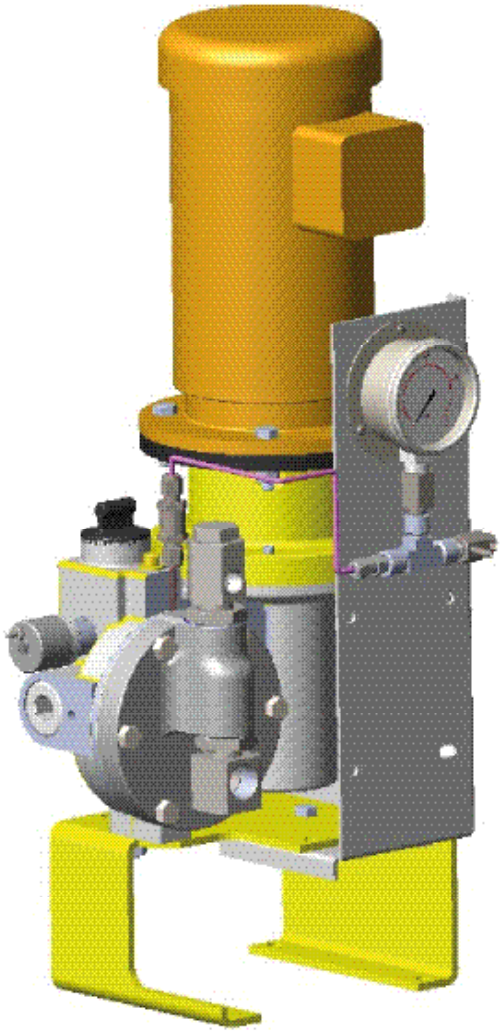
MILTON ROY®



mROY® Diaphragm Rupture Detection System

(Pressure Sensing and Conductance Probe System)

Instruction Manual

Manual No : 53867
Rev. : 01
Rev. Date : 07/2019

MILTON ROY®

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1.1 DESCRIPTION

Milton Roy's mRoy® 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 mRoy® A and B 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 an intermediate ring Pressure in the intermediate ring between the diaphragms is monitored via a pressure gauge. A low cracking pressure check valve and a bleed valve are located between the intermediate ring and the pressure gauge. The diaphragm rupture detection system is available factory installed or as a retrofit kit for field installation.

1.2 PRINCIPLE OF OPERATION

The system consists of two separate diaphragms, a hollow intermediate ring, and a pressure gauge or switch. During normal operation, the two diaphragms are pushed tightly together and are separated only around their outside edge by the intermediate ring. 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 intermediate ring 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 intermediate ring, 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 plug valve after the pump is shut down and system pressure relieved .

1.3 SPECIFICATIONS

1.3.1 Maximum Pressure Ratings

mRoy® A and B Frames ratings are the same as in the basic pump manual 53829.

1.3.2 Materials

1. Diaphragms
2. PTFE
3. Sensing Ring/Tubing
4. Steel/304 SS or 316 SS/316 SS

1.3.3 Flow Rate

Derate flow by 5% on all pumps

1.3.4 Accessories

1. Pressure Guage
2. 316 SS liquid filled (standard)
3. Pressure Switch w/Guage
4. NEMA 4 or Explosion Proof (optional)

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 as directed in instruction manual 53829, and wiring the pressure switch if one is provided. If the Diaphragm Rupture Detection System is being supplied as a field retrofit, refer to field installation instructions below.

2.1 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.

2.2 SAFETY PRECAUTIONS

When installing, operating, and maintaining an mRoy® 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.).

2.3 FIELD INSTALLATION (RETROFIT)

⚠ 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 pump and lay the pump on its side with the diaphragm chamber up.
3. Disassemble the diaphragm head from the pump body following the mRoy® disassembly instructions in manual 53829.
4. Discard the original diaphragm and diaphragm head bolts.
5. Remove both contour plates and set aside. The original contour plates are not reused for the double diaphragm configuration.
6. *Refer to Figures 4-6*, as is appropriate. Place the double diaphragm oil side contour plate in the pump body. The oil side and the process side contour plates are interchangeable.
7. Smear a liberal amount of mineral oil on one side of each diaphragm. Assemble the diaphragms, lubricated sides toward each other, on each side of the intermediate ring by centering them in the shallow recess on each side of the ring.

⚠ 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 POLYMER FLUID SUCH AS FLOUROLUBE.**

8. Carefully center the diaphragm/intermediate ring assembly on the oil side of the contour plate with the vent tube at the 12 o'clock position and pointed to the front of the pump. (Four studs threaded into the body 90° apart will help center the intermediate ring.)

9. Center the process side contour plate on the intermediate ring assembly.
10. Using the guide studs, carefully position the diaphragm head on the pump. Check to make sure that both diaphragms are centered relative to the intermediate ring.
11. Once aligned, mount the switch bracket *(Figures 5 & 6)* then the remaining components should be fitted finger tight and oriented as shown. Remove the guide studs and tighten down the diaphragm head bolts to 22-23 ft. lbs. bolting torque (mRoy® A), or 28-30 ft. lbs. bolting torque (mRoy® B). *See Figure 2* for bolt tightening pattern. Use only the diaphragm head bolts supplied in the retrofit kit.

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

NOTE:

For assemblies shown in Figures 5, 6, the vent tube will have to be bent away from the pump body to facilitate connection to the tube union with the check valve assembly mounted to its support bracket.

12. Use PTFE tape on all NPT threaded connections and tighten to the correct orientation established in step 11.
13. Check all threaded and tube connections to make sure they are tight.

NOTE:

For duplex pumps, repeat steps 1 through 13 on second diaphragm head.

14. Remove the pipe plug(s) and open the bleed valve(s). Follow .the mRoy® oil fill and start up procedure in manual 53829.
15. 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 from the intermediate ring(s). If too much mineral oil was placed between the diaphragms in step 7, some may leak out from the bleed valve(s) at this point. Lubricant leakage is acceptable.
16. Close the bleed valve(s) and replace the pipe plug(s). The leak detector assembly is now complete.

2.4 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.

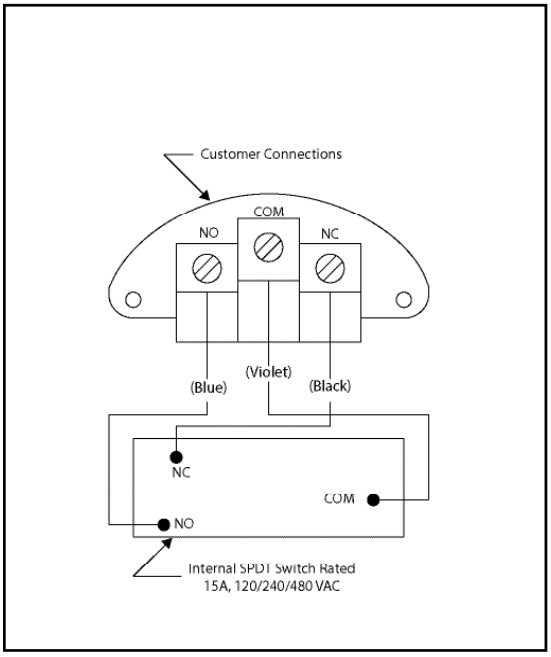


Figure 1. Pressure Switch Wiring Diagram

⚠ 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 labelled "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.

IMPORTANT

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

2.4.1 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.

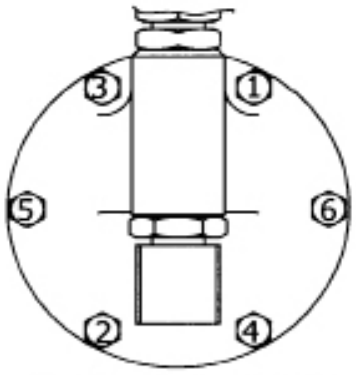
2.4.2 Explosion Proof Pressure Switch Wiring

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.

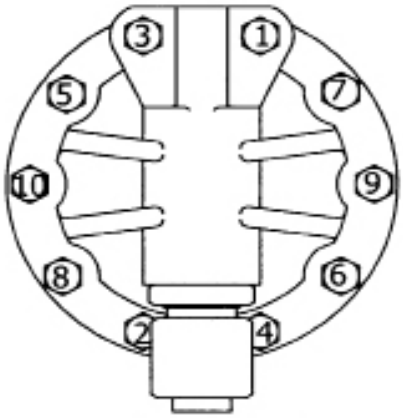
2.5 START-UP

1. *Refer to the manual 53829* 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. Remove the pipe plug(s) and 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) and replace the pipe plug(s).

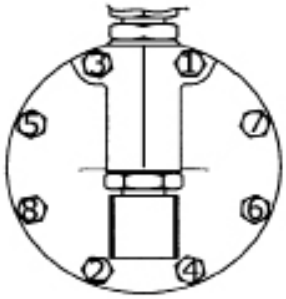
The break-in operation purges any air and excess oil which may be trapped in the intermediate ring(s). The leak detection system is now operational.



mRoy A 6- Bolt Pattern



mRoy B- 10 Bolt Pattern



mRoy A- 8 Bolt Pattern

Figure 2. Diaphragm Head Bolt Tightening Pattern

3.1 SPARE PARTS

To avoid serious delays in repairs, be sure to have all spare parts recommended in the mRoy® manual 53829 on hand. Recommended spare parts which are specific to the double diaphragm leak detection unit are listed below. Double quantity for duplex pumps. Associated parts drawing bubble numbers are in ().

2 Diaphragms (290)

1 Pressure Gauge (1160)

Parts orders must include the following information:

1. Quantity required.
2. Part number.
3. Part description.
4. Pump serial number (on pump nameplate).

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

3.2 RETURNING UNITS TO THE FACTORY

Units will not be accepted for repair without a Return Material Authorization, available from the Factory Repair Department. Process liquid should be flushed from the pump liquid end and oil should be drained from the pump housing before the pump is shipped. Label the unit clearly to indicate the liquid being pumped.

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 shipping crate. These safety precautions will aid the troubleshooting and repair procedure and preclude serious injury to repair personnel from hazardous residue in the pump liquid end.

All inquiries or parts orders should be addressed to your local Milton Roy representative. Representatives can be found on our website (**www.miltonroy.com**).

3.3 MAINTENANCE

The Diaphragm Rupture Detection System is exceptionally reliable and should seldom need maintenance or repair. The only maintenance procedure is the replacement of the diaphragms in the event of a rupture. *See the mRoy® manual 53829* for maintenance procedures not directly related to the double diaphragm rupture detection system.

3.3.1 Diaphragm Replacement - Disassembly

⚠ 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. THESE PROCEDURES DO NOT HAVE TO BE PERFORMED ON BOTH SIDES OF DUPLEX PUMPS, JUST THE SIDE WHICH HAS RUPTURED.**

1. After shutting down the pump and relieving system pressure, remove the pipe plug and carefully open the bleed valve to purge any trapped fluid in the leak detector piping.
2. Disconnect leak detector piping:
   a. For configurations shown in *Figure 4*: The check valve (1150) should be carefully disconnected from the vent tube (300).
   b. For configurations shown in *Figures 5 & 6*: The male elbow (1205) should be carefully disconnected from the vent tube (300). The entire piping assembly will be removed when removing the diaphragm head screws.
3. Disassemble the diaphragm head from the pump body following the standard mRoy® pump disassembly instructions in manual 53829
4. Separate the individual leak detector parts, clean, and inspect.

3.3.2 Diaphragm Replacement - Assembly

1. Discard both diaphragms and replace with new parts.
2. Drain the oil from the pump and lay the pump on its side with the diaphragm ring up.
3. Assemble the oil side contour plate into the pump body. The oil side and process side contour plates are interchangeable.
4. Smear a liberal amount of mineral oil on one side of each diaphragm. Assemble the diaphragms, lubricated sides toward each other, on each side of the intermediate ring by centering them in the shallow recess on each side of the ring.

⚠ 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 POLYMER FLUID SUCH AS FLOUROLUBE.**

5. Carefully center the diaphragm/intermediate ring assembly on the oil side contour plate with the vent tube at the 12 o'clock position and pointed to the front of the pump. (Four studs threaded into the body 90° apart will help center the intermediate ring).
6. Center the process side contour plate on the intermediate ring assembly.
7. Using the guide studs, carefully position the diaphragm head on the pump. Check to make sure that both diaphragms are centered relative to the intermediate ring.
8. Once aligned, mount the switch bracket *(Figures 5 & 6)* then the remaining components should be fitted finger tight and oriented as shown. Remove the guide studs and tighten down the diaphragm head bolts to 22-23 ft. lbs. bolting torque (mRoy® A), or 28-30 ft. lbs. bolting torque (mRoy® B). *See Figure 2* for bolt tightening pattern.
9. Reconnect piping by reversing directions in disassembly step 2.

NOTE:

If the check valve assembly was disassembled for cleaning, inspection, or replacement, make sure that the check valve is reassembled with the flow arrow pointed toward the pressure gauge or pressure switch as shown in Figures 4-6. Improper operation will result if the check valve is not installed correctly.

10. With the bleed valve (1210) open, follow the standard mRoy® oil fill and start up procedure described in manual 53829.
11. Leaving the bleed valve open, run the pump at 100% capacity and normal operating pressure for 10 minutes. This procedure purges any air from the intermediate ring. If excess mineral oil was placed between the diaphragms in step 4 some may leak out from the bleed valve at this point. Lubricant leakage is acceptable.
12. Close the bleed valve and replace the pipe plug. The leak detector assembly is now complete.

SECTION 4 - TROUBLESHOOTING

See the mRoy® instruction manual 53829 for troubleshooting first. If none of the remedies in that manual work, refer to the remedies below.

SYMPTOMS	REMEDIES
Loss of flow/low flow/erratic flow.	• Diaphragm head bolts are unevenly tightened. Make sure all bolts are torqued evenly (22-23 ft. lbs. bolting torque for mRoy® A; 28-30 ft. lbs. bolting torque for mRoy® B). Double check bolts after adjusting. When bolts are all evenly and properly torqued, follow start-up procedures in Section 2 to purge any oil or process fluid which might have leaked between diaphragms. • Air and/or lubricant may not have been completely purged from between the diaphragms. Follow Start-Up procedure in Section 2. • Piping fittings may be loose. If they are loose, air will be drawn between the diaphragms. Check all piping fittings and tighten if necessary. When all fittings are properly tightened, Follow Start-Up procedure in Section 2. • Either or both diaphragms may be ruptured. Follow diaphragm replacement instructions in Section 3. • If neither of the above remedies eliminate the problem, consult factory.
Pressure gauge indicates pressure and/or pressure switch alarm activates.	• Refer to remedies above.
Lubricant does not expel during Start-Up after assembly.	• Too little lubricant was used during assembly. Disassemble and add more lubricant. • Check Valve (1150) is installed backward. Flow arrow must be up, away from the diaphragm. • Valve (1210) is not open or plug is not removed. Open valve or remove pipe plug. • Pump discharge pressure is too low. Discharge pressure should be above 25 psi (0.17 MPa).

SECTION 5 - CONDUCTANCE PROBE SYSTEM

5.1 DESCRIPTION

The Diaphragm Leak Detection System consists of a sensor installed in the liquid end chamber, connected to a conductance-actuated liquid level relay or similar control device. Wired in the manner of a liquid level probe, the Leak Detector can sense intrusion of miscible process liquid into the intermediate chamber of the liquid end and set off an alarm, stop the pump, or trigger other appropriate mechanisms to minimize damage to the pump. The Leak Detector is designed for use with high-conductivity water-base process liquids, and is especially useful for protecting the pump against damage by corrosives.

5.2 PRINCIPLE OF OPERATION

The Leak Detector comprises only two major components: a conductivity sensor, and a conductance actuated on-off relay. The sensor consists of two flat metal strips held in a threaded brass housing with epoxy. The strips extend bare from the epoxy at the threaded end of the housing. Insulated wires attached to the strips lead out the other end of the epoxy.

The threaded end of the sensor housing is screwed into the pump intermediate chamber. When the lead wires are connected to the conductance-actuated relay (or similar device), the metal strips in the sensor are energized. If a highly conductive liquid enters the pump intermediate chamber and mixes with the relatively non- conductive intermediate liquid in the chamber, electricity will pass from one metal strip to the other and the relay will be activated.

5.3 SPECIFICATIONS

Intermediate Liquid: The Leak Detector works in an intermediate chamber normally filled with a mixture of 75% ethylene glycol and 25% deionized water. This special mixture is used because it provides greater then 300,000 ohm-cm specific resistance (less than 3.3 micro mho/cm specific conductance).

Viscosity: Less than 100 cP (100 mPa-s at 100°F (37.7°C)

Freeze Point: Below 30°F (-34.4°C)

⚠ CAUTION **THE INTERMEDIATE LIQUID MUST NOT BE CONTAMINATED BY OTHER SUBSTANCES OF IT WILL HAVE INSUFFICIENT SPECIFIC RESISTANCE.**

Max Pressure:	Same as pump. max. 2000 psig	(13.790 kPa)
Max Temperature:	250°F	(121.1°C)
Min. Temperature:	0°F	(-17.7°C)
Tip Area:	.064 in² (approx.)	(.41 cm²)
Tip Spacing:	.100”-.136”	(2.54mm - 3.43mm)
Tip Material:	Gold-plated brass potted in epoxy	
Body Material:	brass	
Electrical Termination:	Two #22 AWG wire 12” long (min)	

Body of sensor is the same size as 1/2” EMT (conduit) for user wiring enclosure connection.

5.4 MAINTENANCE

5.4.1 Conductance- Actuated Relay

Milton Roy recommends Symcom single or dual adjustable conductivity relay.

PN JS01977 (Dual probe) Or

PN JS01692 (Single probe)

Power supplied to sensor: 10 VAC, 2 mA max. Max. distance from relay to sensor: 126ft (38.1 m)

5.4.2 Field Installation

For field installation, clean intermediate chamber and reassemble to pump; wrap conductivity sensor threads with Teflon tape or coat threads with high quality liquid sealing compound and thread sensor into intermediate chamber (do not contaminate sensor tips), tighten sensor; fill intermediate chamber with the special intermediate liquid according to Instruction Manual.

5.4.3 Wiring

Figure 3 provides an example for wiring the Leak Detector conductivity sensor to a conductance actuated relay:

Connect inputs and outputs according to the typical wiring diagram below. Switches or resistive probes can be used on the inputs. The PC-102 must be powered by 120VAC connected to terminals 2 and 3.

NOTE:

Wired this way, relay will energize only when sensor is immersed in conductive liquid. For reversed operation, reverse the purple and yellow wires from relay body to terminals #9 and #11.

To check for proper operation:

Disconnect resistor from terminal #9; relay should energize, sounding horn. Reconnect resistor and relay should deenergize, silencing horn.

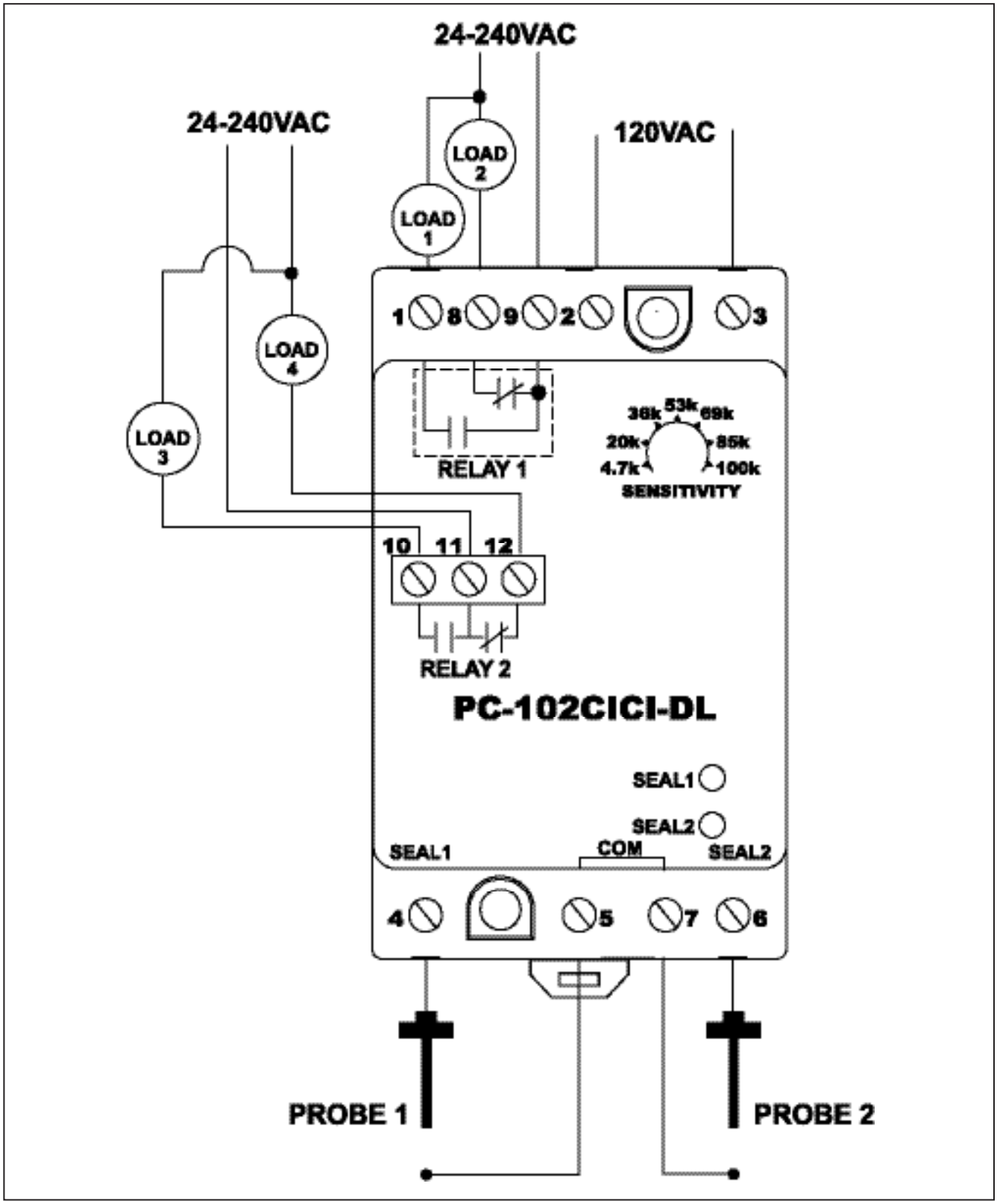


Figure 3. Leak Detector Typical Wring Diagram
(SymCom's PC-102CICI-DL dual seal-leak detector relay)

Relays are shown in their normal/non-energized states.

6.1 mROY® A (RA) PARTS LIST - PRESSURE SENSING SYSTEM
(Six bolt Diaphragm Head Design)

DRAWING LOCATION	DESCRIPTION	PART NUMBER	MATERIAL	QUANTITY
290	Diaphragm 5”	2980106075	Teflon	2
300	Intermediate Ring Assembly	2190111016	316 SS	1
320	Contour Plate	2980091016	316 SS	1
325	Contour Plate	2980091016	316 SS	1
350	Hex Head Screw 5/16-18x1-1/2 Gr5	4050017149	Steel	6
360	Simplex Base mRoy® A	2010441006	Steel	1
370	Hex Head Screw 5/16-18x1-1/4 Gr5	4050017139	Steel	5
380	Bracket	2040199006	Steel	1
390	Spring Lock Washer 5/16	4040040028	Zinc Plated	5
400	Hex Nut 5/16-18 nc	4050065013	18-8 SS	5
1150	Check Valve 1/8tube 1/3 PSI	40065	316 SS	1
1160	Press Gage 0-400 psi Dual Flange mount	40066		1
1170	Red Adapter 1/4f X 1/8m NPT	40067	316 SS	1
1180	Branch Tee 1/18 NPTf x 1/8 tube	40060	316 SS	1
1190	Tee 1/8npt Female	40062	316 SS	1
1191	Tee 1/8npt Female	40062	316 SS	1
1200	Tube conn. 1/8 Tube x 1/8 NPT	40061	316 SS	1
1201	Tube conn. 1/8 Tube x 1/8 NPT	40061	316 SS	2
1210	Bleed Valve 1/8 NPT	40063	316 SS	1
1220	Pan Head screw #4-40x1/2	4050263050	Zinc Plated	3
1230	Spring Lock washer #4	4040095023	18-8 SS	3
1240	Hex Nut #4-40 nc	4050182012	18.8 SS	3
1250	Nema 4 Press Switch 5-30 PSI	4060388001		1
1260	Red Nipple Hex 1/2x1/8 NPT	40064	316 SS	1
1270	Hex Head screw 1/4-20X3/4	4050016095	18-8 SS	2
1280	Spring Lock Washer 1/4	4040039022	18.8 SS	2
1290	Hex Nut 1/4-20nc	4050064012	18.8 SS	2
1300	Tubing Pump To Gauge (formed)	2490137116		1
1300	Tube 1/8 UdX.035 wall	4020502993	316 SS	12”
1320	Tubing Gauge To Switch Nema 4	2490136016		1
1320	Tubing 1/8 Udx.035 wall	4020502993	316 SS	20”
1440	Leak Detector Instruction Manual	3390036000		1
1470	Mineral Oil (available at drug stores)			

NOTE:
The quantities listed above are for single diaphragm pumps.

6.2 mROY® A (RJ ONLY) PARTS LIST - PRESSURE SENSING SYSTEM
(Eight Bolt Diaphragm Head Design)

DRAWING LOCATION	DESCRIPTION	PART NUMBER	MATERIAL	QUANTITY
290	Diaphragm 3.98” Diameter	2980005175	Teflon	2
300	Intermediate Ring Assembly	2190127000	316 SS	1
320	Contour Plate	2980091016	316 SS	1
325	Contour Plate	2980091016	316 SS	1
350	Hex Head Screw 5/16-18x1-1/2 Gr5	4050017149	Steel	6
355	Hex Head Screw 5/16-18x2-3/4 Gr5	4050017199	Steel	2
360	Simplex Base mRoy® A	2010441006	Steel	1
370	Hex Head Screw 5/16-18x1-1/4 Gr5	4050017139	Steel	5
380	Bracket	2040199006		1
390	Spring Lock Washer 5/16	4040040028	Zinc Plated	5
400	Hex Nut 5/16-18 nc	4050065013	18-8 SS	5
1150	Check Valve 1/8” tube 1/3 PSI	40065	316 SS	1
1160	Press Gage 0-400 psi Dual Flange Mt.	40176		1
1170	Red Adapter 1/4f X 1/8m NPT	40067	316 SS	1
1180	Branch Tee 1/18 NPTf x 1/8 tube	40060	316 SS	1
1190	Tee 1/8NPT Female	40062	316 SS	1
1191	Tee 1/8NPT Female	40062	316 SS	1
1200	Tube conn. 1/8 Tube x 1/8 NPT	40061	316 SS	1
1201	Tube conn. 1/8 Tube x 1/8 NPT	40061	316 SS	2
1210	Bleed Valve 1/8 NPT	40063	316 SS	1
1220	Pan Head screw #4-40x1/2	4050263050	Zinc Plated	3
1230	Spring Lock washer #4	4040095023	18-8 SS	3
1240	Hex Nut #4-40 nc	4050182012	18-8 SS	3
1250	Nema 4 Press Switch 5-30 PSI	4060388001		1
1250	Nema 4 Press Switch 5-30 PSI	4060389001		1
1260	Reducing Nipple Hex 1/2x1/8 NPT	40064	316 SS	1
1270	Hex Head screw 1/4-20X3/4	4050016096	18-8 SS	2
1280	Spring Lock Washer 1/4	4040039022	18-8 SS	2
1290	Hex Nut 1/4-20nc	4050064012	18-8 SS	2
1300	Tubing Pump To Gauge	2490137116	316 SS	1
1300	Tube 1/8 OD.X.035 wall	4020502993	316 SS	12”
1320	Tubing Gauge To Nema 7 Switch	2490138016	316 SS	1
1320	Tubing Gauge To Nema 4 Switch	2490136016	316 SS	1
1320	Tube 1/8 OD. X .035 wall	4020502993	316 SS	20”

NOTE:
The quantities listed above are for single diaphragm pumps.

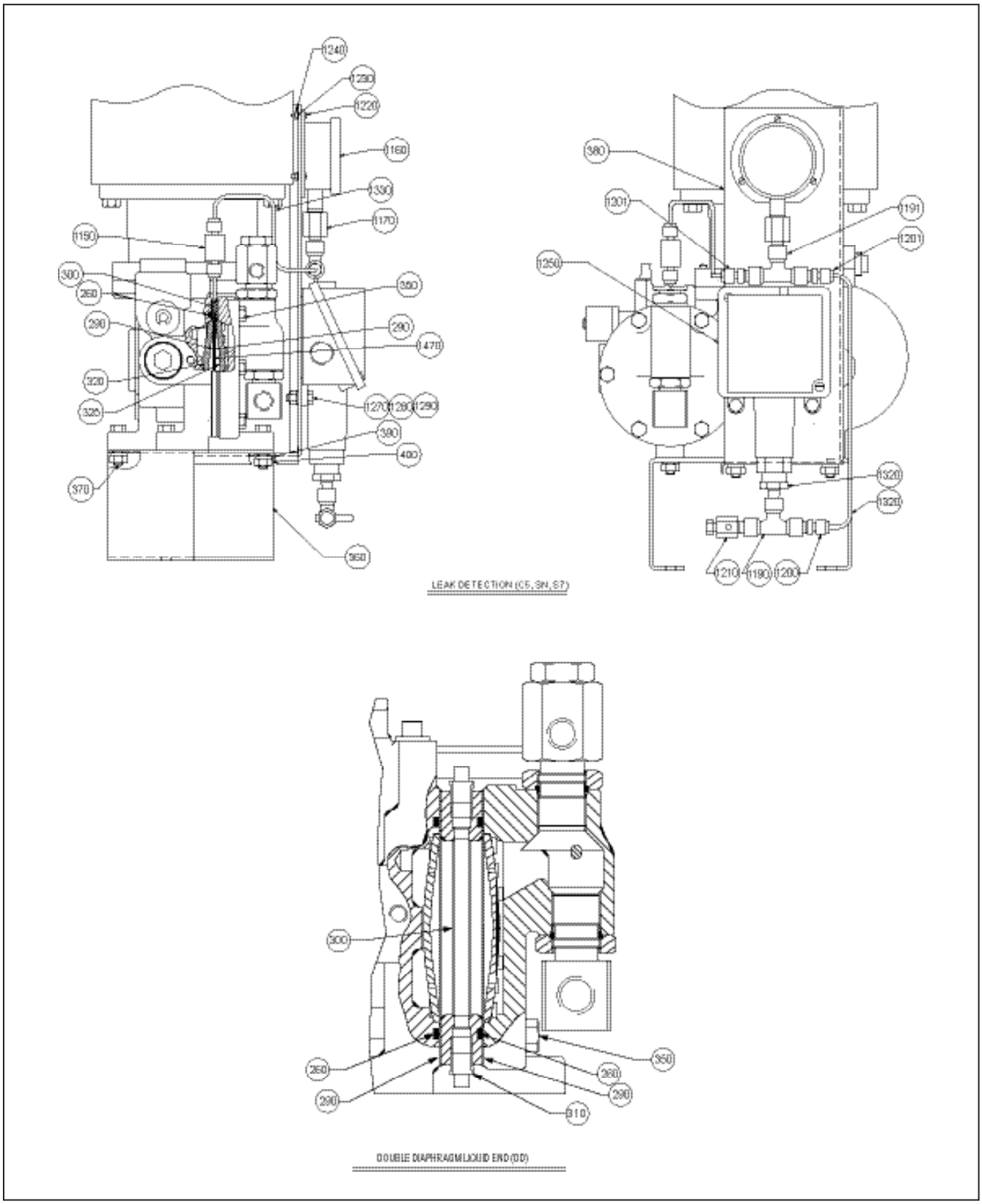


Figure 4. mRoy® A Simplex Both Switch & Gauge, and Conductance Probe Shown (DWG(s) 102 1971 00017 and 102 1971 0002)

6.3 mROY® A (RA) PARTS LIST - CONDUCTANCE PROBE SYSTEM

DRAWING LOCATION	DESCRIPTION	PART NUMBER	MATERIAL	QUANTITY
260	Square Ring, Head (3-3/41.0. X 1/8 wall)	0408-0144-010	Buna N	1
280	Contour Plate-Oil Side (3-1/2")	0298-0061-016	316SS	1
285	Contour Plate-standard Process Side, also used with double non-contacting diaphragms)	0298-0061-016	316SS	1
		0298-0061-028	Alloy 20	1
		0298-0061-030	Alloy C-22	1
290	Diaphragm for 6 bolt design (5" with holes)	0298-0106-075	Teflon	1
300	Intermediate Chamber for double (non-contacting) diaphragms	0221-0865-016	316SS	1
310	Pipe Plug 1/8"	0402-0011-013	316SS	2

6.4 mROY® B PARTS LIST - PRESSURE SENSING SYSTEM

DRAWING LOCATION	DESCRIPTION	PART NUMBER	MATERIAL	QUANTITY
290	Diaphragm 5.230 Dia.	2980013075	Teflon	1
300	Intermediate Ring Assembly	2190089116	316 SS	1
320	Contour Plate (Rupture. Detection)	2980092016	316 SS	1
350	Hex Head Screw 7/16-14x1-3/4	4050019151		2
355	Hex Head Screw 7/16-14x3	4050019201		1
356	Hex Head Screw 7/16-14x2	4050019161		1
357	Flat Washer SAE 7/16	4040151013	Zinc Plated	2
360	Simplex Base mRoy® B Metal L.E.	2010395000		2
370	Hex Head Screw 5116-18x1-1/2 Gr5	4050017149		4
380	Bracket Switch Support	2040159006		1
390	Spring Lock Washer 5/16	4040040028	Zinc Plated	1
400	Hex Nut 5116-18 NC	4050065013	18-8 SS	1
1150	Check Valve 1/4 NPT	4070315701	316 SS	1
1160	Press Gage 0-1500 psi Dual Scale	4030151110		1
1190	Street Tee #Ss-4st 1/4"	4020560022		
1200	Male Connector, 1/8 X 1/2	4020558192	316 SS	1
1205	Male Elbow 1/8 tube X 1/4 NPT	4020553042	316 SS	3
1210	Valve Plug 1/4 Male/Female	4070314082	316 SS	3
1250	Nema 4 Press Switch 5-30 psi	4060388001		3
1270	Hex Head Screw 1/4-20x3/4	4050016095	18-8 SS	
1280	Hex Nut 1/4-20NC	4050064012	18-8 SS	
1290	Spring Lock Washer 1/4	4040039022	18-8 SS	
1300	Pilot Line	2490117016	316 SS	
1305	Support Bracket	2040156015		
1306	1/4"-20 "U" Clamp Bolt	4100153000	Steel	
1440	mRoy® Leak Detector Instruction Manual	3390036000		
1470	Mineral Oil (drug store type)			

NOTE:

The quantities listed above are for single diaphragm pumps.

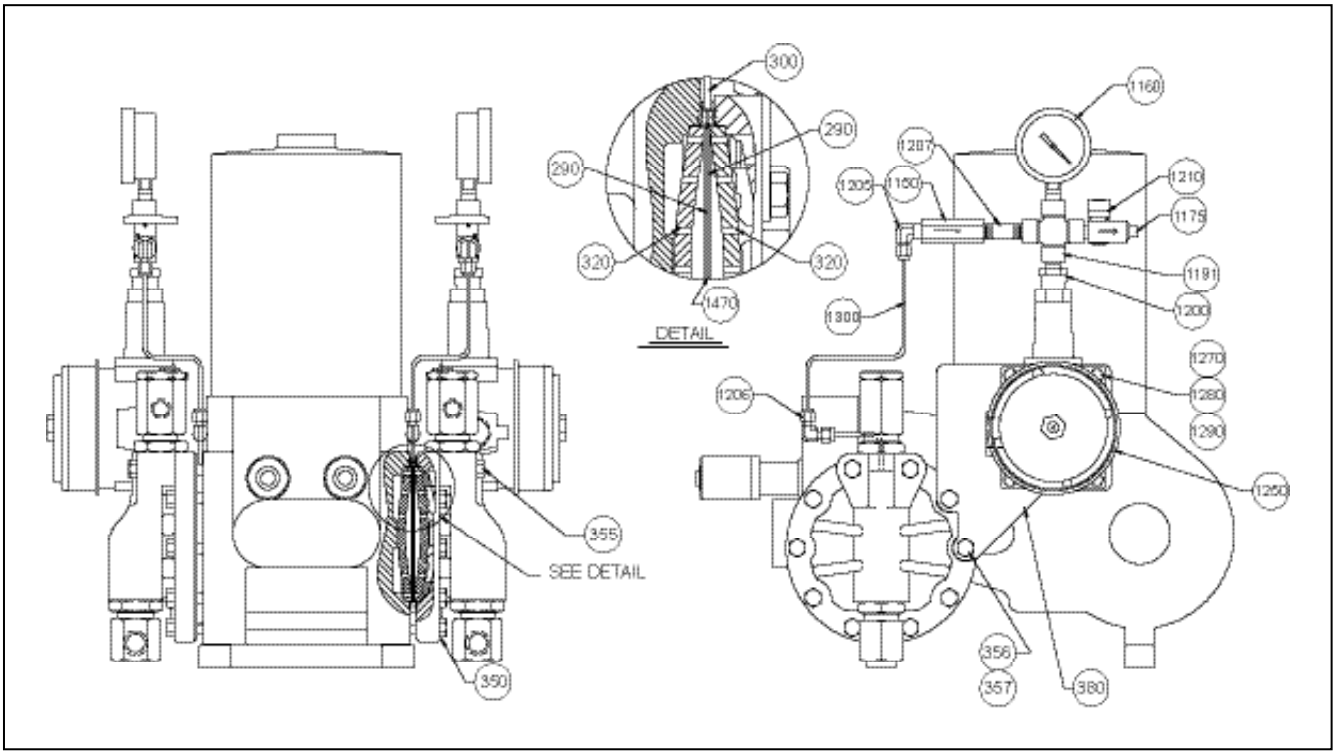


Figure 5. mROY® B Duplex (DWG 102 2146 0006)

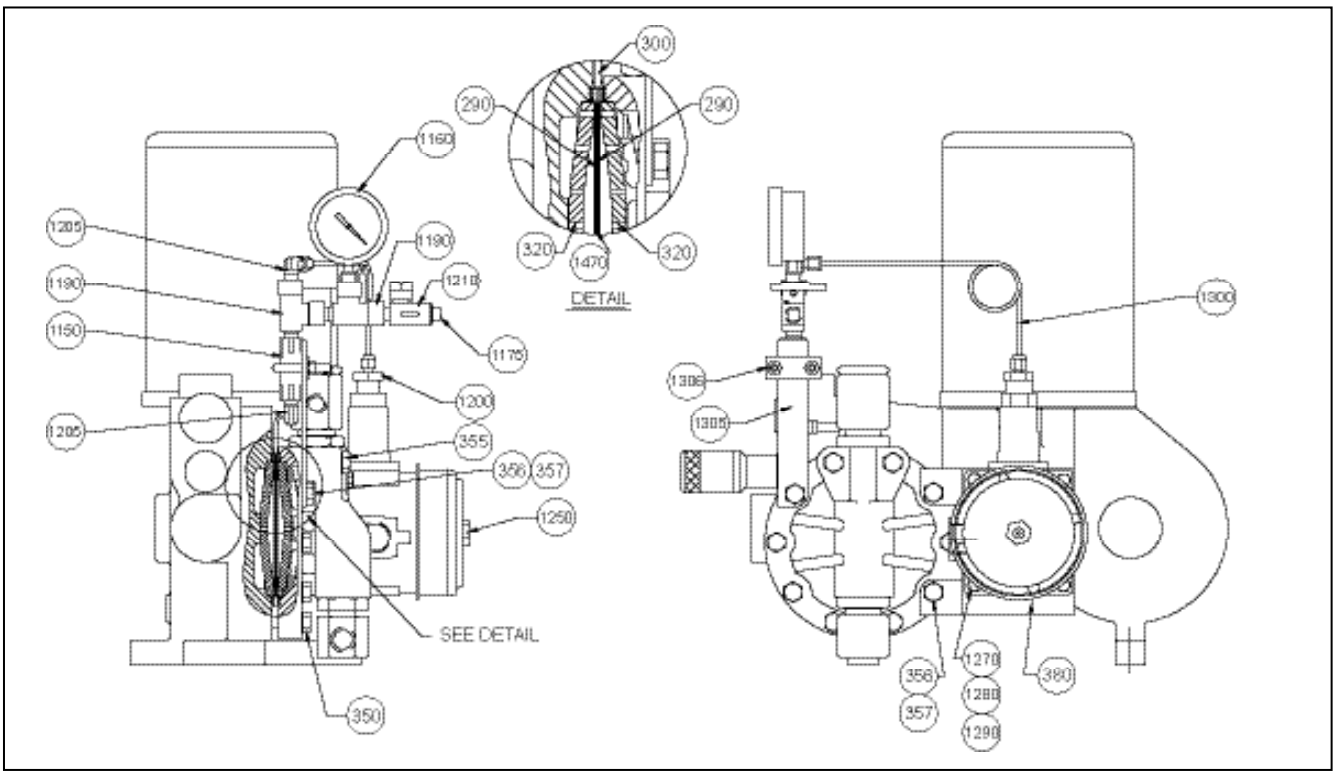


Figure 6. mROY® B Simplex (DWG 102 2146 0004)

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