Peristaltic Pumps: Different Types and How they Work

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Topics

- What is a Peristaltic Pump
- Features and Benefits
- Casing Style Pumps
- Hose Style Pumps
- Roller versus Shoe Technology
- Hose Life

What is a Metering Pump?

Hydraulic Institute Definition:

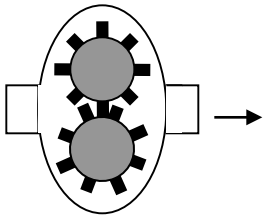
"A controlled volume pump (also called a "metering", "proportioning" or "chemical injection pump") is a reciprocating power pump used to accurately displace a predetermined volume of liquid in a specified time period and is driven by power from an outside source applied to the pump mechanism. It includes a mechanism for varying the effective plunger, piston or diaphragm displacement."

Some Pump Manufacturers Add:

"It includes a mechanism for varying the effective frequency of displacements."

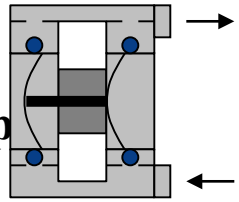
What claims to be a Metering Pump, but isn't?

Gear Pump



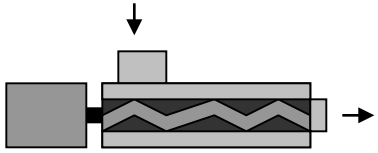
Displacement per revolution not adjustable. Not linear from high to low RPMs due to slip at low speed.

Air Operated Diaphragm Pump



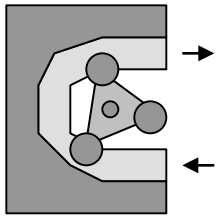
Displacement per stroke not adjustable. Not repeatable due to variable air pressure, flexible diaphragm.

Progressing Cavity Pump



Displacement per revolution not adjustable. Chemical incompatibility common w/ rotor.

Peristaltic Pump

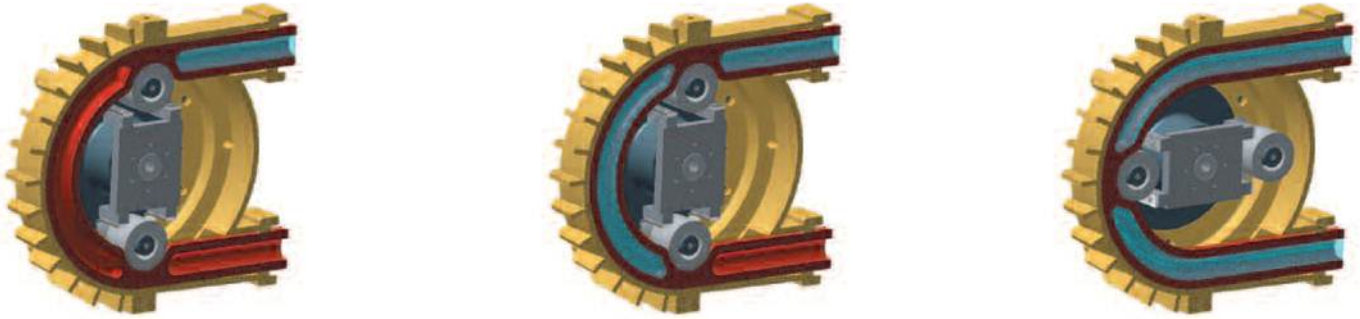


Displacement per revolution not adjustable. Tube stretch degrades repeatability.

Peristaltic Pump Theory

Per·i·stal·sis (per·i·stal·ses) *n. pl.*

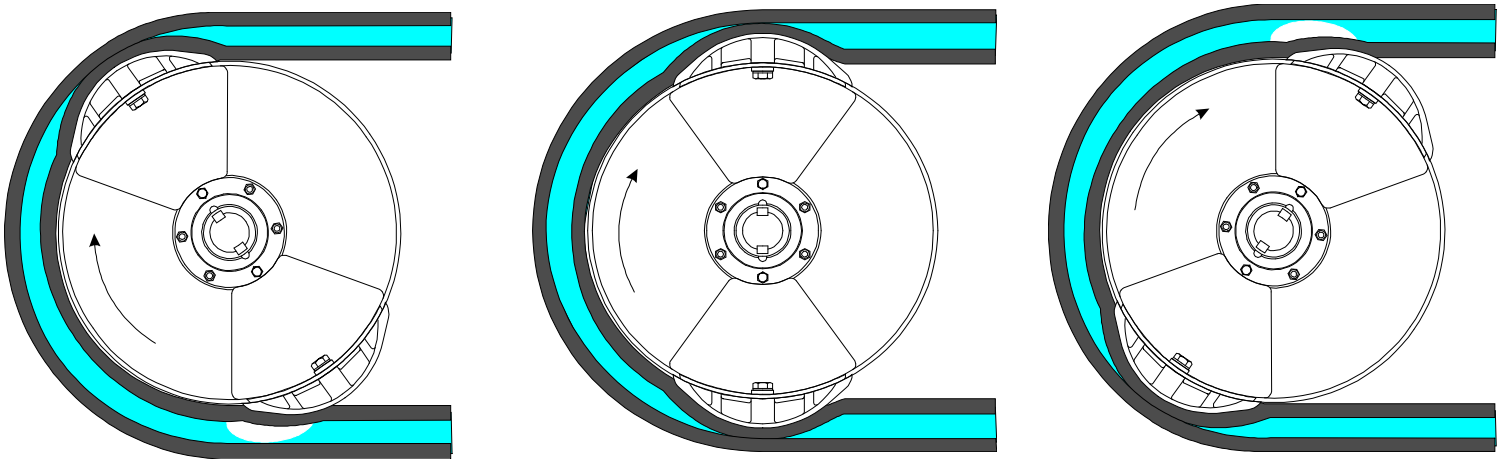
The wavelike contractions of a tubular structure that propel the contents forward by alternate contraction and relaxation.



As the rotor of the pump rotates the fluid is gently pushed forward until it is expelled through the discharge. In a peristaltic pump this occurs twice per revolution.

Peristaltic Pump Theory

Peristalsis is regarded as one of the simplest and efficient means of pumping fluids.



Peristaltic Pump Features & Benefits

Run Dry

- Some PD pumps cannot run dry or risk catastrophic failure.
- Totally capable of running dry for an undetermined amount of time.
- Can handle fluids with entrained air or gases such as NaOCl or NH4OH, without vapor lock, even under operating pressure.

Peristaltic Pump Features & Benefits

Gentle pumping action.

- Since hose pumps turn at slow speeds, the product is gently pushed through the hose with minimal turbulence.
- One of the best pump technologies available for minimizing damage to shear sensitive materials such as activated polymer solution or water based paints.
- Can pump materials with viscosities up to 60,000cps.

Peristaltic Pump Features & Benefits

Abrasion resistant.

- Hose life is **NOT** related to a products abrasive qualities.
- Slow speeds and gentle pumping action of the hose pump allows pumping more abrasive liquids such as lime slurry, MagOH, and sludge.
- Valve-less which mitigates plugging or wear and tear

Tube versus Hose

Tube:
Solid Extruded
Material
(Low Pressure)

Hose:
Layered &
Reinforced Rubber
(High Pressure)

Casing Pump

Casing-Style Peristaltic Pump

- Roller type design
- Tube material only
- Maximum pressure to 100 psig
- Maximum 220 RPM
  - Offers wide range of turndown but at expense of tube life
  - Pump capacity can be over-sized to limit RPM, affecting price?

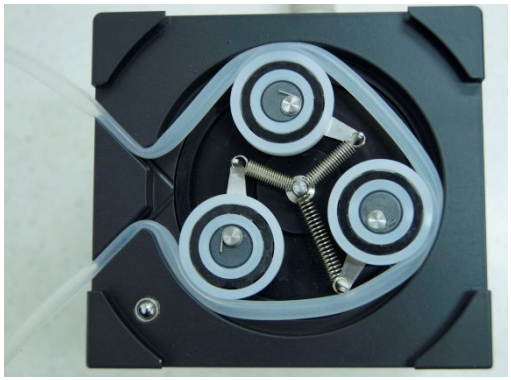
Casing Pump - Control

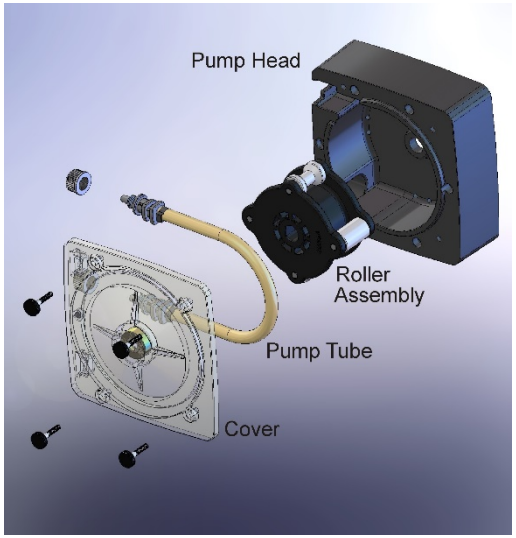
- Complete Unit: Motor, Controls and Liquid End in one housing
- All power and control signals with no need for a VFD or SCR Drive.
- Greater Turndown capabilities up to 10,000:1

Casing-Style - Rollers

- Multiple different offerings:

  1, 2, 3 or 4 Roller assembly options





Hose/Tubing Style Pump

Roller

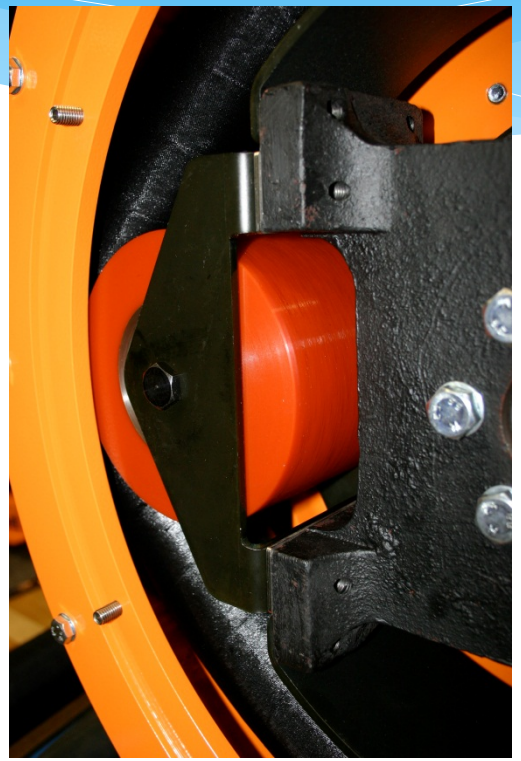
versus

Shoe

Technology

Roller Technology

- Because of reduced hose stress, roller pumps can increase hose life by 30% over shoe compression pump hose life.
- Because of reduced torque, the roller pumps typically consume less HP.
- Roller technology is limited to 116 psig operating pressures. Shoe technology is suitable for operating pressures to 232 psig.



Shoe Technology

- A set of fixed shoes slide over the surface of the hose causing it to compress the hose twice per revolution.
- Since the compression causes friction heat, the chamber is filled with a glycerin based food grade lubricant.

Shoe Technology

- Shoe pumps have a difficult time maintaining system pressure when operated below 3 rpms. However, a similarly sized roller pumps can maintain system requirements at speeds **below 1 rpm!**

Hose Life

Factors affecting hose life:

- Speed
- Temperature
- Process chemical
- Discharge pressure
- Suction conditions

Hose Life - Speed

SPEED KILLS!

- The single biggest impact on a hoses life is speed.
- With a hose life expectation of 10,000,000 restitutions before performance decline, you can see how the proper selection of the pumps speed is so critical.
- 10,000,000 / 2 / pump rpm / 60 = approximate hose life.
- 10,000,000 / 2 / 40 / 60 = 2083 hrs.
- 10,000,000 / 2 / 30 / 60 = 2778 hrs.

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

Hose Life - Temperature

Temperature

- Higher operating temperatures can cause the hoses to swell.
- This makes it more difficult to compress the hoses.
- Hoses are limited to 175° F on the NR, NBR and Hypalon.
- The EPDM hose has a temperature limit of 210° F

Hose Life - Chemical

Process Fluid

- Peristaltic pumps have a limited availability of hose materials.
- Selecting the wrong material can cause premature failure of the hose/tube.
- For example:

  A fluid containing oils or fats/greases is not compatible with natural rubber. NBR would be the hose of choice.
- There are numerous chemical compatibility charts available to help select the correct hose material.

Hose Life – Suction Condition

Suction Conditions

- Extremely high suction lifts can cause premature wearing of a hose. The hose has a hard time restoring itself to it's original shape.
- Pump should be as near as possible to the supply of liquid so that the suction pipe is as short and straight as possible
- The minimum diameter of the piping should be similar to that of the pump connections
- It is recommended to use a flexible connection between the piping and the collars of the pump in order to avoid the transmission of vibration to the piping and to allow for the ease of hose replacement.

Hose Life – Discharge Condition

Discharge Pressure

- Extremely high discharge pressures make it very difficult for the roller or shoe to completely compress the hose.
- Slip can increase causing a decline in performance
- To reduce power being absorbed, use the straightest and shortest piping possible.
- Diameter of piping should be the same as the nominal diameter of the pump.

Thank you for your time and attention

Questions or comments?