

DATA SHEET LS Bubble Free Micropump

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Osmotex' LS Bubble Free micropump for life science applications has the unique property of not releasing bubbles in the liquid flow path under normal conditions (typically a counter pressure of minimum 35 to 70 millibar is required). The micropump must be used with open reservoirs, as electrolytically formed gas bubbles are released on the liquid feeding side.

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Ordering Information

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General

Osmotex' electroosmotic (EO) pumps have the following advantages:

- Very compact disc-shaped design, typical dimensions \varnothing 15mm, thickness 2-4mm
- Do not create gas bubbles in flow path given a certain counter pressure (some versions)
- Reduced influence of electrochemistry
- Low power
- Silent
- Low cost, suitable for volume applications

Osmotex develops advanced EO pumps with strongly reduced influence of electrochemistry and bubble formation, when used in the correct way. Electrochemical reactions should still be considered when considering new liquids.

While Osmotex' standard products cover a wide range of power, flow rates, liquids and other conditions, Osmotex can also develop customized solutions when needed.

Standard pumps are delivered un-calibrated. Like for other EO pumps, the flow – pressure – voltage characteristics depends on the liquid used. Osmotex also offers robust solutions with flow-sensor feedback control.

Typical Performance – LS Bubble Free Micropump

Operating voltage	0 – 15 V
Flow rate	ca 10 - 150 μ l/min
Pressure	up to at least 10 PSI (0.7 bar)

Power consumption: from less than one mW up to a few hundred mW (varies across the wide range of performance settings and liquids). Note that flow rate and pressures are liquid dependent for electroosmotic pumps.

Flow direction: towards negative electrode.

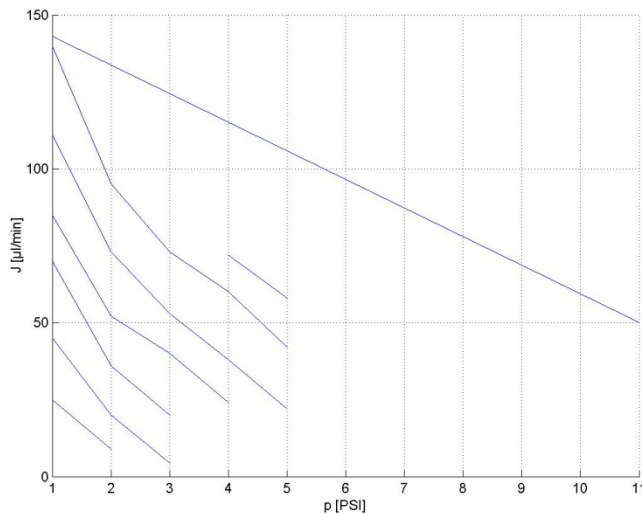


Figure 1: Typical flow-pressure characteristics, curves for 5, 6, 7, 8, 9, 10, 11 and 15 V DC from left to right (fluid: DI water).

Package and Measures

Shape: Circular disc
 Diameter: 15 mm
 Thickness: 4 mm

Despite different characteristics, all Osmotex micropumps are embedded in the same type compact plastic package. These “Pump Cores” (figure 2) do not include fluidic and electric connectors, but can be interfaced with various lab-chips, connectors and other equipment.

Osmotex also offers an evaluation package with fluidic and electric connectors (see Appendix).

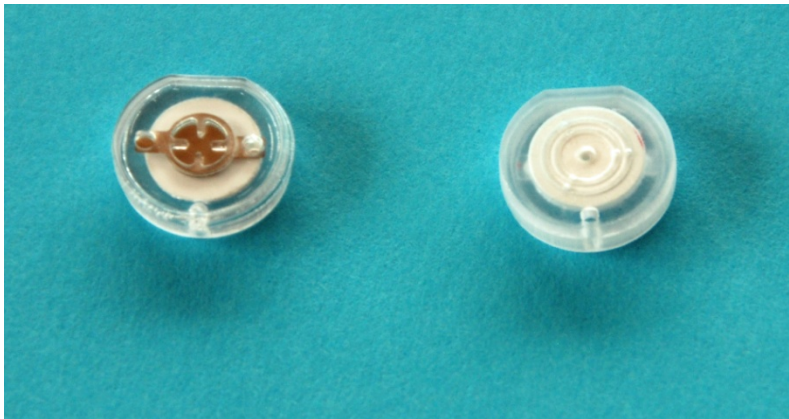


Figure 2: LS Bubble Free Pump Core, top view (left) and bottom view (right). Center hole is for fluid flow, six eccentric holes for gas venting. Holes for electrical connectors and orientation hole visible.

The package is made of PET or other inert polymer.

Geometry and Interfacing with Connectors

In the following is included information necessary to design fluidic and electrical connectors. The clover shaped area in the centre must be available for liquid flow, while the area around can be used for sealing. For example, a flat rubber gasket with diameter large enough to encircle the clover can be pressed against the Pump Core.

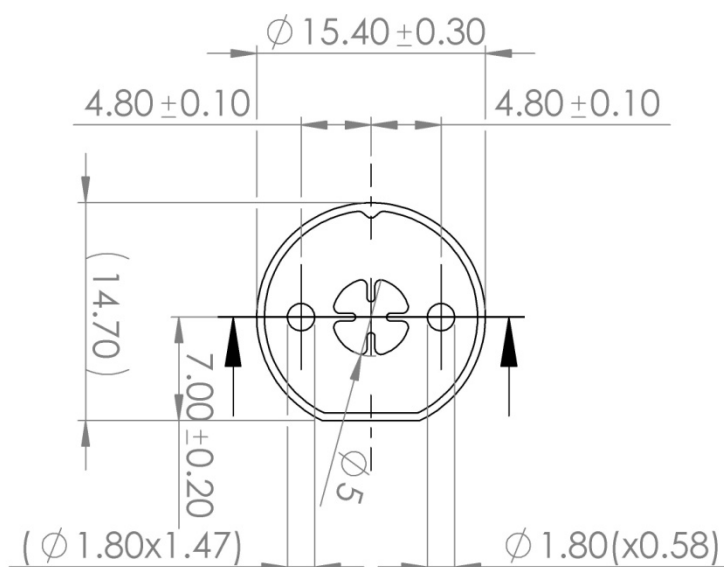


Figure 3: Top view.

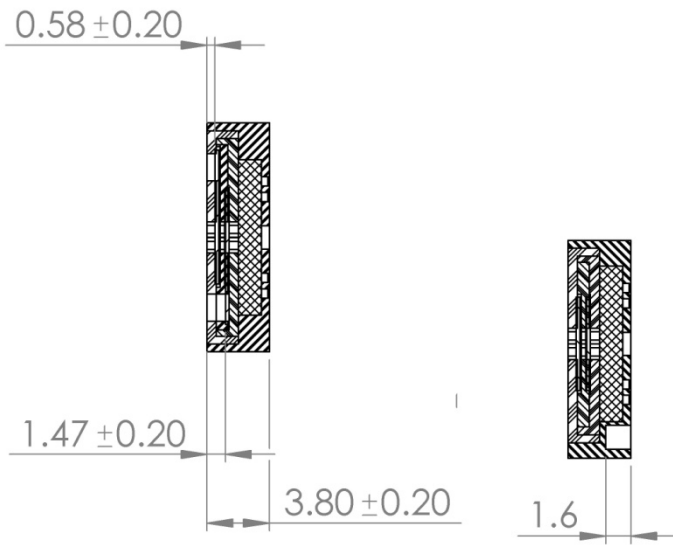


Figure 4: Side view, with orientation hole indicated on the right figure.

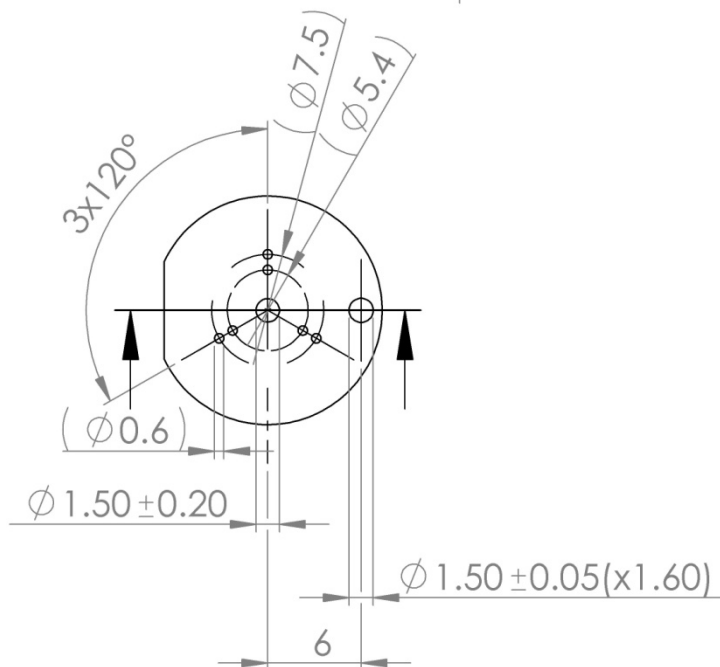


Figure 5: Bottom view. Center hole is for fluid flow, six eccentric holes for gas venting.

Other Diameters

The standard version has electrode diameter 6mm (open flow diameter 5 mm as shown on figure). Osmotex also offer versions with diameters 4 and 8 mm, with maximum flow rates approximately half and double that of the standard version, respectively.

Sealing

The micropump can be interfaced with fluidic connectors using a gasket, for example made of a rubber such as NBR, FKM or (for less deformation) EPDM. It is important that the rubber does not block the gas venting holes and that the gass is allowed to pass to the atmosphere.

Application Notes

Filling and Flushing

The pump can be primed by using a syringe while taking care not to inject air to the pump or applying excessive pressure.

To obtain stable flow, there should be a constant water level in the inlet reservoir.

NB Electroosmotic pumps cannot suck air and are not self priming.

Liquids

The LS Bubble Free pump has been tested with DI water and 0.5x TBE buffer. It should be compatible with many other ionic solutions, although possible electrochemical reactions should be taken into account when considering a fluid. The pump has not been tested with alcohols and other organic solvents, and tightness cannot be guaranteed for such liquids.

Precaution

The pump should not be run at higher voltages than 15 V and should never be allowed to run dry, as this could lead to breakdown of the electrodes and porous pump structure.

Customized Solutions

Osmotex can engage in application specific development for producers of end user equipment. Our broad expertise in electrokinetics and microfluidics makes us ready to meet most challenges, whether the need is a simple pump with package, a robust design with flow sensor feedback control (see Figure 1), or the integration of several pumps on a chip.

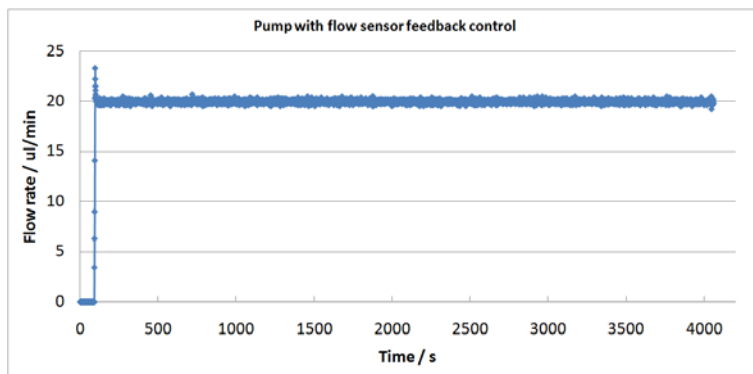


Figure 6: Flow sensor and high precision flow with feedback loop.

Appendix

Auxiliary Equipment

Evaluation Package

Osmotex can deliver the LS Bubble Free micropump embedded in an open reservoir evaluation package with standard fluidic and electrical connectors.

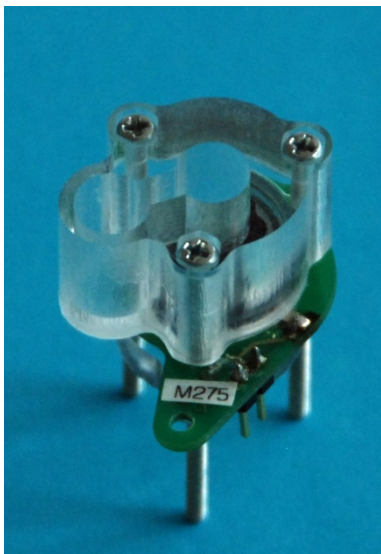


Figure 7: Osmotex open reservoir connector.



Figure 8: Open reservoir connector, bottom view. The fluidic connector has inner diameter 1.7 mm and outer 2.5 mm.

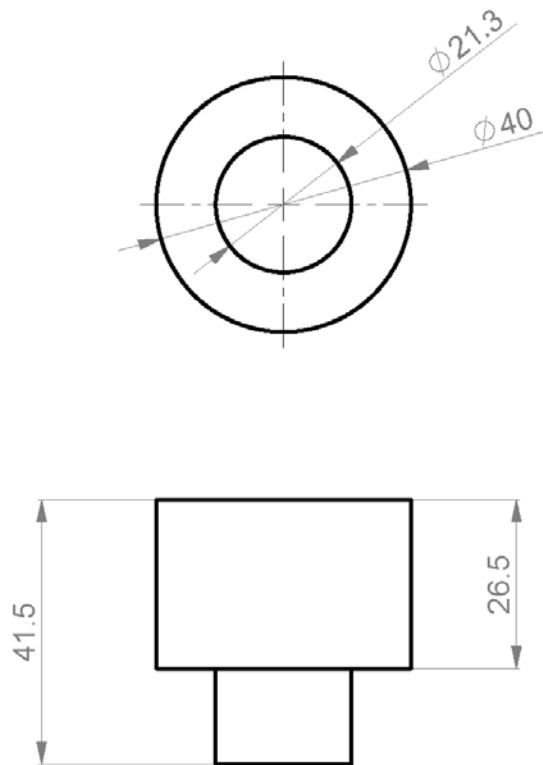


Figure 9: Osmotex' open reservoir connector would fit into a cylinder as shown (top and side views).

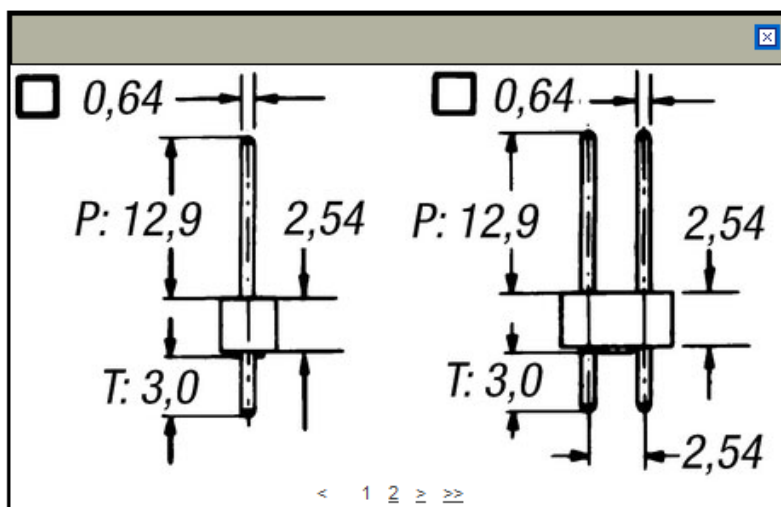


Figure 10: Electrical contact at connectors.

Example Data for DI water

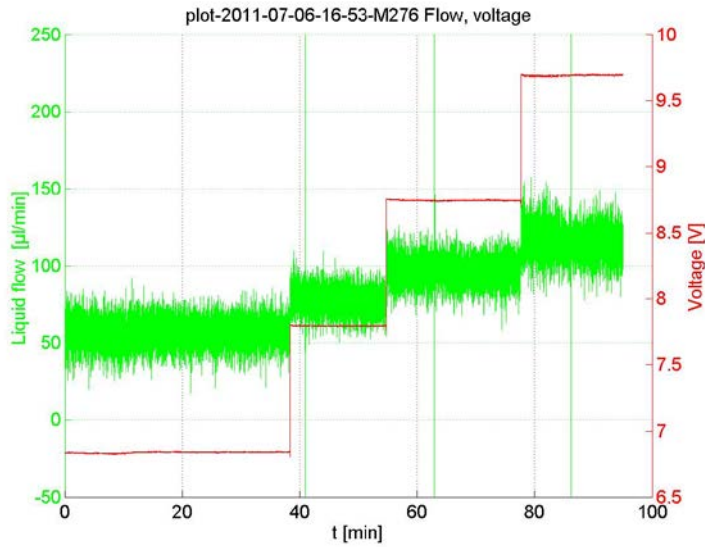


Figure 11: Flow-voltage plot at 1 PSI (69mbar) counter pressure.

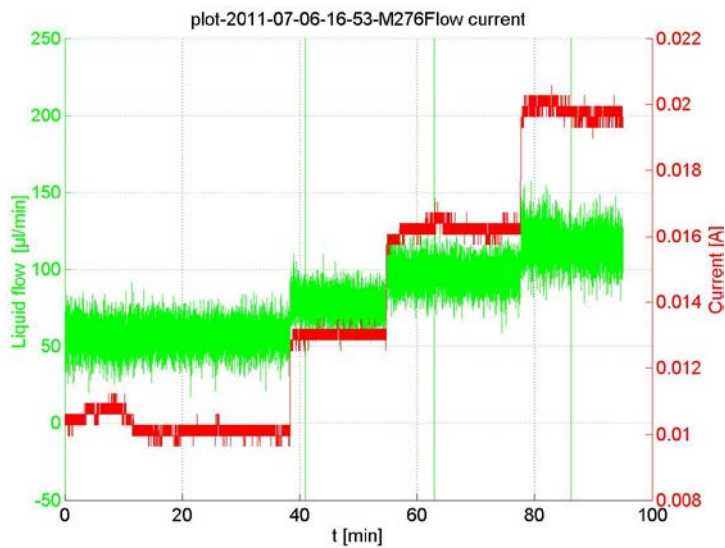


Figure 12: Flow-current plot, 1 PSI, voltage as in previous plot.

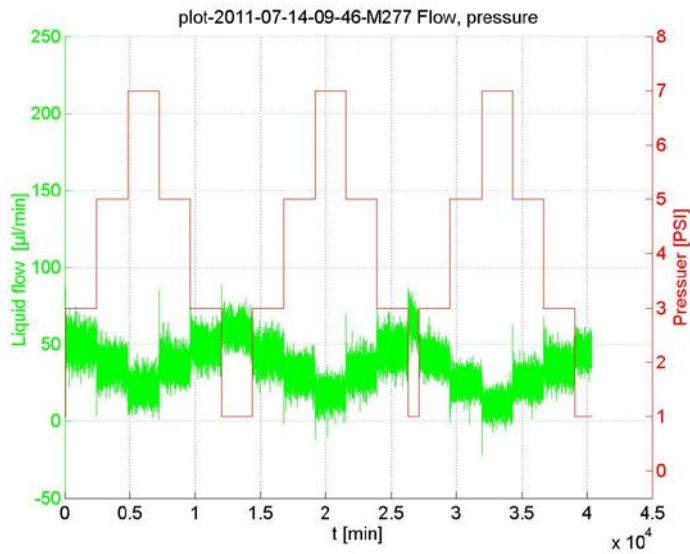


Figure 13: Flow-pressure plot (7 PSI = 0.5 atm), voltage 9 V, current ca 15 mA.

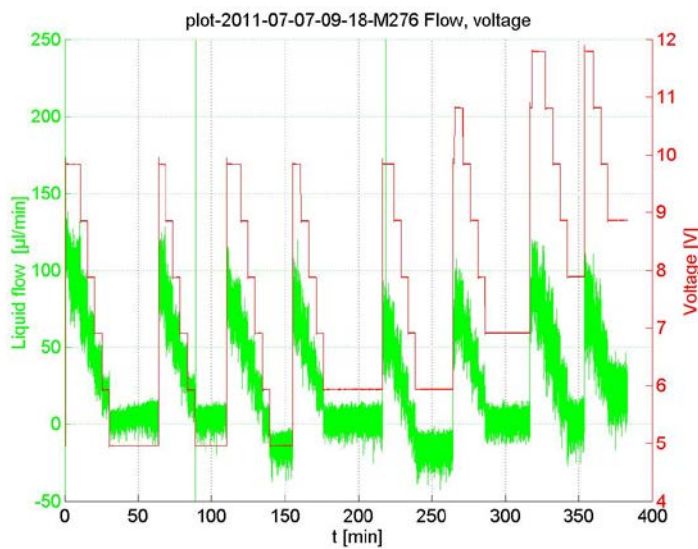


Figure 14: Flow-Voltage plot, two voltage cycles for each pressure (See next figure).

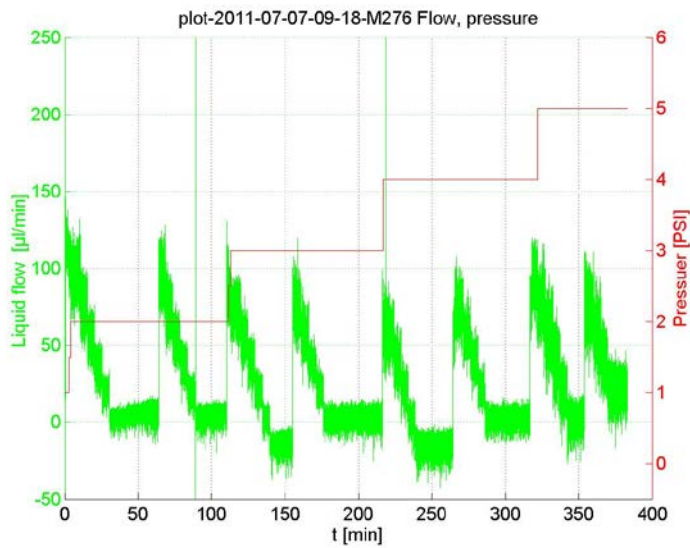


Figure 15: Flow-Pressure plot, for voltage steps in previous figure.

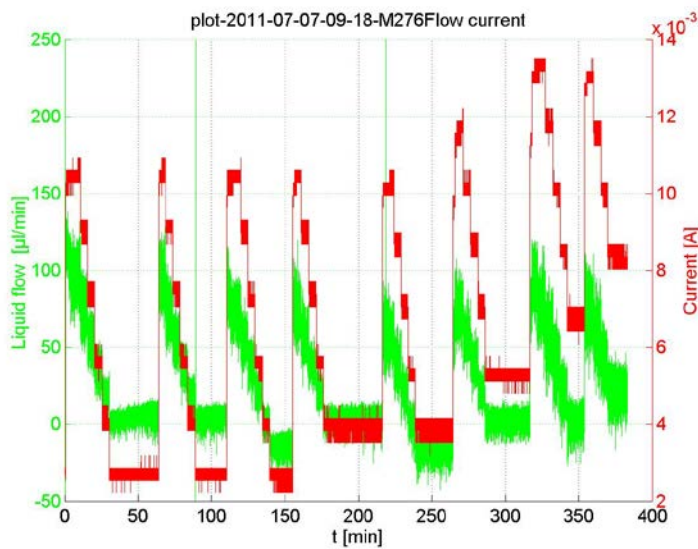


Figure 16: Flow-current plot, see two previous figures. Notice the variation of current not only with voltage but also pressure.