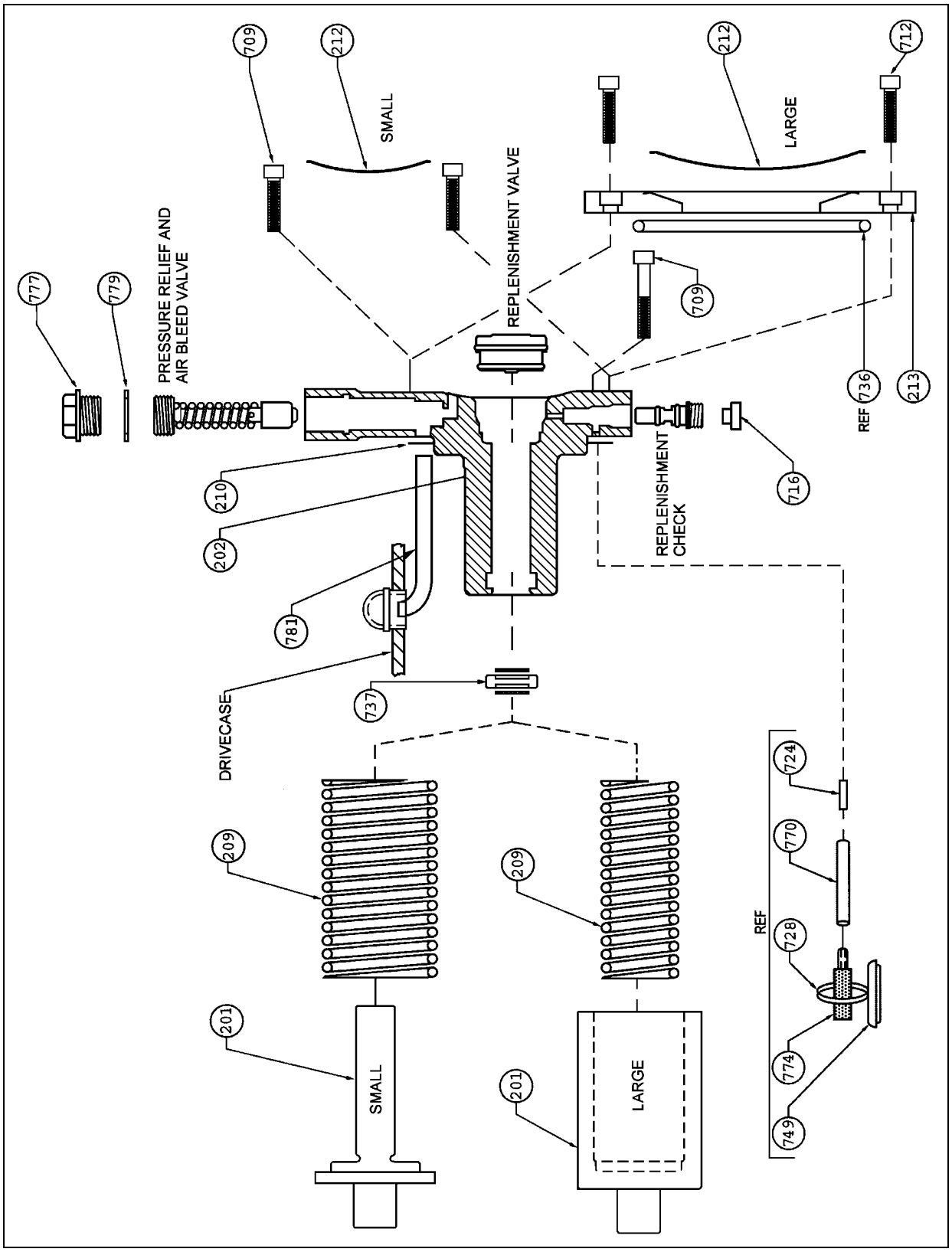


Figure 53. Plunger Body Assembly, Size B & C.

6.19 PLUNGER BODY ASSEMBLY, SIZE B & C (FIGURE 53)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
	PLUNGER			
201	5/8” Plunger	6101-10	1	10D
	7/8” Plunger	6101-14	1	14D
	1-1/4” Plunger	6101-20	1	20D
	1-3/4” Plunger	6101-28	1	28D
	2-3/8 Plunger	6101-38	1	38D
	PLUNGER FOR EVP PULSLESS PUMP (NOT SHOWN)			
-	5/8” Plunger Cam Style	6101P-10	1	10D
-	7/8” Plunger Cam Style	6101P-14	1	14D
-	1-1/4” Plunger Cam Style	6101P-20	1	20D
	1-3/4” Plunger Cam Style	6101P-28	1	28D
	2-3/8 Plunger Cam Style	6101P-38	1	38D
	FOR EVP PULSLESS PUMP (NOT SHOWN)			
-	Guide Block Cam Plunger	61010500	1	ALL
-	Cam Follower	9742301100	1	ALL
-	Socket Head Cap Screw 3/8” Long	9022136000	1	ALL
-	Locknut	9222301740	1	ALL
	PLUNGER BODY			
202	5/8” Plunger Body	21943	1	10D
	7/8” Plunger Body	21944	1	14D
	1-1/4” Plunger Body	21945	1	20D
	1-3/4” Plunger Body	6102-28-N	1	28D
	2-3/8 Plunger Body	6102-38-N	1	38D
	CONTOUR PLATE RING			
213	Contour Plate Ring	22399	1	28D, 38D
	Contour Plate Ring, Leak Detection	6122190LN	1	28D, 38D
	SPRING			
209	Plunger Return Spring	61420300	1	10D,14D,20D,
	Plunger Return Spring	61420400	1	28D
	Plunger Return Spring	61420500	1	38D
210	**Plunger Body Gasket**	61430600	1	ALL
	CONTOUR PLATE			
212	Contour Plate, Size B	61220312	1	10D,14D,20D
	Contour Plate, Size C	61220800	1	28D, 38D
709	**Cap Screw, 1/4” - 20” X 1-1/2” Long**	90222A61CX	2	10D,14D,20D
712	**Cap Screw, 1/4” - 20” X 5/8” Long**	90222741CX	2	28D, 38D

- Items not shown.

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
716	**Plastic Cap**	9102401000	1	28D, 38D
736	**Plunger Body O-Ring**	9520234410	1	28D, 38D
	PLUNGER BODY SEAL			
737	5/8” Plunger Seal	9552502000	1	10D
	7/8” Plunger Seal	9552601000	1	14D
	1-1/4” Plunger Seal	9552702000	1	20D
	1-3/4” Plunger Seal	9552901000	1	28D
	2-3/8 Plunger Seal	9553002000	1	38D
777	**Cap Plug**	9102501560	1	ALL
779	**Relief Valve Cap Gasket**	9562501000	1	ALL
	STANDARD SIGHT TUBE ASSEMBLY			
781	Vertical A Feed	61890900	1	ALL
	Vertical B Feed	61890901	1	ALL

- Items not shown.

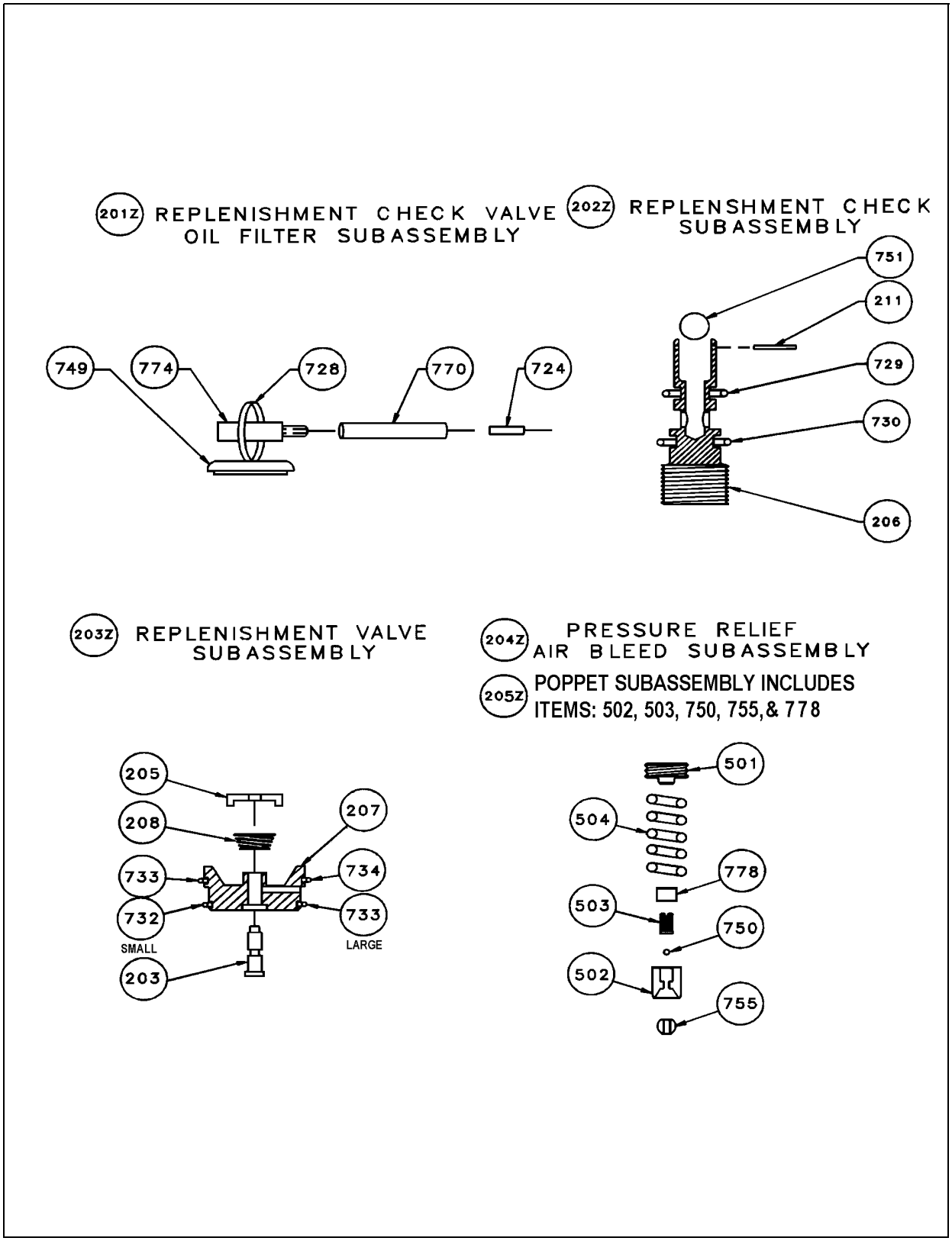


Figure 54. Plunger Body Internal Hydraulic SubAssemblies, Size B & C.

6.20 PLUNGER BODY INTERNAL HYDRAULIC SUBASSEMBLIES, SIZE B & C (FIGURE 54)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
	FILTER SUBASSEMBLY			
201Z	Filter Subassembly Contains Items: 724, 728, 749, 770, & 774	61660100	1	ALL
724	Roll Pin 3/16” Dia X 1-1/4” LG	These Parts are Included in the Above Subassem-bly		ALL
728	Filter Tie			ALL
749	Filter Magnet			ALL
770	Filter Tube, 3/16” ID			ALL
774	Filter, 3/16” MTG.			ALL
	REPLENISHMENT CHECK SUBASSEMBLY			
202Z	Replenishment Check Subassembly Contains Items: 206, 211, 729, 730, 751	61751300	1	ALL
206	Replenishment Check Body	These Parts are Included in the Above Subassem-bly		ALL
211	Replenishment Check Roll Pin			ALL
729	Replenishment Check O-Ring			ALL
730	Replenishment Check O-Ring			ALL
751	Ball, 3/16” D			ALL
	REPLENISHMENT VALVE SUBASSEMBLY			
203Z	Replenishment Valve Subassembly Contains Items: 203, 205, 207, 208, 732, 733	61751800	1	SIZE B
203Z	Replenishment Valve Subassembly Contains Items: 203, 205, 207, 208, 733, 734	61751900	1	SIZE C
203	Replenishment Valve Spool	These Parts are Included in the Above Subassem-bly		SIZE B
203	Replenishment Valve Spool			SIZE C
205	Replenishment Valve Head			SIZE B
205	Replenishment Valve Head			SIZE C
207	Replenishment Valve Housing			SIZE B
207	Replenishment Valve Housing			SIZE C
208	Replenishment Valve Spring			ALL
732	*Replenishment Valve O-Ring #24 Nitrile			SIZE B
733	*Replenishment Valve O-Ring #26 Nitrile			ALL
734	*Replenishment Valve O-Ring			SIZE C
	PRESSURE RELIEF AIR BLEED SUBASSEMBLY			
204Z	Pressure Relief and Air Bleed Assembly Contains Items: 501, 502, 503, 504, 750, 755, & 778	These Parts are Included in the Subassembly Ordered by Spring Number		ALL
501	Relief Valve Assembly Nut			ALL
502	Relief Valve Assembly Poppet			ALL
503	Air Bleed Valve Screw			ALL
219	**Relief Valve Spring**			ALL
	0-165 PSI Spring, Green	61750101Z	1	10D,14D,20D

- Items not shown.

EV1

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
	166-330 PSI Spring, Orange	61750201Z	1	10D,14D,20D
	331-790 PSI Spring, Blue	61750401Z	1	10D,14D,20D
	791-1694 PSI Spring, Gold	61750301Z	1	10D,14D,20D
	1695-2000 PSI Spring, Red	61750501Z	1	10D,14D,20D
	530-740 PSI Spring, Orange	61750201Z	1	10D,14D,20D
	150-220 PSI Spring, Green	61750101Z	1	28D, 38D
	330-470 PSI Spring, Orange	61750201Z	1	28D
750	Air Bleed Ball, 7/64” OD	These Parts are Included in the Subassembly Ordered by Spring Number		ALL
755	Poppet Ball, 5/16” OD			ALL
778	Alignment Collar			ALL

POPPET SUBASSEMBLY

205Z	Poppet Subassembly Contains Items: 502,503, 750, 755, & 778 listed above	61751600	1	ALL

- Items not shown.

6.21 PLUNGER BODY ASSEMBLY, SIZE B & C (FIGURE 53)

ITEM	DESCRIPTION	PART NUMBER	PLUNGER CODE
	*** Complete Plunger Body Assembly Contains Items: 201Z, 202Z, 203Z, 204Z, 205Z, 201, 202, 209, 210, 212, 213, 709, 712, 716, 736, 737, 777, 779, & 781**		
	5/8” Plunger	6173-B-10-EN	10D
	7/8” Plunger	6173-B-14-EN	14D
	1-1/4” Plunger	6173-B-20-EN	20D
	1-3/4” Plunger	6173-C-28-EN	28D
	2-3/8 Plunger	6173-C-38-EN	38D
	5/8” Plunger, EVP Pulseless Pump	6173-B-10P-EN	10D
	7/8” Plunger, EVP Pulseless Pump	6173-B-14P-EN	14D
	1-1/4” Plunger, EVP Pulseless Pump	6173-B-20P-EN	20D
	1-3/4” Plunger, EVP Pulseless Pump	6173-C-28P-EN	28D
	2-3/8 Plunger, EVP Pulseless Pump	6173-C-38P-EN	38D
	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
	0-165 PSI Spring	9372003000	28D
	166-330 PSI Spring	9372006000	28D
	0-150 PSI Spring	9372003000	38D

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

- Items not shown.

PARTS COMMON TO ALL SIZE LIQUID ENDS

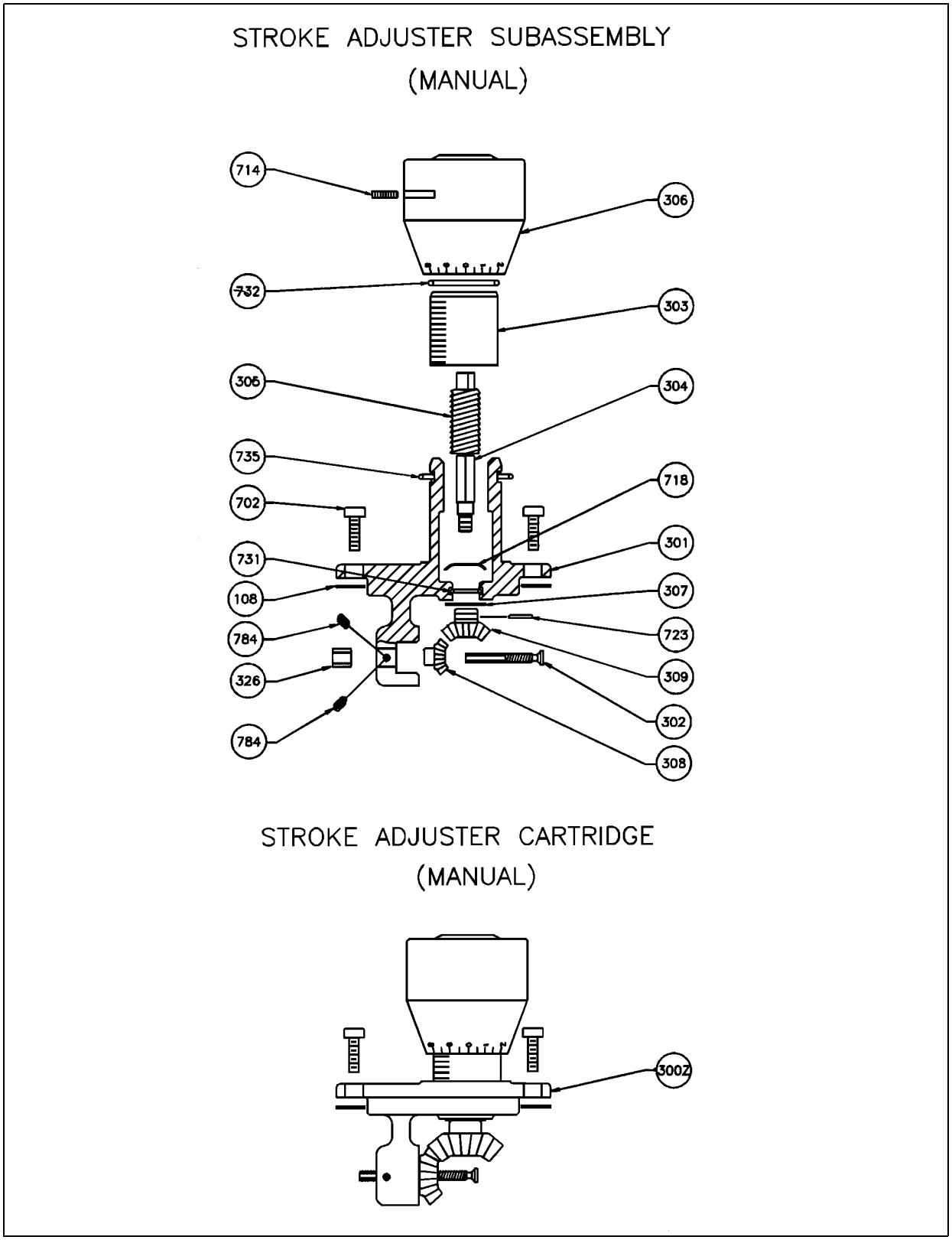


Figure 55. Manual Stroke Adjuster Assembly.

6.22 MANUAL STROKE ADJUSTER ASSEMBLY (FIGURE 55)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
108	Stroke Adjuster Cover Gasket	61430100	1	
301	Stroke Adjuster Housing	61070700	1	
302	Plunger Stop	61120500	1	
303	Stroke Adjuster Sleeve	61120200	1	
304	Stroke Adjuster Gear Shaft	61150200	1	
305	Stroke Adjuster Shaft Screw	61150300	1	
306	Stroke Adjuster Knob	61340101	1	
307	Beveled Gear Washer	61430500	1	
308	Beveled Pinion	61880300	1	
309	Beveled Gear	61880400	1	
326	Plunger Stop Bushing	61120700	1	
702	Socket Head Cap Screw, 10” - 24” X 7/16” Long	90122061C4	1	
714	Set Screw, 8” - 32” X 1/4” Long	90322481CX	1	
718	Spring Washer, 11/16 Dia. Curved	9362301030	1	
723	Roll Pin, 1/16” X 5/8”	943212374E	1	
731	O-Ring, 70 Duro Buna-n	9520012410	1	
732	O-Ring, # 24 Nitrile	9520024410	1	
735	O-Ring, # 120 70 Duro Buna	9520120410	1	
784	Set Screw, 8” - 32” X 1/4” Long Cone Point	90322801C0	2	
	STROKE ADJUSTER ASSEMBLY			
300Z	Complete Manual Stroke Adjuster Assembly, Contains Items: 108, 301-309, 326, 702, 714, 718, 723, 731, 732, 735, & 784	6179MN02A	1	

- Items not shown.

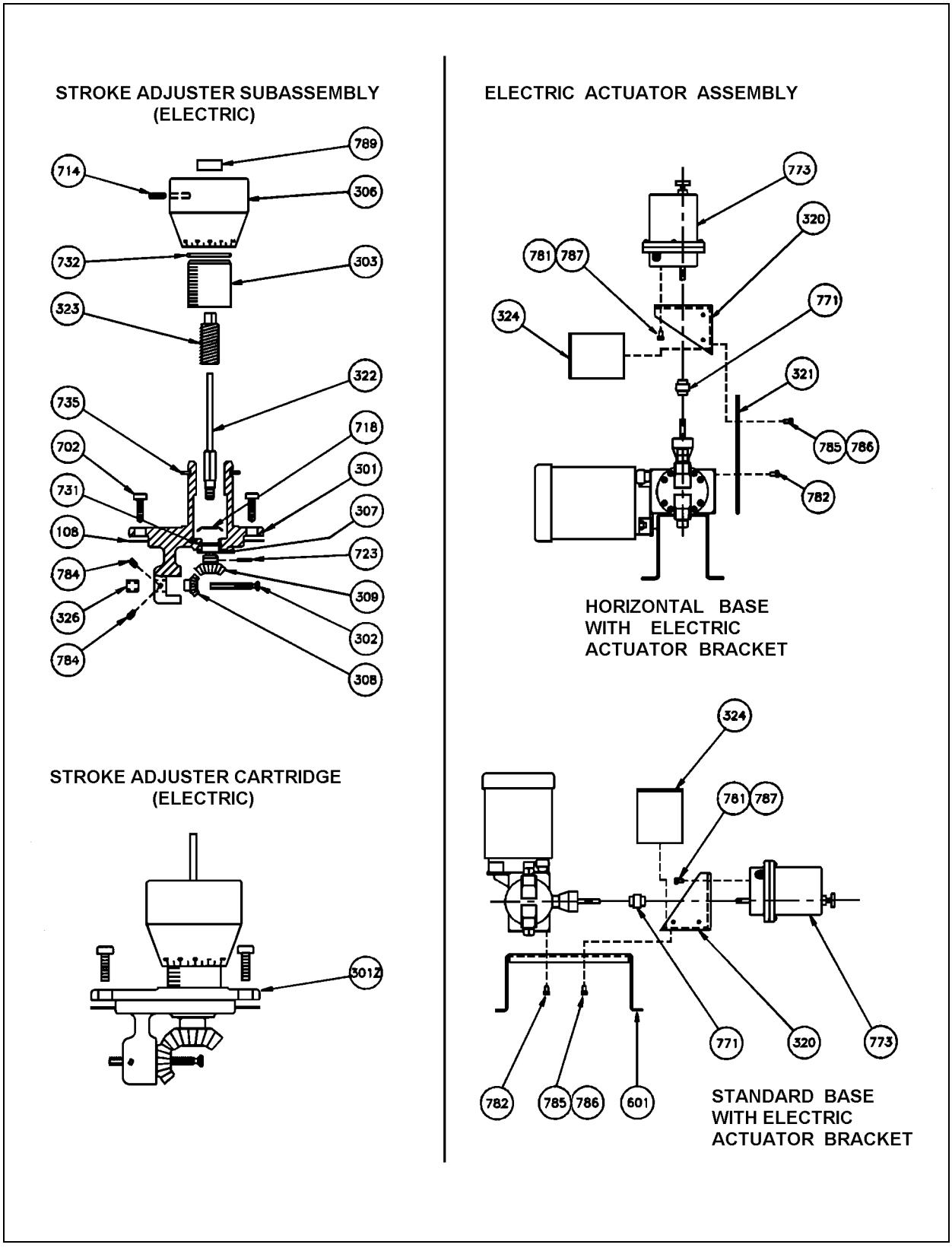


Figure 56. Electronic Stroke Adjuster Assembly.

6.23 ELECTRONIC STROKE ADJUSTER ASSEMBLY (FIGURE 56)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
108	Stroke Adjuster Cover Gasket	61430100	1	
301	Stroke Adjuster Housing	61070700	1	
302	Plunger Stop	61120500	1	
303	Stroke Adjuster Sleeve	61120200	1	
306	Stroke Adjuster Knob	61340101	1	
307	Beveled Gear Washer	61430500	1	
308	Beveled Pinion	61880300	1	
309	Beveled Gear	61880400	1	
322	Gear Shaft, Electric Stroke	61150700		
323	Screw shaft, Electric Stroke	61150800		
326	Plunger Stop Bushing	61120700	1	
702	Screw, 10” - 24” X 3/8” Long	90122061C4	1	
714	Set Screw, 8” - 32” X 1/4” Long	90322481CX	1	
718	Spring Washer, 11/16 Dia. Curved	9362301030	1	
723	Roll Pin, 1/8” X 5/8”	943212374E	1	
731	O-Ring, 70 Duro Buna-n	9520012410	1	
732	O-Ring, # 24 Nitrile	9520024410	1	
735	O-Ring, # 120 70 Duro Buna	9520120410	1	
784	Set Screw, 8” - 32” X 1/4” Long Cone Point	90322801C0	2	
789	Stroke Adjuster Knob Seal	9MT2201000	1	
	ACTUATOR ASSEMBLY			
320	Actuator Bracket	61080900	1	
321	Bracket, Horizontal Motor	61081400	1	
324	Coupling Guard, 304SS	61870600	1	
601	Base Electric Stroke	61062400	1	
771	Actuator Coupling	9M42202000	1	
781	Screw, 1/4” - 20” X 5/8” Long	90122011CE	4	
782	Screw, 3/8” - 16” X 1/2” Long	90223021CX	4	
785	Hex Head Cap Screw, 1/4” - 20” X 0.62” Long	90122011CE	4	
786	Hex Nut 1/4” - 20”	91922031CE	4	
787	Lock Washer 1/4”	935221411E	8	
301Z	Electric Stroke Adjuster Assembly - Less Actuator, Contains Items: 108, 301, 302, 303, 306, 307, 308, 309, 322, 323, 326, 702, 714, 718, 723, 731, 732, 735, 784, & 789	6179EL02A	1	
	Duramatic™ Actuator Contains Items: 302, 303, 306, 307, 322, 323, 326, 714, 718, 723, 731, 732, 735, 784	9MA2007000	1	

- Items not shown.

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
	CONVERSION KIT			
	Manual to Electric NEMA 4/7, Contains Items: 301Z, 320, 321, 324, 714, 771, 773, 781, 782, 785, 786, 787, & 789	6179EL07Z	1	

- Items not shown.

Figure 57. Motor Adapter Assembly (Direct Mount)

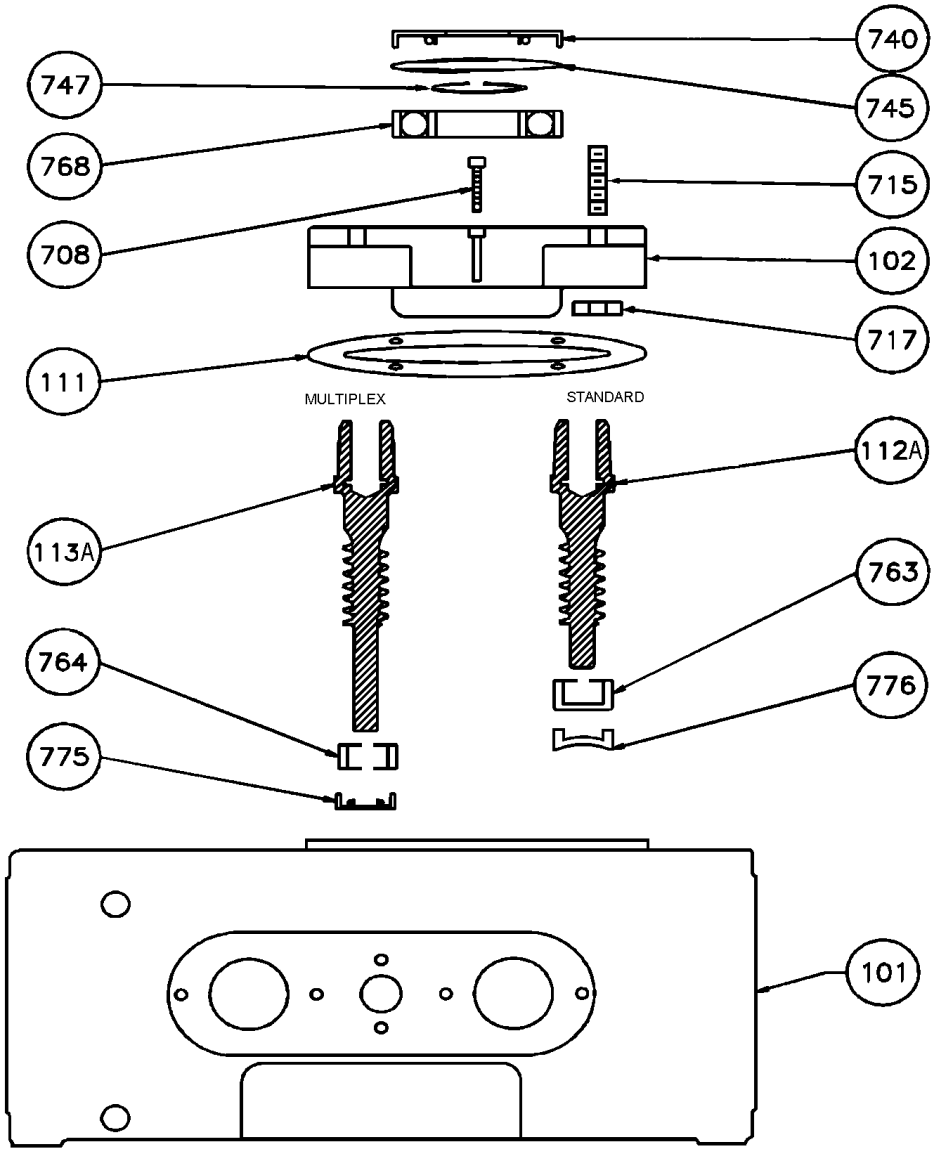
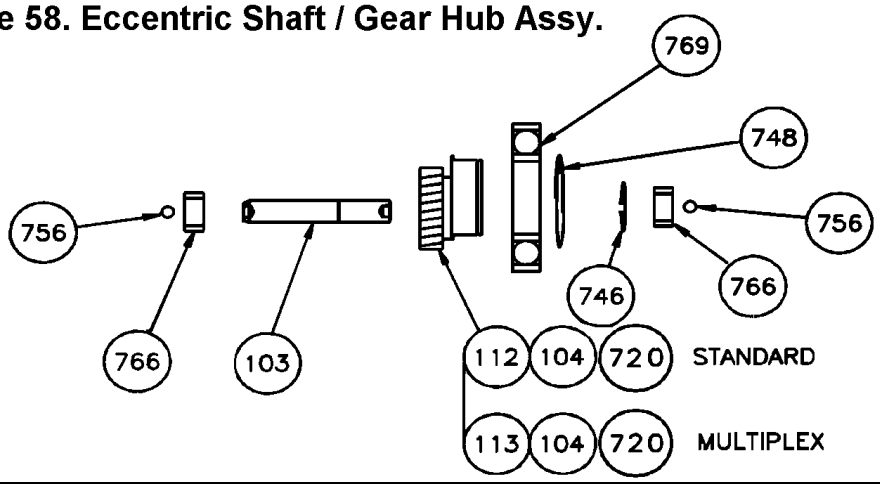


Figure 58. Eccentric Shaft / Gear Hub Assy.



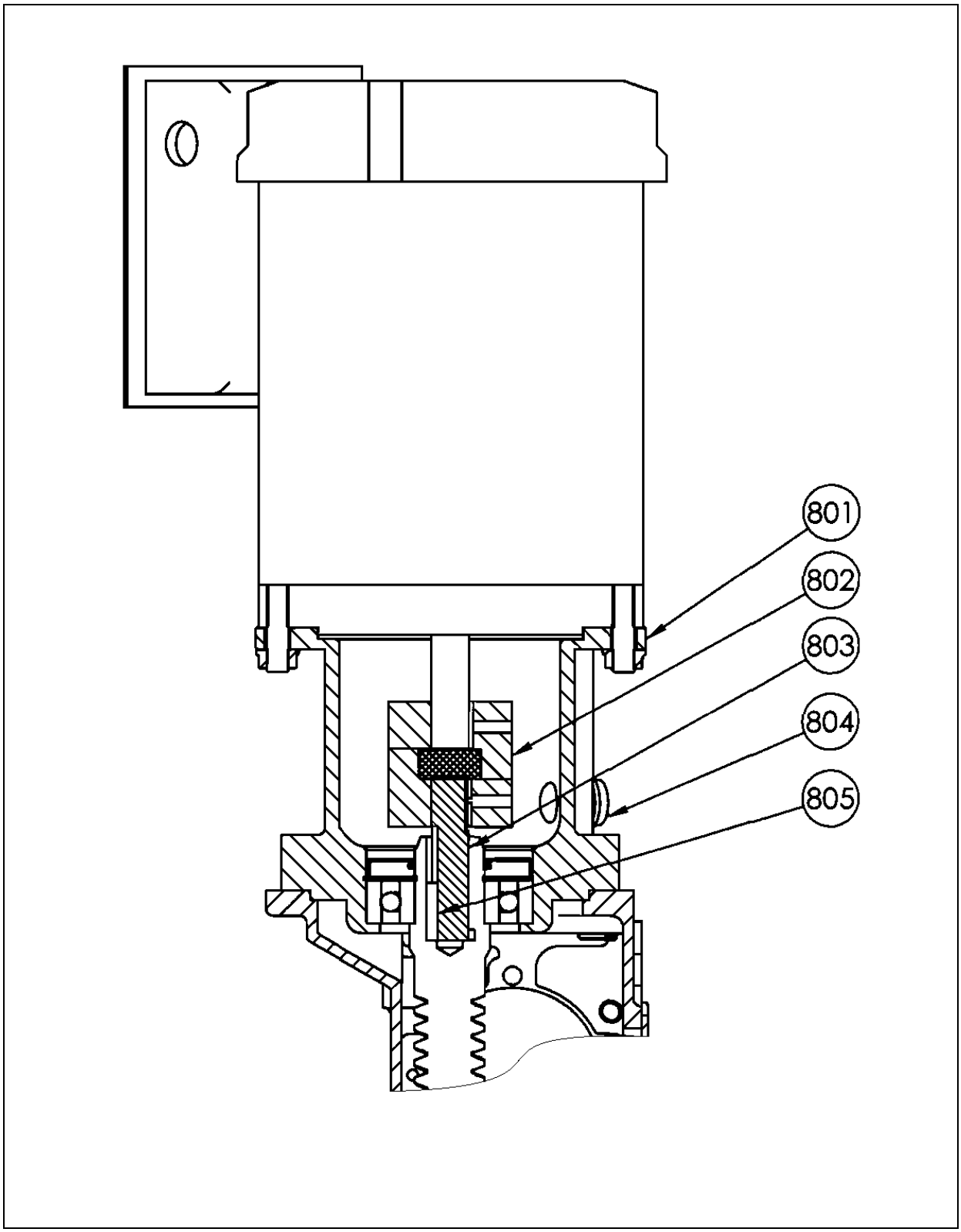


Figure 59. Motor Adapter Assembly (Flexible Coupling Mount).

6.24 MOTOR ADAPTER ASSY AND ECCENTRIC SHAFT / GEAR HUB ASSY (FIGURE 57 & 58)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
101	Drive Case, Finished	61070500	1	
103	Eccentric Shaft	61150100	1	
112/104	**GEAR SET WITH HUB** (Includes Item 720, Dowel Pin) Order With Wormshaft, Item 112A			
	Gear Subassembly, 60:1	6168-60	1	
	Gear Subassembly, 30;1	6168-30	1	
	Gear Subassembly, 15:1	6168-15	1	
	Gear Subassembly, 12.5:1	6168-13	1	
112A	Wormshaft, 60:1 (56C)	61886056	1	
	Wormshaft, 30:1 (56C)	61883056	1	
	Wormshaft, 15:1 (56C)	61881556	1	
	Wormshaft, 12.5:1 (56C)	61881356	1	
	Wormshaft, 60:1 (IEC80)	61886080	1	
	Wormshaft, 30:1 (IEC80)	61883080	1	
	Wormshaft, 15:1 (IEC80)	61881580	1	
	Wormshaft, 12.5:1 (IEC80)	61881380	1	
	Wormshaft, 60:1 (IEC71)	61886071	1	
	Wormshaft, 30:1 (IEC71)	61883071	1	
	Wormshaft, 15:1 (IEC71)	61881571	1	
	Wormshaft, 12.5:1 (IEC71)	61881371	1	
	Gear Subassembly, 60:1, EVP Pulseless Pump, Not Shown	6168P-60	1	
	Gear Subassembly, 30;1, EVP Pulseless Pump, Not Shown	6168P-30	1	
	Gear Subassembly, 15:1, EVP Pulseless Pump, Not Shown	6168P-15	1	
	Gear Subassembly, 12.5:1, EVP Pulseless Pump, Not Shown	6168P-13	1	
113/104	**GEAR SET WITH HUB - MULTIPLEX** (Includes Item 720, Dowel Pin)			
	Gear Subassembly, 60:1, Multiplex	61680660	1	
	Gear Subassembly, 30;1, Multiplex	61680630	1	
	Gear Subassembly, 15:1, Multiplex	61680615	1	
	Gear Subassembly, 12.5:1, Multiplex	61680612	1	
	FOR EVP PULSELESS PUMPS (NOT SHOWN)			
	Cam (Replaces Gear Hub)	61160200	1	
	Cam Support	61160300	1	
	Socket Head Cap Screw, 1/4” X 1” Long	90222071CX	6	
	Lock Washer	93522011CE	6	
746	Eccentric Shaft Snap Ring	9592501740	1	

- Items not shown.

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
748	Eccentric Bearing Snap	9593102740	1	
756	Eccentric Shaf Ballt	96923011H0	2	
766	Needle Bearing	9742517000	2	
769	Ball Bearing	9743102000	1	
	MOTOR ADAPTER ASSEMBLY (Direct Mount)			
102	Motor Adapter, Direct Mount, NEMA 56C	610856	1	
	Motor Adapter, Direct Mount, IEC 71 Frame (B5)	610871	1	
	Motor Adapter, Direct Mount, IEC 80 Frame (B5)	610880	1	
111	C-Face Motor Adapter Pinion Gasket	61432100	1	
708	Screw, 10” - 24” X 1-1/4” Long	90222151CX	4	
715	Stud, 3/8” - 16” X 1-1/2” Long	9092301070	1	
717	Flanged Nut 3/8” - 16”	92323011C4	1	
740	Input Shaft Seal	9552701000	1	
745	Snap Ring Worm Bearing	9582201740	1	
747	Snap Ring Worm Shaft	9592702740	1	
763	Needle Bearing Standard	9742401000	1	
764	Needle Bearing Open	9742414000	1	
768	Ball Bearing/MRC 306	9742708000	1	
775	Oil Seal	9MT2504000	1	
776	Drivecase Plug	9702501000	1	
	MOTOR ADAPTER ASSEMBLY (Flexible Coupling Mount)(Figure 59)			
801	Motor Adapter, Flexible Coupling Mount, NEMA 56C	22536	1	
	Motor Adapter, Flexible Coupling Mount, IEC 71 Frame (B5)	22540	1	
	Motor Adapter, Flexible Coupling Mount, IEC 80 Frame (B5)	22543	1	
802	Coupling, 5/8 Bore, Lovejoy, NEMA 56C	41000	1	
	Coupling, 14 mm bore, Lovejoy	41001	1	
	Coupling, 19 mm bore, Lovejoy	42000	1	
803	Worm Adapter Shaft, NEMA 56C	22539	1	
	Worm Adapter Shaft, IEC 71	22542	1	
	Worm Adapter Shaft, IEC 80	22544	1	
805	Key, 3/16 X 3/16 X 1”, NEMA 56C	2110024406	1	
	Key, 5 MM X 1”, IEC 71	4042001011	1	
	Key, 6 MM X 1”, IEC 80	22541	1	
804	Plug	9102501560	1	
-	**Retrofit Kit:** 56C Direct Mount to 56C Flexible Coupling Mount	22575	1	

- Items not shown.

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
	DRIVECASE ASSEMBLY			
100Z	Complete Drivecase Assembly, 56C, Contains Items: 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112/104 or 113/104, 702, 703, 708, 740, 745, 746, 747, 748, 756, 763, 764, 766, 769, 775, & 776			
	Drivecase Assembly, 60:1, Single Feed	6172-60-1-56-EP	1	
	Drivecase Assembly, 30:1, Single Feed	6172-30-1-56-EP	1	
	Drivecase Assembly, 15:1, Single Feed	6172-15-1-56-EP	1	
	Drivecase Assembly, 12.5:1, Single Feed	6172-13-1-56-EP	1	
	Drivecase Assembly, 60:1, EVP Pulseless Pump	6172-60-P-56-EP	1	
	Drivecase Assembly, 30:1, EVP Pulseless Pump	6172-30-P-56-EP	1	
	Drivecase Assembly, 15:1, EVP Pulseless Pump	6172-15-P-56-EP	1	
	Drivecase Assembly, 12.5:1, EVP Pulseless Pump	6172-13-P-56-EP	1	
	Drivecase Assembly, 60:1, Double Feed	6172-60-2-56-EP	1	
	Drivecase Assembly, 30:1, Double Feed	6172-30-2-56-EP	1	
	Drivecase Assembly, 15:1, Double Feed	6172-15-2-56-EP	1	
	Drivecase Assembly, 12.5:1, Double Feed	6172-13-2-56-EP	1	
100Z	Complete Drivecase Assembly, IEC71, Contains Items: 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112/104 or 113/104, 702, 703, 708, 740, 745, 746, 747, 748, 756, 763, 764, 766, 769, 775, & 776			
	Drivecase Assembly, 60:1, Single Feed	6172-60-1-71-EP	1	
	Drivecase Assembly, 30:1, Single Feed	6172-30-1-71-EP	1	
	Drivecase Assembly, 15:1, Single Feed	6172-15-1-71-EP	1	
	Drivecase Assembly, 12.5:1, Single Feed	6172-13-1-71-EP	1	
	Drivecase Assembly, 60:1, EVP Pulseless Pump	6172-60-P-71-EP	1	
	Drivecase Assembly, 30:1, EVP Pulseless Pump	6172-30-P-71-EP	1	
	Drivecase Assembly, 15:1, EVP Pulseless Pump	6172-15-P-71-EP	1	
	Drivecase Assembly, 12.5:1, EVP Pulseless Pump	6172-13-P-71-EP	1	
	Drivecase Assembly, 60:1, Double Feed	6172-60-2-71-EP	1	
	Drivecase Assembly, 30:1, Double Feed	6172-30-2-71-EP	1	
	Drivecase Assembly, 15:1, Double Feed	6172-15-2-71-EP	1	
	Drivecase Assembly, 12.5:1, Double Feed	6172-13-2-71-EP	1	
100Z	Complete Drivecase Assembly, IEC80, Contains Items: 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112/104 or 113/104, 702, 703, 708, 740, 745, 746, 747, 748, 756, 763, 764, 766, 769, 775, & 776			
	Drivecase Assembly, 60:1, Single Feed	6172-60-1-80-EP	1	
	Drivecase Assembly, 30:1, Single Feed	6172-30-1-80-EP	1	
	Drivecase Assembly, 15:1, Single Feed	6172-15-1-80-EP	1	
	Drivecase Assembly, 12.5:1, Single Feed	6172-13-1-80-EP	1	
	Drivecase Assembly, 60:1, EVP Pulseless Pump	6172-60-P-80-EP	1	

- Items not shown.

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
	Drivecase Assembly, 30:1, EVP Pulseless Pump	6172-30-P-80-EP	1	
	Drivecase Assembly, 15:1, EVP Pulseless Pump	6172-15-P-80-EP	1	
	Drivecase Assembly, 12.5:1, EVP Pulseless Pump	6172-13-P-80-EP	1	
	Drivecase Assembly, 60:1, Double Feed	6172-60-2-80-EP	1	
	Drivecase Assembly, 30:1, Double Feed	6172-30-2-80-EP	1	
	Drivecase Assembly, 15:1, Double Feed	6172-15-2-80-EP	1	
	Drivecase Assembly, 12.5:1, Double Feed	6172-13-2-80-EP	1	

- Items not shown.

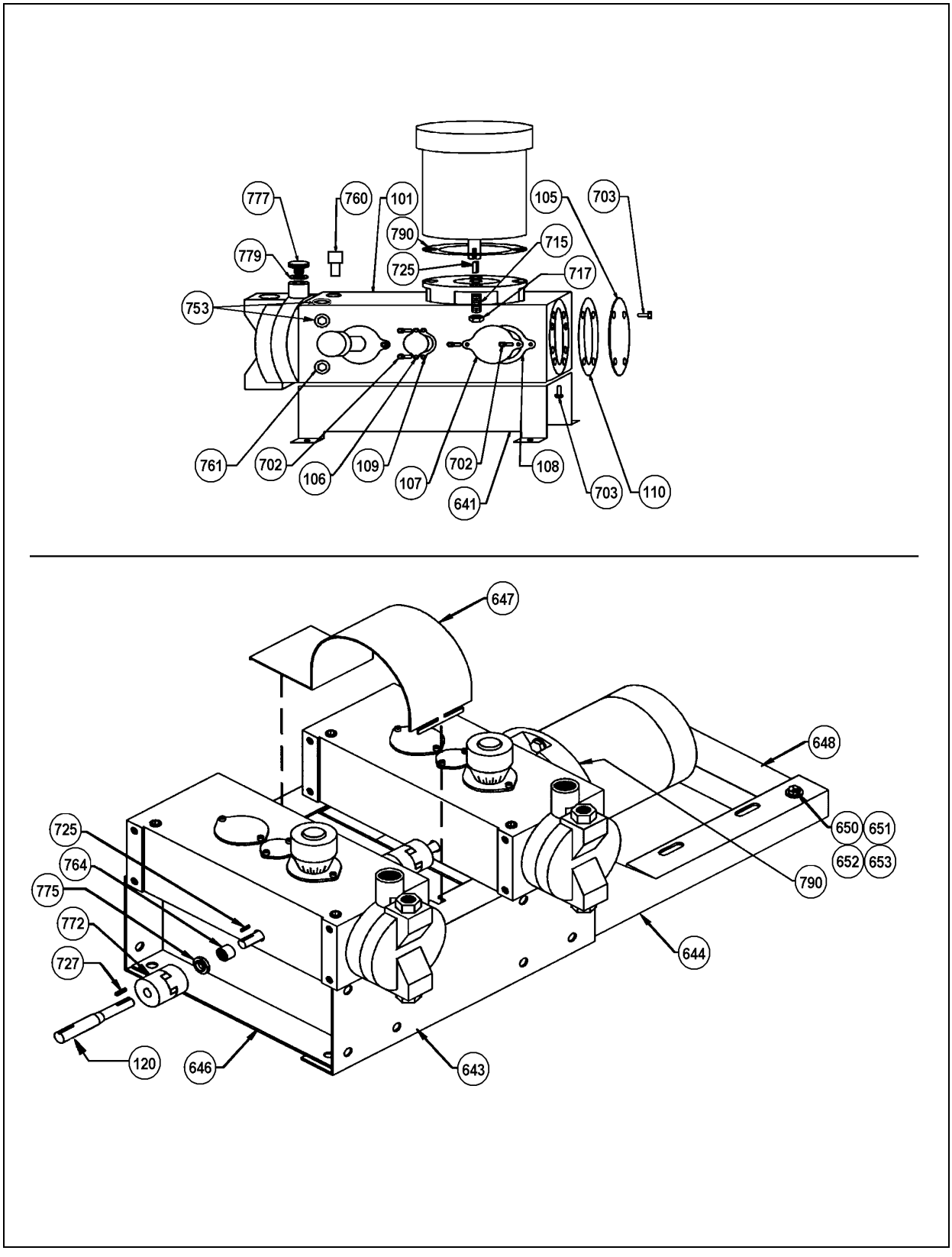


Figure 60. Covers, Drivecase & Multiplex Pump Accessories.

6.25 COVERS, DRIVECASE & MULTIPLEX PUMP ACCESSORIES (FIGURE 60)

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
101	Drive Case	61070500	1	
105	End Cover (1 Feed)	61190100	1	
106	Eccentric Shaft Retainer Plate Cover	61190200	2	
107	Stroke Adjuster Cover (1 Feed)	61190300	1	
108	Stroke Adjuster Gasket Cover	61430100	2	
109	Eccentric Shaft Retainer Plate Shim	61430200	2	
110	End Cover Gasket (1Feed)	61430300	1	
641	Base Top Mount	61063500	1	
702	Screw, 10” - 24” X 3/8” Long	90122061C4	8	
703	Screw, 3/8” - 16” X 1/2” Long	90223021CX	8	
715	Stud, 3/8” - 16” X 1-1/2” Long	9092301070	4	
717	Flanged Nut 3/8” X 16”	92323011C4	4	
725	Key 1/8” X 13/16” Long	9452109020	1	
753	Sight Plug	9702362000	2	
760	Breather	6075A-06	1	
761	Pipe Plug 3/8”	970230402E	4	
777	Cap Plug	9102501560	1	
779	Relief Valve Cap Gasket	9562501000	1	
790	C-Face Motor Gasket	61430400	1	
-	Nipple, 3/8 NPT X 2	970226402H	1	
-	Pipe Cap	970226302H	1	
-	3/8 NPT Steel Elbow	970226202H	1	
	MULTIPLEX PUMP ACCESSORIES			
643	Multiplex Side Rail 2 Unit	61061902	2	
	Multiplex Side Rail 3 Unit	61061903	2	
	Multiplex Side Rail 4 Unit	61061904	2	
	Multiplex Side Rail 5 Unit	61061905	2	
644	Base Motor Mount Multiplex	61062000	1	
646	Cross Member - End Cap Tall	61062600	2 + 3 Unit = 1 4 + 5 Unit = 2	
647*	Coupling Guard - Multiplex	61870700	2 Unit = 1 3 Unit = 2 4 Unit = 3 5 Unit = 4	
648	Cross Member - End Cap Short	61062300	1	
650	Hex Bolt, 3/8” - 16” x 3/4” Long	901230102P	4 Per Drive-case / 6 Per Base	
651	Hex Nut, 3/8” X 16”	91923021CE	6 Per Base	

- Items not shown.

EV1

ITEM	DESCRIPTION	PART NUMBER	QTY	PLUNGER CODE
652	Lockwasher Spring, 3/8”	93523071CE	4 Per Drive-case / 6 Per Base	
653	Flat Washer, 3/8”	934230502E	10 Per Base	
120	Multiplex - Spacer Shaft	61150900	Same as 647	
725	Key, 1/8” X 13/16” Long	9452109020	Same as 647 X 2	
727	Multiplex - Spacer Shaft Key	9452215020	Same as 647	
764	needle Bearing Open	9742414000	Same as 647	
772	Multiplex - Spacer Coupling 0.50”	9M42501100	Same as 647	
775	Oil Seal	9MT2504000	Same as 647	
800	Oil, Size A (Mobil SHC 524)	20040	4 QTS	03D, 04D, 06D
800	Oil, Size B & C (Mobil SHC 629)	4070324030	4 QTS	10D, 14D, 20D, 28D, 38D
-	Foot Mount Motor Coupling 0.62”	9M42501000	Same as 647	
-	Spacer Shaft	61150500	Same as 647	
-	Screw, 5/16” - 18” X 2” Long	90123391CE	4	
-	Hex Jam Nut, 5/16” - 18”	91923011CE	4	
-	Washer	934230211E	8	
-	Lockwasher	93523021CE	4	

- Items not shown.

EV1

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)

Maximum Suction Pressure

Size	Plunger Diameter	STD	Modified
A	3/16", 1/4", 3/8"	150 PSIG	N/A
B	5/8", 7/8", 1-1/4"	150 PSIG	400 PSIG
C	1-3/4", 2-3/8"	50 PSIG	200 PSIG

Higher suction pressures available. Consult Factory.
For maximum discharge pressure, consult Durameter sizing program or selection guide .

Lubrication
Capacity 3.3 quarts
Size A - 3/16, 1/4, 3/8 Plunger Dia. - Mobil SHC 524
Size B & C - 5/8 to 2-3/8 Plunger Dia. - Mobil SHC 629

Flow Range .08 GPH @ 3500 PSI to 110 GPH @ 150 PSI SIMPLEX (220 GPH DUPLEX)

Stroke Length .75"

Shipping Weight
One (1) Feed 100-110 lbs. with 1/3 HP Motor (varies with plunger/liquid end size)
Two (2) Feeds 115-125 lbs. with 1/3 HP Motor (varies with plunger/liquid end size)

Pump Dimensions

Size	Plunger Size	Check Connection Size
A	3/16",1/4",3/8"	1/4" NPT (M) - Metallic Head 1/2" NPT (M) - Plastic Head
B	5/8", 7/8", 1-1/4"	3/8" NPT (F)
C	1-3/4", 2-3/8"	3/8" NPT (F)

Motor Frame NEMA 56C TEFC, IEC 71 OR IEC 80, Chemical Duty or Explosion Proof

Materials of Construction

Drivecase Cast Iron - Powder Coated (Polyester TGIC)
Baseplate Carbon Steel - Powder Coated (Polyester TGIC)

Wetted Material	316SS	Alloy 20	Hast[1] C	PVC	Kynar	Slurry CV
Liquid Head	316SS	Alloy 20	Hast C	PVC	Kynar	316SS
Check Valve Ball	316SS	Alloy 20	Hast C	Al-Cer	Al-Cer	TC
Check Valve Cap	316SS	Alloy 20	Hast C	PVC	Kynar	316SS
Ball Guide	316SS	Alloy 20	Hast C	PVC	Kynar	316SS
Check Valve Seat Size A	316SS	Alloy 20	Hast C	PTFE	PTFE	N/A
Check Valve Seat Size B, C	316SS	Alloy 20	Hast C	PVC	Kynar	C-2/TC
Diaphragm & Check Valve Gasket	PTFE	PTFE	PTFE	PTFE	PTFE	PTFE

[1] Registered trademark for Haynes International

EV1

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. Single or double ball check, lost motion drive.	
Uses:	Viscous Service (NPSH Calculation Required) Hazardous / Carcinogen Service	Odorous / Toxic Service Accurate Chemical Injection
Typical Markets:	Chemical Process Pulp and Paper Pharmaceutical Power Generation Water Treatment Oil Exploration / Transmission / Recovery	Refinery Food and Beverage Waste Water Treatment Mining Manufacturing Gas Exploration / Transmission / Recovery
Options:	Diaphragm Rupture Leak Detection Systems Electronic Stroke Control in Nema 4 or 7 EVP™ Pulse-less, Linear Flow Metering Special Metallics and Non-Metallics	Slurry or Double Ball Check Valves Horizontal Motor Mount Multiplexing (up to12 feeds with 1 motor) Two (2) feeds from one (1) drivecase

Features:	Cartridge Design	Parts Interchangeability	Accuracy
	Dependability	Ease of Maintenance	C-Face Motor Mount
	Durability	Mounting Flexibility	No Process Side Contour Plate
	Dual Feed Capability	Cost Effective	Many Options Available

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