

# Concerned about Particle Generation?

## Quattroflow™ pumps and peristaltic pumps: Particle generation compared

Facts about peristaltic pumps used for biopharmaceutical production processes:

- Particle generation caused by pump design.
- Permanent mechanical stress of the hose may lead to a substantial source of particles entering the fluid stream.
- Possible contamination of the pumped liquid and the pharmaceutical end product.

### Do you want to avoid this in your product?

The images on the right show micrographs of filter membranes, which were used to quantify particles created during a pumping process.

- Particles from the peristaltic pump are visible as bright objects obstructing the pores of the membrane (upper image).
- The filter membrane of the Quattroflow test does not show particles just open membrane pores. The gentle working principle of the 4-piston Quattroflow pump minimizes stress and thus the generation of particles (lower image).

#### Test conditions:

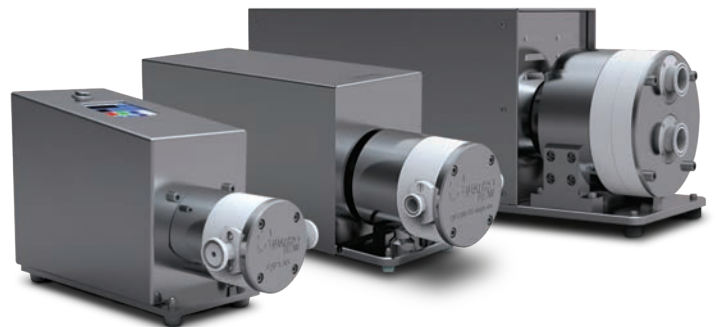
Third party comparison between Quattroflow QF150SU and peristaltic pump using pharma-grade pumping hose. 8h continuous recirculation through 12µm filter at appr. 100 l/h.

#### Result:

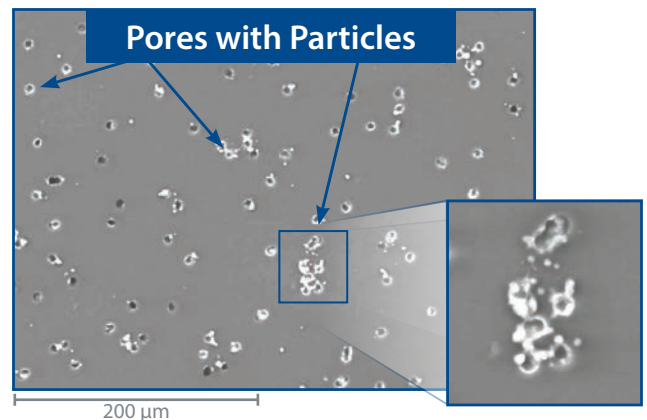
- 2 Mio particles with sizes between 6.1 and 12.7 µm for the peristaltic pump.
- No particles identifiable for the Quattroflow pump.

**Quattroflow pumps help to minimize particle contamination of your product and are suitable for securing the handling of expensive and/or sensitive liquids.**

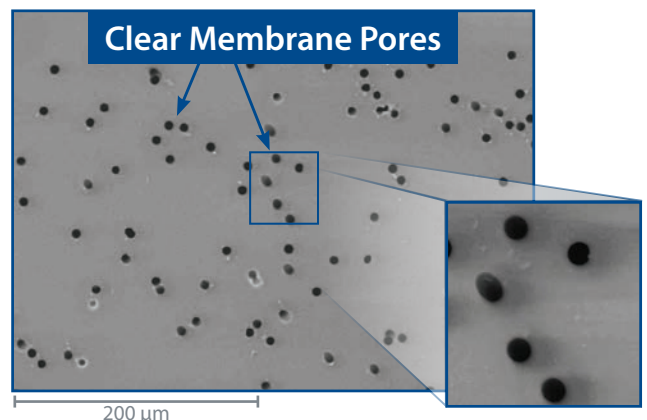
## Quattroflow Single-Use Quaternary Pumps



### Peristaltic Pump



### Quattroflow



# Quattroflow™ Pumps make the difference

Besides the particle generation and product contamination facts mentioned on the first page, peristaltic pumps have some further operational limitations, which can be a disadvantage and risk for your process:

## Pulsation

Due to their operational design, peristaltic pumps create a pulsing flow, which can adversely affect the process.

## Tube failure

High mechanical stress can result in tube rupture, which can lead to a catastrophic failure, costly product loss, downtime and maintenance.

## Flow rate consistency

With increasing operating time of the tube, mechanical stress changes the hose geometries over time and can lead to an inconsistent flow.

These disadvantages inherent in peristaltic pumps ultimately mean potential threats to the quality of the process and the final product. Spallation, performance loss and rupture are also described in scientific literature (see Bahal and Romansky, "Spalling and sorption of tubing for peristaltic pumps") in *Pharmaceutical Development and Technology*, 7(3), 317-323 (2002).

Single-use technologies have created improved production opportunities in bio-pharmaceutical production processes. The correct pump technology can make a significant contribution.

## Particle generation outside the hose

Spallation release may also occur outside the hose. This may compromise the fluid path but also contaminate the external clean room environment.

## Pump technology change

Limited flow and pressure capabilities of peristaltic pumps means changing pump technologies as processes move from process development to cGMP creating scale up issues.

