Chemical Feed

New Jersey RWA 2022 Conference

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- **Sponsoring Organization:**

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Agenda

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- **Types of pumps**
- **Choosing the correct pump**
- **Strengths and weaknesses**
- **Maintenance and troubleshooting**
- **Calculating dose**
- **Understand troublesome chemicals**
- **Questions and closing**

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Types of Chemical Feed Pumps

- **Diaphragm**
- **Peristaltic**

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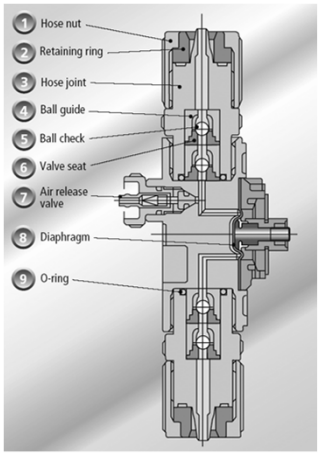
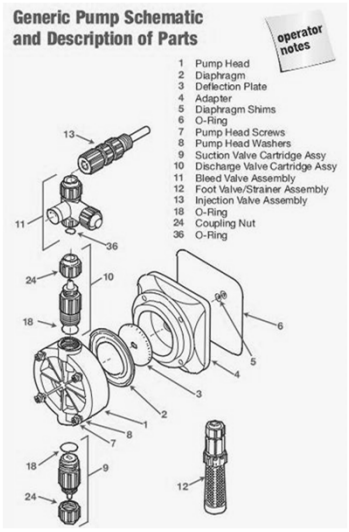
Types of Chemical Feed Pumps (Cont.)

- **Diaphragm**





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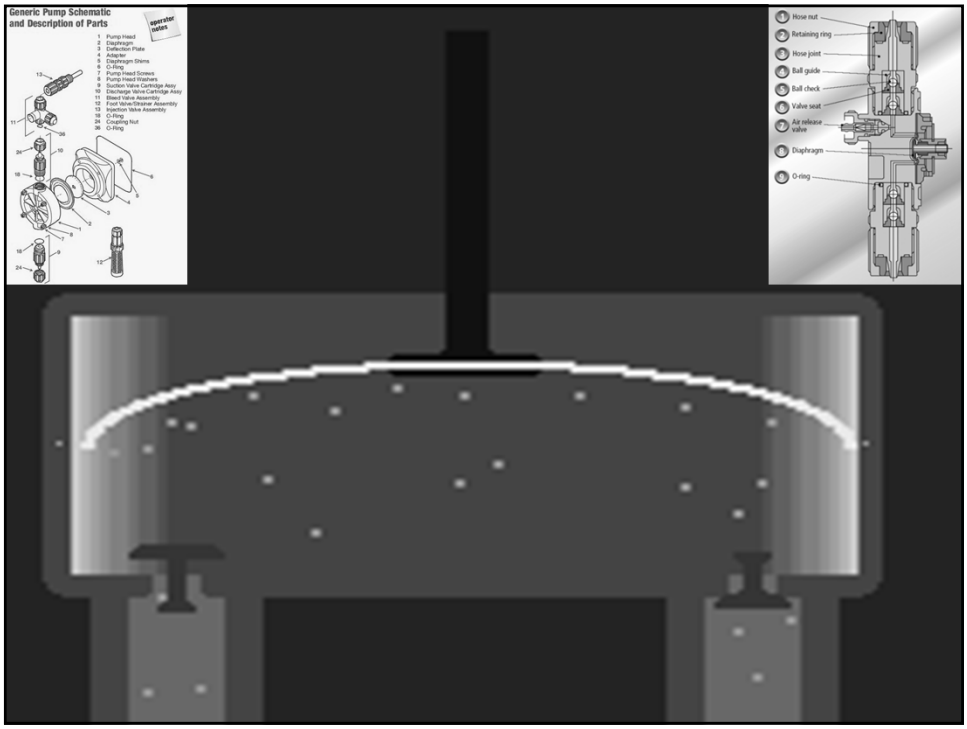

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Types of Chemical Feed Pumps (Cont.)

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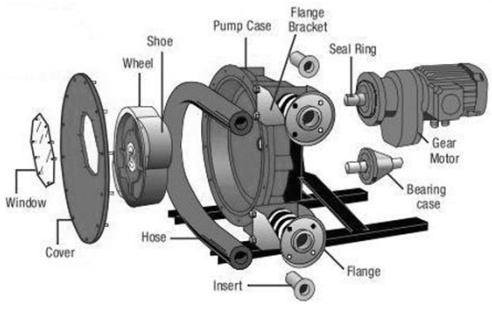
- **Peristaltic**



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How to Select a Chemical Feed Pump

- Base upon
  - Application
  - Comfort
  - Training & technical support

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Selecting a Chemical Feed Pump (cont.)

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Diaphragm

- Long history
- Ability to fine tune
- Works against high discharge pressures

Peristaltic

- Few replacement parts
- Liquid never touches motor or electronics
- Little or no off-gassing

The Choice is Yours!

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Control Methods

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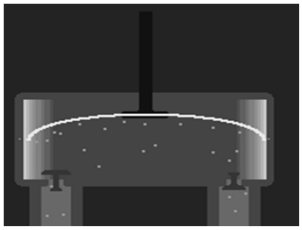
Diaphragm

- Speed (strokes per minute)
- Stroke (length per stroke)



Peristaltic

- Rotations per minute

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Control Methods (continued)

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- Manual
- 4/20 mA or Pulse
- Programmable

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Control Methods (continued)

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- **Manual**
  - Equipment Needed
    - Tank
    - Hose, pump
    - Feed point

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Control Methods (continued)

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- **4/20 mA or Pulse**
  - **Equipment Needed**
    - **Same as Manual**
    - **Signal device**
      - Flowmeter
      - SCADA
      - VFD Pump Control output

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Control Methods (continued)

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- **Programmable**
  - **Equipment Needed**
    - **Same as Manual**
    - **May have internal or external timer**

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Tips for Best Operation

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Location!

Location!

Location!

Stenner Series STS Tanks

LMI Chemical Solution Tanks

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Tips for Best Operation

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- **Proper sizing**
  - **Growth**
  - **Pump range**

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COMMON MISTAKES THAT HAPPEN IN CHEMICAL FEED!

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Maintenance and Troubleshooting

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- **Generic**
  - Follow manufacturers specifications
  - Keep workspace clean
  - Lockout/tagout
  - Consistency
    - Develop Standard Operating Procedure
    - Scheduling

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Calculating Dose

- **Math!!!!**
  - **More than one way to come up with the right answer.**
  - **Pounds Formula**
  - **Volume Concentration Formula**
  - **SWAG Formula**

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Calculating Dose (continued)

- **Pounds Formula**

(Volume, MGD)(Concentration, mg/L)(8.34 lbs/gal) = Mass/day

$$\frac{\text{Mass}}{\text{Weight of Solution x \% Chemical}} = \text{Gallons per Day}$$

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Calculating Dose (continued)

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- **Pounds Formula**

(Volume, MGD)(Concentration, mg/L)(8.34 lbs/gal) = Mass/day

3 MG x 4 mg/L x 8.34 = 100 lbs/day

$$\frac{\text{Mass}}{\text{Weight of Solution x \% Chemical}} = \text{Gallons per Day}$$

$$\frac{\text{100 pounds}}{\text{10.0 lbs/gal x .125 (12.5\%)}} = \text{80 gallons/day or .056 gallons/min}$$

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Calculating Dose (continued)

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- **Volume Concentration Formula**

$$V_1C_1 = V_2C_2$$

$$\frac{\text{Flow (gpm) x Desired Dose}}{\text{Chemical Concentration (mg/L) x Specific Gravity}} = \text{Chemical flow (gpm)}$$

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Calculating Dose (continued)

- **Volume Concentration Formula**

$$V_1C_1=V_2C_2$$

$$\frac{\text{Flow (gpm) x Desired Dose}}{\text{Chemical Concentration (mg/L) x Specific Gravity}} = \text{Chemical flow (gpm)}$$

$$\frac{2083 \text{ gpm} \times 4 \text{ mg/L}}{125{,}000 \text{ mg/L} \times 1.2} = .056 \text{ gpm}$$

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Calculating Dose (continued)

SWAG Formula

$$\text{Pump \%} = \frac{Q \times [1{,}000{,}000 - (\text{fps}) \times (\text{discharge pressure})]}{\sqrt{(\text{turbidity})(d^4)[(\text{conc.} \times .839\mu - V^2)8.34 - SG]}}$$

Make up your own Guess!

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Testing and Calibrating Pumps

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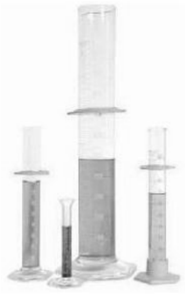
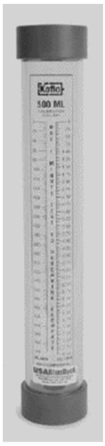
- **Testing**
  - **Drawdown**
  - **Fill-up**





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Testing and Calibrating Pumps (Cont.)

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- **Calibrating**
  - **Should not be required**
  - **Slight adjustments can be done**

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Troubleshooting Chemical Feed

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- **Identifying the problem**
- **Determining a feasible solution**
- **Implementing solution**
- **Testing results**

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Troubleshooting Chemical Feed (cont.)

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Troubleshooting your Chemical Feed Pump

operator notes

Problem	Possible Cause	Solution
Pump will not prime	1. Pump not turned on or plugged in.	1. Turn on or plug in pump.
	2. Output dials not set properly.	2. Always prime pump with speed at 80% and stroke at 100%.
	3. Foot valve not in vertical position on bottom of tank.	3. Foot valve must be vertical. (See installation instructions.)
	4. Pump suction lift too high.	4. Maximum suction lift is 5 ft (1.5m). Pumps with high viscosity liquid handling assemblies require flooded suction.
	5. Suction tubing is curved or coiled in tank.	5. Suction tubing must be vertical. Use tubing straightener either provided with your pump or available separately.
	6. Fittings are over tightened.	6. Do not overtighten fittings. This causes seal rings to distort and not seat properly which causes pump to leak back or lose prime.
	7. Trapped air in suction valve tubing.	7. Suction tubing should be as vertical as possible. Avoid false flooded suction.
	8. Too much pressure at discharge. (Pumps without 4-Function Valves)	8. Shut off valves in pressurized line. Disconnect tubing at injection check valve. When pump is primed, reconnect discharge tubing.
Pump loses prime	1. Solution container ran dry.	1. Refill container with solution and reprime.
	2. Foot valve not in a vertical position on the bottom of the tank.	2. Foot valve must be vertical (See installation instructions.)
	3. Pump suction lift is too high.	3. Maximum suction lift is 5 ft (1.5m). Pumps with high viscosity liquid handling assemblies require flooded suction.
	4. Suction tubing is curved or coiled in tank.	4. Suction tubing must be vertical. Use tubing straightener either provided with your pump or available separately.
	5. Fittings are overtightened.	5. Do not overtighten fittings. This causes seal rings to distort and not seat properly which causes pump to leak back or lose prime.
	6. Trapped air in suction valve tubing.	6. Suction tubing should be as vertical as possible. Avoid false flooded suction.
	7. Air leak on suction side.	7. Check for pinholes, cracks. Replace if necessary.
	8. Chlorine application – Chlorine solution gases off. Entraps in line or pump head.	8. Use continuous bleed valve.
Leakage	1. Worn tubing ends.	1. Cut about 1 inch (25 mm) off tubing and then replace as before.

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Troubleshooting Chemical Feed (cont.)

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- **Resources**

1. Owner's manual
2. Technical Support
3. Knowledgeable Personnel
4. Deductive Reasoning

In this order

Don't create more work!

Shop Rates	
$60/hr	½ hr minimum
$70/hr	If you tried to fix it
$80/hr	If you watch
$90/hr	If you help

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Maintenance and Repair

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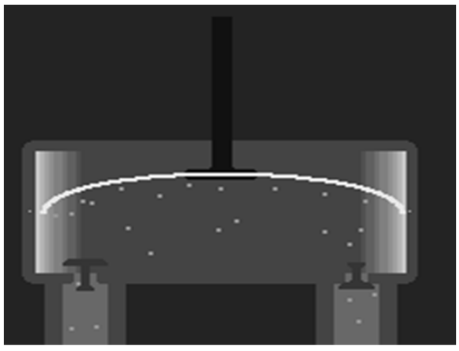
- **Timely**
- **Thorough**
- **Documented**



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Understand Troublesome Chemicals

- Polymers and other coagulants
- Corrosive and caustic
  - Oxidizers and reducers
- Chlorine and Fluoride
- Safety dealing with chemicals

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Material Compatibility

- Based upon:
  - Chemical
  - Pressure
  - Location
  - Temperature

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What are your biggest challenges, horrors stories, etc.?

Understanding Why?

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Chemical Safety

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Chemical Hazards

Chlorine, Chlorine dioxide, Sodium hypochlorite,
Calcium hypochlorite,
Hydrogen peroxide, Ozone,

Sulfur dioxide, Sodium sulfite,
Sodium Metabisulfite, Sodium bisulfite,

Cationic, Anionic, Nonionic polymers,
Ferric chloride, Ferrous chloride,

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More Chemical Hazards

Sulfuric, Hydrochloric, Fluorosilicic acids

Ammonia, Nitrates, Nitrites,
Hydrogen sulfide, Methane, Carbon dioxide,

Caustic soda, Slacked lime, Hydrated lime,
Calcium carbonate, Sodium bicarbonate,

And many more

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General Chlorine Safety

- **When is chlorine dangerous?**
  - **Detectable odor**
  - **Throat irritation**
  - **Permanent damage within 1 hour**
  - **Immediate death**

OSHA 8 hour exposure limit = 0.5 ppm

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Chlorine Gas Leaks

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Questions?

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