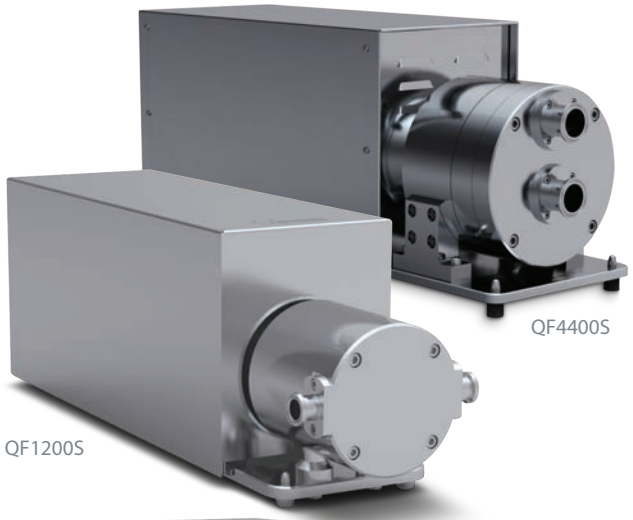
QUATTROFLOW™
Fluid Systems

Concerned about your Lobe Pump Performance?

Quattroflow™ pumps and lobe pumps compared:

Lobe Pump Shortcomings *(And Shortcomings of Gear and PD Pumps)*	Quattroflow Pump Benefits
Can't satisfy all duty needs or scalability requirements	**High turn-down allows for multiple flow duties and scaleup**
Unable to handle both product and CIP flow duties with the same pump	**High turn-down allows for consistent completion of both duties**
Can't self-prime, limited suction-lift capabilities	**Self-priming (even dry), wider range of suction-lift capabilities**
Mechanical seals do not permit dry running	**Risk-free dry running**
Leakage problems with mechanical seals	**Seal-less technology**
High maintenance costs due to expensive mechanical seals	**Seal-less design helps ensure low maintenance costs**
Shock during pump shipment may lead to damaged mechanical leads	**No special risks during transport**
Highly skilled staff required for replacement of mechanical seals	**Easy replacement of wear parts**
Compromised polished fluid path because of incidental metal-to-metal contact resulting in high re-polish costs *(see figure 1)*	**No metal-to-metal parts moving in proximity, so no loss of internal polish finish**
Damage by rigid particles of undissolved salts	**Less prone to damage**
Large clearance required for SIP temperatures	**SIP and CIP capable with no influence on performance**
Low efficiency for low-viscosity products	**Specially developed for low-viscosity products**
Shear produced, unacceptable for shear-sensitive products	**Optimized flow path for shear-sensitive products**
Pump efficiency affected by component wear with time	**Consistent efficiency along the pump curve independent of time**
Particle generation caused by internal pump wear and mechanical seal wear can lead to product contamination	**The quaternary (four-piston) technology does not require a mechanical seal or wetted rotating parts, ensuring total product containment with minimum particle generation**
High power required to compensate for slip results in greater heat and shear generation for pumped products	**Just 0.37 kW needed for a QF1200 pump size**
Pulsation due to the high and irregular slip during rotation	**Low pulsation due to quaternary diaphragm pump principle**
Not suitable for single-use biopharma applications	**Convertible to cleanable Multiple-Use and disposable Single-Use pump chambers**

Quattroflow™
Multiple-Use Quaternary Diaphragm Pumps



QF4400S

QF1200S

QF20k

QF5050S

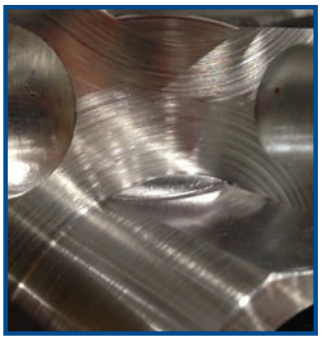


Figure 1

Where Innovation Flows

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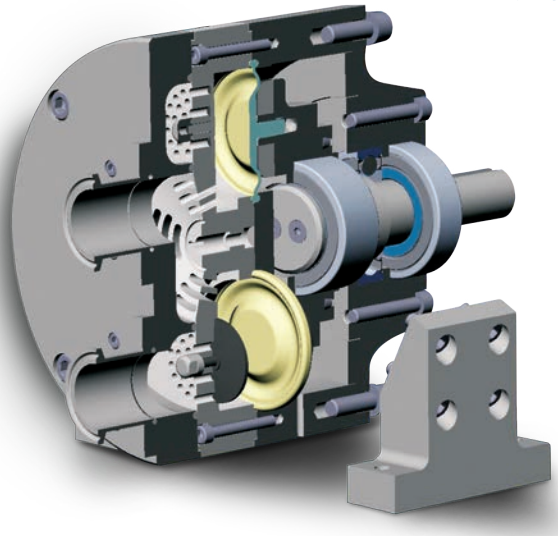
Quattroflow™ Pumps

A better alternative for traditional lobe pump applications



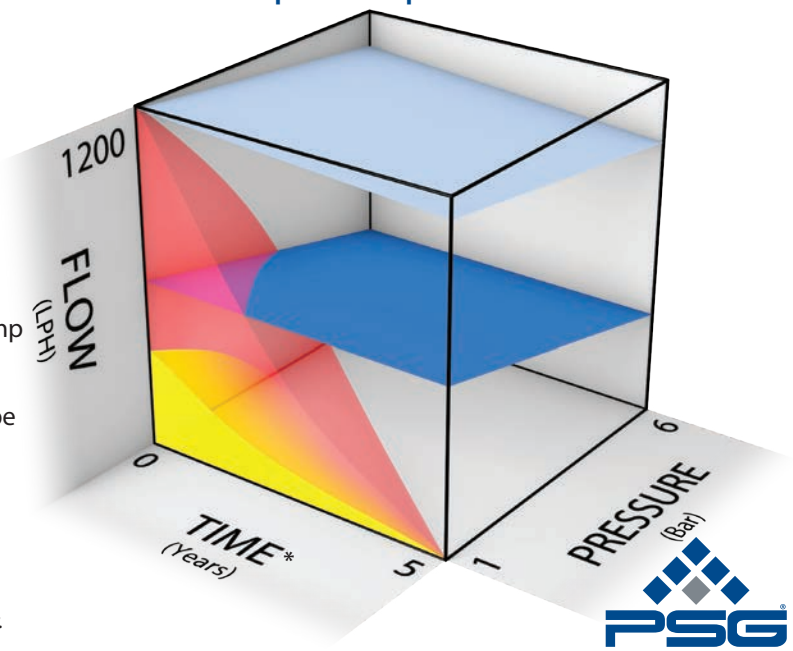
The operation of the positive displacement Quattroflow™ quaternary diaphragm pump is based on the same operational principle as the human heart. The four-piston (quaternary) diaphragm technology enables a gentle pumping action through soft "heartbeats." Each stroke of the four diaphragms is generated by an eccentric shaft, which is connected to the electric motor.

This method of operation for Quattroflow pumps allows them to gently, safely and securely convey aqueous solutions and biologic products that are sensitive to shear forces. The four-piston design does not require a mechanical seal or wetted rotating parts, ensuring total product containment without abrasion and minimum particle generation. Additionally, the four-piston pumping principle enables risk-free dry-running, low pulsation, self-priming and a high turn-down ratio.

Performance of Quattroflow™ Pumps and Lobe Pumps Compared

Fixed Speed Curves

- **Quattroflow pump** at maximum speed. Pump is only slightly influenced by pressure and wear over time.
- **The same Quattroflow pump** at half speed. Pump is only slightly influenced by pressure and wear over time. Pump is able to match a lobe pump that slips at maximum speed.
- Larger traditional **lobe pump** slips and needs to be oversized.
- Smaller traditional **lobe pump** does not have needed flow range (turn-down) to meet flow.



** For applications that experience loss of performance from pump wear.*

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