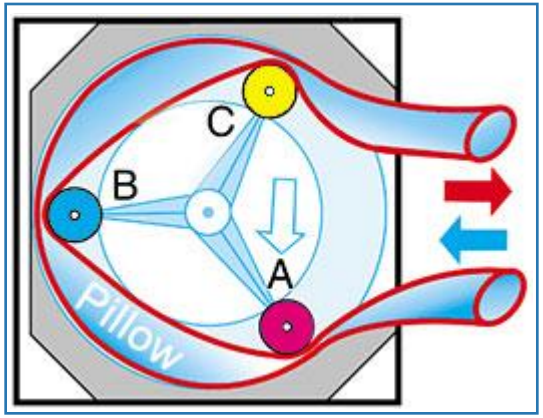
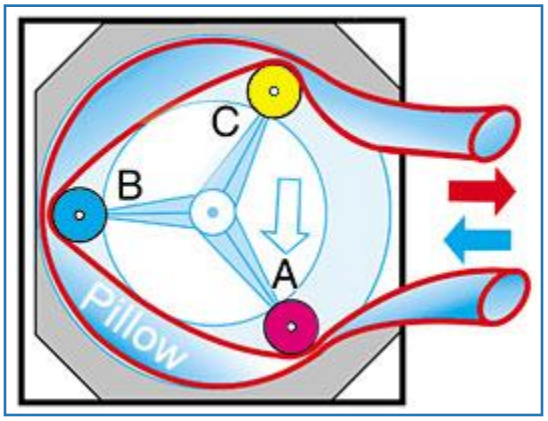
How a Peristaltic Pump works

Peristaltic Principle



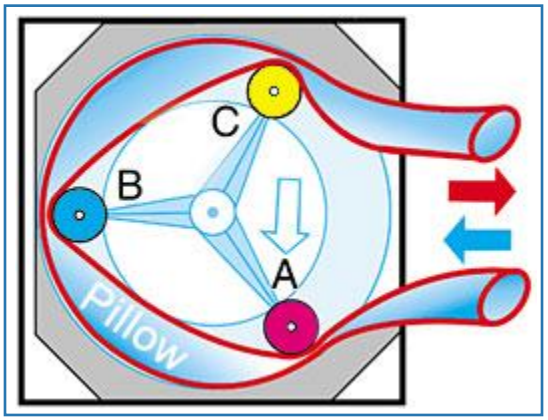
- The tubing is fixed between the tube-bed and the rotor
  - at each roller location the tubing is squeezed
    - position A, B and C
- The rollers on the revolving rotor move across the tubing
  - the tubing is continuously squeezed by the rollers which push the liquid in the direction of the revolving rotor
- The tubing behind the rollers recovers its shape, creates a vacuum and draws liquid in behind it.

Peristaltic Principle



- A 'pillow' of liquid is formed between the rollers
  - the pillow is the pump chamber and determines the volume per roller step and, hence, the flow rate
  - the pillow volume not only depends on the inner diameter (i.d.) of the tubing, but also on the tubing properties, the drive and pump-head specifications as well as the liquid and the physical application conditions

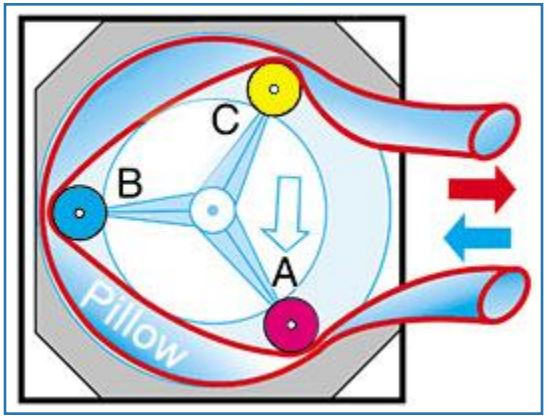
Roller-step volume



The pillow volume determines the roller-step volume which depends on:

- Pump system
  - number of rollers
  - pump-head design
    - e.g. spring-loaded tube-bed
  - occlusion setting
  - rotation speed
- Tubing
  - inner diameter
  - wall thickness
  - formulation
  - age of tubing
- Liquid
  - type of liquid
  - temperature
  - viscosity
- Application conditions
  - suction lift / vacuum
  - differential pressure

Flow rate

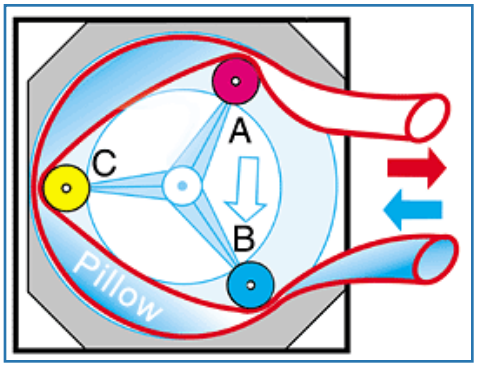


The flow rate is calculated as follows:

- Volume per roller step (pillow volume)
  x Number of rollers
  = Volume per revolution

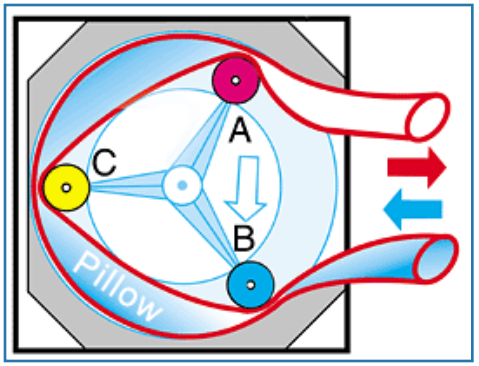
- Volume per revolution
  x Rotation speed per minute
  = Flow rate per minute

Advantages



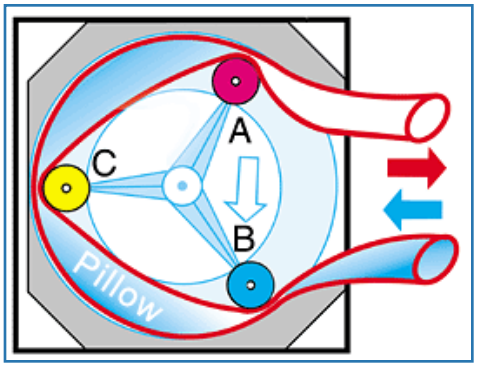
- no contact of the liquid with mechanical parts
- tube is only part to wear
- service and maintenance costs are minimal
- easy to clean and sanitize
- multi-channel systems available
- Ismatec pumps available up to 24 channels
- insensitive to dry-running

Advantages



- self-priming
- excellent suction height
  - use tubing with small i.d., thick wall and stiff material
- no siphoning effect when pump is stopped
- immune to many chemicals
  - depends on the tubing material
- suspensions and sludge can be pumped
  - with a solid content of up to 60%

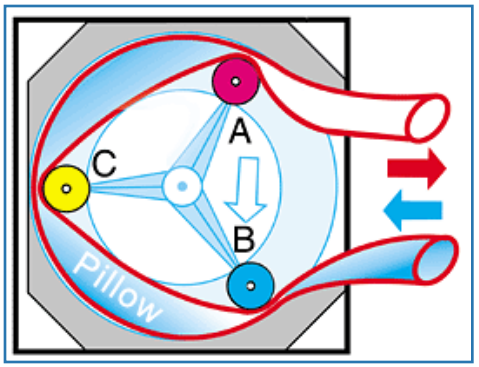
Advantages



- virtually immune to abrasive media
- liquids of high viscosity can be delivered
- gentle delivery due to very low shearing forces
  - ideal for delicate suspensions

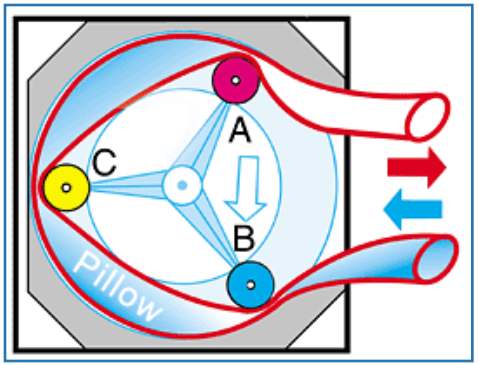
    e.g. blood cells or bio-technological media are not damaged
- some tubing material can be autoclaved
- very high repeatability - suitable for auto-analyzers
  - pumps system must be calibrated

Limitations



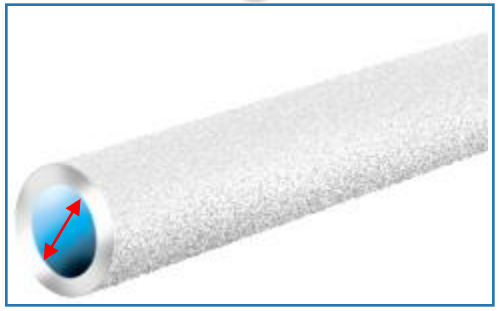
- chemical inertness
  - depends on the tubing material
- slight pulsation is inevitable
- tubing requires recalibrating and changing
  - due to wear
  - at certain intervals depending on the application
  - very important for accurate and repeatable pumping
  - more frequently in comparison to gear and piston pumps
- tubing may leak after extensive use

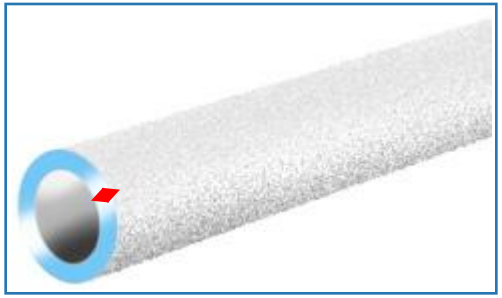
Limitations



- depending on the pump-head system the flow rate is sensitive to varying differential pressure conditions (all spring-loaded tube-beds!)
- accuracy and repeatability of the flow rate also depend on the tubing age and material used
- max. differential pressure is lower in comparison to gear and piston pumps
  - depends very much on tubing material and inner diameter in relation to wall thickness

Tubing size





The tubing is the pump chamber of the peristaltic pump and, hence, one of the most important parts !

The following tubing specifications have particular effects on the pumping process:

- inner diameter (ID)
- wall thickness (WT)
- material (formulation)

Different combinations of these parameters change the pumping behavior and consequently lead to different results.

Tubing Life

- Life expectancy of the tubing depends on the following features:
  - tubing material
  - drive speed
  - number of rollers
  - operating temperature
  - pressure conditions
  - liquid used
    - chemical composition, particles, etc
  - tube-bed and roller design
- Ismatec catalogue provides overview of approximate tubing life