

Supporting Information for

Millifluidic valves and pumps made of tape and plastic

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Supplementary results

Table S1

Pump's head

	Pump types						
	A	B	C	D	E	F	G
Discharge head (m)	9±0.2	9.2±1.2	10.2±0.07	7.8±0.2	6.4±0.2	11.2±0.06	8.7± 0.6
Maximum discharge pressure (kPa)	83± 2	90±12.4	99±0.7	76±2	63±1.58	110±0.62	85± 5.51

Table S2

Pumping membrane diameter estimated by nonlinear fitting

Ratio	Reagent pump		Solvent pump	
	Constant volume (µL/cycle)	Pumping membrane diameter (mm)	Volume desired (µL/cycle)	P. membrane diameter estimated (mm)
1:1	0.0402	1	0.0402	1
1:2	0.0402	1	0.12	1.15
1:4	0.0402	1	0.28	1.28
1:8	0.0402	1	0.60	1.79
1:16	0.0402	1	1.25	2.54
1:32	0.0402	1	2.53	2.99

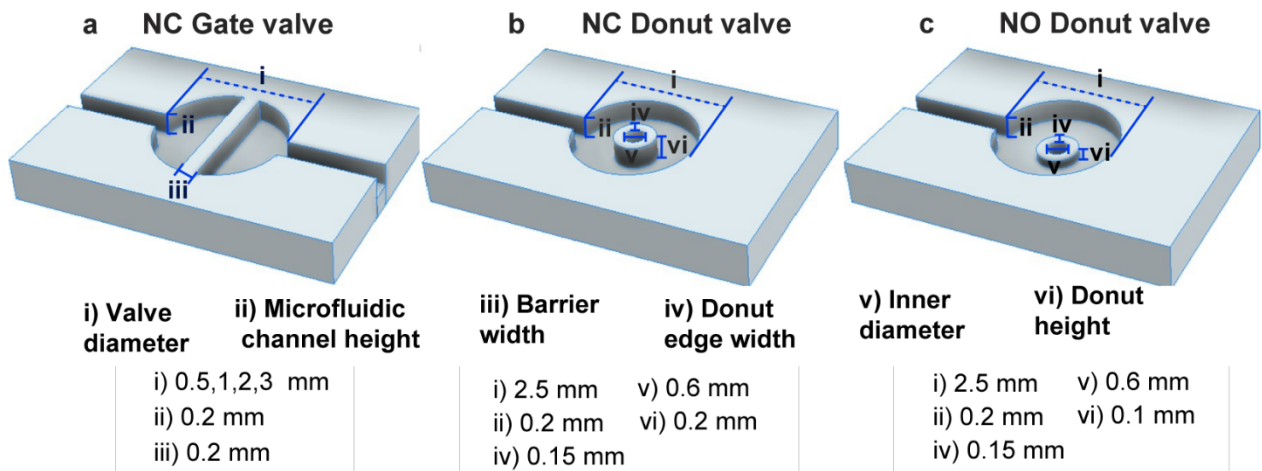


Figure S1. Geometry of flow layer for a) NC gate valve, b) NC donut valve, c) NO donut valve.

Assembly

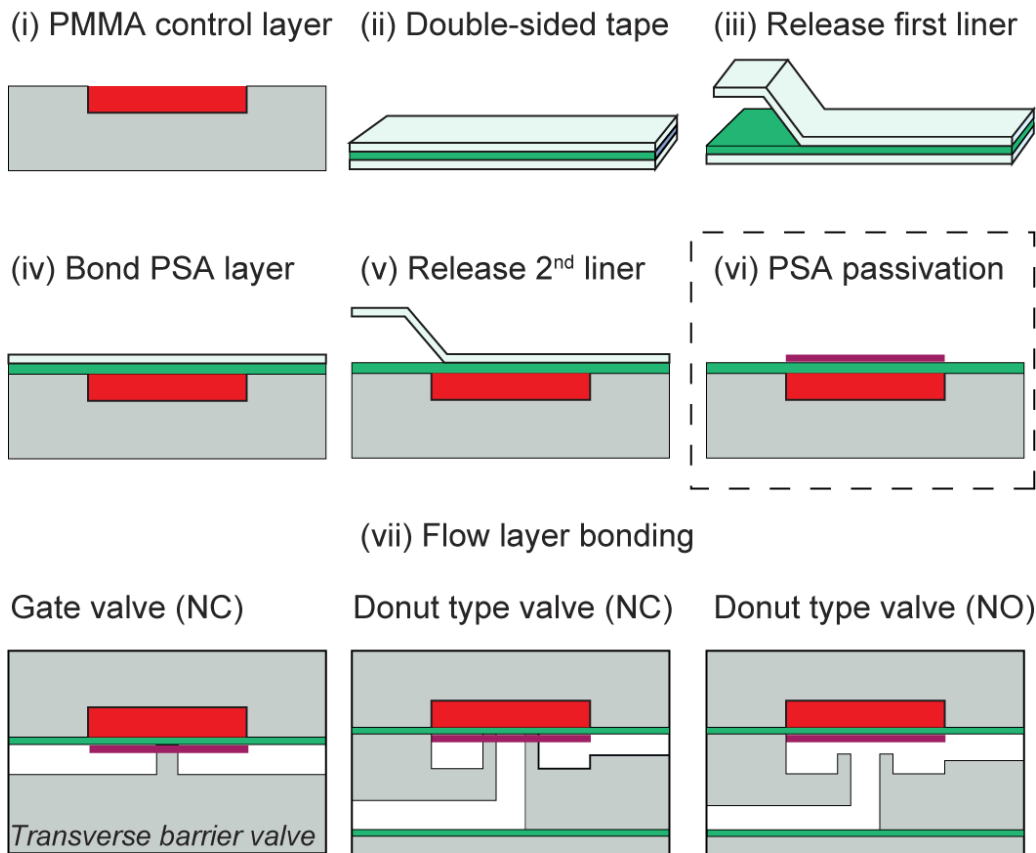


Figure S2. Shows the flow and control layer assembly using a dPSA. An intermediate PSA blocking step is necessary to prevent PSA from sticking to the valve.

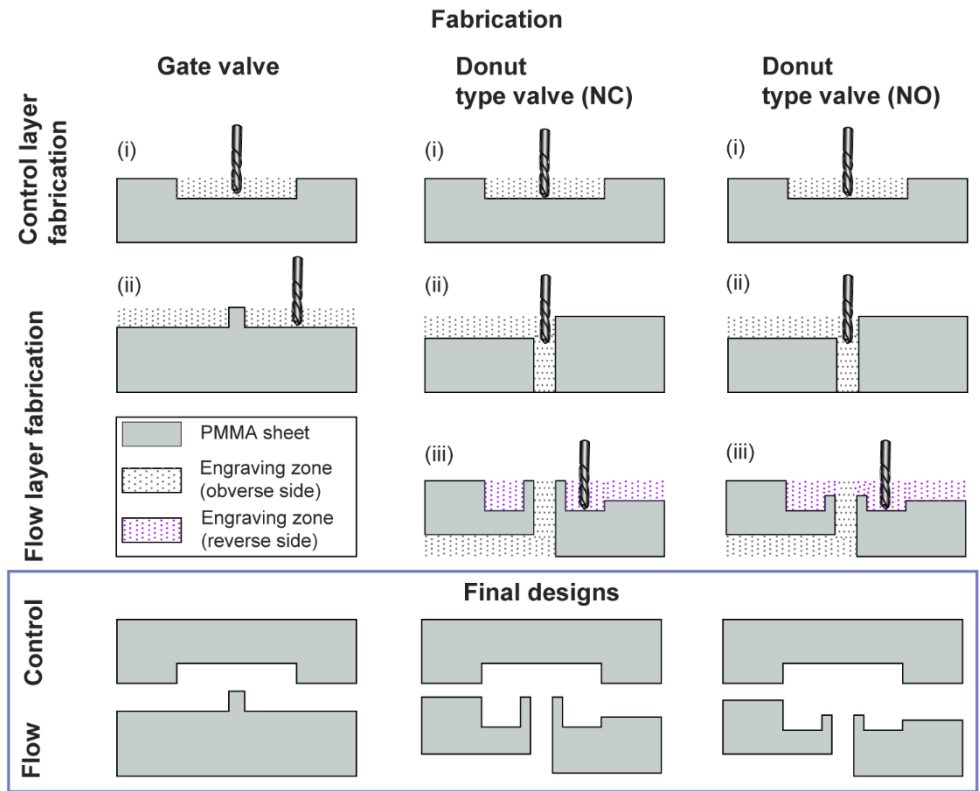


Figure S3. Microfabrication process by micro-milling. Each column represents the manufacture of each valve design. The first row outlines the manufacture of the control layer. The second and third rows show the fabrication of the flow layers. Note that for donut-type valves, the flow layer is micro milled on both sides.

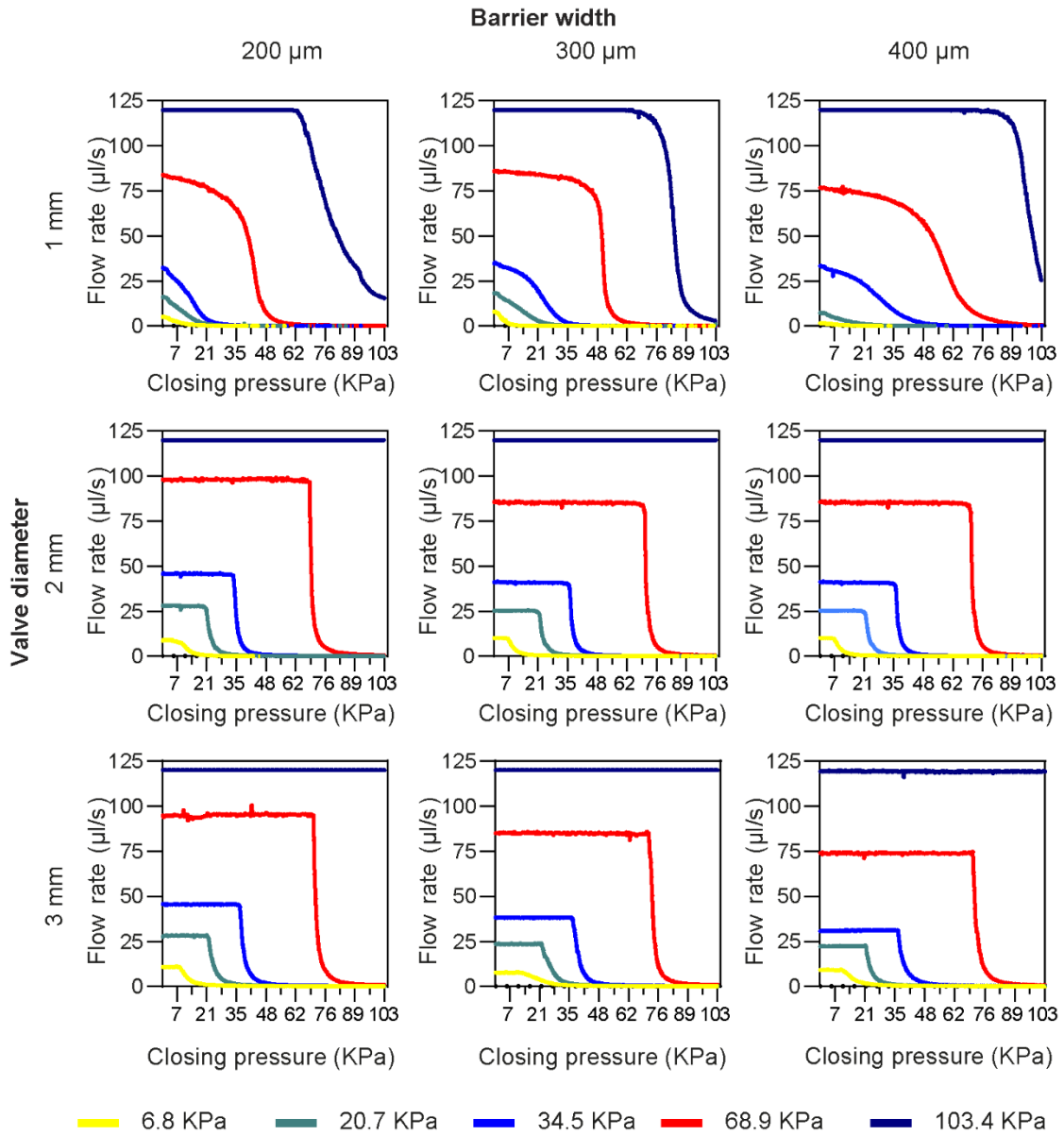


Figure S4. Barrier width and valve diameter effect on valve closing from an initial state where the valve is open (open-to-close dynamic)

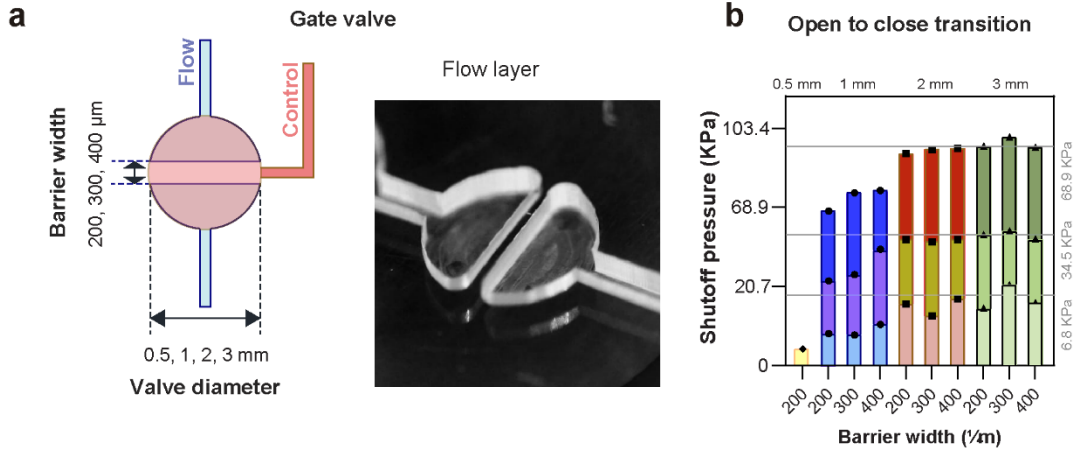


Figure S5. a) Schematic and micrography of gate valves with different diameters and barrier width. b) Pneumatic cut-off pressure required to close the valve when a forward pressure in the fluid of 6.8, 34.5, 68.9 psi is applied (for different barrier widths and valve diameters).

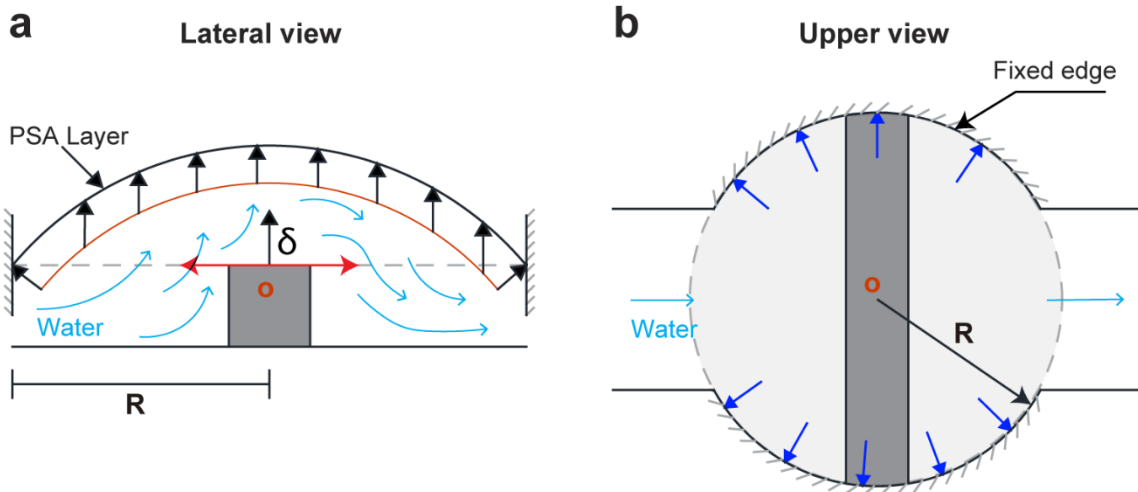


Figure S6. a) Shows the lateral view of PSA membrane of the gate valve opened by pressure-driven flow. b) Shows an upper view of the circular PSA membrane clamped at the edges of the gate valve.

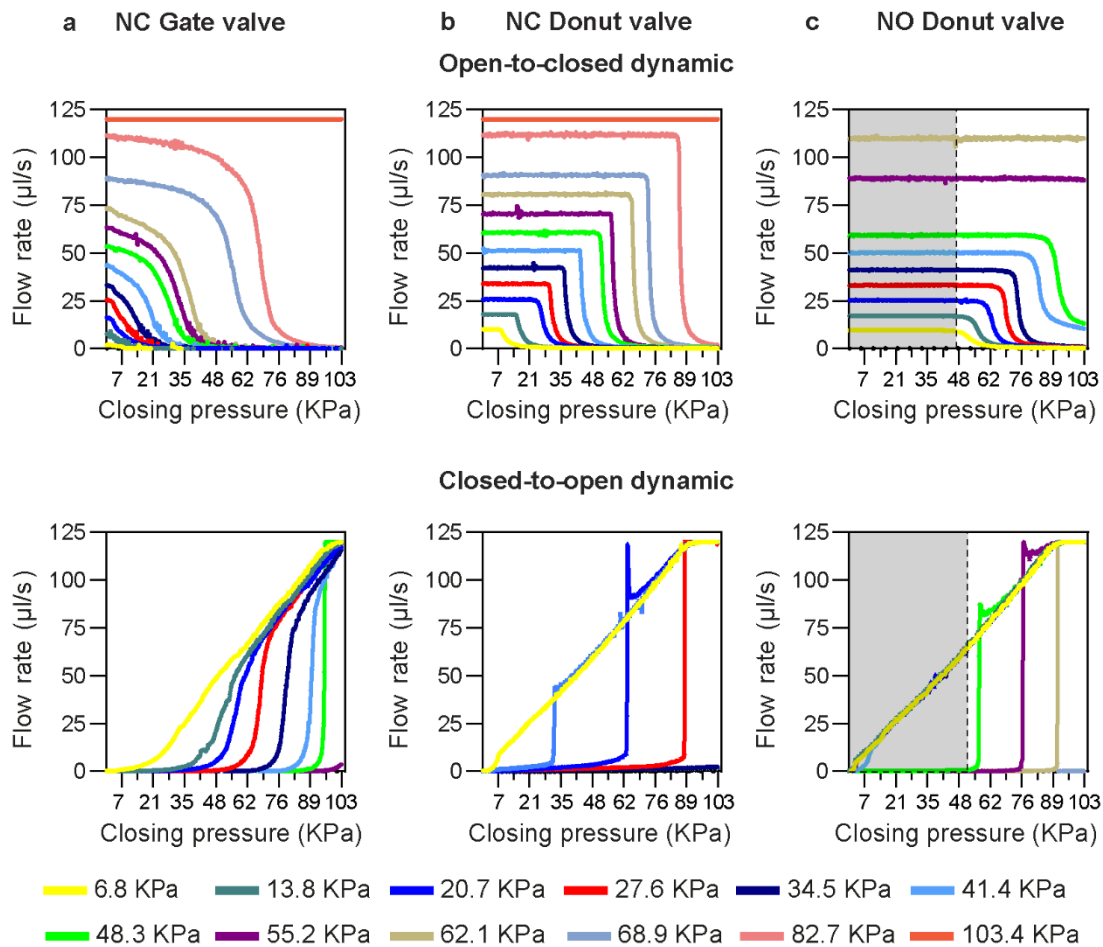


Figure S7. Open-to-closed and closed-to-open transitions for **a)** NC gate valve, **b)** NC donut valve, **c)** NO donut valve. Note that for NO donut valve, pneumatic control pressures above 55.2 KPa are required to actuate the valve.

Volume pumped by each pump type

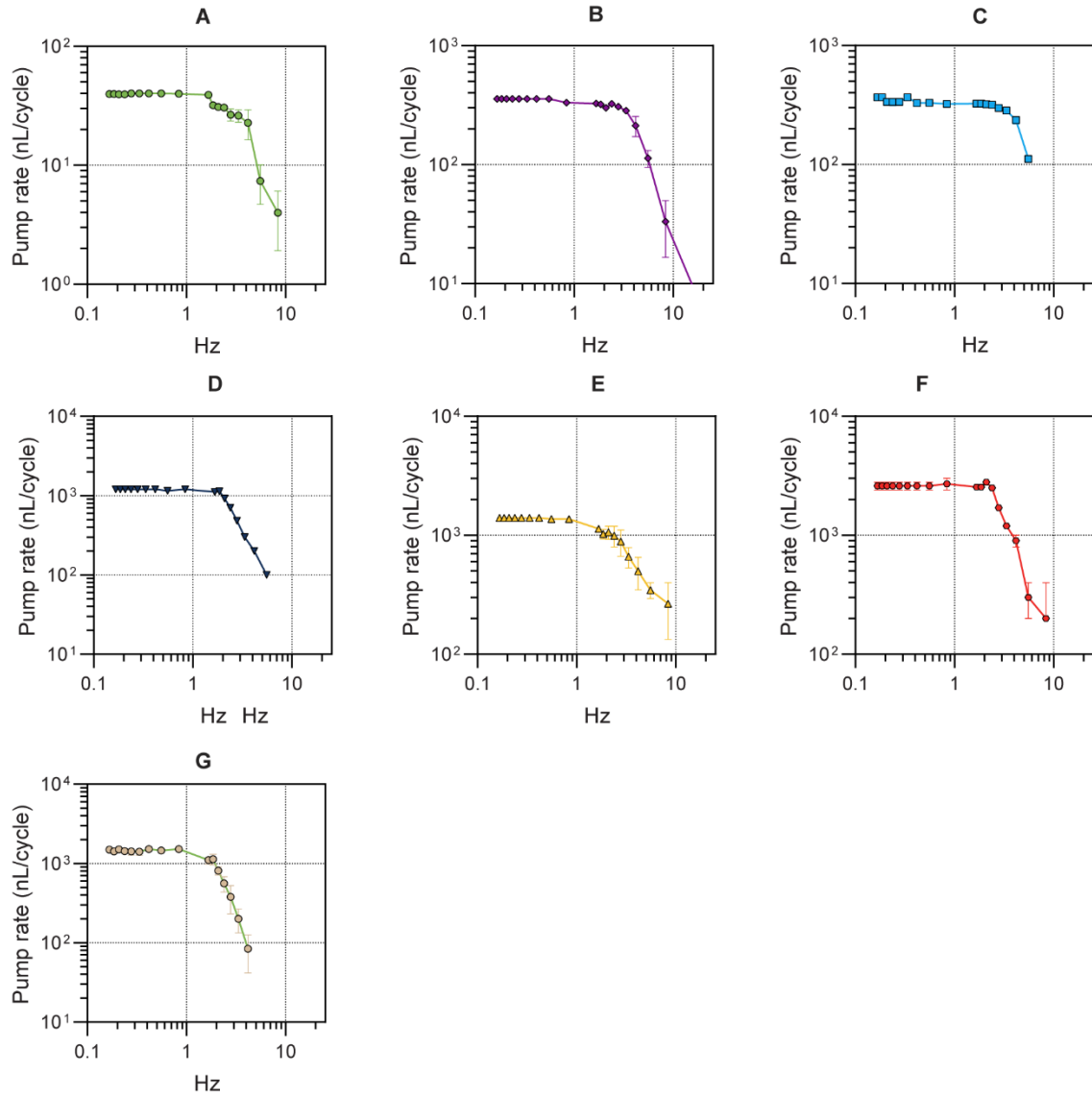


Figure S8. Volume pumped by each pump type at different cycle/s

Flow rate pumped by each pump type

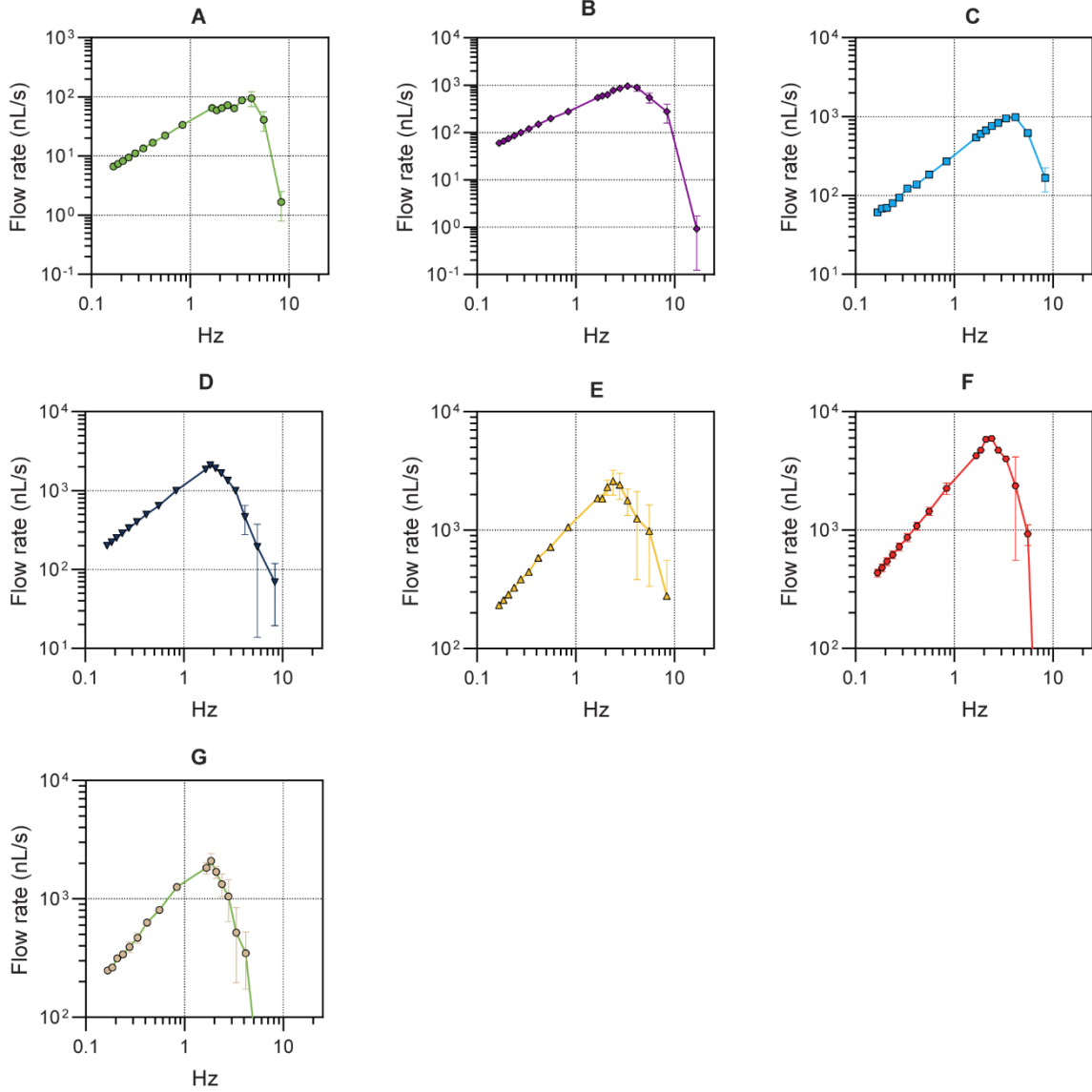


Figure S9. Flow rate for each valve type at different cycle/s

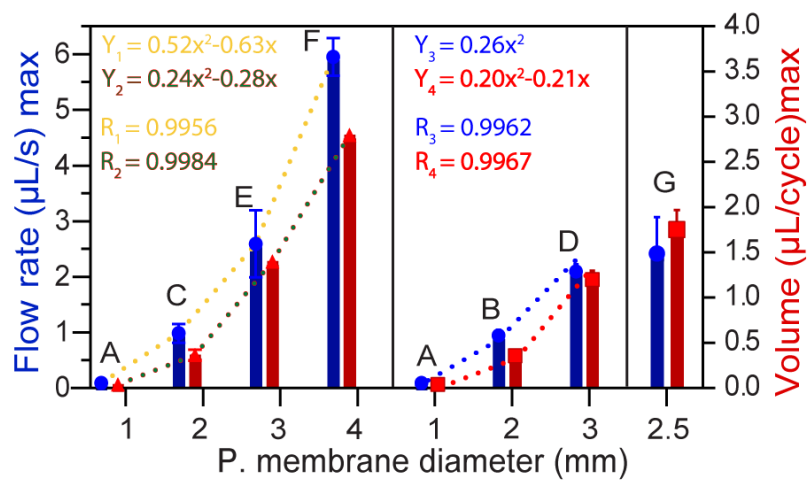


Figure S10. Summarize the maximum flow rate (blue) and volume pumped (red) as a function of the pumping membrane diameter.