

# Masterflex® L/S® Cytoflow™ Pump Heads



## Ensure maximum protection of live cells and shear-sensitive fluids

- Convex-roller design is gentler on live cells and shear-sensitive fluids—validated by independent test data
- Large-diameter rotor delivers higher flow rates at lower speeds; no need to disrupt flow paths with "Y" assemblies
- Low-speed pumping maintains consistency and characteristics of shear-sensitive fluids
- 2- and 3-roller configurations—higher flow rates with 2 rollers, less pulsation with 3 rollers
- Compatible with all Masterflex L/S drives that accept two or more pump heads

When it comes to providing maximum protection to live cells and sensitive fluids not all peristaltic pumps are designed equally. The Masterflex L/S Cytoflow pump head was specifically designed to minimize the impact on live cells and shear-sensitive fluids.

The Cytoflow pump head has an extra-large tubing bed and fewer rollers, resulting in high flow rates at low motor speeds. In addition, the convex roller design furthers its cell viability advantages. This combination makes the Cytoflow pump head the best choice for biopharma and microbiology applications where pump operators want to minimize the impact on live cells and shear-sensitive fluids.



### Cytoflow 2-Roller Pump Heads



Pump tubing size	mL per rev	Flow rates in mL/min		Max system pressure psi (bar)	Catalog number
		0.02 to 100 rpm	0.1 to 600 rpm		
<b>For Precision pump tubing</b>					
L/S 16	1.7	0.03 to 170	0.17 to 1000	22 (1.5)	<b>MK-77253-00</b>
L/S 25	3.9	0.08 to 390	0.39 to 2300	22 (1.5)	
L/S 17	6.1	0.12 to 600	0.61 to 3600	22 (1.5)	
L/S 18	8.6	0.17 to 850	0.86 to 5100	22 (1.5)	
<b>For High-Performance Precision pump tubing</b>					
L/S 15	4.0	0.08 to 390	0.40 to 2300	22 (1.5)	<b>MK-77253-02</b>
L/S 24	6.2	0.12 to 600	0.62 to 3700	22 (1.5)	
L/S 35	9.5	0.19 to 930	0.95 to 5600	22 (1.5)	
L/S 36	12.8	0.26 to 1270	1.3 to 7600	22 (1.5)	



### Cytoflow 3-Roller Pump Heads



Pump tubing size	mL per rev	Flow rates in mL/min		Max system pressure psi (bar)	Catalog number
		0.02 to 100 rpm	0.1 to 600 rpm		
<b>For Precision pump tubing</b>					
L/S 16	1.6	0.03 to 160	0.16 to 980	22 (1.5)	<b>MK-77253-10</b>
L/S 25	3.5	0.07 to 340	0.35 to 2000	22 (1.5)	
L/S 17	5.6	0.11 to 550	0.56 to 3300	22 (1.5)	
L/S 18	7.7	0.15 to 770	0.77 to 4600	22 (1.5)	
<b>For High-Performance Precision pump tubing</b>					
L/S 15	3.5	0.07 to 340	0.35 to 2000	22 (1.5)	<b>MK-77253-12</b>
L/S 24	5.7	0.11 to 570	0.57 to 3400	22 (1.5)	
L/S 35	7.8	0.16 to 780	0.78 to 4600	22 (1.5)	
L/S 36	9.6	0.19 to 950	0.96 to 5700	22 (1.5)	

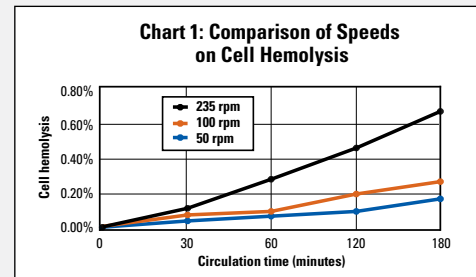
## Cell Viability Test Data

Hemolysis of blood cells was used to evaluate the sensitivity of several pump designs for live cell circulation. In vitro testing was completed using citrated bovine blood circulated through several peristaltic pump systems and settings to establish optimal conditions. Each pump system was evaluated against its Average Hemolytic Index for 180 minutes.

### Factors Affecting Shear Sensitivity

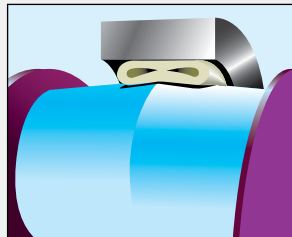
#### Pump Motor Speed

Flow rates in peristaltic pumps are dictated by the rotation speed of the motor, measured in revolutions per minute (rpm). Peristaltic pumps generally present linear flow rates versus rpm with the tubing diameter, number of rollers, and overall occlusion bed size affecting the amount of flow per revolution. Chart 1 shows that the motor speed is very dominant in a pump's ability to maintain cell viability during recirculation.



#### Pump Head Occlusion

Less tubing occlusion allowed space for the blood cells to shift around the force of the roller which decreased the overall percent of hemolysis. Chart 2 compares the effect of flat rollers versus convex rollers on pumps running at the same speed. In this case, equipping a pump head with less than full occlusion improves cell viability 10 to 25%.



Convex roller

