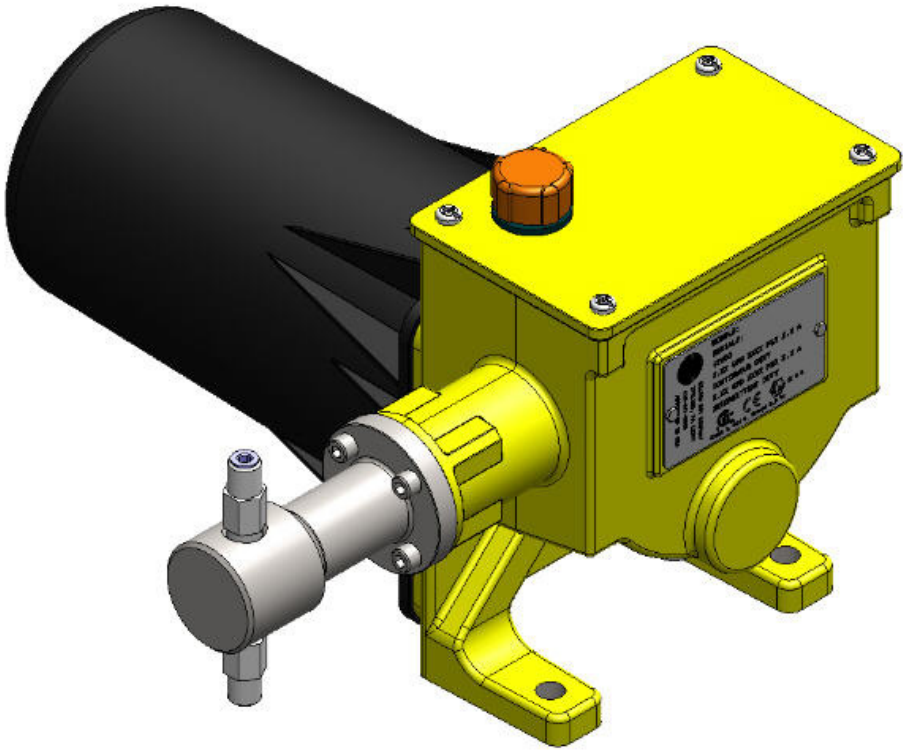
SOLAROY®
MILTON ROY

SOLAROY®
12 VDC Metering Pump



INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

MODEL NUMBER: SR-1PS-TC250 and SR-1PS-TC375

Manual #23858
Revision 2/2012

Precautions / Warnings:

- Proper fuse installation (to be done at the controller not at pump side (ie. we don't want the fuse in the pump's motor cover compartment)
- Break in period typically (1 week of operation) Unit should be recalibrated.
- Pump should be mounted securely.
- Pump must properly grounded to earth.

SOLAROY® Pump Product Code

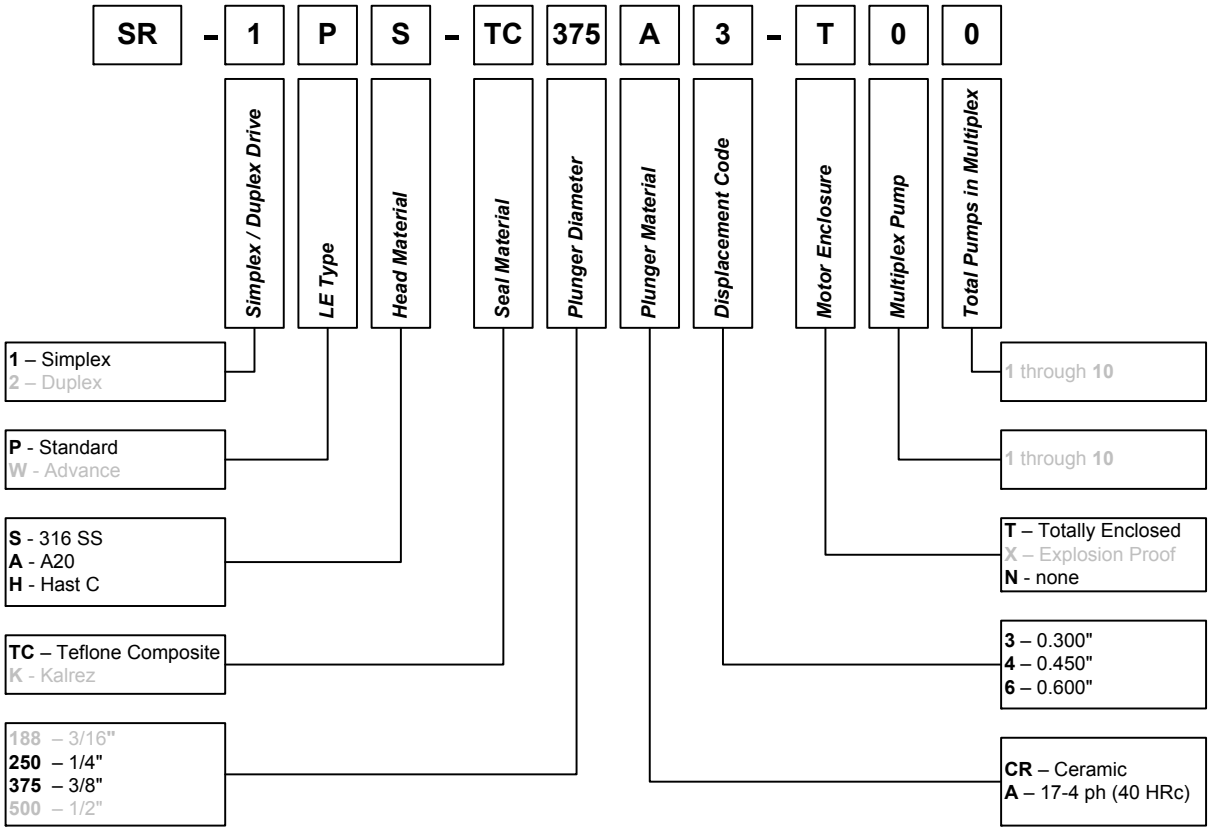
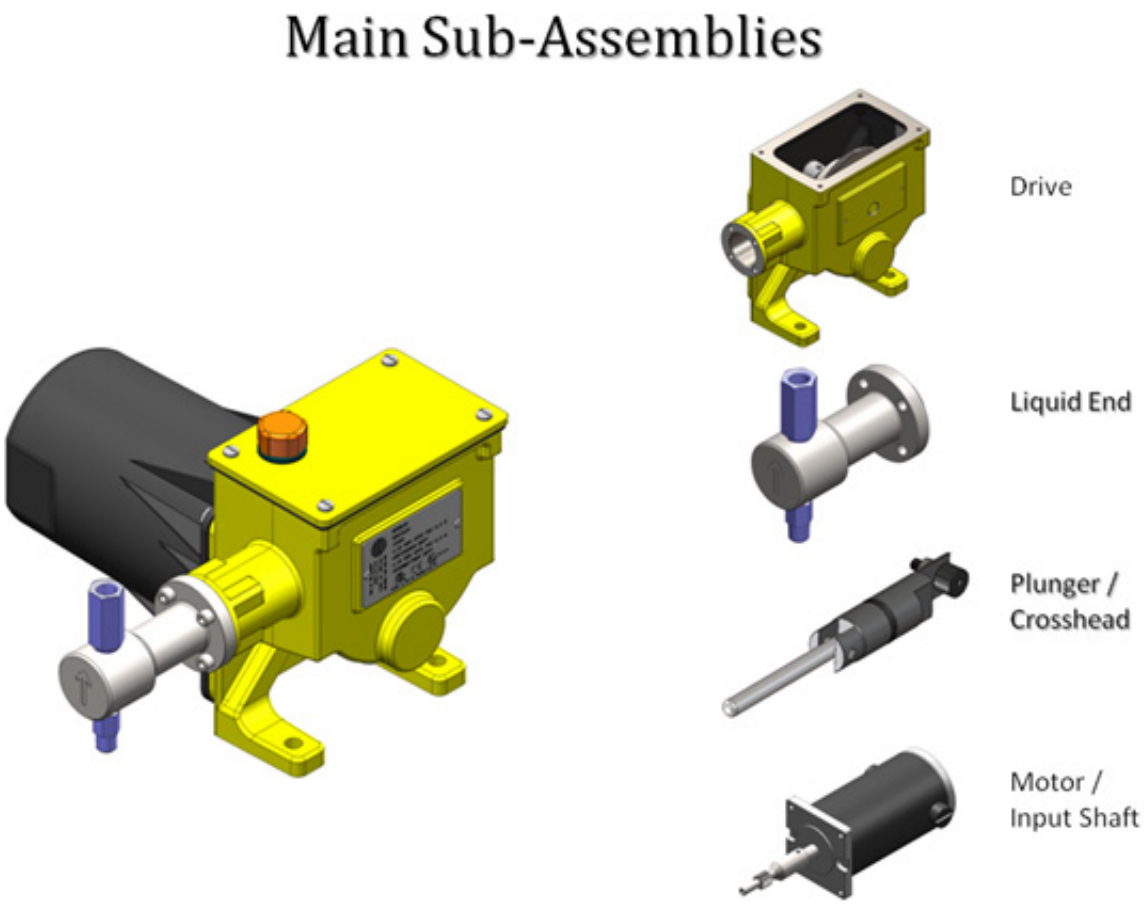


Table of Contents:

SECTION 1 – FUNCTIONAL DESCRIPTION

Milton Roy pumps are composed of four main assemblies: the pump drive, liquid end, plunger/crosshead, and the motor/input shaft. The drive generates the mechanical energy and the liquid end displaces the process chemical. This is an instruction manual for Milton Roy's SOLAROY® Solar powered chemical pump and is designed to serve as both general information and specific instructions for installing, operating, and maintaining the Milton Roy **SOLAROY®** pumps. Do not rely on this manual alone when installing, maintaining and operating Milton Roy pumps.



1.1 PHYSICAL DESCRIPTION

The **SOLAROY®** pump is designed for reliable performance in remote, solar powered applications with a solar array is used to charge a battery that provides power to operate the pump. The amount of injection can be adjusted by using a timing device to control the amount of "on-time" and "off-time" or 12 VDC power the pump motor receives. To increase the amount of injection the "on-time" is increased or the "off-time" is shortened to allow for more injection events to occur. Proper sizing of the solar array for the location required along with the number of days the unit needs to operate occurs is required.

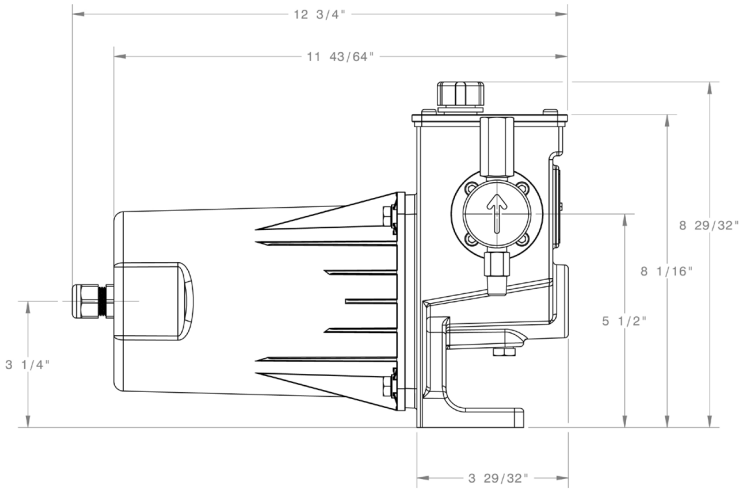
1.2 PRINCIPLE OF OPERATION

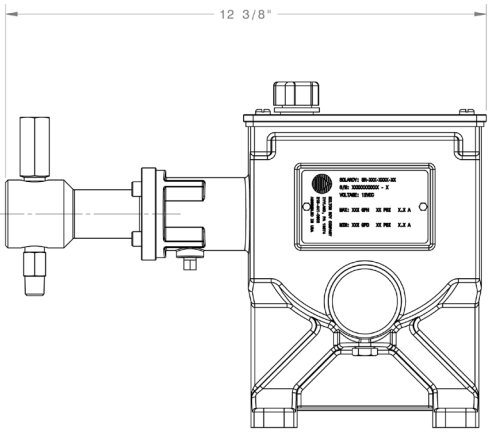
The mechanical drive system of the pump drives the plunger back and forth in the liquid end of the pump. The pump operating cycle consists of fluid being discharged from the liquid end and suctioned into it.

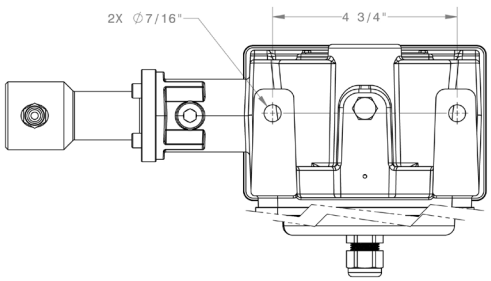
At the start of a suction stroke, the plunger is pulled out of the liquid end, increasing the volume of the chamber and thus lowering the pressure of the chamber fluid. This lower pressure causes the balls in the discharge check valve to seat and causes chemical to flow through the suction check crosshead. The crosshead has a cam follower which rides in an eccentric cam that is part of the spur gear reducer. With the discharge ball check closed, flow is prevented from flowing into the discharge line. The plunger is drawn back, because it is mechanically attached to the crosshead which moves back and forth as it follows the travel of the cam.

At the end of the suction stroke, the process reverses, beginning the discharge stroke. The plunger is then pushed into the liquid end, increasing the volume of the chamber and thus raising the pressure in the chamber fluid. This higher pressure causes the ball in the suction check valve to seat and causes chemical to flow through the discharge check valve into the discharge line. With the suction ball check closed, flow is prevented from flowing into the suction line. This suction / discharge action is repeated with every stroke of the pump plunger.

PUMP DIMENSIONS:







INSTALLATION:

Unpacking:

- Pumps are shipped f.o.b. factory or representative warehouse and the title passes to the customer when the carrier signs for receipt of the pump. In the event that damages occur during shipment, it is the responsi¬bility of the customer to notify the carrier immediately and to file a damage claim.

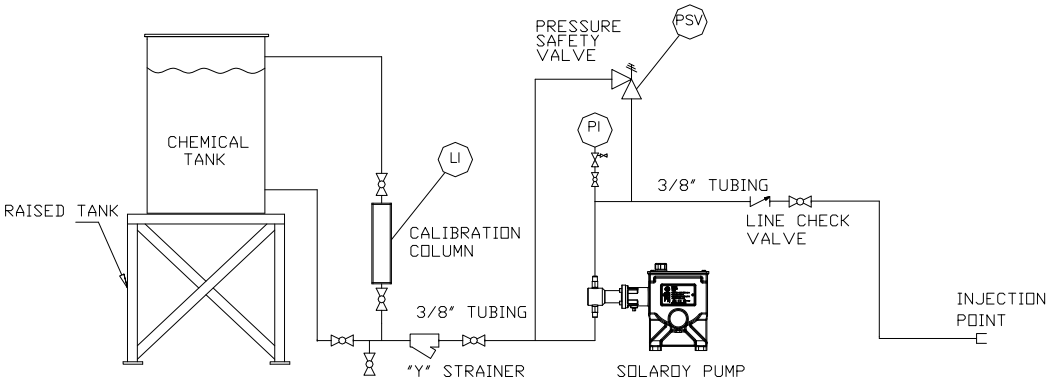
- Carefully examine the shipping crate upon receipt from the carrier to be sure there is no obvious damage to the contents. Open the crate carefully so accessory items fastened to the inside of the crate will not be damaged or lost. Examine all material inside the crate and check against the packing list to be sure that all items are accounted for and intact

Components: INCLUDED IN BOX

- Pump
- Timer
- Manual
- Suction check valve (optional use in place of spring loaded discharge check valve.
- Oil - EP 95 (MSDS included)
- Included misc parts: (3) ¼" x .030" female quick connect to 14 gauge crimp terminals (for connections to timer – if needed), (2) crimp type wire nuts for the motor wires, (2) fuses and (1) crimp type fuse holder (if needed)

Piping Schematic:

- Should include: cal column, pump isolation / shut-off valve, filter, safety relief, etc.



GENERAL

- For the most efficient performance of your pump assembly, we recommend the following:
- Isolation valves (ball type) on inlet and discharge lines of the pump to simplify maintenance.
- A check valve where the pump discharge line joins the main process line to prevent process fluid back flow.
- An inlet filter, with filtration approximately 100 microns, on pump suction line.
- A pump rate setting gauge in the suction line or process fluid discharge line, if you need precise flow rate adjustment.

SUPPLY RESERVOIR

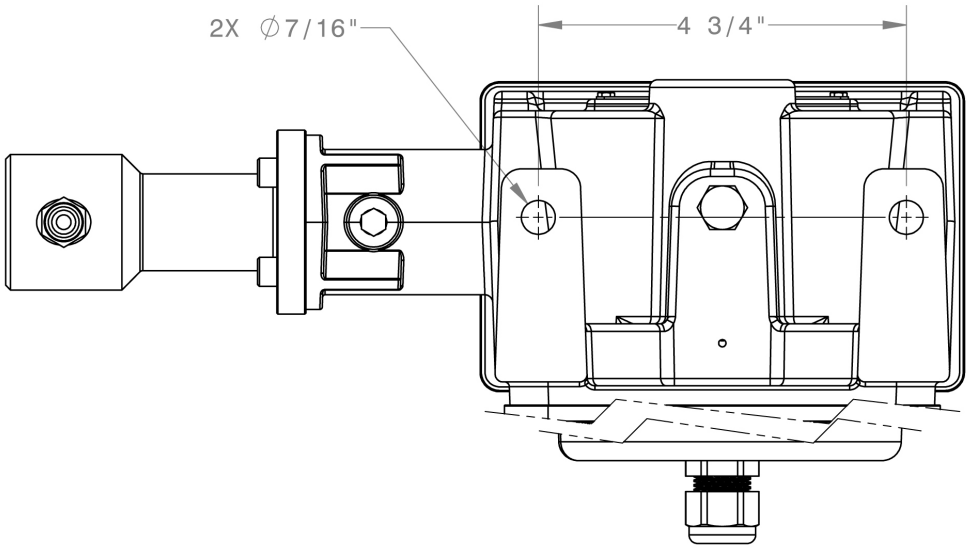
Position the supply reservoir so that the liquid level will not be less than six inches above the inlet check valve (flooded suction). While you can locate the reservoir at any height above the inlet check valve (net positive suction head), the limit is 100 psig net positive suction head, which is the cracking pressure of the discharge check valve. We do not recommend using the pumps in a suction lift position since they were not designed for such operation.

RELIEF VALVE

A safety relief valve is suggested to protect the pump. The maximum discharge pressure the pump can generate can be taken from the performance graphs in pages 19 - 21.
The pump is capable of generating 2500 psig. The pump will stop pumping when the 2520 psig is reached.

MOUNTING PUMP

- Holes in feet accommodate 5/16” threads, use screws / studs / bolts as appropriate.
- Recommend allowing access to the oil drain port so a bucket / container can be located under the pump with enough space to allow the oil to be drained into the container.



PLUMBING CONNECTIONS

- Recommend location with flooded suction (with tank elevated so lowest tank level will ensure flooded suction).

- Recommend location that's elevated to protect equipment from environmental conditions (flooding, snow, etc.).

- Recommend location should allow easy access to pump, piping and valves.

PUMP ASSEMBLY

- Position the pump assembly with enough space around it to allow easy access to all components for maintenance. Install the assembly with the pump inlet/suction check valve pointing straight down. The pump is not designed to work in any other position since the inlet/suction check valve has no spring.

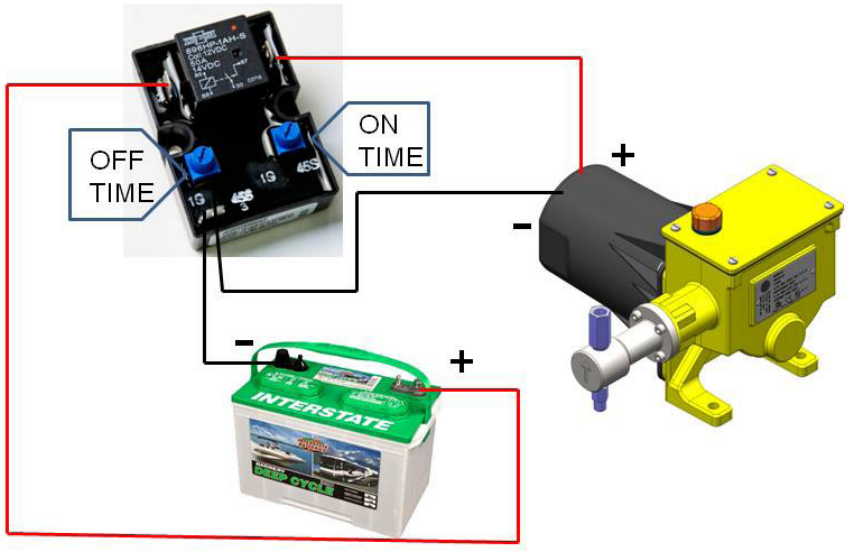
- Recommend the use of secondary containment to not pollute the environment if any leaks develop or servicing of product is needed.

- Mount on flat surface

Connections – Piping

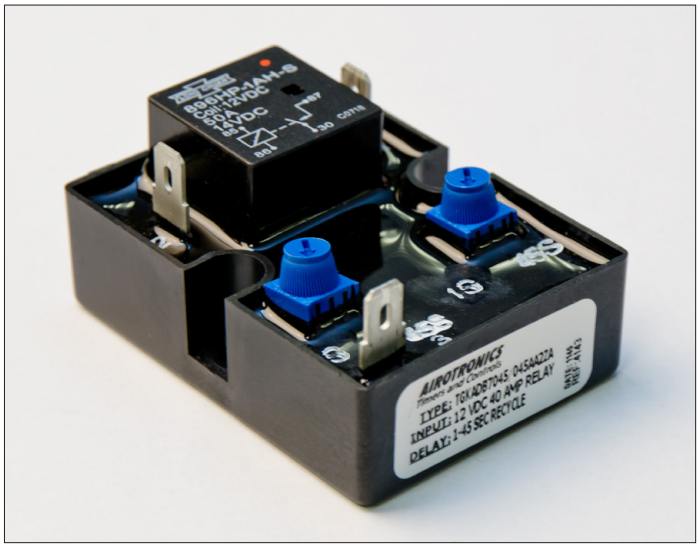
- ¼" NPT are the fluid connections for the check valves
- Be sure to use thread sealant / pipe tape as recommended (Loctite® 567)
- Recommend piping meets the ratings required for pumping. (High pressure metal tubing is recommended to avoid any bending loads being applied to the check valves).
- Reference applicable piping standards for pipe and fittings used for the high pressure lines.

Timer Wiring Schematic



Connections – Wiring

- Warning: Make sure all equipment is off before beginning installation / service of equipment.
- Wire gage you will use is: 14 gage
- Jacketed Cable recommended: SJEOOW 300VAC Service Cord 14/2 AWG, .35" OD
- Reference McMaster Carr- 7082K28 is recommended to be used for main power lines between the pump and control box.
- Proper grounding of electrical components is required. Pump ground wire is inside the motor cover (ground wire with ring terminal connected to the motor mounting bolt).



- Wiring schematic is shown: 2 ways to install:

If connecting pump to a pre-existing system, follow the original hook-up instructions and replace pump with **SOLAROY®**

NOTE: Polarity on motor +/- when connecting.

If connecting pump for a new system installation:

- Wiring schematic shows timer and pump

Procedure for connecting:

Wiring for timer

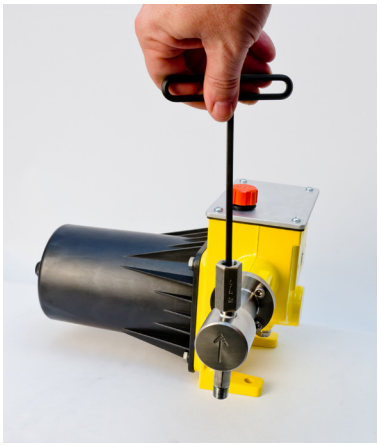
- Strip 14 gauge wires – these are needed inside the enclosure where the timer and battery will be located
- Crimp ¼" x .030" female quick connect terminal to wire. Do this 3 times. One time for the positive, negative and ground conductors per schematic.

Wiring for pump

- Jacketed cable should be cut to length appropriate. Please note, you will need 10 in of cable length at either end of the cable run to allow for wiring length needed inside the motor compartment of the pump and inside the enclosure where the timer and battery are located.
- Remove 8 inches of the outer jacket of the cable at either end. Be careful not to cut the insulation of the individual conductors within the jacket.
- Remove the motor cover by loosening the (4) motor cover fasteners
- Loosen the weather tight strain relief connector on the motor cover to allow the jacketed cable to pass through.
- Pass the power cable through the strain relief such that the outer jacket extends about ½" inside the strain relief.
- Tighten the strain relief to ensure a weather tight seal. 10 to 15 in-lb is recommended (hand tight + ½ turn)
- Next, connect the conductors of the jacketed cable to the wires of the motor. Positive connects to positive. Negative to negative. Ground to Ground. Do this by ensuring ¼" of exposed wire for each conductor. Next, twist the exposed metal of both cable and wire together by hand, placing the crimp nut over the exposed metal of the twisted junction, and then use a crimping tool to finally crimp the connector into place. Apply moderate force to try to pull the wires apart. The joint should be able to withstand 5 lbs of force easily if the connection has been successfully made. If not, please remove the crimp nut and start the wire connection process again. If possible, recommend that an Ohm meter be used at the enclosure end of the cable to verify that the motor is properly connected to the pump motor. In this case, Positive and negative conductors would be probed and you should not get open / infinite resistance. If this is the case, you've successfully connected the pump motor to the cable.
- Next, at the enclosure end of the cable, take appropriate precautions to ensure a weather tight connection around the jacket per the provisions of the enclosure you're using. Connect the quick connect terminals to the jacketed cable using the crimp tool. Use ring terminal for the ground, and quick connect for the positive and negative conductors. Once this connection is made, the quick connect terminals are to be connected to the timer. Per the schematic.

CAUTION: SAFETY – GROUNDING, DICONNECTING BATTERIES, SECURING PUMP

6. Preparation for First Use:



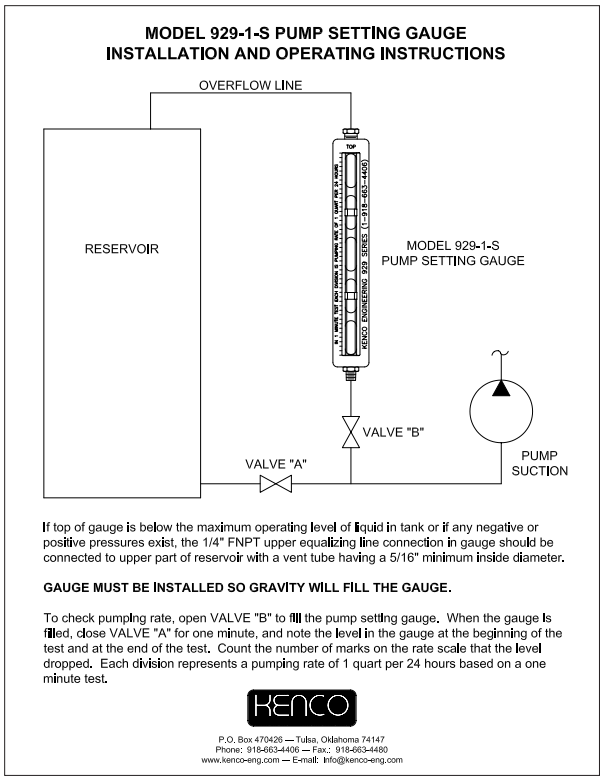
- Priming
  - With discharge tubing off, but suction connection in place, loosen the spring retainer in the discharge check valve with an allen wrench.
- Take care to contain any fluid that may spill. Please use appropriate safety measures for the fluid that will be pumped. MR offers a "bleed check valve" (a check valve with built-in bleed port) to ease this priming procedure.
- Start pump
- Once fluid is observed, stop pump.
- Re-tighten spring retainer (or bleed port if you're using a the "bleed check valve")
- Install the discharge tubing.
- Your pump is now primed, this procedure should be followed any time the pump's liquid end or plumbing connections are serviced.

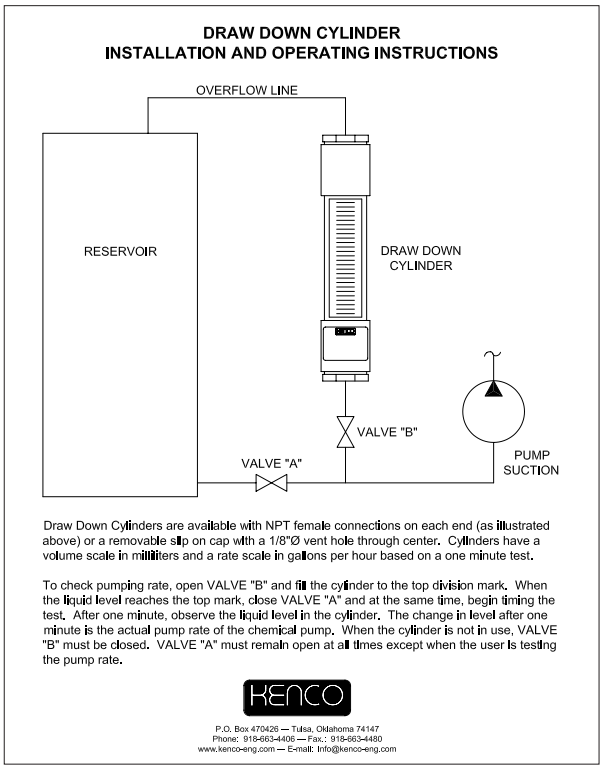
of the pump. The unit must also be properly grounded to earth using approved materials utilizing a proper grounding lug.

You are now finished!

The pump must be secured to the ground or site using proper bolts or anchors and the holes on the bottom

Calibration





See typical calibration procedure below.

Procedure:

1. Open cal column isolation valve to fill column
2. Close tank isolation valve to allow pump to draw from cal column.
3. Set timer to 30 sec on time and lowest amount of OFF time.
4. Start pump and use watch to verify that your 30 sec setting is actually 30 seconds. If it's not, adjust ON time potentiometer until 30 second ON time is achieved.
5. Record the starting volume position of the fluid in the calibration column.
6. Start the pump and allow the pump to draw down for 30 seconds
7. At the end of the 30 seconds, turn off the timer / pump.
8. Record the final volume position of the fluid in the calibration column.
9. The continuous flow rate is computed using the following calculation
    - (Start volume – final volume) divided by 30 sec = Continuous Flow Rate
10. For your actual application, the timer settings may need to be adjusted to achieve your desired flow rate. The method of computing the timer settings to achieve your desired flow rate is as follows:
    - Note your desired flow rate
    - Compute % ON time using the following:
        - % ON Time = Desired Flow Rate divided by Continuous Flow Rate
    - Next, Compute ON time using:
        - ON Time = % ON Time x 60 sec
    - Finally, Compute OFF time using:
        - OFF Time = % OFF Time x 60 sec
11. Next, set the timing potentiometers to the values computed above for ON Time and OFF Time.

12. Verify these settings are actually happening with a watch or stopwatch with a second hand feature.
13. Your pump timer is now set to operate the pump at the desired flow rate.

- Please note: if you are not using the pulse timer supplied by Milton Roy, the procedure used to set the pump to provide the desired flow rate may be different. Please consult the manual of the pulse timer you are using for more specific instructions.
- Finally, re-fill the calibration column by opening the tank isolation valve.
- Once the cal column is refilled, close the tank isolation valve.
- The system is now set-up to perform the final verification of desired flow.

1. First, mark the start volume level of the calibration column.
2. Using a watch or stop watch, you will prepare to run your pump for 3 to 5 timing cycles. Start your pump and watch simultaneously and allow pumping to occur for 3 to 5 timing cycles. At the end of the 3 to 5 cycles (as determined by your application), record the final volume and the time elapsed as indicated on the watch or stopwatch.
3. Finally, compute the actual flow rate using the following:

- (Start volume – final volume) divided by Time elapsed (from watch or stopwatch) = Actual Flow Rate
- Make any adjustments as needed.

7. OPERATION

Run Pump

- Your system should now be properly set-up to operate providing the desired flow output for your application.
- Once you begin running your system please be sure to verify the following items:
- Verify there is no leakage from any of the plumbing connections in your system.
- View any pressure gauge present in your system is indicating desired operation. During an ON pulse from the timer, the pump will cycle at approximately 125 to 145 SPM depending on the backpressure in your system. The pressure gauge should register a each stroke by moving through a 20 to 30 psi range for each pump stroke. During the OFF Time of the cycle, the pressure gauge should remain at pressure without appreciable drop-off.
- Heat of the pump casement after about 2 hrs of operation should be warm to touch but should not be hotter than hot shower water.
- Sound of pump under normal operation will be at a rhythm determined by the timer settings (125 to 145 SPM pulses during the ON Time followed by silence during the OFF Time). The sound during the ON Time will pulse at a rate of 125 to 145 SPM and each pulse will have a moderate whisp noise.

Stop Pump

SHUTDOWN AND STORAGE

1. To shut down the pump assembly, turn the timer/controller to OFF or remove its power supply. To store the pump assembly or if it will not be used for a long time, do the following:
2. Remove pump from the system.
3. Flush out the pump chamber and check valves with water or solvent; drain and then blow the pump dry with compressed air.

4. **CAUTION: To prevent damage to the pump when you clean it, be sure to use a solvent compatible with the metered fluid that will not damage the pump seals.**

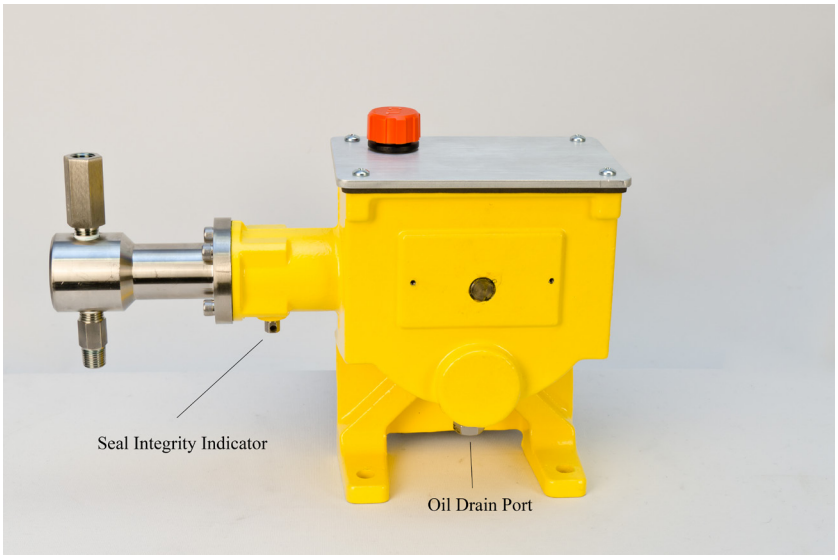
5. Cap off the suction and discharge check valve ports.
6. You may leave the pump, controller, and relay assembled, but make sure to
7. store them in a dry, protected place.

8. Maintenance:

Milton Roy recommends the following to properly maintain your equipment:
Oil changes are to be done annually, please use EP 95 Oil. This is done by:

1. Disconnect power to pump before any servicing takes place.
2. Remove (4) top cover screws
3. Remove top cover
4. Hold bucket / container under oil drain port.
5. Carefully remove the oil drain plug and allow oil to be drained.
6. Once oil draining is completed, replace the oil drain plug.
7. Fill the gear box on the pump to the fill line indicated on the inside side wall of the pump housing.
8. Replace the cover
9. Replace the 4 screws that retain the cover and tighten to 2 FOOT LBS. torque.
    - Check for any pump seal leaks:
    - In addition to checking for leaks in tubing and plumbing connections throughout the system, there are several locations where there are seals on the pump.
    - To check the seal integrity, examine the seal integrity indicator port on the bottom of the LE mount and also the weep hole

- Any fluid leakage indicated at the seal integrity indicator (Item #215, Dwg. #100 Pump, Drive Assembly) will mean one of the seals has become worn with use and will need to be replaced. If fluid is oil, the crosshead seal is worn (Item# 145, Dwg.# 100 Pump, Drive Assembly)



- If fluid is a murky oil or fluid resembling what you're pumping, its likely that the Liquid End seal has become worn with use. This may be replaced with a new seals and back-up rings (bubble #415, 420 on Dwg. #100 Pump, Drive Assembly and we will recommend replacing 430, 435, and 410).
- Also, if any fluid is found coming from the weep hole, the motor shaft seal will need replacement (bubble #120, Dwg. #100 Pump, Drive Assembly).

Check valve operation:

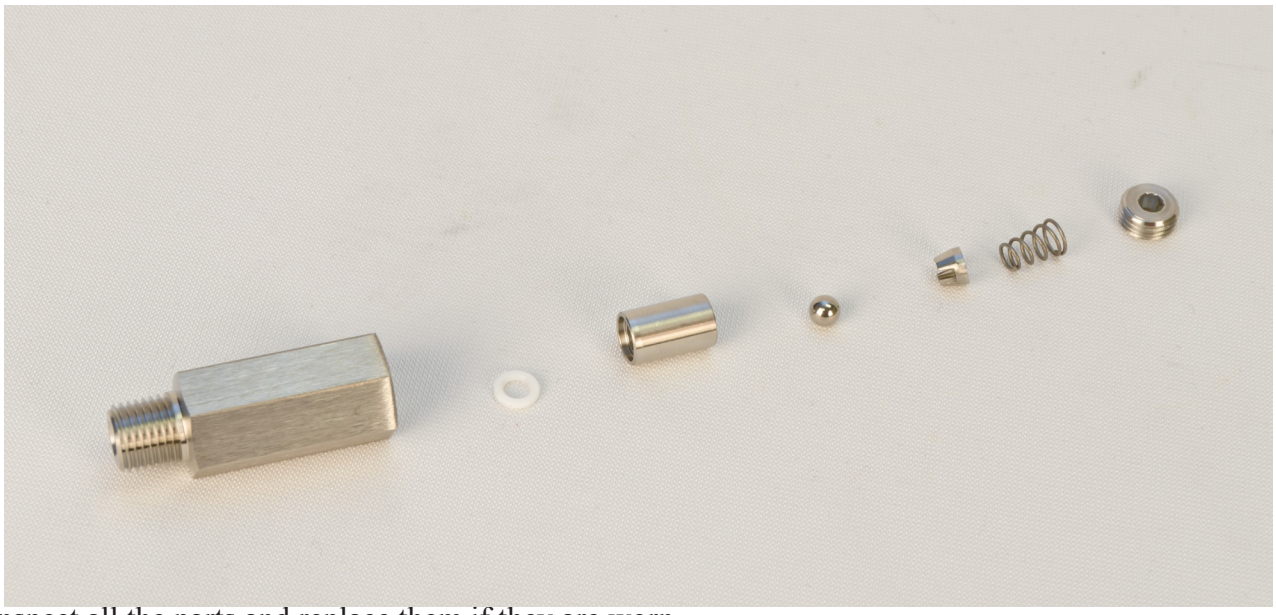
- Observe the pressure gauge operation as indicated in section 7, Run pump. If the pressure gauge does not show the behavior described in this section, check valves will require servicing. This is done by:
    1. Disconnect power to pump before any servicing takes place.

2. Disconnecting the suction and discharge tubing.
3. Removing the discharge and suction check valves
4. Replacing these with Milton Roy replacement check valves (bubble #445 & 450, on FIGURE 400 LIQUID END).
5. Re-priming the pump (follow procedure in Section 6, Priming). **NOTE:** Recalibration may be required as well before return your equipment into service.

Discharge Check Valves:
Refer to the appropriate parts list.
Disassemble the check valve as follows:
1. Clamp the check valve body in the vise.
2. Use the appropriate hex wrench to unscrew and remove the retainer.
3. Remove the body from the vise and dump out the spring, ball seat, ball, sleeve, and Teflon® O-ring (Fig. A)

FIGURE A

4. Remove the Teflon® O-ring from the sleeve.



5. Inspect all the parts and replace them if they are worn.

Reassemble the check valve as follows:
1. Put the Teflon® O-ring in the sleeve and drop the sleeve, O-ring first, into the body.
2. Drop the ball into the body.
3. Put the small end of the spring in the spring cavity on the wide end (not the slotted end) of the ball seat. Drop the two parts, ball seat first, into the body.
4. Drop the retainer, spring cavity first, if it has one, into the body and use the appropriate hex wrench to torque to the values in the table.
   PUMP TORQUE (in-lb): SOLAROY® - 230 - 240

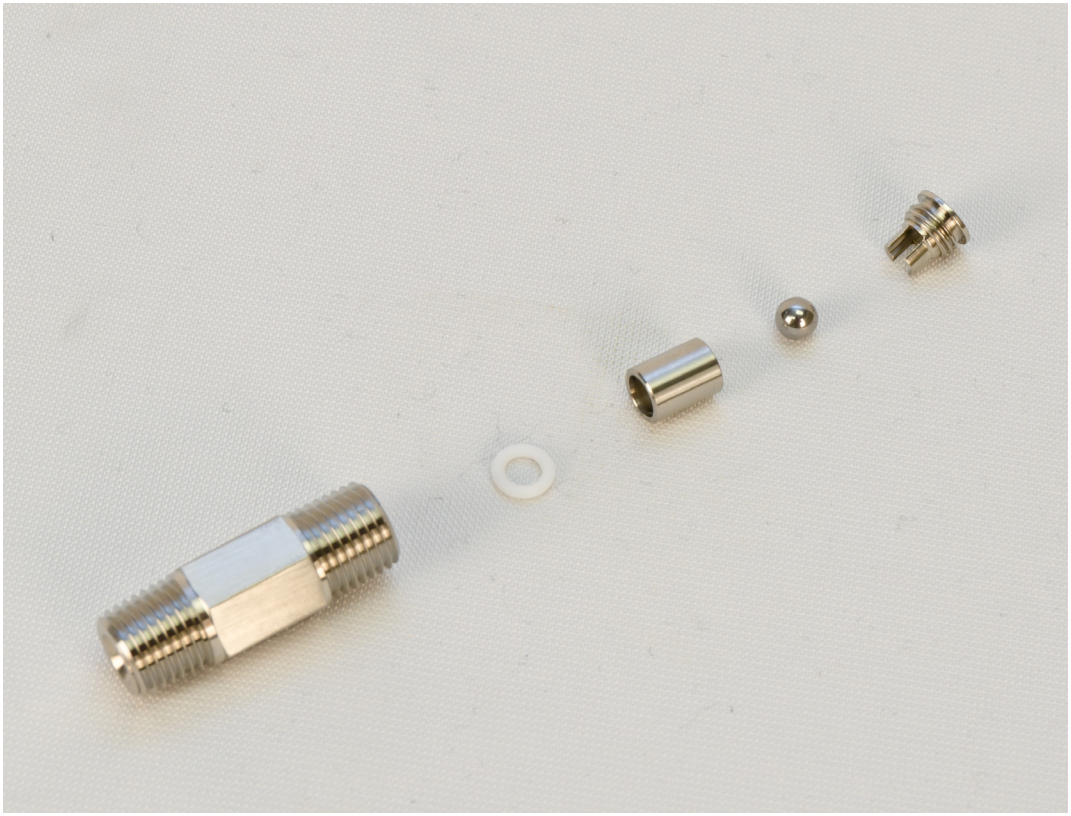
Suction Check Valves: All Pumps
Although there are several sizes of check valves with minor construction differences they are all disassembled and reassembled the same way. The procedures describe the differences. Refer to the appropriate parts list.

Disassemble the check valve as follows:

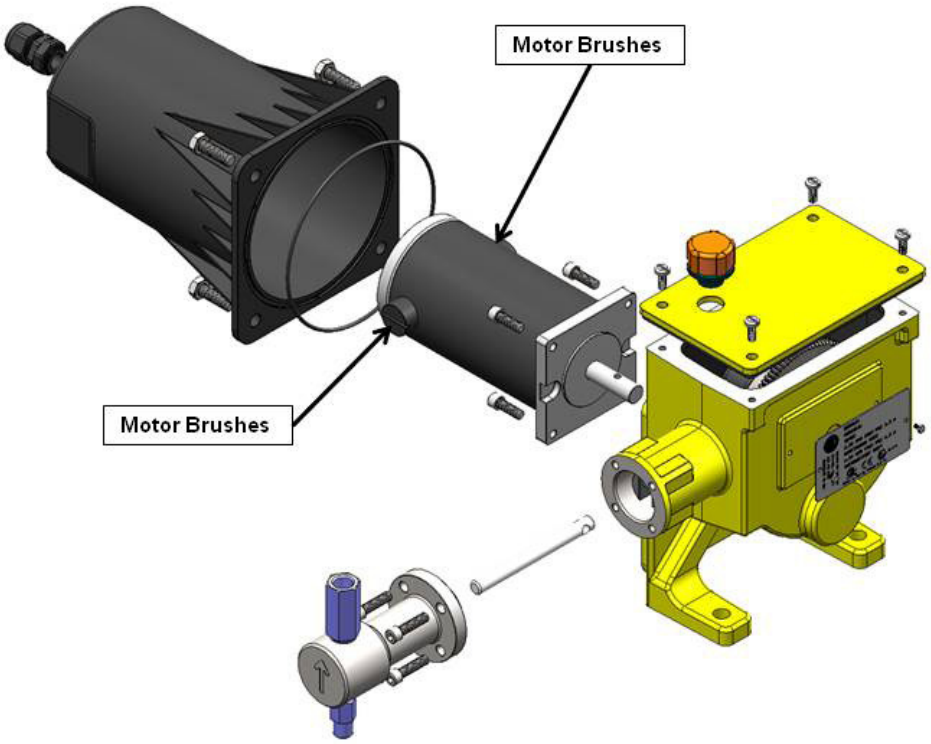
1. Clamp the check valve body in the vise.
2. Use the appropriate hex wrench to unscrew and remove the retainer.(Fig. B)
3. Remove the body from the vise and dump out the ball, sleeve, and O-ring.

NOTE: The use of a pick or small tool to remove the Teflon® O-ring inside the body.

Figure B



Top Level Assembly Exploded View



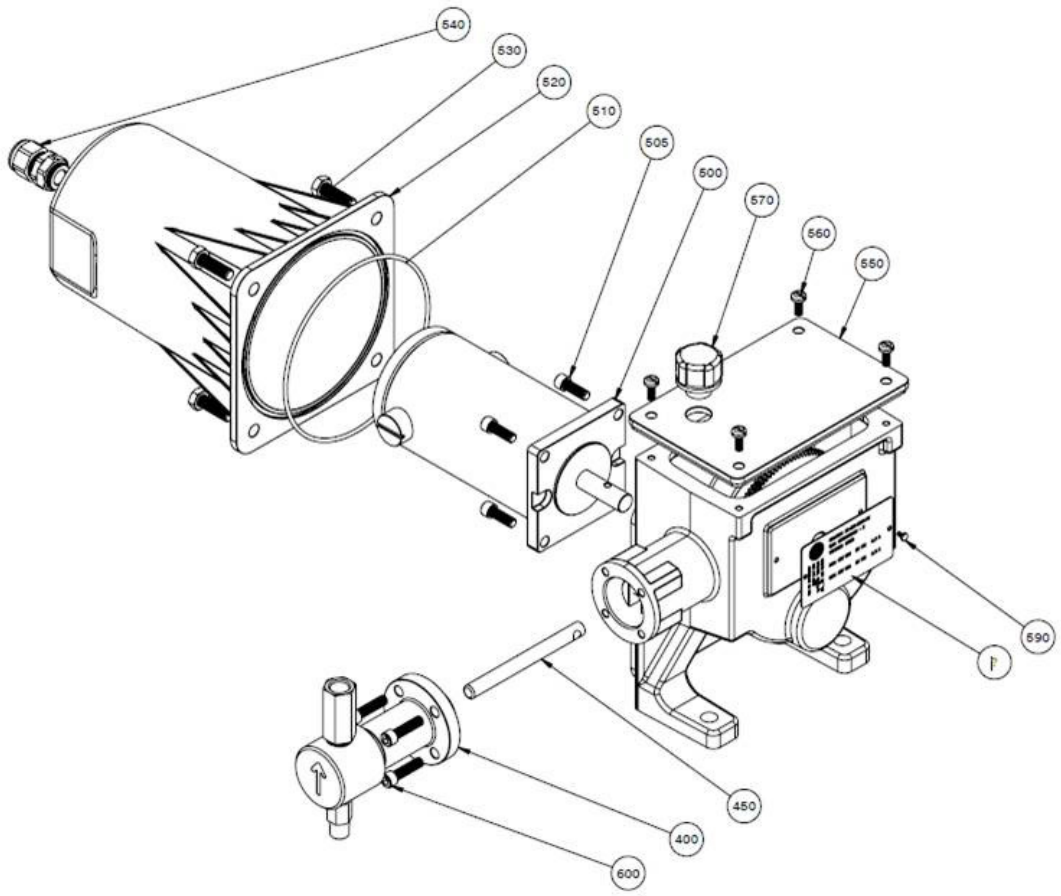
Motor Brushes

Your pump is equipped with a brush style DC motor that is rated to last 4,000 hrs continuous use in a normal application. Your application conditions may vary and therefore impact this anticipated brush life expectancy; however, these are still potentially a maintenance item.

To examine and or replace these bushes, please follow the steps below:

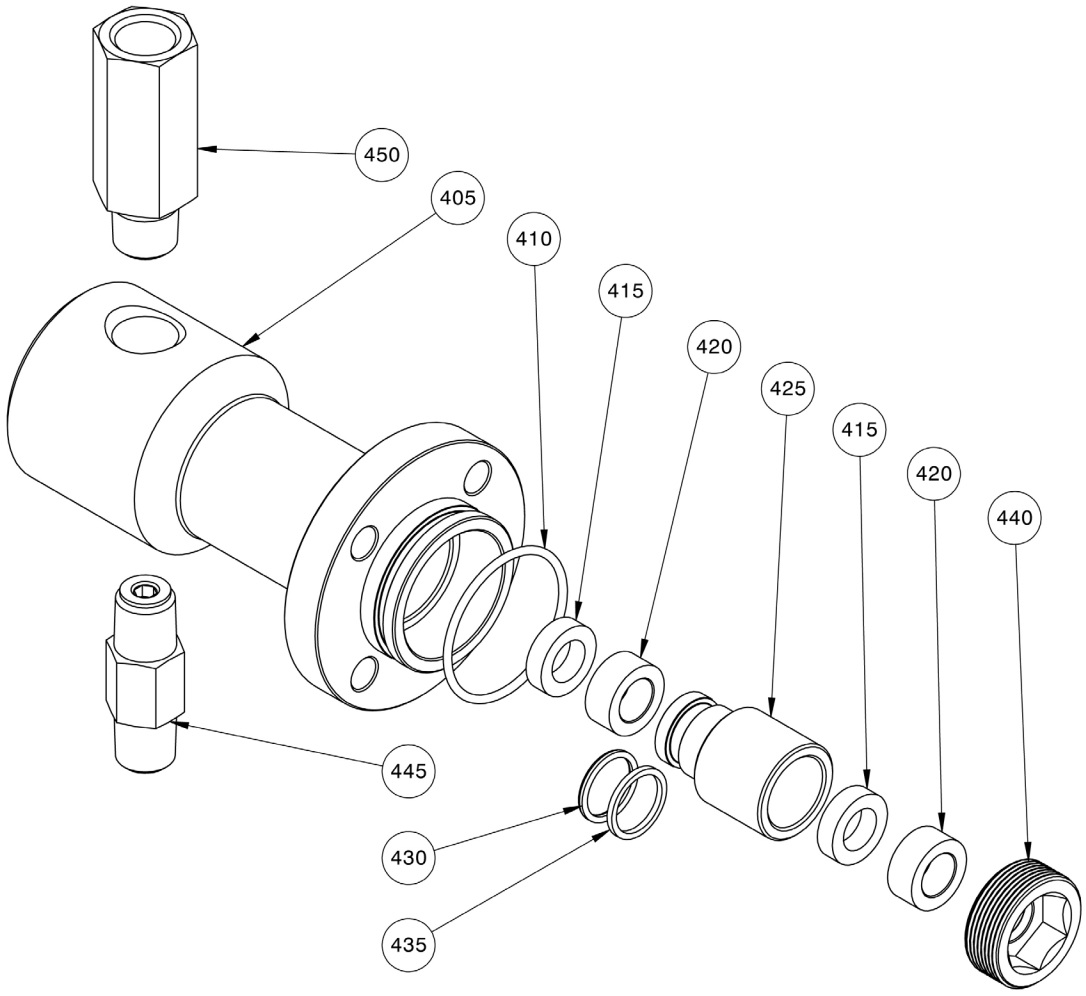
1. Disconnect power to pump before any servicing takes place.
2. Remove (4) motor cover screws
3. Remove motor cover
4. Use large flat blade screwdriver to unthread the plastic caps on either side of the motor.
5. Remove the brushes carefully (they're spring loaded).
6. Examine them. They should be at least 1/8" thick. If they are not, replace them. They will not last much longer.
7. New brushes are (see illustration above). Qty 2 are needed.
8. Replace new brushes into the threaded holes on either side of the motor's outer shell.
9. Replace the motor cover
10. Replace the (4) screws and tighten to 2 FT. LBS. torque.

100 Pump, Drive Assembly



ITEM NO.	QTY	PART NUMBER	DESCRIPTION
100	1	23737	DRIVE ASSEMBLY, SIMPLEX
400	1	23738	LIQUID END ASSEMBLY
450	1	23726	PLUNGER
500	1	42141	RAE .075HP 12VDC MOTOR
505	4	CO-0102	SHCS 1/4-20 X 3/4L
510	1	42164	O-RING, BUNA 2-159
520	1	23721	MOTOR COVER
530	4	L12299	HH SCREW 5/16-18 X 1L
540	1	42161	HEYCO M3213 LIQUID TIGHT FITTING
550	1	23718	DRIVE COVER ASSEMBLY
560	4	41460	PH SCREW #10-24 X 1/2L
570	1	41065	BREATHER PLUG, 3/8 BSP
580	1	22655	NAME PLATE
590	2	42184	PAN HEAD PHILLIPS SCREW #3-48 X 3/16"L
600	4	42168	SHCS 1/4-20 X 1L

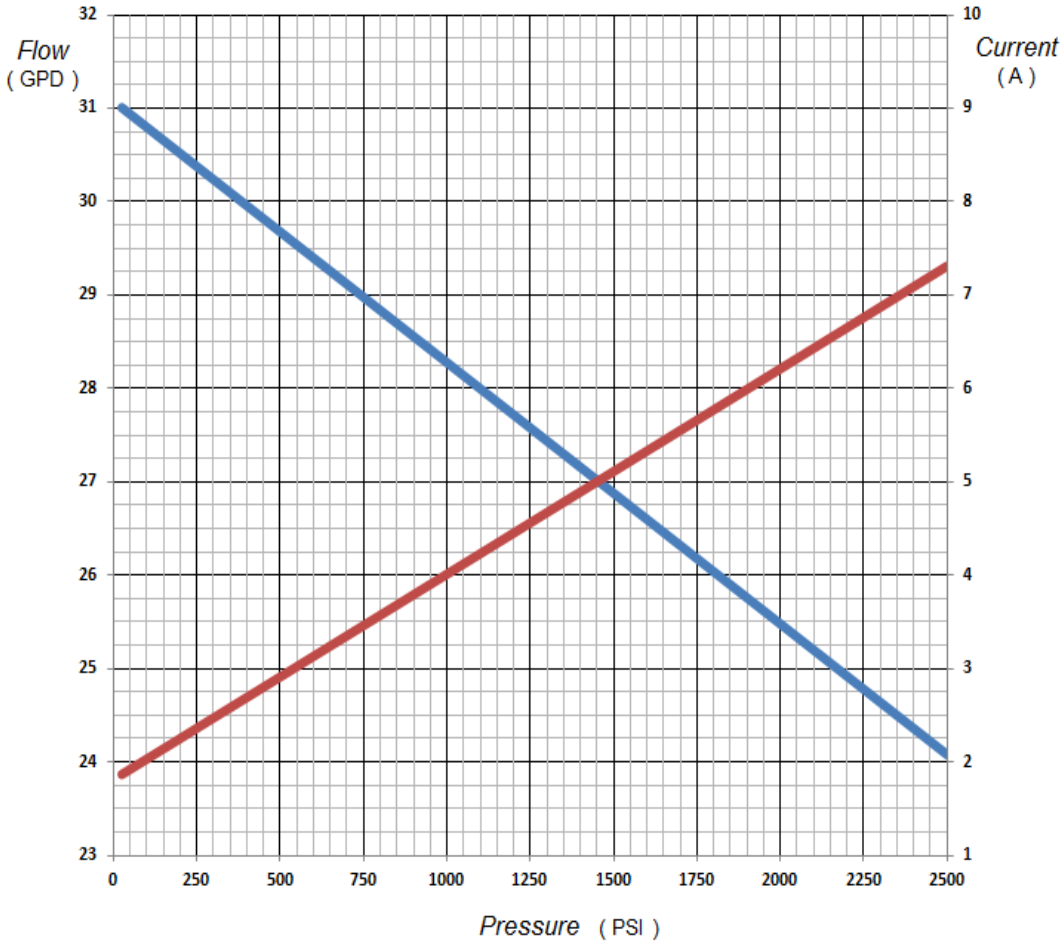
400 Pump, Liquid End Assembly



ITEM NO.	QTY	PART NUMBER	DESCRIPTION
405	1	23725	HEAD, STANDARD
410	1	4080109231	O-RING 2-026 BUNA N 70 DURO
415	2	42165	SEAL FOR 3/8PLUNGER
420	2	42166	BACK-UP RING
425	1	23743	SEAL CARTRIDGE
430	1	L10114	O-RING, 2-014
435	1	42174	O-RING BACKUP RING 2-014
440	1	23727	NUT, SEAL RETAINER
445	1	CV202270	SUCTION CV
450	1	CV202265	DISCHARGE CV

B

Flow, Current vs. Pressure



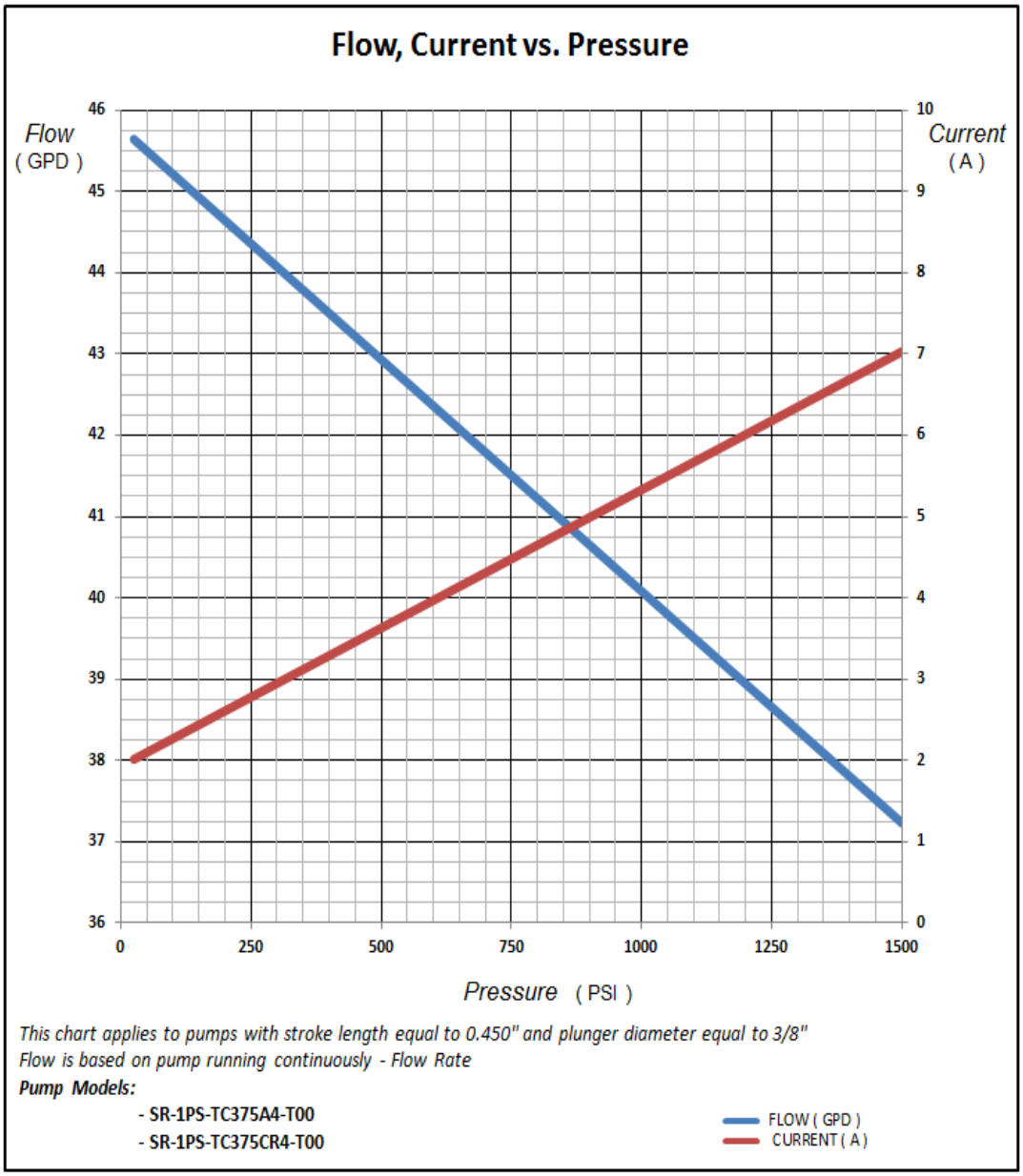
This chart applies to pumps with stroke length equal to 0.300" and plunger diameter equal to 3/8"
Flow is based on pump running continuously - Flow Rate

Pump Models:

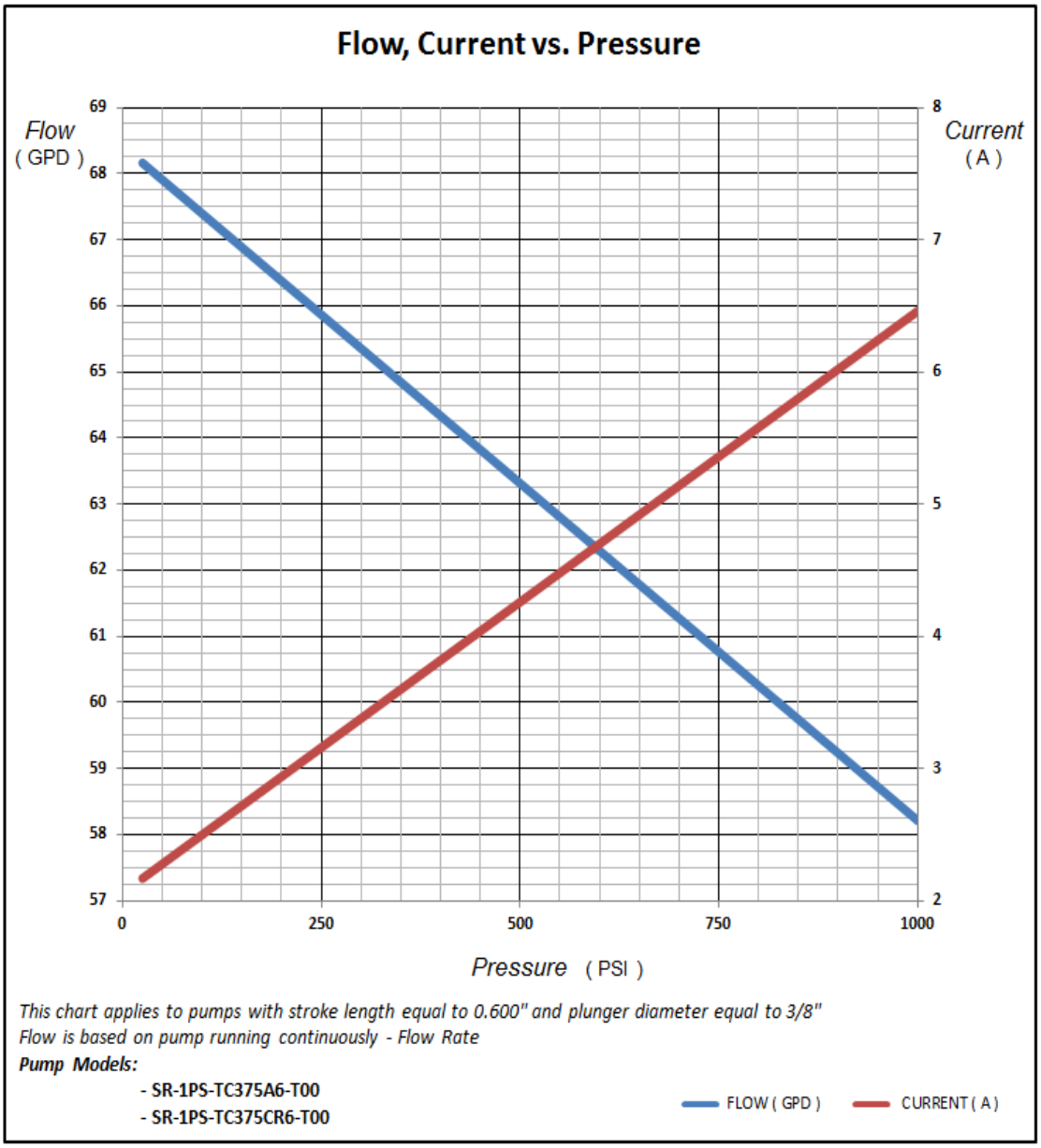
- **SR-1PS-TC375A3-T00**
- **SR-1PS-TC375CR3-T00**

FLOW (PSI) CURRENT (A)

Pressure (psi)		25	50	100	200	300	400	500	750	1000	1250	1500	1750	2000	2250
0.30"	Flow (gpd)	31.0	30.9	30.8	30.5	30.2	30.0	29.7	29.0	28.3	27.6	26.9	26.2	25.5	24.8
	Current (A)	1.9	1.9	2.0	2.3	2.5	2.7	2.9	3.5	4.0	4.6	5.1	5.7	6.2	6.8



Pressure (psi)		25	50	100	200	300	400	500	750	1000	1250	1500	1750	2000	2250
0.45"	Flow (gpd)	45.6	45.5	45.2	44.6	44.1	43.5	42.9	41.5	40.1	38.7	37.2			
	Current (A)	2.0	2.1	2.3	2.6	3.0	3.3	3.6	4.5	5.3	6.2	7.0			



Pressure (psi)		25	50	100	200	300	400	500	750	1000	1250	1500	1750	2000	2250
0.60"	Flow (gpd)	68.2	67.9	67.4	66.4	65.4	64.3	63.3	60.8	58.2					
	Current (A)	2.2	2.3	2.5	2.9	3.4	3.8	4.3	5.4	6.5					

11. Troubleshooting:

PROBLEM	POSIBLE CAUSES	CORRECTIVE ACTION
Plunger not striking (pump not working)	Battery voltage to low	Recharge battery. If problem occures often than battery need to be replaced or solar panel(s) size not properly sized for this application
	Fuse failed	Replace fuse (see operation manual for details)
	Discharge pressure to high	Release pressure, restart pump
Low Pump Output	Viscosity of chamical being pumped to high	Review and inlarge size of supply and dischrge lines to improve flow of chemical
	Pump mounted to high to suck adequate supply of chemical to fluid cylinder	Remove pump and create a flooded suction (six inches minimum)
	Blocked suction filter	Clean and replace filter element
	Check valves leaking or contaminated	Rebuild, replace damaged parts
Oil leaking from bottom of housing (weep hole)	Input shaft oil seal womed out or damage	Minor leak is allowable (2-3 dropes per day) Replace seal (p/n: 42156)
Oil leak from LE breather	Crosshead seal seal womed out or damage	Minor leak is allowable (2-3 dropes per day) Replace seal (p/n: 42155)
Process Fluid Leak from LE Breather	Wear on plunger seals	Replace seals (p/n: 42165) and back-up rings (42166) Refer to instruction for installing seals
	Foreign material in process fluid	Check to see if chemical supply is clean; if not, install chemical filter in supply line
	Seals incorrectly assembled or damaged during installation	Replace seals (p/n: 42165) and back-up rings (42166) Refer to instruction for installing seals
	Plunger nicked, burred or scratched	Replace plunger, seals and back-up rings

Milton Roy Company
201 Ivyland Road
Ivyland, PA 18974
Tel: 215-441-0800
Fax: 215-441-8620
info@miltoroy.com
www.miltonroy-americas.com