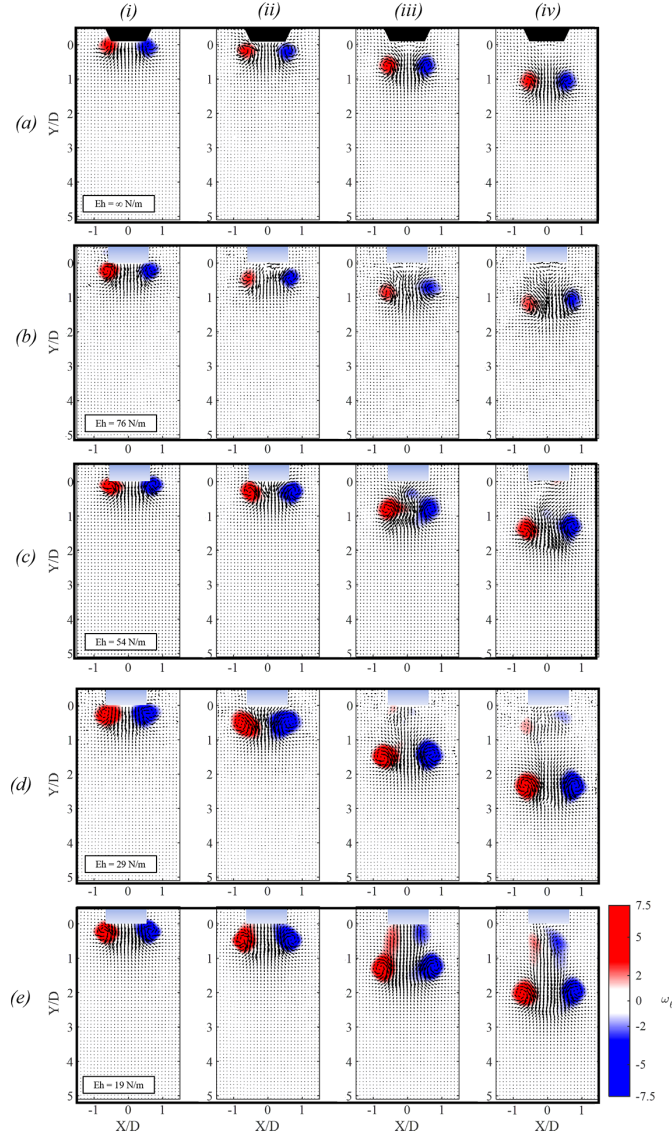**Supplementary Material 1: Vorticity and Vector Plots for all** $L/D$



Figure S1.A: Vorticity and vector fields measured for $(i)t/t_{cycle} = 0.7$, $(ii)t/t_{cycle} = 1$, $(iii)t/t_{cycle} = 2$, and $(iv)t/t_{cycle} = 3$ for each nozzle given the same kinematic input from the pump for $\frac{L}{D} = 1$ (a) Rigid nozzle ($Eh = \infty$ N/m ) (b) $Eh = 76$ N/m; (c) $Eh = 54$ N/m; (d) $Eh = 29$ N/m; (e) $Eh = 19$ N/m

Figure S1.B: Vorticity and vector fields measured for $(i)t/t_{cycle} = 0.23$, $(ii)t/t_{cycle} = 1$, $(iii)t/t_{cycle} = 1.5$, and $(iv)t/t_{cycle} = 1.75$ for each nozzle given the same kinematic input from the pump for $\frac{L}{D} = 4$ (a) Rigid nozzle ($Eh = \infty$ N/m ) (b) $Eh = 76$ N/m; (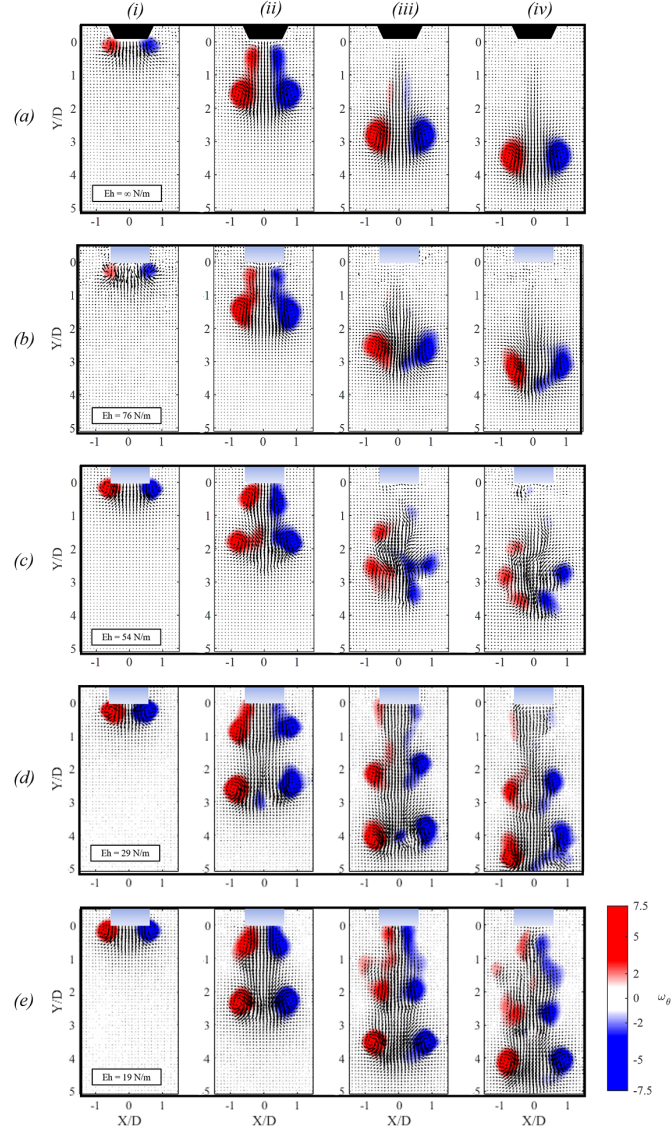c) $Eh = 54$ N/m; (d) $Eh = 29$ N/m; (e) $Eh = 19$ N/m