MILTON ROY

Metering Pumps

Instruction Manual

maxROY B

339-0005-000

Issued 5/92

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LIST OF ILLUSTRATIONS

METERING PUMP PRODUCTS THIRTY-SIX MONTH LIMITED WARRANTY

The Flow Control Division of the Milton Roy Company warrants its metering pump products against defects in workmanship or materials for three years under normal use from the date of shipment from our warehouse or the warehouse of our agent. All metering pump components are warranted for three years, except that warranties on equipment and accessories furnished with the pump but manufactured by others are limited to the warranties offered by the manufacturers of their respective products. This warranty is not extended to electronic or pneumatic control devices supplied with a Milton Roy metering pump. These items are covered by the warranties offered by the manufacturer or the Milton Roy Warranty for Electronic Controls and Actuators.

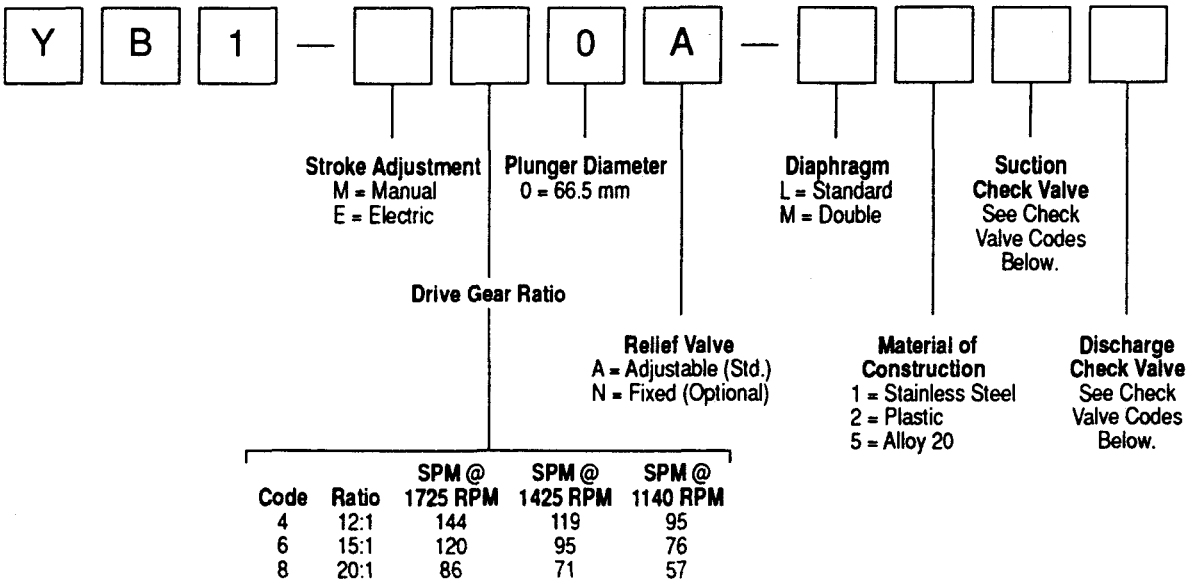
All obligations and liabilities under this warranty are limited to refunding, repairing or replacing (at our option), f.o.b. our plant, such allegedly defective units as are returned to our plant, carrier charges prepaid. Repairs or replacements are made subject to factory inspection of returned items.

This warranty does not extend to damage by corrosion or erosion. The materials of construction offered are recommendations subject in all cases to verification and acceptance by the customer. These recommendations, based on previous Company experience and best available information, do not constitute guarantees against wear or chemical action.

Expressly excluded from this warranty are defects caused by misuse, abuse, or improper application, employment, or operation of the unit. Expendable items and damage resulting from unauthorized repair are not covered by this warranty. No liability for consequential damages or reinstallation labor is accepted. Milton Roy Company will not assume responsibility for contingent liability for alleged failure of its products.

This warranty is in lieu of all other warranties expressed or implied.

MAXROY B PRODUCT CODES



Code	Ratio	SPM @ 1725 RPM	SPM @ 1425 RPM	SPM @ 1140 RPM
4	12:1	144	119	95
6	15:1	120	95	76
8	20:1	86	71	57

Check Valve Codes			
Code	**Description**	**Metal**	**Plastic**
A	1" ANSI Flange Vertical	150#RF	150#FF
B	1½" Ansi Flange Vertical	150#RF	Not Standard
C	1" - 11½ NPT Horizontal	Female	Not Standard
D*	1" - 11½ NPT Vertical	Male	Male
E	1½" - 11½ NPT Horizontal	Female	Not Standard
F	1½" - 11½ NPT Vertical	Male	Not Standard
G	1" ANSI Flange Horizontal	150#RF	Not Standard
H	1½" ANSI Flange Horizontal	150#RF	Not Standard
J	1" Socket Weld	Not Standard	Vertical
*Standard			

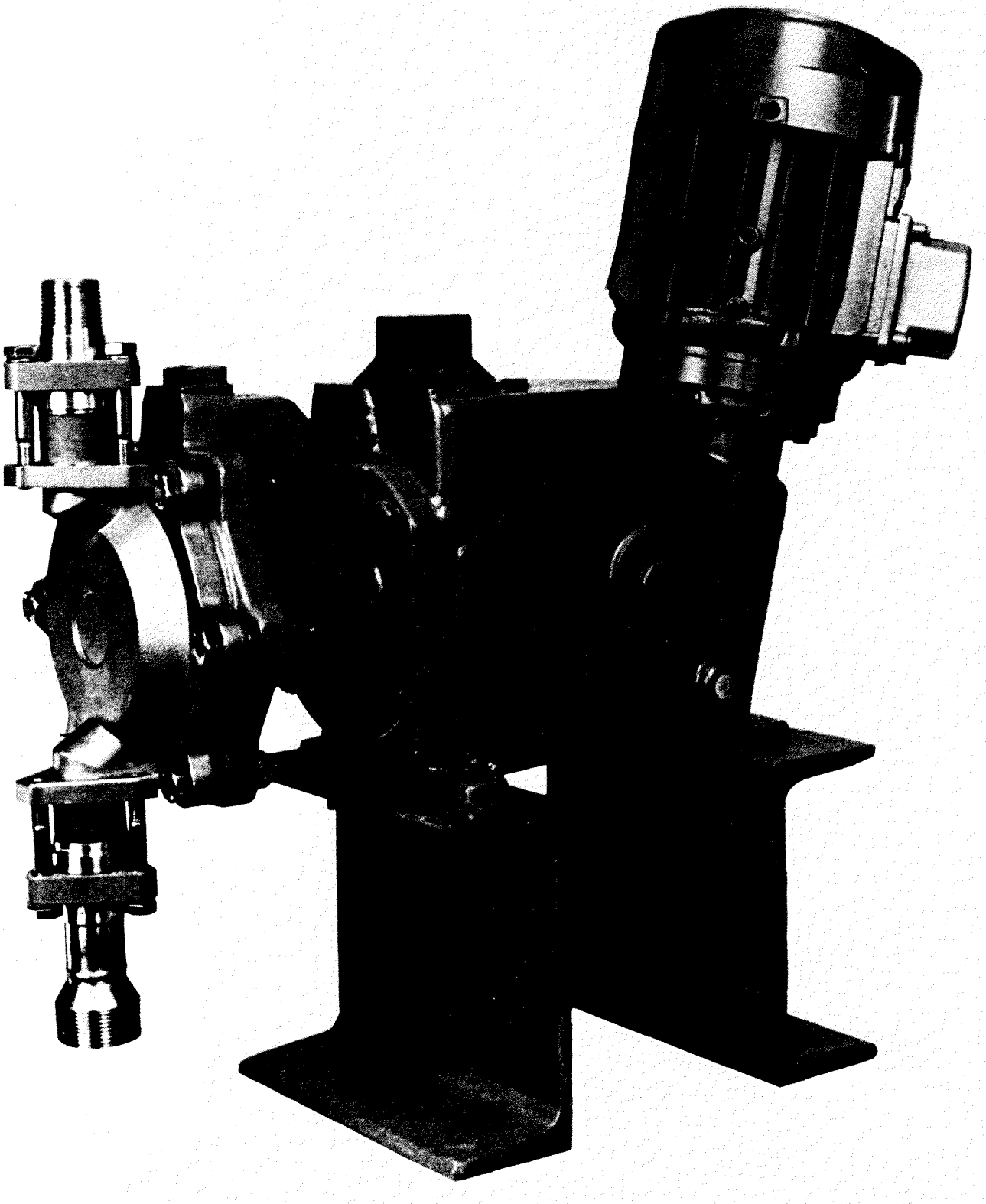


Figure 1. maxROY B Metering Pump.

SECTION 1
DESCRIPTION

GENERAL

The maxROY B is a reciprocating positive displacement controlled volume or metering pump designed to move specific volumes of liquid against a positive pressure differential between the pump suction and the pump discharge. The delivered volume is controllable within one percent of setting.

The pump consists of three major components: (1) a drive unit; (2) a reciprocating plunger; and (3) a liquid end. Pump delivery is a function of drive speed, plunger diameter, and effective plunger stroke length. Although plunger stroke length is fixed, the volume of oil included between the plunger and the diaphragm of the liquid end can be adjusted. Varying this volume adjusts the effective plunger stroke length which in turn determines the volume of process fluid delivered by each stroke of the pump.

PRINCIPLE OF OPERATION

The drive unit moves the pump plunger to draw liquid into the liquid end on the suction stroke and to expel the liquid on the subsequent discharge stroke. Accurate flow control is achievable only if the discharge line pressure (discharge head) is greater than the suction line pressure (suction head).

The maxROY B pump drive motor worm is in constant mesh with a gear. An eccentric mounted on the gear moves the plunger. The plunger is hollow and is filled with oil. The rotating eccentric moves the plunger towards the liquid end, trapping the oil between the bore of the plunger and the disc diaphragm. This causes the diaphragm to flex, forcing liquid on the other side of the diaphragm through the discharge ball-checks.

In the drive side end of the plunger are ports which allow oil in the bore to flow out of the plunger as the oil is compressed. The plunger, however, reciprocates within a movable sleeve. As the plunger begins its travel on the discharge stroke, the ports allow oil to escape from the hollow plunger until the ports become sealed by entry into the sleeve. Varying the position of the sleeve (by vernier adjustment) establishes the point at which the ports become sealed. This determines the volume of oil available for compression between the plunger and the disc diaphragm. The earlier the ports are sealed, the greater the available oil volume, and the longer the effective stroke length.

With each suction stroke of the plunger, negative pressure in the displacement chamber allows the pressure of liquid in the suction line to unseat the suction ball-checks and process liquid flows into the pump liquid end chamber (pump head). On the discharge stroke, the plunger compresses oil to flex the disk diaphragm towards the pump liquid end chamber. The increased pressure in the liquid end unseats the discharge ball-checks and process liquid flows out through the discharge line.

On each suction stroke, the discharge ball-checks are seated, and on each discharge stroke, the suction ball-checks are seated (pressure in liquid end is greater than suction line pressure). This mode of operation prevents back flow and ensures liquid movement from the suction port, through the pump head, and out the discharge port. Precise oil volume is maintained by a pressure relief valve, plunger oil is replenished from the drive sump through the plunger bleeder ports.

SAFETY PRECAUTIONS

When installing, operating, and maintaining the maxROY B, keep safety considerations foremost. Use proper tools, protective clothing, and eye protection when working on the equipment and install the equipment with a view toward ensuring safe operation. Follow the instructions in this manual and take additional safety measures appropriate to the liquid being pumped. *Be extremely careful in the presence of hazardous substances (e.g., corrosives, toxins, solvents, acids, caustics, flammables, etc.).*

SPECIFICATIONS

Detailed specifications for this pump are listed on the pump Data Sheet included with this manual.

SECTION 2
INSTALLATION

UNPACKING

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

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

STORAGE

Pumps that are not expected to be put into service within 90 days of receipt should be stored in a dry place. Apply grease to all non-painted surfaces of the pump. Protect rubber parts from direct sun and from daily temperature variations of 30°F (17°C).

If the pump is not unpacked, heat-seal it in plastic under vacuum along with desiccant bags. Crates exposed to the elements should be covered with marine plywood. Ensure that drain holes in the bottom of the shipping crate are clear to allow any water that does enter the crate to drain out.

MOUNTING

Support the pump firmly in a level position on a solid, vibration-free foundation - preferably with the base above floor level to protect the pump from washdowns and to provide easier access for service. The maxRoy pump is provided with mounting holes to accommodate anchor bolts.

Some maxROY B pumps are shipped with motors dismounted. After anchoring pump in position, install motor.

Pumps installed outdoors should be protected by a roof.

PIPING

General

There are two major factors which can adversely affect the metering function of reciprocating plunger pumps. Flow losses relate to the pressure required to ensure that the liquid flows continually in the system during the peak flow demand portion of the pump stroke; Acceleration losses refer to the pressure required to cause the liquid to move at the beginning of each plunger stroke. If either type of loss is excessive, it can lower the suction head pressure to a point where the pump is starved or liquid cavitates in the liquid end, destroying the metering action.

The NPSH Handbook is for all Milton Roy metering pumps. It should help you establish enough suction head pressure when the pump is installed to keep these destructive losses from occurring. It can also help you figure out which type of loss is dominant if ever a pump does get into trouble.

General Rules

Never connect rigid pipe to plastic liquid ends; rather, use flexible connections to both suction and discharge.

Use piping materials that will resist corrosion by the liquid being pumped. Use care in selecting materials to avoid galvanic corrosion at pump liquid end connections.

Use piping heavy enough to withstand maximum pressures.

Size piping to accommodate peak instantaneous flow. Because of the reciprocating motion of the pump plunger, pump delivery follows an approximate sine curve with a peak instantaneous flow pi (3.14) times the average flow. Therefore, piping must be designed for a flow 3.14 times the pump capacity; this means that a pump rated for 88 gallons per hour (333.1 L/hr.) requires piping sufficient for 3.14 x 88 gph, or 276 gph (1044.7 L/hr.).

To minimize viscous flow losses when handling viscous liquids, it may be necessary to use suction piping up to four times larger than the size of the suction connection on the pump. If in doubt, contact your nearest Milton Roy representative or consult the NPSH Handbook (available free from Milton Roy) to determine the necessary pipe size.

Remove burrs, sharp edges, and debris from inside piping. Blow out all pipe lines before making final connections to pump.

Provide for pipe expansion when hot liquids are to be pumped. Support piping so that pipe weight is not placed on the pump. Never spring piping to make connections.

Piping should be sloped to prevent vapor pockets, because vapor in the liquid end will cause inaccurate pump delivery.

When pumping suspended solids (such as slurries), install plugged crosses at all 90-degree line turns to permit line cleaning without dismantling piping.

See Figure 2 for a typical recommended pump installation scheme.

Suction Piping

It is preferable to have the suction of the pump flooded by locating the liquid end below the lowest level of the liquid in the supply tank. Installing a hold-up tower or supply vessel on the suction line close to the pump can help ensure a foodless suction line. (Consult Milton Roy Company, Flow Control Division for assistance in such applications.)

Avoid negative suction pressure conditions (suction lift), as such conditions adversely affect metering accuracy. If such conditions are unavoidable, contact Milton Roy Flow Control Divisions for recommendations.

When pumping a liquid near its boiling point, provide enough suction head to prevent the liquid from "flashing" into vapor when it enters the pump liquid end on the suction stroke.

If possible use metal or plastic tubing for the suction line because tubing has a smooth inner surface and can be formed into long, sweeping bends to minimize frictional flow losses.

A strainer should be used in the suction line to prevent foreign particles from entering the liquid end. This and any other measures which prevent debris from entering and fouling the ball-checks will give increased maintenance-free service. Check strainer frequently to prevent blockage which could lead to cavitation.

Keep suction piping as short and straight as possible.

When suction piping is long, and particularly at stroke speeds above 70 strokes per minute (spm), piping size should be larger than the liquid end suction fitting to prevent pump starvation.

If long suction lines are unavoidable, install a float box (See Figure 3) or auxiliary feed tank (stand pipe) near the suction side of the pump. The float box may be calibrated and used to check pump capacity by measuring the time required for pumping a specific quantity of liquid from the box. In many cases, installing an accumulator or pulsation dampener at the pump suction connection will promote flooded suction even when the suction line is long. Consult Milton Roy Flow Control Division for details.

Suction piping must be absolutely airtight to ensure accurate pumping. After installation, test suction piping for leaks with air and soap solution.

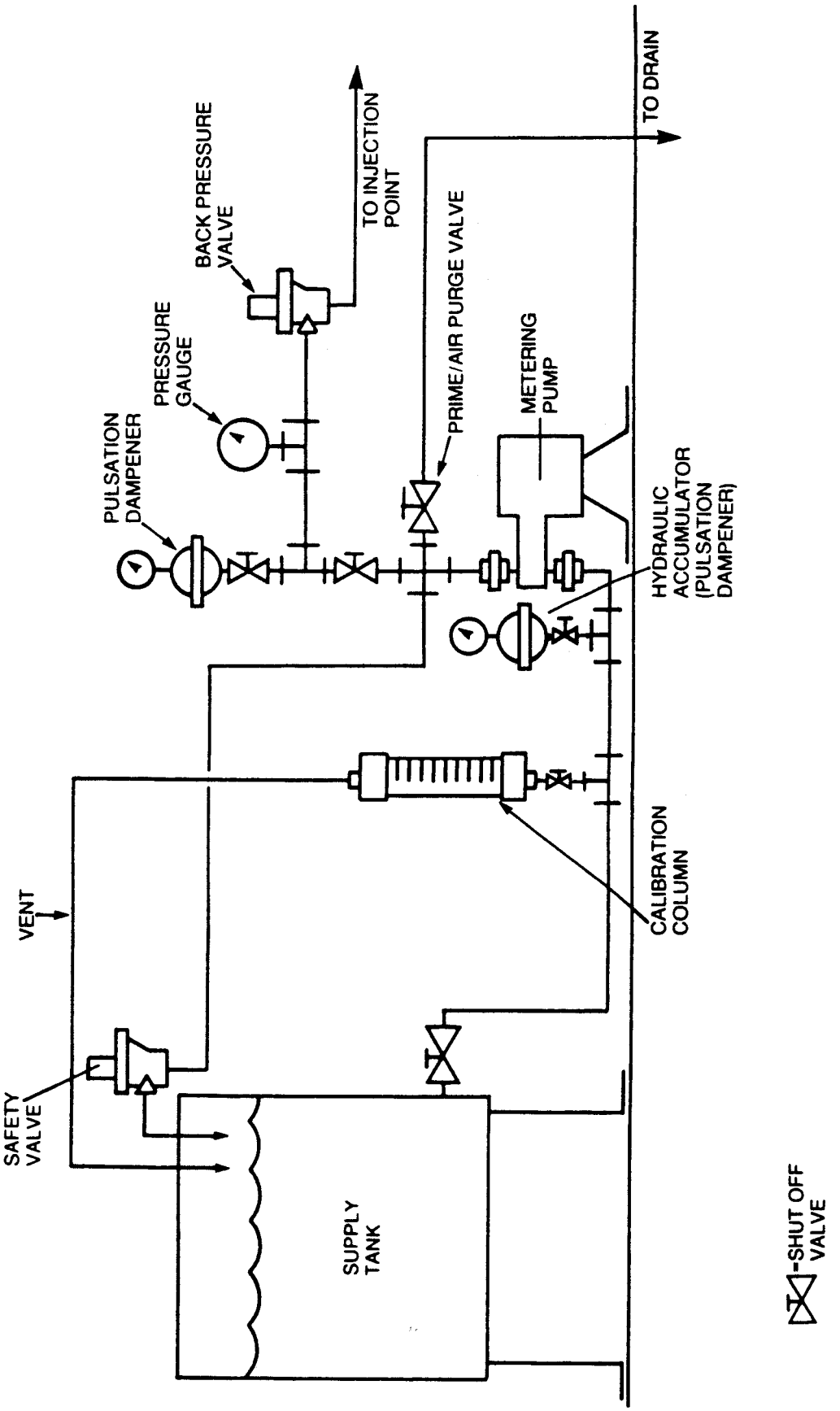


Figure 2. Typical Recommended Pump Installation Scheme.

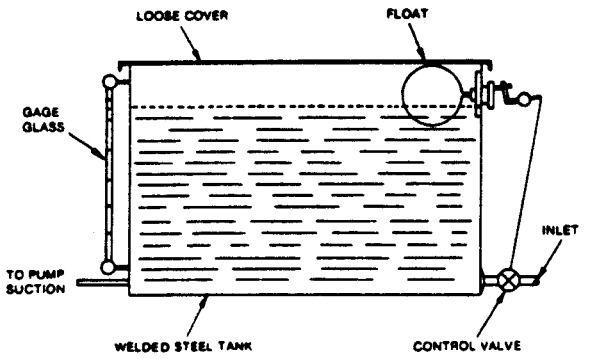


Figure 3. Float Box

Discharge Piping

Install pipe large enough to prevent excessive pressure losses on the discharge stroke of the pump. Maximum pressure at the discharge fitting on the liquid end must be kept at or below the maximum pressure rating shown on the pump nameplate.

The pump will not deliver a controlled flow unless the discharge line pressure is greater than the suction line pressure. If sufficient back pressure is not present, the pump will not meter the flow of liquid accurately. There are a number of ways to create an artificial pressure, such as by installing a vented riser or a back pressure valve. (Please contact Milton Roy Flow Control Division for recommendations to increase back pressure in slurry applications.)

When pumping water-treatment chemicals directly into boiler drums, use one liquid end assembly for each boiler drum. Discharging into a manifold having the slightest pressure difference between its several discharge connections can diminish metering accuracy as the outlet with the lowest pressure will receive more liquid than the other outlets.

Vented Risers

A vented riser (Figure 4) is simply a vertical extension of the discharge pipe into an open tee. The other side of the tee goes to the process. Practically maintenance-free, this device prevents siphoning and reduces pulsations; however, a clogged or closed line may cause the riser to overflow. Therefore, substitute a pulsation dampener and back pressure valve for a vented riser when pumping hazardous liquids.

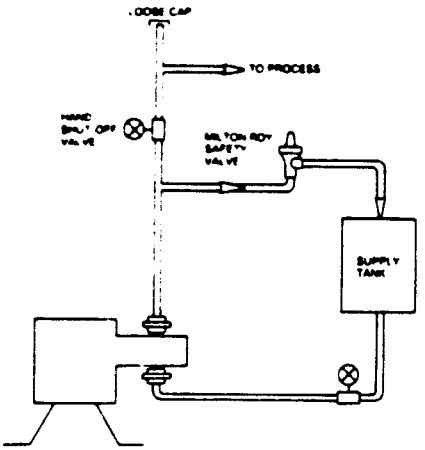


Figure 4. Vented Riser.

Back Pressure Valves

A Milton Roy Back Pressure Valve should be installed in the discharge line near the pump to ensure sufficient discharge head pressure for proper pump metering action. Normally, the valve should be located near the pump; however, back pressure valves for large pumps with long and extremely small discharge lines may have to be installed near the point of discharge into the process (to minimize siphoning tendencies).

Pulsation Dampeners

Accumulators (Surge Chambers)

An accumulator, surge chamber, surge suppressor, or pulsation dampener should be used with the back pressure valve in the discharge line to absorb the flow peaks between the pump and the back pressure valve. Without the pulsation dampener the valve mechanism will snap open and closed with the surge from each pump stroke. The pulsation dampener will allow the back pressure valve to oscillate about a partly-closed position, thus minimizing wear on the valve. Discharge line pulsation dampeners offer the further advantage of limiting the flow and pressure variations characteristic of this kind of pump. Installing a properly sized pulsation dampener will improve pump performance and may reduce system costs dramatically by permitting the substitution of smaller piping. Please contact Milton Roy Company for further information on pulsation dampeners.

Safety Valves

Motor-driven positive displacement pumps can develop tremendous discharge pressures long before thermal overload devices interrupt the motor electrical circuit. To prevent a blocked discharge line from causing damage to the pump, piping, or process equipment, install a Milton Roy Safety Valve in the pump discharge line. This valve is designed and sized to handle system flow rates and pressures safely while resisting corrosion by the process liquid.

Install the safety valve in the discharge line between the pump and the nearest shutoff valve. (This will prevent pump damage from accidental valve closure.) Pipe the safety valve outlet back to the suction tank or to drain, but in either case ensure that the pipe end is continuously visible so safety valve leakage may be detected. Milton Roy safety valves must be installed at top of supply tank in order to function properly (see Figure 4).

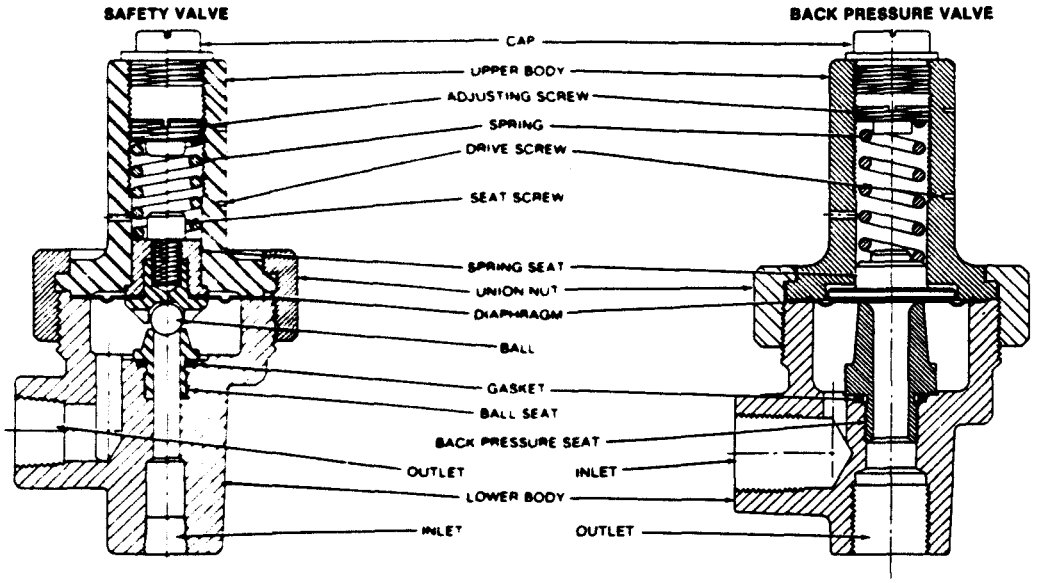


Figure 5. Safety and Back Pressure Valves.

Check Valves

A check valve should be installed at the point where the discharge line enters a boiler or other high-pressure vessel. This will prevent back flow through the discharge piping and will isolate the pump discharge from system pressures (a safety consideration).

Shutoff Valves

Provide shutoff valves in both suction and discharge lines next to the pump. Locate discharge line shutoff valve downstream from the inlet connection of the safety valve. Figure 2 shows recommended valve locations.

Piping Concentrated (95–100%) Sulfuric Acid

Because the high proportion of sludge in commercial concentrated sulfuric acid can foul or clog pump check valves, two recommendations apply to most pumps used for this service (see Figure 6):

1. Install a sulfuric acid tank, fitted with a heel (unused portion below the tank outlet), in the suction line to collect sludge from the system.

2. Filter sludge by installing a glass wool filter or a Milton Roy Sludge Trap in the suction line. (Select a sludge trap for pump flow rates of 30 gph or less.)

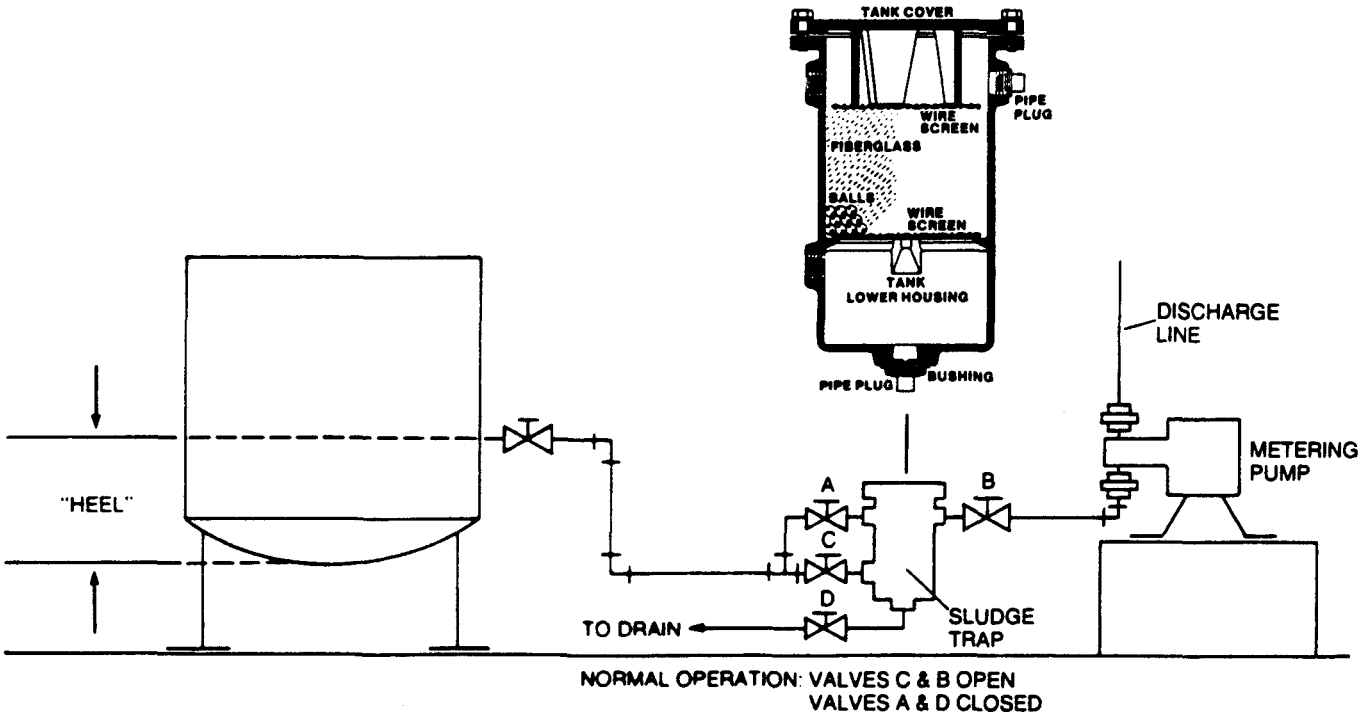


Figure 6. Typical suction piping configuration for a 30 GPH or less capacity metering pump handling concentrated sulfuric acid. (Note: See Figure 2 for other accessories which may be necessary in your installation.)

Suction Lift Conditions

Disc Diaphragm Liquid End pumps are designed to operate with process liquid supplied at or above atmospheric pressure. Although these pumps can move liquids supplied at less than atmospheric pressure, it is important that all connections be absolutely drip-free and vacuum-tight, and that a foot valve be installed at the bottom of the suction line (see Figure 7). Refer to the Milton Roy NPSH Handbook before start-up to determine whether the pump can operate under the conditions proposed.

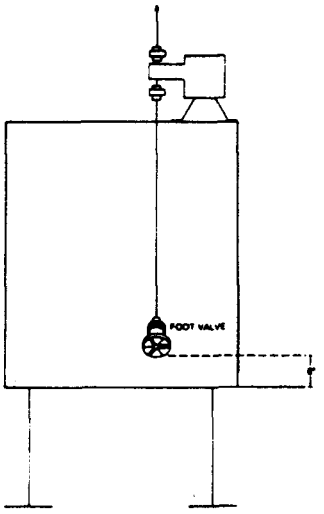


Figure 7. Foot Valve Installation.

SERVICE CONNECTIONS

Pump Drive

Check the nameplate data on the pump drive motor and insure proper power supply is available before making any connections. Motor rotation must be counterclockwise, as viewed when looking down on top of the motor. In addition, an arrow indicating the proper direction of motor rotation is cast directly into the pump housing where the motor is mounted.

For drives other than constant speed electric motors, refer to manufacturer's instructions and service information included with pump.

Auxiliary (Accessory) Equipment

Service connections for auxiliary or accessory electrical equipment should be determined by referring to wiring diagrams, instruction manuals, and the data plate furnished with the equipment.

SECTION 3
OPERATION

INITIAL START-UP

Check that all mounting bolts are tight, piping is installed properly, and the discharge line is open.

NOTE

The oil furnished with the pump is grade AGMA No. 5 EP with a viscosity of 1000 SSU at 100°F (218.4 cSt at 40°C). For operation in ambient temperatures below 50°F (10°C), substitute AGMA No. 2 EP with a viscosity of 400 SSU at 100°F (86.4 cSt at 40°C). Manufacturers' equivalent oils are shown below.

ABOVE 50°F		BELOW 50°F	
Chevron	N.L. Gear Compound 220	Chevron	N.L. Gear Compound 68
Exxon	Spartan E.P. 220	Exxon	Spartan E.P. 68
Mobil	Gear Oil 630	Mobil	Gear Oil 626
Texaco	Meropa 220	Texaco	Meropa 68

Remove the oil fill plug and fill the pump casing with oil, nominal quantity is 4.0 qt. (3.8L).

Connect pump motor for counterclockwise rotation as viewed from top of motor.

INITIAL ADJUSTMENTS

CAUTION

Before switching on power to the pump, turn the capacity adjustment knob to zero. Check that all shutoff valves in the suction and discharge lines are open before increasing the capacity adjustment from zero.

Manual Capacity Control

To adjust pump capacity, release the locking handle and turn the stroke adjusting vernier located on top of the pump.

Filling Pumping System

It is especially important that pump suction and discharge lines be free of entrained air. To ensure this condition, operate the pump without any discharge pressure and fill the entire pumping system with liquid before starting pressure tests. A simple method to assure priming of the pump is to install a tee and a shutoff valve at the discharge connection of the pump.

If the pump is idle for long periods, temperature changes in the process liquid may produce air in the system. To discharge the air, install a valve in the discharge line which will allow the process liquid to be pumped to exhaust when starting the pump.

Capacity Calibration

After the first 12 hours of operation, the pump may be tested and calibrated to find the exact pump capacity under specific operating conditions.

Usually, calibrating the pump at only 100, 50, and 10 percent capacity settings is enough to indicate pump performance throughout the adjustment range.

The pump can be calibrated by measuring the decrease in liquid level pumped from a calibrated vessel. This method is recommended for hazardous liquids because it eliminates operator contact with the liquid. Milton Roy test-tube Calibration Columns are available for convenient and accurate calibration of any pump.

The pump can also be calibrated by collecting and measuring pumped liquid at the pump discharge port. It may be necessary to create discharge head at the liquid take-off point so that the pump will operate properly. (See Section 2 for recommended ways to do this.)

CAUTION

This method is not generally recommended as it may expose operating personnel to hazardous liquids. Furthermore, the pump may over pump dramatically and the position of the capacity adjustment knob may have little effect on measuring flow rate.

PREVENTIVE MAINTENANCE

Milton Roy maxROY B pumps are carefully designed, manufactured, assembled, and quality tested to give reliable service with minimal maintenance. However, a daily maintenance check is recommended to visually confirm proper operation of the pump.

Drive

Initially, change gear drive oil after the first 250 hours of operation. Then change drive oil after every 2500 hours of operation or every six months, whichever comes first. The drive sump drain plug is located under the pump nameplate.

Motor

Lubricate drive motor bearings according to motor manufacturer's instructions.

Check Valves

Check valve assemblies are designed to be self-cleaning and should seldom need servicing. Fouled check valves can usually be cleaned by pumping a solution of mild detergent and warm water (if compatible with liquid being pumped) for 15 minutes, followed by flushing with water.

SECTION 4
TROUBLESHOOTING GUIDE

SYMPTOM	CAUSES	REMEDIES
Pump will not operate.	Low liquid level.	Add liquid.
	Low oil level.	Add oil.
	Worn or dirty check valves.	Clean or replace.
	Blocked discharge line.	Clear line.
	Frozen liquid.	Thaw liquid throughout pumping system.
	Blown fuse.	Replace fuse.
	Open thermal overload device in starter.	Reset device.
	Broken wire.	Locate and repair.
	Low voltage.	Investigate and correct (wiring may be too light).
	Pump not primed.	Allow suction line and pump head to fill with liquid before pumping against pressure.
	Capacity adjustment set at zero.	Readjust.
	System discharge pressure greater than setting of pump internal relief valve.	Investigate and correct condition.
Insufficient delivery.	Incorrect capacity adjustment.	Readjust capacity setting.
	Low oil level.	Add oil.
	Pump internal relief valve actuating.	Investigate and correct condition.
	Incorrect pump speed.	Match line voltage and frequency to pump motor data plate.
	Starved suction.	Increase piping size or suction head.
	Leaky suction piping.	Repair piping.
	High suction lift.	Rearrange equipment to decrease lift.
	Liquid near boiling.	Cool liquid or increase suction head.
	Leaky safety valve in discharge line.	Repair or replace safety valve.
	High liquid viscosity.	Reduce viscosity (e.g., heat or dilute liquid).
	Worn or dirty check valve seats.	Clean or replace.

SYMPTOM	CAUSES	REMEDIES
Erratic delivery.	Leaky suction piping.	Repair piping.
	Leaky safety valve.	Repair or replace safety valve.
	Low oil level.	Add oil.
	Pump internal relief valve actuating.	Investigate and correct condition.
	Insufficient suction head.	Raise suction tank level or pressurize tank.
	Liquid near boiling.	Cool liquid or increase suction head.
	Worn or dirty check valves.	Clean or replace.
	Clogged or dirty line strainer.	Clean strainer.
Motor overheating. (Note: Totally enclosed and explosion-proof motors run hotter than open or fan-cooled motors.)	Wrong or insufficient gear case lubricant.	Check oil level and type. Replace questionable lubricant.
	Operation beyond rated capacity.	Constrain operations to specifications.
	Incorrect power supply.	Match line voltage and frequency to pump motor data plate.
	Misalignment.	Check alignment of moving parts.
Pump still pumps even at zero capacity setting.	Misadjusted vernier knob.	Readjust capacity setting.
	Insufficient discharge pressure.	Correct condition (e.g., install a backpressure valve).
Gear noise.	Excessive backlash.	Adjust backlash or replace gears.
	Worn bearings.	Replace bearings.
	Wrong or insufficient lubricant.	Replace or replenish lubricant.
Loud knock with each stroke.	Excessive gear set wear.	Replace gear set.
	Worn bearings.	Replace bearings.
Noisy operation in liquid end.	Noise in check valves.	Ball checks move up and down with some force. A distinct "banging" noise is normal—especially in metal piping systems.

SECTION 5
CORRECTIVE MAINTENANCE

SPARE PARTS

The following spare parts should be stocked for each pump to prevent serious delays in repairs. Before ordering, identify the correct liquid end material of construction (316 SS, Alloy 20, or Plastic (PVC).

Drawing Location Reference	Description	Qty. per Pump	Part Number	Recommended Spares Qty.
Pump Drive Recommended Spare Parts—Figure 8.				
D	Screw HM 6 x 25	4	6435-0035-384	4
H	Bearing (3302) (Worm Shaft)	1	6439-0044-030	1
J	Retaining Ring (Worm Shaft)	1	6434-0031-151	1
M	Plug, ⅜ R ⅜ (equals ⅜ BSPT)	1	6432-0267-021	1
O	Housing Gasket	1	6025-0144-099	1
S	Screw HM 12 x 35	4	6435-0035-884	4
Y	Retaining ring (Valve Body)	1	6434-0031-141	1
AR	O-Ring (Relief Valve)	2	6438-0006-181	2
BF	Retaining Ring (Relief Valve)	1	404-0145-071	1
BL	O-Ring (Hand Knob)	1	408-0095-151	1
BW	O-Ring Seal (Gear Shaft) (21.3 x 28.3 x 3.6)	2	6438-0006-191	2
BX	Retaining Ring (Gear Shaft)	2	6434-0031-281	2
Stainless Steel Liquid End Recommended Spare Parts—Figure 9.				
AD	Diaphragm (145 mm)	1	6098-0241-339	1
AE	Check Valve Gasket (requires 3 per check valve)	6	225-0075-275	12
AF	Seat (requires 1 per check valve)	2	6024-0108-016	2
AG	Ball (requires 1 per check valve)	2	407-0014-232	2
AK	Ball Guide (requires 1 per check valve)	2	6003-0068-016	2
Alloy 20 Liquid End Recommended Spare Parts—Figure 9.				
AD	Diaphragm (145 mm)	1	6098-0241-339	1
AE	Check Valve Gasket (requires 3 per check valve)	6	225-0075-275	12
AF	Seat (requires 1 per check valve)	2	6024-0108-016	2
AG	Ball (requires 1 per check valve)	2	407-0014-233	2
AK	Ball Guide (requires 1 per check valve)	2	6003-0068-016	2
Plastic Liquid End Recommended Spare Parts—Figure 10.				
AD	Diaphragm (145 mm)	1	6098-0241-339	1
CL	Check Valve O-Ring	9	408-0068-135	18
CJ	Seat	3	6024-0137-073	3
CK	Ball	3	407-0015-231	3
CM	Ball Guide	2	6003-0106-071	2
CS	Ball Guide (Spring Check)	1	6003-0134-071	1
CP	Spring Seat	1	6044-045-071	1
CR	Spring	1	6080-0083-026	2

Parts orders must include the following information:

1. Quantity required*.
2. Part number*.
3. Part description*.
4. Pump serial number** (include in all correspondence regarding the pump).
5. Full model number**.

**Found in this manual. **Found on pump nameplate.*

EXAMPLE:

One No. 6012-0249-001 plunger for Serial No. 123459 model YB1-M60N-L2DD Milton Roy Pump.

(1) (2) (3) (4) (5)

RETURNING PUMPS TO THE FACTORY

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

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 pump liquid end. A Materials Safety Data Sheet must accompany all returns.

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
P. O. Box 5011
Ivyland, PA 18974-0577
Phone: (215) 441-0800
FAX: (215) 441-8620

In Canada:
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DISASSEMBLY

The pump may be dismantled for parts replacement through the following procedures. (Numbers in parentheses are parts numbers from drawings at end of manual.)

WARNING

Disconnect power from the pump motor before performing any disassembly of the pump.

Check Valves

First, flush process liquid from liquid end. Then drain and disconnect suction and discharge piping.

NOTE

Whenever check valves are removed from the liquid end, all valve gaskets must be replaced.

1. Remove the clamping screws that hold the check valve to the liquid end.
2. Remove the check valve and gaskets from the liquid end.

Reassembly of check valves is in reverse order from disassembly. Reassemble with new check valve gaskets.

Diaphragm

Flush process liquid from liquid end. Drain and disconnect suction and discharge piping.

1. Remove filling plug and drain plug to drain oil from pump housing.
2. Remove the nuts holding the liquid end onto the displacement chamber.
3. Remove the liquid end.
4. Remove the diaphragm. (See Common Steps, 6, below.)

Reassembly is in reverse order from disassembly.

Non-adjustable Relief Valve

1. Carefully unscrew the spring retainer plug.
2. Remove the spring from the valve body.
3. Remove the ventil valve body and attached parts as an assembly. Disassembly, clean, and replace the parts as necessary.

Reassemble in reverse order, using a new O-ring on the relief valve plug.

Adjustable Relief Valve

1. Unscrew and remove the valve cap.
2. Carefully unscrew and remove the relief valve plug.
3. Remove the spring and spring seat from the valve body.
4. Remove the ventil valve body as an assembly. Disassemble, clean, and replace the parts as necessary.

Reassemble in reverse order, using a new O-ring on the relief valve plug.

Common Steps

To disassemble the drive assembly, begin with these common steps:

1. Flush process liquid from liquid end.
2. Drain and disconnect suction and discharge piping.
3. Remove the fill plug.
4. Remove drain plug to drain oil from pump housing.
5. Remove the nuts holding the liquid end onto the displacement chamber.
6. Remove the liquid end. Remove the diaphragm by unscrewing (turn counterclockwise). Lift the edge of the diaphragm with a small flat tool; take care not to damage the surface. Hold the edge of the diaphragm to unscrew by hand. Washer Z will be removed with the diaphragm.

Capacity Control

To remove the stroke adjust sleeve or the capacity adjustment knob assembly, first complete the Common Steps for disassembly.

Stroke Adjust Sleeve

1. Remove the screws holding the displacement chamber to the pump housing and remove the displacement chamber.
2. Remove the sleeve from the plunger.

Installation of the capacity control sleeve is in reverse order from disassembly.

Capacity Adjustment Knob Assembly

1. Remove the stroke locking handle.
2. Remove the capacity adjustment knob assembly by lifting it up and out of the pump.

Installing the capacity adjustment knob assembly

1. Replace the O-ring with a new one.
2. There is a hole in the center of the shoe on the knob assembly. Carefully position this hole so that it lines up with the point at the end of the locking handle. Install the locking handle.
3. Carefully line up the teeth of the rack and pinion gears on the sleeve (which fits over the piston); lift the piston to the center of the pump bore and install the displacement chamber.

NOTE

When the capacity adjust knob assembly and/or the capacity adjust sleeve is removed and reassembled, the correct relationship will be lost and the stroke indicator will have to be re-located on the control drum. These two parts snap together with an interference fit but they can be separated by hand, when in or out of the housing.

It will usually be best to gently pry off the stroke indicator while the control drum is retained in the housing. Use two small tools under the edge where the numbers are.

Refer to maxROY B Test Specification below. *Setting the stroke control for zero flow is done with the control drum installed in the housing and the stroke indicator dial removed from the control drum.*

Make the adjustment for zero flow by turning the control drum. After setting, press the stroke indicator on to the control drum with zero opposite the index mark.

Plunger

1. Remove the capacity control sleeve.
2. Remove the two snap rings which secure the eccentric shaft and drift the eccentric shaft out of the pump housing.
3. Set the pump on its side with the oil drain plug facing up.
4. Remove the plunger, the eccentric gage, and the wheel as an assembly.

Assemble in reverse order of disassembly, using two new O-rings and seals.

NOTE

The eccentric shaft must be clean, free of oil and grease. On simplex pumps, apply Loctite between the O-ring and the end of the shaft - both sides - to keep the shaft from rotating during operation.

Worm Shaft and Worm Shaft Bearing

Complete Common Steps.

1. Remove the bolts that hold the pump drive motor to the pump. Remove the motor. If the motor is connected to the pump with a semi-flexible coupling, remove the motor adapter.
2. Remove the set screw (BT) which holds the bearing.

NOTE

To access the set screw, remove RTV from the hole covering the set screw.

3. Remove the worm shaft and bearing assembly.
4. Remove retaining ring at underside of bearing.
5. Using a puller, remove the worm shaft bearing.

Installation is in reverse order from disassembly.

NOTE

If only the bearing will be changed, do not follow the common steps. Simply drain oil and replace with new oil.

MAXROY B TEST SPECIFICATION

Rotation of Motor

Rotation shall be as shown by arrow on the pump.

Pressure at Zero Capacity, Zero Flow

With pump operating and capacity adjust set at 0%, allow pump to run for six (6) minutes to warm pump and oil (to approximately 10° above ambient). With discharge flow stopped by a valve, the discharge pressure shall be 25 psi maximum.

Capacity/Pressure

At 100% capacity setting and 150 psi discharge pressure, discharge flow rate shall be as specified.

Leaks

Under conditions of above paragraph, there shall be no leaks of oil or process fluid.

Motor Load

Maximum (as indicated on an ammeter) motor current shall not exceed motor rated current.

Pressure Relief

Pressure relief valve shall limit discharge pressure to the range 160 - 180 psi. With pump operating and after valve has opened on pressure relief, reducing discharge pressure from 160 - 180 psi to 150 psi shall allow the pump to resume full specified flow rate.

Noise, Oil Temperature

Pump shall operate without excessive noise and/or rise in temperature. Oil temperature shall not exceed 135°, or 45° above ambient.

Repetitive Accuracy

Two consecutive flow rate measurements, each equal or exceeding specified flow rate, shall differ by not more than 2% of the larger of the two.

FIGURE 8.
MAXROY DRIVE ASSEMBLY PARTS.

Drawing Location Reference	Description	Qty.	Part Number
A	56C Motor Flange Adapter	1	6072-0262-006
B	Cap Screw ⅜-16 x 1 Socket Head	4	405-0029-114
C	Motor Cover Gasket	1	6025-0166-199
D	Screw HM 6 x 25	4	6435-0035-384
E	Key (Supplied with Electric Motor)	0	N/A
F	Housing	1	6081-0139-000
G	Worm, 12:1, NEMA 56C Shaft Worm Gear (Worm and Worm Gear Supplied Only as a Set)	1 1	6052-0225-016 252-0131-000
	Worm, 15:1, NEMA 56C Shaft Worm Gear (Worm and Worm Gear Supplied Only as a Set)	1 1	6052-0225-006 252-0131-010
	Worm, 20:1, NEMA 56C Shaft Worm Gear (Worm and Worm Gear Supplied Only as a Set)	1 1	6052-0225-026 252-0131-020
H	Bearing (3302) (Worm Shaft)	1	6439-0044-030
J	Retaining Ring (Worm Shaft)	1	6434-0031-151
K	Eccentric Cage	1	6037-0051-062
L	Plunger, 66.5 mm dia.	1	6012-0249-001
M	Plug, ⅜ R ⅜	1	6432-0267-021
N	Stroke Adjust Sleeve	1	6068-0105-006
O	Housing Gasket	1	6025-0144-099
P	Displacement Chamber	1	6072-0303-001
Q	Lockwasher ½ Steel	4	404-0043-021
R	Dowel 10 x 20	2	6068-0083-006
S	Screw HM 12 x 35	4	6435-0035-884
T	Compression Spring	1	6080-0110-006
U	Back Valve	1	221-0788-062
W	Valve Pin	1	6119-9956-539
X	Loctite 222	A/R	407-0123-903
Y	Retaining Ring (Valve Body)	1	6434-0031-141

FIGURE 8 (CONT.).
MAXROY DRIVE ASSEMBLY PARTS.

Drawing Location Reference	Description	Qty.	Part Number
AN	Washer	1	237-0074-006
AO	Sleeve	1	6439-0048-000
AP	Relief Valve Body	1	6021-0576-006
AQ	Relief Valve Spring	1	6080-0112-006
AR	O-Ring (Relief Valve)	2	6438-0006-181
AS	Relief Valve Plug (Fixed)	1	6022-0035-006
AT	Set Screw (Fixed) M12 x 25, Dog Point	1	6435-0071-454
AU	Seal, Silicone	A/R	408-2019-019
AW	Ball, ¼ 440 SST	1	407-0014-070
AX	Adjustable Relief Valve Set Plug	1	6043-0038-106
AZ	Relief Valve Cap	1	6008-0068-006
BA	Set Screw	1	6435-0071-284
BC	Nut, Hex 10 mm	1	6435-0000-065
BD	Spring Seat	1	6024-0159-006
BE	Filling Plug, ¾ BSP	1	6432-0358-040
BF	Retaining Ring (Relief Valve)	1	404-0145-071
BG	Level Indicator	1	6432-0264-020
BH	Loctite 222 (for "BJ" set screw)	A/R	407-0123-903
BJ	Set Screw M 12 x 40	1	6435-0068-535
BJ1	Shoe	1	6019-0269-062
BK	Handle	1	6440-0082-000
BL	O-Ring (Hand Knob)	1	408-0095-151
BM	Pin	1	401-0004-012
BN	Nameplate	1	6053-0143-162
BO	Stroke Indicator Knob	1	6055-0026-077
BP	Control Drum	1	6055-0027-074
BQ	Ring	2	6440-0002-021
BR	Screw, CM 4 x 16	2	405-0295-102
BR1	Loctite 222	A/R	407-0123-903
BS	Protection Plug, Silicone, RTV	A/R	408-2019-019
BT	Set Screw, M 12 x 20, Cone Point, Steel	1	6435-0068-491
BU	Loctite 222	A/R	407-0123-903
BV	Eccentric Shaft	1	6068-0111-006
BW	O-Ring Seal (Gear Shaft) 21.3 x 28.3 x 3.6)	2	6438-0006-191
BX	Retaining Ring (Gear Shaft)	2	6434-0031-281
BY	Nameplate	1	253-0102-015
BZ	Loctite 569	A/R	407-0123-909
CA	Washer, Flat ¼	4	404-0005-012
CB	Washer	4	6434-0009-015

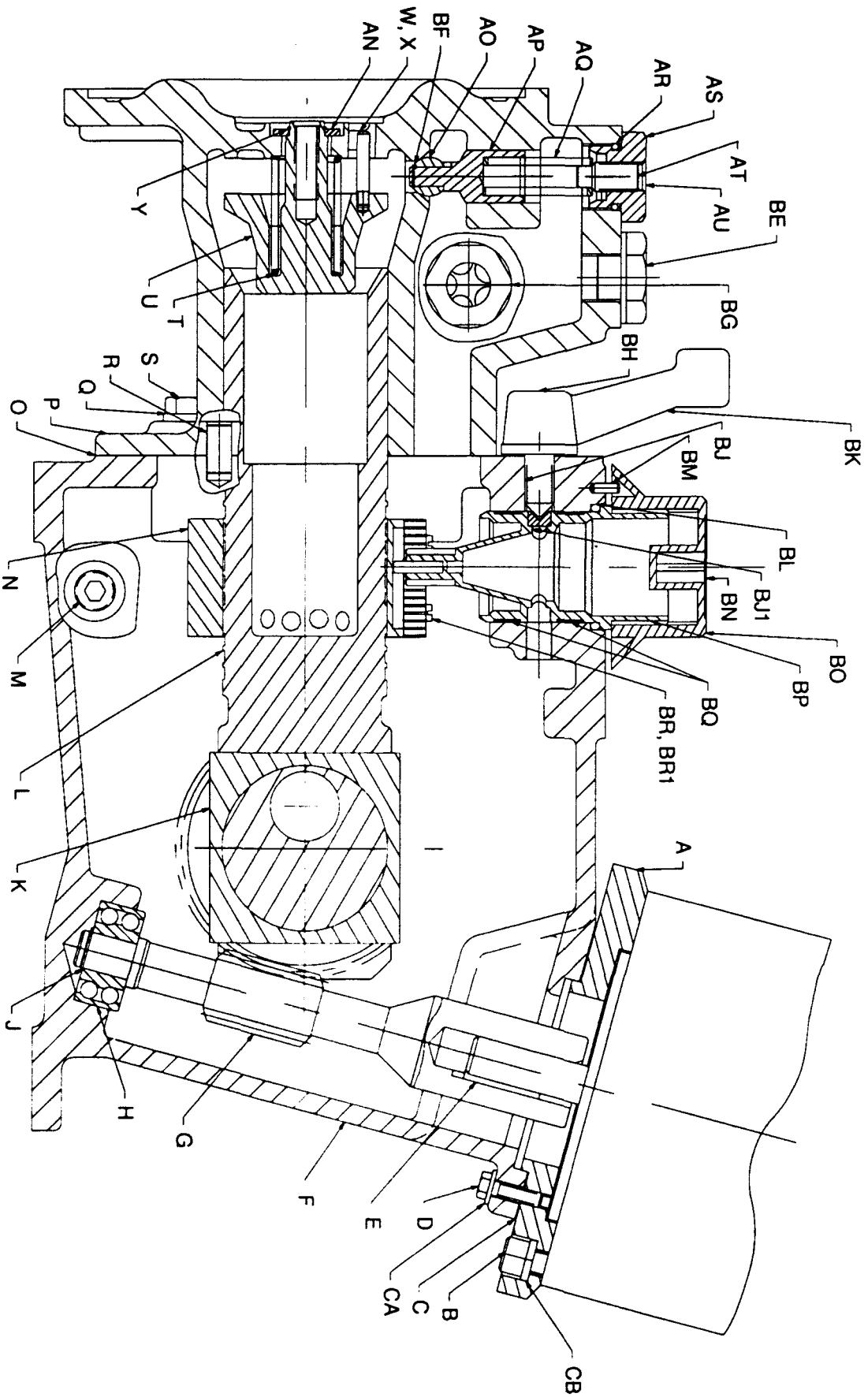

Figure 8. maxRoy Drive Assembly Parts Reference Drawing.

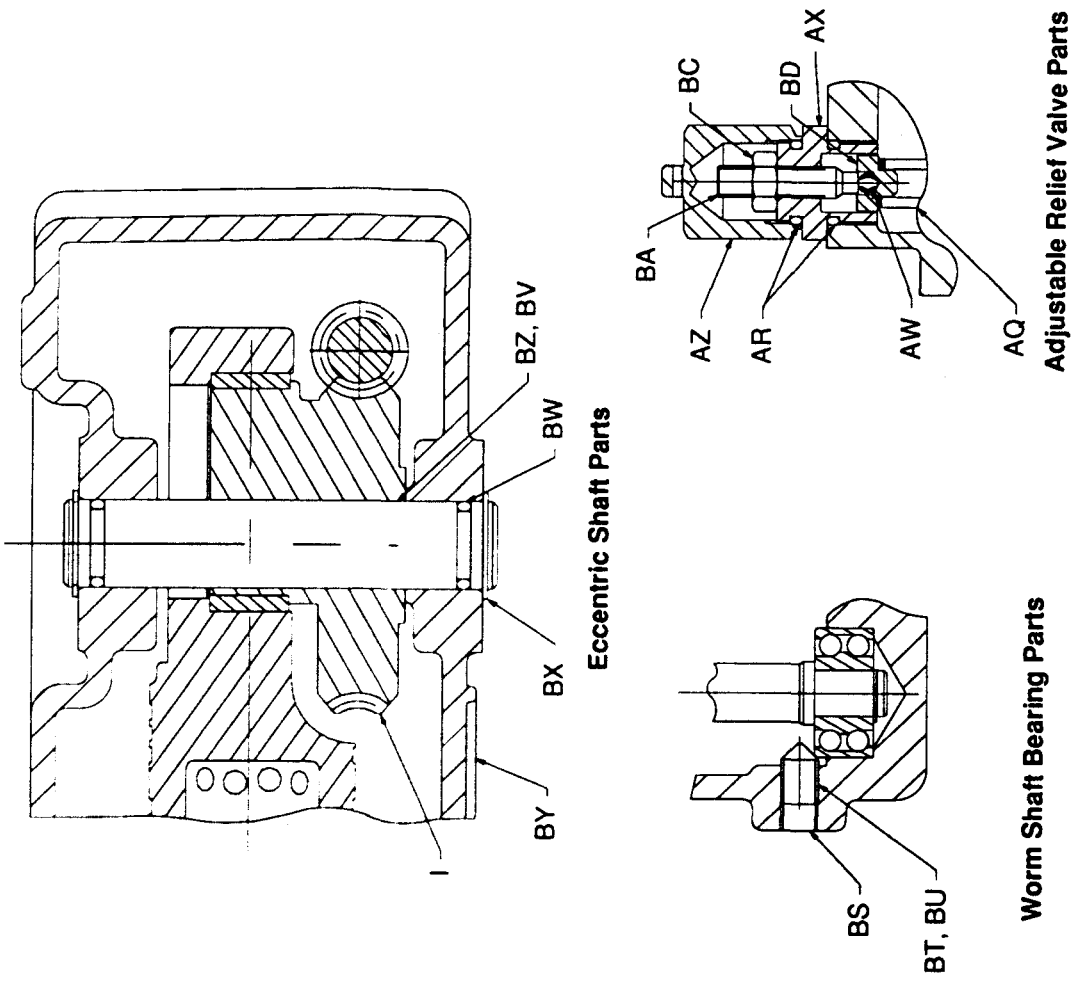

Figure 8. maxRoy Drive Assembly Parts Reference Drawing (Cont.).

FIGURE 9.
MAXROY METALLIC LIQUID END PARTS.

MAXROY STAINLESS STEEL LIQUID END PARTS

Drawing Location Reference	Description	Qty.	Part Number
Z	Washer	1	6019-0268-006
AA	Screw HM 12 x 60	6	6435-0035-935
AB	Nut, Hex M12	6	6435-0000-085
AC	Washer 12 mm	6	6434-0009-095
AD	Diaphragm (145 mm)	1	6098-0241-399
AE	Check Valve Gasket (requires 3 per check valve)	6	225-0075-275
AF	Seat (requires 1 per check valve)	2	6024-0108-016
AG	Ball (requires 1 per check valve)	2	407-0014-232
AH	Diaphragm Head	1	6021-0594-016
AI	Nut, hex M10 S8 (requires 3 per check valve)	6	6435-0000-065
AK	Ball Guide (requires 1 per check valve)	2	6003-0068-016
AL	Screw HM10 x 80 (requires 3 per check valve)	6	6435-0035-795
AM	Check Valve Body (requires 1 per check valve)1" NPT (Standard)	2	6045-0128-116
CC	Valve Clamp (requires 1 per check valve)	2	6004-0215-015

MAXROY ALLOY-20 LIQUID END PARTS

Drawing Location Reference	Description	Qty.	Part Number
Z	Washer	1	6019-0268-006
AA	Screw HM 12 x 60	6	6435-0035-935
AB	Nut, Hex M12	6	6435-0000-085
AC	Washer 12 mm	6	6434-0009-095
AD	Diaphragm (145 mm)	1	6098-0241-399
AE	Check Valve Gasket (requires 3 per check valve)	6	0225-0075-275
AF	Seat (requires 1 per check valve)	2	6024-0108-028
AG	Ball (requires 1 per check valve)	2	0407-0014-233
AH	Diaphragm Head	1	6021-0594-029
AI	Nut, hex M10 S8 (requires 3 per check valve)	6	6435-0000-065
AK	Ball Guide (requires 1 per check valve)	2	6003-0068-029
AL	Screw HM10 x 80 (requires 3 per check valve)	6	6435-0035-795
AM	Check Valve Body (requires 1 per check valve)1" NPT (Standard)	2	6045-0128-128
CC	Valve Clamp (requires 1 per check valve)	2	6004-0215-015

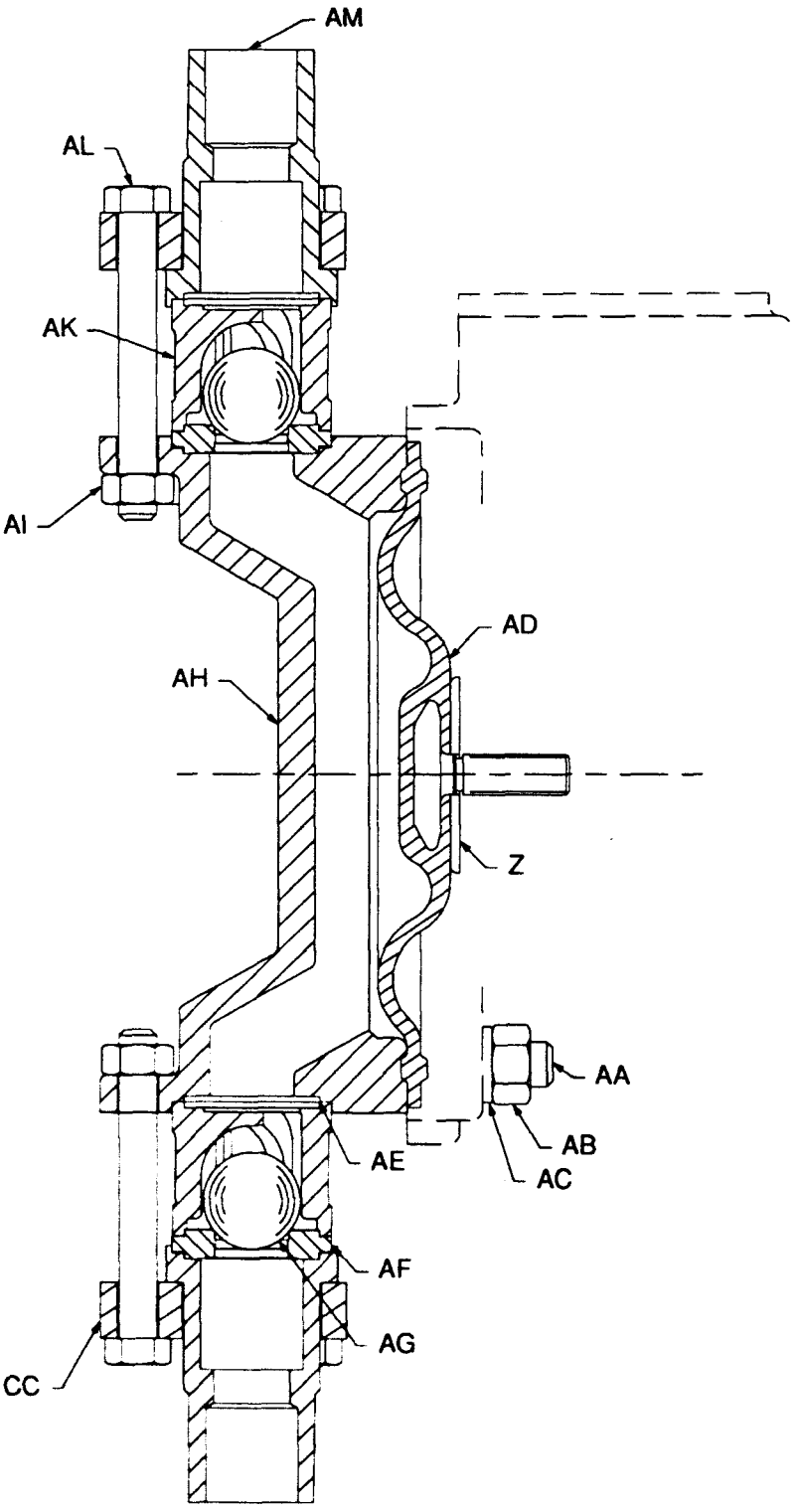

Figure 9. maxRoy Metallic Liquid End Parts Reference Drawing.

FIGURE 10.
MAXROY PLASTIC LIQUID END PARTS (PVC).

Drawing Location Reference	Description	Qty.	Part Number
Z	Washer	1	6019-0268-006
AB	Nut, Hex M12	6	6435-0000-085
AC	Washer 12 mm	6	6434-0009-095
AD	Diaphragm (145 mm)	1	6098-0241-399
CD	Diaphragm Head (PVC)	1	221-0774-071
CE	Bolt, M12 x 130	6	6435-0036-035
CF	Back up Plate	1	6004-0195-006
CG	Union Nut (1 per check valve)	2	245-0026-071
CH	Coupling 1" NPT (1 per check valve)	2	209-0032-071
CJ	Seat (Note 1)	3	6024-0137-073
CK	Ball (Note 1)	3	407-0015-231
CL	O-Ring (Note 2)	9	408-0068-135
CM	Ball Guide (Note 3)	2	6003-0106-071
CN	Coupling (Note 4)	1	6047-0494-071
CP	Spring Seat (Note 4)	1	6044-0045-071
CR	Spring (Note 4)	1	6080-0083-026
CS	Ball Guide (Spring Check) (Note 4)	1	6003-0134-071

Notes:

1. 1 per suction check valve, 2 per discharge check valve.
2. 3 per suction check valve, 6 per discharge check valve.
3. 1 per suction check valve, 1 per discharge check valve.
4. Used on discharge check valve only.

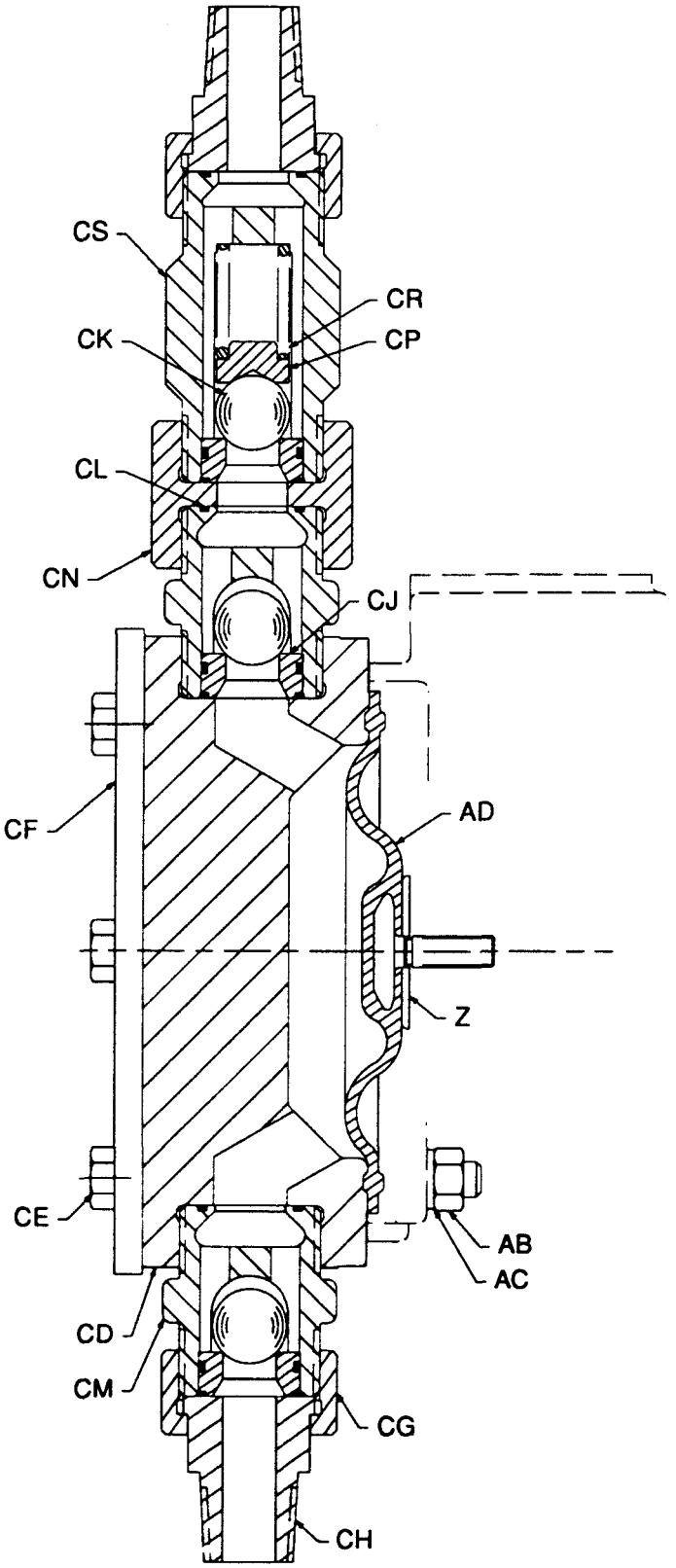

Figure 10. maxRoy Plastic Liquid End Parts Reference Drawing.

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