

The background of the slide features a close-up photograph of industrial machinery. It shows several thick, brown-painted metal pipes. A prominent horizontal pipe runs across the lower half of the frame. Above it, a vertical pipe is visible, and a circular pressure gauge with a white face and black markings is mounted on a small vertical pipe. The overall scene is set against a dark, textured blue background.

OPERATION & Maintenance of Chemical Metering Pumps

Prepared For...

New Jersey Water Environment Association

2022 SPRING TECHNOLOGY TRANSFER SEMINAR

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Chemical Metering Pumps - Safety

Protective Safety Equipment & Procedures

- Safety Glasses
- Hard Hat
- Chemical-resistant Gloves (possibly Apron)
- Respirator, when recommended
- Protective clothing, when recommended
- Locate eye wash station
- Locate closest exit
- Flush System w/water if possible
- Practice extreme caution when in a containment area

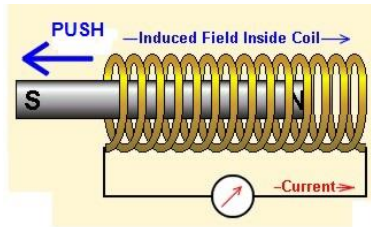


Chemical Metering Pumps - Definition

- Metering pumps (also known as controlled volume pumps, chemical injection/feed pumps, or dosing pumps) are typically used for the injection of chemical additives, proportional blending of multiple components or metered transfer of a single liquid.
- These types of pumps are used in applications requiring highly accurate, repeatable and adjustable rates of flow.
- Hydraulic Institute Definition - A Metering Pump should be capable of frequency (speed) and stroke length (volume) adjustment

Chemical Metering Pumps - Types

Solenoid Operated



Motor Driven



DRIVES

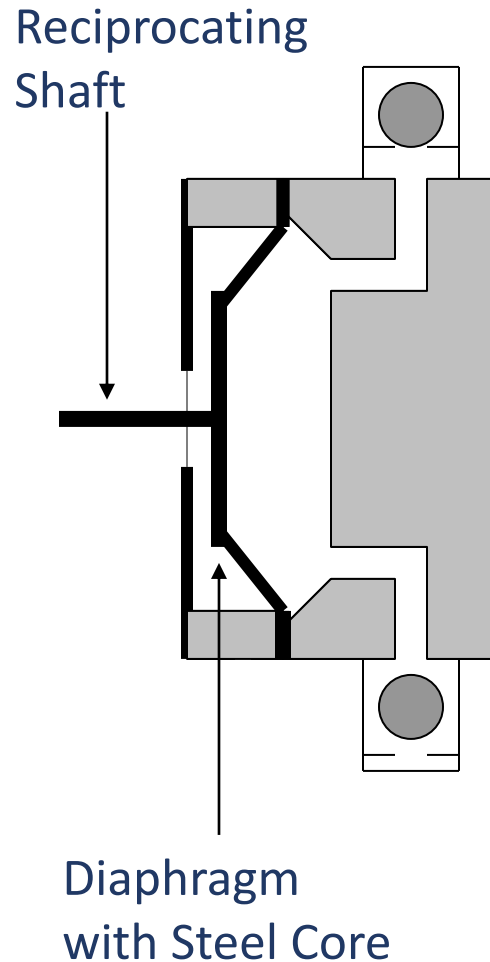
- **Mechanically Actuated Diaphragm Metering Pumps**
- **Hydraulically Actuated Diaphragm Metering Pumps**
- **Peristaltic Pumps ***

Note: AOD (Air Operated Diaphragm) Pumps are also available. Motor and Solenoid Operated are most common



Mechanically Actuated Diaphragm Metering Pumps

Mechanically Actuated - Operation



Advantages:

- Lower cost due to simpler construction
- Ease of diaphragm replacement
- Seal less design - no fugitive emissions
- No possibility of cross-contamination of hydraulic fluid and chemical

Disadvantages:

- Lower pressure ratings (max <200 psig)
- Lower repeatability (< +/- 2%)

Mechanically Actuated – Troubleshooting

- 1. Leak in suction side of pump
 - 2. Valve balls/seats not sealing
 - 3. Low setting on pump stroke length
 - 4. Low solution level
 - 5. Diaphragm ruptured
 - 6. Pump head cracked or broken
 - 7. Pump head contains air, chlorine, hydrogen peroxide or ammonia gas
- 1. Examine suction tubing. Check if foot valve is operating properly
 - 2. Clean valve seats if dirty or replace with alternate material if deterioration is noted
 - 3. When pumping against pressure, the dial should be set above 20% capacity for a reliable feed rate
 - 4. Solution must be above foot valve
 - 5. Replace diaphragm. Check for pressure above rated maximum at the injection point. Check if there is abrasive material in chemical.
 - 6. Replace pump head. Make sure fittings are hand tight only. Using pliers and wrench can crack pump head.
 - 7. Bleed pump head, open priming valve or degassing valve on discharge piping

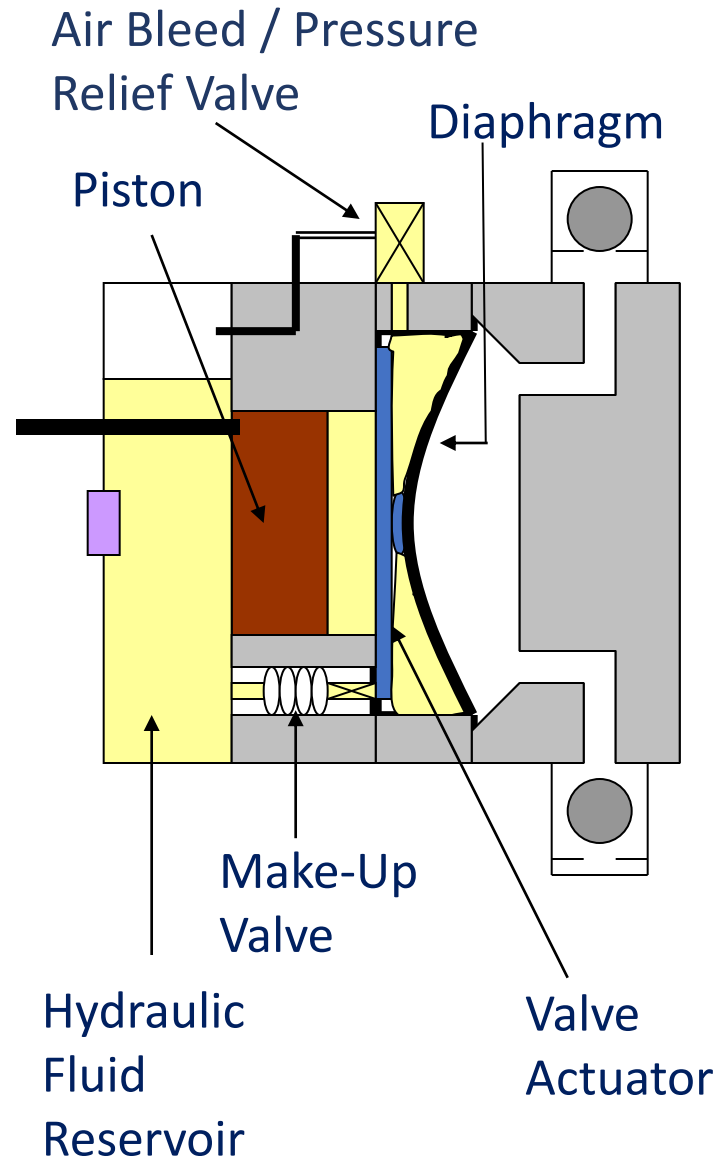
Mechanically Actuated – Maintenance

- 1. Foot Valves
 - 2. Suction/Discharge Valve balls/seats
 - 3. Diaphragm
 - 4. Injection Fitting or Lance
 - 5. Inlet Tubing
 - 6. Discharge Tubing
 - 7. Rigid Piping
 - 8. Reagent Head
- 1. Clean or Replace Foot Valves yearly
 - 2. Clean or Replace Suction/Discharge Valve balls/seats yearly
 - 3. Inspect Diaphragm yearly
 - 4. Inspect/Clean Injection Fitting quarterly
 - 5. Inspect Inlet Tubing quarterly
 - 6. Inspect Discharge Tubing quarterly
 - 7. Address leaks w/new seats or O-rings or Teflon tape. Do not over torque
 - 8. Reagent Head. Check bolts 2 weeks after start up. Every 6 months thereafter

Hydraulically Actuated Diaphragm Metering Pumps



Hydraulically Actuated - Operation



Advantages:

- Higher pressure capabilities
- Seal less design - no fugitive emissions
- Greater repeatability ($< \pm 0.5\%$)
- Rugged Design capable of feeding against pressures as high as 2500 psig

Disadvantages:

- Higher cost due to complexity of design
- Difficulty of diaphragm replacement and balancing of hydraulic fluid

Hydraulically Actuated - Operation

PTP – Push-to-Purge

Ease of commissioning Auto/Manual air bleeder

Automatic removal of air entrained in the hydraulics
On demand purge system
Manual purge of air when pressed to aid in start-up



HPV – High Performance Valve

Mechanical Refill Hydraulic System

Provides resiliency to system upsets

i.e. blocked discharge, starved suction
Shortens down time
Reduces maintenance cost



HBV – Hydraulic Bypass Valve

Provides protection of the pump from over-pressurization

Externally adjustable internal relief valve

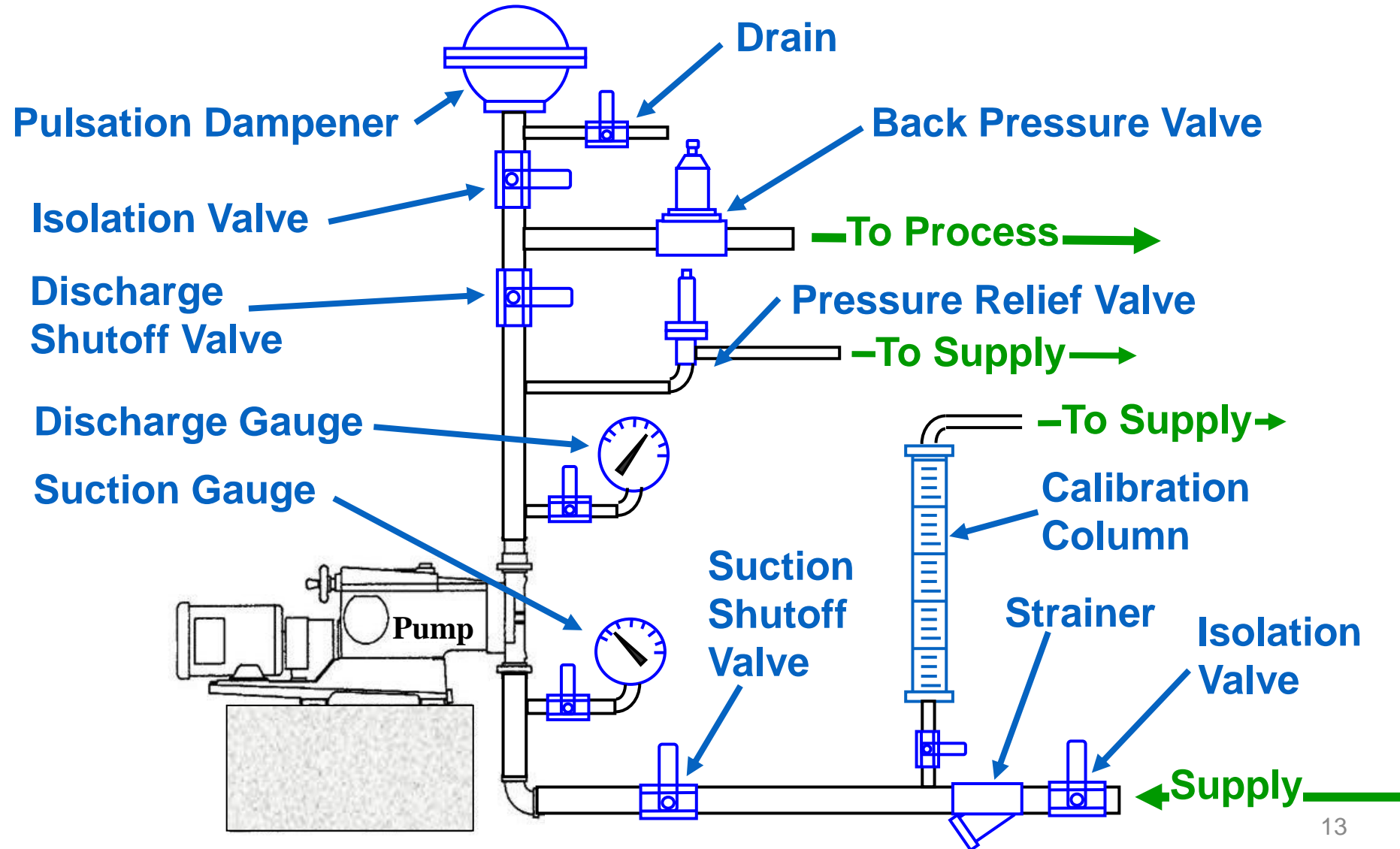


Hydraulically Operated – Maintenance

Accurate records of pump operation will indicate the type and levels of required maintenance. A preventative maintenance program based on such records will minimize operational problems.

- 1. Check oils/lubrication products regularly – site glasses aid greatly
- 2. Inspect Suction/Discharge Valve balls/seats after 3 months of operation, yearly thereafter unless a decrease in feed rate is noted
- 3. Diaphragms are not subjected to mechanical wear; long life is common. Inspect diaphragm after 6 months of operation to establish protocol
- 4. Run a draw down test after any maintenance is performed. Draw down tests should be run at least yearly. Industrial applications more frequently to ensure product quality
- 5. Clean Purge Valves, High Performance Valves and Hydraulic Bypass Valves per manufacturers recommendations. Check Hydraulic Bypass Valve at startup if feed against system pressure tops out
- 6. Basket Strainers are a maintenance saver. Duty/Standby arrangements are ideal. Check collection of debris on a regular basis, particularly in applications with high feed rates.

Chemical Metering Pumps - System



Chemical Metering Pumps - Accessories

ACCESSORY

Foot valve

Backpressure Valve

Anti-Siphon Valve

Pressure Relief Valve

Pulsation Dampener

Injection Valve

Diaphragm Isolated
Pressure Gauge

Calibration Column

FUNCTION

Keeps prime

Provides pressure

Prevents siphoning

Prevents overpressure

Minimizes slugs

Provides Injection

Monitor System Pressure

Calibrate pump

ADDITIONAL BENEFITS

Prevents cavitation, Element of straining, Weighted assembly

Constant pressure = repeatable, consistent feed

Usually additional function of Backpressure Valve

Protects People, Piping and Pump

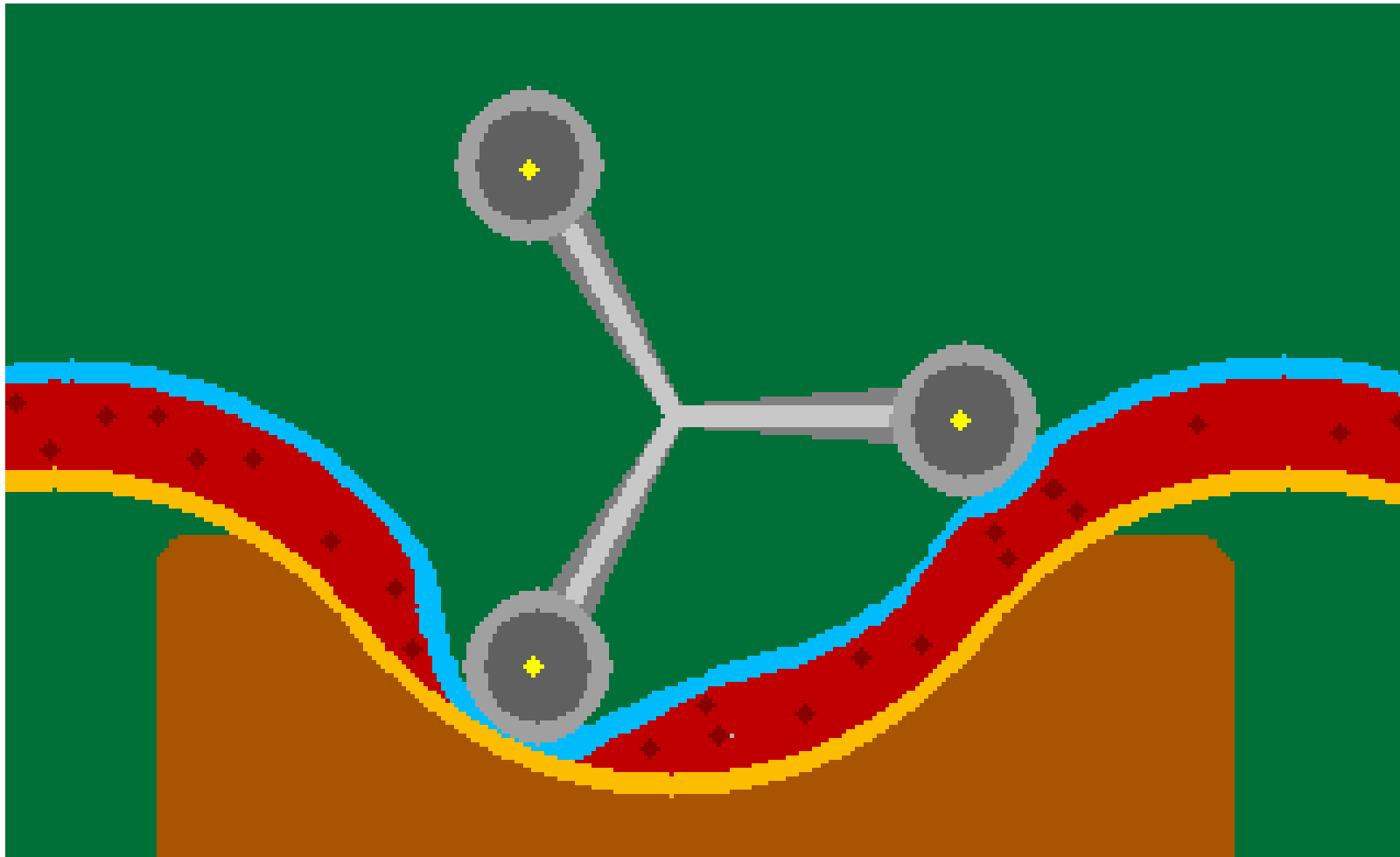
Stabilizes pulsatile energy,

Provides a slight pressure at the application point

Allows accurate setting of Back Pressure, Pressure Relief and monitoring of System Pressure

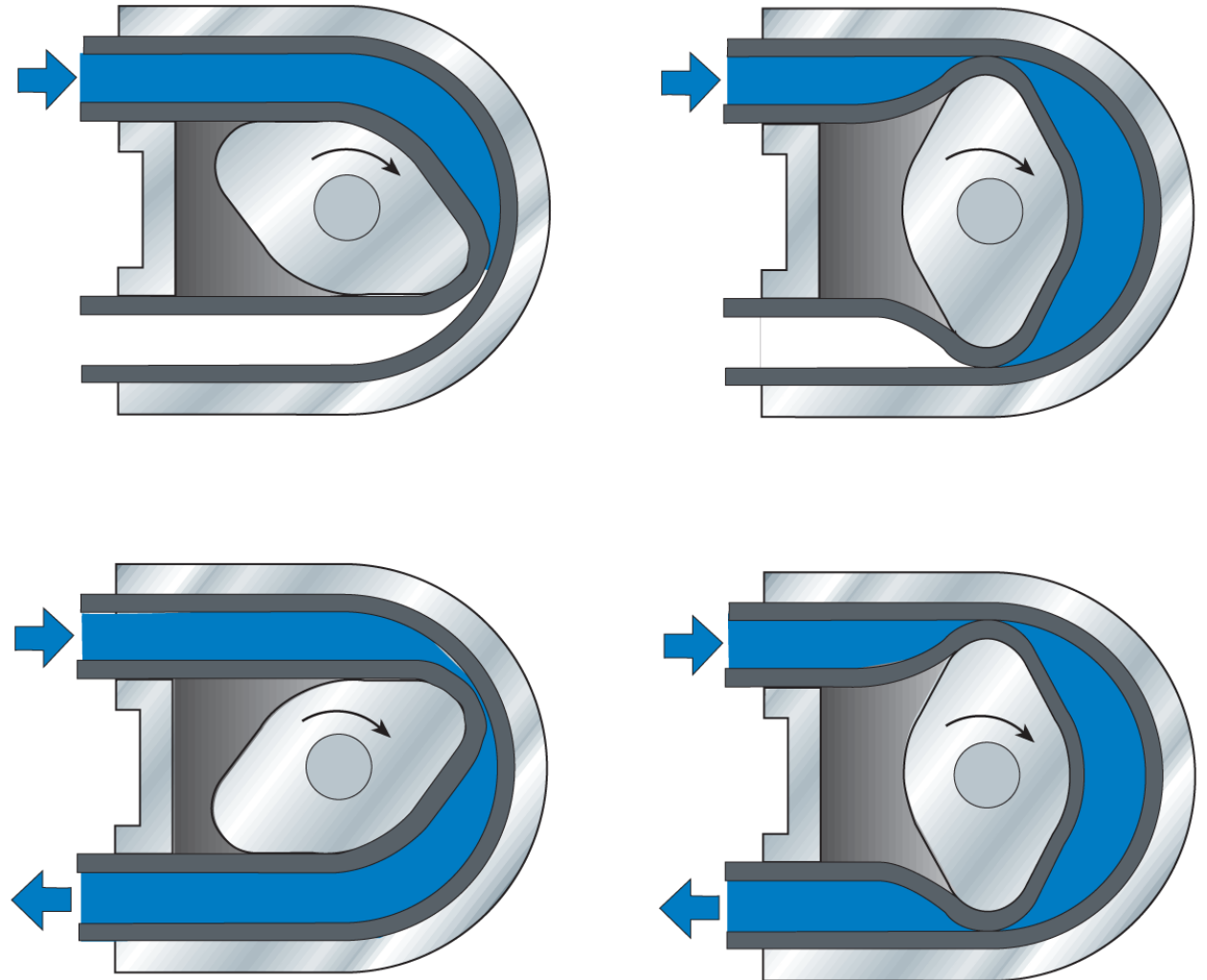
Allows check of pump performance via draw down tests. Can also aid as a priming device when installed in systems with suction lift

Peristaltically Operated Pumps

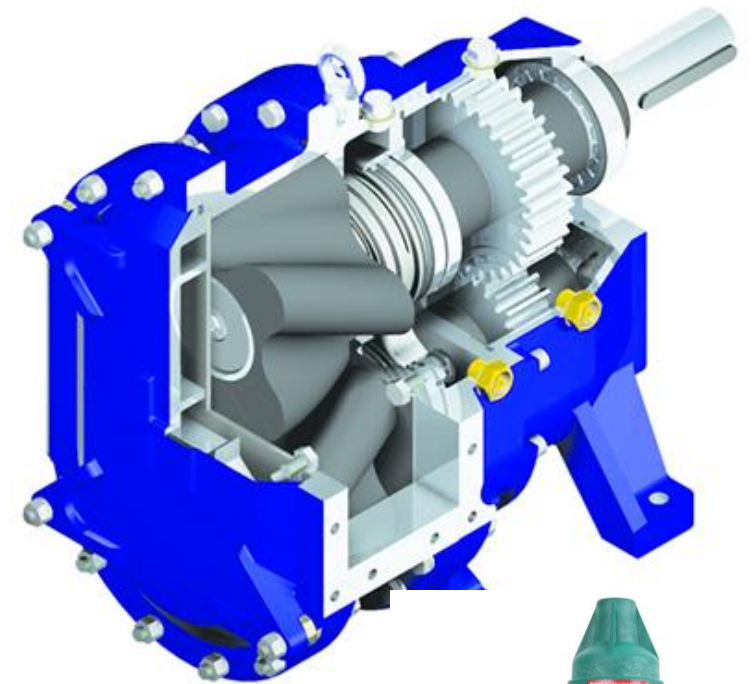


Peristaltically Operated Pumps

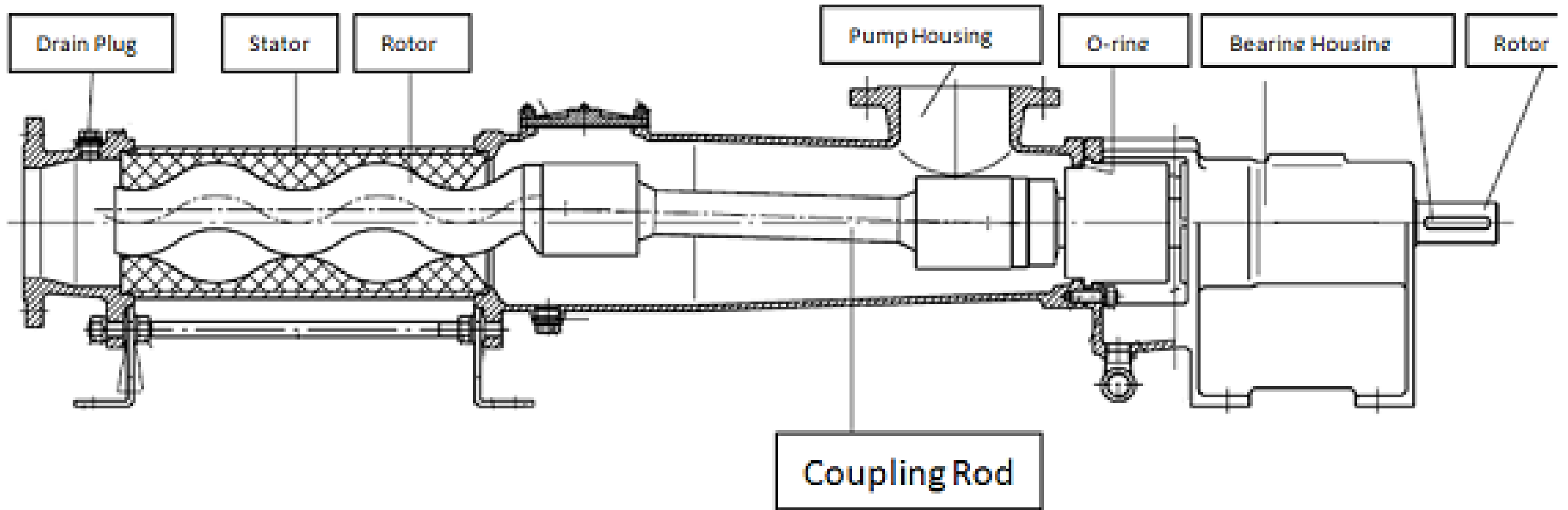
- Operation is based on moving a product through a hose or tube, by compressing and decompressing the tube
- Compression of peristaltic pump tube creates negative pressure drawing fluid into the pump
- Rotation of roller assembly allows fluid to be moved from the fluid supply, through the pump, to the application point
- Speed of this rotation will greatly affect peristaltic pump tube life
- Roller assemblies are used in most tube applications
- Shoes or Rollers are employed in hose applications



Chemical Feed Pumps – Other Types

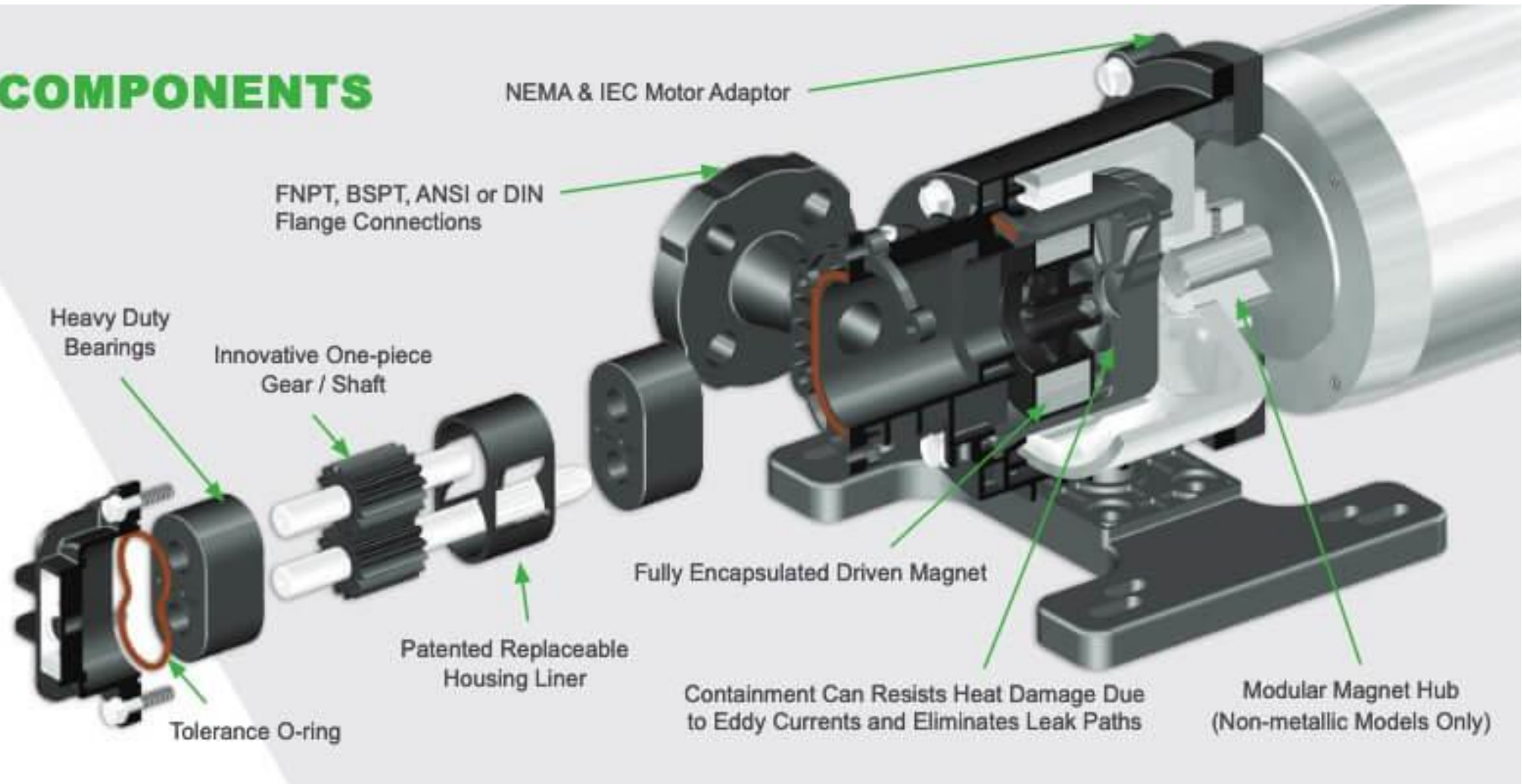


Progressive Cavity Pumps



Magnetically Driven Rotary Gear Pumps

COMPONENTS



OPERATION & Maintenance of Chemical Metering Pumps

Thank You!



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Questions?

