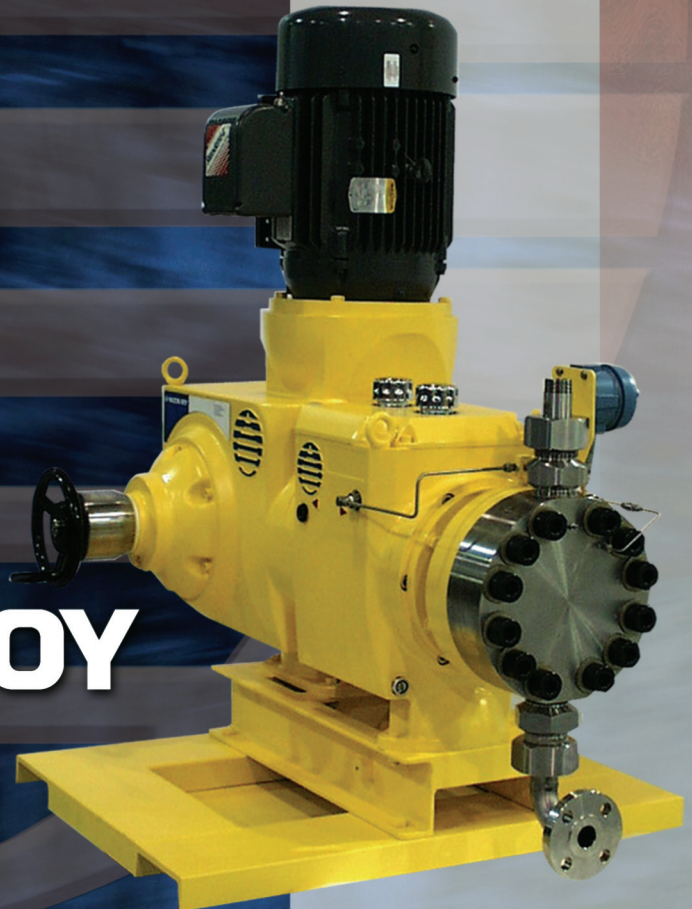
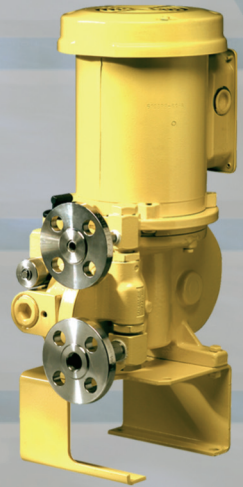


Milton Roy Metering Pump Technology

Meets API 675 Requirements



MILTON ROY

The Metering Pump

The metering pump is a positive displacement chemical dosing device with the ability to vary capacity manually or automatically as process conditions require. It features a high level of repetitive accuracy and is capable of pumping a wide range of chemicals including acids, bases, corrosives or viscous liquids and slurries.

The pumping action is developed by a reciprocating piston which is either in direct contact with the process fluid, or is shielded from the fluid by a diaphragm. Diaphragms are actuated by hydraulic fluid between the piston and the diaphragm.

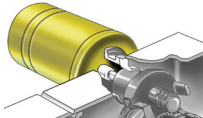
Metering pumps are generally used in applications where one or more of the following conditions exist.

- Low flow rates in ml/hr or GPH are required
- High accuracy feed rate is demanded
- Corrosive, hazardous, or high temperature fluids are handled
- High system pressure exists
- Dosing is controlled by computer, microprocessor, DCS, PLC, or flow proportioning
- Viscous fluids or slurries need to be pumped

Metering Pump Basic Components

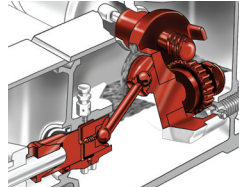
Driver:

The pump is usually driven by an AC constant speed motor. Variable speed, pneumatic, and hydraulic drivers are also utilized.



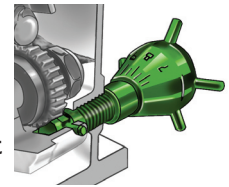
Driver Mechanism:

The drive mechanism translates the rotary motion of the driver into reciprocating movement. Industrial duty pumps will submerge this portion of the pump in an oil bath to assure reliability during continuous operation.



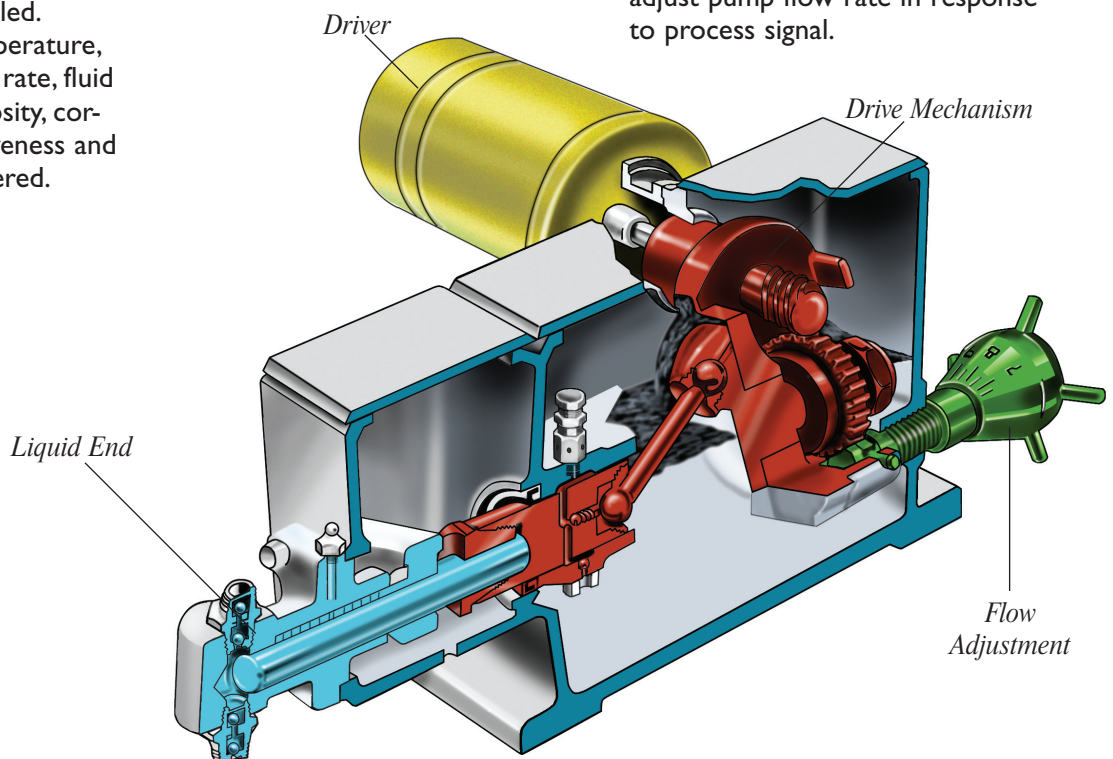
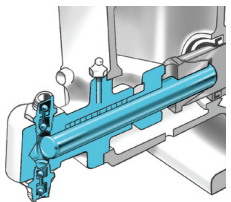
Flow Adjustment:

Pump flow rate is adjustable by varying stroke length, effective stroke length, or stroking speed. Most metering pumps are supplied with a micrometer screw adjustment similar to the one shown here. The micrometer can also be replaced by an electronic or pneumatic actuator to adjust pump flow rate in response to process signal.

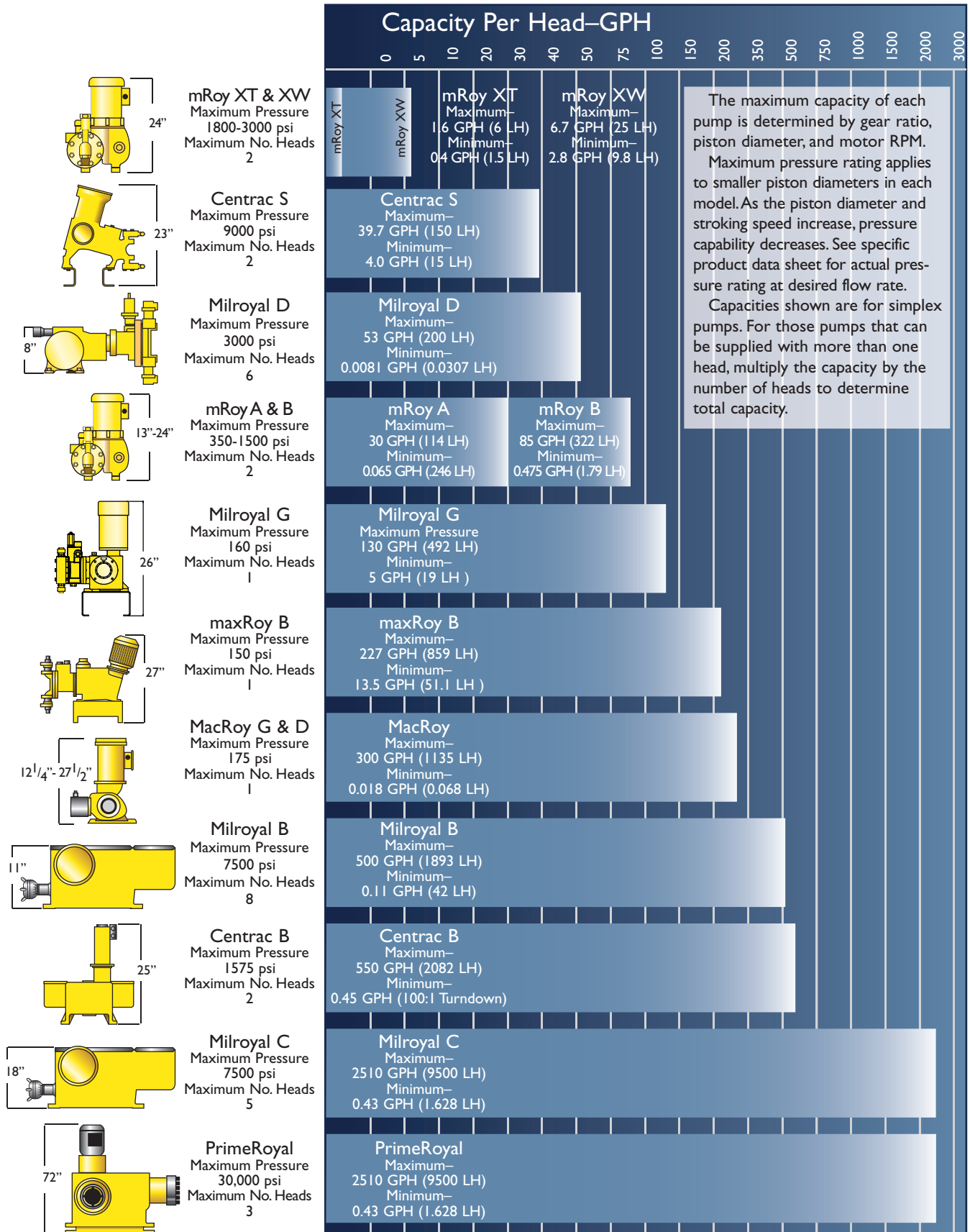


Liquid End:

The liquid end design and materials of construction are determined by the service conditions, and the nature of the fluid to be handled. Temperature, flow rate, fluid viscosity, corrosiveness and other factors are considered.

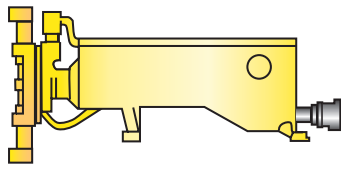


Capacity and Pressure Capabilities

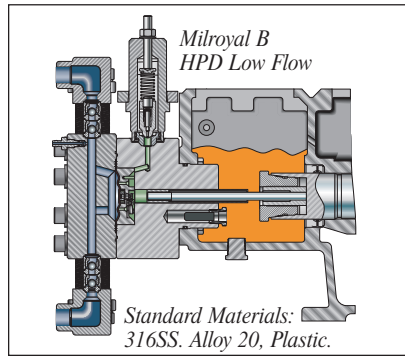


...Advanced Liquid End Technology

HPD Preshaped Composite Diaphragm

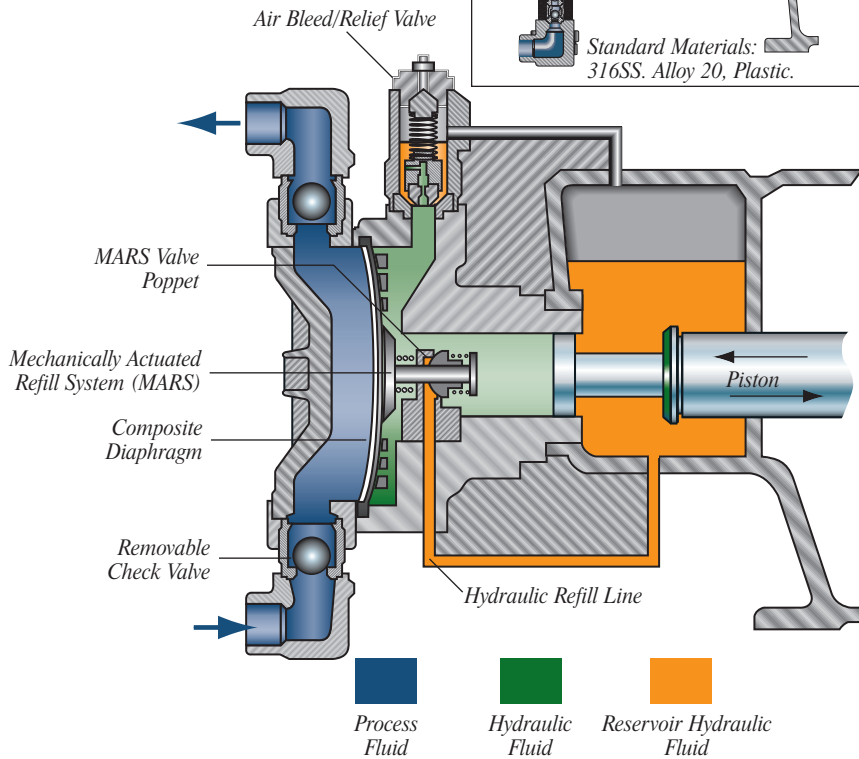


Full side view of HPD Liquid End on MilRoyal Drive



Milroyal B HPD Low Flow

Standard Materials: 316SS, Alloy 20, Plastic.

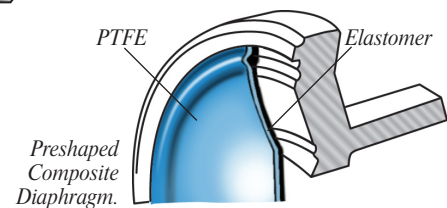


Available on: Milroyal B, Milroyal C, Milroyal D, Centrac and Maxroyal.
Standard Materials of Construction: 316SS, Alloy 20, Plastic.

The HPD features a pre-shaped PTFE/elastomer composite disc diaphragm. On the process side, the chemical resistance of PTFE is utilized. On the hydraulic side, the elastomer imparts favorable elastic and mechanical factors.

The composite diaphragm eliminates the inherent problems of pure PTFE diaphragms. PTFE tends to cold flow when compressed between two metal parts (such as those required to seal the hydraulic side from the process side). The HPD composite diaphragm features an integral "O" ring seal around the perimeter of the diaphragm, which provides a better seal between hydraulic and process fluids than conventional diaphragm materials.

The HPD is capable of handling pressures up to 3025 psi and temperatures up to 300°F (with special modifications).



MARS System Operation

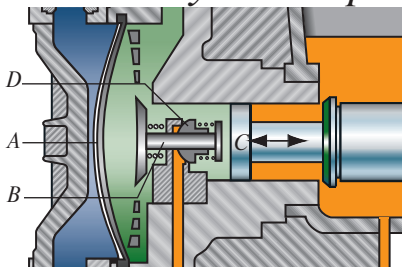


Figure 1
Diaphragm (A) and piston (C) are full forward. Mars valve (B) in forward position holds poppet valve (D) closed, preventing refill line hydraulic oil from entering the chamber.

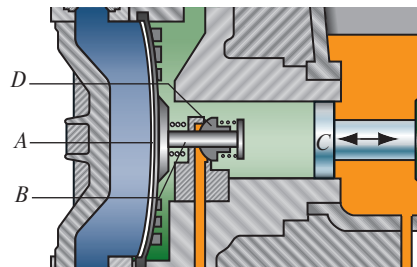


Figure 2
Diaphragm (A) and piston (C) are full rearward. Mars valve (B) is also rearward due to diaphragm position, thus freeing poppet (D) to open if required. Poppet (D) is shown closed, indicating hydraulic oil refill is not required.

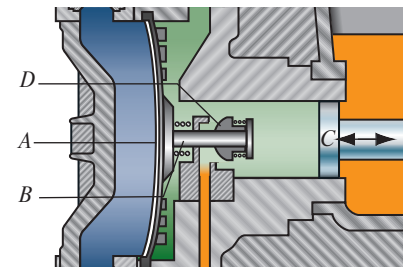
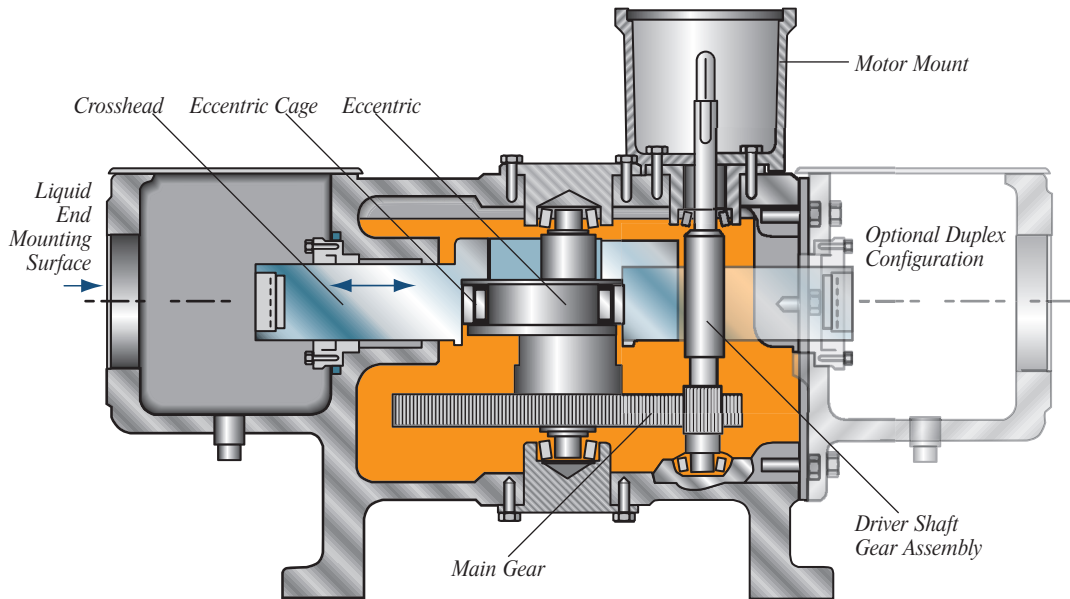


Figure 3
Diaphragm (A) and piston (C) are full rearward, once again forcing Mars valve (B) to its rearward position, which allows poppet (D) to open if required. Low oil volume creates a vacuum and opens poppet, permitting hydraulic fluid to enter the chamber from the refill line.

Metering Pump



Centrac's variable speed drive features:

- 100:1 turndown ratio
- $\pm 0.1\%$ steady state speed control
- smart commutation - permits accurate feedback signal
- no brushes (low maintenance)
- constant torque at low speeds - permits efficient driver sizing

100:1 Turndown Ratio

The flexibility of a 100:1 turndown ratio permits Centrac to be applied where a wide range of dosage rates are required. It also provides built-in growth potential by pumping efficiently in systems requiring a fraction of the pump's capacity for the short term during start-up or early phases of an expanding project. Centrac provides all this without compromising accuracy or drive power.

Response

Centrac responds instantly to changes in dosage rate. Its constant stroke length does not upset the balance within the liquid end hydraulic system, that is, hydrau-

lic fluid volume remains constant. When the hydraulic balance is disturbed, as in variable stroke length designs, the full result of dosage changes can take minutes or hours.

Centrac's instant response provides smoother operation in closed loop or automated systems. It also assures proper dosage at all time in systems requiring very close dosage tolerance.

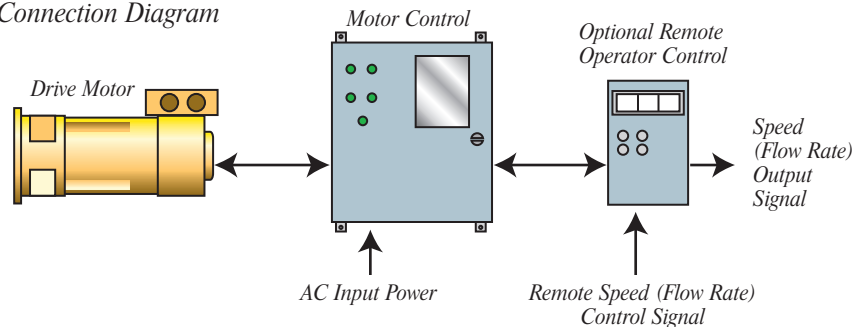
Accuracy

Centrac's $\pm 0.5\%$ steady state accuracy over its full turndown ratio is a result of the constant stroke length, and the precise speed control of Centrac's drive. This level of accuracy provides maximum chemical economy while assuring stable automatic operation and optimum process quality.

Centrac's features include:

- 100:1 turndown ratio
- $\pm 0.5\%$ steady state accuracy
- Instant response to dosage changes
- Simple but robust design for reliability
- Precise feedback signal
- Efficient drive sizing
- Mates with advanced HPD liquid end for maximum performance
- Capacity range between 0.45 GPH minimum and 1100 GPH maximum
- Discharge pressures up to 1575 psi
- Economical duplex configuration availability
- Compact design higher capacity in a small footprint

Connection Diagram



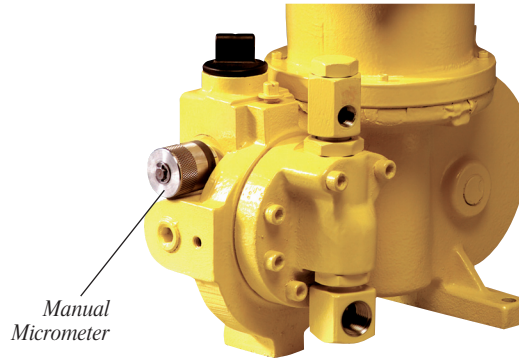
Capacity Adjustment

Metering pumps allow the user to vary capacity as the process requires. All Milton Roy metering pumps permit adjustment whether the pump is running or not.

With the exception of the Centrac (see Centrac drive), Milton Roy pumps are supplied with a manual micrometer for performing manual capacity adjustments. Depending on the type of drive mechanism and the application requirements, one of several capacity adjustment options can be supplied.

Manual Micrometer

The manual micrometer can be used to adjust the metering pump's capacity anywhere between 0 and 100%. While not directly proportional to flow, this calibrated adjustment can be used to accurately set pump capacity based on the pump performance curve within $\pm 1.0\%$ over the turndown ratio.



Manual Micrometer

Electronic Actuator

Option Available for: mRoy A & B, MaxRoy, Milroyal B & C

The Milton Roy Electronic Actuator responds to electronic process signals or remote manual adjustments. In addition, a local handwheel is provided to permit manual adjustments when unpowered.

Milton Roy's electronic actuator is different from electric actuators in that it utilizes electronic limits. It is built around stepper motor technology, which allows it to travel precisely to position without overshoot or hunting.

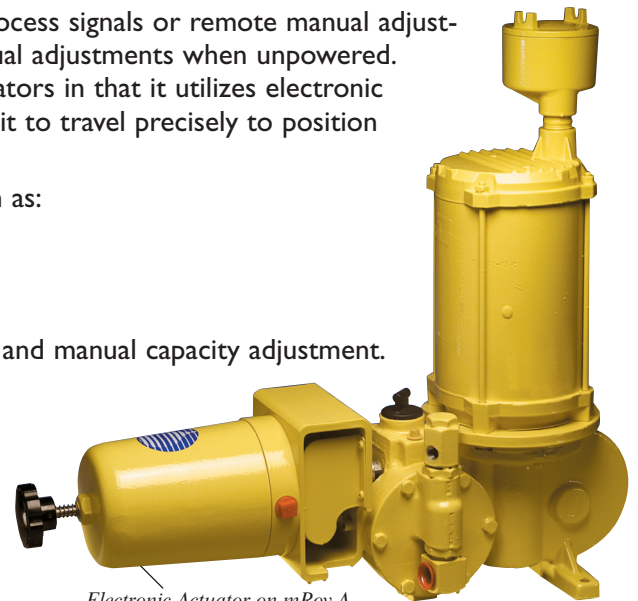
This design also provides superior operating characteristics such as:

- 100% duty cycle
- $\pm 0.5\%$ position accuracy or better
- low maintenance

Remote control stations are available for local/remote selection and manual capacity adjustment.

Specifications:

- NEMA 4 (Explosion proof available)
- 4-20 mA input signal standard
- Direct or reverse acting
- 1-5 VDC stroke position output signal
- Single phase 50/60 cycle 115 VAC



Electronic Actuator on mRoy A

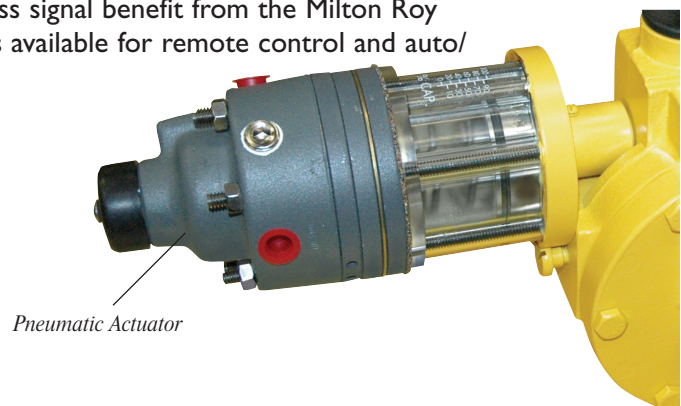
Pneumatic Actuators

Option Available for: mRoy A & B, Milroyal B & C

Automatic systems that supply a pneumatic process signal benefit from the Milton Roy pneumatic actuator. A separate air control panel is available for remote control and auto/manual switching.

Specifications:

- 3-15 or 3-27 psi pneumatic signal
- Direct or reverse acting
- Requires 60 psi supply air pressure



Pneumatic Actuator

Modifications

Double Diaphragm With Diaphragm Rupture Detection System

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

The system consists of two separate diaphragms, a hollow intermediate ring, and a pressure gauge or switch. During the normal opera-

tion, the two diaphragms are pushed tightly together and are separated only around their outside edge by the intermediate ring. The rupture detection system senses a pressure only when a diaphragm ruptures. The system is not affected by changes in pump discharge pressures.

This system is available for mRoys, maxRoys, MacRoys, and HPD's. A different design centered around sensing changes in conductivity is also available for a number of liquid ends.



Application Engineering: Custom Modifications

Milton Roy offers a wide variety of standard pumps to satisfy most applications. In addition, our Applications Engineering department is capable of supplying specialty engineered products.

Capabilities include:

- Special liquid end materials including diaphragms, diaphragm heads, check valves, etc.
- Special piston diameters
- High temperature or pressure modifications
- Unique multiplex arrangements
- Application counseling
- Special sensors, indications, or instrument interface
- Special drive modifications or gear ratios



Metering Pump System Components

Proper metering pump system operation depends upon the selection of appropriate system components. Milton Roy offers high quality accessories to suit your application requirements.



1. Safety Relief Valves

Most piping systems require the use of an external safety valve to protect the piping from over-pressure. Diaphragm pumps feature internal safety valves to protect the pump, but external safety valves are still recommended. Milton Roy provides safety relief valves to match the operating pressures of all pumps we manufacture. Standard safety relief valves are available in specialty steel, 316 SS, alloy 20, and PVC.



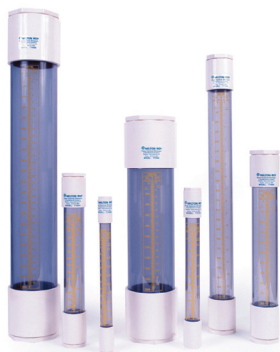
2. Back Pressure Valves

To prevent unmetered liquid from free-flowing through the pump, metering pump systems require a greater pressure in the discharge line than the suction or inlet line. When the process does not supply a minimum of 25 psi above the suction pressure, a back pressure valve is required. Standard back pressure valves are available in specialty steel, 316 ss, alloy 20 and PVC .



3. Pulsation Dampeners

The metering pump's reciprocating motion provides a pulsating discharge flow. Applications requiring a steady flow can eliminate over 90% of the pulsations with a pulsation dampener. Dampeners are available for pressures to 1000 psi. Sizing is based on cubic inch/stroke displacement of the specific pump.



4. Calibration Columns

All Milton Roy metering pumps are factory tested. Once installed, pump calibration should be periodically determined to verify proper operation, especially after the performance of any maintenance. Milton Roy calibration columns provide an inexpensive means of assuring pumping accuracy.



5. Mixroy® Mixers

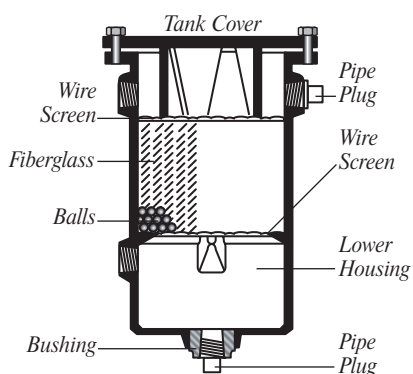
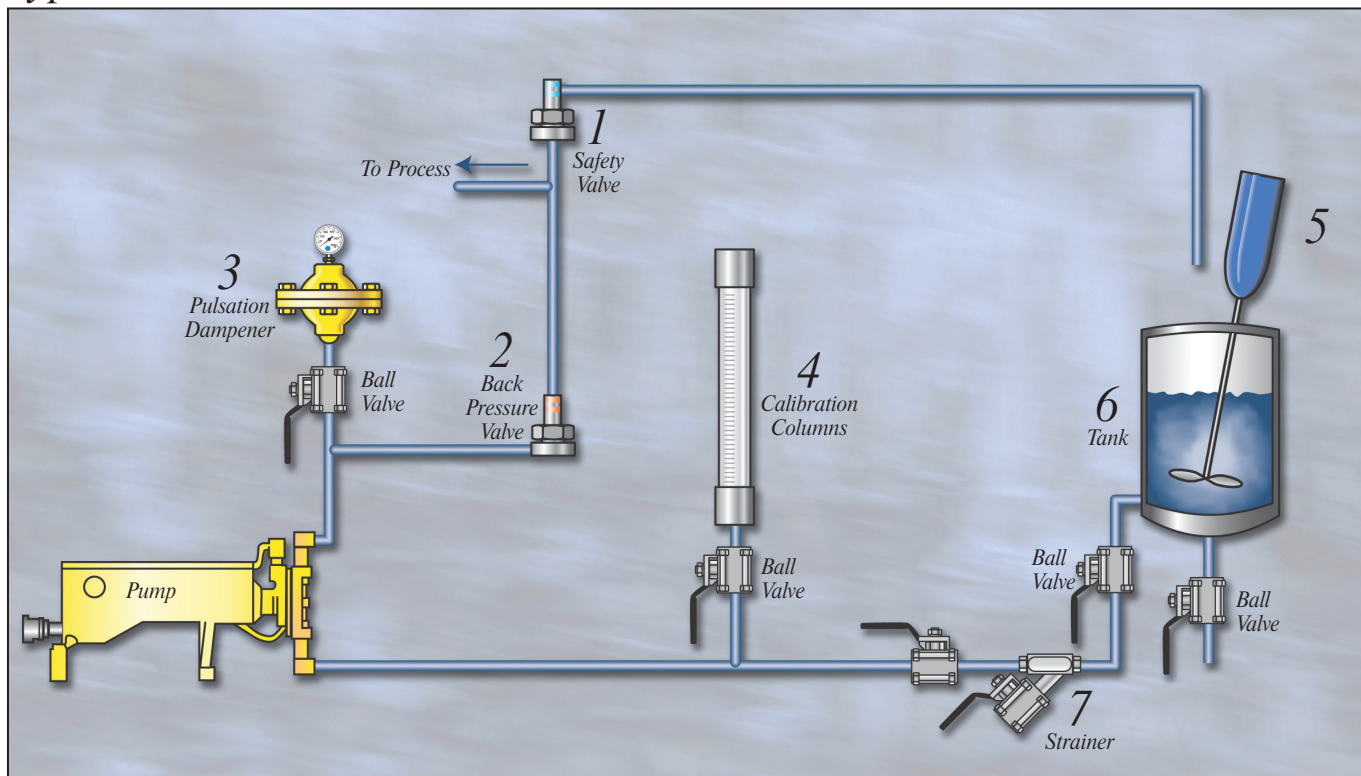
Accurate dosing requires proper mixing of the solution being pumped. Mixroy® mixers are direct drive, high speed units designed for mixing medium and low viscosity fluids and dispersion of light solids.



6. Tank Chemical Feed Systems

Milton Roy offers tanks (in most available tank capacities) in steel, stainless steel, and polyethylene. They are also available with pumps and mixers mounted, plumbed, and ready for installation.

Typical Installation



7. Strainers/Sludge Traps

The metering pump's check valves should be protected from particles and debris by installing a strainer in the suction line.

When pumping concentrated sulfuric acid, a sludge trap is required to trap sludge particles while providing easy cleaning or flushing.

Foot valves and strainers are available for applications that pump fluid from replaceable drums. "Y" type strainers can also be supplied for in-line protection in standard systems.

8. Chemical Dosing Systems

Milton Roy offers the "RoyPak" family of chemical dosing pre-engineered systems. The standard RoyPak provides manual control and all accessories to allow for proper operation.

The RoyPak *Setpoint* paces the dosing from your single input. The RoyPak *Setpoint Plus* uses a line of instruments to provide a full closed-loop solution.

Other Milton Roy Products

Streaming Current Detector

Milton Roy's Streaming Current Detector (SCD) is used to monitor and control coagulants in water or wastewater treatment. The SCD is an on-line instrument, therefore consistent effluent quality is assured.

In addition to water and wastewater treatment, the SCD is widely used in paper making, petroleum, food, chemical, and other industries where close control of coagulant or charge altering chemicals are beneficial.



The Milton Roy Family of Streaming Current Detectors

Electronic Actuators

A broad line of electronic actuators, similar to those used on Milton Roy pumps, is available for control valve actuation and other applications requiring precision and dependability. These advanced electronic actuators outperform standard electric designs by utilizing stepper motor technology.

Milton Roy's electronic actuators offer the following advantages:

- 100% duty cycle
- Electronic limit switches
- Direct to position operation-no hunting or overshoot
- Rotary or linear designs
- AC and DC units
- Responds to 4-20 mA, split range, digital and other process signals
- Maximum torque - 3800 in-lbs (317 ft-lbs)
- Maximum thrust - 1100 lbs
- Optional controllers and failsafe units

