

DIAPHRAGM VS PERISTALTIC METERING PUMPS: A TECHNICAL COMPARISON

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AGENDA

CHEMICAL METERING PUMP



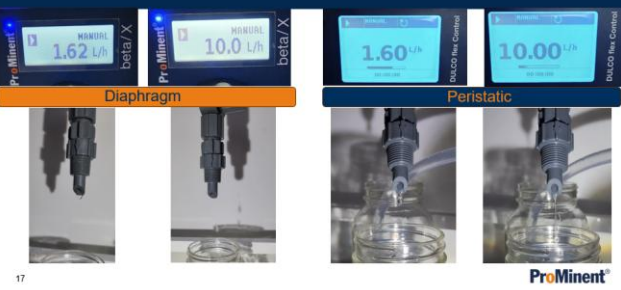
DIAPHRAGM PUMP OPERATION



PERISTALTIC PUMP OPERATION



COMPARING SAME DUTY POINT DIAPHRAGM VS PERISTALTIC



KEY TAKE AWAYS PERISTALTIC VS DIAPHRAGM METERING PUMPS

Task	Peristaltic	Diaphragm
Pressure	Max. 102 psi. High pressure is bad for tube life. No minimum pressure needed.	Max. 305 psi. No problem with higher pressure. Minimum 21 psi pressure needed for good result.
Viscosity	Excellent - 200,000 mPa	Max. 3,000 mPa
Air	Just pumps air through. Excellent priming.	Certain models can pass gas.
Lifespan	Depending on pressure, chemical and rpm.	Excellent lifespan. Very long service intervals.
Chemicals	Not with every chemical. Check List!	Excellent with PVDF head.
Particle	1.5 mm particles are no problem. Particle size of 1/4 of inner diameter are fine.	Particles can block the valves
Pulsation	At low rpm nearly no pulsation	At low speed also ok with <i>continuous</i> mode.
Shear force	Hardly any shear forces. Great for polymer.	Shear forces present
Capital Cost	\$\$\$\$	\$\$\$

CHEMICAL METERING PUMP



KEY CHARACTERISTICS CHEMICAL METERING PUMP

- **High dosing accuracy**

Delivers a precise, repeatable volume per stroke or revolution, typically within $\pm 1\text{--}2\%$ under defined conditions.

- **Adjustable flow rate**

Output can be controlled by changing stroke length, stroke frequency, or motor speed.

- **Positive displacement operation**

Moves a fixed volume per cycle, largely independent of system pressure (within design limits).

- **Designed for chemical compatibility**

Wetted materials are selected to safely handle corrosive, abrasive, or hazardous fluids.

- **Process control integration**

Easily interfaces with PLCs, analyzers, and control signals (4–20 mA, pulse, digital) for automated dosing.

MUNICIPAL CHLORINE DOSING, NEAT VS DILUTION



Metering pump flow rate (l/h) for a 1ppm DOSE

GPM USgal	12%	6%	4%	2%
25	0.04	0.08	0.12	0.24
50	0.08	0.16	0.24	0.49
75	0.12	0.24	0.36	0.73
100	0.16	0.32	0.49	0.97
200	0.32	0.65	0.97	1.94
400	0.65	1.30	1.94	3.89
800	1.30	2.59	3.89	7.78
1000	1.62	3.24	4.86	9.72



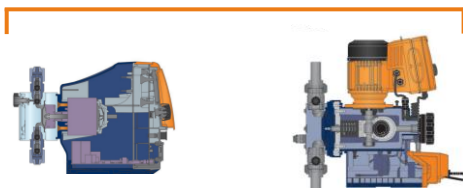
Part		Solution concentration
Water	Hypo	%
0	1	12
1	1	6
2	1	4
3	1	3
5	1	2
11	1	1

CHEMICAL METERING PUMPS

Mechanically Actuated Diaphragm



Solenoid Driven Motor Driven



Hydraulically Actuated Diaphragm



Lost Motion



Continuous Motion



Peristaltic

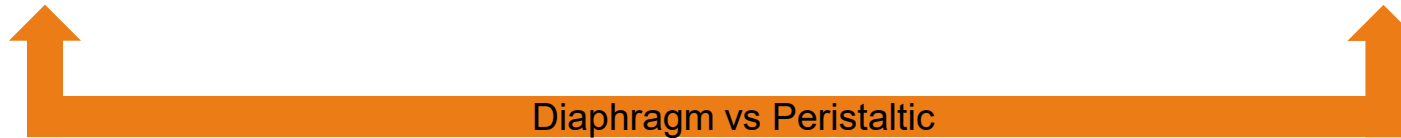


Hose

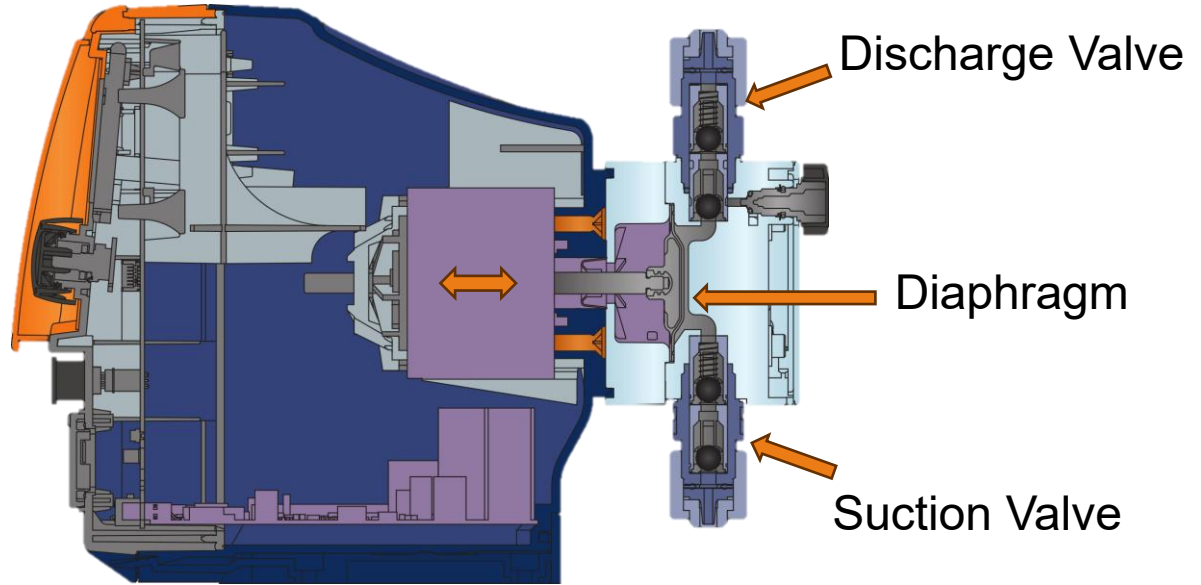
Tube

Roller

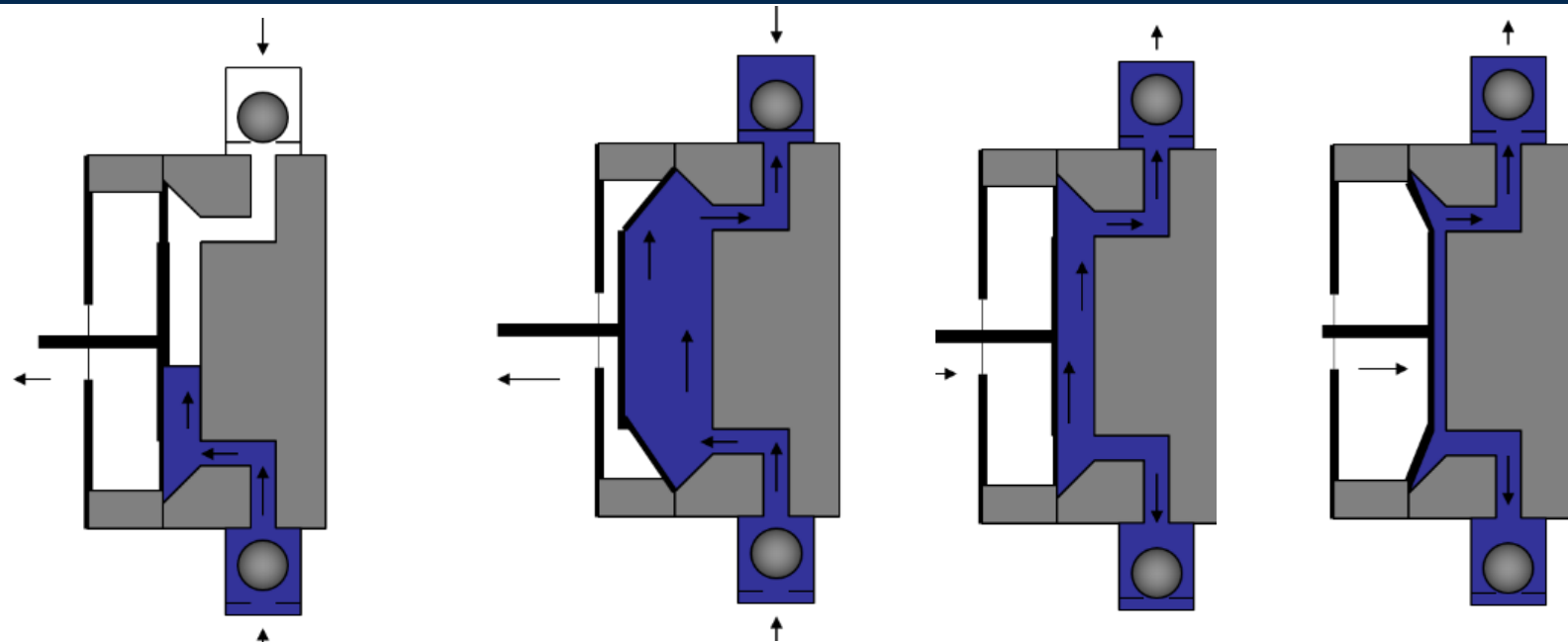
Shoe



DIAPHRAGM PUMP OPERATION



DIAPHRAGM METERING PUMP BASIC OPERATION

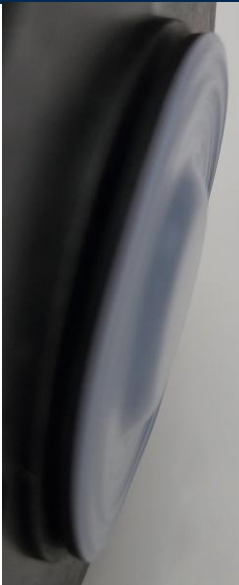


Suction Stroke Begins: discharge valve closes, suction valve opens, chamber fills.

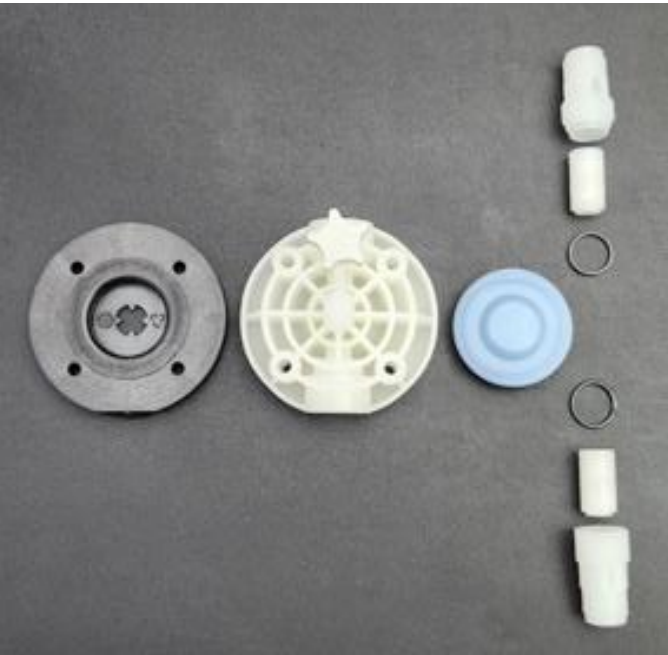
Suction Stroke Complete. The Fluid chamber is full.

Discharge Stroke Begins: discharge valve opens, suction valve closes

Discharge Stroke Complete. Fluid in chamber is displaced



Diaphragm travel 1.5-2 mm



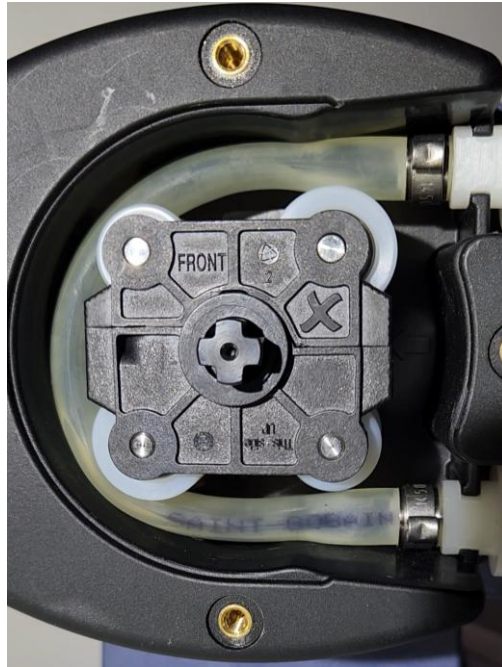
Dosing Head	Suction/ Discharge Valve	Ball Seat	Seals	Valve Balls
Clear acrylic	PVC	EPDM	EPDM	Ceramic
Clear acrylic	PVC	FKM	FKM	Ceramic
PVDF	PVDF	PVDF	PTFE	Ceramic
Stainless Steel	Stainless Steel	Ceramic	PTFE	Ceramic

- Check the NFS website for compliance and chemical compatibility

CONDITIONS AFFECTING DIAPHRAGM LIFE

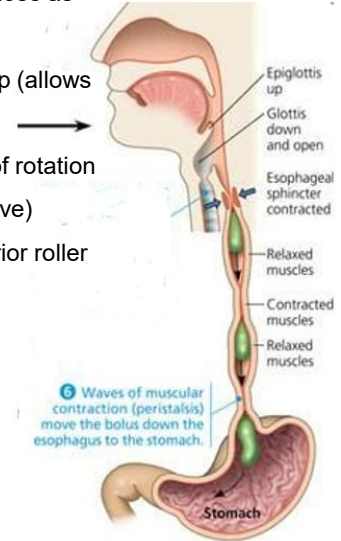
- Process Chemical
- Discharge Pressure
- Suction Pressure
- Pulsations
- Abrasion

PERISTALTIC PUMP OPERATION



Working Principal called Peristalsis

- Rollers compress (occlude) and relax (restitute) hose as rotor turns
- As hose restitutes, product is drawn into the pump (allows for self-priming)
- Product follows the path of the hose in direction of rotation through to discharge (acting as a rotary pinch-valve)
- No Slip - Hose compressed completely before prior roller releases
- Hose pumps cannot be dead-headed



FLOW / SPEED TURNDOWN












- Wide Variety of Turndown Capabilities
 - 100:1
 - 3000:1
 - 10,000 : 1
 - 20,000: 1
 - 100,000 : 1
- At 0.1rpm, it takes 10 minutes for 1 revolution
- While over time the pump will maintain accuracy, there will be periods with zero flow rate as the tubing restitutes
- Recommend speeds no less than 2-3rpm



TUBE AND HOSE MATERIAL

- Verify NFS 61 certification
www.NFS.org



	Material	Characteristics	Max. Pressure / Temp.
TUBES	 Santoprene NSF61	Excellent chemical, abrasion and fatigue resistance. Can withstand sterilization methods.	102 psi (7 bar) 176 °F (80 °C)
	 TPV-FDA	As above, but with FDA-compliant seal material.	102 psi (7 bar) 176 °F (80 °C)
	 Polyurethane NSF61	Good durability, flexibility and chemical resistance. Excellent abrasion resistance.	73 psi (5 bar) 176 °F (80 °C)
	 PUR-FDA	As above, but with FDA-compliant seal material.	73 psi (5 bar) 176 °F (80 °C)
	 SEBS NSF61	Good chemical and abrasion resistance. High elasticity which extends life.	43 psi (3 bar) 176 °F (80 °C)
HOSES	 Norprene (TPE) FDA Compliant	Excellent chemical resistance and long flex life, particularly in harsh environments. Wide temperature range. Not for abrasives. FDA: Title 21, CFR Sect 21 177.2600	30 psi (2 bar) 248 °F (120 °C)
	 NBR	Resistant to oils (non-mineral), alkalis, greases and detergents. Good for abrasives.	232 psi (16 bar) 176 °F (80 °C)
	 NBR-A FDA Compliant	Food products including oils and greases and detergents. Good for abrasives. FDA: Title 21, CFR Sect 21 177.2600	232 psi (16 bar) 176 °F (80 °C)
	 EPDM NSF61	High chemical resistance to concentrated acids, corrosive chemicals, ketones and alcohols. Excellent abrasive protection.	232 psi (16 bar) 176 °F (80 °C)
	 Hypalon (CSM) NSF61	For highly corrosive products and high concentration acids. High abrasion resistance. Waterproof and impermeable.	232 psi (16 bar) 176 °F (80 °C)
	 NR NSF61	Outstanding abrasion resistance. Generally resistant to diluted acids and alcohols. Strongest and longest lasting.	232 psi (16 bar) 176 °F (80 °C)

FACTORS AFFECTING HOSE LIFE

- Speed
- Discharge Pressure
- Temperature
- Process Chemical
- Suction Pressure
- Pulsations

SPEED KILLS

The single biggest impact on a hose's life is speed.

We hope to get 10,000,000 restitutions before performance decline.

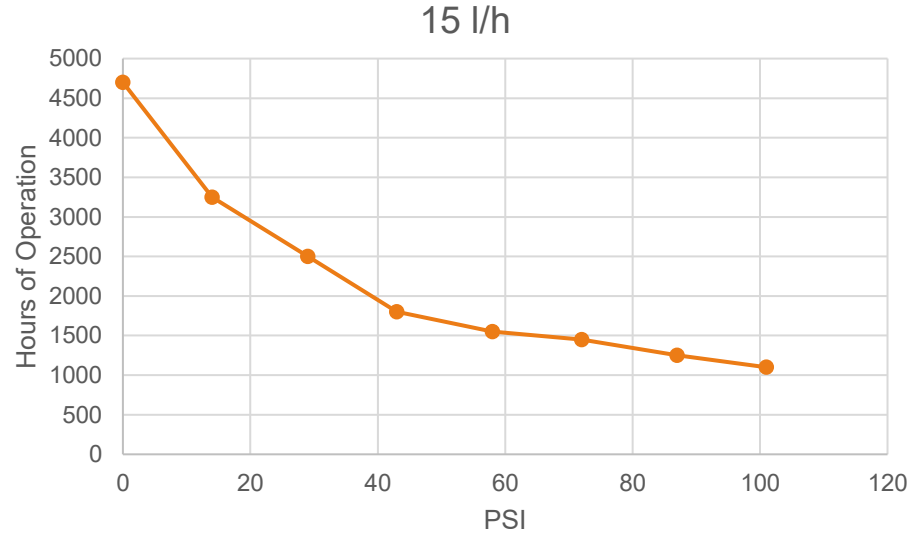
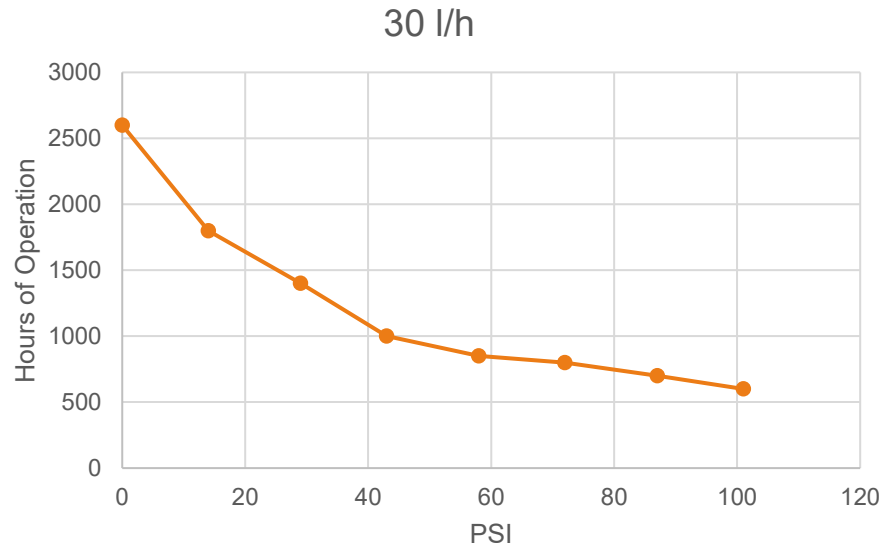
$10,000,000 / 2 / \text{pump rpm} / 60 = \text{approximate hose life in hrs.}$

$10,000,000 / 2 / 40 / 60 = 2083\text{hrs.}$

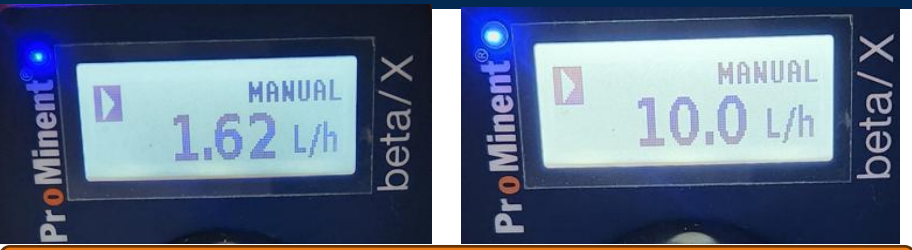
$10,000,000 / 2 / 30 / 60 = 2778\text{hrs.}$

By selecting a pump 10 rpms slower, the hose life expectation increases by 25%!!!

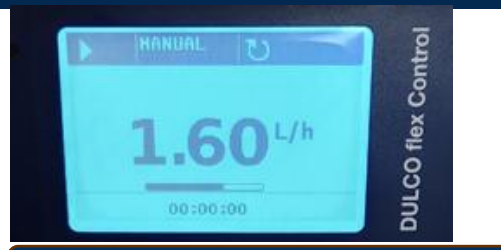
TUBE LIFE VS PRESSURE



COMPARING SAME DUTY POINT DIAPHRAGM VS PERISTALTIC



Diaphragm



Peristaltic



NEW TECHNOLOGY OFFGASSING DEMO



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WHAT PUMP TO USE

- **When do I use a peristaltic metering pump?**
 - High viscosity media
 - Outgassing media
 - Abrasive media
 - Large particles in the medium
 - Shear sensitive media
 - High suction lift needed
- **When do I use a diaphragm pump?**
 - Continuous operation (significantly longer maintenance intervals)
 - High precision dosages
 - High pressures (>116psi)
 - Outgassing media

KEEP IT FRESH



- Tank size should be 4-8 week supply. $\frac{1}{2}$ life 6M
- Made of Polyethylene, UV protected
- Containment basin 110% volume of tank
- Should be in a well ventilated area with a vent pipe if possible
- Location as close as possible to the metering pump
- Kept in a cool place.
- Controls – Alarms & Inventory, Levels, Leaks

THANK YOU TO ALL THE FANS

