PERISTALTIC OR DIAPHRAGM METERING PUMP?

HOW TO CHOOSE

NEWEA – Industrial Wastewater Committee Conference
Portland, ME
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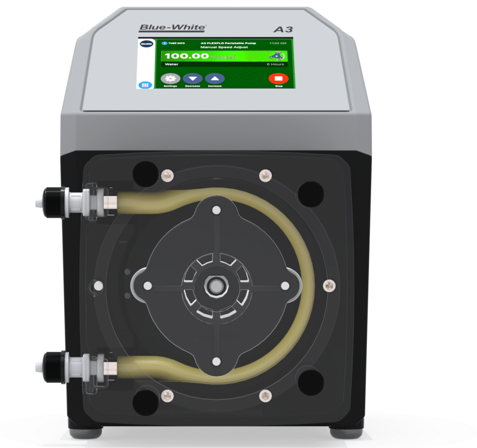
Ti-SALES

WHAT IS A PERISTALTIC PUMP?

- **Peristalsis** – The wavelike contractions of a tubular structure that propel the contents forward by alternate contraction and relaxation.
- Peristaltic pumps use rollers or shoes to push solution through tubes or hoses.
- As the rotor of the pump rotates the fluid is gently pushed forward until it is expelled through the discharge.



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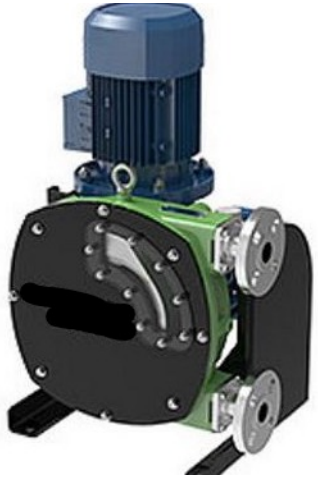
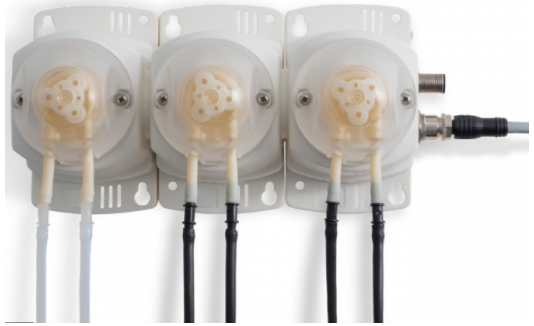
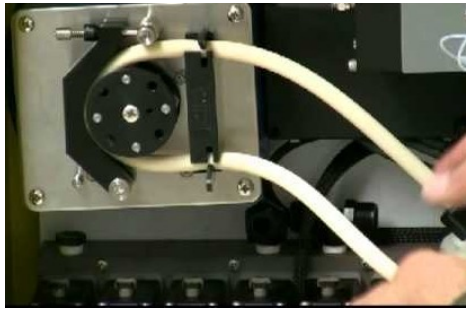
EXAMPLES OF PERISTALTIC PUMPS

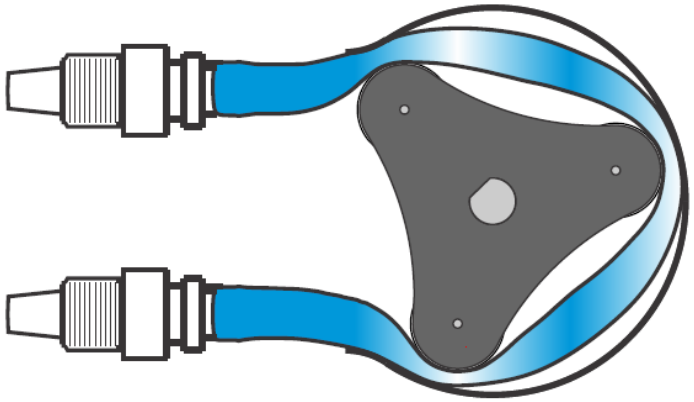


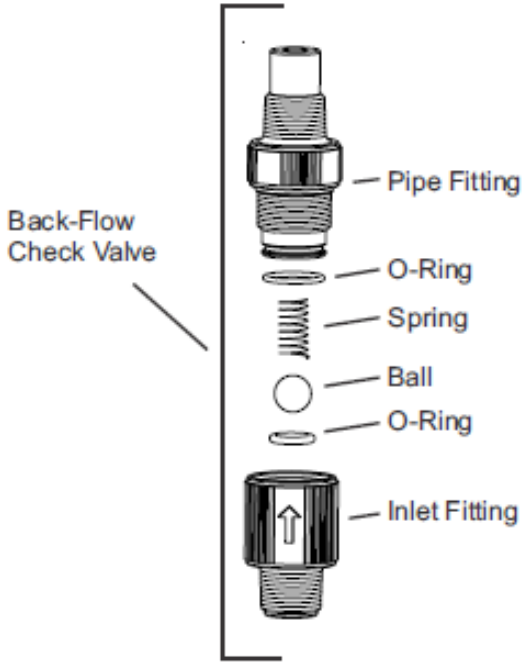




PERISTALTIC PUMP COMPONENTS

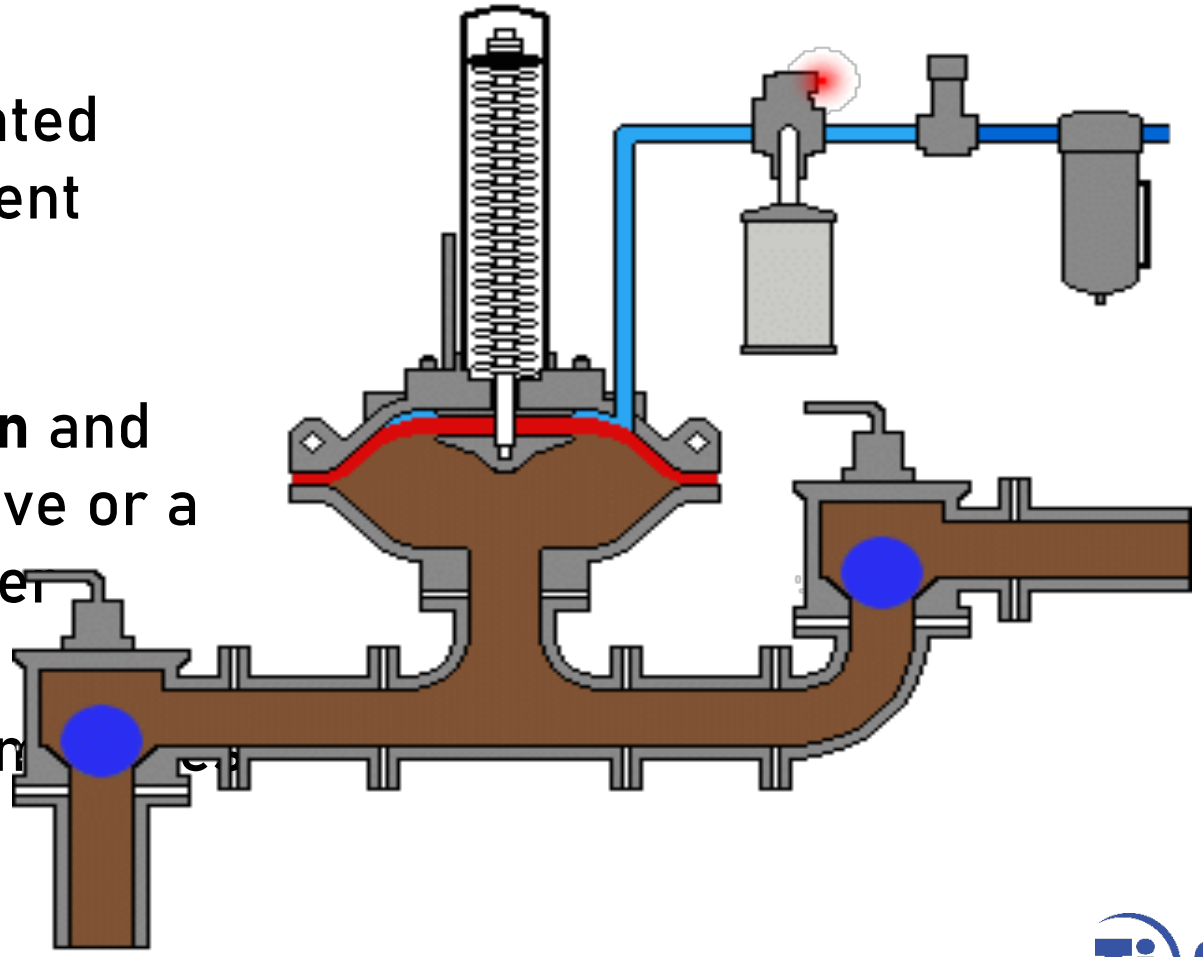
- Pump tubing
- Connection fittings
- Suction piping (tubing)
- Discharge piping (tubing)
- Back-flow check valve





WHAT IS A DIAPHRAGM PUMP?

- A diaphragm pump is a hydraulically, pneumatically, or mechanically actuated positive displacement pump that uses a combination of **reciprocating action** and either a flapper valve or a ball valve to transfer liquids.
- Diaphragms or mem[illegible] must be flexible.



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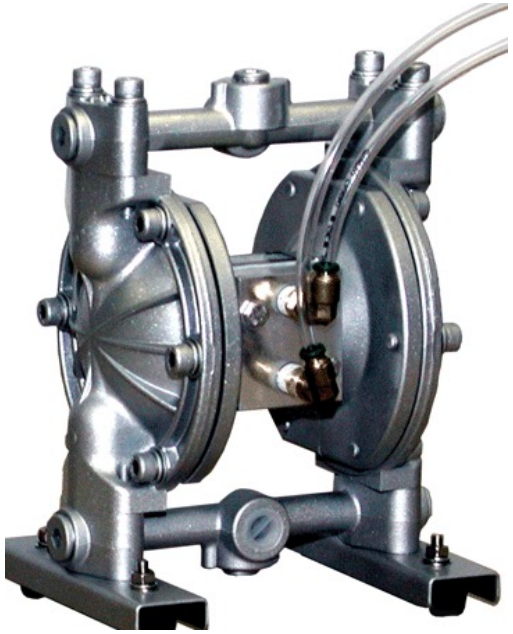
EXAMPLES OF DIAPHRAGM PUMPS



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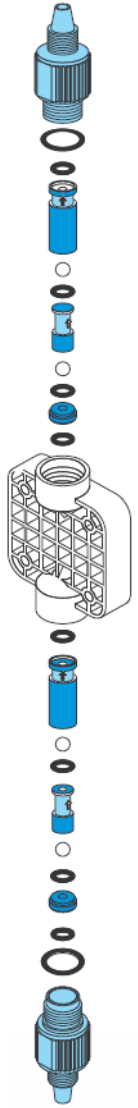
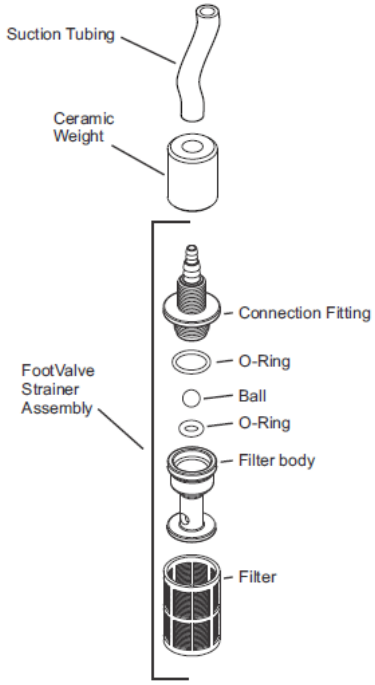
DIAPHRAGM PUMP COMPONENTS

- Pump head
- Diaphragm
- Valves
  - O-rings
  - Check Balls
  - Housings
- Connection fittings

- Back Pressure Valve
- Foot Valve & Strainer
- Dampener





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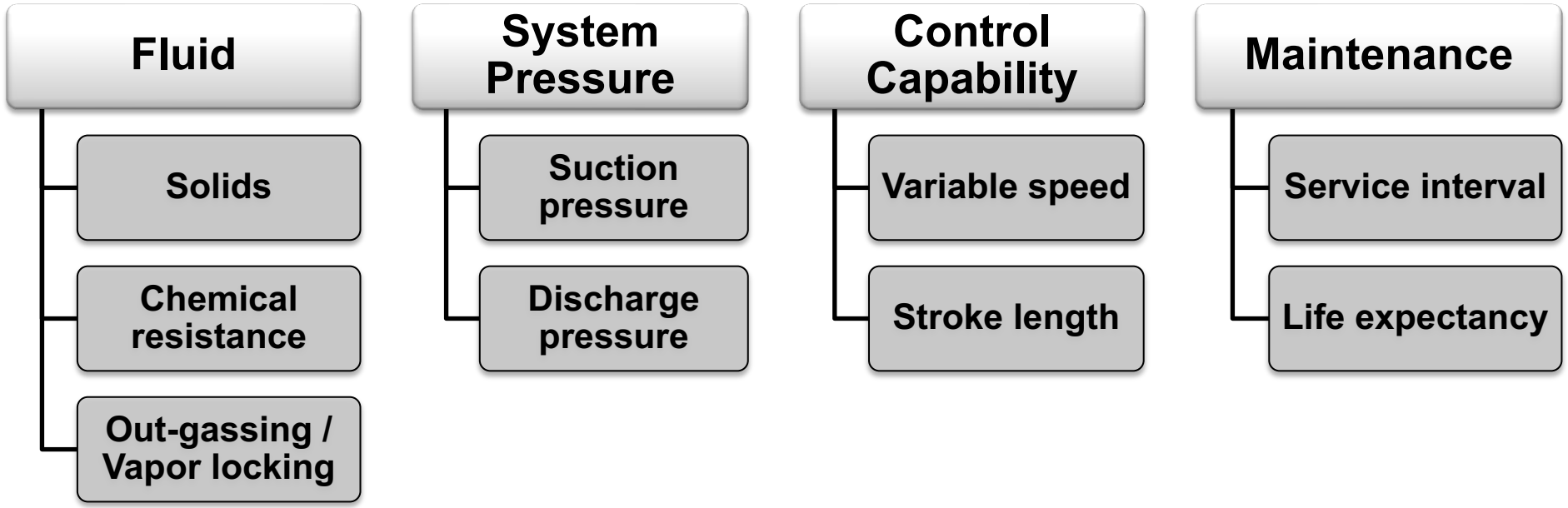
FOUR PRIMARY VARIABLES

- Fluid/Solution/Chemical
- Flow/Pressure Required (Performance)
- Flow Control / Adjustment
- Reliability/Maintenance/Total cost of ownership

FOUR PRIMARY VARIABLES

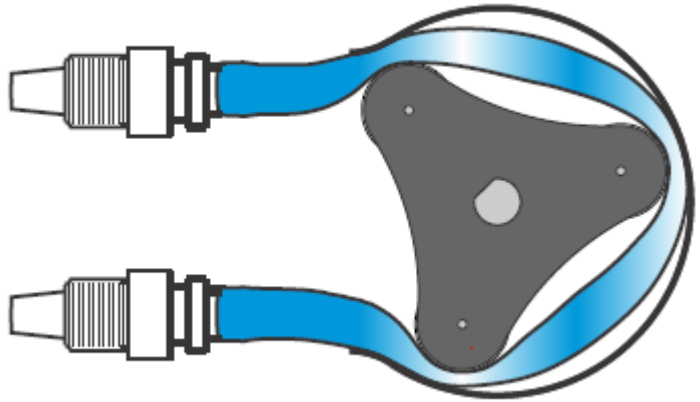


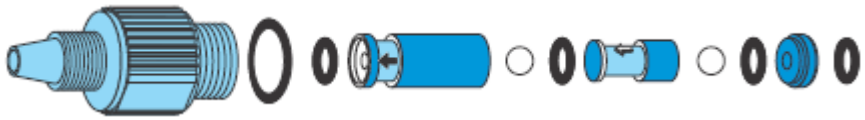
Peristaltic or Diaphragm?

Fluid

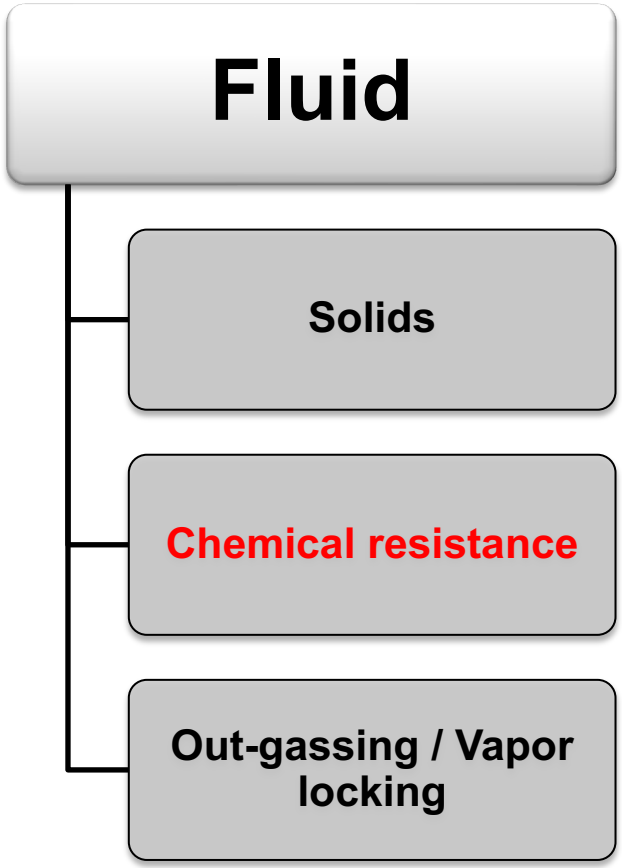
- **Solids**
- **Chemical resistance**
- **Out-gassing / Vapor locking**

SOLIDS AND PARTICULATES	
PERISTALTIC PUMP	**DIAPHRAGM**
• No valves to clog • Few surfaces	• Valves can clog causing pump failure • Many small surfaces





Peristaltic or Diaphragm?



CHEMICAL RESISTANCE	
PERISTALTIC PUMP	**DIAPHRAGM**
• Fewer components to be attacked • Limited material options	• Many components to be attacked • Many material options

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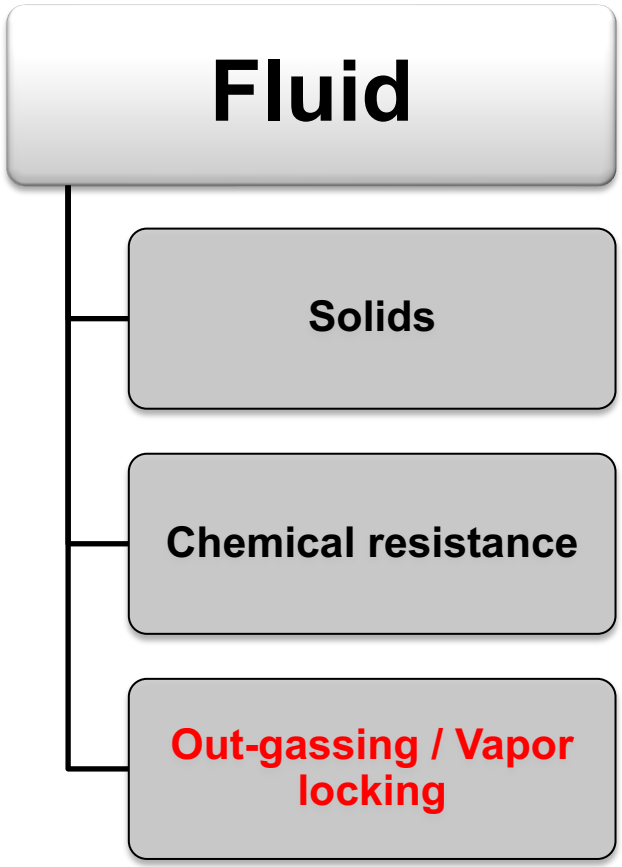
Peristaltic or Diaphragm?



OUTGASSING / VAPOR LOCKING	
PERISTALTIC PUMP	**DIAPHRAGM**
• Can pump air - no valve losses to overcome • Automatically primes	• Head can become vapor locked • Difficult to prime

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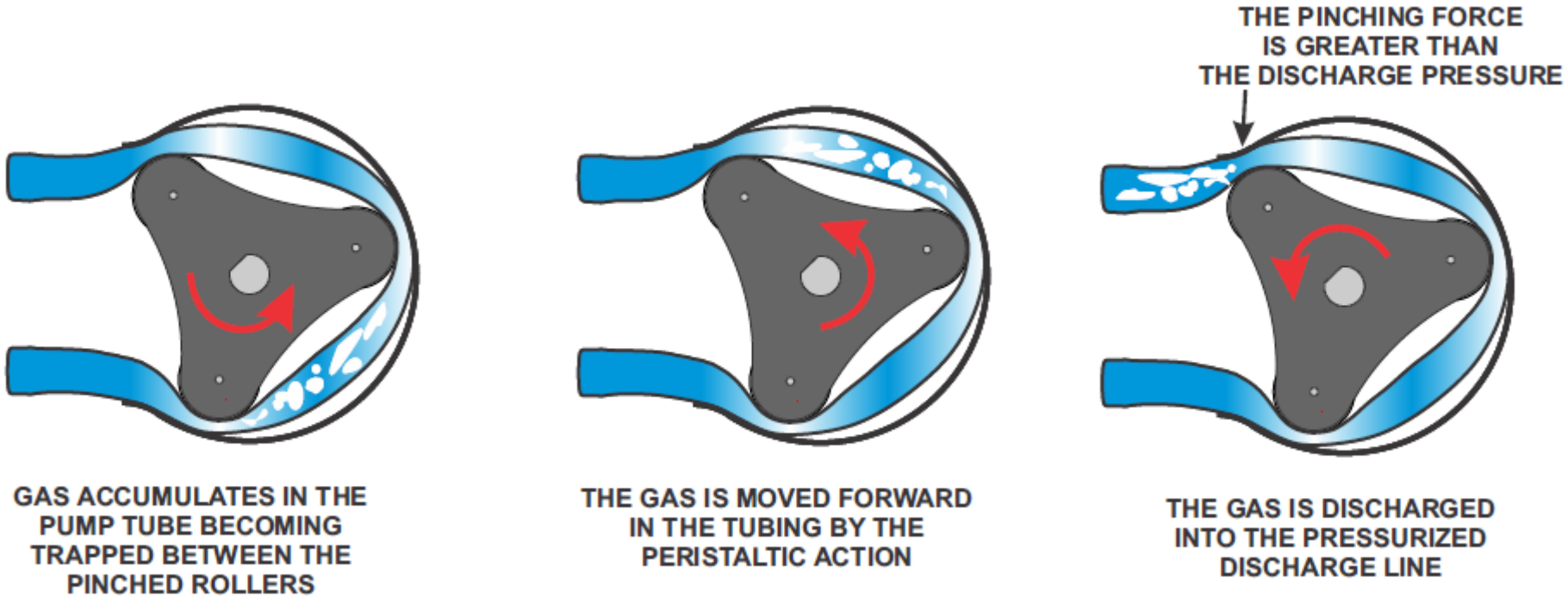
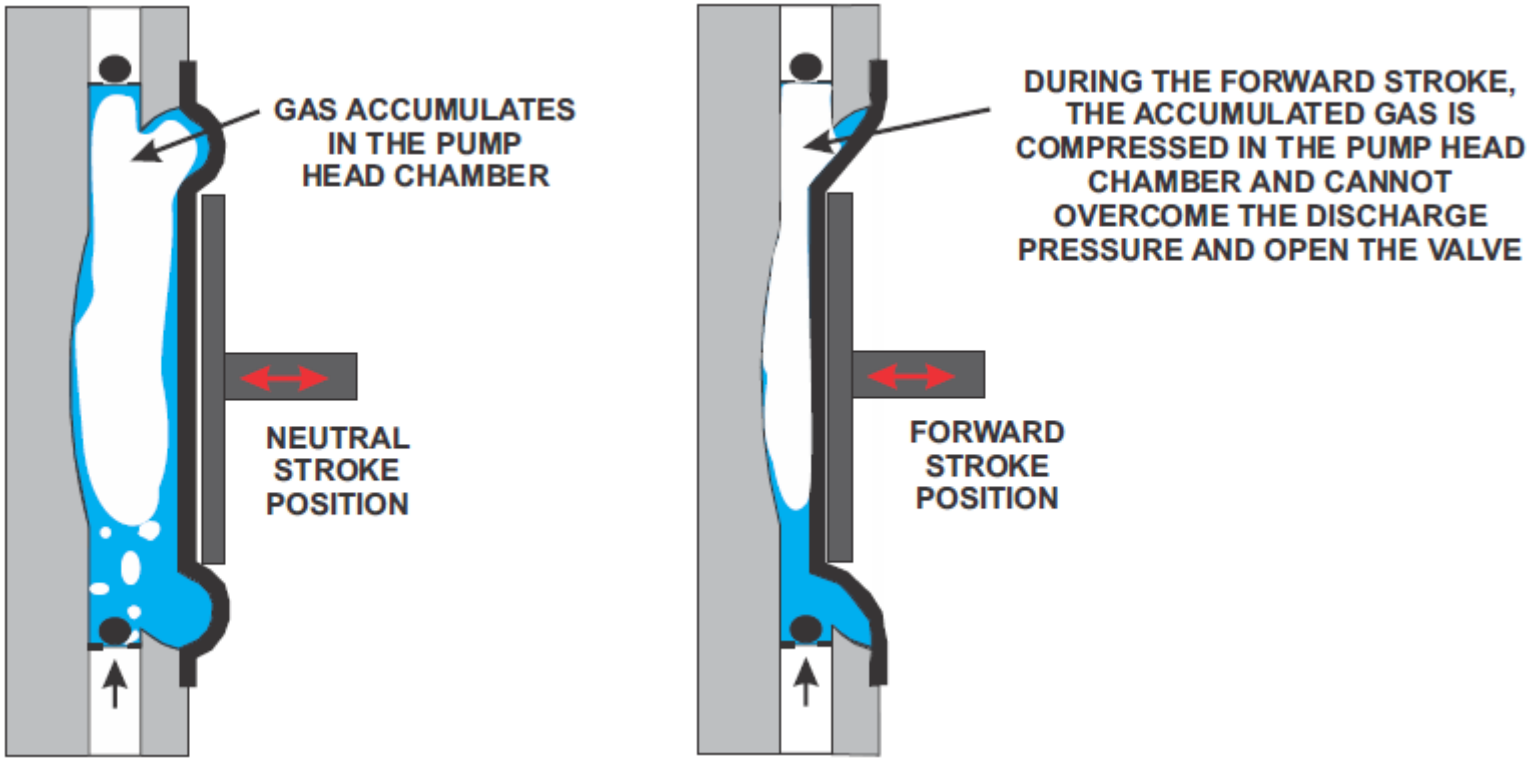
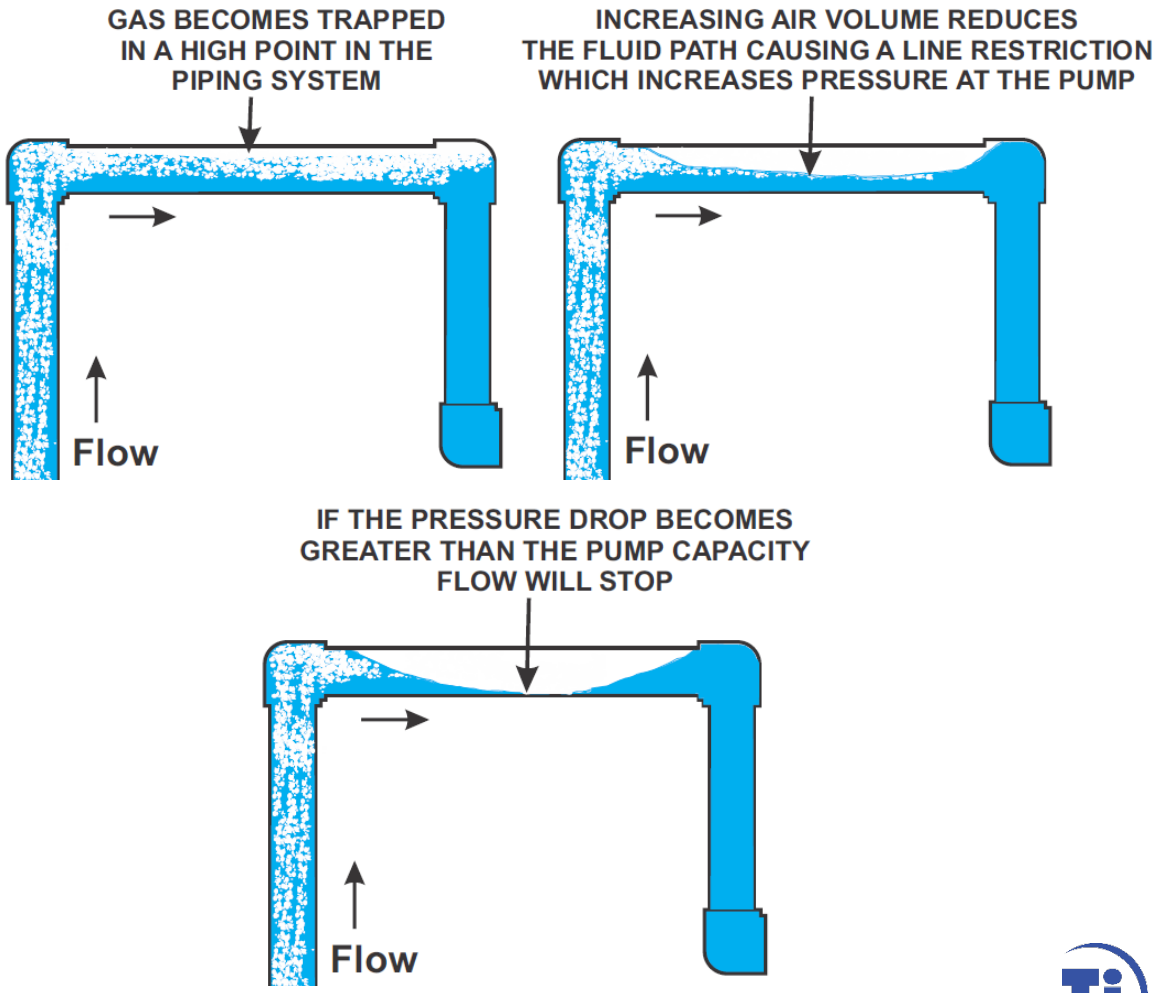
Peristaltic pump cannot vapor lock



Diaphragm pump can vapor lock



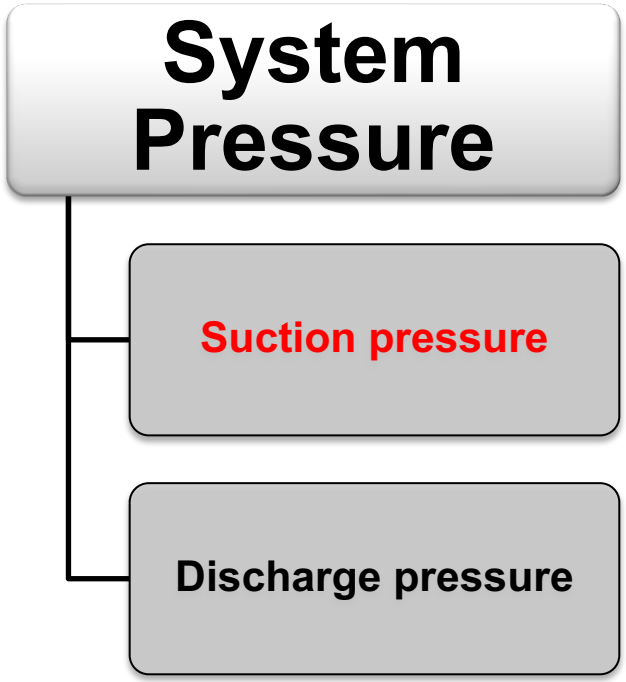
Plumbing design can affect both suction and discharge



What about viscosity and specific gravity?

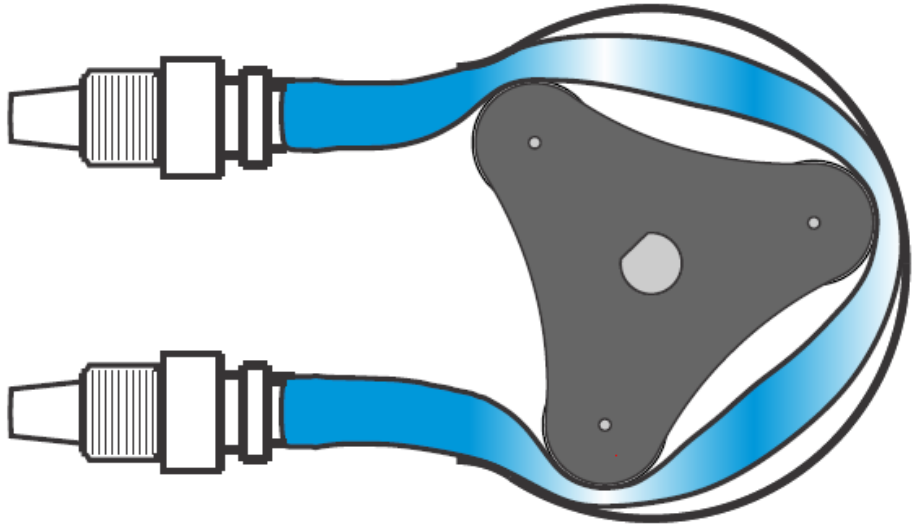
- Most pumps are tested with water. How does your solution compare to water?
- Higher viscosity affects flow rate.
- Higher specific gravity affects system suction capabilities.

Peristaltic or Diaphragm?



SUCTION PRESSURE	
PERISTALTIC PUMP	**DIAPHRAGM**
• Suction lift to 30ft of water • Output is affected by changes in suction pressure • Larger diameter tubes affected more then smaller tubes	• Limited suction lift height • Can be hard to prime – especially when stroke lengths are short • Output is less affected by changes in suction pressure

Peristaltic pump output is affected by suction pressure



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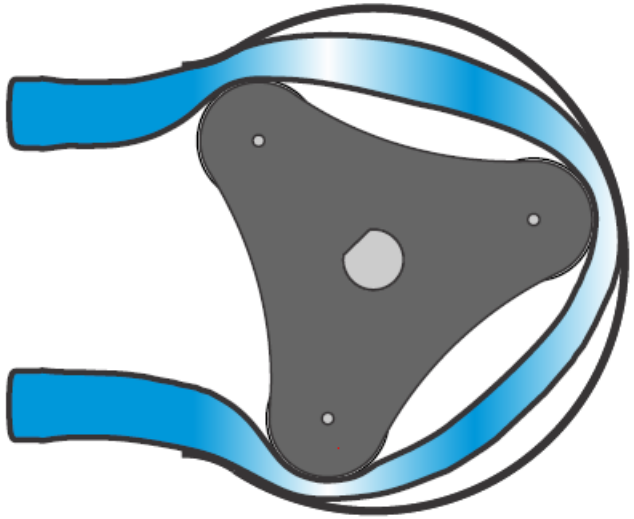
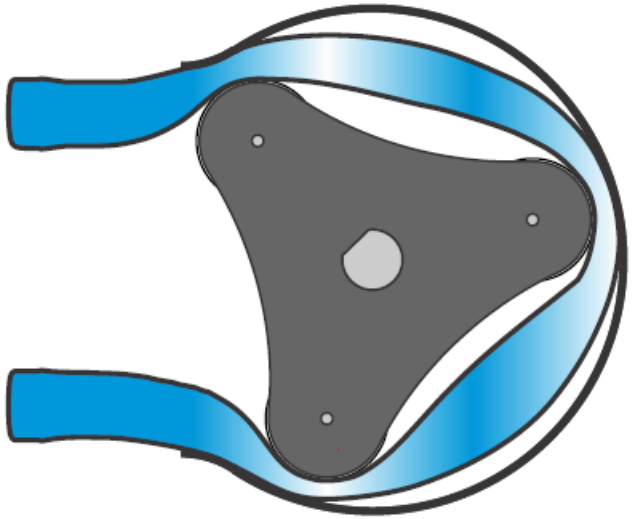


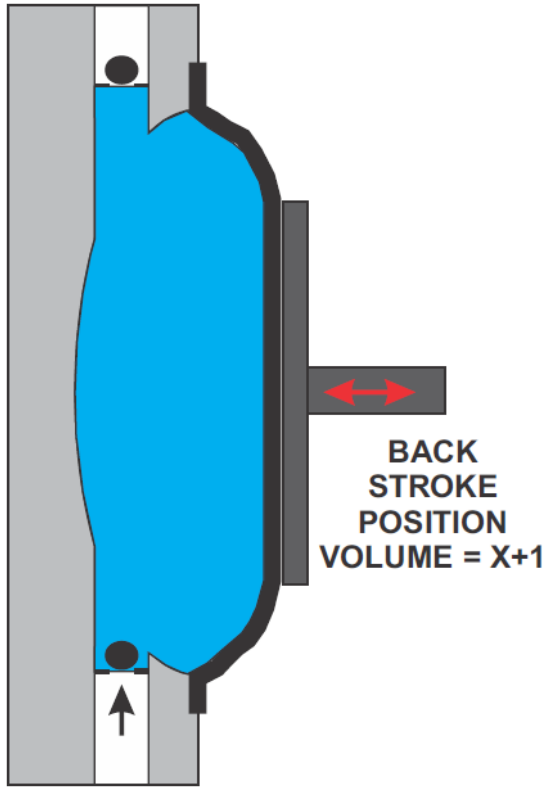
TUBE COLLAPSES DUE TO
NEGATIVE SUCTION PRESSURE
REDUCING PUMP TUBE VOLUME
(CAUSED BY INCREASED SUCTION
LIFT AND/OR INCREASED VISCOSITY)

Peristaltic pump output is affected by suction pressure

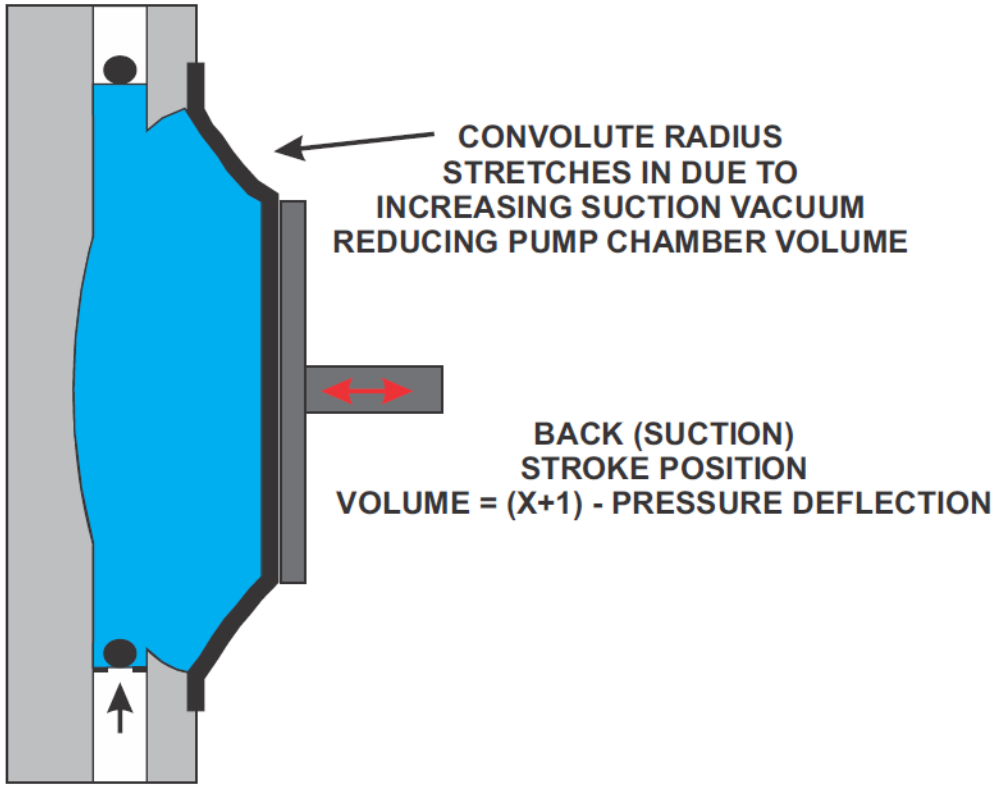


TUBE BALLOONS DUE TO
POSITIVE SUCTION PRESSURE
INCREASING PUMP TUBE VOLUME
(CAUSED BY INCREASED TANK LEVEL
AND/OR REDUCED VISCOSITY)

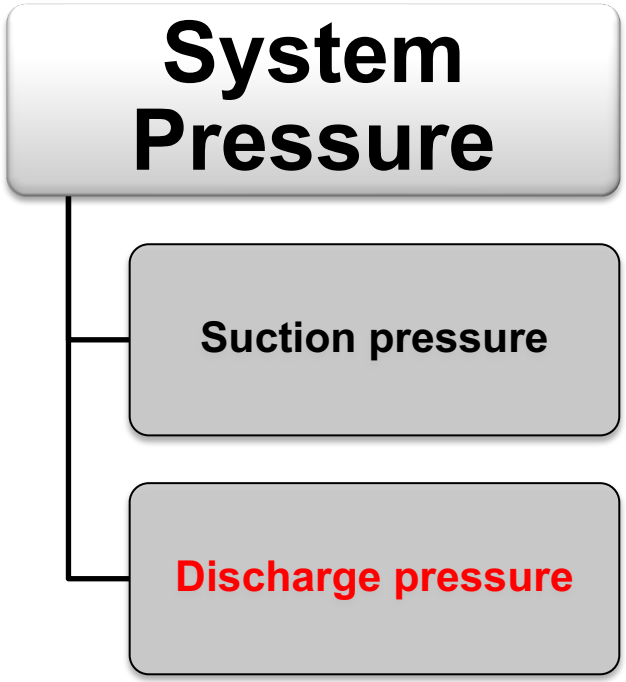
Diaphragm pump output is affected by suction pressure



Diaphragm pump output is affected by suction pressure



Peristaltic or Diaphragm?



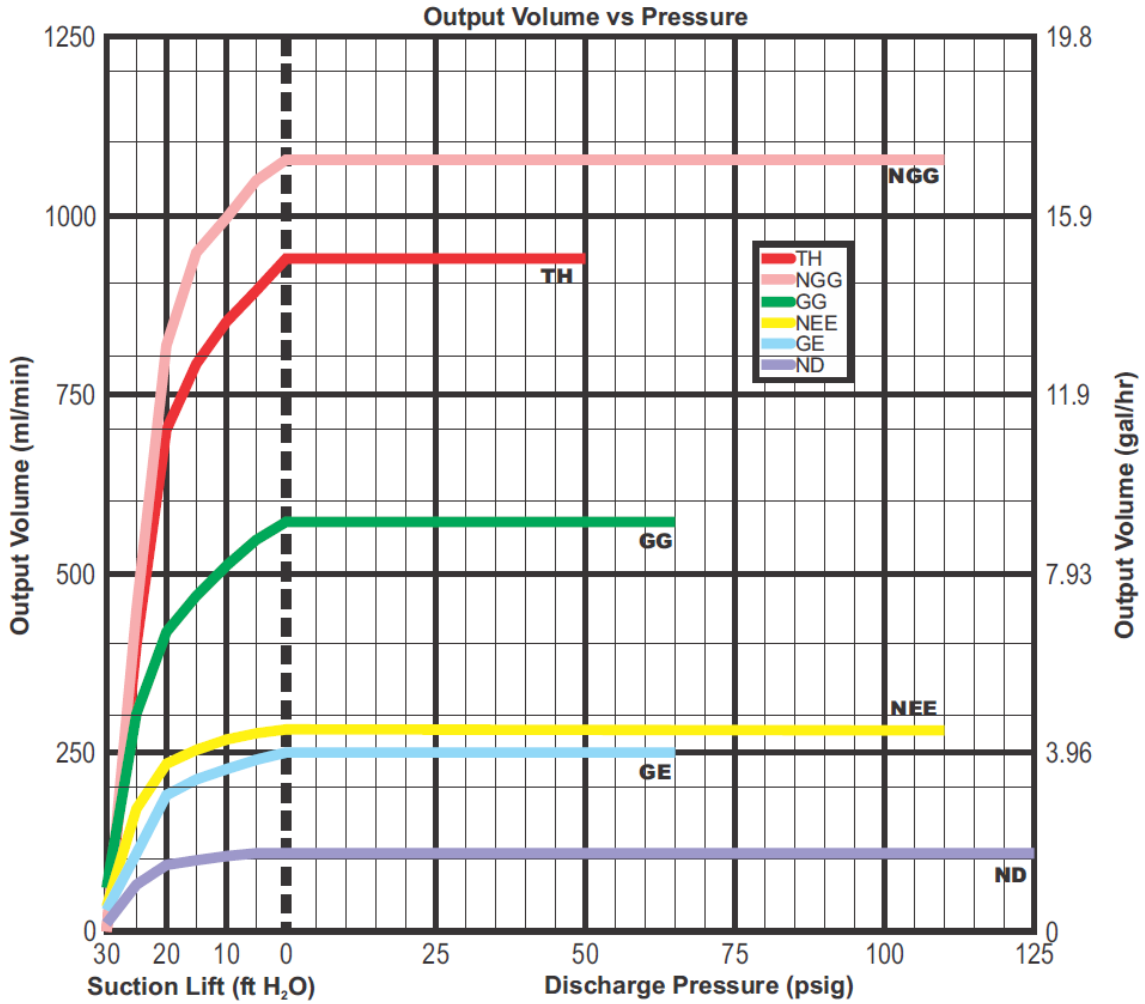
DISCHARGE PRESSURE	
PERISTALTIC PUMP	**DIAPHRAGM**
• Output is not affected by changes in the discharge pressure • Pump tubing life is reduced as the discharge pressure increases • Limited to pressures less than 125 psi (tubing style) • Easily primes against maximum pressure • Can pump into a vacuum (cannot syphon)	• Output is affected by changes in the discharge pressure • Can pump into high pressures without severe wear issues • Can pump against very high pressures over 1,000 psi • Hard to prime against pressure • Must pump into positive pressure to prevent syphoning (pressurized valve required)

Peristaltic or Diaphragm?

System Pressure

- Suction pressure
- Discharge pressure

Peristaltic pump curve

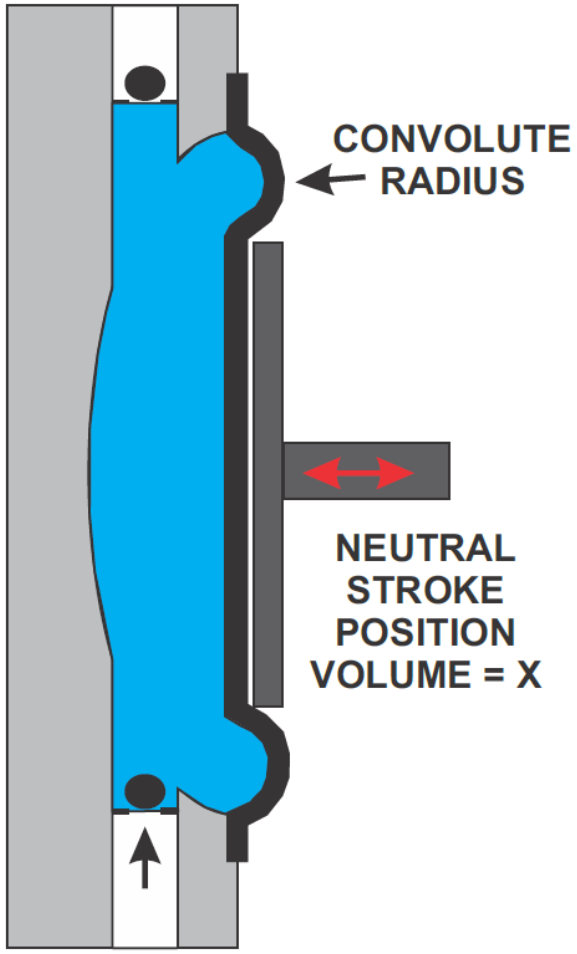


Peristaltic or Diaphragm?

System Pressure

- Suction pressure
- Discharge pressure

Diaphragm pump discharge stroke

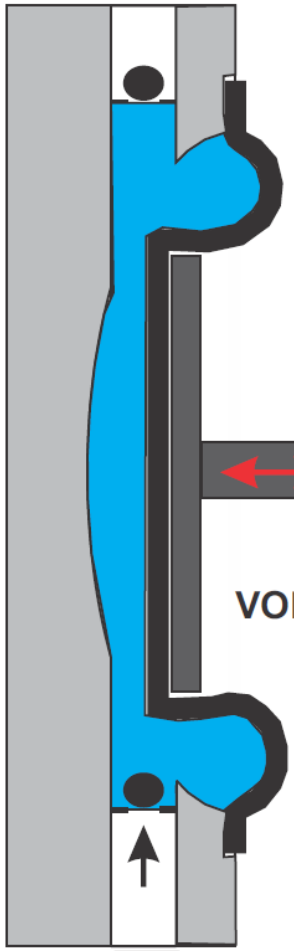


Peristaltic or Diaphragm?

System Pressure

- Suction pressure
- Discharge pressure

Diaphragm pump discharge stroke



CONVOLUTE RADIUS
STRETCHES OUT DUE TO
INCREASING DISCHARGE PRESSURE
REDUCING PUMP CHAMBER VOLUME

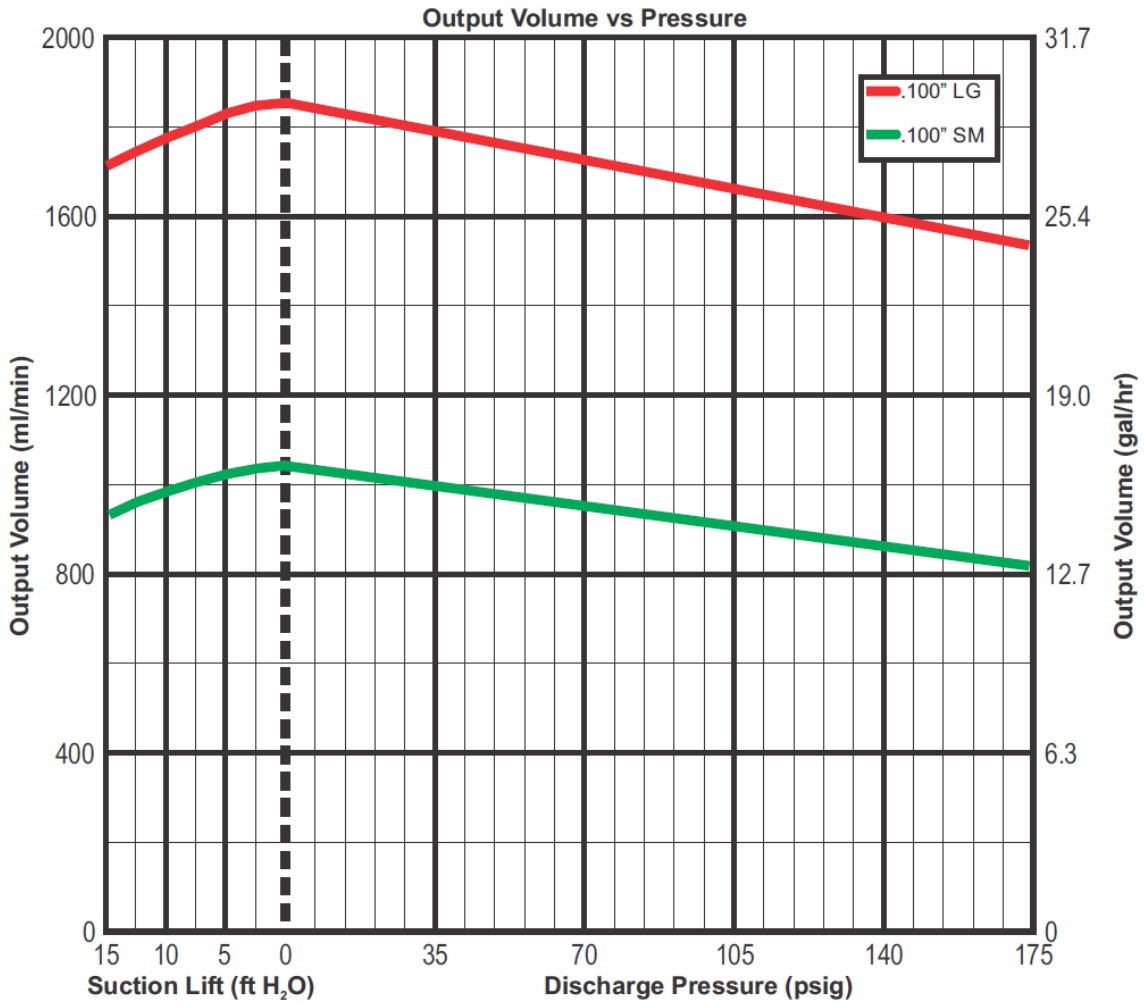
FORWARD (DISCHARGE)
STROKE POSITION
VOLUME = (X-1) + PRESSURE DEFLECTION

Peristaltic or Diaphragm?

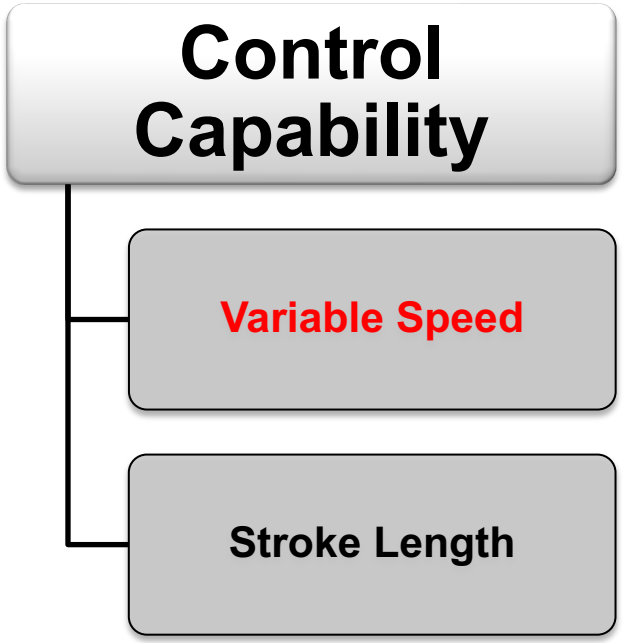
System Pressure

- Suction pressure
- Discharge pressure

Diaphragm pump curve



Peristaltic or Diaphragm?



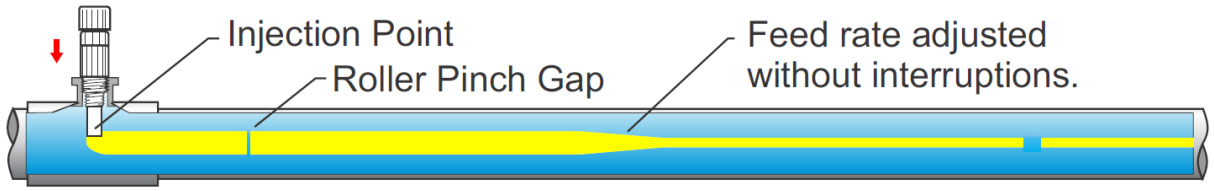
CONTROL CAPABILITY	
PERISTALTIC PUMP	**DIAPHRAGM**
• Motor speed adjustment results in near continuous output • Can be pulsed on/off by timers for batch type injection • No stroke length adjustment – so motor speed turn-down is important – but… • Tubing size can be easily changed to vary the volume per revolution	• Motor speed adjustment results in greater time between chemical injection strokes • Can be pulsed on/off by timers for batch type injection • Stroke length can be adjusted to change the volume per stroke • Difficult to change the diaphragm size.

Peristaltic or Diaphragm?

Control Capability

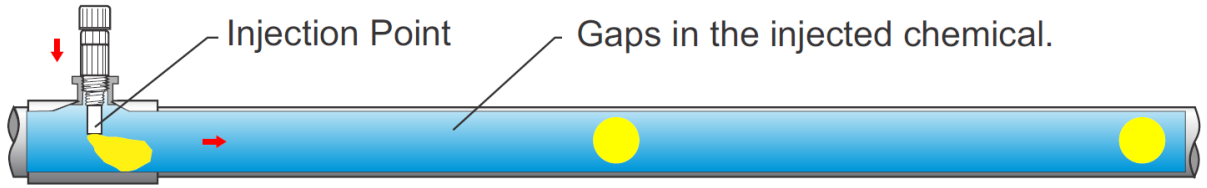
- **Variable Speed**
- **Stroke Length**

Variable Speed Peristaltic Pump



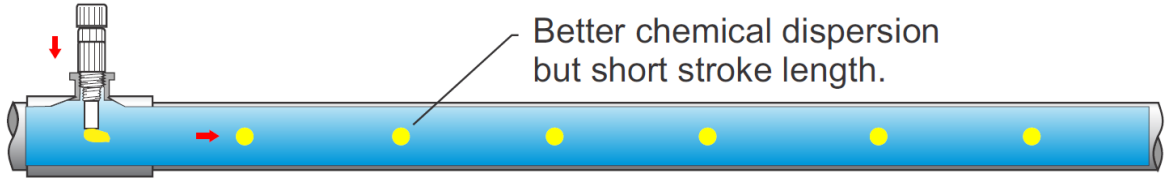
Near continuous injection even at very low motor speed

Variable Frequency & Stroke Diaphragm Pump



Long stroke and low frequency result in intermittent chemical injection.

Variable Frequency & Stroke Diaphragm Pump



High frequency results in better dispersion but shorter stroke lengths.

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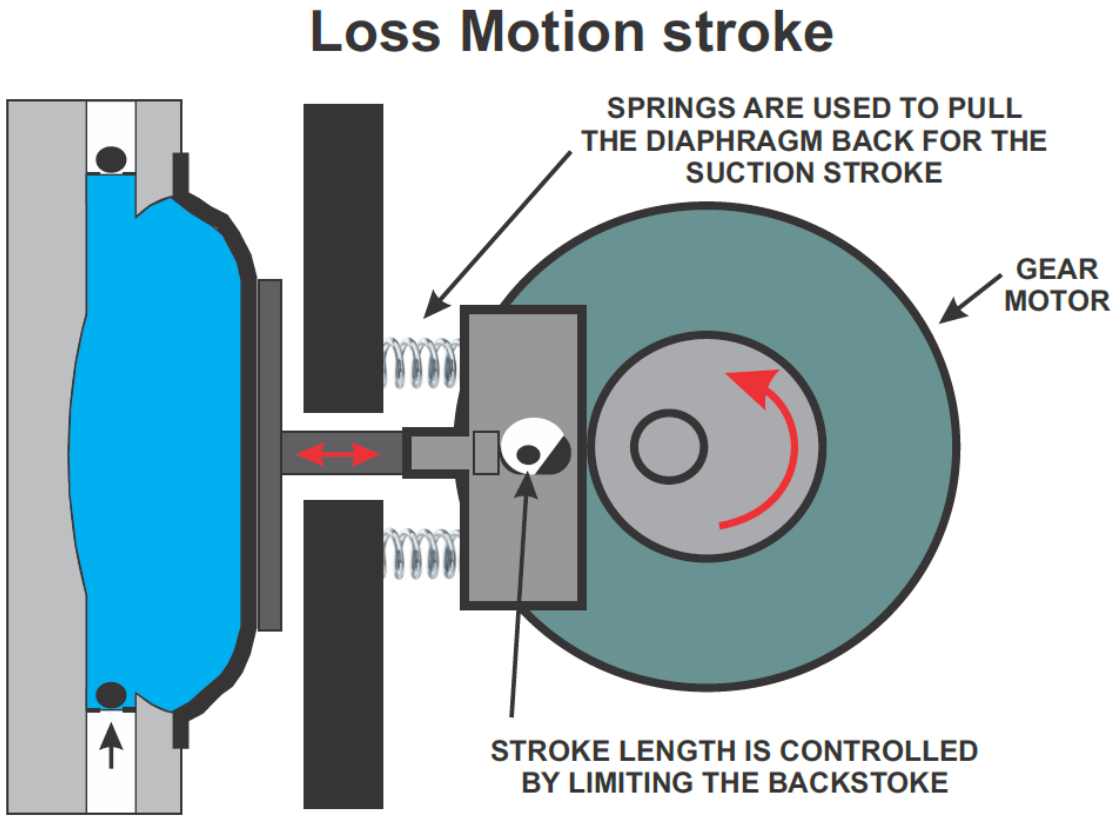
SYSTEM PARAMETERS

Control Capability

- Variable Speed
- Stroke Length

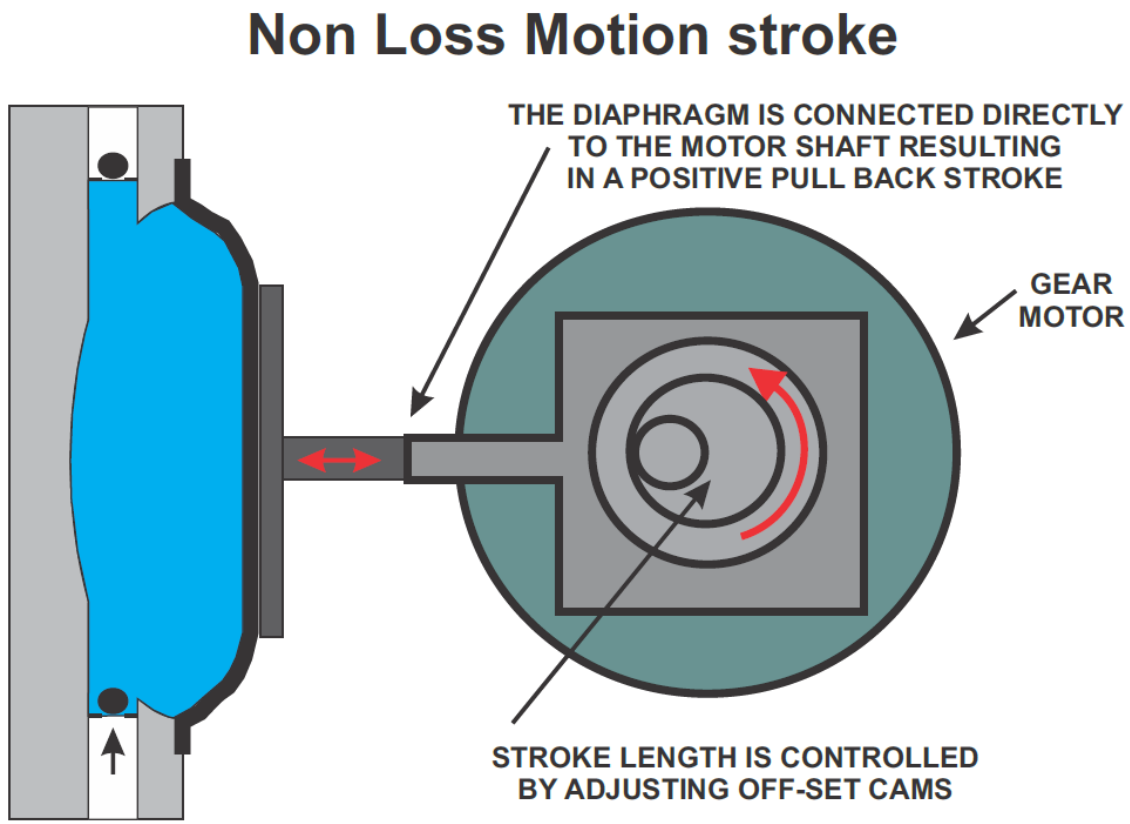
Diaphragm stroke length adjustment



Control Capability

- Variable Speed
- Stroke Length

Diaphragm stroke length adjustment



Setting Pump Speed

- Try to keep stroke length at the largest setting
- Adjust the pump speed for flow rate
- Example, we needed 1.39 GPH
  - Pump Capacity selected is 1.66 GPH
  - Feed rate / pump capacity = pump percentage
  - 1.39 GPH / 1.66 GPH = 84%
  - Metering pump has 180 SPM so we set the pump speed at (180 SPM x 84%) = 151 SPM
  - Or adjust the stroke length to 84%

Types of metering pumps:

Solenoid diaphragm metering pumps


Conventional Solenoid
Driven Diaphragm Pump

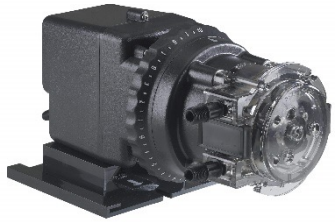
Types of metering pumps:

Motorized diaphragm metering pumps


Conventional Motor
Driven Diaphragm Pump

Types of metering pumps:

Peristaltic metering pumps



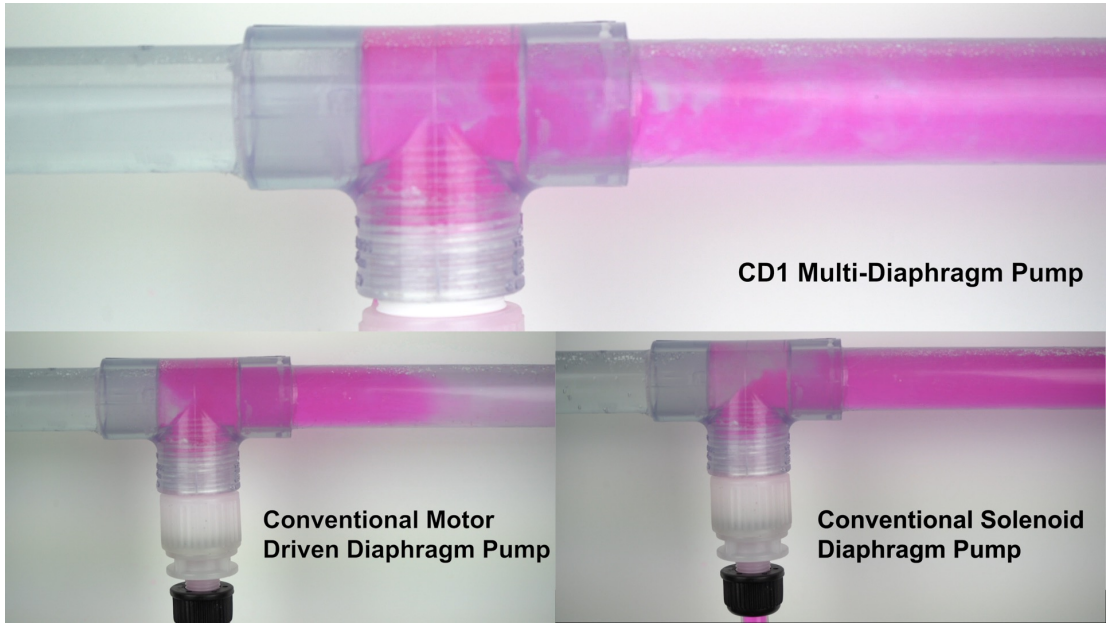

Peristaltic
Pump

Types of metering pumps:

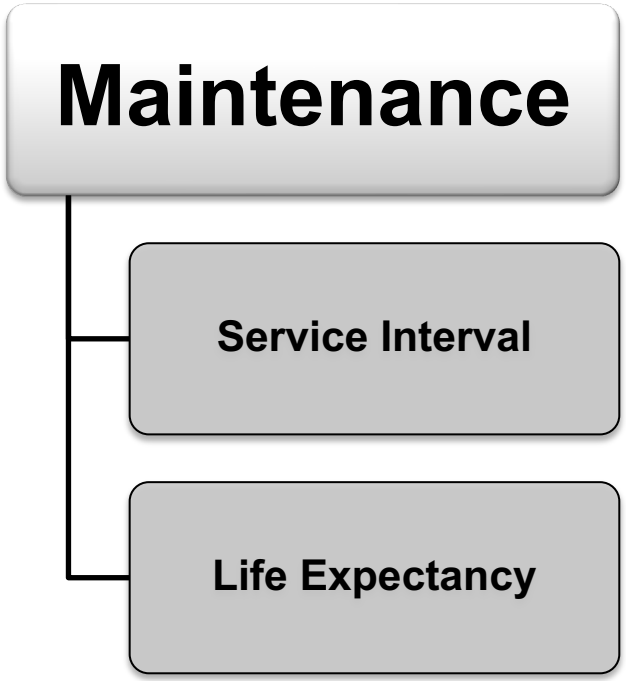
Multi-diaphragm metering pumps


Multi-Diaphragm
Pump

Diaphragm Flow Comparison



Peristaltic or Diaphragm?



MAINTENANCE	
PERISTALTIC PUMP	**DIAPHRAGM**
• Few wear components • Changing the tube and wiping out the head is the only maintenance, about five minutes • Pump tubing life is typically predictable, from 2 weeks to 2 years • Replacement tubes are inexpensive	• Many wear components • Valves and diaphragms must be periodically cleaned or replaced, about one hour • Valve life, failure is unpredictable • Pump head & valve rebuild kits can be expensive

DIAPHRAGM VS. PERISTALTIC

Diaphragm	Peristaltic
Vapor lock with gaseous chemicals	Handle fluids containing air or gas like NaOCl,
Shear polymers and clog valves	Gentler on polymer
Pulsating dosing	Smoother, continuous feed
Maximum capacity at continuous duty. Commonly setup to run at speeds 50% or greater under continuous operation.	Maximum capacity at intermittent duty. Ideal to oversize the pump and run at a lower speed (5%-25%)
Ideal for high pressures	Ideal for low pressures and low speeds

Thank You!