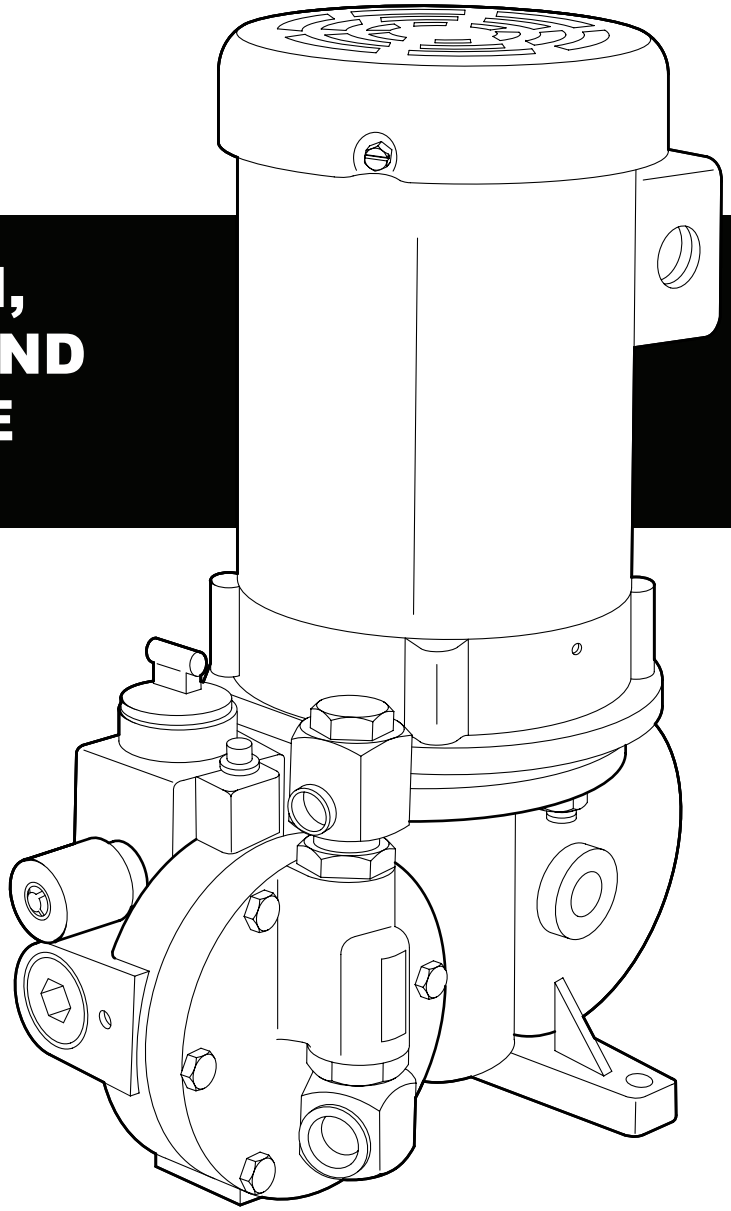
MILTON ROY

mRoy A & B

METERING PUMP



INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

Please record the following data for file reference

Tag Number(s):_____

Model Number:_____

Serial Number:_____

Installation Date:_____

Installation Location:_____

339-0047-000

ISSUED 08/09

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 **Material 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**
- 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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SECTION 1
GENERAL DESCRIPTION

1.1 INTRODUCTION

The mRoy pump is a highly reliable controlled volume pump of hydraulically actuated diaphragm design. The family of mRoy “A” and “B” frame pumps are further broken down into Model Codes. For ease of discussion, this manual will refer to either frame size as mRoy A and mRoy B rather than the specific Model Code (RA or RS). The new product codes for the mRoy A are given in Figures 4 through 6. The product codes for the mRoy B are shown in Figure 12.

Historical Model Codes are found in Appendix A.

1.2 GENERAL INFORMATION

Pump capacity is adjustable while the pump is running or stopped. Capacity adjustment can be made manually or automatically by a signal from remote control instruments.

Repetitive accuracy of the metered discharge volume is maintained within a ±l% range at constant conditions of pressure, temperature and pump capacity adjustment setting.

The mRoy pump is a reliable, compact, controlled volume diaphragm pump for normal corrosive or toxic chemicals and light slurries with viscosities up to 200 S.S.U. (40 cps). For higher viscosities, the mRoy “P” series pump is available (to 12,200 cps).

A plunger, reciprocating at a fixed stroke, displaces a fixed volume of hydraulic fluid, which actuates a flexible, chemically inert PTFE diaphragm to create pumping action. Double ball check valves are used on the suction and discharge to insure consistent metering accuracy. Capacity control is established by adjusting the volume of hydraulic fluid, which bypasses the diaphragm cavity.

Metering with repetitive accuracy is possible only if the volume of the hydraulic oil in the displacement chamber is maintained constant for each stroke. This is accomplished by mechanically opening the displacement chamber to the oil reservoir for a short period at the end of every suction stroke and the beginning of each pressure stroke. During this period air or vapor is bled from the system, lost oil is replenished, and allowances are made for the expansion or contraction of the oil due to temperature change. For more information, refer to Principle of Operation.

1.3 PUMP CHARACTERISTICS

For a general description of the mRoy pump you have purchased, compare the model number and product code printed on the pump’s data plate (shown in Figure 3) to the appropriate model number and product code shown in Figures 4 through 6 and Figure 12.

1.4 PUMP PERFORMANCE

The charts in Figures 8 through 10 show the performance ranges for all mRoy A & B frame pumps. If appropriate, refer also to the derating table shown in Figure 11.

1.5 PRINCIPLE OF OPERATION

Pumping action is developed and controlled by four basic components as follows (Figures 1 & 2):

1. The pump plunger “A” reciprocates with a constant stroke length and displaces oil into and out of the diaphragm chamber “C”.

2. The flexible diaphragm “X” is a movable partition between the plunger oil and fluid being pumped.

3. An oil bypass circuit from the diaphragm chamber “C” to the reservoir “D” through passage “E” bypass port “H” and control spool (valve) “F.”

4. A bypass control plunger “G” which moves with and is directly coupled to the pump plunger to correlate bypass shut off at port “H” to pump plunger position.

In operation, as the pump plunger and bypass control plunger move forward as shown in Figure 1, the displaced oil is bypassed to the oil reservoir until the control plunger “G” closes the bypass port “H” as shown in Figure 2. Then the balance of the plunger displacement is imposed on the flexible diaphragm that moves and displaces the fluid being pumped through the discharge ball checks.

On the suction stroke, the pump plunger pulls oil out of the diaphragm cavity, which moves the flexible diaphragm and pulls fluid through the suction ball checks. When the control plunger “G” opens the bypass port “H” the balance of the plunger oil displacement can be supplied from the reservoir through the bypass passages.

The discharge capacity is adjusted from 0–100% by rotating the adjustment knob that moves the control spool (valve) “F” so that the bypass port “H” is closed at the desired percentage of the total plunger stroke. When the control spool (valve) is adjusted to 100% capacity the bypass port will be positioned so that it is opened at the very end of the suction stroke. Then on the pressure stroke, the bypass port is immediately closed so the entire plunger displacement is imposed upon the flexible diaphragm.

With the control spool (valve) adjusted for 50% capacity the bypass port will be positioned so that it is opened when the plungers have completed one-half of the suction stroke. On the next pressure stroke, the oil displaced by the pump plunger will be bypassed through the open port to the reservoir for the first 50% of the stroke before the by-pass port is closed by the control plunger. The remaining 50% of the plunger displacement will then be imposed on the flexible diaphragm so that fluid is discharged for only 50% of the plunger travel. A similar analysis would apply for 0% capacity setting on the control spool (valve) where all the plunger oil displacement is bypassed to the reservoir.

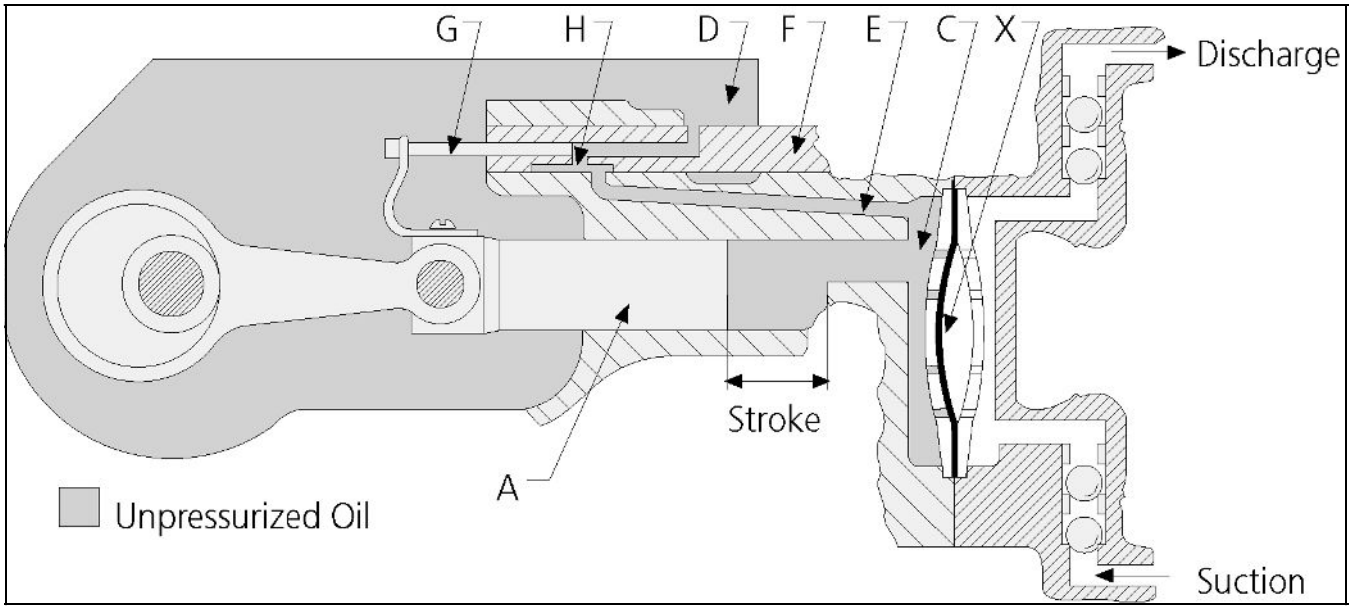

Figure 1. Pump Operation With By-Pass Port Open

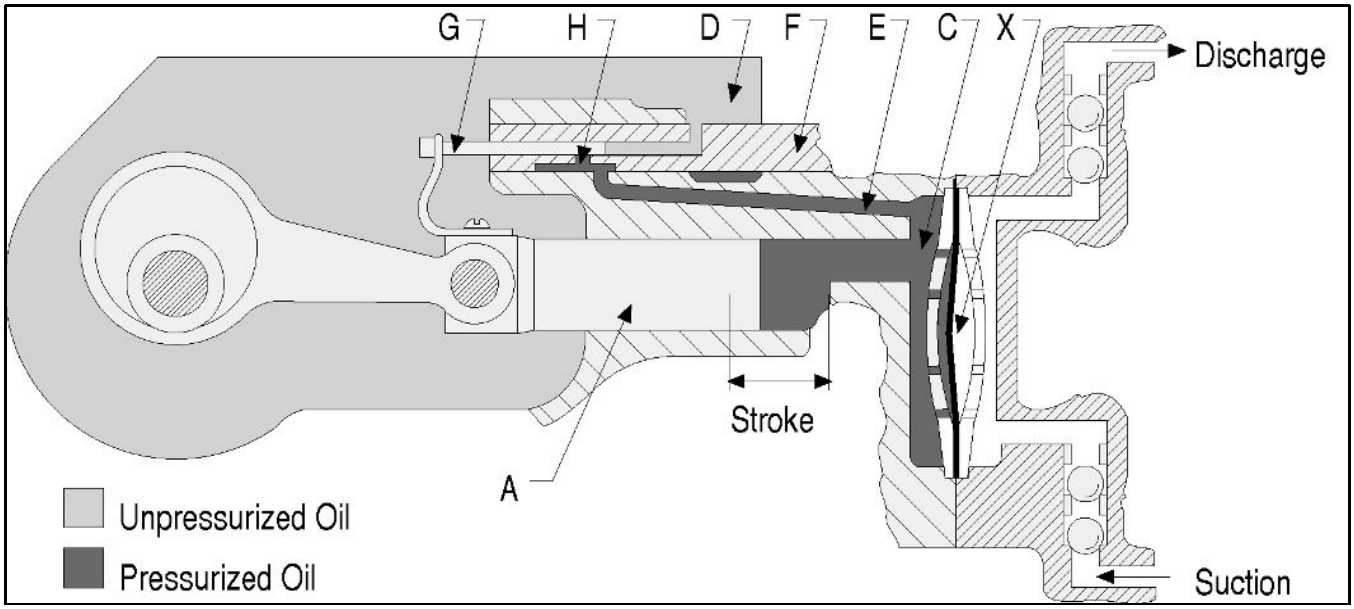

Figure 2. Pump Operation With By-Pass Port Closed

1.6 GENERAL SPECIFICATIONS

Accuracy

±1% steady state accuracy over 10:1 turndown

Drive

Hydraulic bypass design allows adjustment from 0 to 100% of rated capacity while stopped or running

Liquid End

High performance check valves

Diaphragm

Hydraulically actuated diaphragm provides extra long diaphragm life

Relief Valve

Adjustable internal relief valve

Capacity Control

Micrometer .....standard
Electronic .....4–20 mA (except L series)
Pneumatic .....3–15 psi (except L series)

Stroke Length

Models RA, RH, RT, RJ, RP ..... 0.7” (1.78 cm)
Models RB, RM, RS ..... 1.5” (3.81 cm)

Figure 3. mRoy Data Plate

MODEL CODE SELECTION

END ITEM AND OPTION SELECT NUMBER

mROY A SERIES

End item Model Code | Option Select Number

R	A	1*	[ ]	—	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]
			Material Code		Plunger Diameter	Gear Set	Mount / Motor	Suction Connection	Discharge Connection	Capacity Control	Rupture Detection & Base	

* 2 for Duplex

mRoy A LIQUID END MATERIAL CODE SELECTION

Code	Description
0	Cast Iron
1	316 SS **(STANDARD)**
2	PVC (N/A with 9.5:1 Gear Ratio)
7	PVDF (N/A with 9.5:1 Gear Ratio)
5	Alloy 20
6	Alloy C22

mRoy A PLUNGER DIAMETER

Code	Description
07	7/16" Diameter
10	5/8" Diameter
17	1-1/16" Diameter

mROY H/T SERIES

End Item Model Code | Option Select Number

R	H	1	[ ]	-	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]
			Material Code		Gear Set	Mount / Motor	Suction Connection	Discharge Connection	Capacity Control	Base	

RH=7/16" Dia. Plunger
RT=3/8" Dia. Plunger

mRoy H LIQUID END MATERIAL

Code	Description
0	Cast Iron
1	316 SS **(STANDARD)**
5	Alloy 20

mRoy J SERIES

End Item Model Code | Option Select Number

R	J	1	[ ]	-	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]
			Material Code		Gear Set	Mount / Motor	Suction Connection	Discharge Connection	Capacity Control	Rupture Detection & Base	

mRoy J LIQUID END MATERIAL

Code	Description
1	316 SS **(STANDARD)**
5	Alloy 20

mRoy P SERIES

End item Model Code | Option Select Number

R	P	1	[ ]	-	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]	[ ][ ]
			Material Code		Plunger Diameter	Gear Set	Mount / Motor	Suction Connection	Discharge Connection	Capacity Control	Rupture Detection & Base	

mRoy P LIQUID END MATERIAL

Code	Description
0	Cast Iron
1	316 SS **(STANDARD)**
5	Alloy 20

mRoy P PLUNGER DIAMETER

Code	Description
07	7/16" Diameter
10	5/8" Diameter
17	1-1/16" Diameter

Figure 4. mRoy A, H, T, J, and P Model Code

GEAR SET (ALL mRoy A FRAME)

Code	Description		1725 rpm	1425 rpm	1140 rpm
77	77:1 Gear Ratio	**N/A for RJ or RP**	23 spm	19 spm	15 spm
48	48:1 Gear Ratio		37 spm	30 spm	24 spm
24	24:1 Gear Ratio		73 spm	60 spm	47 spm
15	15:1 Gear Ratio		117 spm	96 spm	76 spm
10	9.5:1 Gear Ratio	**N/A for RJ or RP**	185 spm	152 spm	120 spm

MOTORS and MOUNTS

STANDARD MOTOR with Close Coupled flange

Does not require motor mount from below

Code	Description
A1	1/4 HP Motor, TE, 1725 RPM, 1 Phase, 60 Hertz, 115 Volt & Close Coupled Flange
A8	1/4 HP Motor, TE, 1725 RPM, 3 Phase, 60 Hertz, 230/460 Volt & Close Coupled Flange

Note: These motors replace the obsolete integral motor offering. They are standard NEMA 56 C frame motor on a short flange.

MOTOR MOUNTS (Use only when motor is ordered from Milton Roy

1/4 HP minimum.

Motor supplied by Milton Roy from Accessory Section

Code	Description
SR	Close Coupled Flange, NEMA 56C **(STANDARD)**
SS	Close Coupled Flange, IEC Frame 71, B5 Flange
FR	API Flange Mount, NEMA 56C
F4	API Flange Mount, NEMA 143TC/145TC
FS	API Flange Mount, IEC Frame 71, B5 Flange
MD	API Flange Mount, IEC Frame 80, B5 Flange

MOTOR MOUNTS ***NOTE: Must be used when pump is not ordered with motor***

1/4 HP minimum.

Motor supplied by others

Code	Description
1X	Close Coupled Flange, NEMA 56C
2X	Close Coupled Flange, IEC Frame 71, B5 Flange
3X	API Flange Mount, NEMA 56C
4X	API Flange Mount, NEMA 143TC/145TC
5X	API Flange Mount, IEC Frame 71, B5 Flange
6X	API Flange Mount, IEC Frame 80, B5 Flange

SUCTION CONNECTION

Metallic Liquid Ends

Code	Description	PVC	316 SS	Alloy 20
SE	NPT 1/2" Female **(STANDARD)**	**N/A**	**Standard**	**Standard**
T1	ANSI 150# RF 1/2" Threaded	**N/A**		
T3	ANSI 300# RF 1/2" Threaded	**N/A**		
S1	ANSI 150# RF 1/2" Socket Welded	**N/A**		
S3	ANSI 300# RF 1/2" Socket Welded	**N/A**		

Plastic Liquid Ends

Code	Description			
SE	NPT 1/2" Male **(STANDARD)**	**Standard**	**N/A**	**N/A**
T1	150# 1/2" Thd flange		**N/A**	**N/A**

Notes:

1. Base option recommended with flanged connections.
2. Flanges can only be welded at flanged end

DISCHARGE CONNECTION

Codes and prices are the same as Suction Connection.

Discharge connection size for SE code on metallic liquid ends is 1/4" NPT.

CAPACITY CONTROL

Code	Description
M2	Manual Micrometer Knob - PVC **(STANDARD)**
M1	Manual Micrometer Knob - 316 SS
ML	Locking Manual Micrometer Knob - 316 SS
E1	Electronic - NEMA 4, 4-20 mA, 115 Volt
E2	Electronic - NEMA 4, 4-20 mA, 220 Volt
EA	Electronic - Explosion Proof, 4-20 mA, 115 Volt
EB	Electronic - Explosion Proof, 4-20 mA, 220 Volt
EE	Mount for Electronic, Less Actuator
PN	Pneumatic, 3-15 psi, Direct Acting

Figure 5. mRoy A, H, T, J, and P Gear/Motor Mount/Connection/Capacity Control; Select Mode Code

RUPTURE DETECTION & BASE (mRoy A FRAME)

Metallic Liquid Ends

Code	Description	
NN	None (**STANDARD**)	
NB	Base Only - Recommended with Flanges	
C5	Rupture Detection with Base & Gauge	**N/A on RH/RT**
SN	Rupt. Detect. w/ Base, Gauge, & NEMA 4 Switch	**N/A on RH/RT**
S7	Rupt. Detect. w/ Base, Gauge, & Ex. Prf Switch	**N/A on RH/RT**
DD	Double Diaphragm with Base	**N/A on RH/RT or RJ**
DP	Double Diaphragm with Base & Conductivity Probe Relay supplied separately - see accessory pricing	

Plastic Liquid Ends

Code	Description
NB	Base Only (**STANDARD**)
DD	Double Diaphragm with Base
DP	Double Diaphragm with Base & Conductivity Probe Relay supplied separately - see accessory pricing

Figure 6. mRoy A, H, T, J, and P Type of Liquid End; Select Mode Code

ROUTINE MAINTENANCE KITS mRoy A

MRoy RPM kits for pumps noted above

Model	Liquid End Material	Kit Number
MRoy A, H, T, J	316 SS & Cast Iron	RPM002
	Alloy 20	RPM005
	PVC w/NPT connections	RPM007
	PVC w/tubing connections	RPM003
	PVDF w/NPT connections	RPM008
	PVDF w/tubing connections	RPM004
	Alloy C22	RPM006
	RA11 w/Peek Diaph., 5 inch	RPM087
	Hast B	RPM093
	Diaph Teflon, 3.98 inch	RPM0013037
MRoy P	316 ss & Cast Iron	RPM009
	Alloy 20	RPM010

Figure 7. mRoy A, H, T, J, and P Routine Maintenance Kit List, By Model Code

MODEL RA CAPACITY/PRESSURE TABLE

Plgr. Dia.	Gear Code	SPM 60 hz (50 hz)	Metallic					Plastic	
			100 PSI	150 PSI	200 PSI	300 PSI	350 PSI	100 PSI	150 PSI
7/16"	77	23 (19)	Use H Series					0.48 (0.40)	0.46 (0.38)
	48	37 (30)	0.8 (0.66)	0.7 (0.58)	0.7 (0.58)	0.7 (0.58)	0.7 (0.58)	0.65 (0.54)	0.62 (0.51)
	24	73 (60)	1.7 (1.41)	1.7 (1.41)	1.7 (1.41)	1.6 (1.33)	1.6 (1.33)	1.5 (1.25)	1.5 (1.25)
	15	117 (96)	2.8 (2.32)	2.7 (2.24)	2.7 (2.24)	2.7 (2.24)	2.6 (2.16)	2.5 (2.08)	2.4 (1.99)
5/8"	48	37 (30)	1.8 (1.49)	1.7 (1.41)	1.7 (1.41)	1.6 (1.33)	1.6 (1.33)	1.6 (1.33)	1.5 (1.25)
	24	73 (60)	3.8 (3.15)	3.7 (3.07	3.7 (3.07	3.6 (2.99)	3.5 (2.90)	3.5 (2.90)	3.4 (2.82)
	15	117 (96)	6.2 (5.15)	6.1 (5.06)	6.0 (4.98)	5.9 (4.90)	5.7 (4.73)	5.6 (4.65)	5.5 (4.57)
1-1/16"	48	37 (30)	6.1 (5.06)	6.0 (4.98)	5.9 (4.90)	5.7 (4.73)	5.5 (4.57)	5.7 (4.73)	5.6 (4.65)
	24	73 (60)	12.3 (10.21)	12.2 (10.13)	12.1 (10.04)	11.5 (9.55)	11.2 (9.30)	11.3 (9.38)	11.2 (9.30)
	15	117 (96)	19.4 (16.10)	19.4 (16.10)	19.2 (15.9)	18.5 (15.35)	18.1 (15.02)	18.1 (15.02)	18.0 (14.94)
	10	185 (152	30.0 (24.90)	29.5 (24.48)	29.0 (24.07)	-- --	-- --	-- --	-- --

NOTES: Refer to notes shown in Figure 10, mRoy B Capacity/Pressure Table.

Figure 8. mRoy A Capacity/Pressure Table (capacities shown in GPH)

MODEL RT, RH, & RJ CAPACITY/PRESSURE TABLE

Plgr. Dia.	Gear Code	SPM 60 hz (50 hz)	Metallic Only						
			100 PSI	500 PSI	700 PSI	925 PSI	1500 PSI	1800 PSI	2000 PSI
mRoy T 3/8"	77	23 (19)	0.46 (0.38)	0.41 (0.34)	0.37 (0.31)	0.35 (0.29)	0.28 (0.23)	0.24 (0.20)	0.21 (0.18)
	48	37 (30)	0.73 (0.61)	0.66 (0.55)	0.6 (0.50)	0.56 (0.47)	0.45 (0.38)	0.38 (0.34)	0.34 (0.28)
	24	73 (60)	1.45 (1.21)	1.31 (1.09)	1.18 (0.98)	1.11 (0.92)	0.89 (0.74)	0.75 (0.62)	0.68 (0.57)
	15	117 (96)	2.32 (1.93)	2.10 (1.75)	1.9 (1.58)	1.78 (1.48)	1.43 (1.19)	1.2 (1.00)	1.09 (0.91)
	10	185 (152)	3.67 (3.06)	3.32 (2.77)	3 (2.5)	2.81 (2.34)	2.26 (1.88)	2 (1.7)	1.72 (1.43)
mRoy H 7/16"	77	23 (19)	0.57 (0.47)	0.54 (0.45)	0.5 (4.2)	0.5 (4.2)	0.43 (0.36)	0.4 (0.33)	
	48	37 (30)	0.8 (0.66)	0.7 (0.58)	0.6 (0.5)	0.6 (0.5)	0.6 (0.5)	0.6 (0.5)	
	24	73 (60)	1.7 (1.41)	1.6 (1.33)	1.5 (1.25)	1.5 (1.25)	1.3 (1.08)	1.2 (1.0)	
	15	117 (96)	2.8 (2.32)	2.6 (2.17)	2.5 (2.08)	2.4 (2.0)	2.1 (1.74)	2 (1.66)	
	10	185 (152)	4.4 (3.65)	4.1 (3.42)	4.0 (3.33)	3.8 (3.17)	3.3 (2.74)	3.1 (2.57)	
mRoy J 5/8"	48	37 (30)	1.8 (1.5)	1.5 (1.25)	1.4 (1.17)	-- --			
	24	73 (60)	3.8 (3.17)	3.4 (2.83)	3.2 (2.67)	3.1 (2.59)			
	15	117 (96)	6.2 (5.17)	5.6 (4.67)	5.3 (4.42)	5.1 (4.25)			

NOTES: Refer to notes shown in Figure 10, mRoy B Capacity/Pressure Table

Figure 8A. mRoy RT, RH, & RJ Capacity/Pressure Table (capacities shown in GPH)

MODEL RP CAPACITY/PRESSURE TABLE

Plgr. Dia.	Gear Code	SPM 60 hz (50 hz)	Metallic Only					Max. Fluid Viscosity (Centipoise)
			100 PSI	150 PSI	200 PSI	300 PSI	350 PSI	
7/16”	77	23 (19)	Not Available					
	48	37 (30)	0.72 (0.60)	0.63 (0.52)	0.63 (0.52)	0.63 (0.52)	0.63 (0.52)	7,500
	24	73 (60)	1.5 (1.25)	1.5 (1.25)	1.5 (1.25)	1.4 (1.16)	1.4 (1.16)	4,000
	15	117 (96)	2.5 (2.08)	2.4 (1.99)	2.4 (1.99)	2.4 (1.99)	2.3 (1.91)	2,000
5/8”	48	37 (30)	1.6 (1.33)	1.5 (1.25)	1.5 (1.25)	1.4 (1.16)	1.4 (1.16)	5,000
	24	73 (60)	3.4 (2.82)	3.3 (2.74)	3.3 (2.74)	3.2 (2,66)	3.1 (2.57)	2,500
	15	117 (96)	5.6 (4.65)	5.5 (4.57)	5.4 (4.48)	5.3 (4.40)	5.1 (4.23)	1,250
1 1/16”	48	37 (30)	5.5 (4.57)	5.4 (4.48)	5.3 (4.40)	5.1 (4.23)	4.9 (4.07)	1,000
	24	73 (60)	11.0 (60)	10.9 (9.05)	10.8 (8.96)	10.2 (8.47)	9.9 (8.22)	500
	15	117 (96)	17.5 (14.52)	17.4 (14.44)	17.3 (14.36)	16.6 (13.78)	16.2 13.45)	300

NOTES: Refer to notes shown in Figure 10, mRoy B Capacity/Pressure Table

Figure 9. mRoy P Capacity/Pressure Table (capacities shown in GPH)

MODEL RB, RM, RS CAPACITY PRESSURE TABLE

MODEL	SPM	PVC & Metallic		Metallic Only						
		100 PSI	150 PSI	200 PSI	400 PSI	600 PSI	800 PSI	1000 PSI	1200 PSI	1500 PSI
RS 19/32" Dia.	48 (40)	4.7 (3.90)	4.6 (3.82)	4.6 (3.82)	4.4 (3.65)	4.2 (3.49)	4.0 (3.32)	3.8 (3.15)	3.6 (2.99)	3.3 (2.74)
	72 (60)	7.0 (5.81)	6.9 (5.73)	6.9 (5.73)	6.7 (5.56)	6.5 (5.39)	6.3 (5.23)	6.1 (5.06)	5.9 (4.90)	5.6 (4.65)
	96 (80)	9.5 (7.88)	9.4 (7.80)	9.3 (7.72)	8.9 (7.39)	8.6 (7.14)	8.3 (6.89)	7.9 (6.56)	7.6 (6.31)	7.1 (5.89)
	144 (120)	13.3 (11.04)	13.2 (10.96)	13.1 (10.87)	12.8 (10.62)	12.5 (10.38)	12.3 (10.21)	12.0 (9.96)	11.8 (9.79)	11.4 (9.46)
RM 7/8" Dia.	48 (40)	10.0 (8.30)	9.7 (7.80)	9.4 (7.80)	8.2 (6.81)	7.0 (5.81)	5.9 (4.90)	4.7 (3.90)		
	72 (60)	16.0 (13.28)	15.7 (13.03)	15.4 (12.78)	14.3 (11.87)	13.2 (10.96)	12.1 (10.04)	11.0 (9.13)		
	96 (80)	21.0 (17.43)	20.7 (17.18)	20.4 (16.93)	19.3 (16.02)	18.2 (15.11)	17.1 (14.19	16.0 (13.28)		
	144 (120)	30.4 (25.23)	30.1 (24.98)	29.9 (24.82)	28.9 (23.99)	27.9 (23.16)	27.0 (22.41)	25.6 (21.25)		
RB 1-7/16" Dia.	48* (40)*	27.0 (22.41)	26.0 (21.58)	25.0 (20.75)	21.0 (17.43)					
	72* (60)*	42.0 (34.86)	41.0 (34.03)	40.0 (33.20)	36.0 (29.88)					
	96** (80)**	57.0 (47.31)	56.0 (46.48)	55.0 (46.65)	51.0 (42.33)					
	144** (120)**	85.0 (70.55)	84.0 (69.72)	83.0 (68.89)	79.0 (65.57)					

NOTES:

1. Capacities shown are for simplex pumps. Double capacity for duplex pumps.
2. Certain options require that the maximum capacity be derated. Refer to the derating table.
3. Capacities shown are the max. pump capacities in gph, based on 60 hz, 1725 rpm. 50 hz, 1425 max. capacities are shown in ().
4. Non-shaded ranges require ½ hp 3 phase of ¾ hp single phase motors. Shaded Ranges require ¾ hp 3 phase or 1 hp single phase motors.

* Duplex 1 7/16" plungers at 96 or 144 SPM are limited to 250 psi.

** Duplex 1 7/16" plungers at 96 or 144 SPM are limited to 250 psi.

PVC is limited to 150 psi. PVC is not available on pumps with a 19/32" plunger

Figure 10. mRoy B Capacity/Pressure Table (capacities shown in GPH)

MROY PUMP FLOW DERATING TABLE

Plunger Diameter	7/16" & 5/8"				3/8"	1 1/16"		19/32"	7/8"	1 716"
Series	L	A	H	P	T	A	P	B	B	B
Electronic or Pneumatic Capacity Control	--	0.95	0.95	0.95	0.95	0.90	0.90	1.0	0.90	0.90
Diaphragm Rupture Detection	--	0.95	--	0.95		0.95	0.95	0.95	0.95	0.95
Double Diaphragm	0.95	0.95	--	0.95		0.95	0.95	0.95	0.95	0.95

NOTES:

Certain options require that the maximum capacity be derated. Multiply capacities in the capacity/pressure tables in Figures 7 through 10 by the appropriate factors in the table above.

Figure 11. mRoy Pump (All Models) Capacity Derating Table

mRoy B Series

MODEL CODE SELECTION

END ITEM AND OPTION SELECT NUMBER

End item Model Code				Option Select Number							
R		1*	-								
Plunger Diameter			Liquid End Material	Gear Set		Motor Mount		Suction Connection		Discharge Connection	Capacity Control	Rupture Detection & Base

* 2 for Duplex

PLUNGER DIAMETER

Code	Description
S	19/32" Diameter
M	7/8" Diameter
B	1-7/16" Diameter

LIQUID END MATERIAL

Code	Description
1	316 SS **(STANDARD)**
2	PVC (not available with plunger code "S")
5	Alloy 20
7	PVDF (Plunger code "B" only)

GEAR SET

Code	Description	1725 rpm	1425 rpm	1140 rpm
38	38:1 Gear Ratio	48 spm	40 spm	31 spm
25	25:1 Gear Ratio	72 spm	60 spm	48 spm
19	19:1 Gear Ratio	96 spm	80 spm	62 spm
12	12:1 Gear Ratio	144 spm	120 spm	95 spm
10	9.51 Gear Ratio	N/A	148 spm	N/A

MOTOR MOUNTS

MOTOR MOUNTS (Use only when motor is ordered from Milton Roy - see section 4100)

Refer to Capacity/Pressure table for horsepower required.

Motor supplied by Milton Roy from Accessory Section

Code	Description
FR	API Flange Mount, NEMA 56C
F4	API Flange Mount, NEMA 143TC/145TC
F8	API Flange Mount, IEC Frame 80, B5 Flange
F9	API Flange Mount, IEC Frame 90, B5 Flange

MOTOR MOUNTS ***NOTE: Must be used when pump is not ordered with motor (to cover added cost of testing).***

Refer to Capacity/Pressure table for horsepower required.

Motor supplied by others

Code	Description
3X	API Flange Mount, NEMA 56C
4X	API Flange Mount, NEMA 143TC/145TC
5X	API Flange Mount, IEC Frame 80, B5 Flange
6X	API Flange Mount, IEC Frame 90, B5 Flange

SUCTION CONNECTION

Metallic Liquid Ends

Code	Description	PVC	316 SS	Alloy 20
SE	NPT 1/2" Female **(STANDARD)**	**N/A**	**Standard**	**Standard**
T1	ANSI 150# RF 1/2" Threaded	**N/A**		
T3	ANSI 300# RF 1/2" Threaded	**N/A**		
S1	ANSI 150# RF 1/2" Socket Welded	**N/A**		
S3	ANSI 300# RF 1/2" Socket Welded	**N/A**		

Plastic Liquid End

Code	Description	PVC	316 SS	Alloy 20
SE	NPT 1/2" Male **(STANDARD)**	**Standard**	N/A	N/A
T1	150# 1/2" Thd flange		N/A	N/A

Notes: 1. Base option recommended with flanged connections. 2. Flanges can only be welded at flanged end.

DISCHARGE CONNECTION Same codes and prices as Suction Connection

NOTE: Connection sizes for SE code metallic are 3/8" NPT on RM & RB series, and 1/4" NPT on RS series.

CAPACITY CONTROL

Code	Description	
AL	Manual Micrometer Knob - Aluminum **(STANDARD)**	
ML	Manual Micrometer Locking Knob - 316 SS	
E1	Electronic - NEMA 4, 4-20 mA, 115 Volt	**Remember to derate pump**
E2	Electronic - NEMA 4, 4-20 mA, 220 Volt	**Remember to derate pump**
EA	Electronic - Explosion Proof, 4-20 mA, 115 Volt	**Remember to derate pump**
EB	Electronic - Explosion Proof, 4-20 mA, 220 Volt	**Remember to derate pump**
EE	Mount for Electronic, Less Actuator	
PN	Pneumatic, 3-15 psi, Direct Acting	**Remember to derate pump**

RUPTURE DETECTION & BASE

All Liquid Ends

Code	Description	
NN	None **(STANDARD)**	**Standard**
NB	Base	

Metallic Liquid Ends Only

Code	Description	
C5	Rupture Detection with & Gauge	**Remember to derate pump**
SN	Rupt. Detect. W/Gauge, & NEMA 4 Switch	**Remember to derate pump**
S7	Rupt.Detect. W/Gauge, & Exp. Prf Switch	**Remember to derate pump**

Plastic Liquid End Only

Code	Description	
DD	Double Diaphragm	**Remember to derate**
DP	Double Diaphragm w/Conductivity Probe Relay supplied separately - see accessory pricing	**Remember to derate**

Figure 12. mRoy B Model Codes

ROUTINE MAINTENANCE KITS mRoy B MRoy RPM kits for pumps noted above		
Model	**Liquid End Material**	**Kit Number**
MRoy S	316 ss	RPM011
	Alloy 20	RPM012
	RS 11 w/Peek Diaph.	RPM092
MRoy M & B	316 ss	RPM-0014-021
	PVC	RPM-0014-032
	Alloy 20	RPM-0014-025
	RB Kynar	RPM-0014-037

Figure 13. mRoy B Routine Maintenance Kit List, By Model Code

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SECTION 2
INSTALLATION

2.1 UNPACKING/INSPECTION

Units are shipped Ex Works, Ivyland, Pa. 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 the crate and check against the 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

1. Remove motor and 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 lubricant for equipment commissioning.

2. Brush all unpainted metal surfaces with multipurpose grease (NLGI grade 2 or 3). Store these unattached.

Electrical 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 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

When installing, operating, and maintaining the mRoy 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.).*

2.4 PUMP MOUNTING/LOCATION

The mRoy pump can be mounted on any surface that is flat and level for the support feet. Three mounting bolt holes are provided in the support feet for use when the pump is to be firmly anchored to a base surface (see Figure 14.)

Increased reliability can be expected if pump locations are avoided which are subjected to high ambient temperatures above 100°F (38°C) with poor free-air circulation over the pump assembly.

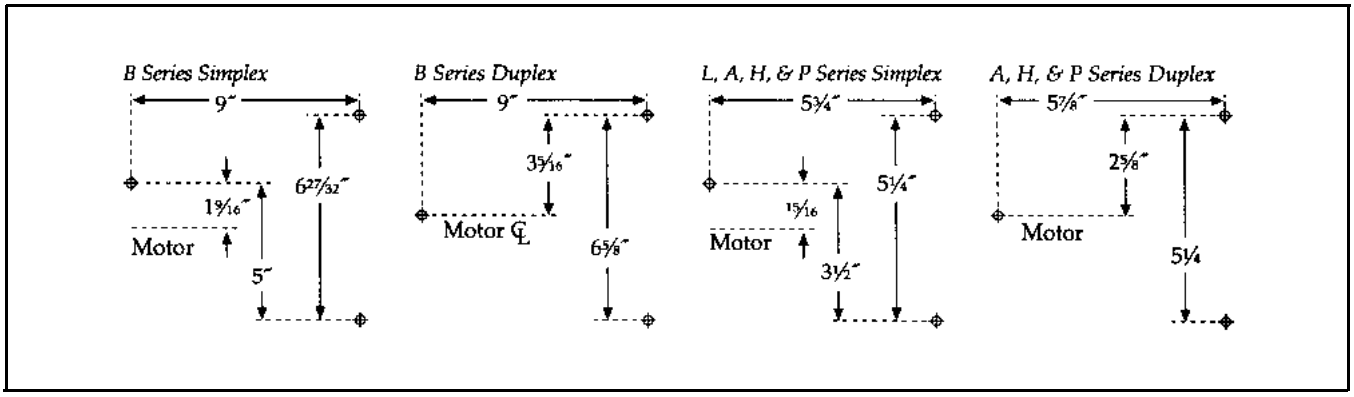

Figure 14. Mounting Bolt Holes

2.5 OUTDOOR INSTALLATIONS

The mRoy pump is designed as a totally enclosed unit suitable for installation either indoors or outdoors. However, for outdoor installations the pump mounting area should be selected to provide protection against environmental extremes:

1. Operation with continuous exposure to tropical or subtropical sunshine with ambient temperatures above 90°F (32°C), which would cause higher oil temperatures and affect lubricity should be avoided. Good installation practice would dictate providing a sun shade cover over the pump with open sides to obtain the best air circulation around the pump.

2. Frequent start-up where the pump has been idle in an ambient temperature below 30°F (-1°C) is not recommended. Provide a removable, insulated enclosure over the pump and mounting base with provisions for an electrical heater (100 watt light, heat lamp, heater tape etc.) to maintain the pump oil temperature above 30°F (-1°C).

2.6 FLANGE MOUNTED MOTORS

If a flange mounted motor option was selected for the mRoy pump, the customer supplied motor will need to be mounted to the pump. This is generally a straight forward procedure. Refer to Figure 18 or 19, as appropriate.

When mounting the motor to a NEMA 56C Close Coupled Flange (product code option SR, refer to Figure 19), the motor mount plate (710) must be removed from the pump body and bolted to the motor. The motor/motor mount plate assembly can then be bolted to the pump.

2.7 ELECTRICAL CONNECTIONS

Check to be sure that the electrical supply matches the pump motor nameplate electrical characteristics. Motor rotation must be **counter clockwise** when viewed from the top end of the motor.

CAUTION

ON SINGLE-PHASE PUMP MOTORS THE ROTATION WILL BE DETERMINED AT THE FACTORY AND MUST NOT BE CHANGED. ON THREE-PHASE PUMP MOTORS THE ROTATION MUST BE DETERMINED AT THE TIME OF INSTALLATION AND PRIOR TO START-UP. OPERATION WITH THE WRONG ROTATION WILL DAMAGE THE PUMP AND MOTOR AND VOID THE WARRANTY. SHAFT ROTATION CAN BE OBSERVED BY REMOVING THE COVER PLATE OVER THE ELECTRICAL CONNECTIONS.

2.8 MOTORS

Adequate power is provided to the simplex mRoy A pump by the standard ¼ HP (0.2 Kw) motor. The motor is normally a totally enclosed non-ventilated, type, that is mounted on a 56C-face flange or IEC Frame 71 flange. The gear reducer (worm shaft) fits onto the standard motor without using a coupling.

On the larger mRoy B (Figures 10-13), the normal temperature rise for these motors is 50°C above ambient temperature, and it can be expected that these motors will appear to operate at higher temperatures than are normally experienced. However, there is no cause for worry if the following precautions are observed:

1. The motor is placed where there is adequate ventilation and is protected against excessive radiation from steam pipes and other heat sources.

2. The overload heater in the starting device should be correctly sized for motor full load current rating as shown on the motor data plate.

2.9 PUMP LUBRICATION

CAUTION

CAREFULLY TWIST AND PULL TO REMOVE OIL RESERVOIR CAP. DO NOT APPLY PRESSURE TO JOG CAP FROM SIDE TO SIDE OR DIP STICK MAY BREAK.

Oil is supplied for the average installation (ambient temperature above 50°F (10°C). See recommendation below for lower temperature. Fill pump and gear box by slowly pouring the proper oil through the air bleed reservoir opening until the oil level in the reservoir is level with oil level mark on outside surface of reservoir. Level can also be checked with dipstick on oil reservoir cap. Recheck while pump is operating.

CAUTION

DO NOT OVER FILL AS MOTOR DAMAGE CAN RESULT.

NOTE: *Synthetic oils are available that span the entire temperature range. Contact Milton Roy for further information.*

Recommended Oil

Any equivalent oil is acceptable.

Oil Type	Ambient Temp. 15-50 °F (-9-10 °C)	Ambient Temp. Above 50°F (10 °C)
AGMA Spec	No. 2 EP	No. 5 EP
Zurn Oil Co	No. EP 35	No. EP 95
ISO Grade	68	220

Nominal Oil Capacity

Pump Model	Simplex	Duplex
mRoy A	1 Qt. (.95 liters)	2 Qts. (1.9 liters)
mRoy B	3 Qts. (2.8 liters)	4 Qts. (3.8 liters)

2.10 PIPING

General

Refer to Figure 16 for a diagram of a typical recommended piping system.

Support all piping connections to the pump so that no stress is placed on pump fittings. In no case should the piping be sprung to make the connections to the pump. The suction and discharge cartridge pipe connections can be positioned within an arc of approximately 150° to facilitate piping to pump.

Flush and blow out all pipelines before connecting the pump. This eliminates any foreign matter that might seriously damage the internal working parts of the liquid end. Install a 20 mesh Y-type strainer that is sized to remove foreign particles with minimum pressure drop in the suction line of the pump.

Install shut-off valves, with unions on the pump side of the valves, in the suction and discharge lines to facilitate servicing.

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

NOTE: *Many pipe joint compounds are not suitable for use with plastic pipe and, if used, will cause stress cracking at the connection. Use only compounds commended for use with plastic materials.*

Suction Piping

The suction piping must be absolutely tight and leak-free. For mRoy pumps on water-like solutions we recommend that the suction pipe be ¾" minimum diameter and a maximum of 6 feet (2 meters) long. The intent is that the piping must be designed to provide an adequate net positive suction head (NPSH). Obtain our NPSH Calculation software at the Milton Roy Web site (miltonroy.com). If assistance in determining NPSH is

needed, contact the Milton Roy Aftermarket Service department.

A flooded suction is recommended for optimum service life and maintenance-free operation. However, the mRoy pump can operate with less than flooded suction if necessary, in accordance with the following schedule shown in the chart below.

	Model Number	Min. NPSH (PSIA)	Max. Lift (Ft. (meter) H_2O)
mRoy A	RA	10	10 (3)
mRoy H/T	RH or RT	10	10 (3)
mRoy P	RP	10	10 (3)
mRoy B	RS	10	5 (1.5)
	RM	10	5 (1.5)
	RB	10	2 (.6)

Refer to “Installation with Suction Lift,” which outlines limiting conditions if suction lift requirements are anticipated.

The supply tank should incorporate a low-level switch to cut off the pump motor circuit before the suction intake is exposed to air. Otherwise, the pump may occasionally run dry.

Discharge Piping

The installation of an external Safety Valve is recommended, since the pump’s internal relief valve is not intended to protect the piping system. Refer to “Setting the Relief Valve” in Section 3, for further relief valve discussion. (Milton Roy offers a complete line of back pressure and safety valves).

For satisfactory metering and capacity control, the discharge pressure at the pump must be 50 PSIG (3.5 Bar) Minimum for the mRoy A and 70 PSIG (4.8 Bar) minimum for the mRoy B. Therefore, when the pump is to discharge into an open system, a back pressure device must be installed in the pump discharge cartridge or line. (except the mRoy A plastic design). Installation of this spring will assure repetitive metering accuracy.

A spring (1390) is attached to each pump (Metallic Liquid End) in a small cloth bag (1380) for installation in the discharge cartridge to develop the required back pressure on the pump if a separate back pressure valve is not used (mRoy A Figure 15 and 21, mRoy B Figure 25). The back pressure spring should slip easily through the hole in the seat. Do not disassemble the seat and/or ball from metallic check valves. These check valves are precision manufactured at Milton Roy and should not be disassembled in the field.

2.11 BACK PRESSURE SPRING INSTALLATION

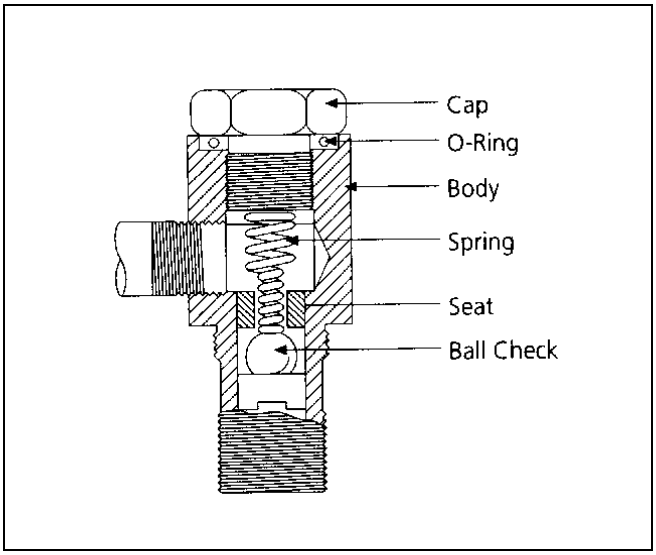

Figure 15. Back Pressure Spring Installation

The plastic liquid end mRoy B pumps (Figure 25) always use a back pressure spring in the discharge cartridge, so retrofitting the back pressure spring into the discharge is not required on these pumps.

CAUTION

AFTER PUMP HAS BEEN FULLY PRIMED, REMOVE THE CAP FROM THE BODY AND INSERT SPRING THROUGH THE TOP SEAT TO REST ON TOP OF THE BALL CHECK. REPLACE CAP AND TIGHTEN UNTIL FIRMLY SEATED ON BODY. DO NOT OVER-TIGHTEN, AS O-RING PROVIDES THE SEAL.

CAUTION

REMOTE HEAD SYSTEMS: DO NOT INSTALL A BACK PRESSURE SPRING IN THE DISCHARGE BALL CHECK CARTRIDGE OF DIAPHRAGM HEADS WHICH ARE "REMOTE MOUNTED" (NOT ATTACHED TO THE MAIN HOUSING). A SEPARATE BACK PRESSURE VALVE MUST BE INSTALLED IN THE DISCHARGE-LINE FROM THE REMOTE HEAD CARTRIDGE.

CAUTION

TAKE CARE WHEN INSERTING THE DISCHARGE PIPE NIPPLE INTO THE BALL CHECK CARTRIDGE. NIPPLE SHOULD NOT EXTEND INTO CAVITY, CAUSING CLAMPING OF THE SPRING AND RETARDING NORMAL OPERATION.

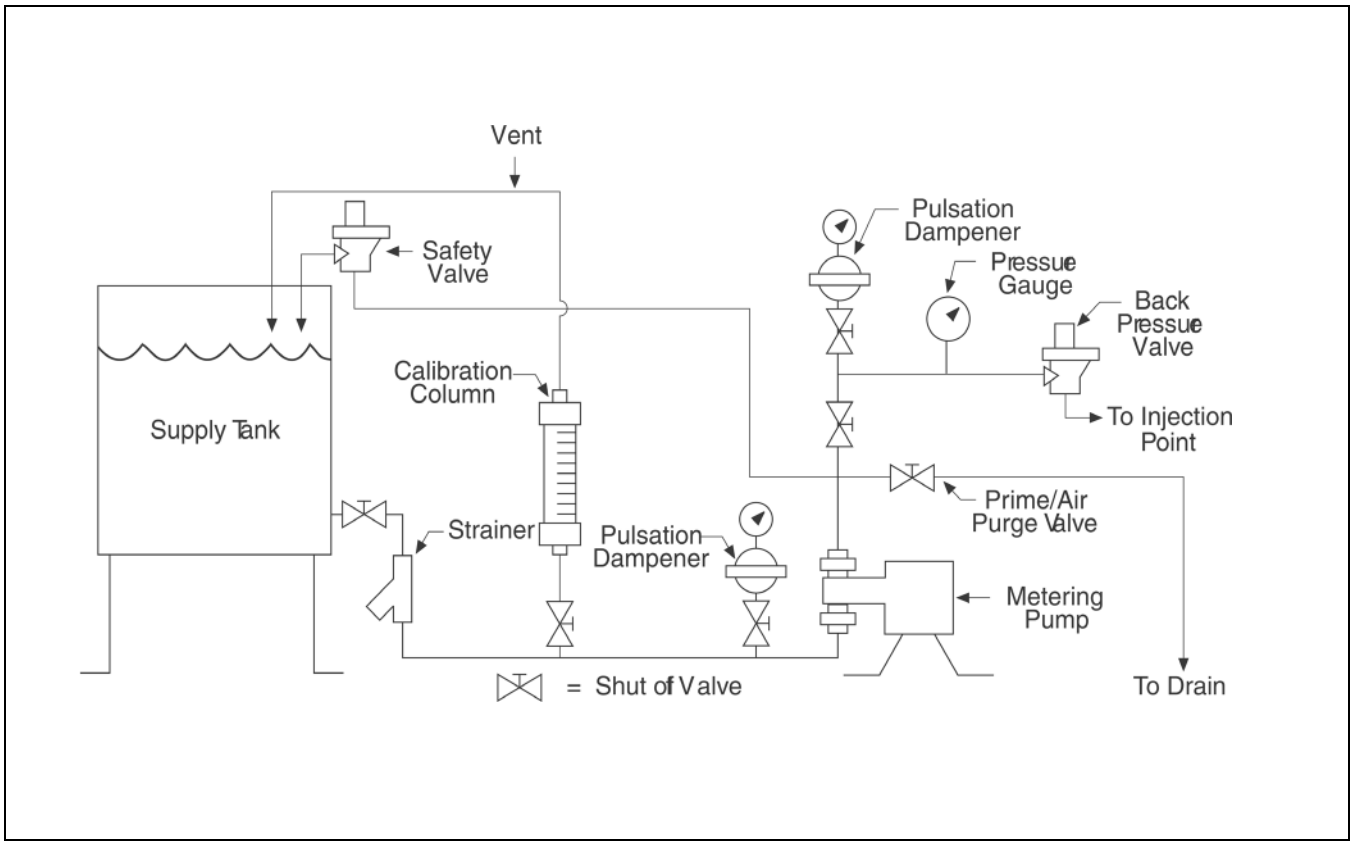

Figure 16. Typical Piping System Installation

2.11 OPERATION WITH SUCTION LIFT

It is desirable that the mRoy pump operate with a flooded suction; however, operation with net positive suction head (NPSH) less than atmospheric pressure is possible.

NPSH is the head available, above the vapor pressure of the liquid being pumped, to feed the liquid into the pump suction port. NPSH minimum is the head below which the pump cavitates.

Both values are calculated at the suction port of the pump. In controlled volume pump applications, two conditions must be considered in the selection of a pump to meet the NPSH minimum requirements:

1. At the start of the suction stroke, the liquid in the suction line has no velocity and NPSH minimum depends on the force necessary to accelerate the liquid in the suction pipeline.

2. At the peak of the suction stroke there is no acceleration factor and NPSH minimum depends on friction losses as calculated from standard flow equations. With all viscous fluids and in pilot plants and other places where unusual numbers of fittings and valves are used, the second condition that includes friction losses should be considered. For water-like fluids, the first condition will define the limiting configuration.

For Static NPSH (Condition 1)

Available NPSH = Pa + Ph – Pv (must be equal to or greater than minimum NPSH as listed under Installation Instructions.

$$\text{Required NPSH min} = \frac{\text{Sp. Gr. } (0.0925)\ LpD}{Dp^2}$$

For Dynamic NPSH (Condition 2)

Available NPSH = Pa ± Ph – Pf Le (must be equal to or greater than minimum NPSH as listed under Installation Instructions.

D = Plunger Diameter (inches)

Dp = Pipe Diameter (inches)

Lp = Actual Length of suction pipe (feet)

Le = Equivalent length of suction pipe including allowance for fittings (feet)

Pa = Ambient pressure above liquid (PSIA)

Ph = Head of liquid column above (+) or below (–) center line of plunger (PSIA) equals Head in feet x (0.435) (Sp.Gr.)

Pv = Vapor pressure of liquid (PSIA)

Pf = Friction loss per foot of pipe calculated from Reynold Number evaluation (PSIA) (Use 3.2 times average velocity for calculating friction losses when referring to a standard pipe losses table.)

Minimum NPSH = Minimum hydraulic pressure at plunger (listed under Installation Instructions).

When operating the pump with a NPSH of less than atmospheric pressure (negative suction head or suction lift), special attention should be given to keep the suction line strainer clean and prevent other system conditions that might inadvertently decrease the NPSH available.

NOTE: *Obtain our NPSH calculation software at the Milton Roy web site (miltonroy.com). If assistance in determining NPSH is needed, contact the Milton Roy Aftermarket Service Department.*

SECTION 3
OPERATION

3.1 INITIAL START-UP

Before initial start up of the pump, check the following:

WARNING

FAILURE TO CHECK TORQUE ON NON-METALLIC HEAD BOLTS PRIOR TO STARTUP AND AFTER ONE WEEK OF OPERATION MAY EXPOSE OPERATING PERSONNEL TO HAZARDOUS LIQUIDS.

1. Check the torque on all non-metallic head bolts prior to startup. Recheck torque on all non-metallic head bolts after pump has been operating for one week. Torque the head assembly screws in a crosswise pattern (Figure 17) as follows:

   a) mRoy Model A Plastic Heads: 60–70 in. lbs. (7-8 N-m) bolting torque.

   b) mRoy Model B Plastic Heads:75–85 in. lbs. (8.5-9.6 N-m) bolting torque, tie down nuts—25 in. lbs. (3 N-m).

2. Oil level in air bleed filler reservoir up to or slightly above the indicated oil level.

3. Set the capacity control knob to approximately 30-40% of maximum capacity.

4. Make certain that the suction line, liquid end and discharge cartridge are filled with water or system fluid.

5. Relieve all back pressure in the discharge line and pump hydraulic system to allow air to purge. Reduce pressure on the oil relief valve until air is purged. Refer to “Start-Up after the Suction System has Run Dry” section.

6. If practical, install a temporary discharge line piped back to the suction tank incorporating a 100 PSI (7 Bar) relief valve to facilitate establishing performance during first hours of operation.

On initial start-up, run the pump for 10–20 seconds, then stop for 20–30 seconds. Repeat a few times in order to fill the diaphragm oil cavity. Check for proper motor rotation as described in general installation instructions. During these short runs listen for any abnormal motor or crank noises, and if present, refer to Section 5, Troubleshooting.

Run pump for 1/2 to 1-1/2 hours to warm up oil. Check discharge line for indication of flow.

Increase capacity adjustment setting to 100% of capacity and operate for 10–20 minutes

CAUTION

DO NOT SET THE CAPACITY ADJUSTMENT KNOB IN EXCESS OF 100% BECAUSE ERRATIC OR REDUCED METERING WILL DEVELOP.

Reduce capacity adjustment setting to 30–40% of maximum capacity and operate for several minutes, then increase capacity adjustment back to 100% for approximately 10 minutes. Repeat several times to insure that the air is bled from the pump displacement chamber and the liquid end. (As a general rule, to bleed air or vapor from the pump oil displacement chamber reduce the capacity adjustment to the 20 to 40% range, and to bleed air or vapor from the liquid end increase capacity to 100%, or if possible reduce the discharge pressure to atmospheric pressure for 30 seconds to one minute.)

The pump is now ready for “on-line” service. Calculate what the desired capacity as a percentage of either the maximum capacity rating on the pump data plate, or the nominal capacity at the required system pressure. Each pump is tested at the factory to confirm that the performance meets these capacity-pressure requirements (when tested with water). (Milton Roy offers a complete line of calibration columns for calibrating the pump.)

Start-Up with Back Pressure Spring in Discharge Cartridge

The start-up procedure with the back pressure spring installed is identical to the above procedure; however, the back pressure device will hold air in the liquid end. It is necessary to make certain that the liquid end is filled with fluid, either by removing the discharge cartridge and filling liquid end and inlet lines before start up, or by backing out the discharge cartridge cap approximately seven (7) turns to remove the spring load on the ball check permitting the air in the liquid end to be discharged.

Start-Up after the Suction System has Run Dry

In applications where the suction tank does not have a low level cutoff interconnected into the pump motor circuit, the pump may occasionally run dry. This should be avoided to insure full integrity of the diaphragm. Running the pump dry occasionally will not harm the diaphragm or the pump. When the pump is repeatedly allowed to run dry, especially for long periods of time, the diaphragm is fatigued and could fail before the next scheduled replacement.

Before restarting a pump that has run dry, provisions should be made for filling the liquid end with liquid by opening the discharge line to atmospheric pressure to either refill liquid end with flooded suction pressure or start pump with open discharge and run for a short period of time (up to 2 minutes) that will 'prime' the liquid end if the ball checks are wet. If these steps fail, remove the discharge cartridge and fill liquid end with liquid through the top discharge opening in the head.After establishing flow, return to the regular discharge system configuration.

3.2 RESETTING THE RELIEF VALVE

DESCRIPTION

The mRoy pump incorporates an internal relief valve that is preset at the factory to relieve when the hydraulic fluid pressure exceeds 125 PSIG (8.6 Bar). This setting can be readjusted as required up to 15% above the maximum rated pressure of the pump. Resetting the internal relief valve will change the potential discharge pressure of the pump.

Refer Figure 19 for a pictorial description of the mechanism.

Examination of these drawings will reveal a small passage connecting the oil side of the diaphragm head cavity with the oil reservoir (See Figures 1 & 2). This passage is stopped off by a poppet that is held in place by a spring secured by a set screw. A plastic screw plug keeps the adjusting threads free of dirt.

In operation, the spring-loaded poppet is held against the seat in the housing until the pressure in the oil side of the diaphragm cavity exceeds the pressure for which the valve has been set. When this occurs, the poppet is forced off its seat, permitting the oil to flow from the diaphragm cavity through the mechanical passage to an opening (Figure 18) in the side of the oil reservoir. The resilient material of the poppet permits the relief valve to actuate without erosion of the poppet or seat surface.

Relief Valve Setting

Pump must be at operational pressure and capacity set at 95%.

1. Remove yellow plastic plug located at top of pump next to the oil fill hole.

2. Using a 3/16" hex. key (mRoy A), or a 5/16" hex. key (mRoy B) as required for the different models, turn the adjusting screw clockwise to increase cracking pressure until pump ceases to bypass through the relief valve at the desired working pressure. When relieving has stopped, adjust the screw clockwise up to one full turn beyond this point to set a reasonable buffer zone between operating pressure and relief pressure. To determine if relieving is taking place, insert your index figure into the oil reservoir opening and place it against the bypass opening (Figure 18) where the oil pulse from the relief valve can be determined.

   NOTE: *No moving parts are present in the oil reservoir in this location.*

3. Reinstall the plastic screw plug.

CAUTION

WHEN RELIEVING IS TAKING PLACE, ESPECIALLY ON PUMPS WITH THE LARGE PLUNGER SIZES, OIL MAY BE EJECTED AT HIGH VELOCITY FROM THE BYPASS PORT. NORMAL PRECAUTION SHOULD BE OBSERVED TO PREVENT THIS FROM SPLASHING THE SURROUNDING AREA.

NOTE: *This relief is intended primarily for pump protection in the event that the discharge or suction system is blocked while the pump is in operation. It is a good practice to install a high-grade chemical type relief valve in the pump discharge line as close to the pump as possible, and always between the pump and any shut-off valve. Pipe the outlet of the system relief valve back to the suction tank, with the open end of the pipe visible at all times. In this way, relief valve leakage may be easily detected.*

CAUTION

FOR SAFETY REASONS, A CHECK VALVE IS RECOMMENDED FOR USE IN THE DISCHARGE LINE NEAR THE POINT WHERE THE LINE ENTERS A HIGH-PRESSURE PROCESS VESSEL.

3.3 OPERATION

The mRoy pump is designed for reliable, unassisted operation. During normal operation, a periodic check of the pump is recommended every 24 or 48 hours to visually confirm satisfactory operation:

1. Make sure the oil level in the air bleed filler reservoir is above the oil level mark.

2. Inspect the pump liquid end for indication of leakage or seepage.

If anything seems to be amiss, refer to Section 4, Maintenance.

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SECTION 4
MAINTENANCE

4.1 SPARE PARTS

To avoid excessive downtime in the event of a parts malfunction, the spare parts shown below should be maintained in your stores to support each mRoy pump. For your convenience, these parts can be purchased either separately or packaged in the form of Routine Preventive Maintenance (RPM) Kits. RPM kit numbers are listed in Section 1, Figure 7 (mRoy A) & Figure 13 (mRoy B).

Double quantities required for duplex pumps. Two diaphragms are required for double diaphragm simplex liquid ends; four are required for double diaphragm duplex liquid ends.

4.2 RPM KIT COMPONENTS

mRoy A, B, H, T, J, & P Metallic Liquid End

1 Relief Valve Poppet
1 Suction Check Valve
1 Discharge Check Valve
Diaphragm(s) of various sizes
2 Check Valve O-Ring
2 Split Ring
1 Square Ring (not use on RH/RT or mRoy B)
1 Ball (used on model P only)

mRoy A Plastic Liquid End

1 Relief Valve Poppet
1 Suction Check Valve
1 Discharge Check Valve
Diaphragm(s) of various sizes
2 Check Valve Seals
1 Square Ring
2 Tube Coupling Nut (used on tube connection checks only)

mRoy B, M, & S Plastic Liquid End

1 Relief Valve Poppet
1 Suction Check Valve
1 Discharge Check Valve
1 Diaphragm
3 Check Valve O-ring

Parts Orders Must Include The Following Information:

1. Quantity required (in this manual)
2. Part number (in this manual)
3. Part description (in this manual)
4. Pump model no. (on pump nameplate)
5. Pump product code (on pump nameplate)
6. Pump serial no. (on pump nameplate)

Always include the serial number, product code, and model number in all correspondence regarding the unit.

4.3 RETURNING UNITS TO THE FACTORY

Pumps will not be accepted for repair without a Return Material Authorization Form, available from the Aftermarket Department. Process liquid must 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 Material Safety Data Sheet (MSDS). A completed MSDS must be packed in the shipping 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 the pump liquid end.*

All inquiries or parts orders should be addressed to your local Milton Roy representative or sent to:

Parts Department
Milton Roy Company Flow Control Division
201 Ivyland Road
Ivyland, PA 18974-0577
Phone: (215) 441-0800
FAX (215) 441-0735

4.4 ROUTINE MAINTNANCE

The mRoy pump is designed for reliable service with a minimum amount of maintenance required. However, a yearly tune-up is recommended, during which the check valves, diaphragm, and relief valve poppet are replaced. For convenience, these parts are available in a Routine Preventative Maintenance (RPM) Kit from your local representative. RPM kit numbers are listed in Section 1, Figure 7 (mRoy A) & Figure 13 (mRoy B).

4.5 SEMI ANNUAL OIL CHANGE

The oil in the main housing should be drained twice a year, using the drain plug provided, and new oil installed. This can usually be scheduled to coincide with the change from winter to summer grade lubricants and vice versa. Refer to “Pump Lubricants” in Section 2, Installation, for information on recommended oil and oil capacity.

> ***NOTE:*** *When adding oil, pour in a thin, slow stream to avoid overflow.*

4.6 CHECK VALVE CARTRIDGES

Milton Roy Company recommends that check valves be replaced on an annual basis. If highly corrosive material (acids, slurries, etc.) is being pumped, some applications may require more frequent replacement.

In general, poor or reduced pump performance indicates that the check valves need to be replaced (refer to Section 5, Troubleshooting).

Complete instructions for replacing worn check valve parts are given in the “Corrective Maintenance” section.

The mRoy check valves are complete assemblies manufactured at the factory and should not be disassembled in the field.

To determine if the check valves need replacement, with the pump off and pressure removed from system unscrew the check valve from the liquid end and peer through the hole in the check valve seat. The ball should appear perfectly round and free of pits, mars, or scratches. If the ball and/or seat is excessively damaged, the replacement schedule should be shortened accordingly. If the ball and seat are both in good condition, the replacement schedule can be lengthened.

4.7 DIAPHRAGM(S)

The mRoy PTFE diaphragm is extremely durable and often lasts for many years. As a preventative measure, however, Milton Roy Company recommends that the mRoy diaphragm be replaced yearly to coincide with check valve replacement. Also whenever the head is removed freeing the diaphragm the diaphragm must be replaced. Refer to the instructions in the “Corrective Maintenance” section for diaphragm replacement.

4.8 RELIEF VALVE POPPET

Milton Roy Company recommends that the relief valve poppet be replaced yearly during preventative maintenance. This can usually be timed to coincide with check valve replacement. Refer to the instructions in the “Corrective Maintenance” section.

4.9 CORRECTIVE MAINTENANCE

CAUTION

BEFORE CARRYING OUT ANY SERVICING OPERATION ON THE METERING UNIT OR PIPES, DISCONNECT ELECTRICAL POWER FROM THE PUMP. TAKE THE NECESSARY STEPS TO ENSURE THAT ANY HARMFUL LIQUID IN THE PUMP OR PIPING SYSTEM CANNOT ESCAPE OR COME INTO CONTACT WITH PERSONNEL. SUITABLE PROTECTIVE EQUIPMENT MUST BE PROVIDED. CHECK THAT THERE IS NO PRESSURE BEFORE PROCEEDING WITH DISMANTLING.

4.9.1 Check Valve Cartridge Replacement

With the exception of the model A and L plastic versions, mRoy suction and discharge check valve cartridges are precision and assembled at the factory. Do not attempt to disassemble these cartridges. If they become inoperative flush them with Safety Solvent, wash them with warm detergent and blow them out with compressed air to remove any foreign matter. If this treatment does not eliminate the trouble, the cartridge assembly should be replaced. mRoy A plastic suction and discharge check valve cartridges may be disassembled for cleaning or parts replacement.

4.9.1.1 Metallic Liquid Ends (Figures 20, 21, 22 & 25)

Disassembly

1. The check valve cartridge assemblies use an SAE straight thread with an O-ring seal to facilitate port alignment with the connecting pipes. To remove the cartridge from the liquid

end, first loosen the lock nut (520) one or two threads then unscrew the cartridge.

2. Remove and discard the O-ring (540) and spiral back-up ring (530).

3. On model mRoy P pumps only, the ball in the suction port of the liquid end is not sealed inside the suction check valve. This ball should fall out easily when the suction check valve is removed.

4. Carefully clean any parts to be reused. If any chemicals are used in the cleaning process, ensure that they are compatible with the process liquid.

Reassembly

1. To install the cartridge, position the lock nut (520) toward the shoulder of the cartridge so that the recess on the face of the lock nut is adjacent to the O-ring (540) land (thread undercut) in the cartridge.

2. Make certain the spiral back-up ring (530) is coiled in a counterclockwise helix (this is opposite the direction normally employed by suppliers of these rings. Fit the spiral back-up ring (530) in the lock nut (520) recess. Push it firmly down in the recess as completely as possible.

3. Install new O-ring (540) against the spiral back-up ring (530).

NOTE: *To assure a tight, leak free seal, new o-rings and* spiral back-up rings *should be used each time the check valves are disassembled.*

4. On model mRoy P pumps only (Figure 20), the separate ball (570) needs to be balanced on the end of the suction check valve cartridge so that it will be held in place in the suction port by the check valve when it is screwed in.

5. Screw the cartridge assembly into the liquid end until the O-ring band is approximately level with the top of the spotface in the liquid end, then screw it in one (1) additional turn plus a partial turn as required to align the pipe thread port with connecting pipe.

CAUTION

SUCTION AND CHECK VALVE CARTRIDGES ARE NOT IDENTICAL. BE SURE THAT THE CORRECT CARTRIDGE IS BEING SCREWED INTO THE PROPER PORT. (DISCHARGE CARTRIDGES HAVE HEXAGONAL CAP ON THE TOP; SUCTION CARTRIDGES DO NOT.) IF CHECK VALVE CARTRIDGES ARE INSTALLED INTO THE WRONG PORT, ONE OF THE FOLLOWING WILL OCCUR: (A) IMMEDIATE SEVERE DAMAGE TO PUMP MECHANISM, (B) NO PUMPING, (C) REVERSE PUMPING ACTION (FROM DISCHARGE LINE INTO SUCTION LINE).

6. After completing pipe connection, tighten lock nut (520) securely against spotface so that O-ring (540) is trapped in chamfer of liquid end thread. Make sure that the spiral back-up ring (530) is completely contained in its recess and not extending to the outside.

4.9.1.2 mRoy A Plastic Liquid End, Current Design (Figure 20)

Disassembly

1. Unscrew the check valve assembly from the pump liquid end.

2. Both the suction and discharge check valves may be disassembled in the same way. While carefully holding the body use a 5/16” rod to push out the internal parts. Do not damage the sealing face (opposite the threaded end) on the valve body. It is essential to reinstall the ball guides and ball stop in the proper direction, so take note during disassembly and follow the assembly drawing.

3. Carefully clean any parts to be reused. If any chemicals are used in the cleaning process, ensure that they are compatible with the process liquid.

Reassembly

NOTE: *To assure a tight, leak free seal, new seals and O-rings should be used each time the check valves are disassembled.*

1. Lightly coat the O-rings on the ball guides with mineral oil or other food grade lubricant. It is

essential to reinstall the ball guides and ball stop in the proper direction. Remember the ball always lifts off the seat in the direction of fluid flow. The ball stop is used to retain the last ball check on the suction cartridge.

2. Remove the old valve-to-head seal (435) from the head and install a new seal. *A fracture of the diaphragm head may result from installing the check valve against two seals or excessive tightening.* The groove in the seal is to be oriented against the check valve body.

4.9.1.3 mRoy B Plastic Liquid End (Figure 25)

Disassembly

1. The mRoy B plastic check valves are held to the liquid end by two long bolts (521) that extend through the diaphragm head. Unscrew the nuts (519) on one end of these bolts to remove the check valves from the liquid end. Use caution when doing so, as the suction check valve and compression plate (518) will fall off when the bolt is removed.

2. Remove and discard the check valve o-rings (540).

3. Carefully clean any parts to be reused. If any chemicals are used in the cleaning process, ensure that they are compatible with the process liquid.

Reassembly

NOTE: *To assure a tight, leak free seal, new o-rings should be used each time the check valves are disassembled.*

1. The discharge check valve consists of two separate pieces that are shipped held together with masking tape. Leaving the masking tape in place during assembly will make the process easier. These parts already have an o-ring in place between them.

2. Drop a new o-ring (540) into position in the discharge port of the liquid end. Slip the entire discharge cartridge (still held together with masking tape) into the discharge port (only one end will fit in).

3. Screw a nut (521) two or three turns (just enough to hold) on one end of each through bolt. Slide the compression plate over the discharge cartridge (517). Slip the bolts (521) through the holes in the compression plate and diaphragm head so that they fall through and hang out the bottom.

4. Fit a new o-ring (540) into position on the top of the suction cartridge.

5. Slip the suction cartridge and o-ring up into the suction port of the liquid end. Position the other compression plate (518) under the suction check valve by sliding it up on the bolts. Screw on the two remaining nuts (519). The suction check should now be held in place in the liquid end. Tighten the nuts on the through bolts firmly. Do not over-tighten or plastic fittings may be damaged.

4.9.2 Relief Valve Poppet Replacement (Figure 19)

If the pump is allowed to operate for long periods with the relief valve relieving pressure, there is a possibility that the poppet will wear, causing erratic flow and discharge pressure. If this occurs, the relief valve poppet should be replaced. Even if excessive wear has not occurred, it is still recommended that the poppet be replaced on a yearly basis.

Disassembly

1. Unscrew and remove the relief valve screw plug (1350).

2. Unscrew and remove the relief valve adjustment screw (50).

3. Remove the relief valve spring (40). A pair of tweezers may be required to fish the spring from the relief valve port.

4. Remove the relief valve poppet (30) with a tweezer or by “jogging” the motor, causing oil to flow up through the relief port to float the poppet up and out of the threaded hole.

Reassembly

1. Temporarily “glue” a new poppet (30) into the end of the spring (40) with thick grease. Drop this assembly into place in the relief valve port.

2. Install the relief valve adjustment screw (50) until the spring (40) is lightly compressed. Follow the instructions for resetting the relief valve given in Section 3, Operation.

4.9.3 Diaphragm Replacement (Figures 20-27)

The different mRoy models (A, B, H, T, M, P, S & double diaphragm) all have slightly varying diaphragm configurations. Be sure to refer to the appropriate Figure (20-27) when replacing the diaphragm(s).

Disassembly

1. Remove the six (6) or eight (8) bolts (350 or 355) from the diaphragm head (330), depending on the model.

2. Remove diaphragm (290) using knife blade.

3. Remove contour plate(s) (282).

4. If servicing a pump with a square ring (260), remove and discard the square ring.

5. If servicing a double diaphragm style pump, remove the intermediate chamber and square head plated pipe.

6. Carefully clean any parts to be reused. If any chemicals are used in the cleaning process, ensure that they are compatible with the process liquid and hydraulic oil.

Reassembly

1. Place pump on its side with diaphragm cavity facing up.

2. Install contour plate(s) (282) into position in the housing and/or diaphragm head (330), as appropriate.

3. If servicing a pump with a square ring, fit a new square ring (260) into position in the recessed square ring groove in the housing.

4. Carefully center diaphragm (290) in the shallow recess in the housing.

5. If servicing a double diaphragm style pump, position the intermediate chamber and square head plated pipe over the diaphragm. Fit a second new square ring (260) (if required) into position in the recessed square ring groove. Carefully center the second diaphragm (290) in the shallow recess in the intermediate ring.

6. Retain diaphragm with thin, flat blade 1/2” to l” wide.

7. Carefully position the diaphragm head and contour plate (this diaphragm head side contour plate is not used on some models) in place, aligning bolts holes. Remove blade and torque bolts as follows (See Figure 17):

    a. mRoy Model A, H, T, & P Metal Heads:
    265–275 in. lbs. (30-31 N-m) bolting torque (grade 5 or stronger bolts)

    b. mRoy Model A Plastic Heads:
    60–70 in. lbs. (7-8 N-m) bolting torque

    c. mRoy Model B, M, & S Metal Heads:
    340–360 in lbs. (38-41 N-m) bolting torque

    d. mRoy Model B Plastic Heads:
    75–85 in. lbs. (8.5-9.6 N-m) bolting torque
    tie down nuts— 25 in. lbs. (3 N-m).

Procedures for complete disassembly of the mRoy pump are listed below. Some steps can be omitted depending on which part is replaced.

4.9.4 Motor and Worm Replacement (Figures 18 & 19)

The motor will need to be removed in order to replace or inspect the motor or the gears.

Disassembly

1. Remove oil drain plug and drain oil.

2. Remove the screws that attach the motor to the pump.

3. On plate mounted units, remove motor; the gear shaft may come out as well. If the motor separates from the worm shaft (640), use care not to lose the shaft key and coil spring.

4. Remove worm assembly (120).

5. On units with API motor mount adapters; removal of the motor and adapter together will also lift the worm gear shaft from the pump.

Reassembly

1. Reinstall by reversing steps 1 through 5 or follow the “motor conversion” directions.

4.9.5 Control Spool O-Rings Replacement (Figure 18, 20, & 21)

Occasionally, the control spool o-rings may need to be replaced. Replacement is usuall indicated if pump delivers less rated flow than expected.

Disassembly

1. Remove E-ring (220).
2. Unscrew and remove capacity control knob (210).
3. Remove screw (180) in threaded sleeve (170) (capacity control).
4. Remove diaphragm head (330), diaphragm (290), contour plate (280 & 285), and motor and motor mount.
5. Remove control spool (160) from bore.
6. For mRoy A pumps, fabricate a tool by inserting a 3/16" diameter x 4-in. long soft plastic (e.g. Nylon) solid rod into the 3/16" hole and shaping the end with a 7/16" reamer inserted into the control spool bore. For the mRoy B pumps, a tool is not required.

CAUTION

CAREFUL USE OF REAMER IS HIGHLY RECOMMENDED AS DAMAGE MAY OCCUR TO THE SURFACE OF THE BORE. A TOOL, P/N - ORINGTOOL CAN BE PURCHASED FROM MILTON ROY.

Reassembly

1. Place new O-rings (150) on control spool (160) and coat O-rings liberally with grease to hold them in place.
2. Place O-ring tool (notch facing up to guide O-ring across intersecting passage), into 3/16 hole at 12:00 oclock position behind the contour plate.
3. Push control spool and O-rings into bore carefully, using O-ring tool to guide O-ring across intersecting passage. This is done to prevent damage to O-rings. Finally, guide control piston into center of control spool, motor side.

4.9.6 Worm Gear Replacement (Figure 18)

Disassembly

1. Remove motor assembly, following instructions shown in "Motor and Worm Replacement" section.
2. Remove two screws (250), linkage arm (240), and control plunger (230).
3. Use arbor press or hammer and brass punch to remove the gear shaft from the gear.
4. Lift worm gear, connecting rod, and plunger assembly up and out of pump housing.

Reassembly

1. Reverse steps 1 through 4 above.

4.9.7 Connecting Rod and Plunger Replacement (Figure 18)

Disassembly

1. Lift connecting rod (100) up and back to disengage plunger (90) from bore.
2. Use arbor press or hammer and brass punch to remove wrist pin (110) from connecting rod (100) and plunger (90).
3. To assure proper installation, **note** position of oil groove for wrist pin (110) and oil groove for worm gear (120) with respect to connecting rod (100) and plunger (90). Groove should be located at bottom of bore.

Reassembly

1. Reverse steps 1 through 3 above. Be sure to properly align oil groove to its original position, as noted in step 3.

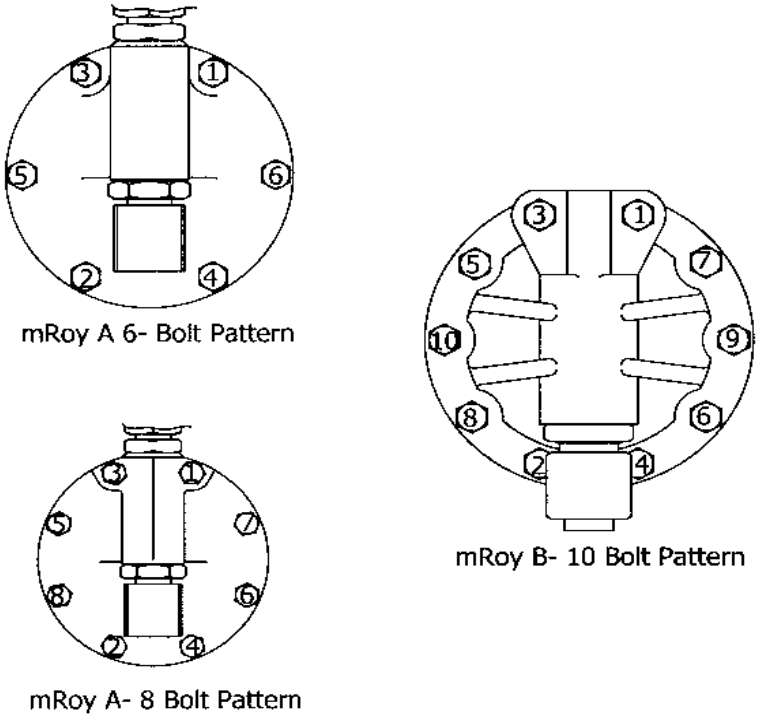

Figure 17. Diaphragm Head Bolt Torque Pattern

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SECTION 5
TROUBLESHOOTING GUIDE

SYMPTOMS	REMEDIES
Pump motor won't operate.	• No power. Supply correct power in accordance with motor nameplate. • Blown fuse. Check for short circuit or overload. • Open thermal overload device in starter. Reset overload. • Broken wire. Locate and repair. • Low voltage. Check for too thin wiring. • Low liquid level (where low level cutoff is used). Fill tank. • Oil is frozen in pump. Thaw out. • Bad motor. Replace motor.
Pump doesn't deliver rated capacity.	• Starved suction. Replace suction piping with larger size, or increase suction head. • Leaky suction piping. Repair or replace defective piping. • Excessive suction lift. Rearrange equipment location to reduce suction lift. • Liquid too close to boiling point. Lower temperature or increase suction pressure. • Air in hydraulic or reagent system. Bleed system. • Air or gas trapped in oil or pumpage. Decrease capacity to 20% for 5 mins. then increase to 100% for 5 mins. • Worn or dirty valves or seats. Clean or replace cartridges. • Viscosity of liquid too high (cps). Reduce viscosity by heating or other means, or increase size of suction piping, or increase suction pressure. • Insoluble materials; crystallization of liquid; settling of solids. Limit solution strength to proper value. Flush and clean solution tank periodically. Suction connection should be 2" to 4" from bottom of solution tank. • Low discharge pressure. A minimum discharge pressure is required to insure proper capacity control (see Discharge Piping, Section II.) • Relief valve being actuated. Refer to symptom marked with an *. • Capacity adjustment set above 100% capacity mark. Reposition adjustment knob to 100% mark.
Pump delivers erratically.	• Leaky suction line. Repair or replace piping. • Worn or dirty valves or seats. Clean or replace cartridges. • Excessive excursion of ball valves from seats (indicated by ball chatter). Replace cartridges. • Insufficient suction pressure. Increase suction pressure by raising tank level or pressurizing suction tank. • Liquid too close to boiling point. Reduce temperature or raise suction pressure. • Leaky system relief valve. Repair or replace relief valve.

SYMPTOMS	REMEDIES
Motor overheats thermal overload switches.	• Power supply does not match motor characteristics. Check power supply against motor nameplate data. • Overload caused by operating pump above its discharge pressure. Check operating pressure against pump manufacturer's data plate max. rating and correct the cause of the pressure abnormality.
Noisy operation of pump liquid end.	• Pump valves must move to open and close, and they will make a clicking noise as they operate. These noises are sometimes amplified by natural resonances in the piping system. They are usually indications of normal valve functioning.
Noisy operating in drive casing (pounding noise at high discharge pressure).	• Fluid compressibility causes reversal load on gears at end of pressure stroke. Not considered detrimental. No action needed. • Pump internal relief valve actuating, caused by excessive suction lift conditions. Lower pump or raise level of liquid. • Pump internal relief valve actuating, caused by insufficient suction pressure. Correct poor suction condition. • Pump internal relief valve actuating, caused by clogged or partially blocked filter or strainer in suction line. Clean strainer. • Pump internal relief valve actuating, caused by clogged or fouled suction or discharge check valves. Clean or replace. • Pump internal relief valve actuating, caused by blocked discharge line. Remove blockage. • Pump internal relief valve actuating, caused by insufficient discharge pressure. Install back pressure valve or device to create back pressure at pump discharge connection (see Discharge Piping, in Section II).
Improper oil level in reservoir increases and overflows.	• Flexible diaphragm punctured by foreign material. Replace diaphragm.
Pump delivery is not adjustable.	• System pressure too low. Install a back pressure valve in the discharge line (preferred method), or install a back pressure spring (provided) into discharge cartridge.
Pump does not develop required pressure.	• Refer to symptom marked with an *, or check to see if system pressure exceeds rated capacity on data plate. • O-rings on control spool are nicked. Replace O-rings. (Note: you must use a special tool. See section on control spool disassembly.) • Carefully review causes and remedies for the second and third symptoms listed.

SECTION 6
PARTS

6.1 GENERAL

1. This section gives information regarding replaceable components.

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. Material/SPM Column

    a) The material used to manufacture the part is listed in the material/SPM column.

    b) The strokes per minute is listed for all worm and shaft assemblies in the material/SPM column.

5. Quantity Column

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

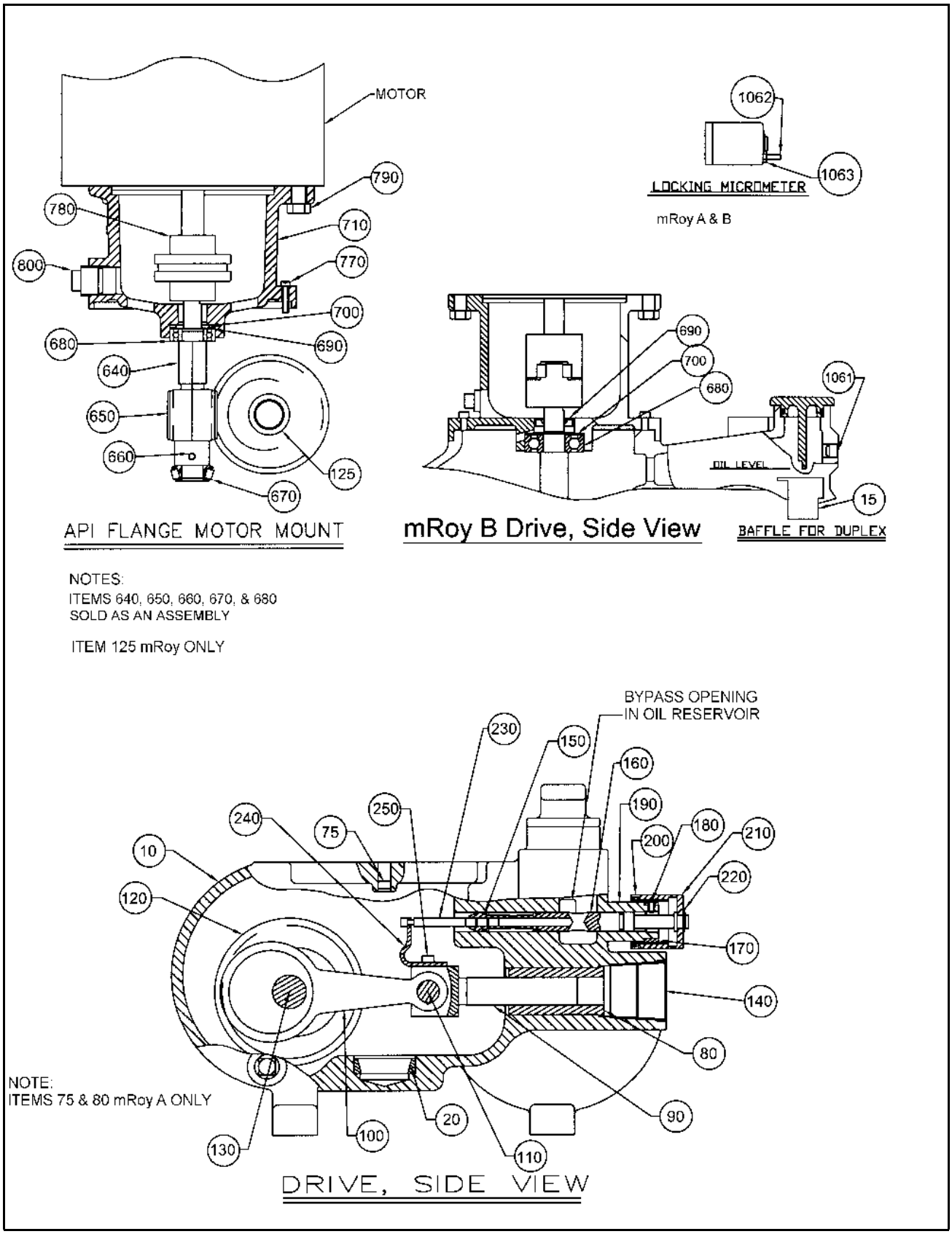
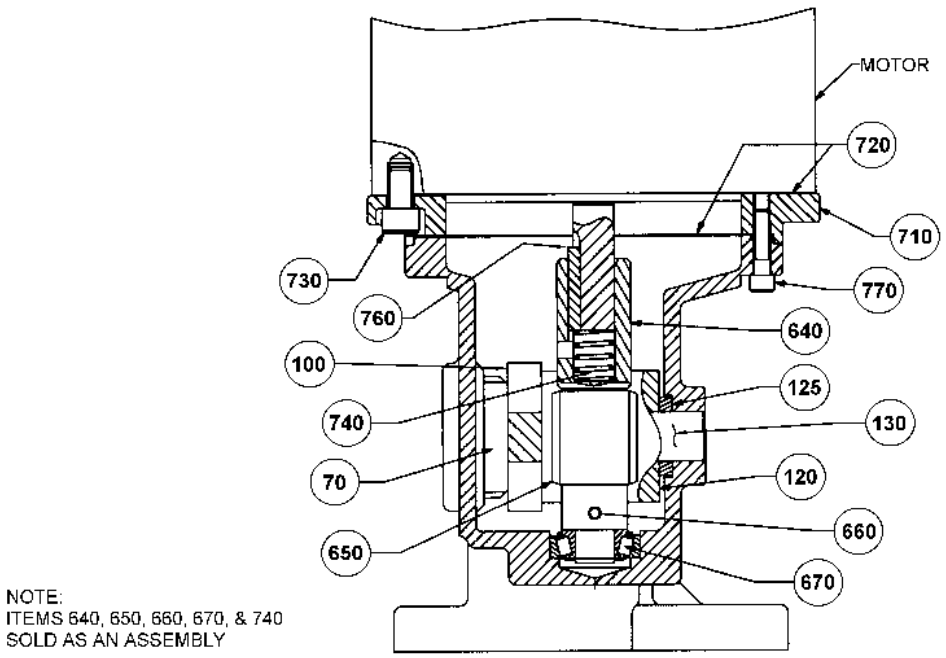
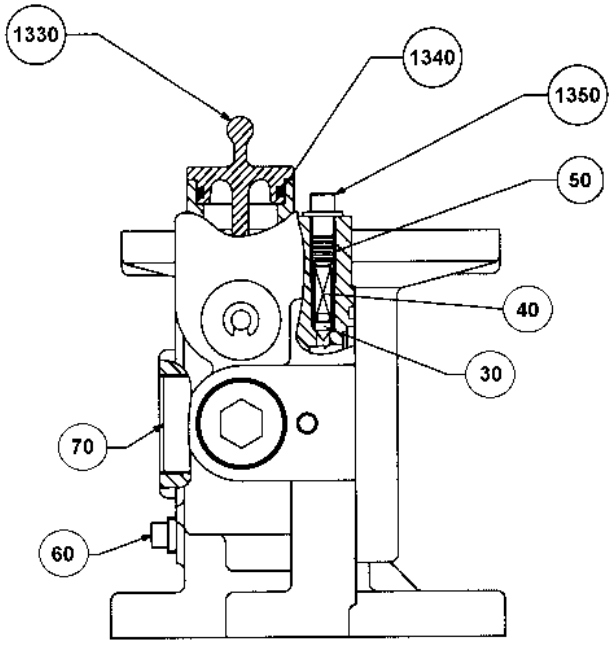


Figure 18. Common Parts - mRoy A & B Side View and API Motor Mount (DWG(s) 102-1971-0001 and 102-1971-0003)



CLOSE COUPLED MOTOR MOUNT FLANGE (mRoy A ONLY)



HOUSING END VIEW

Figure 19. Common Parts - mRoy A & B End View and mRoy A Close Coupled Motor Mount (DWG(s) 102-1971-0003 and 102-1971-300)

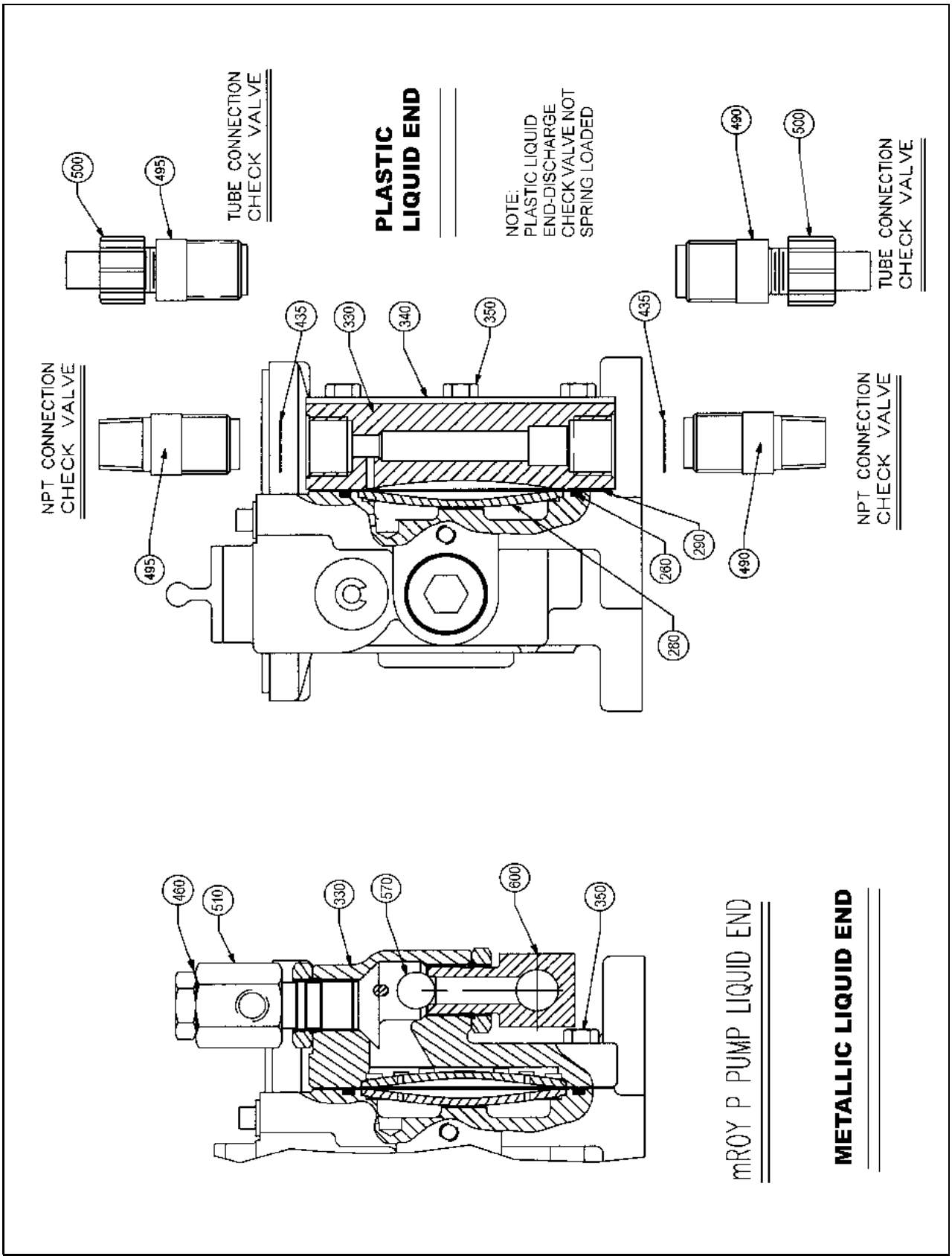


Figure 20. mRoy A Metallic and Plastic Liquid End
(DWG 102-1971-0002)

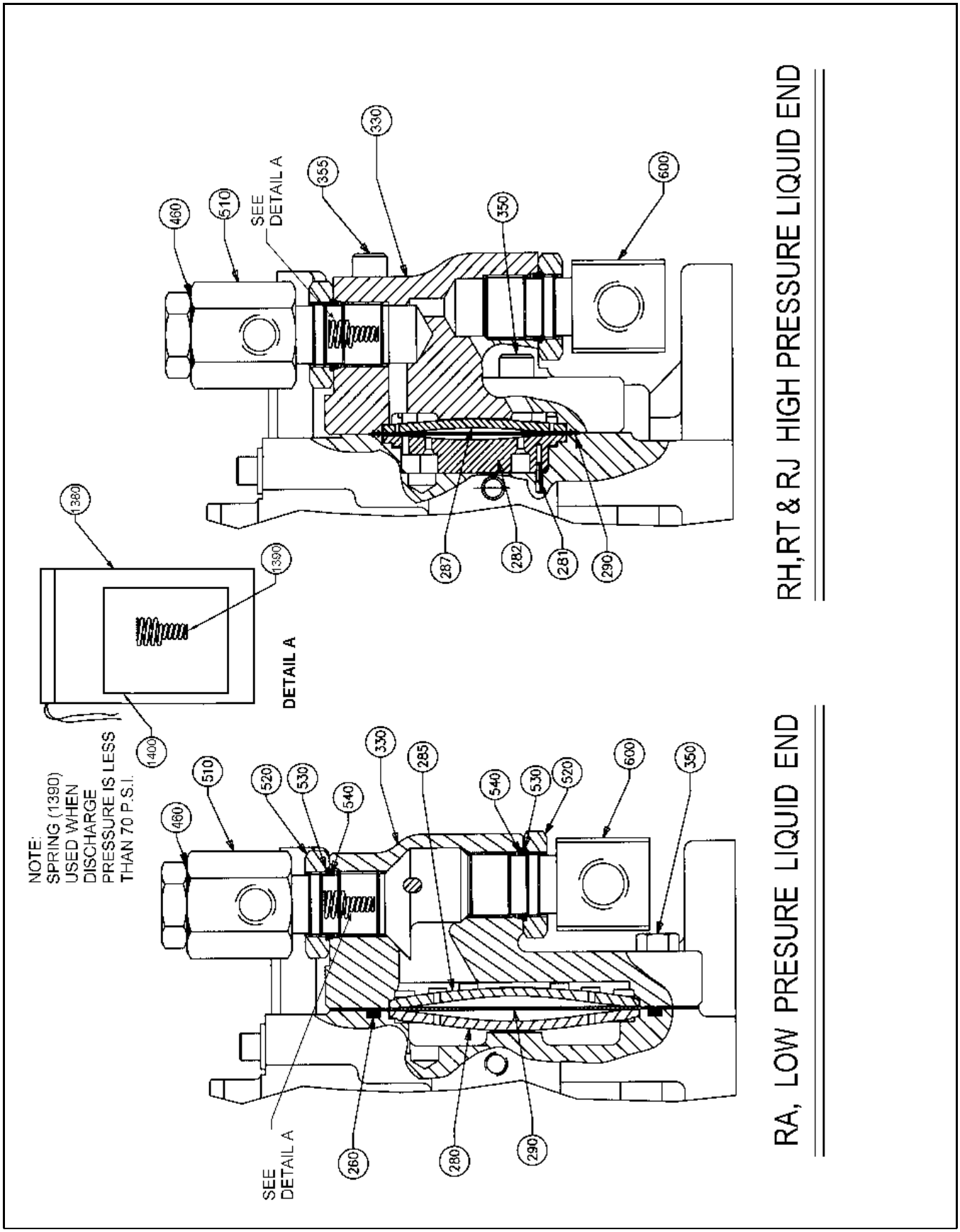


Figure 21. mRoy A Metallic Low Pressure and High Pressure Liquid End (DWG 102-1971-0002)

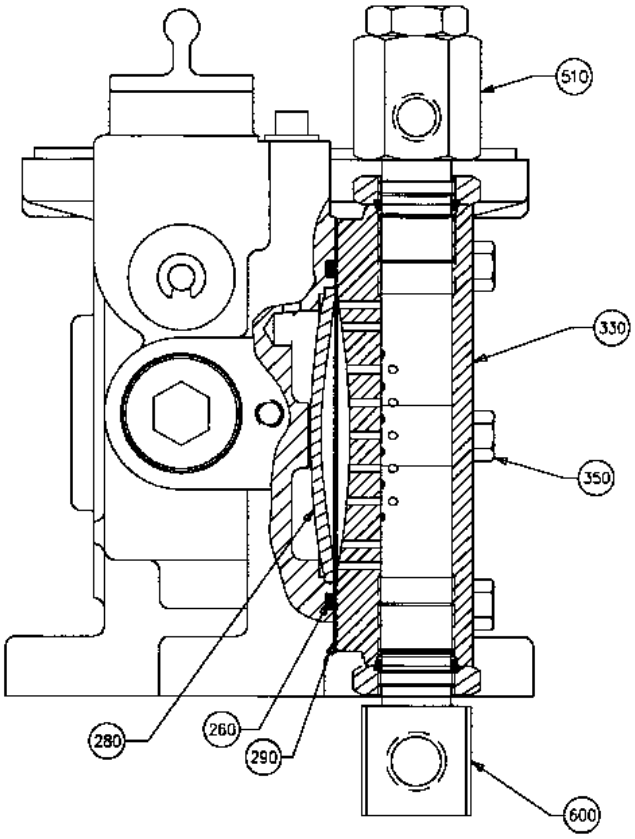


Figure 22. mRoy A Bar Stock Liquid End (DWG 102-1971-00019)

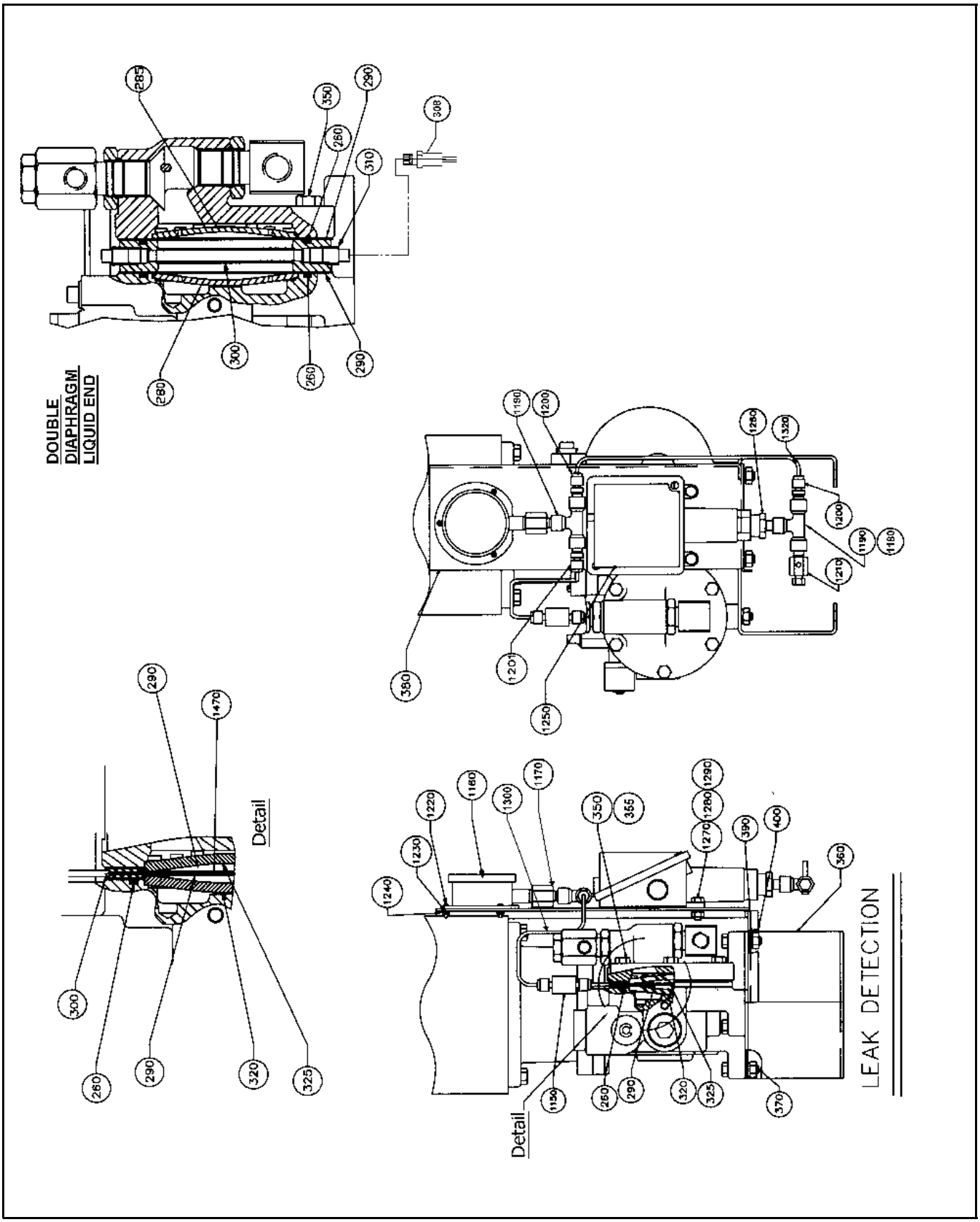


Figure 23. mRoy A Double Diaphragm and Leak Detection (DWG(s) 102-1971-0002 and 102-1971-0005)

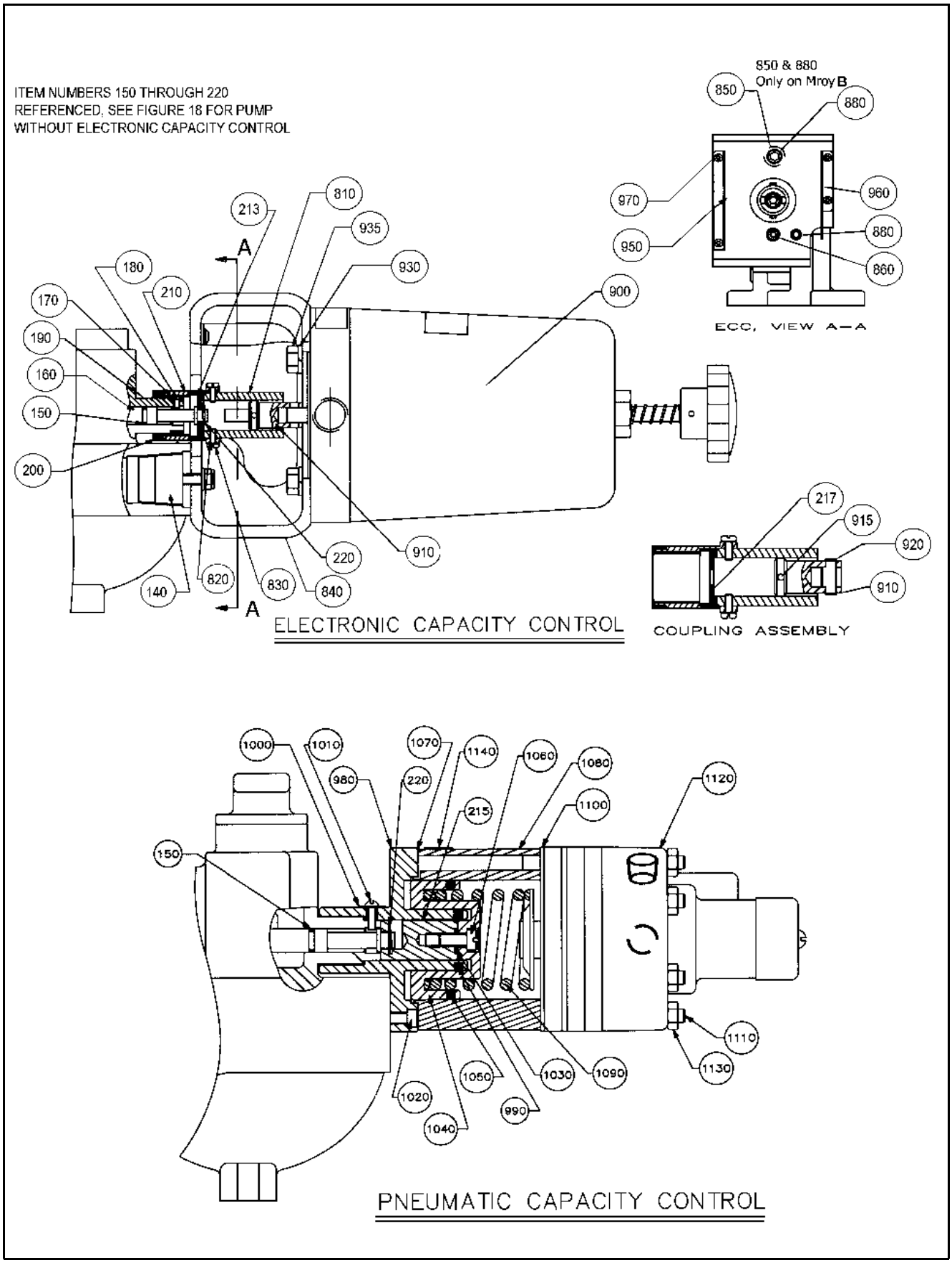


Figure 24. mRoy A and B Actuator (DWG(s) 102-1971-0003 and 102-1971-0004)

6.3 BASIC PARTS LIST FOR DRIVE MODELS “RA”, “RH”, “RT”, “RJ”, AND “RP” (FIG. 18 &19)

DRIVE MODEL “RA”

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY
10	Housing, Main	Consult with aftermarket group for replacement. Provide serial number and model number of pump.		1
20	Cup, Race	409-0064-020	Steel	1
30	Poppet, Relief Valve	212-0056-074	Nylon	1
40	Spring, Relief Valve	280-0043-041	Steel	1
50	Adjusting Screw, Relief Valve	405-0241-014	Steel	1
60	Plug - 1/4" NPT, Sq. Head	402-0009-111	Steel	1
70	Gear Shaft Bushing, (factory installed, not recommended for field service, call factory)	237-0029-006	Steel	1
80	Housing Sleeve 7/16", “RA and RP” (plunger factory in-stalled, not recommended for field service, call factory).	237-0073-006	Steel	1
	Housing Sleeve for 5/8", “RA and RP” (plunger factory in-stalled, not recommended for field service, call factory).	237-0060-006	Steel	1
90	Plunger, 7/16"	212-0055-006	Steel	1
	Plunger, 3/8	212-0055-106	Steel	1
	Plunger, 5/8"	212-0054-006	Steel	1
	Plunger, 1-1/16"	212-0053-006	Steel	1
100	Rod, Connecting	214-0025-062	Aluminum	1
110	Pin, Wrist	211-0030-006	Steel	1
120	Gear, Worm (Ratio 77:1)	252-0125-001	15/23 spm Simplex	1
	Gear, Worm (Ratio 77:1)	252-0127-001	15/23 spm Duplex	1
	Gear, Worm (Ratio 48:1)	252-0052-001	37 spm Simplex	1
	Gear, Worm (Ratio 48:1)	252-0053-001	37 spm Duplex	1
	Gear, Worm (Ratio 24:1)	252-0090-201	73 spm Simplex	1
	Gear, Worm (Ratio 24:1)	252-0091-001	73 spm Duplex	1
	Gear, Worm (Ratio 15:1)	252-0019-200	117 spm Simplex	1
	Gear, Worm (Ratio 15:1)	252-0026-001	117 spm Duplex	1
	Gear, Worm (Ratio 9.5:1)	252-0086-201	185 spm Simplex	1
	Gear, Worm (Ratio 9.5:1)	252-0087-001	185 spm Duplex	1
125	Gear Spacer, Simplex	219-0071-006	Steel	1
	Gear Spacer, Duplex	219-0109-006	Steel	1
130	Gear Shaft, Simplex	268-0021-006	Steel	1
	Gear Shaft, Duplex	268-0018-006	Steel	1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RA"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY
140	Plug, 1" NPT Socket Hex Head, "RA" and "RP"	402-0095-061		1
	Plug, 1/2" NPT Socket Hex Head, "RJ", RT, and "RH"	402-0095-041		1
150	O-Ring, Parker 2-011	408-0109-082	Polyurethane	3
160	Control Spool	268-0037-006	Steel	1
170	Sleeve, Threaded	243-0058-016	316SS	1
180	Screw, Socket Set - 6-32NC x 1/4	405-0039-035		1
190	Plate, % Capacity	253-0015-062	Aluminum	1
200	Ring, Calibration	253-0024-062	Aluminum	1
	Ring, Calibration	253-0024-071	PVC	1
210	Knob, Control	255-0019-016	316SS	1
	Knob, Capacity Adjust	255-0019-071	PVC	1
	Knob, Capacity Adjust, (Locking Micrometer)	255-0045-000		1
220	E-Ring - 1/4", Control Knob	404-0124-096	Steel	1
230	Plunger, Control	212-0036-039	Steel	1
240	Arm, Linkage	214-0009-006	Steel	1
250	Screw, Linkage - 8-32 x 1/4" Socket head	405-0245-011	Steel	2
1062	Screw, Socket Head - 6-32 x 1, Locking Micrometer Knob	40201	Steel	1
1063	Nut, Hex Head - 6-32NC (Locking Micrometer)	405-0060-017	Steel	1
1330	Cap, Reservoir With O-Ring	30256		1
	Cap, Reservoir	20183		1
1340	O-Ring, Reservoir Cap	408-0095-071	NBR	1
1350	Screw Plug, Relief Valve	405-2001-011	Plastic	1
-	Screw, Mount Data Plate	405-0280-000	Steel	2
-	Plate, Data	253-0186-000		1
-	Decal, Caution Motor	253-0021-198		1
Lubrication				
-	Oil, Gear - EP-35	407-0195-010	1 Quart	1
-	Oil, Gear - EP-95	407-0152-010	1 Quart	1
-	Oil, Gear - EP-95	407-0152-040	1 Gallon	A/R

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RA"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY

6.4 PARTS COMMON TO LIQUID END MODELS "RA", "RP", AND "RJ" (FIGURE 20 & 21)

260	Ring, Sq. - 3.75 Id x 1/8wall (Models "RA", "RJ", and "RP" only)	408-0144-010	NBR	1
280	Contour Plate–Oil Side - 3-1/2"	298-0061-016	316 SS	1
285	Contour Plate-Process Side, Also Used With Double Non-Contacting Diaphragms)	298-0061-016	316SS	1
		298-0061-028	Alloy 20	1
		298-0061-030	Alloy C-22	1
460	O-Ring, Discharge Check Valve Cap	408-0068-043	PTFE	1
510	Cartridge, Discharge Assembly	221-0897-216	316SS	1
		221-0897-228	Alloy 20	1
		221-0897-230	Alloy C-22	1
520	Nut, Locking, Check Valve	209-0020-014	Stainless Steel	1
530	Back-up Ring, Spiral, Check Valve Lock Nut	408-0073-141	PTFE	2
540	O-Ring, Check Valve Lock Nut	408-0068-065	FKM (VITON)	2
600	Cartridge, Suction Assembly (Double Ball) 1/2" NPT Connection, (Except Model "RP")	221-0896-216	316SS	1
		221-0896-228	Alloy 20	1
		221-0896-230	Alloy C-22	1
-	Bushing, Reducing - 1/2" x 3/8", Used To Install New Suction Check Valve to 3" - 8" piping.	402-0001-045	316SS	1
		402-0001-049	Alloy 20	1
1390	Spring - Discharge Cartridge, when required	280-0033-016	316SS	1
		280-0033-030	Alloy C-22	1
		280-0033-026	Alloy C-276	1

Diaphragm Head Designs And Diaphragms Are Grouped According To Size And Are Not Interchangeable

6.5 DIAPHRAGM HEAD DESIGN- 6 BOLT (5" WITH HOLES) LIQUID END MODEL "RA" (FIGURE 21)

290	Diaphragm, 6 Bolt Design (5" With Holes)	298-0106-075	PTFE	1
	Diaphragm, PEEK, 6 Bolt Design (5" With Holes)	298-0123-000	PEEK	1
300	Ring, Intermediate, Leak Detection, (Contacting Diaphragm)	219-0111-016	316SS	1
	Ring, Intermediate Chamber, Double (Non-Contacting) Diaphragm	221-0865-016	316SS	1
325	Contour Plate- (Process Side) Leak Detection, (Contacting Diaphragm)	298-0091-016	316SS	1
		298-0091-028	Alloy 20	1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RA"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY
330	Head, Diaphragm - 6 bolt, 5" Diaph. Design 1996 (Models "RA", "RL", and "RP")	221-0859-001	Cast Iron	1
		221-0858-016	316SS	1
		221-0858-029	Alloy 20	1
		21194	Alloy C-22	1
350	Screw, Hex Head - 5/16" x 1-1/4"	405-0017-139	Steel	6
	Screw, Hex Head - 5/16" x 1-1/2" Leak Detection Ring/Head.	405-0017-149	Steel	6
	Screw, Hex Head - 5/16" x 2" Double Diaphragm/Head.	405-0017-169	Steel	6

6.6 DIAPHRAGM HEAD DESIGN- 8 BOLT (2-7/8") LIQUID END MODEL "RH" & "RT" (FIGURE 21)

281	Pin, Spring - 0.062 x ½	401-0001-061	Steel	1
282	Contour Plate–Oil Side - 2-1/2´´ (After 1998)	298-0107-006	Steel	1
	Contour Plate–Oil Side - 2-1/2´´ (Before 1998)	298-0007-016	316 SS	1
287	Contour Plate-Process Side	298-0007-016	316SS	1
		298-0007-028	Alloy 20	1
289	O-Ring - 2-039	21146	Viton	1
290	Diaphragm - 2-7/8" Diameter, 8 bolt Diaphragm Design	298-0005-275	PTFE	1
330	Head, Diaphragm - 2-7/8" Diameter, 8 bolt Diaphragm design	221-0179-001	Cast Iron	1
		221-0179-016	316SS	1
		221-0179-029	Alloy 20	1
		221-0179-030	Alloy C-22	1
350	Screw, Socket Head - 5/16-18, 1-1/4"	405-0028-134	Steel	6
355	Screw, Socket Head - 5/16–18, 2-1/2"	405-0028-184	Steel	2
460	O-Ring, Discharge Check Valve Cap	408-0068-043	PTFE	1
510	Cartridge Assembly, Discharge (Double Ball)	221-0897-216	316SS	1
		221-0897-228	Alloy 20	1
		221-0897-230	Alloy C-22	1
520	Nut, Locking, Check Valve	209-0020-014	Stainless Steel (303SS)	1
530	Ring, Spiral Back-up, Check Valve Lock Nut	408-0073-141	PTFE	2
540	O-Ring, Check Valve Lock Nut	408-0068-065	FKM (VITON)	2

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RA"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY
600	Cartridge Assembly, Suction (Double Ball) 1/2" NPT Connection	221-0896-216	316SS	1
		221-0896-228	Alloy 20	1
		221-0896-230	Alloy C-22	1
1390	Spring, Discharge Check Valve	280-0033-016	316SS	1
		280-0033-030	Alloy C-22	
		280-0033-026	Alloy C-276	1

6.7 DIAPHRAGM HEAD DESIGN- 8 BOLT (4") LIQUID END MODEL "RJ" (FIGURE 21)

290	Diaphragm, 8 bolt - 4" Diameter	298-0005-175	PTFE	1
330	Head, Diaphragm - 8 bolt, 4" Diameter	221-0632-116	Replaces Cast Iron	1
	Model "RJ" and all 5/8" Plunger Pumps Prior To 1996	221-0632-116	316SS	1
		221-0632-129	Alloy 20	1
		21324	Alloy C-22	1
350	Screw, Hex Head - 5/16-18, 1-1/4"	405-0017-139	Steel	6
	Screw, Hex Head, Double Diaphragm/ Head	Call Factory	Steel	8
355	Screw, Hex Head - 5/16–18, 2-1/2"	405-0017-189	Steel	2

6.8 MODEL "RP" SUCTION CHECK VALVE PARTS (FIGURE 20)

330	Head	221-0859-001	Cast Iron	1
		221-0858-016	316 SS	1
		221-0858-029	Alloy 20	1
		21194	Alloy C-22	1
570	Ball Check, Suction - 5/8"	407-0014-172	316 SS	1
		407-0014-173	Alloy 20	1
		407-0014-076	Alloy C	1
600	Valve Body, Suction	221-0864-016	316 SS	1
		221-0864-028	Alloy -20	1
		221-0864-030	Alloy C-22	1

6.9 MODEL "RA12" PLASTIC LIQUID END PARTS (FIGURE 20)

260	Sq. Ring 3.75 ID x 1/8 Wall (Models "RA", "RJ", and "RP" only)	408-0144-010	NBR	1
280	Contour Plate(Oil Side	298-0061-016	316 SS	1
290	Diaphragm 5"	298-0106-075	PTFE	1
330	Head	221-0845-071	PVC	1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RA"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY
340	Plate, Back-Up	271-0054-015	Steel	1
350	Screw, Hex Head - 5/16-18 x 2	405-0017-163	18-8 SS	6
360	Base, Simplex Mroy A	201-0441-006	Steel	1
	Base, Duplex Mroy A	201-0434-006	Steel	1
370	Screw, Hex Head - 5/16-18 x 1-1/4 Gr5	405-0017-139	Steel	3
390	Lock-Washer, Spring - 5/16	404-0040-028	Zinc Plated	3
400	Nut, Hex - 5/16-18NC	405-0065-013	18-8 SS	3
435	Seal- Head to Check Valve (PVC Checks)	408-0143-075	PTFE	2
500	Nut, Coupling - Tubing Connection ONLY	407-0350-079		2
490	Check Valve Assembly, Suction - Tube End	20287	PVC	1
Parts Included	O-Ring - 3/8 x 3/32	225-0032-675	PTFE	2
	Ball Stop	20289	PVC	2
	Seat	20290	PVC	2
	Ball, 3/8 Ad995	407-0015-111	Ceramic	2
	Body, Cartridge	20288	PVC	1
490	Suction Assembly, NPT	20299	PVC	1
Parts Included	O-Ring - 3/8 x 3/32	225-0032-675	PTFE	2
	Ball Stop	20289	PVC	2
	Seat	20290	PVC	2
	Ball, 3/8 Ad995	407-0015-111	Ceramic	2
	Body, Cartridge	20291	PVC	1
495	Discharge Assembly-Tube End	20292	PVC	1
Parts Included	O-Ring - 3/8 x 3/32	225-0032-675	PTFE	2
	Ball Stop	20289	PVC	2
	Seat	20290	PVC	2
	Ball, 3/8 Ad995	407-0015-111	Ceramic	2
	Body, Cartridge	20288	PVC	1
495	Discharge Assembly, NPT	20302	PVC	1
Parts Included	O-Ring - 3/8 x 3/32	225-0032-675	PTFE	2
	Ball Stop	20289	PVC	2
	Seat	20290	PVC	2
	Ball, 3/8 Ad995	407-0015-111	Ceramic	2
	Body, Cartridge	20291	PVC	1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RA"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER		MATERIAL/SPM	QUANTITY

6.10 MROY "RA" MOTOR MOUNT PARTS (FIGURES 18 & 19)

Close Coupled Flange Mount NEMA 56C (SR)

SR (NEMA 56C) Worm and Shaft Assembly includes Worm Shaft (640), Worm (650), Pin (660), Cone Bearing (670) and Spring (740).					
	Worm and Shaft Assembly	21594	77:1	23 spm @1725 RPM	1
	Worm and Shaft Assembly	21593	48:1	37 spm @1725 RPM	1
	Worm and Shaft Assembly	21590	24:1	73 spm @1725 RPM	1
	Worm and Shaft Assembly	21591	15:1	117 spm @1725 RPM	1
	Worm and Shaft Assembly	21592	9.5:1	185 spm @1725 RPM	1
640	Shaft, Worm	252-0157-006		Steel	1
650	Worm	252-0126-006	77:1		1
		252-0051-006	48:1		1
		252-0090-106	24:1		1
		252-0019-100	15:1		1
		252-0086-106	9.5:1		1
660	Pin, Spring	401-0005-091		Steel	1
670	Bearing, Cone	409-0064-010			1
710	Plate, Motor Mount	272-0130-062		Aluminum	1
720	Gasket, Motor	225-0115-099			2
730	Screw, Socket Head - 3/8 - 16 x 5/8	405-0029-086		Steel	4
740	Spring, Compr. Lee LHL-625-C-1	403-0166-011		Steel	1
770	Screw, Socket Head - 1/4-20 x 1	405-0027-111		Steel	2

Close Coupled Flange IEC Frame 71, B5 (SS)

SS (IEC Frame 71, B5) Worm and Shaft Assembly includes Worm Shaft (640), Worm (650), Pin (660), Cone Bearing (670) and Spring (740).					
	Worm and Shaft Assembly	252-0158-600	77:1	23 spm @1725 RPM	1
	Worm and Shaft Assembly	252-0158-700	48:1	37 spm @1725 RPM	1
	Worm and Shaft Assembly	252-0158-800	24:1	73 spm @1725 RPM	1
	Worm and Shaft Assembly	252-0158-900	15:1	117 spm @1725 RPM	1
	Worm and Shaft Assembly	252-0158-110	9.5:1	185 spm @1725 RPM	1
640	Shaft, Worm	252-0167-006		Steel	1
650	Worm	252-0126-006	77:1		1
		252-0051-006	48:1		1
		252-0090-106	24:1		1
		252-0019-100	15:1		1
		252-0086-106	9.5:1		1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RA"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER		MATERIAL/SPM	QUANTITY
660	Pin, Spring	401-0005-091		Steel	1
670	Bearing, Cone	409-0064-010			1
710	Plate, IEC Motor Mount	272-0142-062		Aluminum	1
720	Gasket, Motor	225-0115-099			1
-	Gasket, Motor IEC71	225-0121-099			1
730	SHCS - 8 MM x 1.25 x 30	405-2007-074		Steel	4
740	Spring	60059			1
770	Screw, Socket Head - 1/4 - 20 x 1	405-0027-111		Steel	2

Parts Common To ALL API Motor Mounts

FR (NEMA 56C) Stub Shaft Assembly includes Worm Shaft (640), Worm (650), Pin (660), Cone Bearing (670), & Ball bearing (680).					
	Stub Shaft Assembly	252-0144-500	77:1	23 spm @1725 RPM	1
	Stub Shaft Assembly	252-0144-100	48:1	37 spm @1725 RPM	1
	Stub Shaft Assembly	252-0144-400	24:1	73 spm @1725 RPM	1
	Stub Shaft Assembly	252-0144-000	15:1	117 spm @1725 RPM	1
	Stub Shaft Assembly	252-0144-300	9.5:1	185 spm @1725 RPM	1
640	Shaft, Worm	252-0110-006		Steel	1
650	Worm	252-0126-006	77:1		1
		252-0051-006	48:1		1
		252-0090-106	24:1		1
		252-0019-100	15:1		1
		252-0086-106	9.5:1		1
660	Pin, Spring	401-0005-091		Steel	1
670	Bearing, Cone	409-0064-010			1
680	Bearing, Ball	409-0094-020			1

API Flange Mount NEMA 56C (FR)

75	Plug, Expansion - 9/32	40059	Steel	2
690	Washer, Flat	219-0030-006	Steel	1
700	Spring, Finger - 0.563	403-0121-006	Steel	1
710	Adapter, Motor	272-0090-001	Cast Iron	1
770	Screw, Socket Head - 8-32NC x 3/4	405-0132-031	Steel	4
780	Coupling - 1/2 x 5/8 Key	410-0127-040		1
790	Screw, Hex Head - 3/8-16 x 1 GR5	405-0018-119	Steel	4
800	Plug, Sq. Head Pipe - 1/2" NPT	402-0009-137	Steel	1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RA"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY
	API Flange Mount NEMA 143/145TC (F4)			
75	Plug, Expansion - 9/32	40059	Steel	2
690	Washer, Flat	219-0030-006		1
700	Spring, Finger - 0.563	403-0121-006		1
710	Adapter, Nema 56c - 143/145 TC	272-0090-001		1
770	Screw, Socket Head - 8-32NC x 3/4	405-0132-031	Steel	4
780	Coupling - 5/8 x 7/8 3/16 Key	410-0064-120		1
790	Screw, Hex Head - 3/8-16 x 1 GR5	405-0018-119		4
800	Plug, Sq. Head Pipe - 1/2" NPT	402-0009-137	Steel	1
	API Flange Mount NEMA IEC Frame 71, B5 (FS)			
75	Plug, Expansion - 9/32	40059	Steel	2
690	Washer, Flat	219-0030-006		1
700	Spring, Finger - 0.563	403-0121-006		1
710	Adapter, Motor, mRoy A API IEC	272-0146-001		1
770	Screw, Socket Head - 8-32NC x 1/4	405-0132-031	Steel	4
780	Coupling - 1/2 x 14MM(Lovejoy L095)	40202		1
-	Nut, Hex - 5/16-18NC	405-0065-013		
790	Screw, Hex Head - 3/8-16 x 1 Gr5	405-0018-119	Steel	4
-	Lock-Washer, Spring - 5/16	404-0040-028		
800	Plug, Sq. Head Pipe - 1/2" NPT	402-0009-137	Steel	1
	API Flange Mount IEC 80 B5 (MD)			
75	Plug, Expansion - 9/32	40059	Steel	2
690	Washer, Flat	219-0030-006		1
700	Spring, Finger - 0.563	403-0121-006		1
710	Adapter, Motor - IEC 80 B5	272-0090-001		1
-	Plate, Motor Adapter	60199		1
770	Screw, Socket Head - 8-32NC x 3/4	405-0132-031	Steel	4
780	Coupling - 5/8 x 19mm (Lovejoy l-100)	40244		1
790	Screw, Hex Head - M10 x 25mm	435-0001-732	Steel	4
800	Plug, Sq. Head Pipe - 1/2" NPT	402-0009-137	Steel	1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RA"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY

6.11 ELECTRONIC CAPACITY CONTROL MOUNTING (FIGURE 24)

Complete Kits: 30268 for 7/16", 3/8", & 5/8" plungers & 335-1401-040 for 1-1/16" plunger) Parts included are below:

140	Plug, Adapter - 1-1/16" Plunger (1" NPT)	243-0045-020	Steel	1
	Plug, Adapter - 7/16, 3/8, & 5/8 Plunger (1/2" NPT)	243-0045-000	Steel	1
150	O-Ring, Parker - 2-011	408-0109-082	Polyurethane	3
160	Control Spool	268-0037-006	Steel	1
170	Sleeve, Threaded	243-0058-016	316SS	1
180	Screw, Socket Set - 6-32NC x 1/4	405-0039-035		1
190	Plate, % Capacity	253-0015-062	Aluminum	1
200	Ring, Calibration	253-0024-062	Aluminum	1
210	Knob, Capacity Adjust	255-0035-077	Acetal	1
213	Bearing, Control Spool ECC	237-0076-052		1
217	Washer, Thrust - 5/16	404-0147-031	Steel	1
220	E-Ring (1/4" for Control Knob)	404-0124-096	Steel	1
810	Coupling, Drive ECC	252-0138-077		1
820	Lock-Washer - #6	404-0104-071	Steel, Zinc Plated	2
830	Screw, Pan Head - 6-32NC x 3/8	405-0178-033	18.8SS	2
840	Bracket, Mounting, Mroy A ECC	204-0149-006		1
860	Nut, Serrated Flange - 1/4-20NC	405-0323-036	Steel, Zinc Plated	1
880	Screw, Socket Head - 5/16-18 x 5/8	405-0157-024	Steel / Nylon	1
900	Actuator (mRoy)	per SPEC		1
910	Shaft, Drive ECC Assembly: Includes Items 915 & 920.	268-0055-000		1
915	Pin, Dowel - 1/8" Assemble w/268-0052-077	401-0021-133		1
920	Pin, Spring - 0.187dia.x 5/8	401-0005-032	Steel	1
930	Lock-Washer, Spring - 3/8"	404-0041-022	18.8SS	4
935	Screw, Hex Head - 3/8-16 x 3/4	405-0018-096	Steel, Zinc Plated	4
950	Guard, Left Side ECC	249-0110-006	Steel	1
960	Guard, Right Side ECC	249-0109-006	Steel	1
970	Screw, Button Head - 10-32 x 5/16	405-0282-087	18.8SS	4
1440	Mroy ECC Instruction Manual	339-0083-000		1

6.12 PNEUMATIC CAPACITY CONTROL (3-15 PSI DIRECT, FIGURE 24)

150	O-Ring, Parker - 2-011	408-0109-082	Polyurethane	3
215	Adapter	272-0052-017		1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RA"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY
220	E-Ring (1/4" for Control Knob)	404-0124-096	Steel	1
980	Flange, Mount mRoy A PCC	204-0070-062	Aluminum	1
990	O-Ring - 0.921 x 0.139	408-0095-041	NBR	1
1000	Lock-Washer, Int. Tooth - #6	404-0104-071	Steel, Zinc Plated	1
1010	Screw, Rd. Head - 6-32NC x 7/16	405-0002-061	Steel, Zinc Plated	1
1020	Screw, Slotted Shoulder - 5/16-18	405-0299-000	Steel	1
1030	O-Ring, Parker - 2-011	408-0109-082	Polyurethane	1
1040	Piston	212-0051-062	Aluminum	1
1050	O-Ring, - 2-226	408-0095-171	NBR	1
1060	Screw, - 1/4-20 x 1/2	405-0112-039	Steel, Zinc Plated	1
1070	Gasket, Pneumatic Cylinder	225-0073-098		1
1080	Cylinder, Pneumatic	281-0173-198		1
1090	Spring, Actuator	280-0041-000		1
1100	Gasket, Pneumatic Positioner	225-0030-098		1
1110	Stud	232-0010-106	Steel	6
1120	Postioner, Moore	403-0043-002		1
1130	Nut, Hex - 1/4-20NC	405-0064-012	18.8SS	6
1140	Decal, Pneumatic % Capacity	253-0029-198		1
1440	Mroy PCC Instruction Manual	339-0004-000		1

6.13 SIMPLEX LEAK DETECTION PARTS, FIGURE 23 (DOUBLE QUANTITIES FOR DUPLEX PUMPS)

260	Ring, Sq. - 3.75 Idx1/8wall (Models "RA", "RJ", and "RP" only)	408-0144-010	NBR	1
290	Diaphragm (5" with holes) "RA"	298-0106-075	PTFE	2
	Diaphragm (4", 8 bolt design) "RJ"	298-0005-175	PTFE	2
300	Ring Assembly, Intermediate "RA"	219-0111-016	316 SS	1
	Ring Assembly, Intermediate "RJ"	219-0127-000	316 SS	1
320	Contour Plate, Process Side	298-0091-016	316 SS	1
325	Contour Plate, Oil Side	298-0091-016	316 SS	1
350	Screw, Hex Head - 5/16-18 x 1-1/2 Gr5, "RA" and "RJ"	405-0017-149	Steel	6
355	Screw, Hex Head - 5/16-18 x 2-3/4 Gr5, "RJ"	405-0017-199	Steel	2
360	Base, Simplex Mroy A	201-0441-006	Steel	1
	Base, Duplex Mroy A	201-0434-006	Steel	1
370	Screw, Hex Head - 5/16-18 x 1-1/4 Gr5	405-0017-139	Steel	3
380	Bracket	204-0199-006	Steel	1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RA"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY
390	Lock-Washer, Spring - 5/16	404-0040-028	Zinc Plated	3
400	Nut, Hex - 5/16-18nc	405-0065-013	18-8 SS	3
1150	Check Valve - 1/8tube, 1/3 PSI	40065	316 SS	1
1160	Gage, Press - 0-400psi, Dual Flange Mount	40066		1
	Gage, Press - 1000psi, Dual Flange Mount	40176		1
1170	Adapter, Red - 1/4f x 1/8m, NPT	40067	316 SS	1
1180	Tee, Branch - 1/8NPTf 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	Valve, Bleed - 1/8 NPT	40063	316 SS	1
1220	Screw, Pan Head - 4-40 x 1/2	405-0263-050	Zinc Plated	3
1230	Lock-Washer, Spring #4	404-0095-023	18-8 SS	3
1240	Nut, Hex - 4-40nc	405-0182-012	18.8 SS	3
1250	Switch, Pressure, Nema 4 - 5-30 PSI	406-0388-001		1
1250	Switch, Pressure, Nema 7 - 5-30 PSI	406-0389-001		1
1260	Nipple, Red Hex - 1/2x1/8, NPT	40064	316 SS	1
1270	Screw, Hex Head - 1/4-20x3/4	405-0016-095	18-8 SS	2
1280	Lock-Washer, Spring - 1/4	404-0039-022	18.8 SS	2
1290	Nut, Hex - 1/4-20nc	405-0064-012	18.8 SS	2
1300	Tubing, Pump To Gauge (formed)	249-0137-116		1
	Tube - 1/8 od x 0.035 wall	402-0502-993	316 SS	12 in.
1320	Tubing, Gauge To Switch Nema 4	249-0136-016		1
	Tubing, Gauge To Switch Nema 7	249-0138-016		1
	Tubing, - 1/8 od x 0.035 wall	402-0502-993	316 SS	20 in.
1440	Leak Detector Instruction Manual	339-0036-000		1
1470	Mineral Oil (available at drug stores)			

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RA"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY

6.14 DOUBLE DIAPHRAM PARTS (FIGURE 23)

260	Ring, Sq. - 2-240S (Models "RA", "RJ", and "RP" only)	408-0144-010	Nitrile	1
285	Contour Plate, Process Side, also used with double non-contacting diaphragms)	298-0061-016	316SS	1
		298-0061-028	Alloy 20	1
		298-0061-030	Alloy C-22	1
290	Diaphragm (5" with holes), model "RA"	298-0106-075	PTFE	2
	Diaphragm (4", 8 bolt design), model "RJ"	298-0005-175	PTFE	2
300	Ring Assembly, Intermediate	20536		1
-	Probe, Alarm Conductivity	301-0307-000		1
310	Plug, - 1/8" THRD. SQ Head Pipe	402-0011-013		1
350	Screw, Hex Head - 5/16-18 x 3	402-0017-233	Steel	6

-	Oil, Vegetable	40104		0.013 Gal

- Parts Not Illustrated

Parts Continued Next Page

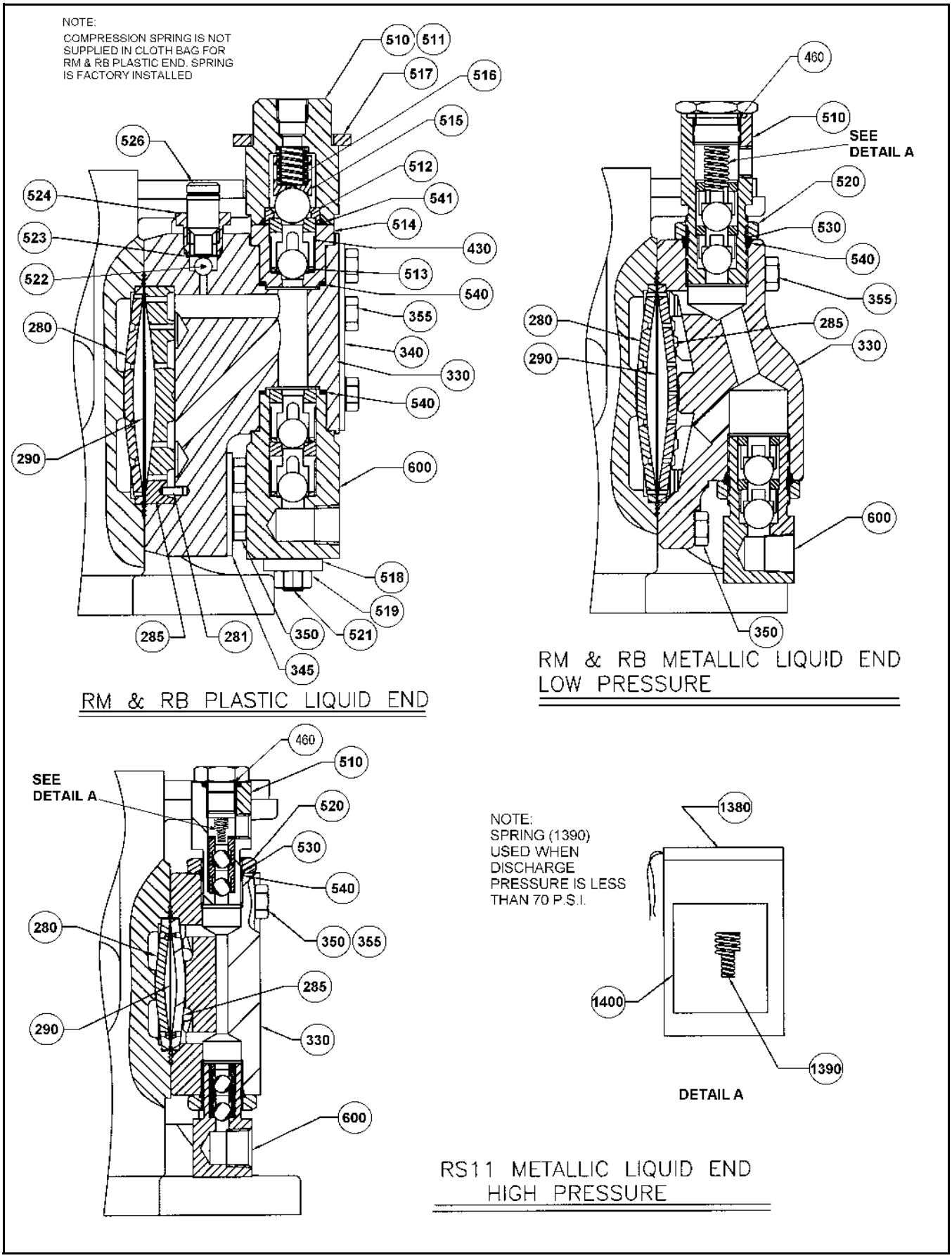


Figure 25. mRoy B Metallic and Plastic Liquid End (DWG 102-2146-0002)

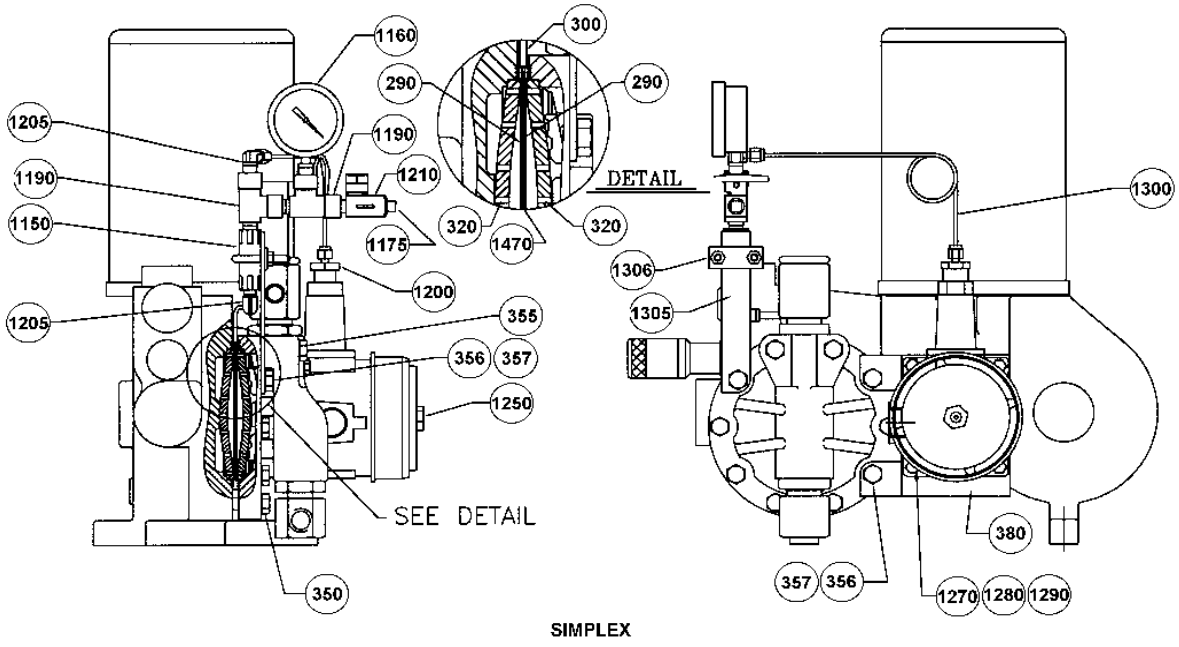


Figure 26. mRoy B Leak Detection With Switch and Gauge (DWG 102-2146-0004)

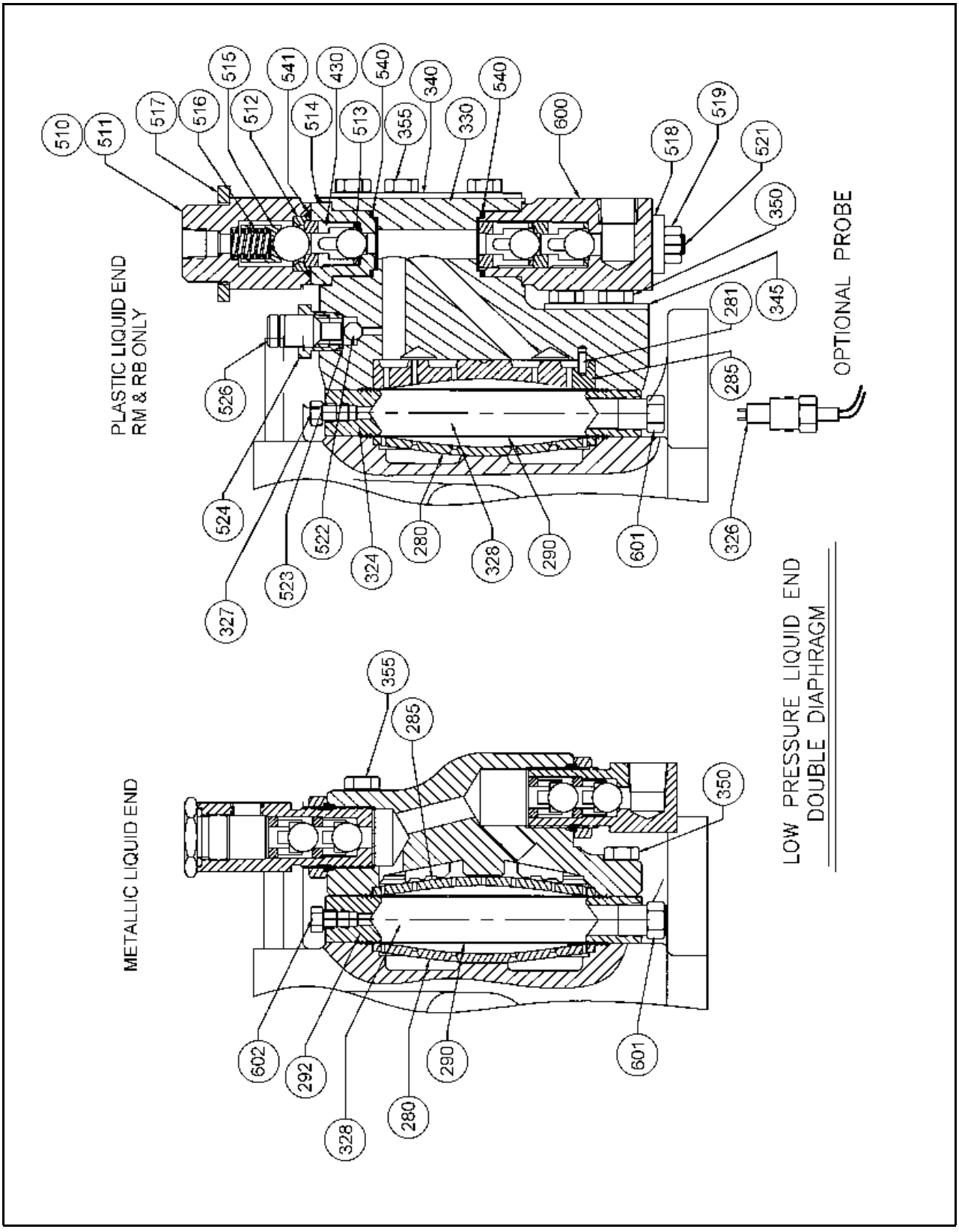


Figure 27. mRoy B Double Diaphragm (DWG 102-2146-0007)

6.15 BASIC PARTS LIST FOR DRIVE MODELS “RB” (“RS”, “RM”, “RB”) (FIGURES 18 & 19)

DRIVE MODEL “RB”

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY
10	Housing, Main Simplex 19/32"	281-0104-101		1
	Housing, Main Duplex 19/32"	281-0148-101		1
	Housing, Main Simplex 7/8"	281-0104-301		1
	Housing, Main Duplex 7/8"	281-0148-301		1
	Housing, Main Simplex 1 7/16"	281-0104-201		1
	Housing, Main Duplex 1 7/16"	281-0148-201		1
20	Cup, Race	409-0066-020	Steel	1
30	Poppet, Relief Valve	212-0057-074	Nylon	1
40	Spring, Relief Valve	280-0046-541	Steel	1
50	Adjusting Screw, Relief Valve	256-0037-051	Brass	1
60	Plug - 1/4" NPT, Sq. Head	402-0009-111		1
90	Plunger, 19/32 "RS"	22714		1
	Plunger, 7/8 "RM"	22716		1
	Plunger, 1-7/16 "RB"	22715		1
100	Rod, Connecting	214-0013-162	Aluminum	1
110	Pin, Dowel 5/8x1-1/2	401-0028-031	Steel	1
120	Gear, Worm (Ratio 38:1)	252-0094-201	48 spm Simplex	1
	Gear, Worm (Ratio 38:1)	252-0095-001	48 spm Duplex	1
	Gear, Worm (Ratio 25:1)	252-0082-201	72 spm Simplex	1
	Gear, Worm (Ratio 25:1)	252-0058-001	72 spm Duplex	1
	Gear, Worm (Ratio 19:1)	252-0092-201	96 spm Simplex	1
	Gear, Worm (Ratio 19:1)	252-0093-001	96 spm Duplex	1
	Gear, Worm (Ratio 12.5:1)	252-0081-201	144 spm Simplex	
	Gear, Worm (Ratio 12.5:1)	252-0057-001	144 spm Duplex	1
	Gear, Worm (Ratio 9.5:1)	252-0088-201	148 SPM Simplex, 1425 RPM	1
130	Gear Shaft	268-0030-006	Simplex, Steel	1
	Gear Shaft	268-0022-006	Duplex, Steel	1
140	Plug, 1-1/4 NPT, Socket Hex Head	402-0095-071		1
	Plug, 3/4 NPT, Socket Hex Head, Models “RM” & “RS”	402-0095-051		1
150	O-Ring, Parker 2-113, Control Spool	408-0068-032	Urethane	3
160	Control Spool	268-0049-006	Steel	1
170	Sleeve, Threaded, Mroy B ECC	243-0059-051		1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RB"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY
180	Screw, Socket Set, Cup Pt. - 6-32NC x 1/4	405-0039-035		1
190	Decal, Capacity	253-0026-062		1
200	Ring, Calibration	253-0025-062	Aluminum	1
210	Knob, Control	255-0020-062	Aluminum	1
220	E Ring Clip, External	404-9983-151		1
230	Plunger, Control	212-0048-039		1
240	Arm, Linkage	214-0014-006		1
250	Screw, Socket Head - 8-32NC x 1/2	405-0245-031	Steel	2
1061	Screw, Socket Set - 7/16-14 x 3/8	405-0133-024	Steel	2
1062	Screw, Socket Head - 8-32 x 1-5/8 (Locking Micrometer)	40224	Steel	1
1063	Nut, Hex - 8-32 NC 18-8SS (Locking Micrometer)	405-0061-017	Steel	1
1330	Cap, Reservoir Simplex	249-0106-276		1
	Cap, Reservoir Duplex	281-0269-000		1
1340	O-Ring, Parker - 2-216, Simplex, Reservoir Cap	408-0095-071	BUNA	1
	O-Ring Parker - 2-216, Duplex, Reservoir Cap	408-0095-075	VITON	1
1350	Screw Plug - 7/8-14	405-2001-021	Plastic	1
-	Plate, Data	253-0186-000		1
-	Screw, Stick For Data Plate, 5/32	405-0280-000	Steel	1
-	Decal, Caution Motor	253-0021-198		1
Lubrication				
-	Oil, Gear - EP-35	407-0195-010	1 Quart	1
-	Oil, Gear - EP-95	407-0152-010	1 Quart	1
-	Oil, Gear - EP-95	407-0152-040	1 Gallon	A/R

6.16 LIQUID END "RB" & "RM" (FIGURE 25)

280	Contour Plate - Oil Side	298-0012-006	Steel	1
285	Contour Plate - Process Side	298-0016-016	316 SS	1
		298-0016-028	Alloy 20	1
		298-0016-030	Alloy C-22	1
290	Diaphragm - 5.230 Dia.	298-0013-075	PTFE	1
350	Screw, Hex Head - 7/16-14 x 1-1/2 Gr5	405-0019-149	Steel	8
355	Screw, Hex Head - 7/16-14 x 2-3/4	405-0019-191	Steel	2

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RB"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY
330	Head, Diaphragm	221-0214-001	Cast Iron	1
		221-0215-016	316 SS	1
		221-0215-029	Alloy 20	1
		221-0215-030	Alloy C22	1
-	Base, Simplex	201-0395-000		1
	Base, Duplex	201-0428-000		1
370	Screw, Hex Head - 5/16-18 x 1-1/2 Gr5	405-0017-149	Steel	3
390	Lock-Washer, Spring - 5/16	404-0040-028	Zinc Plated	3
400	Nut, Hex - 5/16-18NC	405-0065-013	18-8 SS	3
460	O-Ring, Discharge Check Valve Cap	408-0068-043	PTFE	1
510	Check Valve Assembly, Discharge	221-0156-016	316 SS	1
		221-0156-028	Alloy 20	1
		30577	Alloy C22	1
	Check Valve Assembly, Discharge (Slurry Applications)	22077	316SS	1
520	Nut, Lock	209-0021-017	416 SS	1
530	Back Up Ring, Spiral	408-0073-221	PTFE	1
540	O-Ring, Check Valve Locking Nut - 3-916, 1.171 x 0.116,	408-9998-151	VITON	1
600	Check Valve Assembly, Suction	221-0154-016	316 SS	1
		221-0154-028	Alloy 20	1
		30578	Alloy C22	1
	Check Valve Assembly, Suction (Slurry Applications)	22078	316SS	1
1390	Spring, Compression	280-0038-016	316SS	1
		280-0038-026	Alloy C-276	1

6.17 LIQUID END "RS" (FIGURE 25)

280	Contour Plate - Oil Side	298-0014-006	Steel	1
285	Contour Plate - Process Side	298-0014-006	Steel	1
		298-0014-016	316 SS	1
		298-0014-028	Alloy 20	1
		298-0014-030	Alloy C-22	1
290	Diaphragm - 3.390 Dia.	298-0015-075	PTFE	1
330	Head, Diaphragm	221-0212-001	Cast Iron	1
		221-0213-016	316 SS	1
		221-0213-029	Alloy 20	1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RB"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY
		221-0213-030	Alloy C-22	1
350	Screw, Hex Head - 7/16-14 x 1-1/2	405-0019-149	Steel	4
355	Screw, Hex Head - 7/16-14 x 2-1/4	405-0019-171	Steel	4
-	Base, Simplex	201-0395-000		1
	Base, Duplex	201-0428-000		1
370	Screw, Hex Head - 5/16-18 x 1-1/2 Gr5	405-0017-149	Steel	3
390	Lock-Washer, Spring - 5/16	404-0040-028	Zinc Plated	3
400	Nut, Hex - 5/16-18NC	405-0065-013	18-8 SS	3
460	O-Ring, Discharge Check Valve Cap	408-0068-113	PTFE	1
510	Check Valve, Discharge	221-0897-216	316 SS	1
		221-0897-228	Alloy 20	1
		221-0897-230	Alloy C-22	1
520	Nut, Lock - Check Valve	209-0020-014	303 SS	1
530	Ring, Spiral Back Up	408-0073-141	PTFE	1
540	O-Ring, Check Valve Lock Nut - 2-116,	408-0068-065	FKM (VITON)	1
600	Check Valve, Suction	221-0896-216	316 SS	1
		221-0896-228	Alloy 20	1
		221-0896-030	Alloy C-22	1
1390	Spring	280-0033-016	316 SS	1
		280-0033-026	Alloy C-22	1

6.18 MODEL "RB12" & "RM12" PLASTIC LIQUID END PARTS (FIGURE 25)

Conversion Kit (P/N: PARTSKIT307) includes the following parts:

280	Contour Plate	298-0012-006	Steel	1
281	Pin, Orientation	211-0043-071	PVC	1
285	Contour Plate	298-0038-071	PVC	1
290	Diaphragm - 5.230 Dia.	298-0013-075	PTFE	1
330	Head, Diaphragm	221-0359-071	PVC	1
-	Head Assembly Kit, Diaphragm (Includes 330, 522, 523, 524, 526, and 527)	221-0393-100		1
340	Reinforcing Plate, Upper	204-0088-016	316SS	1
345	Reinforcing Plate, Lower	204-0089-016	316SS	1
350	Screw, Hex Head - 7/16-14 x 2-1/2	405-0019-187	18-8S	4
355	Screw, Hex Head - 7/16-14 x 5	405-0019-297	18-8SS	6
-	Base, Simplex	201-0395-000		1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RB"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY
-	Base, Duplex	201-0428-000		1
510	Check Valve Assembly, Discharge (Includes 430, 511, 512, 513, 514, 515, 516, and 541)	221-0464-007	PVC	1
		221-0464-009	PVDF	1
517	Plate, Compression	204-0091-016	316 SS	1
518	Plate, Compression	204-0090-016	316SS	1
519	Nut, Hex - 5/16-18NC	405-0065-013	18-8SS	4
521	Stud - 5/16-18UNC x 10 1/4	232-0014-216	316SS	2
522	Ball - 3/8" Dia.	407-0015-111	Ceramic AD995	1
523	Diaphragm - 0.703 Dia.	298-0062-075	PTFE	1
524	Bushing - 1/2 NPT	237-0049-171	PVC	1
526	Plug, Purge	243-0047-171	PVC	1
527	Connector, (Tubing ¼ x ¼)	402-0479-028	PVC	1
540	O-Ring, - 3-916, 1.171 x 0.116, Check Valve	408-9998-151	FKM (VITON)	2
600	Check Valve Assembly, Suction	221-0360-007	PVC / Ceramic Ball	1
		221-0360-009	PVDF	1

6.19 MROY "RB" MOTOR MOUNTS (FIGURES 18 & 19)

Parts Common To All Motor Mounts

Worm and Shaft Assembly includes Stub Shaft (640), Worm (650), Spring Pin (660), Tapered Roller Bearing (670), and Single Roll Bearing (680).

	Worm and Shaft Assembly	252-0142-401	38:1	48 spm @1725 RPM	1
		252-0142-000	25:1	72 spm @1725 RPM	1
		252-0142-300	19:1	96 spm @1725 RPM	1
		252-0142-100	12.5:1	144 spm @1725 RPM	1
		252-0047-200	9.5:1	148 spm @1425 RPM	1
640	Stub Shaft	252-0143-006			1
	Stub Shaft (9.5:1 Only)	252-0048-006			1
650	Worm	252-0094-106	38:1	48 spm @1725 RPM	1
		252-0082-106	25:1	72 spm @1725 RPM	1
		252-0092-106	19:1	96 spm @1725 RPM	1
		252-0081-106	12.5:1	144 spm @1725 RPM	1
		252-0088-106	9.5:1	148 spm @1425 RPM	1
660	Pin, Spring 0.187 x 1	401-0005-091		Steel	1
670	Bearing, Tapered Roller	409-0066-010			1
680	Bearing, Single Row	409-9994-000			1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RB"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY
	API Flange Mount NEMA 56C (FR)			
690	Seal, Oil	408-9997-011		1
700	Spring, Finger	403-0121-009		1
710	Adapter Nema 56c - 143/145 TC	272-0051-001		1
770	Screw, Socket Head - 10-32 x 3/4	405-0026-094	Steel	2/4
780	Coupling - 5/8 x 5/8, Key 3/16	410-0064-020		1
790	Screw, Hex Head - 3/8-16 x 1 Gr5	405-0018-119	Steel	1
	API Flange Mount 143/145 TC			
690	Seal, Oil	408-9997-011		1
700	Spring, Finger	403-0121-009		1
710	Adapter Nema 56c - 143/145 TC	272-0051-001		1
770	Screw, Socket Head - 10-32 x 3/4	405-0026-094	Steel	2/4
780	Coupling - 5/8 x 7/8 3/16 Key	410-0064-090		1
790	Screw, Hex Head - 3/8-16 x 1 Gr5	405-0018-119		4
	API Flange Mount IEC 80 B5			
690	Seal, Oil	408-9997-011		1
700	Spring, Finger	403-0121-009		1
-	Lock-Washer, Spring - 3/8"	404-0041-022	18-8 SS	1
-	Nut, Hex - 3/8-16NC	405-0066-012	18-8 SS	1
710	Adapter, Motor - IEC 80 B5	607-20388-001		1
770	Screw, Socket Head - 10-32 x 3/4	405-0026-094	Steel	2/4
780	Coupling Assembly - 5/8 x 19mm	39238		1
790	Screw, Hex Head - 3/8-16 x 1-1/4	405-0018-136	Zinc Plated	1
800	Plug, Sq. Head Pipe - 3/8"	402-0011-031	Steel	1
	API Flange Mount IEC 90 B5			
690	Seal, Oil	408-9997-011		1
700	Spring, Finger	403-0121-009		1
-	Lock-Washer, Spring - 3/8"	404-0041-022	18-8 SS	4
-	Nut, Hex - 3/8-16NC	405-0066-012	18-8 SS	4
710	Adapter, Motor - IEC 80 B5	607-20388-001		1
780	Coupling Assembly - 5/8 x 24mm	30459		1
790	Screw, Hex Head - 3/8-16 x 1-1/4	405-0018-136	Zinc Plated	4
800	Plug, Sq. Head Pipe - 3/8"	402-0011-031	Steel	1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RB"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY

6.20 ELECTRONIC CAPACITY CONTROL MOUNTING (FIGURE 24)

140	Plug, Adapter - 1-7/16 and 7/8 Plunger 1-1/4 NPT	243-0045-030		1
	Plug, Adapter - 19/32 Plunger, 3/4 NPT	243-0045-010		1
170	Sleeve, Threaded Mroy B ECC	243-0059-051		1
180	Screw, Socket Set - 6-32NCx1/4	405-0039-035		1
190	Decal, Capacity	253-0026-062		1
200	Ring, Calibration	253-0025-062	Aluminum	1
210	Knob, Capacity Adjust	255-0036-077	Acetal	1
213	Bearing, Control Spool	237-0075-052		1
217	Washer, Thrust - 1/2"	404-0147-051	Steel	1
220	Clip, E Ring - External	404-9983-151		1
810	Coupling, Drive	252-0120-077		1
820	Lock-Washer, Internal Tooth - 8	404-0104-082	Zinc Plated	2
830	Screw, Pan Head - 8-32NC x 1/2	405-0179-073	18-8 SS	2
840	Bracket, Mounting	204-0148-006	Steel	1
850	Stud, Mounting	232-0033-006		1
860	Nut, Serrated Flange - 1/4-20NC	405-0323-036	Zinc Plated	1
880	Screw, Socket Head - 5/16-18 x 5/8	405-0157-024	Steel	1
880	Bolt, Tri-Groove - 5/16 x 3/4 L	405-0336-011		1
900	Actuator, Mroy	Per Spec		1
910	Shaft, Drive	268-0053-077	Acetal	1
915	Pin, Dowel - 1/8 x 1-3/8	401-0021-143	Steel	1
920	Pin, Spring, 0.187 x 13/16 CRS	401-0005-062		1
930	Lock-Washer, Spring - 3/8	404-0041-022	18-8 SS	4
935	Screw, Hex Head - 3/8-16 x 3/4	405-0018-096	Zinc Plated	4
950	Guard, Side	249-0108-006		2
970	Screw, Button Head - 10-32 x 5/16	405-0282-087	18-8 SS	4
1442	Mroy ECC Instruction Manual	339-0002-000		1
1460	Label, Warning	253-0097-000		1

6.21 SIMPLEX LEAK DETECTOR PARTS- GAUGE & NEMA SWITCH (FIGURE 26)

Double Quantities For Duplex Pumps

290	Diaphragm, 5.230 Dia.	298-0013-075	PTFE	2
	Diaphragm, 3.390 Dia., "RS"	298-0015-075	PTFE	2
300	Ring Assembly, Intermediate	219-0089-116	316 SS	1
	Ring Assembly, Intermediate "RS"	179-1260-116	316 SS	1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL “RB”

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY
320	Contour Plate	298-0092-016	316 SS	2
	Contour Plate	298-0092-028	C-20	2
	Contour Plate, “RS”	298-0101-016	316 SS	2
350	Screw, Hex Head - 7/16-14 x 1-3/4	405-0019-151		5
	Screw, Hex Head - 7/16-14 x 1-3/4, “RS”	405-0019-151		1
355	Screw, Hex Head Screw - 7/16-14 x 3	405-0019-201		2
	Screw, Hex Head - 7/16-14x3, “RS”	405-0019-181		4
356	Screw, Hex Head - 7/16-14 x 2	405-0019-161		3
357	Washer, Flat - SAE 7/16	404-0151-013	Zinc Plated	3
-	Base, Simplex	201-0395-000		1
	Base, Duplex	201-0428-000		1
380	Bracket, Switch	204-0159-006		1
	Bracket, Switch, “RS” Only	179-1239-015		1
1150	Check Valve - 1/4 NPT	407-0315-701	316 SS	1
1160	Gage, Press, 0-1500psi Dual Scale	403-0151-110		1
1175	Plug, Pipe - 1/4, Threaded, “RS”	402-0011-023	316 SS	1
1190	Tee, Street - Ss-4st 1/4"	402-0560-022		2
1200	Connector, Male -1/8 x 1/2	402-0558-192	316 SS	1
1205	Elbow, Male - 1/8 tube1/4 NPT	402-0553-042	316 SS	2
1210	Plug, Valve - 1/4 Male/Female	407-0314-082	316 SS	1
1250	Switch, Pressure, Nema 4 - 5-30psi	406-0388-001		1
	Switch, Pressure, Nema 7 - 5-30psi	406-0389-001		1
1270	Screw, Hex Head - 1/4-20x3/4	405-0016-095	18-8 SS	4
1280	Nut, Hex - 1/4-20NC	405-0064-012	18-8 SS	4
1290	Lock-Washer, Spring 1/4	404-0039-022	18-8 SS	4
1300	Pilot Line	249-0117-016	316 SS	1
	Pilot Line, “RS” - 1/8 Dia.	179-1262-000	316 SS	1
1305	Bracket, Support	204-0156-015		1
	Bracket, Support “RS”	179-1238-015		1
1306	Bolt, - 1/4”-20 "U" Clamp	410-0153-000	Steel	1
1440	Mroy Leak Detector Instruction Manual	339-0036-000		1
1470	Mineral Oil (available at drug stores)	407-0317-020	Oz.	1

- Parts Not Illustrated

Parts Continued Next Page

DRIVE MODEL "RB"

DRAWING LOCATION NUMBER	DESCRIPTION	PART NUMBER	MATERIAL/SPM	QUANTITY

6.22 DOUBLE DIAPHRAGM PARTS FOR METALLIC LIQUID END (FIGURE 27)

280	Contour Plate - Oil Side	298-0012-006		
285	Contour Plate - Process Side	298-0016-016	316 SS	1
		298-0016-028	Alloy 20	1
		298-0016-030	Alloy C-22	1
290	Diaphragm - 5.230 Dia.	298-0013-075	PTFE	2
292	Intermediate Chamber	20539	316 SS	1
328	Oil, Vegetable	40104		105-115 ml (3.6-3.9 oz)
350	Screw, Hex Head - 7/16-14 x 2 1/2	405-0019-181	Steel	8
355	Screw, Hex Head - 7/16-14 x 3 3/4	40894	Steel	2
601	Plug, Pipe - 3/8" Threaded	402-0011-033	316 SS	1
602	Plug, Pipe - 1/8" Threaded	402-0011-013	316 SS	1

6.23 DOUBLE DIAPHRAGM PARTS- WITH CONDUCTIVITY PROBE FOR PLASTIC LIQUID END ("RM" & "RB") (FIGURE 27)

290	Diaphragm 5.230 Dia.	298-0013-075	PTFE	2
324	Intermediate Chamber	20539	316 SS	1
326	Probe, Alarm Conductivity	301-0307-000		1
	Plug, Pipe - 3/8", Used without Alarm Probe	402-0011-033	316SS	1
327	Plug, Pipe - 1/8" Threaded	402-0011-013	316 SS	1
328	Oil, Vegetable	40104		105-115 ml (3.6-3.9 oz)
355	Screw, Hex Head - 7/16-14 X 3 1/2	40448	18-8 SS	4
	Screw, Hex Head - 7/16-14 X 6	40447	18-8 SS	6

- Parts Not Illustrated

Parts Continued Next Page

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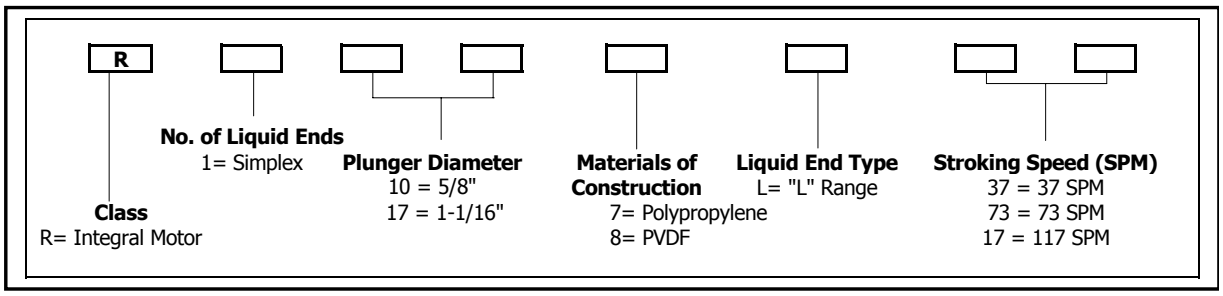
APPENDIX A
MODEL CODE HISTORY

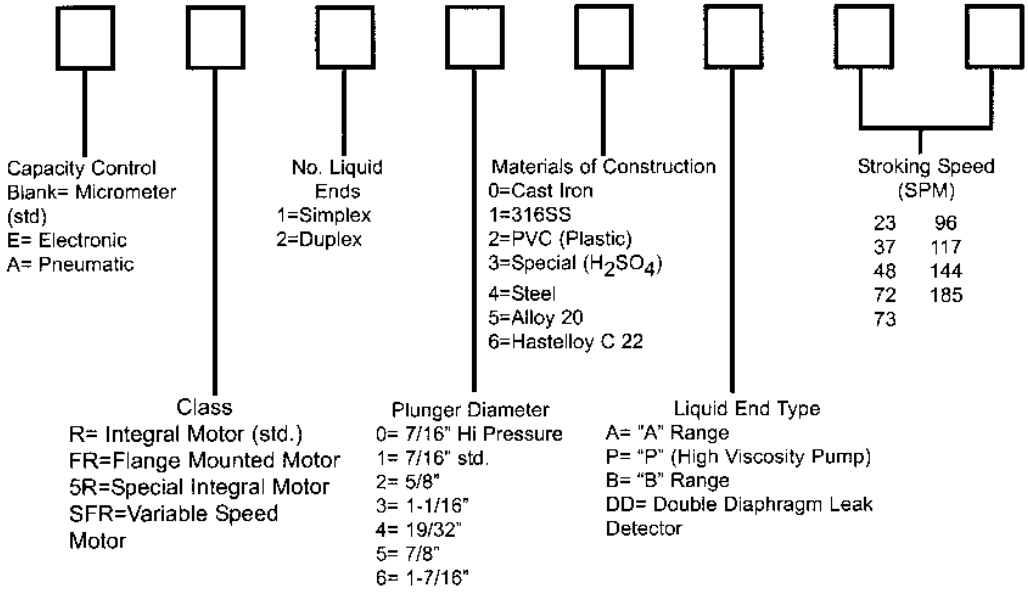
Mroy L History



PUMP SPECIFICATIONS (mRoy L) :

- Liquid End: Hydraulically actuated, simplex only
- Plunger Diameter: 5/8" or 1-1/16"
- Capacity Range: 0.2 GPH to 18 GPH (0.752 LPH to 68 LPH)

Mroy A History



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