sartorius stedim biotech

Sartobind®
Membrane Adsorbers for Rapid Purification of Proteins

turning science into solutions


STPA
STPA
IEKO

... for Robust Separations

Unique microporous structure
Sartobind Membrane Adsorbers display a macroporous structure with a pore size of > 3 µm.

That's orders of magnitudes larger than conventional chromatographic gel matrices. Molecules are transported by convective flow to ligands.

Characteristics of Membrane Adsorbers (MA)
- Ready-to-use units
- Simple handling
- Pore sizes > 3 and 0.45 µm
- Negligible diffusion limitation
- The disposable capsules with 4 mm bed height fit for polishing, the capsules with 8 mm bed height are for capturing and polishing (single-use | batch reuse). Both capsule groups are fully scalable
- Robust high performance separations
- No bed cracking, channeling, air entrapment
- Flow rate of ion exchange membranes 5–30 membrane volumes per minute
- Chemistries: strong and weak ion exchange, coupling, affinity and metal chelate ligands

Low unspecific adsorption
The basis for all Sartobind membranes is a stabilized reinforced cellulose. It is made from regenerated cellulose and during the production to Sartobind it runs through a number of stabilization and grafting steps until a chromatographic matrix is formed on the cellulose backbone.

Speed up
Sartobind ready-to-use units are run at 5 to 30 membrane volumes per minute. This is at least one order of magnitude faster than chromatographic columns. A typical speed up factor is about 25 measured in direct comparison to conventional column technology (reference: Walter, J. K. in: Bioseparation and Bioprocessing, Strategies and Considerations for Advanced Economy in Downstream Processing of Biopharmaceutical Proteins. G. Subramanian (ed.) Wiley VCH, Vol. II p. 447–460 (1998). Flow rate does not affect break through performance (see fig. 2).

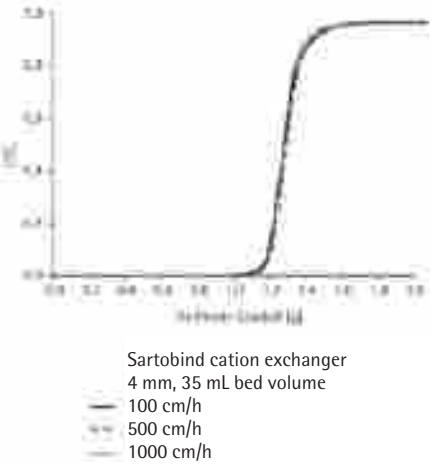

Fig. 2: Break through performance of a Sartobind 35 mL cation exchange module at monoclonal antibody purification with various flow rates. For other published data see also: H.L. Knudsen et al., Genentech Inc., J. Chromatogr. A 907 (2001) 145–154 .

Sartobind membrane types
- Sartobind S, Q, STIC PA and D ion exchangers
- Sartobind IDA (iminodiacetic acid) metal chelate
- Sartobind Aldehyde
- Sartobind Protein A (recombinant)

Sartobind applications
Purification and Concentration
- Viruses, large proteins, blood factors, protein conjugates, VLP, mAbs
Contaminant removal
- Host cell proteins, DNA, viruses, leached ligands, endotoxins, aggregates

Chemical compatibility
The housing of Sartobind 4 and 8 mm capsules is polypropylene. The housing of Sartobind MA 15, 75 and 100 is polysulfone which is stable to many standard solvents applied in chromatography. Sartobind ion exchange membranes are compatible with alcohols such as ethanol, isopropanol, glycerol, and denaturing solvents such as 8 M urea and 8 M guanidine HCl and can be cleaned with 1 N sodium hydroxide.

Constant capacity
The robustness of Sartobind Membrane Adsorbers in ion exchange and affinity chromatography has been tested in consecutive runs of 1000 chromatographic cycles, (Fig. 3). Sartobind can be reused many times, and affinity membranes maintain their binding capacity over many cycles reflecting the chemical stability of the ligands.

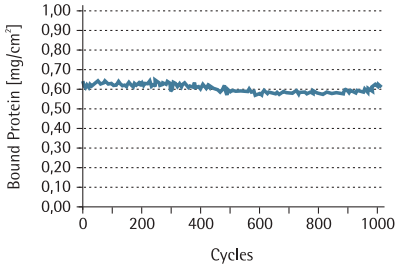

Fig. 3: Purification cycles of bovine serum albumin on Sartobind Q 75 strong anion exchanger repeated 1000 times. Flow rate: 10 mL/min, cycle time: 10 min, equilibration buffer: 20 mM phosphate buffer pH 7.0, sample: 5 mL bovine serum diluted 1:20 with equilibratioin buffer, elution buffer: 20 mM phosphate buffer pH 7.0 + 1 N NaCl, regeneration after each 100 cycles with 1 N NaOH

Fig. 1: Sartobind pico with 0.08 mL membrane volume is the perfect device to start with

Validated Technology

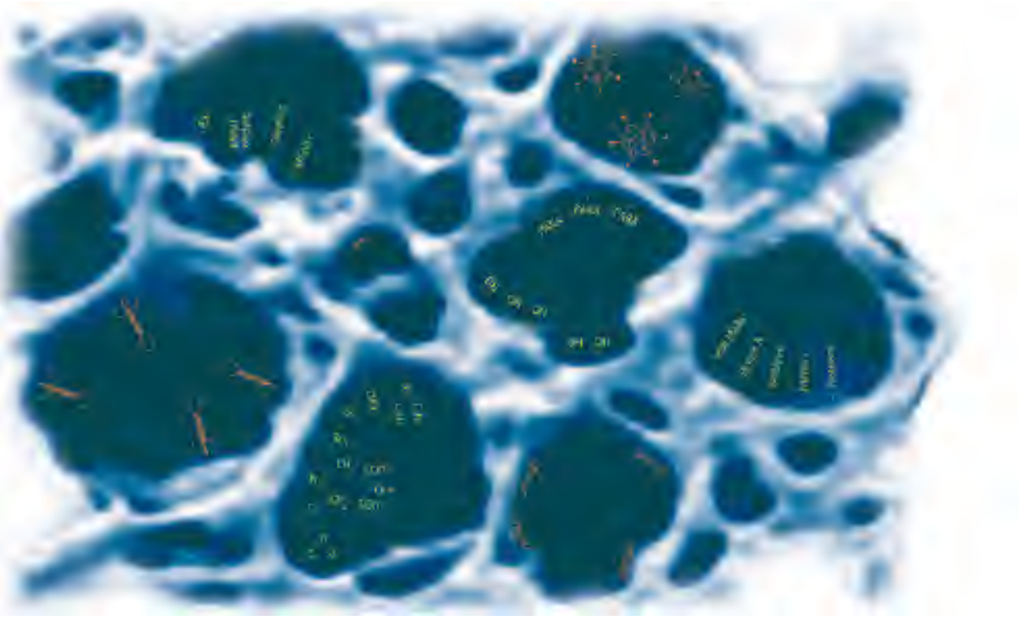

Fig. 4: There are no restrictions regarding ligands and applications.

Quality assurance
Membranes are tested for protein dynamic binding capacity, charge density, thickness and flow rate. Capsules are tested for dynamic binding capacity and flow rate.

Validated technology
Sartobind 4 mm and 8 mm capsules have met the requirements of current USP Plastic Class V and VI, respectively. Validation guides are available with detailed technical data and test results according to USP. Additionally, extractables guide is available for modules with data of GC-MS, HPLC and FT-IR analysis from aqueous, ethanolic and sodium hydroxide extraction.

FDA approved
Sartobind is the first Membrane Adsorber applied in approved pharmaceutical production (approval of CAMPATH-1H® by Food and Drug Administration, March 2001).

Formats from Lab to Process

Fig. 5: Sartobind MAs may be used by hand or with a chromatographic system via Luer adapters.

Sartobind MA units
You may use Sartobind Membrane Adsorbers for any ion exchange or affinity chromatography which require high speed and simple operation. The small scale units for laboratory use is the MA 15 with 0.8 mm bed height (3 membrane layers), MA 75 with 4 mm bed height (15 layers) and MA 100 with 1.4 mm (5 layers). These may be reused hundreds of times.

Fig. 6: Sartobind MA units for laboratory applications

Work horse Sartobind MA 75 for lab purification work
The Sartobind MA 75 format with 4 mm bed height is available with all membrane types. It can be scaled straightly to the production format with the same bed height. They are designed for high throughput laboratory purification of biomolecules in the range of 5–50 mg.

Fig. 7: Sartobind Protein A 2 mL runs at 10 mL/min with a dynamic binding of 10–15 mg IgG per unit

Protein A
The Sartobind Protein A is the ideal tool for ultra rapid quantification of immunoglobulins (IgG). You may achieve much more sample throughput per mL than with any other Protein A matrix. You can use the unit by a syringe and perform the quantification within 10 minutes. The enclosed Luer adapters allow direct connection to a liquid chromatography system.

Fig. 9: Sartobind pico

Sartobind pico 0.08 mL
This format keeps the bed height of larger 4 mm capsules and allows for small scale trials with minute amount of samples e.g. for virus removal studies.

Fig. 10: Vivapure centrifugal units

Centrifugal format
If you don't need flow control but you have to screen a large number of proteins in parallel, use the Vivapure® centrifugal units.

Fig. 11: 8 strip | 96 well plates

8 strips in 96 well plates
This format is suitable for process developers in biopharma to screen a large number of buffer conditions in a short time.

Fig. 8: Sartobind capsules with 8 mm bed height: for single-use or batch-use bind and elute or flow through applications

Production: Sartobind Jumbo reusable and disposable

The Jumbo is a 5 liter membrane chromatography device for large scale capturing and impurity removal at high flow rates. The Sartobind nano 3 mL is the appropriate scale down model with same bed height of 8 mm.

Fig. 12: Sartobind 150 mL capsule cross section displays small upstream and downstream channels

Void volume optimized construction

Sartobind 8 mm capsules are designed to achieve smallest peak | pool volumes. That is the reason for sharp peak resolution of this capsule family and the applicability for bind and elute purification processes.

Sartobind 4 mm Capsules for Contaminant Removal

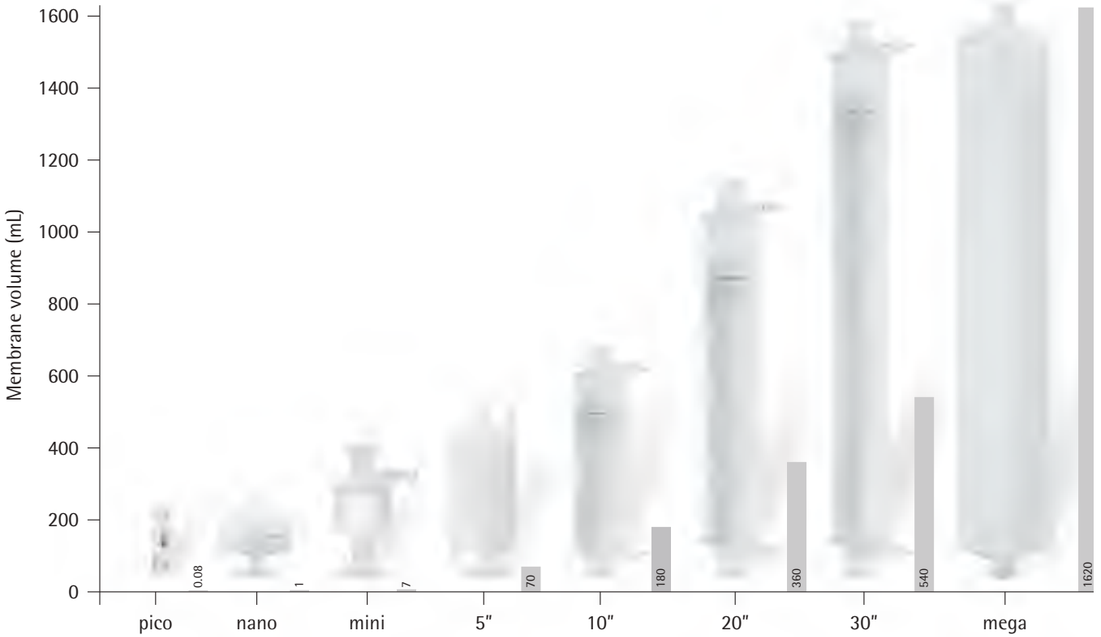

Fig. 13: Sartobind 4 mm capsule scale up from mL to 10000 liter scale: Sartobind pico 0.08 mL to Sartobind mega 1.62 L

High speed polishing
Sartobind 4 mm capsules are designed to remove charged contaminants from therapeutic proteins at accelerated flow rates of 10 to 30 membrane volumes per minute by ion exchange membrane chromatography. The high throughput is a direct result of negligible mass transfer effects and is made possible by the >3 µm macroporous membrane with 4 mm bed height.

Capsule design
The Sartobind 4 mm looks like a standard filter capsule except that the adsorbing membrane is rolled up on a core to form a cylinder. The flow is from top into the outside channel and then perpendicular through the membrane layers to the center of the cylinder and leaves the capsule at the outlet.

Downscale with Sartobind pico and nano
The Sartobind pico is the smallest member of the 4 mm capsule family with 0.08 mL membrane volume scalable up to the largest capsules. It saves costs in sample consumption and virus spiking studies. Sartobind nano 1 mL is the smallest cylindric capsule with 4 mm bed, Sartobind pico displays a flat sheet design to obtain the smallest scalable device.

Membrane ligands available with 4 mm capsules
- Quaternary ammonium – anion exchanger
- Sartobind STIC primary amine – salt tolerant anion
- Sulfonic acid – cation exchanger

Efficient
- Higher throughput for trace impurity removal at 10 kg protein per liter membrane in flow through mode

Economical
- No hardware investment & maintenan
- No column packing, testing, regeneration
- No re-use validation
- Less labor and smaller foot print
- Buffer consumption may be decreased 95% compared to columns
- Sartobind STIC PA reduces tank investments and buffer usage as cation exchange pools are cleared from contaminants without dilution

Easy to use
- Disposable
- Simple and fast set up
- Handling like a filter capsule
- Less complex

A Standard for Virus Purification

Unique for large proteins, DNA and viruses
Sartobind membranes are unique for purification of large proteins and virus particles. Conventional gel beads possess 95% of the binding capacity within the bead and large particles cannot enter their small pores. In contrast Sartobind membranes display huge capacities for large molecules. E.g. for DNA 10 times more dynamic capacity than conventional beads (reference: Sartobind Application Note DNA removal) and for virus purifications gels cannot compete at all. Sartobind membranes have been successfully applied for the purification of alphaherpesvirus, adenovirus and adenoassociated virus. The Vivapure AdenoPACK adenovirus purification and concentration kits offer researchers a convenient way to clean up within 1–2 hours. The LentiSELECT kit reduces the purification time of lenti viruses up to 8×10^6 particles below 1 hour. Both systems are scalable to production format.

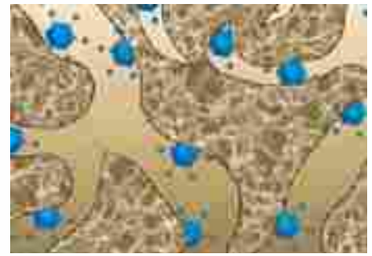

Fig. 14: Viruses can bind to the internal membrane structure

Fig. 15: Adeno PACK for convenient adenovirus purification and concentration

Technical Data

To connect to a chromatography system or Luer syringe					
	pico	**MA 15**	**MA 75 | 2mL**	**MA 100**	**nano**
Application	Down-scale for biopharma development	Screening, application optimization, reusable	Screening, application optimization, reusable	Screening, application optimization, reusable	Down-scale for biopharma production
Membrane material	Stabilized reinforced cellulose				
Adsorption area [cm^2]	2.9	15	75 | 100	100	36 | 110
Number of layers	15	3	15 | 20	5	15 | 30
Bed height [mm]	4	0.8	4.0	1.4	4 | 8
Bed volume* [mL]	0.08	0.41	2.1 | 2	2.8	1 | 3
Membrane diameter [mm]	5	25	25	50	–
Housing material	Polypropylene	Polysulfone	Polysulfone	Polysulfone	Polypropylene
Inlet connector	Female Luer	Female Luer	Female Luer	Female Luer	Female Luer
Outlet connector	Female Luer	Male Luer	Male Luer	Male Luer	Female Luer
Typical dynamic binding capacity 10% binding capacity* [mg/unit]	2.3 / Q pico 4.0 / PA pico 2.0 / S pico 0.6 / Phenyl pico	10.5 / S 15 12 / Q 15	52.5 / S 75 60 / Q 75 60 / D 75 7.5 / IDA 75 15 / Protein A	70 / S 100 80 / Q 100	29 / Q nano 1 mL 25 / S nano 1 mL 60 / PA nano 1 mL 88 / Q nano 3 mL 77 / S nano 3 mL 44 / Phenyl nano 3 mL
Recommended flow rate [mL/min]	0.8–2.4	10–30	10–30	20–50	10–30 | 5–15
Maximum pressure [MPa]	0.6	0.6	0.6	0.6	0.4

* Reference proteins ion exchange: S: lysozyme, Q, D, PA: BSA, IDA: 6 × His-tagged protein, epoxy. IgG, Protein A: IgG, Phenyl: IgG

Overview Membrane Types and Formats

Membrane Type	**Description**	**Pore size (µm)**	**Capacity* (mg/mL)**	**Sartobind Lab Scale**				**Process Scale**		
				A4 sheet	**96 well 19 µl**	**MA 15, 100**	**MA 75**	**pico 0.08 mL**	**Capsule FT 4 mm**	**Capsule FT/B&E** 8 mm**
S	Sulfonic acid	>3	25	•	•	•	•	•	•	•
Q	Quaternary ammonium	>3	29	•	•	•	•	•	•	•
PA	Primary amine	>3	60		•			•	•	
D	Diethylamine	>3	22	•			•			
IDA	Iminodiacetic acid	>3	3.6	•			•			
HIC	Phenyl	>3	44		•			•		•
Aldehyde	Aldehyde	0.45	1	•						
Protein A	Recombinant Protein A	0.45	5–7.5				•			

* Typical dynamic binding capacity 10%
** Flow through | Bind and elute
• available

Spin colmuns for operation with centrifuge

	Mini	**Maxi**
Application	Screening, application optimization, disposable	Screening, application optimization, disposable
Membrane ligands	Q, D, S	Q, S
Membrane diameter [mm]	6.4	22.5
Housing material	Polypropylene	Polypropylene
Minimum static binding capacity* [mg/unit]	H: 4	H: 48–64
Maximum volume [mL] (device inner volume)	H: 0.4	H: 19
Spin speed [g]	H: 2000	H: 500
Storage before use at	Room temperature	Room temperature

M: medium, H: high

* Reference proteins ion exchange: S: lysozyme, Q, D: BSA

Screening devices for operation with centrifuge | vacuum

	96-well plates equipped with 8 strips
Application	Screening for process development work
Membrane ligands	S, Q, STIC PA and HIC Phenyl
Housing material	Polypropylen
Number of layers	3
Bed height	0.8 mm
Membrane volume	0.019 mL
Membrane diameter	5.5 mm
Maximum well volume [mL]	0.5 mL
Collection plate well volume [mL]	2 mL

Ordering Information

Luer Lock units | sheets | kit

Order No.	Sartobind MA units | Kit	Quantity
93IEXQ42GB-12--A	Sartobind Q 15	4
93IEXS42GB-12--A	Sartobind S 15	4
93IEXQ42DB-12--V	Sartobind Q 75	2
93IEXS42DB-12--V	Sartobind S 75	2
93IEXD42DB-12--V	Sartobind D 75	2
93IEXQ42BC-12	Sartobind Q 100	1
93IEXS42BC-12	Sartobind S 100	1
93IDA426DB-12--V	Sartobind IDA 75	2
93PRAP06HB-12--A	Sartobind Protein A 2 mL	4
90-KIT-01	Sartobind Demo Kit	

Order No.	Sartobind A4 Sheet	Quantity
94IEXS42-001	Sartobind S A4 Sheet	1
94IEXQ42-001	Sartobind Q A4 Sheet	1
94IEXD42-001	Sartobind D A4 Sheet	1
94IDA-42-001	Sartobind IDA A4 Sheet	1
94ALD-06-001	Sartobind Aldehyde A4 Sheet	1

Sartobind capsules 4 mm bed height

Order No.	Sartobind Q	Quantity
92IEXQ42DD-11--D	Sartobind Q pico 0.08 mL	10
92IEXQ42DN-11	Sartobind Q SingleSep nano 1 mL	1
92IEXQ42DN-11--A	Sartobind Q SingleSep nano 1 mL	4
92IEXQ42D4-OO--A	Sartobind Q SingleSep mini capsule, hose barb	4
92IEXQ42D4-SS--A	Sartobind Q SingleSep mini capsule, sanitary	4
92IEXQ42D9-OO--A	Sartobind Q SingleSep 5" capsule, hose barb	4
92IEXQ42D9-SS--A	Sartobind Q SingleSep 5" capsule, sanitary	4
92IEXQ42D1-SS	Sartobind Q SingleSep 10"capsule	1
92IEXQ42D2-SS	Sartobind Q SingleSep 20"capsule	1
92IEXQ42D3-SS	Sartobind Q SingleSep 30"capsule	1
92IEXQ42DC3SS	Sartobind Q SingleSep mega capsule	1

Order No.	Sartobind S	Quantity
92IEXS42DD-11--D	Sartobind S pico 0.08 mL	10
92IEXS42DN-11	Sartobind S SingleSep nano 1 mL	1
92IEXS42DN-11--A	Sartobind S SingleSep nano 1 mL	4
92IEXS42D4-OO--A	Sartobind S SingleSep mini capsule, hose barb	4
92IEXS42D4-SS--A	Sartobind S SingleSep mini capsule, sanitary	4
92IEXS42D9-OO--A	Sartobind S SingleSep 5" capsule, hose barb	4
92IEXS42D9-SS--A	Sartobind S SingleSep 5" capsule, sanitary	4
92IEXS42D1-SS	Sartobind S SingleSep 10"capsule	1
92IEXS42D3-SS	Sartobind S SingleSep 30"capsule	1

Order No.	Sartobind STIC	Quantity
92STPA42DD-11--D	Sartobind STIC PA pico 0.08 mL	10
92STPA42DN-11--A	Sartobind STIC PA nano 1 mL	4
92STPA42D9-FF--A	Sartobind STIC PA 5" capsule	4
92STPA42D1-SS	Sartobind STIC PA 10" capsule	1
92STPA42D2-SS	Sartobind STIC PA 20"capsule	1
92STPA42D3-SS	Sartobind STIC PA 30" capsule	1
92STPA42DC3SS	Sartobind STIC PA mega capsule	1

Sartobind capsules 8 mm bed height

Order No.	Sartobind Q	Quantity
96IEXQ42EUC11--A	Sartobind Q nano 3 mL	4
96IEXQ42E9BFF	Sartobind Q 150 mL	1
96IEXQ42E3FSS	Sartobind Q 1.2 L	1
96IEXQ42E3ESS	Sartobind Q Jumbo 5 L	1

Order No.	Sartobind S	Quantity
96IEXS42EUC11--A	Sartobind S nano 3 mL	4
96IEXS42E9BFF	Sartobind S 150 mL	1
96IEXS42E3FSS	Sartobind S 1.2 L	1
96IEXS42E3ESS	Sartobind S Jumbo 5 L	1

Order No.	Sartobind Phenyl	Quantity
92HICP42DD-11--D	Sartobind Phenyl pico 0.08 mL	10
96HICP42EUC11--A	Sartobind Phenyl nano 3 mL	4
96HICP42E9BFF	Sartobind Phenyl 150 mL	1
96HICP42E3FSS	Sartobind Phenyl 1.2 L	1
96HICP42E3ESS	Sartobind Phenyl Jumbo 5 L	1

Virus purification kits

Order No.	AdenoPACK | LentiSELECT	Quantity
VS-AVPQ020	Vivapure AdenoPack 20	
VS-AVPQ022	Vivapure AdenoPack 20 RT	
VS-AVPQ101	Vivapure Adenopack 100	
VS-AVPQ102	Vivapure Adeno PACK 100 RT*	
VS-AVPQ501	Vivapure Adeno PACK 500	
VS-AVPQ502	Vivapure AdenoPack 500 RT	
VS-LVPQ040	Vivapure LentiSELECT 40	

* Vivapure Adeno PACK RT does not contain Benzonase®

Accessories

Order No.	Adapters | Holders	Quantity
1ZA---0004	Adapter UNF 10–32 to Luer male, PEEK	1
1ZA---0005	Adapter UNF 10–32 to Luer female, PEEK	1
17002---140	Pair of Luer adapters, black Tefzel M6 thread	2
16517----------E	Syringe filter holders, 25 mm diameter, polycarbonate for filter or adsorber membrane	12
16214	Syringe filter holder 25 mm diameter, stainless steel for filter or adsorber membrane	1
9ZAIAM0001	Legs for Sartobind mega capsule (stainless steel)	3
9ZGL--0102	Trolley for Sartobind Jumbo 5 L capsule	1

Spin columns

Order No.	Vivapure Mini Spin Columns	Spin columns | Centrifuge tubes
VS-IX01SH24	Vivapure S Mini H	24 | 48
VS-IX01QH24	Vivapure Q Mini H	24 | 48
VS-IX01DH24	Vivapure D Mini H	24 | 48

Order No.	Vivapure Maxi Spin Columns	Spin columns | Centrifuge tubes
VS-IX20SH08	Vivapure S Maxi H	8 | 16
VS-IX20QH08	Vivapure Q Maxi H	8 | 16

96-well plate

Order No.	96-well plates | Accessories | Software	Quantity
99IEXQ42GC-----V	Sartobind® Q 96-well plate, 2 units	2 (24× 8-strips)
99IEXQ42GC-----D	Sartobind® Q 96-well plate, 10 units	10 (120× 8-strips)
99STPA42GC-----V	Sartobind® STIC PA 96-well plate, 2 units	2 (24× 8-strips)
99STPA42GC-----D	Sartobind® STIC PA 96-well plate, 10 units	10 (120× 8-strips)
99IEXS42GC-----V	Sartobind® S 96-well plate, 2 units	2 (24× 8-strips)
99IEXS42GC-----D	Sartobind® S 96-well plate, 10 units	10 (120× 8-strips)
99HICP42GC-----V	Sartobind® Phenyl 96-well plate, 2 units	2 (24× 8-strips)
99HICP42GC-----D	Sartobind® Phenyl 96-well plate, 10 units	10 (120× 8-strips)
VW96VAC01	Vac96 vacuum manifold	1
VW96VAA02	Vac96 liquid trap and reservoir	1
VW96VAA04	96 deep well collection plate 2 mL (square wells)	25
VW96VAA05	Replacement seal for Vac96 vacuum manifold	25
VW08VAC01	Vac8 vacuum manifold	1
VW08VAA02	Vac8 liquid trap and reservoir	1
VW08VAA03	8-well collection strips 1.2 mL (round wells)	125
VW08VAA04	Replacement seal for Vac8 vacuum manifold	1
BBI-8582670	Swing-out rotor for deep well plates (max. 64 mm high) incl. 2 buckets	1
16694-2-50-06	Microsart® mini.vac vacuum pump 230 V | 50 Hz	1
16694-1-60-06	Microsart® mini.vac vacuum pump 115 V | 60 Hz	1
BB-8870600	MODDE Single User License (with 1 year maintenance)	1
BB-8870602	MODDE Single University License (with 1 year maintenance, 85% discount)	1

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