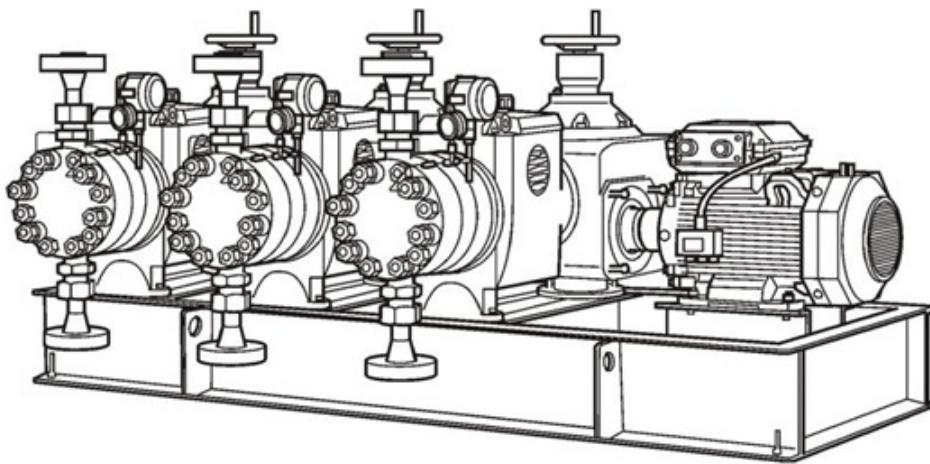




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Primeroyal / Milroyal[®] Critical Service HPD Liquid End Instruction Manual

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PRECAUTIONS

The following precautions should be taken when working with metering pumps.
Please read this section carefully prior to installation.

Protective Clothing



ALWAYS wear protective clothing, face shield, safety glasses and gloves when working on or near your metering pump. Additional precautions should be taken depending on the solution being pumped. Refer to **Safety Data Sheets** for the solution being pumped.

Hearing Protection



It is recommended that hearing protection be used if the pump is in an environment where the time - weighted average sound level (TWA) of 85 decibels is exceeded. (as measured on the A scale - slow response)

Electrical Safety



- Remove power and ensure that it remains OFF while maintaining pump.
- **DO NOT FORGET TO CONNECT THE PUMP TO EARTH / GROUND.**
- Electric protection of the motor (Thermal protection or by means of fuses) is to correspond to the rated current indicated on the motor data plate.

Liquid Compatibility



Verify if the materials of construction of the wetted components of your pump are recommended for the solution (chemical) to be pumped.

Pumps Water “Primed”



All pumps are tested with water at the factory. If your process solution is not compatible with water, flush the **Pump Head Assembly** with an appropriate solution before introducing the process solution.

Plumbing and Electrical Connections



Always adhere to your local plumbing and electrical codes.

Line Depressurization



To reduce the risk of chemical contact during disassembly or maintenance, the suction and discharge lines should be depressurized before servicing.

Over Pressure Protection



To ensure safe operation of the system it is recommended that some type of safety / pressure- relief valve be installed to protect the piping and other system components from damage due to over-pressure.

Lifting



This manual should be used as a guide only - Follow your company's recommended lifting procedures. It is not intended to replace or take precedence over recommendations, policies and procedures judged as safe due to the local environment than what is contained herein. Use lifting equipment that is rated for the weight of the equipment to be lifted.



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Milton Roy's High Performance Diaphragm (HPD) liquid end overcomes the Net Positive Suction Head (NPSH) restrictions associated with conventional disc diaphragm metering pumps. This is accomplished by a patented Mechanically Actuated Refill System (MARS) that eliminates the process side support plate.

The MARS also does away with the need for field adjustment of the refill mechanism by automatically compensating for process liquid modifications. This, combined with removable check valves, makes the HPD an ideal choice for any process in which downtime is critical. The HPD features a diaphragm that is compatible with a wide range of process liquids and chemicals.

The HPD liquid end is particularly suitable for pumping costly, aggressive or hazardous liquids without leakage.

1.1 SPECIFICATIONS

Steady State Accuracy / Turndown	Ratio: + 1% over 10:1 Turndown ratio.
Liquid Temperature:	+20°F to 250°F
Minimum Suction Pressure:	3 PSIA minimum (12 psi maximum vacuum).
Minimum Discharge Back Pressure:	35 psi above suction pressure.
Hydraulic Fluid:	Mobile SHC-524 or Equivalent.
Ball Checks:	Double ball checks in suction and discharge.
Gear Lubricant	SHC-634 or Equivalent.

SECTION 2 - INSTALLATION

2.1 UNPACKING

Pumps are shipped Free on Board (FOB) from the factory and the title passes to the customer when the carrier signs for receipt of it. The customer, therefore, must file damage claims with the carrier.

The shipping crate should be carefully examined upon receipt from the carrier to be sure there is no obvious damage to the contents. Open the crate carefully, as there are sometimes accessory items fastened to the inside of the crate that may be lost or damaged. Examine all material inside crate and check against the packing list to be sure that all items are accounted for and undamaged.

2.2 SAFETY PRECAUTIONS

When installing, operating, and maintaining an HPD 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, toxics, solvents, acids, caustics, flammables etc.).

2.3 MOUNTING

The HPD liquid end is shipped already mounted to the appropriate pump. Mounting, therefore, is simply a matter of securing the pump to a safe, level surface. For further information on proper pump mounting, see the appropriate pump instruction manual.

2.4 PIPING CONNECTIONS

2.4.1 General

General piping instructions are given in the pump drive instruction manual. No reciprocating plunger pump can be expected to perform satisfactorily unless those recommendations are followed. Pay particular attention to plastic liquid ends, as these units are relatively fragile and can be damaged by the installation. For best results, avoid straining the liquid end by installing a very short section of flexible tubing between rigid, fixed piping and suction and discharge cartridges on plastic liquid ends.

NOTE:

Maximum safety and reliability may be ensured by protecting liquid ends and piping with an external relief valve installed in the system discharge line.

2.5 NPSH CONSIDERATIONS

The HPD liquid end is far superior to conventional diaphragm liquid ends for suction lift and many other NPSH critical applications. It's patented diaphragm and advanced design refill mechanism give this liquid end truly high performance in these applications.

For more NPSH information, refer to Milton Roy web site (www.miltonroy.com) for aid in evaluating applications for this liquid end.

2.6 TYPICAL PIPING

In order to adjust the HPD relief valve, it is necessary to have a pressure gauge and a shut OFF valve installed in the discharge line. The pressure gauge must have a higher range than the desired pump relief pressure, and should be installed as close to the pump discharge connection as possible. The shut OFF valve should be installed downstream of the pressure gauge. These items are not required for normal operation, but for ease of pump maintenance and adjustment, it is suggested that they be permanently piped into the line.

Also see the instructions in the appropriate pump instruction manual for additional typical piping instructions.

SECTION 3 - OPERATION

3.1 PUMP START-UP PROCEDURE (VARIABLE STROKE PUMPS)

⚠ CAUTION DO NOT RUN THE MOTOR UNTIL ALL START UP STEPS HAVE BEEN COMPLETED. YOU COULD DAMAGE THE PUMP IF YOU RUN THE MOTOR BEFORE ALL OF THE STEPS HAVE BEEN COMPLETED. IT MAY BE NECESSARY TO TEST THE MOTOR OFF THE PUMP TO INSURE PROPER DIRECTION AND OPERATION. THE MOTOR DIRECTION IS CRITICAL. WIRE THE MOTOR SO THAT IT ROTATES IN THE DIRECTION OF THE ARROW CAST ON THE MOTOR MOUNT FLANGE. CONSULT MANUFACTURER DOCUMENTATION FOR MOTOR START UP RECOMMENDATIONS.

1. Follow the motor mounting procedure before attempting to start your pumps. On some pumps, the motor is mounted at the factory.
2. Make the proper electrical connections to the motor per the manufacturer's recommendations. Make sure the motor is properly grounded.
3. Make sure that all of the mounting holes for the pump base are used to securely tighten the base to the mounting area.
4. Do not run the motor until **ALL** start up steps have been completed.
5. Remove the gear drive fill cap (the chamber closest to the motor).
6. Fill the gear drive chamber with appropriate gear lubricant (SHC-634). This oil was shipped with the pump. Fill this chamber so that the oil level is even with the midpoint of the sight glass. Do not overfill.
7. Remove the catchall chamber cover (closest to the process liquid end of the pump) revealing the plunger and bleed valve. Fill this chamber with hydraulic oil, ISO -32 (SHC-524). This oil was shipped with your pump, and is a lower viscosity compared to the gear oil. The hydraulic fluid must fill the catchall chamber so that the oil level is even with the midpoint of the sight glass. Do not overfill.

NOTE:

Two types of oils have been provided. They must be added at the proper location.

8. Remove all of the tubing connecting the air bleed valve (at the top of the displacement chamber behind the discharge check valve). There is a compression fitting at the point where the tubing enters the front catchall reservoir. Loosen the nut and remove the tubing from this fitting. There is a fitting connected to the air bleed valve that needs to be removed. Remove all air bleed valves from the top of the displacement chamber.
9. The displacement chamber must be filled with, ISO-32 (SHC-524) through the air bleed port. If pump equipped with leak detection see *Section 5*.

⚠ CAUTION IF THE DISPLACEMENT CHAMBER IS FILLED WITH THE PLUNGER FULLY REARWARD, THE DIAPHRAGM COULD RUPTURE AT START-UP. TO PROPERLY FILL THE DISPLACEMENT CHAMBER, THE PLUNGER MUST BE POSITIONED SO THAT IT IS TOP DEAD CENTER IN THE DISPLACEMENT CHAMBER.

10. With the plunger fully engaged in the displacement chamber (pump at TDC, Top Dead Center) adjust the stroke adjustment mechanism until the indicating needle reads 100%. Either turn the hand wheel on a micrometer, apply a 15-PSI supply signal for a Pneumatic, or apply a 20-mA signal for an Electronic actuator. In order to fill each displacement chamber and fully purge the air from the oil, rotate the motor either by hand (by removing the fan cover and spinning the fan by hand), or by rotating the motor electrically. The motor may be jogged by turning the power ON and OFF very quickly. (During this process watch for air bubbles escaping the oil)

⚠ CAUTION IT IS VERY IMPORTANT NOT TO ROTATE THE MOTOR AT HIGH SPEED, BECAUSE HYDRAULIC FLUID WILL BE FORCED FROM THE AIR BLEED PORT AT A VERY HIGH VELOCITY.

11. Rotate the motor shaft again so that the pump is back at TDC (fully extended plunger into the displacement chamber). Fill this chamber with ISO-32 oil and check that no air bubbles are present.
12. Replace the air bleed valve and tighten. Use a pipe thread sealant to seal the threads. Be very careful not to get any sealant into the displacement chamber air bleed port. Place the end of the tubing into the compression fitting and tighten the lock nut to secure the tubing.
13. On multiplex units, repeat these two steps for each pump to insure proper hydraulic fill in each displacement chamber.
14. Recheck the oil level in the catchall reservoir and install the cover, screws and lock washers. The gaskets have an adhesive backing that should be removed and the gaskets should be firmly attached to the covers using this adhesive.
15. Make sure that all oil fill caps are securely tightened to prevent oil leakage.

▲ CAUTION ALWAYS WEAR THE PROPER PROTECTIVE GEAR WHEN WORKING ON THE PUMP LIQUID END.

16. Connect suction and discharge piping manifolds. Use the proper gaskets and tighten each flange per specification. Check that all connections are tight including the check valves, flanges, air bleed valves and the motor mount bolts.
17. Make sure the process bleeder barb, if so equipped, is tight. It is located on the front face of the pump directly under the discharge check valve. This fitting is used to purge any air that is trapped in the process liquid end. If this fitting is loose when you fill the pump, a stream of process fluid will come out and create a hazardous condition.

18. It is advisable to test the pump for proper operation by testing it with water before you use a process fluid. Now fill the process liquid ends with process fluid.

▲ WARNING TAKE ADDITIONAL SAFETY MEASURES APPROPRIATE TO THE LIQUID BEING PUMPED. BE EXTREMELY CAREFUL IN THE PRESENCE OF HAZARDOUS SUB-STANCES (CORROSIVES, TOXINS, SOLVENTS, ACIDS, CAUSTICS, AND FLAMMABLES).

19. Loosen each process bleeder barb, if so equipped, on each pump to bleed any air from the liquid end. Connect a hose to this barb and use caution if you are pumping a hazardous chemical. After all process liquid ends have been purged of air, you can tighten all bleeder barbs to prevent leakage.
20. Now the motor can be started if and only if all steps have been followed.
 - A. For constant speed motors, adjust the stroke adjustment mechanism so that the indication needle reads 25-30%. Gradually increase the capacity adjustment mechanism and increase back-pressure to insure that the pump has time to purge all air from the system.
 - B. For a variable speed drive, the motor should be run at a very slow speed between 75-100 revolutions per minute, and the pump should have minimal process back pressure for initial start-up. Gradually increase the motor speed and increase back-pressure to insure that the pump time to purge all air from the system.

NOTE:

This concludes the start-up procedure. Please follow these steps to insure start-up success and reduce any risk of damage to the pump.

SECTION 3 - OPERATION

3.2 RELIEF VALVE ADJUSTMENT

⚠ WARNING THE PRESSURE RELIEF VALVE IS FACTORY SET TO OPEN AT A PRESSURE SLIGHTLY ABOVE THE PUMP MAXIMUM OPERATING DISCHARGE PRESSURE; NEVER SET THE VALVE AT ANY GREATER PRESSURE.

All HPD liquid ends have a built in relief valve that allows hydraulic fluid to return to the hydraulic fluid reservoir if excessive pressure builds up in the discharge line. This effectively stops the pump from pumping, since the forward stroke of the piston will not displace the hydraulic fluid and force the diaphragm to flex.

The HPD liquid end relief valve may be adjusted to operating conditions by the following procedure. Adjust the relief valve after first installing the pump and after any maintenance procedures.

1. A pressure gauge and shut OFF valve must be installed in the discharge line to complete this procedure. If the necessary equipment is not installed, refer to the "Typical Piping" instructions in *Section 2*.
2. Make sure shut OFF valve is open. Start pump and pump process liquid to drain or other safe point to establish proper pumping action.
3. Set capacity control at 30%.

⚠ WARNING KEEP HANDS AWAY FROM RECIPROCATING PLUNGER AND CROSSHEAD. DO NOT LEAVE PUMP OPERATING UNATTENDED WITH SHUT OFF VALVE CLOSED. EXCESSIVE PRESSURE CAN BUILD QUICKLY, POSSIBLY CAUSING SEVERE DAMAGE TO PUMP AND / OR PIPING. SINCE THE RELIEF VALVE IS NOT YET PROPERLY ADJUSTED, IT CAN NOT BE RELIED ON TO LIMIT EXCESSIVE PRESSURE BUILD-UP. BE SURE TO WATCH PRESSURE GAUGE VERY CAREFULLY AND OPEN SHUT OFF VALVE IMMEDIATELY IF EXCESSIVE PRESSURE DEVELOPS.

4. Close shut OFF valve slowly ("dead head" the pump) and closely watch the pressure increase on the pressure gauge. If pressure exceeds desired value, quickly open shut OFF valve to relieve pressure in line.
5. With shut OFF valve still closed, loosen relief valve adjusting screw located on top of valve until the maximum pressure gauge reading reaches and maintains the relief valve pressure setting desired.
6. After setting relief valve, make sure shut OFF valve is fully open. Remove pressure gauge from line or leave in place, as desired, and place pump in routine service.

⚠ WARNING NEVER OPEN THE AIR PURGE VALVE (IF EQUIPPED 0261) DURING PRESSURIZED PUMP OPERATION.

7. The diaphragm head is equipped with an air bleed purge valve built in just below the discharge port. (Item 0350). The purpose of this device is to vent entrapped air from the diaphragm head during priming and start-up. This end of this fitting will accept flexible tubing in order to pipe OFF the solution to a non-hazardous location. Immediately after priming, the fitting should be tightened.

4.1 DIAPHRAGM REPLACEMENT (FIGURE 2, SHEET 1 & 2)

The HPD diaphragm is extremely durable and often lasts for many years of service. As a preventive measure, however, Milton Roy recommends that the diaphragms be replaced yearly to coincide with annual check valve replacement. The liquid end must be removed from the pump to replace the diaphragm. The following is the diaphragm replacement procedure:

1. Stop pump and relieve all pressure from system. Isolate the liquid end from all sources of process liquid with appropriate valving and purge liquid end of all process fluid.
2. Disconnect both the suction inlet and discharge outlet from the piping system.

NOTE:

Approximately one pint of oil will still be present in the contour plate area which will be released when the diaphragm is removed. Prepare your work area accordingly.

3. Remove the catchall cover and drain catchall of hydraulic oil by removing pipe plug at bottom of casing.
4. Completely loosen the piston rod retention nut (1750) located inside the catchall.
5. Disconnect all tubing that connects the liquid end to the pump body.

NOTE:

The liquid end is very heavy (150 lbs. or more). A hoist is required to move it.

6. Support liquid end with a hoist and unscrew nuts (980) that hold the displacement chamber (630) to the pump body. Pull liquid end and plunger assembly (2000) OFF, being careful to protect the plunger from damage. Carefully raise liquid end and plunger over catchall and pull plunger from liquid end, allowing hydraulic fluid to drain back into catchall. Pull plunger firmly but carefully, being careful not to bend or otherwise damage the plunger.

7. Remove relieve valve (1040) and refill valve (400) from displacement chamber.
8. Place liquid end, diaphragm head up (bolts (710) on top), on a bench or other clean, flat, and convenient working area.
9. Once the diaphragm head is adequately supported, the diaphragm head bolts (710) can be removed. Carefully pull the diaphragm head (700) away from the displacement chamber. The diaphragm (670) may pull OFF with the diaphragm head or remain with the displacement chamber. Remove diaphragm (670). (When equipped with leak detection (See Section 5) remove two diaphragms, leak detection ring A (8080), leak detection ring B (8081), and leak detection ring spacer (8082). Leak detection rings A, leak detection rings B, and leak detection ring spacer can be reused).
10. Clean all sealing surfaces and install new diaphragm (670). (When equipped with leak detection (See Section 5) install two diaphragms, leak detection ring A (8080), leak detection ring B (8081), and leak detection ring spacer (8082) removed previously. Apply a small amount of mineral oil between the diaphragms. Stacked diaphragms and rings may be aligned using the three small holes as a guide).
11. Reinstall liquid end on catchall, using the bolts as a guide.

NOTE:

Apply anti-seize thread lubricant to the bolts.

NOTE:

The bolt torque value stamped on the head only applies to the material grade supplied with the pump.

SECTION 4 - MAINTENANCE

12. Torque bolts in sequence to one half of the final torque value stamped on the head. Follow the bolt torque pattern as stamped on the head. Repeat the torque sequence until bolts are tightened to final torque value.
13. Reconnect suction inlet and discharge outlet to piping system. Follow *Section 5* if your pump is equipped with leak detection.
14. Fill the liquid end with hydraulic oil (refer to above "INITIAL START-UP" procedure).

4.2 HYDRAULIC OIL REPLACEMENT

Inspect and replace hydraulic oil on same schedule as the pumps gear drive lubricant (or whenever diaphragm is replaced). Annual replacement is recommended.

4.3 MARS REFILL VALVE (400)

The MARS refill valve (400) requires no periodic maintenance. Clean hydraulic oil is critical for proper operation.

Strainer service: while replacing the hydraulic oil, it is also recommended that the hydraulic oil strainer be replaced. The strainer, (390) which screws into the displacement chamber can become fouled or clogged over time.

Screw the valve back into the chamber. If the valve is damaged or broken, replace the entire assembly.

4.4 RETURNING UNITS TO THE FACTORY

Pumps will not be accepted for repair without a Return Material Authorization, available from the factory or other authorized Customer Service Department. Pumps returned to the factory for repairs should be clearly labeled to indicate the liquid being pumped. Process liquid should be flushed from the pump liquid end before the pump is shipped.

NOTE:

Federal law prohibits handling of equipment that is not accompanied by an OSHA Safety Data Sheet (SDS). A completed SDS must be packed in the ship-ping crate with any pump returned to the factory. These safety precautions will aid the troubleshooting and repair procedure and preclude serious injury to repair personnel from hazardous residue in pump liquid end. A Safety Data Sheet must accompany all returns.

4.5 RECOMMENDED SPARE PARTS

Be Prepared. To avoid delays in repairs, the following spare parts should be ordered for each pump:

One Routine Preventive Maintenance Kit, which contains replacements for those parts which are subject to wear; specifically the ball checks, check valve seats, gaskets, and the hydraulic fluid strainer. Replacing these parts annually with an RPM kit can reduce the possibility of unexpected downtime and will help to extend pump life.

Parts orders must include the following information:

1. Serial number (found on nameplate)
2. Model number (found on nameplate)
3. Quantity required
4. Part number
5. Part description

Always include the serial and model numbers in all correspondence regarding the unit.

4.6 ROUTINE PREVENTIVE MAINTENANCE

▲ WARNING BEFORE ANY MAINTENANCE, RELIEVE ALL PRESSURE FROM SYSTEM, ISOLATE LIQUID END FROM ALL SOURCES OF PROCESS LIQUID WITH APPROPRIATE VALVING, AND PURGE LIQUID END OF ALL PROCESS LIQUID.

All inquiries on part order should be addressed to your local Milton Roy sales representative or sent to: www.miltonroy.com.

4.7 HYDRAULIC OIL REPLACEMENT

Inspect and replace hydraulic oil on the same schedule as the pump's gear drive lubricant (see the appropriate pump drive instruction manual for this information). Semiannual replacement is recommended, and can be scheduled to coincide with season oil changes.

To replace the hydraulic oil:

1. Remove the catchall cover by unscrewing the four screws, which hold it on.
2. Place a container under the pump catchall to catch the oil and unscrew the catchall drain plug.
3. When oil has finished draining, make sure that the area around the drain hole is clean. Screw drain plug back in securely.
4. Fill the catchall to the top of the oil seal that surrounds the crosshead with new, clean oil. Use hydraulic oil or any good quality type A automobile transmission fluid.
5. Replace the catchall cover the screw firmly in place.

NOTE:

It is not necessary to purge the liquid end displacement chamber of oil during annual oil replacement.

6. Dispose of oil according to federal, state, or local codes that may apply.

4.8 CHECK VALVE MAINTENANCE

4.8.1 Disassembly

▲ WARNING BEFORE PERFORMING ANY MAINTENANCE ON THE CHECK VALVES, RELIEVE ALL PRESSURE FROM SYSTEM, ISOLATE LIQUID END FROM ALL SOURCES OF PROCESS LIQUID WITH APPROPRIATE VALVING, AND PURGE LIQUID END OF ALL PROCESS FLUID.

After insuring that all system pressure has been relieved and that all hazardous process liquids have been flushed from the liquid end, disconnect both the suction inlet and discharge outlet from the system piping.

1. Loosen the retaining nut, then remove. Once disassembled, the O-rings should be discarded.
2. Check valves may be removed. A compressed O-ring provides the seal to the head. Inspect the balls carefully. If they are smooth, round and free of deposits or pits, then they are suitable for continued use. Examine the check valve seats. The area of the seat where it meets the ball (the un-chamfered side) must be in near perfect condition for continued use. Any imperfection visible on the seating surface (pits, erosion, cracks, or a ball shaped contour greater than 0.030 deep) makes the seat unusable. If both the balls and seats are in good condition, then the length of time between parts replacement may be lengthened. If the balls and seats are severely damaged, then the length of time between parts replacement should be shortened.

4.8.2 Re-assembly

1. Replace O-ring on the check valves. Lubricate the O-rings and check valve threads before assembly.
2. Attach port adapter and tighten retaining nut.

SECTION 4 - MAINTENANCE

4.9 CORRECTIVE MAINTENANCE

4.9.1 Relief Valve Assembly

The relief valve assembly operates in filtered hydraulic oil and should require maintenance only if unusual circumstances occur, such as if corrosive media contaminates the fluid. Assembly and disassembly is straightforward. Field servicing should be limited to inspection and cleaning only. Repairs of this critical component should only be carried out by an authorized Milton Roy repair facility.

SECTION 5 - LEAK DETECTION (PRESSURE SENSING SYSTEM)

5.1 DESCRIPTION (FIGURE 2, SHEET 1 & 2)

Milton Roy's pumps are, by design, leakproof and durable. In some applications, however, added assurance is desired to protect the pump from hostile chemicals, or protect the process from contamination by hydraulic fluids. For these situations, Milton Roy has developed a highly reliable diaphragm rupture detection system.

The diaphragm rupture detection system is an optional feature, available on the Critical Service line of metering pumps, which is used to detect and signal if a hole or tear occurs in one or both diaphragms. The system consists of two PTFE diaphragms separated by four leak detection rings (two A rings (8080) & two B rings (8081)). Pressure in the four leak detection rings between the diaphragms is monitored via a pressure gauge. A machined port in the displacement chamber at (5021) connects the diaphragms and rings with tubing, gauge, and or pressure switch. A low cracking pressure check valve (5000) and a bleed valve (5100) are located between the displacement chamber and the pressure gauge.

5.2 PRINCIPLE OF OPERATION

The system consists of two separate diaphragms, four leak detection rings, leak detection ring spacer (8082), and a pressure gauge (5030) or switch (1250). During normal operation, the two diaphragms are pushed tightly together and are separated only around their outside edge by the rings. Because there is no fluid and very little air between the two diaphragms, the system does not experience pressure from the process when both diaphragms are intact. The pressure is therefore at atmospheric pressure, and the pressure gauge displays 0 psi. The rupture detection system senses process pressure only when one of the diaphragms rupture. In the event of a rupture in either diaphragm, fluid rushes into the rings, and the pressure at the ring rises rapidly to the pump's operating pressure. This pressure will be displayed directly on the pressure gauge for visual indication. An optional pressure switch is also available to shut down the pump or provide an alarm signal. The pressurized fluid trapped between the pressure gauge and the check valve can be relieved via the bleed valve after the pump is shut down and system pressure relieved.

5.3 SPECIFICATIONS

Maximum Pressure Ratings:	Same as pump rating.
Materials:	Diaphragms: PTFE
	Leak Detection Ring / Tubing: Steel 304SS or 316SS
Flow Rate:	Derate flow by 5% on all pumps
Accessories:	Pressure Gauge: 316SS liquid filled (Standard)
	Pressure Switch W/Gauge : NEMA 4 or Explosion Proof (optional)

SECTION 6 - INSTALLATION & OPERATION (PRESSURE SENSING SYSTEM)

The Diaphragm Rupture Detection System is usually shipped already mounted to the pump. Installation, therefore, is usually only a matter of piping in the pump, and wiring the pressure switch if one is provided.

6.1 UNPACKING

Units are shipped Free on Board (FOB) factory and the title passes to the customer when the carrier signs for receipt of the unit. 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 crate and check against packing list to be sure that all items are accounted for and intact.

6.2 SAFETY PRECAUTIONS

When installing, operating, and maintaining a Critical Service pump with Diaphragm Rupture Detection, 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, toxics, solvents, acids, caustics, flammables etc.).

6.3 DISASSEMBLY / ASSEMBLY (REFER TO DRAWING 1029026000, FIGURE 2, SHEET 1 & 2)

⚠ CAUTION LOOSENING ANY HYDRAULIC CONNECTIONS OR OPENING ANY VALVES COULD CAUSE PROCESS LIQUID TO BE RELEASED UNDER PRESSURE. CAREFULLY DISCONNECT PUMP FROM ALL ELECTRICAL AND HYDRAULIC SERVICE BEFORE PERFORMING ANY MAINTENANCE.

1. After shutting down the pump and relieving system pressure, disconnect all hydraulic connections.
2. Drain the oil from the catchall.
3. Disassemble the diaphragm head from the pump body following the instructions in *Section 4*.
4. Remove diaphragms (670) and discard along with four leak detection rings (8080 and 8081), and leak detection ring spacer (8082). Items (8080, 8081, and 8082) can be reused if not damaged by process fluid. *Refer to Figure 2, Sheet 2, Detail C as needed.*

⚠ CAUTION IF THE PROCESS FLUID IS HYDROGEN PEROXIDE OR ANOTHER STRONG OXIDIZING AGENT, MINERAL OIL SHOULD NOT BE USED BETWEEN THE DIAPHRAGMS. SUBSTITUTE WITH A CHLOROTRIFLUOROETHYLENE POLY-MER FLUID SUCH AS FLOUROLUBE.

5. Clean all sealing surfaces and install new diaphragms (670), leak detection ring A (8080), leak detection ring B (8081), and leak detection ring spacer (8082), leak detection ring A (8080), leak detection ring B (8081) removed previously (*Figure 2, Sheet 1, Detail C*). Apply a small amount of mineral oil between the diaphragms. Stacked diaphragms and rings may be aligned using the three small holes as a guide. Make sure diaphragms (670) fit into pocket on diaphragm head (700).

6. Reassemble diaphragm head following *Section 4*.
7. Once the suction inlet and discharge outlets are connected to piping system mount the switch bracket (5090, *Figure 2 Sheet 2*) then the remaining components should be fitted finger tight and oriented as shown.

NOTE:

Check the flow direction arrow on the check valve. The check valve must be assembled with the arrow pointed toward the pressure gauge or pressure switch as shown in the figures. Improper operation will result if the check valve is not installed correctly.

8. Check all threaded and tube connections to make sure they are tight.

IMPORTANT

9. Remove the pipe plug(s) and open the bleed-valve(s). Follow the oil fill and start up procedure in manual.
10. Leaving the bleed valve(s) open, run the pump at 100% capacity and normal operating pressure for 10 minutes. This procedure purges any excess air and oil from in between the diaphragms. If too much mineral oil was placed between the diaphragms in *step 5*, some will leak out from the bleed valve(s) at this point. Lubricant leakage is acceptable.
11. Close the bleed valve(s) and replace the pipe plug(s). The leak detector assembly is now complete.
12. Additional oil may need to be purged again. Return to *step 10*.

6.4 ELECTRICAL CONNECTIONS

THIS SECTION ONLY APPLIES TO MODELS EQUIPPED WITH THE PRESSURE SWITCH ALARM OPTION.

The diaphragm leak detection system can be equipped with a pressure switch which can be wired to activate an alarm or shut down the pump in the event of a diaphragm failure. This switch is either NEMA 4 (indoor / outdoor, weather and dust proof) or Explosion Proof (for hazardous locations). In both cases the switch relay is single-pole double-throw (SPDT), normally open or normally closed and rated for 15 amps, 125/240/480 VAC resistive.

6.5 NEMA 4 PRESSURE SWITCH WIRING

The switch terminals are accessed by removing the two screws retaining the cover and cover gasket. A 1/2" NPT conduit connection is provided in the switch enclosure.

6.5.1 Wiring

Unscrew the switch cover to access the wiring connections. A 3/4" NPT conduit connection is provided in the switch enclosure. Replacing the cover hand tight (5 full threads engaged) is sufficient to maintain proper protection. Additional tightening may be required to fully engage the O-ring and seal enclosure for rain tight protection.

SECTION 6 - INSTALLATION & OPERATION (PRESSURE SENSING SYSTEM)

6.6 EXPLOSION PROOF PRESSURE SWITCH

CAUTION ALWAYS WIRE IN ACCORDANCE WITH LOCAL OR NATIONAL CODES. BE SURE ALL LIVE SUPPLY CIRCUITS ARE DISCONNECTED BEFORE WIRING TO THE SWITCH. MAXIMUM RECOMMENDED WIRE SIZE IS #14 AWG.

The three switch terminals are clearly labeled “Com” (common), “NO” (normally open), and “NC” (normally closed). A grounding screw is also provided. Keep wires as short as possible to prevent interference with the plunger and differential switch wheel inside the switch.

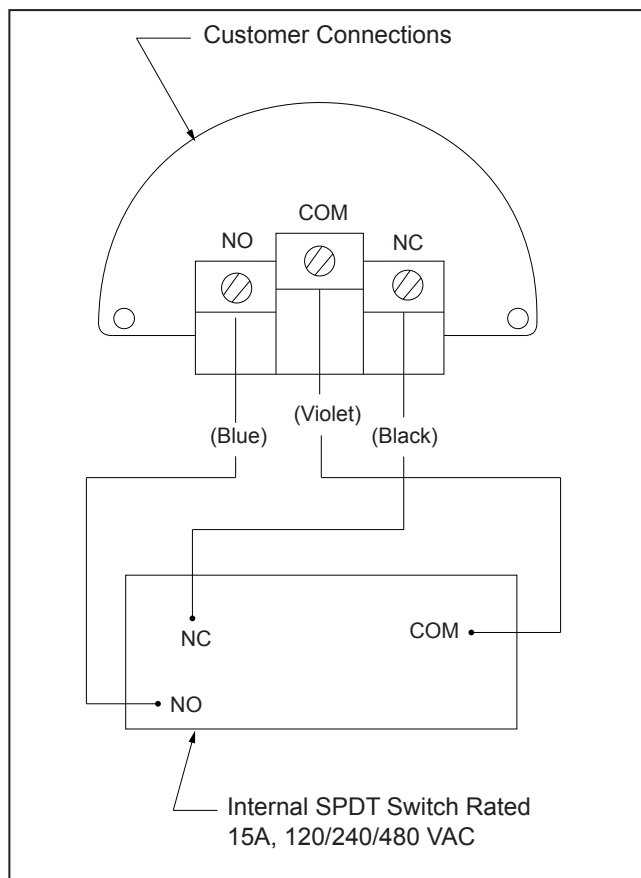


Figure 1. Pressure Switch Wiring Diagram

IMPORTANT

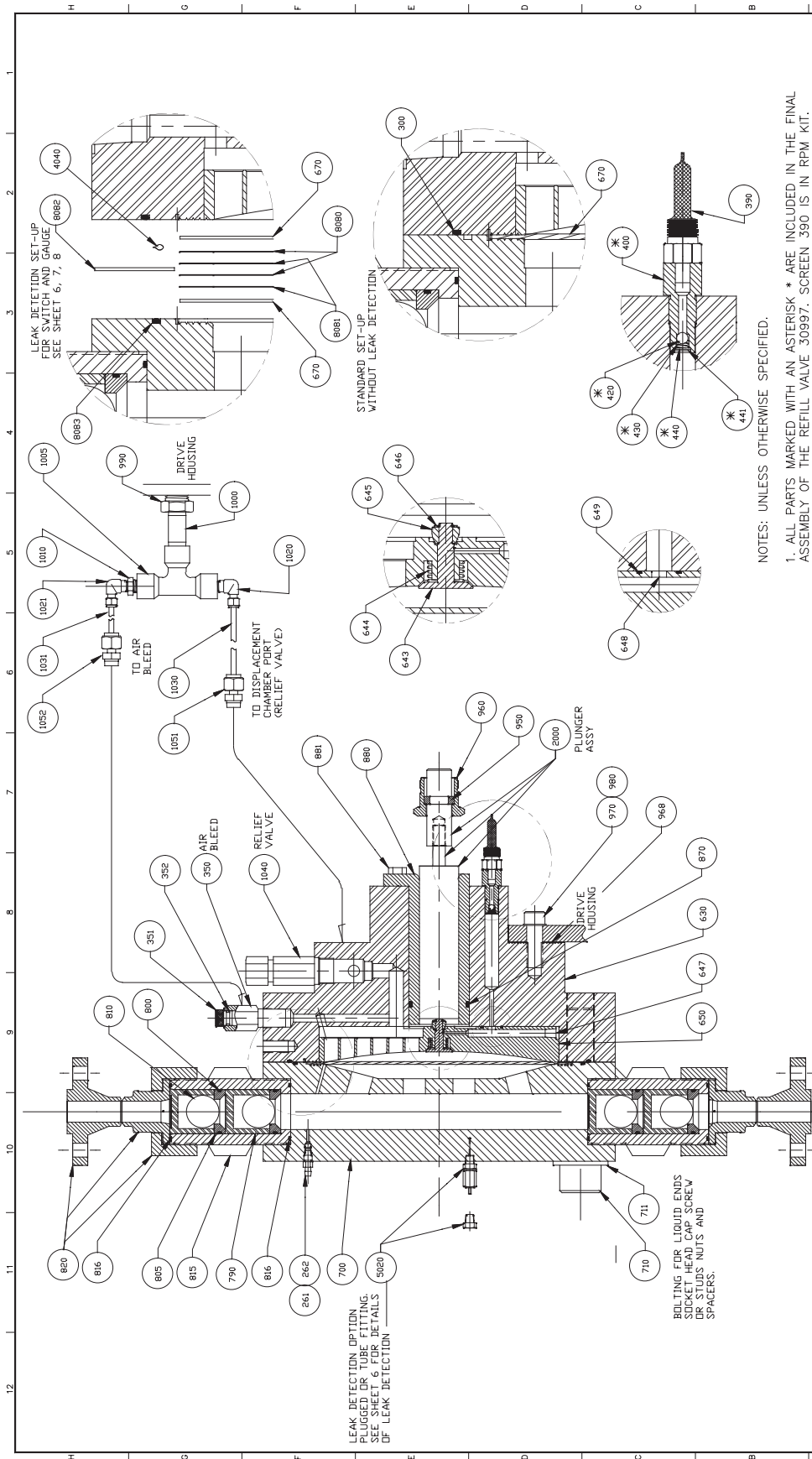
Connections must always be made through cable connectors which maintain the integrity of the NEMA 4 switch or Explosion Proof enclosure.

6.7 START-UP

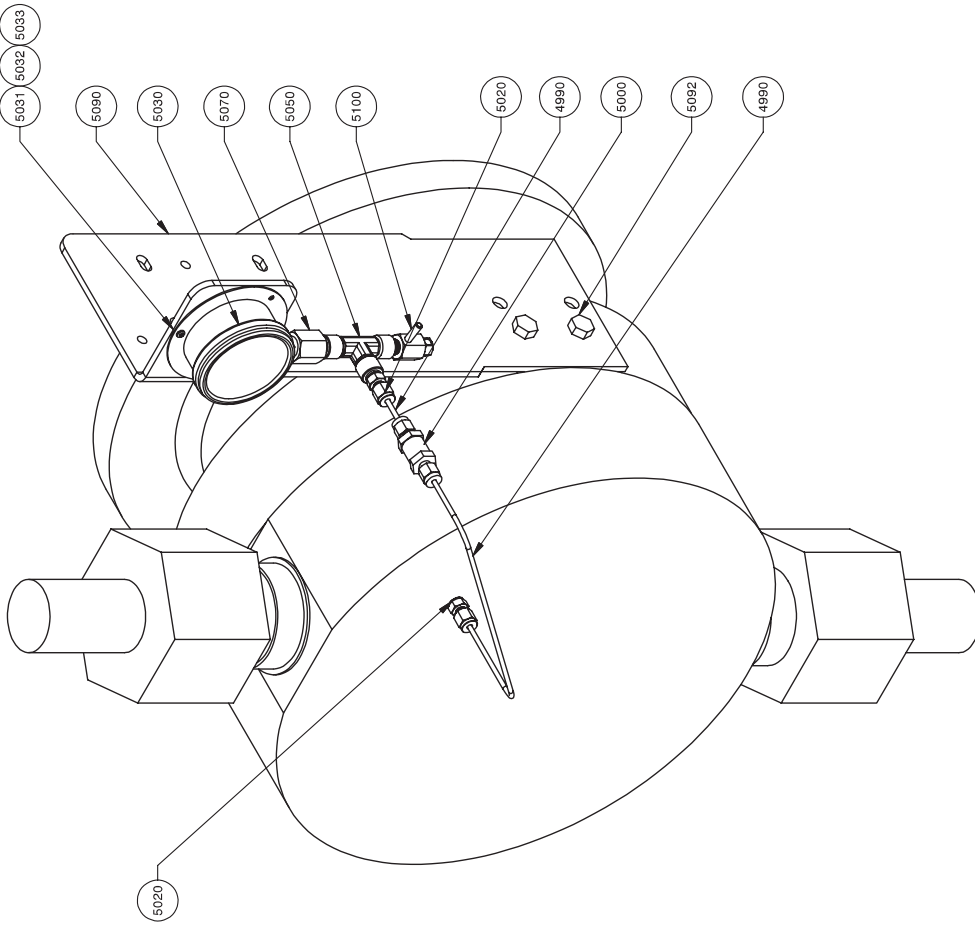
1. Refer to the manual for pump installation and start-up instructions.
2. During the initial installation, following any disassembly of the leak detection system, or if the pump has not been operated for a prolonged period, a short break-in procedure for the leak detector system is required. On duplex pumps, be sure to follow directions on both sides of the pump.
 - a. Open the bleed valve(s) on the leak detection system.
 - b. Operate the pump at 100% capacity and normal system operating pressure. Air and a small amount of oil may leak from the bleed valve(s).
 - c. After a minimum of ten minutes of operation, close the bleed valve(s).

The break-in operation purges any air and excess oil which may be trapped in the intermediate ring(s). The leak detection system is now operational.


1. Please refer to the Bill of Material and assembly for spare parts.
2. Use the drawing to identify the sequence for the part.
3. The sequence number is used on the drawing and Bill of Material.
4. Parts should be ordered by the “**Part Number**” listed in the Bill of Material.
5. Also reference the sequence number of the part, since component upgrades occur.



MILTON ROY A FLOW CONTROL DIVISION OF THE MILTON ROY COMPANY PITTSBURGH, PA. 15217-0577 USA		OPEN UNDER REPAIR SIZE 1/2, 1/4, 1/8, 1/16
MILTON ROY A FLOW CONTROL DIVISION OF THE MILTON ROY COMPANY PITTSBURGH, PA. 15217-0577 USA		D 102-2397-0001
MILTON ROY A FLOW CONTROL DIVISION OF THE MILTON ROY COMPANY PITTSBURGH, PA. 15217-0577 USA		SCALE 1:1:1
MILTON ROY A FLOW CONTROL DIVISION OF THE MILTON ROY COMPANY PITTSBURGH, PA. 15217-0577 USA		SHEET 1 OF 3



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 MILTON ROY FLOW CONTROL DIVISION 201 LYVLAND RD MILTON, MA 02177 USA WWW.MILTONROY.COM		CRITICAL SERVICE LIQUID ENDS DETECTION OPTIONS C5 W/ GAUGE CUSTOMER DIMENSIONAL OUTLINE C 102-2397-000
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION. IT IS THE PROPERTY OF MILTON ROY COMPANY AND IS TO BE USED ONLY FOR THE PURPOSES SPECIFIED HEREIN. WITHOUT THE WRITTEN PERMISSION OF MILTON ROY COMPANY, NO PART OF THIS DOCUMENT IS TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM. REFER TO PURCHASE ORDER FOR TERMS AND CONDITIONS OF SALE.		SCALE: NONE SHEET 6

TOLERANCE UNLESS OTHERWISE SPECIFIED INCHES (MILLIMETERS)	±.012" (3 MIL) HOLE PROJECTION
DRAWN BY/DATE S.C.S. 5-10	CHECKED/DATE S.C.S. 5-10

CERTIFIED DIMENSIONS: _____
 SERIAL NO: _____
 DATE: _____

**BILL OF MATERIAL
FOR
MCB2418GPCCDEAV6H311C522
MR SO #2441959 / PO6019493
MILROYAL® C
MODEL # MCB241
TAG # 41-67-2011, 41-67-2012**

ITEM NUMBER	PART NUMBER	NOMENCLATURE	QUANTITY	U/I
261	20352	BARB,AIR BLEED 316/316LSS	1	EA
262	A5-1007	OR -007 VITON	1	EA
300	40538	'O' RING 2-176 VITON	1	EA
350	30342	AIR BLEED VALVE HI TEMP	1	EA
351	21801	PLUG, AIR BLEED VALVE	1	EA
352	V-112	POPPET O-RING / VITON STD.	1	EA
390	2450021000	STRAINER FITTING HPD	1	EA
400	20749	REFILL VALVE BODY	1	EA
420	L10626	BALL, 1/4" 440C SS	1	EA
430	20024	SPRING MARS CS	1	EA
440	60668	FLATWASHER M4 ZINC PLT	1	EA
441	40605	RETAINING RING #RCLBHO0037STPA	1	EA
630	21269	DISP. CHMBR '116' SLEEVED	1	EA
643	20663	MARS BUTTON	1	EA
644	60677	SPRING, MARS BUTTON	1	EA
645	60673	POPPET MARS VALVE	1	EA
646	40570	WALDES RETAINING RING X5133-31	1	EA
647	4020095011	PLUG 1/8 NPT SOCKET HEX HEAD	1	EA
648	4050025144	SOC HD SCR #10-24X1-1/2 STL	2	EA
649	4080068015	O-RING 2-111 VITON / USE V-111	1	EA
650	20658	CONTOUR PLATE 7.50 MILC BAR	1	EA
670	40515	DIAPHRAGM - GYLON 8.730 X .060	2	EA
700	20747	DIAPHRAGM HEAD '116'BAR ASTM A479	1	EA
710	40525-G7	SOC HD CAP SCR 1 1/4-7 X 5 1/2	12	EA
711	40893	WASHER, FLAT 1 1/4 NARROW	12	EA
790	20684	CAGE - 1-1/2" BALL CHECKS 316SS	4	EA
800	40564	O-RING , TFE ENC VITON,V-133	4	EA
805	20683	SEAT - 1-1/2" BALL CHECKS 316SS	4	EA
810	4070014272-G7	BALL 1-1/2 316SS	4	EA
815	20680	CHECK VALVE BODY - 1-1/2"	2	EA
816	40565	O-RING, TFE ENC VITON, V-142	4	EA
820	53720	FLANGE WELD ASSY 1" 600# VERT	2	EA

ITEM NUMBER	PART NUMBER	NOMENCLATURE	QUANTITY	U/I
870	40791	'O'RING 2-230 NITRILE 70 DURO	1	EA
880	21268	SLEEVE, PLUNGER BORE 1.50 DIA	1	EA
881	4050020136	HEX HD SCR 1/2-13X1-1/4 ULTRA	5	EA
950	2190063006	HALF MOON STEEL MILROY HPD ALL	2	EA
960	2720026406	PLUNGER ADAPTER 7/8 HOLE CRS	1	EA
968	2250028099	GASKET 5-1/2ID LE TO DRIVE HSG	1	EA
970	4040044022	SPRING LOCK WASHER 5/8 18.8SS	4	EA
980	4050021151	HEX HD SCR 5/8-11X1-3/4STL GR2	4	EA
990	4020001124	HXPIPEBSHG 1X1/2 304SS	1	EA
1000	4020052012	NIPTHRDSCH40 1/2X1-1/8 304SS	1	EA
1005	42170	TEE3000#THRD 1/2 304SS	1	EA
1010	4020001054	HXPIPEBSHG 1/2X1/4 304SS	1	EA
1020	4020553152	MALE ELBOW 1/2 NPT X 3/8 TUBE	1	EA
1021	A1-0013	MELBOW 1/4T 1/4P SS	1	EA
1030	C7-0028	3/8" 316 SEAMLESS .035W	12	IN
1031	C7-0027	1/4" 316 SEAMLESS .035W	24	IN
1040	4070177051	RELIEF VALVE 50/2500 PSI	1	EA
1051	A1-0007	MCONN 3/8T 1/4NPT SS	1	EA
1052	A1-0003	MCONN 1/4T 1/8P SS	1	EA
2000	53744	PLUNGER ASSEMBLY 1 1/2"	1	EA
4040	4070317020	MINERAL OIL-NOT FOR RESALE	1	OZ
4990	C7-0044	1/8" 316 SEAMLESS .035W	24	IN
5000	40065	CHECK VALVE 1/8TUBE 1/3PSI 316SS	1	EA
5020	40061	TUBE CONN 1/8 TUBEX 1/8NPT 316SS	2	EA
5030	53716	GAUGE, PRES, 2.5", ASHCRO, 2000PSI	1	EA
5031	4050263050	PAN HD SCR #4-40X1/2 ZNCR	3	EA
5032	4040095023	SPRING LOCK WASHER #4 18.8SS	3	EA
5033	C0-0051	4-40 NUT SS	3	EA
5050	40062	TEE 1/8NPT FEMALE 316SS	1	EA
5070	40067	RED ADAPTER 1/4F X1/8M NPT 316SS	1	EA
5090	21094	SUPPORT BRACKET, SWITCH / GAGE	1	EA
5092	4050016095	HEX HD SCR 1/4-20X3/4 18.8SS	2	EA
5100	40063	BLEED VALVE 1/8 NPT 316SS	1	EA
8080	40610	LEAK DETECTION RING 'A'	2	EA
8081	40611	LEAK DETECTION RING 'B'	2	EA
8082	40609	SPACER RING '116' RUP. DET.	1	EA
8083	40790	O-RING, TFE ENC VITON, 2-178	1	EA

**BILL OF MATERIAL
FOR
MCB2018JPCCCEAV6H311C522
MR SO #2441959 / PO6019493
MILROYAL® C
MODEL # MCB201**

TAG # 40-67-3316 A/B, 40-67-3326 A/B, 40-67-3336 A/B, 40-67-3346 A/B

ITEM NUMBER	PART NUMBER	NOMENCLATURE	QUANTITY	U/I
261	20352	BARB,AIR BLEED 316/316LSS	1	EA
262	A5-1007	OR -007 VITON	1	EA
300	40538	'O' RING 2-176 VITON	1	EA
350	30342	AIR BLEED VALVE HI TEMP	1	EA
351	21801	PLUG, AIR BLEED VALVE	1	EA
352	V-112	POPPET O-RING / VITON STD.	1	EA
390	2450021000	STRAINER FITTING HPD	1	EA
400	20749	REFILL VALVE BODY	1	EA
420	L10626	BALL, 1/4" 440C SS	1	EA
430	20024	SPRING MARS CS	1	EA
440	60668	FLATWASHER M4 ZINC PLT	1	EA
441	40605	RETAINING RING #RCLBHO0037STPA	1	EA
630	21269	DISP. CHMBR '116' SLEEVED	1	EA
643	20663	MARS BUTTON	1	EA
644	60677	SPRING, MARS BUTTON	1	EA
645	60673	POPPET MARS VALVE	1	EA
646	40570	WALDES RETAINING RING X5133-31	1	EA
647	4020095011	PLUG 1/8 NPT SOCKET HEX HEAD	1	EA
648	4050025134	SOC HD SCR #10-24X1-1/4 STL	2	EA
649	4080068015	O-RING 2-111 VITON / USE V-111	1	EA
650	20658	CONTOUR PLATE 7.50 MILC BAR	1	EA
670	40515	DIAPHRAGM - GYLON 8.730 X .060	2	EA
700	20747	DIAPHRAGM HEAD '116'BAR ASTM A479	1	EA
710	40524	WASHER SAE HI STRENGTH 1 1/4	12	EA
711	40525-G7	SOC HD CAP SCR 1 1/4-7 X 5 1/2	12	EA
790	20684	CAGE - 1-1/2" BALL CHECKS 316SS	4	EA
800	40564	O-RING , TFE ENC VITON,V-133	4	EA
805	20683	SEAT - 1-1/2" BALL CHECKS 316SS	4	EA
810	4070014272-G7	BALL 1-1/2 316SS	4	EA
815	20680	CHECK VALVE BODY - 1-1/2"	2	EA
816	40565	O-RING, TFE ENC VITON, V-142	4	EA

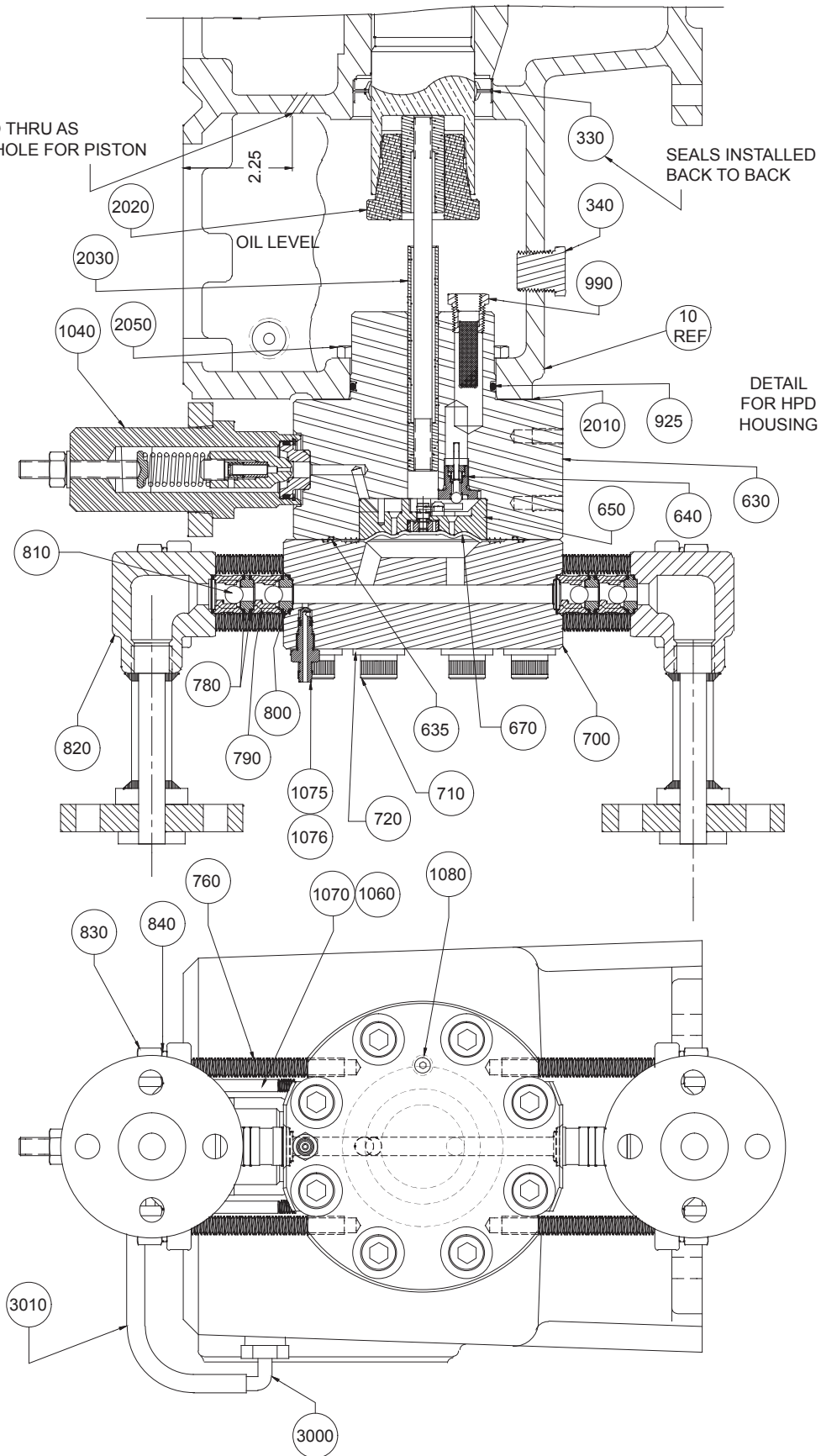
ITEM NUMBER	PART NUMBER	NOMENCLATURE	QUANTITY	U/I
820	53720	FLANGE WELD ASSY 1" 600# VERT	2	EA
870	4080095215	O-RING 2-230 VITON	1	EA
880	22731	SLEEVE, PLUNGER BORE 1.25 DIA	1	EA
881	4050020136	HEX HD SCR 1/2-13X1-1/4 ULTRA	5	EA
950	2190063006	HALF MOON STEEL MILROY HPD ALL	2	EA
960	2720026406	PLUNGER ADAPTER 7/8 HOLE CRS	1	EA
968	2250028099	GASKET 5-1/2ID LE TO DRIVE HSG	1	EA
970	4040044022	SPRING LOCK WASHER 5/8 18.8SS	4	EA
980	4050021151	HEX HD SCR 5/8-11X1-3/4STL GR2	4	EA
990	4020001124	HXPIPEBSHG 1X1/2 304SS	1	EA
1000	4020052012	NIPTHRDSCH40 1/2X1-1/8 304SS	1	EA
1005	42170	TEE3000#THRD 1/2 304SS	1	EA
1010	4020001054	HXPIPEBSHG 1/2X1/4 304SS	1	EA
1020	4020553152	MALE ELBOW 1/2 NPT X 3/8 TUBE	1	EA
1021	A1-0013	MELBOW 1/4T 1/4P SS	1	EA
1030	C7-0028	3/8" 316 SEAMLESS .035W	12	IN
1031	C7-0027	1/4" 316 SEAMLESS .035W	12	IN
1040	4070177051	RELIEF VALVE 50/2500 PSI	1	EA
1051	A1-0007	MCONN 3/8T 1/4NPT SS	1	EA
1052	A1-0003	MCONN 1/4T 1/8P SS	1	EA
2000	53719	PLUNGER ASSEMBLY 1 1/4"	1	EA
4040	4070317020	MINERAL OIL-NOT FOR RESALE	1	OZ
4990	C7-0044	1/8" 316 SEAMLESS .035W	12	IN
5000	40065	CHECK VALVE 1/8TUBE 1/3PSI 316SS	1	EA
5020	40061	TUBE CONN 1/8 TUBEX 1/8NPT 316SS	1	EA
5030	53716	GAUGE,PRES,2.5",ASHCRO,2000PSI	1	EA
5031	4050263050	PAN HD SCR #4-40X1/2 ZNCR	3	EA
5032	4040095023	SPRING LOCK WASHER #4 18.8SS	3	EA
5033	C0-0051	4-40 NUT SS	3	EA
5050	40062	TEE 1/8NPT FEMALE 316SS	1	EA
5070	40067	RED ADAPTER 1/4F X1/8M NPT 316SS	1	EA
5090	21386	BRACKET, LEK DET, GAGE MCB	1	EA
5092	40710	SCREW 3/8-16X3/4 SHCS, 18.8SS	2	EA
5100	40063	BLEED VALVE 1/8 NPT 316SS	1	EA
8080	40611	LEAK DETECTION RING 'B'	2	EA
8081	40610	LEAK DETECTION RING 'A'	2	EA
8082	40609	SPACER RING '116' RUP. DET.	1	EA
8083	40790	O-RING, TFE ENC VITON, 2-178	1	EA

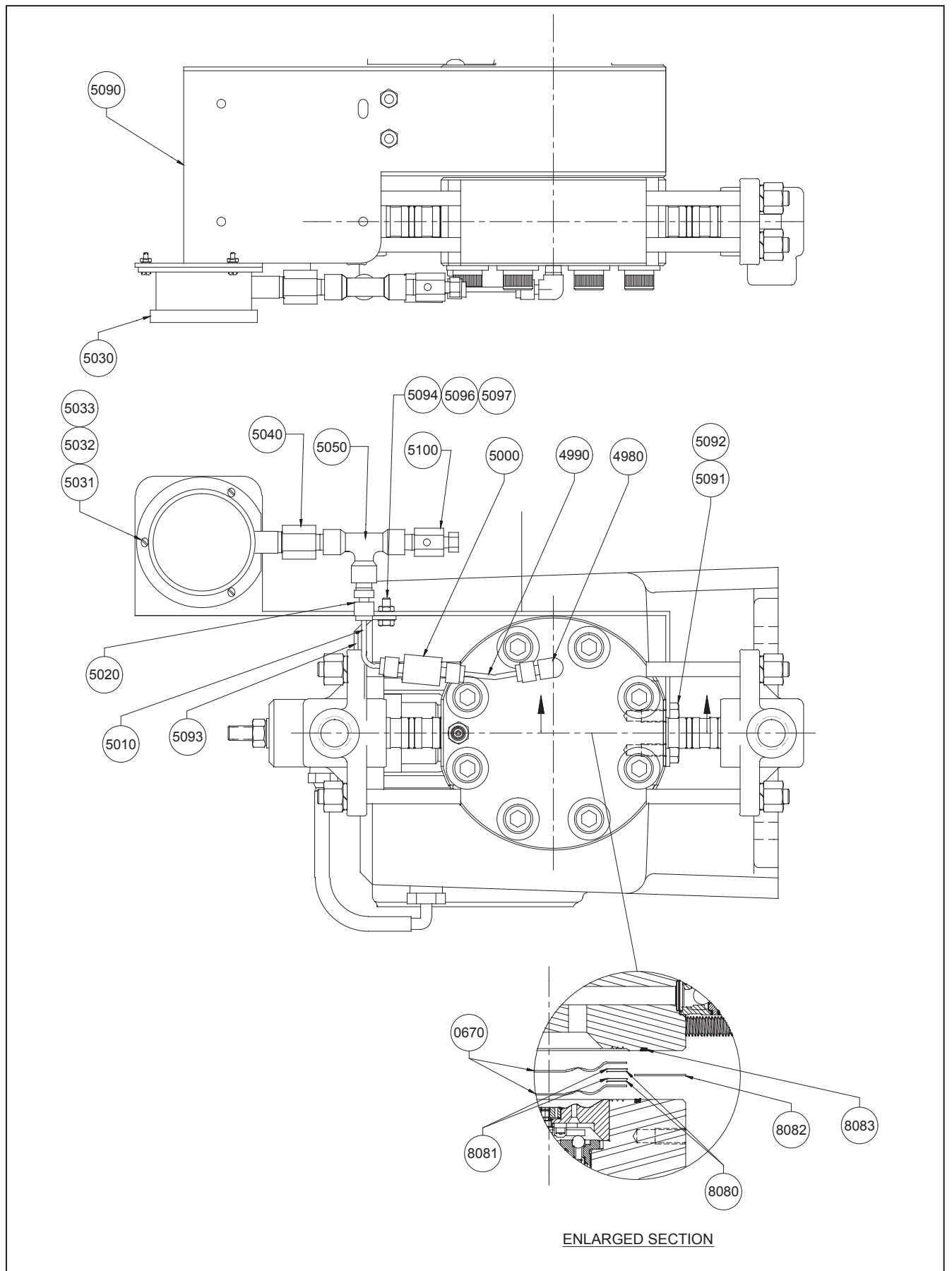
**BILL OF MATERIAL
FOR
MCB1418BPBCDEAV6ST33C5C2
MR SO #2441959 / PO6019493
MILROYAL® C
MODEL # MCB141
TAG # 40-67-3111 A/B/C/D**

ITEM NUMBER	PART NUMBER	NOMENCLATURE	QUANTITY	U/I
261	20352-G7	BARB,AIR BLEED 316SS	1	EA
262	A5-1007	OR -007 VITON	1	EA
300	40780	O-RING, TFE ENC VITON, V-167	1	EA
350	30342	AIR BLEED VALVE HI TEMP	1	EA
351	21801	PLUG, AIR BLEED VALVE	1	EA
352	V-112	POPPET O-RING/VITON STD.	1	EA
390	2450021000	STRAINER FITTING HPD	1	EA
400	20749	REFILL VALVE BODY	1	EA
420	L10626	BALL, 1/4" 440C SS	1	EA
430	20024	SPRING MARS CS	1	EA
440	60668	FLATWASHER M4 ZINC PLT	1	EA
441	40605	RETAINING RING #RCLBHO0037STPA	1	EA
630	53777	DISP. CHMBR .875 '72' MIL C	1	EA
643	20663	MARS BUTTON	1	EA
644	60677	SPRING, MARS BUTTON	1	EA
645	60673	POPPET MARS VALVE	1	EA
646	40570	WALDES RETAINING RING X5133-31	1	EA
647	OS601	PLUG - 1/8" NPT, SOC HEX HD	1	EA
648	4050025134	SOC HD SCR #10-24X1-1/4 STL	2	EA
649	40534	'O' RING 2-109 NITRILE	1	EA
650	20659	CONTOUR PLATE 4.50 MILC BAR	1	EA
670	40516	DIAPHRAGM -6" OD X .030 THK	2	EA
700	21092	DIAPHRAGM HEAD '72' L/D	1	EA
710	43195-G7	SOC HD SCR 7/8-9X4-1/2 ST XYLN	10	EA
711	40749	WASHER 7/8 AN 960 C ULTRA COAT	10	EA
790	22710-G7	CAGE 3/4 BALL, SLURRY SERVICE	4	EA
800	2250043075	SEAL .915ID 1.197OD .141THK	4	EA
805	41054-G7	SEAT,HARDENED INSERT ASSEMBLY	4	EA
810	4070015191	BALL 3/4 CERAMIC AD995	4	EA
815	20678-G7	CHECK VALVE BODY - 1"	2	EA
816	40566	O-RING, TFE ENC VITON,M V-128	4	EA
820	52861	FLANGE WELD ASSY 1/2" 600#VERT	2	EA

ITEM NUMBER	PART NUMBER	NOMENCLATURE	QUANTITY	U/I
950	2190063006	HALF MOON STEEL MILROY HPD ALL	2	EA
960	2720026406	PLUNGER ADAPTER 7/8 HOLE CRS	1	EA
968	2250028099	GASKET 5-1/2ID LE TO DRIVE HSG	1	EA
970	4040044022	SPRING LOCK WASHER 5/8 18.8SS	4	EA
980	4050032164	SOC HD SCR 5/8-11X2 ULTRA COAT	4	EA
990	A2-0066	BUSHING RED 1 X 1/4 SS	1	EA
1000	HN1414304	SS-4-HN	1	EA
1005	A2-0115	TEE 1/4 SS	1	EA
1020	L11439	ELBOW 3/8ODTX1/4MPT 316SS	1	EA
1021	A1-0013	MELBOW 1/4T 1/4P SS	1	EA
1030	41028	TUBE MECH 3/8 ODX.035WALL 317L	18	IN
1031	41027	TUBE MECH 1/4 ODX.035WALL 317L	24	IN
1040	53779	RELIEF VLV ASSY 1500-2250 PSIG	1	EA
1051	A1-0007	MCONN 3/8T 1/4NPT SS	2	EA
1052	A1-0003	MCONN 1/4T 1/8P SS	1	EA
2000	2120062110	PLUNGER ASSEMBLY 7/8"	1	EA
4040	4070317020	MINERAL OIL-NOT FOR RESALE	1	OZ
4990	C7-0044	1/8" 316 SEAMLESS .035W	12	IN
5000	40065	CHECK VALVE 1/8TUBE 1/3PSI 316SS	1	EA
5020	40061	TUBE CONN 1/8 TUBEX 1/8NPT 316SS	1	EA
5030	53716	GAUGE,PRES,2.5",ASHCRO,2000PSI	1	EA
5031	4050263050	PAN HD SCR #4-40X1/2 ZNCR	3	EA
5032	4040095023	SPRING LOCK WASHER #4 18.8SS	3	EA
5033	C0-0051	4-40 NUT SS	3	EA
5050	40062	TEE 1/8NPT FEMALE 316SS	2	EA
5070	40067	RED ADAPTER 1/4F X1/8M NPT 316SS	1	EA
5090	21094	SUPPORT BRACKET,SWITCH / GAGE	1	EA
5092	40710	SCREW 3/8-16X3/4 SHCS, 18.8SS	2	EA
5100	40063	BLEED VALVE 1/8 NPT 316SS	1	EA
8080	20847	LEAK DETECTION RING 'A'	2	EA
8081	20848	LEAK DETECTION RING 'B'	2	EA
8082	53965	MOD. SPACER RING'72' 316SS	1	EA
8083	40781	O-RING, TFE ENC VITON, V-165	1	EA

DRILL 1/4" Ø THRU AS
BREATHER HOLE FOR PISTON





**BILL OF MATERIAL
FOR
MBH0918JPECCEAS6ST11C522
MR SO #2441959 / PO6019493
MILROYAL® B
MODEL # MBH091
TAG # 40-67-3610, 40-67-3611, 40-67-3612**

ITEM NUMBER	PART NUMBER	NOMENCLATURE	QUANTITY	U/I
10	2810047001	HOUSING MIL B	1	EA
330	4080031020	OIL SEAL- CROSSHEAD	2	EA
340	4020009024	SQHDPLPIPE150#THRD 1 304SS	1	EA
630	20391	DISP CHMBR 9/16 LO FLO HPD STL	1	EA
635	4080109415	O-RING 2-044 VITON 70 DURO	1	EA
640	20021	BODY MARS CS	1	EA
650	20079	CONTOUR PLT ASS'Y CS-USE 30616	1	EA
670	20493	DIAPHRAGM LO FLOW HPD DBL DIA	2	EA
700	20319	DIAPHRAGM HEAD LOFLO HPD 6"D A479	1	EA
710	53768-G7	SOC HD SCR 1/2-13X3-1/4 XYLAN	8	EA
720	4040151033	FLAT WASHER SAE 1/2 NOM ULTRA	8	EA
760	4050160143-G7	STUD 3/8-16UNCX4-1/2 300SS	8	EA
780	2250075075-G7	GASKET TEFLON 3/8 BALL 106 HPD	10	EA
790	2920054016-G7	GUIDE 3/8 BALL 316SS HPD	4	EA
800	2240099016-G7	SEAT 3/8 BALL 316SS HPD	4	EA
810	4070014112-G7	BALL 3/8 316/316LSS	4	EA
820	2710060000-G7	FLANGE PORT ADAPTER WELD ASSY	2	EA
830	4050066012-G7	HEX NUT 3/8-16NC 18.8SS	8	EA
840	4040041022-G7	SPRING LOCK WASHER 3/8 316SS	8	EA
925	4080095231	O-RING 2-232 NITRILE 70 DURO	1	EA
990	2450021000	STRAINER FITTING HPD	1	EA
1040	1010021306	RELIEF VALVE ASSY MAX 1780 PSI	1	EA
1060	4040040028	SPRING LOCK WASHER 5/16 Z PL	2	EA
1070	4050028194	SOC HD SCR 5/16-18X2-3/4 ALY	2	EA
1075	20352	BARB,AIR BLEED 316/316LSS	1	EA
1076	A5-1007	OR -007 VITON	1	EA
2010	2250035199	GASKET	1	EA
2020	2720026406	PLUNGER ADAPTER 7/8 HOLE CRS	1	EA
2030	20390	PLUNGER ASSY. 9/16 LO FLO HPD	1	EA

ITEM NUMBER	PART NUMBER	NOMENCLATURE	QUANTITY	U/I
2050	4050018136	HEX HD SCR 3/8-16X1-1/4 ULTRA	4	EA
3000	4020503182	ELL 1/2 NPT 3/4 ID TUBE NYLON	1	EA
3010	4020296171	TUBING 1"OD X 3/4"ID-1/8" WALL	1	FT
4980	A1-0100	MELBOW 1/8T X 1/8P SS	2	EA
4990	20495	TUBE HEAD TO VALVE	1	EA
5000	40065	CHECK VALVE 1/8TUBE 1/3PSI 316SS	1	EA
5010	52425	TUBE, STRAIGHT, VALVE TO GAUGE	1	EA
5020	40061	TUBE CONN 1/8 TUBEX 1/8NPT 316SS	1	EA
5030	53716	GAUGE,PRES,2.5",ASHCRO,2000PSI	1	EA
5031	4050263050	PAN HD SCR #4-40X1/2 ZNCR	3	EA
5032	4040095023	SPRING LOCK WASHER #4 18.8SS	3	EA
5033	C0-0051	4-40 NUT SS	3	EA
5040	40067	RED ADAPTER 1/4F X1/8M NPT 316SS	1	EA
5050	40062	TEE 1/8NPT FEMALE 316SS	1	EA
5090	20428	SUPPORT BRACKET LOW FLOW HPD	1	EA
5091	4050017091	HEX HD SCR 5/16-18X3/4 STL GR5	4	EA
5092	4040040028	SPRING LOCK WASHER 5/16 Z PL	4	EA
5093	22222	SUPPORT BRACKET LK DET MIL B	1	EA
5094	40415	HEX HD SCR 1/4-20 X 5/8 316SS	2	EA
5096	C0-0062	1/4" FLAT WASHER SS	2	EA
5097	C0-0095	1/4-20 HEX NUT SS	2	EA
5100	40063	BLEED VALVE 1/8 NPT 316SS	1	EA
8080	20431	INTERMEDIATE RING MIL-BLOWFLOW	2	EA
8081	20429	INTERMEDIATE RING MIL-BLOWFLOW	2	EA
8082	20430	SPACER RING MIL-BLOW FLOW	1	EA
8083	4080109425	O-RING 2-045 VITON 70 DURO	1	EA

**BILL OF MATERIAL
FOR
MBH0718KPECCEAS6ST11C522
MR SO #2441959 / PO6019493
MILROYAL® B
MODEL # MBH071
TAG # 41-67-3620, 41-67-3621, 41-67-3622**

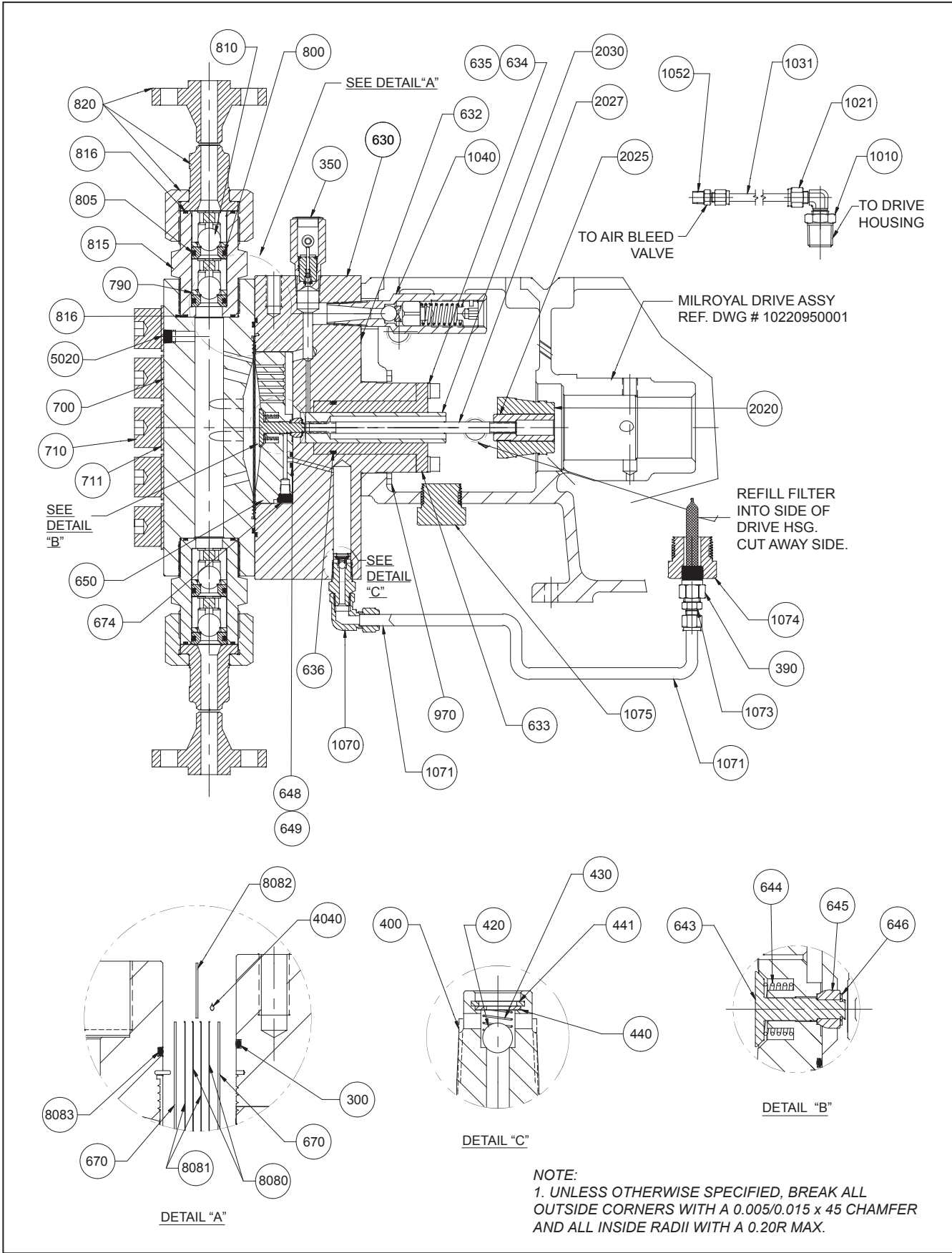
ITEM NUMBER	PART NUMBER	NOMENCLATURE	QUANTITY	U/I
10	2810047001	HOUSING MIL B	1	EA
330	4080031020	OIL SEAL- CROSSHEAD	2	EA
340	4020009024	SQHDPLPIPE150#THRD 1 304SS	1	EA
630	20317	DISP CHMBR 7/16 LO FLO HPD STL	1	EA
635	4080109415	O-RING 2-044 VITON 70 DURO	1	EA
640	20021	BODY MARS CS	1	EA
650	20079	CONTOUR PLT ASS'Y CS-USE 30616	1	EA
670	20493	DIAPHRAGM LO FLOW HPD DBL DIA	2	EA
700	20319	DIAPHRAGM HEAD LOFLO HPD 6"D A479	1	EA
710	53768-G7	SOC HD SCR 1/2-13X3-1/4 XYLAN	8	EA
720	4040151033	FLAT WASHER SAE 1/2 NOM ULTRA	8	EA
760	4050160143-G7	STUD 3/8-16UNCX4-1/2 300SS	8	EA
780	2250075075-G7	GASKET TEFLON 3/8 BALL 106 HPD	10	EA
790	2920054016-G7	GUIDE 3/8 BALL 316SS HPD	4	EA
800	2240099016-G7	SEAT 3/8 BALL 316SS HPD	4	EA
810	4070014112-G7	BALL 3/8 316/316LSS	4	EA
820	2710060000-G7	FLANGE PORT ADAPTER WELD ASSY	2	EA
830	4050066012-G7	HEX NUT 3/8-16NC 18.8SS	8	EA
840	4040041022-G7	SPRING LOCK WASHER 3/8 316SS	8	EA
925	4080095231	O-RING 2-232 NITRILE 70 DURO	1	EA
990	2450021000	STRAINER FITTING HPD	1	EA
1040	1010021306	RELIEF VALVE ASSY MAX 1780 PSI	1	EA
1060	4040040028	SPRING LOCK WASHER 5/16 Z PL	2	EA
1070	4050028194	SOC HD SCR 5/16-18X2-3/4 ALY	2	EA
1075	20352	BARB,AIR BLEED 316/316LSS	1	EA
1076	A5-1007	OR -007 VITON	1	EA
2010	2250035199	GASKET	1	EA
2020	2720026406	PLUNGER ADAPTER 7/8 HOLE CRS	1	EA
2030	20321	PLUNGER ASSY, 7/16 LO FLO HPD	1	EA
2050	4050018136	HEX HD SCR 3/8-16X1-1/4 ULTRA	4	EA

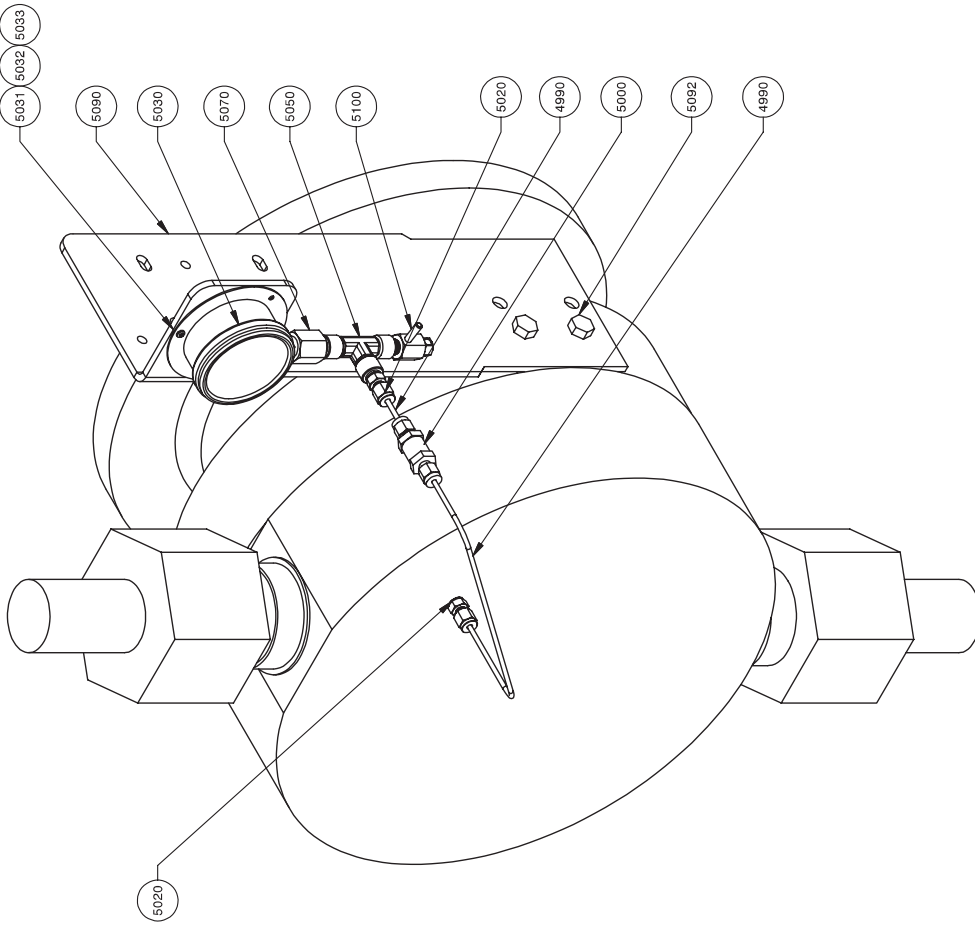
ITEM NUMBER	PART NUMBER	NOMENCLATURE	QUANTITY	U/I
3000	4020503182	ELL 1/2 NPT 3/4 ID TUBE NYLON	1	EA
3010	4020296171	TUBING 1"OD X 3/4"ID-1/8" WALL	1	FT
4980	A1-0100	MELBOW 1/8T X 1/8P SS	2	EA
4990	20495	TUBE HEAD TO VALVE	1	EA
5000	40065	CHECK VALVE 1/8TUBE 1/3PSI 316SS	1	EA
5010	52425	TUBE, STRAIGHT, VALVE TO GAUGE	1	EA
5020	40061	TUBE CONN 1/8 TUBEX 1/8NPT 316SS	1	EA
5030	53716	GAUGE,PRES,2.5",ASHCRO,2000PSI	1	EA
5031	4050263050	PAN HD SCR #4-40X1/2 ZNCR	3	EA
5032	4040095023	SPRING LOCK WASHER #4 18.8SS	3	EA
5033	C0-0051	4-40 NUT SS	3	EA
5040	40067	RED ADAPTER 1/4F X1/8M NPT 316SS	1	EA
5050	40062	TEE 1/8NPT FEMALE 316SS	1	EA
5090	20428	SUPPORT BRACKET LOW FLOW HPD	1	EA
5091	4050017091	HEX HD SCR 5/16-18X3/4 STL GR5	4	EA
5092	4040040028	SPRING LOCK WASHER 5/16 Z PL	4	EA
5093	22222	SUPPORT BRACKET LK DET MIL B	1	EA
5094	40415	HEX HD SCR 1/4-20 X 5/8 316SS	2	EA
5096	C0-0062	1/4" FLAT WASHER SS	2	EA
5097	C0-0095	1/4-20 HEX NUT SS	2	EA
5100	40063	BLEED VALVE 1/8 NPT 316SS	1	EA
8080	20431	INTERMEDIATE RING MIL-BLOWFLOW	2	EA
8081	20429	INTERMEDIATE RING MIL-BLOWFLOW	2	EA
8082	20430	SPACER RING MIL-BLOW FLOW	1	EA
8083	4080109425	O-RING 2-045 VITON 70 DURO	1	EA

**BILL OF MATERIAL
FOR
MBH0718JPECCEAS6ST11C522
MR SO #2441959 / PO6019493
MILROYAL® B
MODEL # MBH071
TAG # 40-67-3620 A/B, 41-67-3630, 41-67-3631, 41-67-3632**


ITEM NUMBER	PART NUMBER	NOMENCLATURE	QUANTITY	U/I
10	2810047001	HOUSING MIL B	1	EA
330	4080031020	OIL SEAL- CROSSHEAD	2	EA
340	4020009024	SQHDPLPIPE150#THRD 1 304SS	1	EA
630	20317	DISP CHMBR 7/16 LO FLO HPD STL	1	EA
635	4080109415	O-RING 2-044 VITON 70 DURO	1	EA
640	20021	BODY MARS CS	1	EA
650	20079	CONTOUR PLT ASS'Y CS-USE 30616	1	EA
670	20493	DIAPHRAGM LO FLOW HPD DBL DIA	2	EA
700	20319	DIAPHRAGM HEAD LOFLO HPD 6"D A479	1	EA
710	53768-G7	SOC HD SCR 1/2-13X3-1/4 XYLAN	8	EA
720	4040151033	FLAT WASHER SAE 1/2 NOM ULTRA	8	EA
760	4050160143-G7	STUD 3/8-16UNCX4-1/2 300SS	8	EA
780	2250075075-G7	GASKET TEFLON 3/8BALL 106 HPD	10	EA
790	2920054016-G7	GUIDE 3/8 BALL 316SS HPD	4	EA
800	2240099016-G7	SEAT 3/8 BALL 316SS HPD	4	EA
810	4070014112-G7	BALL 3/8 316/316LSS	4	EA
820	2710060000-G7	FLANGE PORT ADAPTER WELD ASSY	2	EA
830	4050066012-G7	HEX NUT 3/8-16NC 18.8SS	8	EA
840	4040041022-G7	SPRING LOCK WASHER 3/8 316SS	8	EA
925	4080095231	O-RING 2-232 NITRILE 70 DURO	1	EA
990	2450021000	STRAINER FITTING HPD	1	EA
1040	1010021306	RELIEF VALVE ASSY MAX 1780 PSI	1	EA
1060	4040040028	SPRING LOCK WASHER 5/16 Z PL	2	EA
1070	4050028194	SOC HD SCR 5/16-18X2-3/4 ALY	2	EA
1075	20352	BARB,AIR BLEED 316/316LSS	1	EA
1076	A5-1007	OR -007 VITON	1	EA
2010	2250035199	GASKET	1	EA
2020	2720026406	PLUNGER ADAPTER 7/8 HOLE CRS	1	EA
2030	20321	PLUNGER ASSY, 7/16 LO FLO HPD	1	EA
2050	4050018136	HEX HD SCR 3/8-16X1-1/4 ULTRA	4	EA
3000	4020503182	ELL 1/2 NPT 3/4 ID TUBE NYLON	1	EA
3010	4020296171	TUBING 1"OD X 3/4"ID-1/8" WALL	1	FT

ITEM NUMBER	PART NUMBER	NOMENCLATURE	QUANTITY	U/I
4980	A1-0100	MELBOW 1/8T X 1/8P SS	2	EA
4990	20495	TUBE HEAD TO VALVE	1	EA
5000	40065	CHECK VALVE 1/8TUBE 1/3PSI 316SS	1	EA
5010	52425	TUBE, STRAIGHT, VALVE TO GAUGE	1	EA
5020	40061	TUBE CONN 1/8 TUBEX 1/8NPT 316SS	1	EA
5030	53716	GAUGE,PRES,2.5",ASHCRO,2000PSI	1	EA
5031	4050263050	PAN HD SCR #4-40X1/2 ZNCR	3	EA
5032	4040095023	SPRING LOCK WASHER #4 18.8SS	3	EA
5033	C0-0051	4-40 NUT SS	3	EA
5040	40067	RED ADAPTER 1/4F X1/8M NPT 316SS	1	EA
5050	40062	TEE 1/8NPT FEMALE 316SS	1	EA
5090	20428	SUPPORT BRACKET LOW FLOW HPD	1	EA
5091	4050017091	HEX HD SCR 5/16-18X3/4 STL GR5	4	EA
5092	4040040028	SPRING LOCK WASHER 5/16 Z PL	4	EA
5093	22222	SUPPORT BRACKET LK DET MIL B	1	EA
5094	40415	HEX HD SCR 1/4-20 X 5/8 316SS	2	EA
5096	C0-0062	1/4" FLAT WASHER SS	2	EA
5097	C0-0095	1/4-20 HEX NUT SS	2	EA
5100	40063	BLEED VALVE 1/8 NPT 316SS	1	EA
8080	20431	INTERMEDIATE RING MIL-BLOWFLOW	2	EA
8081	20429	INTERMEDIATE RING MIL-BLOWFLOW	2	EA
8082	20430	SPACER RING MIL-BLOW FLOW	1	EA
8083	4080109425	O-RING 2-045 VITON 70 DURO	1	EA





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 MILTON ROY FLOW CONTROL DIVISION 201 LYVLAND RD MILTON, MA 02177 USA WWW.MILTONROY.COM		CRITICAL SERVICE LIQUID ENDS DETECTION OPTIONS C5 W/ GAUGE CUSTOMER DIMENSIONAL OUTLINE C 102-2397-000
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TOLERANCE UNLESS OTHERWISE SPECIFIED INCHES (MILLIMETERS)	
$\pm .012" (3 \text{ MM})$	
HOLE PROJECTION DRAWN BY/DATE S.C.K. 5-10	CHECKED/DATE S.C.K. 5-10

CERTIFIED DIMENSIONS: _____
 SERIAL NO: _____
 DATE: _____

**BILL OF MATERIAL
FOR
MBB1618BPECCEAV6H233C5C2
MR SO #2441959 / PO6019493
MILROYAL® B
MODEL # MBB161
TAG # 40-67-3211 A/B, 41-67-3110, 41-67-3111, 41-67-3112, 41-67-3210,
41-67-3211, 41-67-3212**

ITEM NUMBER	PART NUMBER	NOMENCLATURE	QUANTITY	U/I
300	40780	O-RING, TFE ENC VITON, V-167	1	EA
350	30342	AIR BLEED VALVE HI TEMP	1	EA
390	2450021000	STRAINER FITTING HPD	1	EA
400	20749	REFILL VALVE BODY	1	EA
420	L10626	BALL, 1/4" 440C SS	1	EA
430	20024	SPRING MARS CS	1	EA
440	60668	FLATWASHER M4 ZINC PLT	1	EA
441	40605	RETAINING RING #RCLBHO0037STPA	1	EA
630	52851	DISP. CHMBR '72' SLEEVED MIL B	1	EA
632	2250035199	GASKET	1	EA
633	52849	SLEEVE, BORE 1.00 DIA MB (72)	1	EA
634	53650	FLAT WASHER 5/16 ID 1/2 OD	1	EA
635	MC600-06	5/16-18X1 SHCS SS 92185A583	1	EA
636	4080095131	O-RING PARKER 2-222 BUNA N	1	EA
643	20663	MARS BUTTON	1	EA
644	60677	SPRING, MARS BUTTON	1	EA
645	60673	POPPET MARS VALVE	1	EA
646	40570	WALDES RETAINING RING X5133-31	1	EA
647	4020095011	PLUG 1/8 NPT SOCKET HEX HEAD	1	EA
648	4050025134	SOC HD SCR #10-24X1-1/4 STL	2	EA
649	40534	'O' RING 2-109 NITRILE	1	EA
650	52856	CONTOUR PLATE 4.50 MILC CS	1	EA
670	40516	DIAPHRAGM -6" OD X .030 THK	2	EA
700	21092	DIAPHRAGM HEAD '72' L/D	1	EA
710	43195-G7	SOC HD SCR 7/8-9X4-1/2 ST XYLN	10	EA
711	40749	WASHER 7/8 AN 960 C ULTRA COAT	10	EA
790	22710-G7	CAGE 3/4 BALL, SLURRY SERVICE	4	EA
800	2250043075	SEAL .915ID 1.197OD .141THK	1	EA
805	41054-G7	SEAT,HARDENED INSERT ASSEMBLY	4	EA
810	4070015191	BALL 3/4 CERAMIC AD995	4	EA
815	20678-G7	CHECK VALVE BODY - 1"	2	EA
816	40566	O-RING, TFE ENC VITON,M V-128	4	EA
820	52861	FLANGE WELD ASSY 1/2" 600#VERT	2	EA

ITEM NUMBER	PART NUMBER	NOMENCLATURE	QUANTITY	U/I
970	4050018136	HEX HD SCR 3/8-16X1-1/4 ULTRA	4	EA
1010	4020001054	HXPIPEBSHG 1/2X1/4 304SS	1	EA
1021	A1-0013	MELBOW 1/4T 1/4P SS	2	EA
1031	C7-0027	1/4" 316 SEAMLESS .035W	1	IN
1040	1010013002	RELIEF VALVE	1	EA
1052	A1-0003	MCONN 1/4T 1/8P SS	1	EA
1070	40927	FEMALE ELBOW, SWAGelok	1	EA
1071	C7-0028	3/8" 316 SEAMLESS .035W	12	IN
1072	40683	UNION ELBOW SWAGelok SS-600-9	1	EA
1073	L11439	ELBOW 3/8ODTX1/4MPT 316SS	1	EA
1074	4020001044	HXPIPEBSHG 1/2X3/8 304SS	1	EA
1075	4020095066	PLUG 1 NPT HEX SOCKET 18.8SS	1	EA
2020	2720026406	PLUNGER ADAPTER 7/8 HOLE CRS	1	EA
2025	2720062306	PLUNGER ADAPTER	1	EA
2027	2680024539	PLUNGER ROD 3/8 DIA 7-5/16 LG	1	EA
2030	20882	PLUNGER 1.0 HI PERF DISC MIL B	1	EA
4040	4070317020	MINERAL OIL-NOT FOR RESALE	1	OZ
4980	A1-0100	MELBOW 1/8T X 1/8P SS	1	EA
4990	C7-0044	1/8" 316 SEAMLESS .035W	12	IN
5000	40065	CHECK VALVE 1/8TUBE 1/3PSI 316SS	1	EA
5020	4020095012	PIPE PLUG HEX SOCKET 1/8 NPT	1	EA
5020	40061	TUBE CONN 1/8 TUBEX 1/8NPT 316SS	2	EA
5030	53716	GAUGE,PRES,2.5",ASHCRO,2000PSI	1	EA
5031	4050263050	PAN HD SCR #4-40X1/2 ZNCR	3	EA
5032	4040095023	SPRING LOCK WASHER #4 18.8SS	3	EA
5033	C0-0051	4-40 NUT SS	3	EA
5050	40062	TEE 1/8NPT FEMALE 316SS	2	EA
5070	40067	RED ADAPTER 1/4F X1/8M NPT 316SS	1	EA
5090	21094	SUPPORT BRACKET, SWITCH / GAGE	1	EA
5092	40710	SCREW 3/8-16X3/4 SHCS, 18.8SS	2	EA
5100	40063	BLEED VALVE 1/8 NPT 316SS	1	EA
8080	20847	LEAK DETECTION RING 'A'	2	EA
8081	20848	LEAK DETECTION RING 'B'	2	EA
8082	20846	SPACER RING '72' 304/316SS	1	EA
8083	40781	O-RING, TFE ENC VITON, V-165	1	EA

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