

## BioContinuum™ Seed Train Platform

# Cellicon™ Perfusion Filter and Controller

## A Superior Cell Retention Solution for N-1 Seed Train Intensification with Optimized Process Control

The benchtop Cellicon™ Perfusion Solution is designed to meet your perfused seed train challenges. It consists of a controller and a flat sheet cell retention filter with a single-use assembly running in tangential flow filtration mode. This easy-to-use solution increases perfusion process efficiency, and provides real-time monitoring and control for reliable and consistent performance.

Perfusion operations deliver high-density cell cultures that alleviate the burden of processing large production bioreactor volumes while increasing manufacturing flexibility. Introducing perfusion to your seed train makes it possible to inoculate a higher quantity of cells for one or more production bioreactors, thus increasing process efficiency.

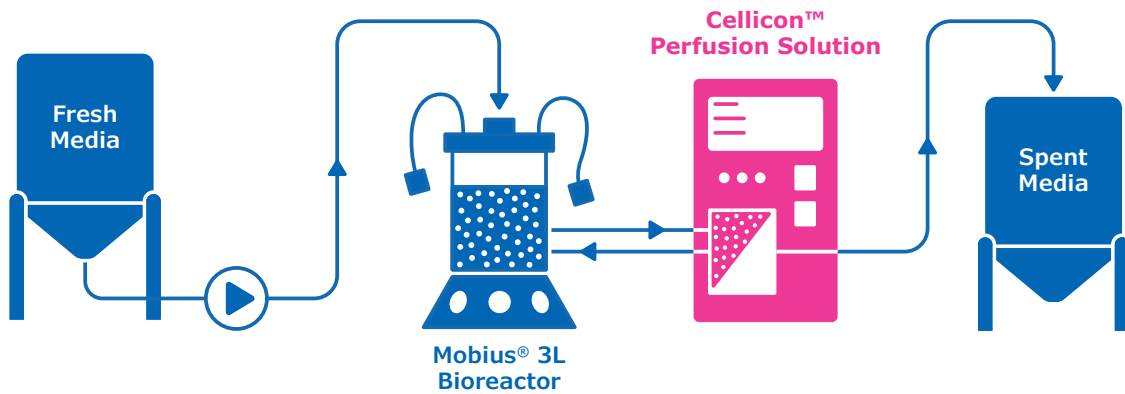


### Benefits

- High throughput and low fouling
- Predictable linear scale up from lab to manufacturing scale
- Reliable and reproducible performance
- Low crossflow and cell shear
- Comprehensive monitoring and precise control
- Ready to process in minutes

### Applications

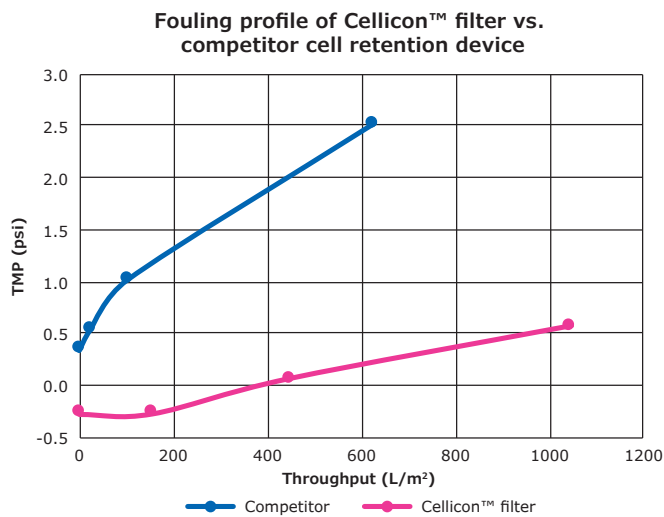
- Monoclonal antibodies
- Recombinant proteins



**Figure 1:** Perfusion set-up with Cellicon™ Perfusion Solution

## High throughput and low fouling

While perfusion processes deliver high cell densities, most filters still experience premature fouling requiring change outs to achieve the required throughput. The Cellicon™ filter has been specifically designed to maximize throughput while effectively retaining cells (Figure 2).



**Figure 2:** Fouling profiles of the Cellicon™ filter vs. a competitor filter

## Predictable linear scale up from lab to manufacturing scale

All filters in the seed train Cellicon™ family have the same flow channel length and height, ensuring predictable linear scale up and scale down from the bench to production.

### Trusted Durapore® Membrane

A trusted name in the industry, our Durapore® hydrophilic PVDF 5.0 µm microfiltration membrane is ideally suited for achieving maximum cell retention while minimizing fouling.

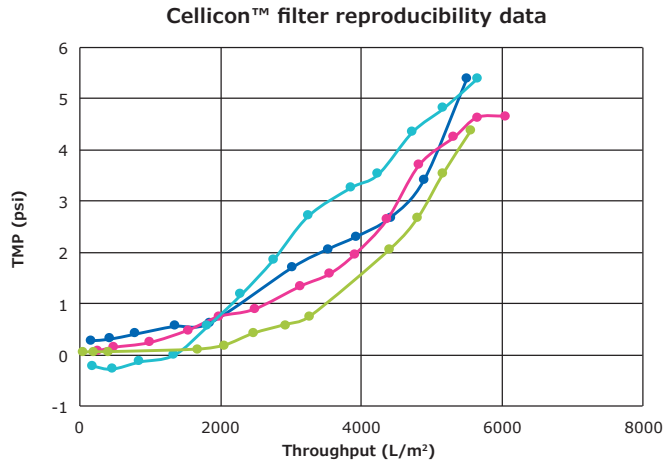
Durapore membranes are well-known for their exceptional combination of:

- Low extractables, low shedding, and broad chemical compatibility
- Low protein binding
- Tough and proven

## Reliable and reproducible performance

The Cellicon™ controller's precise flow control feature helps maintain consistent crossflow, ensuring reproducible performance from run to run. Pressure sensors also allow real-time process monitoring, which enables improved process development capabilities and consistent performance.

The devices are manufactured in accordance with Good Manufacturing Practices (GMP). Our design and manufacturing process ensures repeatable performance from run to run (Figure 3).



**Figure 3:** Data showing that the Cellicon™ filter produced reliable and reproducible data across four separate runs.

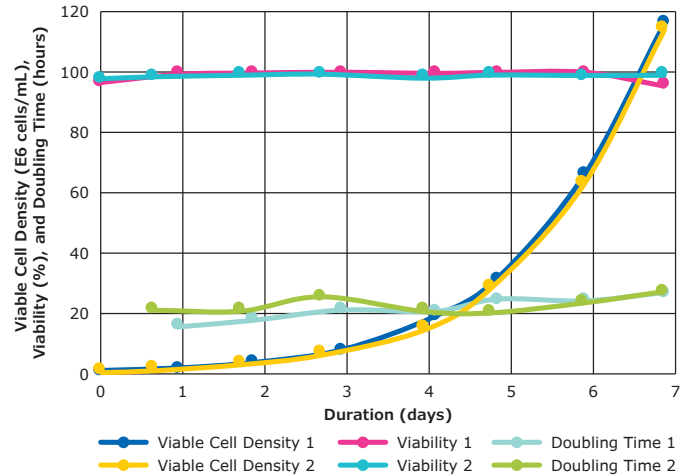
## Low crossflow and gentle on cells

In a perfused seed train, high cell densities need to be achieved while preserving cell viability.

The filter allows you to run perfusion at crossflow rates ten times lower than traditional perfusion solutions, so a smaller pump is needed, which is especially beneficial at larger scales.

The low-shear levitating pump and unique filter design enable higher cell viability and reduced residence time of cells outside of the bioreactor, for optimal growth conditions. As a result, highly viable cell cultures of > 100 millions cells per mL can be reached (Figure 4).

## N-1 process cell growth with Cellicon™ Perfusion Solution



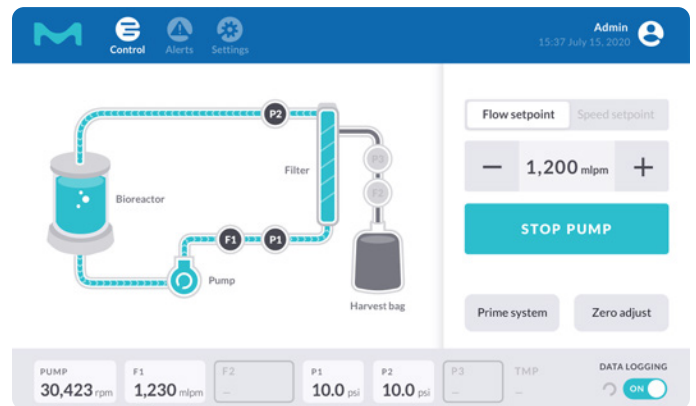
**Figure 4:** Viable cell density, viability and doubling time profiles of Cellicon™ filter

## Comprehensive monitoring and precise control

The controller's touchscreen interface is easy to use. The P&ID screen monitors all active parameters, and the data display provides real-time processing at a glance (Figure 5).

Monitoring of feed, retentate and perfusate pressure allows users to quickly adjust conditions in real time. A consistent crossflow is maintained via a proportional-integral (PI) control loop, enabling high reproducibility from run to run. For individualized process control, visible and audible alarms can be enabled and configured to alert you to any changes in conditions.

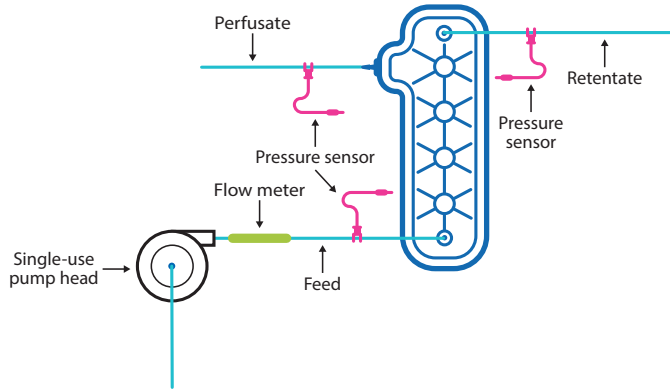
The solution is easily integrated into your distributed control system (DCS) for remote monitoring.



**Figure 5:** Main touchscreen of the Cellicon™ controller

## Ready to process in minutes

This intuitive single-use system can be up and running in minutes. The filter assembly is supplied gamma-irradiated and dry (preservative-free), eliminating the need for flushing. Detailed assembly components are shown in Figure 6.



**Figure 6:** Diagram of Cellicon™ perfusion filter assembly with components labeled.

Simple tube welds connect the filter assembly to the bioreactor. The pressure sensors are easily plugged into the controller, and the non-fluid contact flow meter is clamped onto the assembly. After a quick priming step, you are ready to begin your perfusion process.

## Part of the BioContinuum™ Seed Train Platform

Optimize your seed train intensification process with our range of perfusion products that will help you achieve optimum performance.

Our **Cellvento® 4CHO-X Expansion Medium** is specifically prepared to support seed train applications through N-1. It allows for optimal preparation of cells for production phases in perfusion while supporting high cell growth at low cell-specific perfusion rates (CSPR) to increase productivity at the N-stage.

Our **Mobius® 3L single-use bioreactor** combines the predictability of a stirred tank design with the flexibility of single-use, making it the ideal solution for bench-scale cell culture process development and N-1 perfusion.

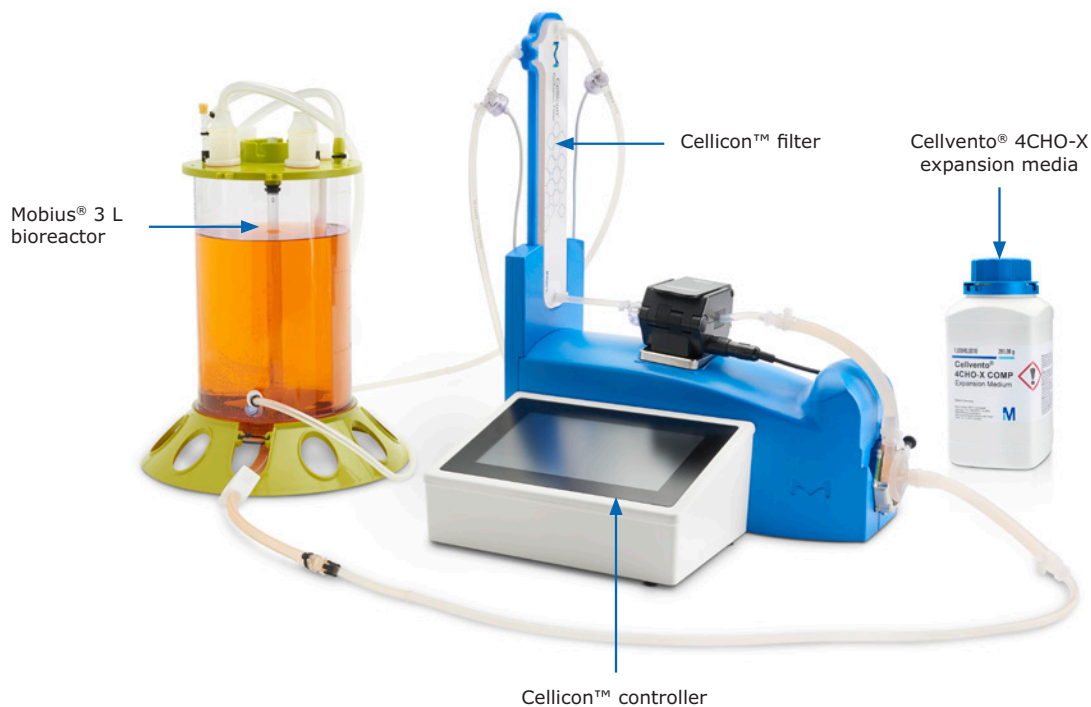
For more information, please visit:  
[www.EMDMillipore.com/Seed-Train](http://www.EMDMillipore.com/Seed-Train)

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Complementing our product portfolio, the Emprove® Program provides three types of dossiers to support different stages of development and manufacturing operations such as qualification, risk assessment and process optimization. The dossiers combine comprehensive product-specific testing data, quality statements and regulatory information in a readily available format to simplify your compliance needs.

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## BioContinuum™ Seed Train Platform



## Specifications

Cellicon™ Filter Assembly					
Materials of Construction					
Filter					
Membrane	Polyvinylidene fluoride (Durapore® membrane, 5 µm) cast on non-woven support				
Feed Screen	Polyethylene terephthalate (PET); Polyester				
Housing/Housing Overmold	Polypropylene/Polypropylene (colored blue)				
Assembly Components					
Tubing	AdvantaFlex® thermoplastic elastomer				
Fittings	Polypropylene				
Pressure Sensors	Polysulfone				
Single-Use Pump Head	Polypropylene; magnet encapsulated in polypropylene (non-fluid contact)				
Tubing Tie Wraps	Nylon (non-fluid contact)				
Gamma Irradiation					
Each assembly is gamma irradiated					
Storage Conditions					
Temperature	15 – 30 °C				
Storage Solution	None; filtration device assembly is supplied dry				
Maximum Operating Conditions					
Recommended Feed Crossflow Rate	10 L/min/m <sup>2</sup>				
Maximum Recommended Flux	23 L/m <sup>2</sup> /hr				
Maximum Feed (Inlet) Pressure	5 psi (345 mbar)				
Maximum Reverse Pressure	1 psi (69 mbar)				
Maximum Transmembrane Pressure (TMP) before ending run	5 psi (345 mbar)				
Operating pH Range	4-8				
Nominal Dimensions and Hold-up Volume					
Membrane Area	100 cm <sup>2</sup>				
Length	26 cm (10 in.)				
Width	7 cm (2.8 in.)				
Feed to Retentate Fitting Distance	22.5 cm (8.8 in.)				
Feed Hold-up Volume (with tubing)	3 ml (37 ml)				
Perfusate Hold-up Volume (with tubing)	11 ml (42 ml)				
Tubing Dimensions					
Location	Material	Diameter		Length In. (cm)	Quantity
		Inner in.	Outer in.		
Feed	AdvantaFlex®	1/8"	1/4"	5 in. (12.7) pre-cut, 2 in. (5) nominal	1
	AdvantaFlex®	1/8"	1/4"	5 in. (12.7) nominal	1
	Silicone	1/4"	7/16"	6 in. (15.2)	2
	AdvantaFlex®	1/8"	1/4"	24 in. (60.9)	1
Retentate	AdvantaFlex®	1/8"	1/4"	2 in. (5)	1
	AdvantaFlex®	1/8"	1/4"	24 in. (60.9)	1
Perfusate	AdvantaFlex®	1/8"	1/4"	2 in. (5)	1
	AdvantaFlex®	1/8"	1/4"	24 in. (60.9)	1

\*The filter is connected to the bioreactor via tube welding on the feed and retentate lines. The perfusate line is also tube welded to a sterile bag or collection vessel to collect the perfusate.

## Manufacturing Release Criteria

<b>100% Filter Integrity Tested</b>	Each filter unit must pass an in-process integrity test using a visual inspection under magnification method.
<b>100% Filter Housing Pressure Test:</b>	Each filter unit must pass a housing pressure decay test at an operating pressure above 5 psi.
<b>Flow Rate and Pressure Drop</b>	A statistically representative number of filter units from each lot must meet a pressure drop of less than or equal to 2 psi at 100 mL/min average feed flow of water.
<b>100% Assembly Leak Integrity Testing in Manufacturing</b>	Each assembly unit is tested and must pass a leak integrity test using a pressure decay method.

## Regulatory Information

<b>Component Material Toxicity</b>	All parts in the fluid path were tested pre-gamma irradiation and met the criteria of the USP <88>. Biological Reactivity Tests for Class VI Plastics and USP <87>, Cytotoxicity Testing.
<b>Good Manufacturing Practices</b>	This product is manufactured in a facility that adheres to current GMP.
<b>ISO® 9001 Quality Standard</b>	This product was manufactured in a facility with a Quality Management System approved by an accredited registering body to the appropriate ISO® 9001 Quality System Standard.
<b>Validated Production Process</b>	This product was fabricated using a validated manufacturing process. Principles of statistical process control and determinations of process capability have been applied to critical variables in the device fabrication process. In-process controls are used to assure stability of the process.

## Specifications

Cellicon™ Controller	
<b>Pressure measurement</b>	
Number of pressure sensors	3 single-use sensors (feed, retentate, perfusate)
Pressure range	-7 to 15 psi
Pressure accuracy	+/- 0.25 psi @ 5 psi
Calibration required (Y/N)	No
Tare required (Y/N)	Yes
<b>Flow measurement</b>	
Technology	Ultrasonic
Flow range	0.05 to 1 L/min (or 5-100 L/min/m <sup>2</sup> )
Flow accuracy	Characterized at 100 mL/min
Tare required (Y/N)	Yes
Way of detection	Measurement out of fluid path
<b>Pump motor</b>	
Pump motor	Levitronix® Puralev i30
Pump flow	capped at 7000 RPM
Max. Viscosity	10 cP
Priming required (Y/N)	Yes
<b>Console Interfaces</b>	
PLC interface	2X digital inputs, 2X digital outputs, 1 analog input 4-20 mA, 1 analog output 4-20 mA
Network interface	Modbus® TCP/IP control and access to setpoints, data registers, alarms, warnings and recipes
DC supply connector	24 VDC with external AC/DC supply, software configurable, auto-resume function, 3-pin connector, global power supply
USB interface	USB port for data collection and software updates
Touch screen interface	7 in. color multi touch
<b>Controls</b>	
Pump control	RPM (priming mode) or flow rate (perfusion mode) control possible, maximum pump RPM and RPM ramp rate both field adjustable
Language	English
PLC control	PLC control confirmed on touchscreen, disabling controls on console
Flow rate PID settings	P and I values are field settable
Pressure scaling and calibration	Via HMI
<b>Software</b>	
Definable user account levels	Yes
Alarm systems	Yes
Data logging	Yes, via USB
Start-up requirements	System has default settings
Back-up solution (Y/N)	Yes
<b>Material of construction</b>	
Pump head socket	Anodized aluminum
Integrated pump driver	Epoxy coated aluminum, polypropylene for bottom lid
Flow meter clamp on sensor	Anodized aluminum, 304 stainless steel
Filter holder	Zinc-aluminum alloy
<b>Dimensions and weight</b>	
Dimensions	D: 31 cm (12 in.) H: 21 cm (8.2 in.) W: 11 cm (4.4 in.)
Weight	3.6 kg (8 lbs)
<b>Regulatory Information</b>	
Enclosure rating	IP54
CE Mark	Controller is self-declared to meet the applicable European Directives. Please reference the product's Declaration of Conformity for more information.
User guide	Yes, online

## Ordering information

Product Description	Catalog Number
Cellicon™ perfusion filter with 5 µm Durapore® membrane, filtration area 0.01 m <sup>2</sup>	C5VP001A
Cellicon™ bench-scale controller (includes stand, flow meter, pump head socket, and controller power supply and cable)	CRS003L01
Power Supply	
US, Canada, Taiwan, Thailand, Columbia, Peru	CRS00PW01
Switzerland	CRS00PW02
EU	CRS00PW03
Japan	CRS00PW04
UK, Hong Kong, Ireland, Singapore	CRS00PW05
China, Australia, New Zealand, Argentina	CRS00PW06
Korea	CRS00PW07
India	CRS00PW08
Replacement Parts	
Cellicon™ controller flow meter	CRS000SP01
Cellicon™ controller pump head socket	CRS000SP02
Cellicon™ controller Leviflow® connection cable	CRS000SP03
Cellicon™ controller pressure sensor adaptor cable	CRS000SP04
Cellicon™ controller holder spare parts kit	CRS000SP05

### BioContinuum™ Platform

Converge, Intensify and Evolve. Together.

An expanding environment of advanced processing, software, automation and analytic technologies, unlocking the potential of Bioprocessing 4.0 and empowering biomanufacturers to achieve greater speed, flexibility and quality.



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