

Resolute[®] BioSMB 80 and BioSMB 350

Single-Use Continuous
Chromatography Systems
for Perfusion and Batch
Bioreactor Processes

Features and Benefits

- Highly efficient resin utilization
- 3–5× increase in productivity
- Flexibility to reduce production line equipment
- Easy-to-install flow kits (less than 30 minutes)

Product Information

The Resolute[®] BioSMB 80 and BioSMB 350 multi-column chromatography systems are designed for clinical and commercial manufacture of biologics. Compared to traditional chromatographic processes, the Resolute[®] BioSMB 80 and 350 deliver a 3 to 6-fold increase in throughput while requiring up to 30% less chromatography media. This is achieved through a unique single-use valve system which enables multi-column processing and flexible flow configurations.



System Concept

The Resolute® BioSMB 80 and 350 systems enable full scale up from process development (via the Resolute® BioSMB PD) up to 4,000 L fed-batch and perfusion clinical and commercial processes. Chromatographic processes developed using batch methodology can be readily transferred to the Resolute® BioSMB without changing resin, buffers, or product quality assays.

Two operators can install the disposable flow kit on the Resolute® BioSMB 80 and 350 in less than 30 minutes. By using up to eight smaller pre-packed columns, the need for column packing skids, large columns, and other column support infrastructure is eliminated.

Resolute® BioSMB Continuous Chromatography Systems

1. Process Flexibility

The flexibility of the valve cassette to support multiple columns and the modular design of the Resolute® BioSMB 80 and 350 enable a downstream production line to hold a wide range of processing volumes. The Resolute® BioSMB can be used to increase the efficiency of chromatography steps in a process by reducing resin requirements, increasing throughput, and offering the flexibility equivalent to multiple batch chromatography systems.

The Resolute® BioSMB 80 and 350 are designed with a pump module that can be exchanged to support a wide flow rate range without requiring a separate chromatography system (see next page, Resolute® BioSMB pump modules).

2. Resin Utilization

Batch chromatographic processing typically utilizes only 50% to 70% of the available binding capacity in the column. The Resolute® BioSMB platform can simultaneously load product onto multiple columns, maximizing the available binding capacity. This enables better utilization and requires less total buffer consumption. Additionally, the Resolute® BioSMB 80 and 350 can achieve a higher binding capacity at lower residence times, offering throughput advantages over batch chromatography.

The resin utilization benefits can be leveraged to optimize the throughput of a purification strategy by running processes at shorter residence times and thus increasing productivity.

3. Achieving Higher Throughput

Essential to the process economics of the Resolute® BioSMB platform is the availability of multiple columns for continuous loading. In high-titer chromatography applications, the non-loading steps of the process are typically longer than the loading steps. With single and two-column system designs, loading cannot be repeated until the non-load steps are completed. With the Resolute® BioSMB, the process can be configured with more columns such that the loading steps are continuous; there is always a column ready to be loaded.

The Resolute® BioSMB 80 and 380 have the ability to process on up to eight columns and are capable of achieving up to 6-fold increase in throughput over batch, even at titers greater than 10 g/L.

4. Valve Cassette and Flow Kit

The core of the Resolute® BioSMB technology is a valve array arranged in a compact disposable valve cassette. This is specifically designed and patented as a disposable flow kit component and eliminates the need for difficult cleaning validation processes. All Resolute® BioSMB 80 and 350 flow kits are supplied gamma-irradiated and meet the standards set by the Sartorius quality team for clinical and commercial manufacturing.

Each column used with the Resolute® BioSMB system is assigned a series of valves arranged in a dedicated array, resulting in each pump delivering a single fluid through the entire process and eliminating the need for pump washes between steps.

Additionally, throughout the Resolute® BioSMB product range, the system hold-up volume is minimized, eliminating many of the uncertainties associated with scaling, validation, and process control.

5. Scale Up and Scale Down

To complement the Resolute® BioSMB 80 and 350, a bench scale version is available: the Resolute® BioSMB PD. The Resolute® BioSMB PD uses the same valve technology, flow kit configuration, and recipe creation and handling to ensure simple scale-down or scale-up. This system is available for flow rates ranging from 1–100 mL/min.

Applications

Resolute® BioSMB Pump Modules

If a complete Resolute® BioSMB 80 or 350 system is purchased, it is possible to buy a Resolute® BioSMB 350 or 80 pump module, respectively, to increase the flexibility of the main system.

The pump module can be exchanged easily, requiring a mechanical changeout of the module and a switch in the software. The mechanical swap of the two pump modules typically takes less than an hour. This modularity allows the system to run either from 5 L/h – 80 L/h (Resolute® BioSMB 80 pump module) or 30 L/h – 350 L/h (Resolute® BioSMB 350 pump module).

With the Resolute® BioSMB 80 and 350 systems, the pump module aligns with the applicable flow kit. The rest of the Resolute® BioSMB 80 and 350 system can support either a Resolute® BioSMB 80 or Resolute® BioSMB 350 flow kit.

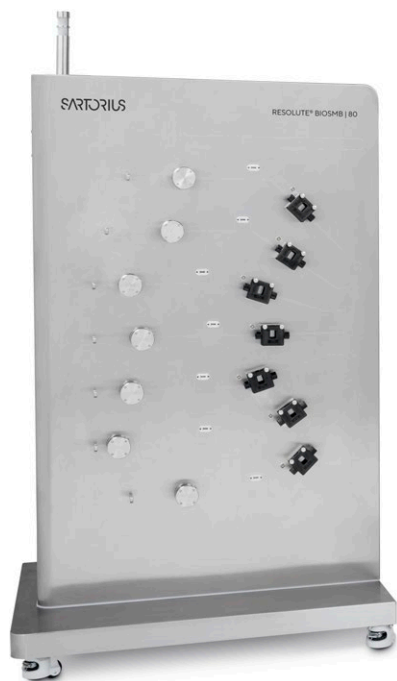


Figure 1: Resolute® BioSMB 80 Pump Module

The Resolute® BioSMB 80 and 350 are the ideal solution for manufacturing-scale chromatography processes and can offer efficiency, throughput, and flexibility benefits for all modes of chromatography.

Resolute® BioSMB 80 for Perfusion Bioreactor Processes

The Resolute® BioSMB 80, when coupled with the aseptic connector Resolute® BioSMB 80 flow kit, is ideal for extended continuous processes where bioburden contamination may become a higher risk to product quality. The Resolute® BioSMB 80 aseptic connector flow kit is supplied gamma-irradiated and closed with aseptic connections to minimize any bioburden risk from manufacture or installation.

Resolute® BioSMB 350 for Batch Bioreactor Processes

The Resolute® BioSMB 350 is targeted for batch bioreactor-based processes upwards of 4,000 L. The flow rate capability, wider single-use tubing, and larger bore cassette manifold meet the requirements for high throughput continuous processing in a flexible facility.

Software

The software is designed to provide the operator with a clear and easy-to-use interface. It has been developed in accordance with usability and user interface standards for GMP systems for the most efficient and accessible experience.

Technical Data

Resolute® BioSMB 80/350 System and Resolute® Flow Kits

System Specifications

Dimension (w × d × h)	2.7 × 1.4 × 2.2 m (106 × 55 × 87 inch) Height without alarm tower: 1.9 m (75 inch)	
Weight	1,000 kg	
Flow rate range Resolute® BioSMB 80	5 – 80 mL/h	
Flow rate range Resolute® BioSMB 350	30 – 350 mL/h	
Inlets number	8 (7 usable + 1 for system use as second pass)	
Outlets number	6 (5 usable + 1 for system use as second pass)	
Number of column positions	8	
Number of pumps	7	
Maximum operating pressure	4 bar (58 psi)	
Air supply	6 bar (87 psi) with integrated pressure regulator	
Electricity supply (other voltages available)	CE version 400 VAC 50/60 Hz 32 A – 15 kW	UL version 208 VAC 50/60 Hz 32 A – 15 kW

Flow Kit Specifications

Item	Description
Hose and connectors Resolute® BioSMB 80	<ul style="list-style-type: none"> ▪ Silicone braided tubing ID: ¼ inch ▪ Kleenpak® ▪ Presto sterile connector for external connections. HFC39 connectors for internal connections (Note: The process 80 flow kit is available with sanitary connection connections in place of the Kleenpak® connectors. Contact us for more details.)
Hose and connectors Resolute® BioSMB 350	<ul style="list-style-type: none"> ▪ Silicone braided tubing ID: ⅜ inch with HFC39 connectors for internal connections and sanitary connection clamp ¾ inch for upstream and downstream connections
Pressure sensor	<ul style="list-style-type: none"> ▪ 7 pressure transmitters (1 after each pump with integrated pressure switch) ▪ –0.48 – 5.20 bar (Note: Maximum operating pressure for system is 4 barg 58 psig)
Flow sensor	<ul style="list-style-type: none"> ▪ 7 ultrasonic non-invasive flowmeters (1 after each pump) ▪ Resolute® BioSMB 350: 3% or 5.4 L/hr whichever is higher ▪ Resolute® BioSMB 80: 5% or 4.5 L/hr whichever is higher
Air sensor	<ul style="list-style-type: none"> ▪ 7 integrated with flowmeters
Conductivity sensor	<ul style="list-style-type: none"> ▪ 4 sensors (on outlets 1–4) ▪ Range: 0.0 µS/cm – 150.0 mS/cm, accuracy*: ±2% of measuring value ±0.4 µS/cm (dependent on ambient and process temperature being equal)
pH sensor	<ul style="list-style-type: none"> ▪ 4 sensors (on outlets 3–10) ▪ Range: 0.0 – 14.0, Probe specific depending on sensor calibration
UV sensor	<ul style="list-style-type: none"> ▪ 4 UV-VIS sensors each with wavelengths in 280 nm as standard 0 – 2 AU
Process pump	<ul style="list-style-type: none"> ▪ 4 piston diaphragm single-use ▪ The single-use pump heads are Quattroflow™ sanitary diaphragm pumps, 4 pistons with polypropylene (PP), ethylene propylene diene monomer (EPDM)/PP compound diaphragm and EPDM valves
Gamma irradiation dose	<ul style="list-style-type: none"> ▪ 25 kGy

* Accuracy from supplier documentation

Process Wetted Components Materials of Construction

Description	Materials
Tubes	Platinum cured silicone
Fittings	Polycarbonate, polypropylene, polyphenylsulfone
Valve diaphragm	Fluoroelastomer (FKM)
pH sensor	Glass
Pump head	Polypropylene, EPDM/PP compound
Pressure sensor	Polysulfone
UV-VIS sensor windows	Quartz
Conductivity sensor	Polysulfone

Ordering Information

For quotation, please contact your local Sales Representative.

Resolute® BioSMB 80 System

Part Number	Description
BIOSMB-PRO-080-CE	Resolute® BioSMB 80 system (Electrical rating: CE)
BIOSMB-PRO-080-UL	Resolute® BioSMB 80 system (Electrical rating: UL)
BIOSMB-PRO-080-PUM	Resolute® BioSMB 80 with pump module

Resolute® BioSMB 80 Flow Kits

Part Number	Description
BIOSMB PF-5-BPF	Resolute® BioSMB 80 aseptic flow kit with BioPAT® flow
BIOSMB-PF-TC-BPF	Resolute® BioSMB 80 TC flow kit with BioPAT® flow

The Resolute® BioSMB 80 system is comprised of one single flow kit. The system is supplied double-bagged and gamma-irradiated.

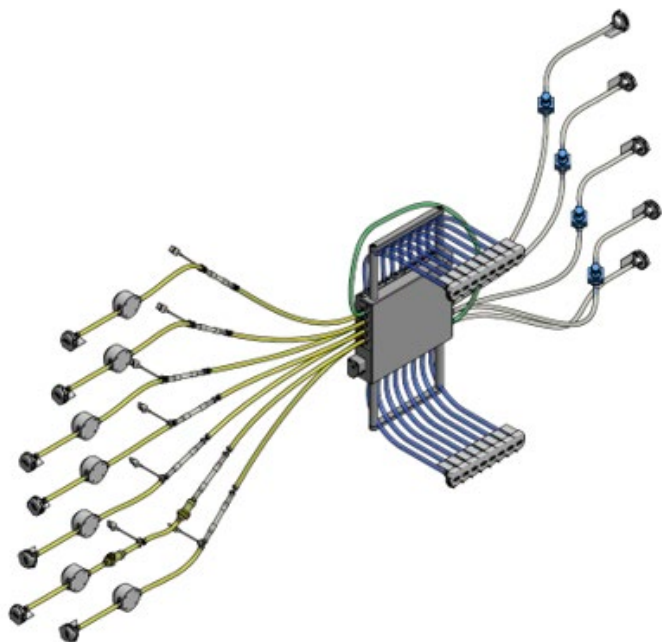


Figure 2: Resolute® BioSMB 80 Flow Kit

Resolute® BioSMB 350 System

Part Number	Description
BIOSMB-PRO-350-CE	Resolute® BioSMB 350 system (Electrical rating: CE)
BIOSMB-PRO-350-UL	Resolute® BioSMB 350 system (Electrical rating: UL)
BIOSMB-PRO-350-PUM	Resolute® BioSMB 350 with pump module

Resolute® BioSMB 350 Flow Kits

Part Number	Description
BIOSMB-IT-8-BPF	Resolute® BioSMB 350 inlet lines with BioPAT® flow
BIOSMB-OT-8	Resolute® BioSMB 350 outlet tubing set
BIOSMB-CT-8	Resolute® BioSMB 350 column tubing set
BIOSMB-VB-8	Resolute® BioSMB 350 valve cassette assembly

The Resolute® BioSMB Process 350 system is comprised of four separate flow kits; inlet flow kit, valve cassette flow kit, column flow kit and outlet flow kit. These can be purchased individually. The flow kits are supplied individually double-bagged and gamma-irradiated.

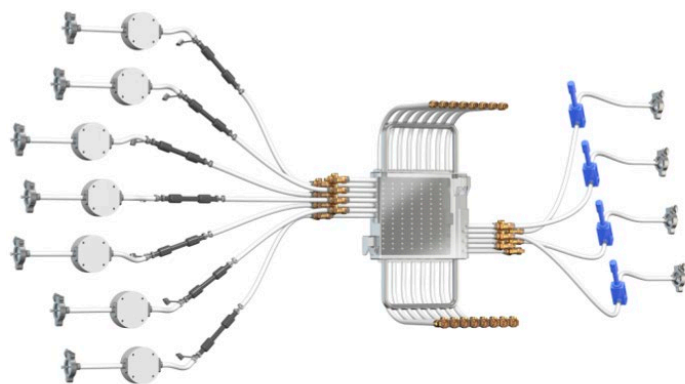


Figure 3: Resolute® BioSMB 350 Flow Kit
(Second Pass and Column Tubing Not Shown.)

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