Membrane Technologies

0.1µm *AseptiCap* KS

Sterilization Grade

Hydrophilic Polyethersulfone (PES) Membrane Devices for Liquid Streams in Biopharmaceuticals

Data Sheet

Biopharmaceutical processing requires sterilizing grade microfiltration at multiple stages to meet specific process requirements.

Processes managers are continuously looking for microfiltration solutions to upstream, downstream, intermediate processes and final biological preparations. Since bio manufacturing is a multi stage process and bio molecules by nature are extremely sensitive, they are looking for:

- Minimizing protein losses due to adsorption to improve over all product yields
- Minimizing filter extracts which add up due to multiple points of use in a process
- High throughputs to achieve process economy
- Choice of filter end connections for easy and reliable quick connections
- Absolute retentions for higher sterility assurance

mdi produces a wide range of Sterilizing grade PES membrane devices to meet filtration requirements of biopharmaceutical processing. These filter devices are validated to meet compendia and regulatory requirements and are well characterized. They meet key process requirements such as high retention efficiency, very high protein recoveries, extremely low extractables, high throughputs, wide chemical compatibility and other important characteristics.

With the advantages of pre filtration layer built into the device for higher throughputs, linear scalability of filter area for smooth transitions from lab scale to pilot to process scale and widest range of end connections for quick and reliable connections to the existing fittings, **mdi** *AseptiCap* KS filters are a universal solution for process filtration.

AseptiCap KS

PES Membrane Devices

for Biopharmaceuticals

Datasheet

Asepticap KS 0.1 micron capsule filters uses **mdi** PES membrane in Polypropylene housing. No adhesives or glue are used in the manufacturing process and all bonding is done by heat welding.

The products are deeply validated for use in Biopharmaceutical applications and specially recommended for single use systems. *Asepticap KS* are manufactured in class 10,000 clean rooms and ISO 9001 certified facilities.

Applications

Sterile Filtration of

- Cell culture media
- Cell culture media containing serum
- Media additives
- pH adjusters
- Final product concentrates

Key Features

- Absolute retention
- 100% integrity tested
- Low protein binding
- Very low hold up volume in filters
- High flow rates
- Serial construction with prefilter for higher throughput with fouling streams
- Bioburden maintained below 1000 cfu/device
- Endotoxin level certified to be <0.25 EU/ml
- Widest range of end connections
- Products available for total scalability from a few ml to thousands of liters
- Total traceability through unique serial number for each filter
- Individual certificate of quality for each device
- Sterilizable by EO gas or autoclaving

Validation Services

The regulatory requirements emphasize on the need to validate the efficacy of the 'Sterilizing Filter' with drug product under simulated worst-case conditions of use.

mdi provides validation services supported by customized validation protocols and world class test facilities to assist you in filter validations with your specific drug product.

Quality Assurance

Datasheet

mdi's quality management system emphasizes on quality by design rather by end product testing. Robust processes are developed for product manufacturing and are continuously monitored to ensure that the products meet their predetermined specifications and lot to lot reproducibility is ensured.

Certificate of Quality

Each capsule filter is accompanied by individual certificate of quality to ensure traceable documentation at user's end.

It certifies the product compliance to various regulatory as well as user requirements.

Validated for Microbial Retention

Integrity test data have been correlated to actual microbial retention with *Acholeplasma laidlawii* ATCC 23206 at a challenge level $\geq 10^7$ organisms per cm^2 to establish acceptable integrity test values. Also validated for retention of *B. diminuta* ATCC 19146 as per ASTM F838-05.

100% Integrity Tested

Each *AseptiCap KS* is tested for integrity to comply with validated Acceptable Integrity Test Specifications.

Flow Rate

Each lot is tested for clean water flow rates to ensure that flow rates are within the specifications.

Adsorption

AseptiCap KS filters are validated for low protein binding to ensure minimal active ingredient losses when used for filtration of high value proteins.

Pressure, Temperature Endurance

AseptiCap KS filters are validated to endure high operating pressure and temperature conditions which may be encountered during use.

These filters are also validated for high burst pressure to ensure user safety in case of inadvertent pressure build-up.

Extractables

Extractables/leachables from sterilizing filters, used at various stages of a biopharmaceutical manufacturing process, will add on and may impact the impurity profile of the desired product.

AseptiCap KS filters are validated to exhibit low extractables under harsh extraction conditions.

Bioburden Testing

Device bioburden is tested as per ISO 117 37-1 and assured to be <1000 cfu/device.

Endotoxin Testing

Aqueous extracts exhibit < 0.25 EU/ml as established by Limulus Amebocyte Lysate (LAL) Test

Total Traceability

AseptiCap KS filters come with completely traceable lot numbers and unique identification number to facilitate easy and fast retrieval of manufacturing and quality control data.

These unique lot and identification numbers are laser etched on each filter device and also printed on the labels of the box in which individual filter is packed.

Packaging Integrity

AseptiCap KS filters are fitted with vent caps and are packed in pouch to ensure package integrity during transit as well as to prevent particulate contamination while transferring to clean room assembly or process areas.

Other Regulatory Compliance

- Complies with USFDA 21 CFR 210.3(b)(6) for fiber release
- Complies with USFDA 21 CFR 177.1520 for fractional dissolution
- Materials of construction tested for toxicity as per Biological Reactivity Tests, In vivo, USP <88> for class VI Plastics
- Complete filter devices tested for cytotoxicity as per Biological Reactivity Tests, In vitro, USP <87>

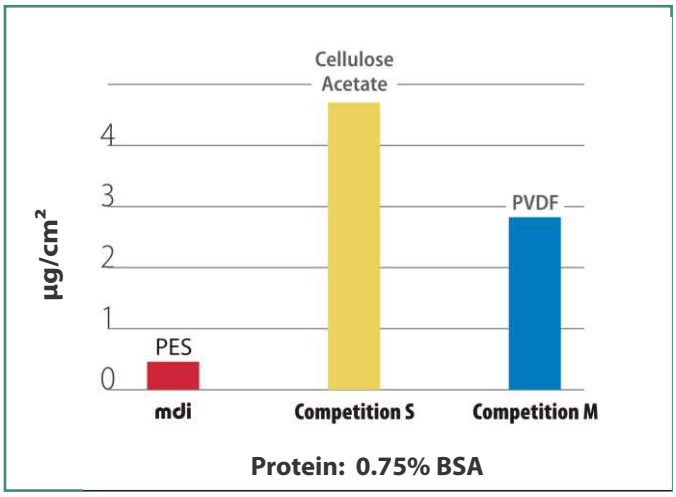
Performance Data

Low Protein Binding

A comparative study on mdi PES membrane exhibits much lower protein adsorption than other competing membranes of Cellulose Acetate and PVDF.

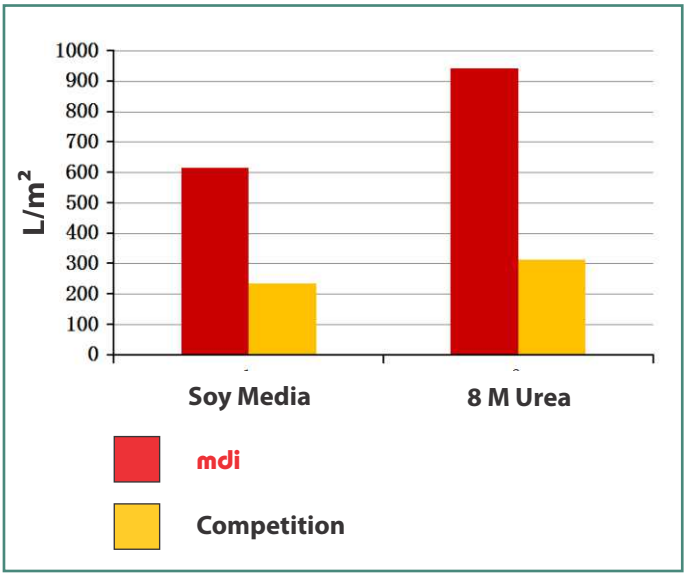
The low protein binding results in increased overall product yield and higher throughputs with biological streams.

Protein Binding (µg/cm²)



0.1 µm *AseptiCap* Filters	Protein Binding
25 mm, 5 cm²	1.7 µg
50 mm, 20 cm²	7 µg
1", 250 cm²	88 µg
2", 500 cm²	187 µg
10", 6000 cm²	2275 µg

High Throughputs



The high throughput translates to lower filtration costs, less number of filter changes and overall economy of operations.

Very Low Hold-Up Volumes

mdi PES membrane capsule filters are designed to offer very low hold-up volumes to minimize filtration losses and maximize product recovery.

Filter Devices	EFA* (Nominal)	Hold up Volume
AseptiCap KS, 25mm	5cm²	< 50µl
AseptiCap KS, 50mm	20cm²	< 200µl
AseptiCap KS, 1"	250cm²	< 5ml
AseptiCap KS, 2"	500cm²	< 25ml
AseptiCap KS, 5"	1000cm²	< 45ml
AseptiCap KS, 8"	2000cm²	< 60ml

*EFA: Effective Filtration Area

Performance Data

Extractables

It is useful to evaluate extractables that may be leeched out of the filter and enter the process stream. **mdi** filters give low extractables under harsh preconditioning and extraction conditions.

Low extractables mean less addition to impurity profile of the biological product from the filters.

Extraction Time: 24 hours

Model Solvent	Non Volatile Residue	
	AseptiCap KS 1″ (250 cm^2)	*AseptiCap KS* 10″ (6000 cm^2)
Water @ 35 °C	1.6 mg	38.26 mg
Water @ 80 °C	1.8 mg	43.04 mg

Model Solvent	Non Volatile Residue	
	AseptiCap KS 1″ (250 cm^2)	*AseptiCap KS* 10″ (6000 cm^2)
100% Ethanol @ 35 °C	13.4 mg	320.43 mg

FTIR Analysis of Extractables From *AseptiCap KS* 1″ Capsule Filter with Water @ 35 °C

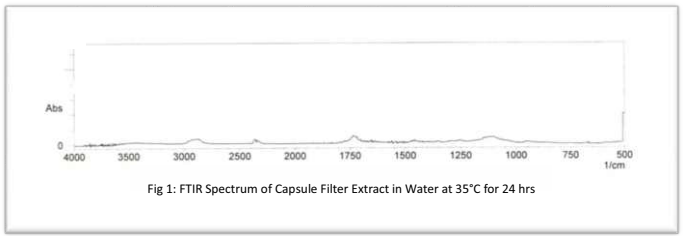


Fig 1: FTIR Spectrum of Capsule Filter Extract in Water at 35°C for 24 hrs

FTIR Analysis of Extractables From *AseptiCap KS* 1″ Capsule Filter with 100% Ethanol @ 35 °C

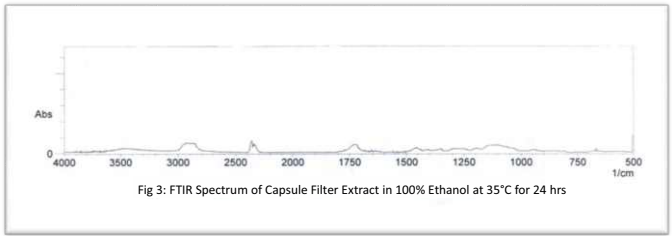


Fig 3: FTIR Spectrum of Capsule Filter Extract in 100% Ethanol at 35°C for 24 hrs

FTIR Analysis of Extractables From *AseptiCap KS* 1″ Capsule Filter with Water @ 80 °C

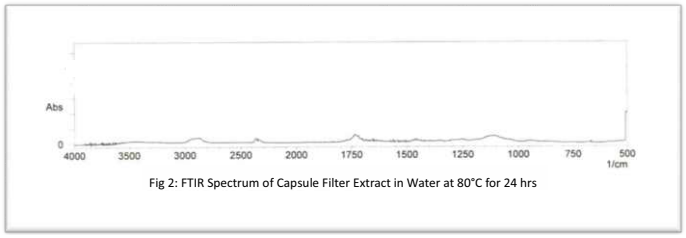


Fig 2: FTIR Spectrum of Capsule Filter Extract in Water at 80°C for 24 hrs

FTIR Analysis of Extractables From *AseptiCap KS* 1″ Capsule Filter with 100% Ethanol @ 80 °C

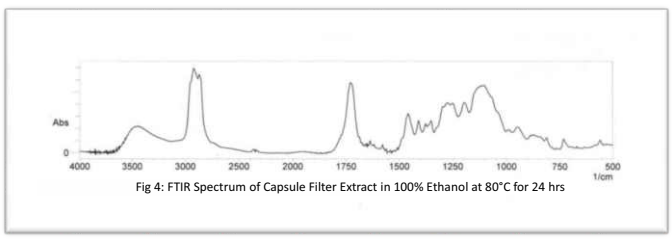


Fig 4: FTIR Spectrum of Capsule Filter Extract in 100% Ethanol at 80°C for 24 hrs

The Spectrum of extracts from *AseptiCap KS* capsule filters with 100% ethanol under extreme extraction conditions show presence of various components used in the manufacture of **mdi** PES membrane capsule filters.

Easy Connect

Datasheet

Widest Range of End Connections

Biopharmaceutical processes involve transfer of high value fluids through multiple process steps. Making high quality, reliable, flexible and functionally convenient connectivity with filters is of utmost value to the bio-processors.

mdi *AseptiCap KS* filters offer a wide range of reliable end connections for functional convenience and customized connectivity.

Validated for Performance

These end connections are manufactured with tight dimension tolerance and are validated for strength and connection integrity under extreme use conditions as well as for their ability to withstand prevalent sterilization methods including EO sterilization and autoclaving.

¾" Sanitary Flange

1½" Sanitary Flange

½" HB

1/2" Single Stepped HB

¼" SHB

Quick Connector

Some end connections available with AseptiCap

Customized Connectivity

mdi *AseptiCap KS* filters are available in a wide range of end connections and are also customized to offer different inlet-outlet combinations to meet the unique connectivity needs in biopharmaceutical process assemblies where, for example, stainless steel components with sanitary flange connections are sometimes required to be connected to single use disposable systems through quick-connectors or hose barb connections.

1½" Sanitary Flange to ½"Barb Hose

1½" Sanitary Flange to ¾" Sanitary Flange

***AseptiCap* with HighSecurity ½" hose barb connection**

Linear Upscaling from R&D to Production Process

Datasheet

Scientists are concerned about filter fluid interaction impacting the stability, purity, strength etc. of the drug product, and they take a keen interest in filter selection at the formulation development stage itself. Although preliminary compatibility data support initial filter selection, for stability studies detailed filter validations are required to provide enough documented evidence to justify specific filter use.

A critical requirement that needs to be addressed at this stage is of scalability from R&D to pilot scale to full scale production processes.

mdi offers a wide range of *AseptiCap KS* filters to provide linear scale up from lab scale to production process. While scaling up the process, the appropriate size filter can be selected by increasing the effective filtration area of filter proportionate to the process fluid volumes.

All Materials of construction as well as manufacturing process are identical for all filter devices starting from 5 cm^2 to 18000cm^2 hence process scaling can be facilitated without triggering additional validation studies for given process conditions. **mdi** provides complete documentation for each of the *AseptiCap KS* filters there by reducing the additional validation cost and time.

AseptiCap KS
25mm, 5cm^2

AseptiCap KS
50mm, 20cm^2

AseptiCap KS
1", 250cm^2

AseptiCap KS
2", 500cm^2

AseptiCap KS
5", 1000cm^2

AseptiCap KS
8", 2000cm^2

Filter Devices	EFA* (Nominal)	Hold up Volume
AseptiCap KS, 25 mm	5cm^2	< 50µl
AseptiCap KS, 50 mm	20cm^2	< 200µl
AseptiCap KS, 1"	250cm^2	< 5ml
AseptiCap KS, 2"	500cm^2	< 25ml
AseptiCap KS, 5"	1000cm^2	< 45ml
AseptiCap KS, 8"	2000cm^2	< 60ml
AseptiCap KS, 10"	6000cm^2	–
AseptiCap KS, 20"	12000cm^2	-
AseptiCap KS, 30"	18000cm^2	–

AseptiCap KS
10", 6000cm^2

Specifications

Datasheet

0.1 µm *AseptiCap KS* (with Prefilter)

Construction			
Membrane		0.1 µm Hydrophilic PES	
Prefilter Membrane		0.2 µm or 0.45 µm Hydrophilic PES	
Plastic parts		Polypropylene	
Integrity Testing/ Retention			
Bubble Point		≥ 31 psi (2.18 Kg/cm^2) with 50% IPA	
Bacterial Retention		LRV> 7 for *Acholeplasma laidlawii* ATCC 23206 per cm^2 of filter area	
		LRV> 7 for *Brevudimonas diminuta* ATCC 19146 per cm^2 of filter area as per ASTM F 838-05	
Size			
Size		25mm	50mm
Effective Filtration Area (Nominal)		5 cm^2	20 cm^2
Dimensions (End to End)	¼" SHB I/O	–	79 mm
	¾" Sanitary Flange Inlet I/O	–	51 mm
	Female Luer Lock Inlet/ Male Luer Slip Outlet	23 mm	–
Operational Radius (with Vent/ Drain)		15 mm	28 mm
Operational			
Max. Operating Temperature		55 °C	60 °C
Max. Differential Pressure		75 psi (5 Kg/cm^2) @ 25 °C	42 psi (3 Kg/cm^2) @ 30 °C
Sterilization	By Gas	Sterilizable by Ethylene Oxide	
	By Autoclave	Autoclavable at 125 °C for 30 minutes, 25 Cycles. Can not be in-line steam sterilized	
Shelf Life		3 year after EO sterilization	
Assurance			
Toxicity		Passes Bioreactivity test, In Vivo, as per USP <88> for Class VI plastics	
Cytotoxicity		Passes Biological Reactivity Tests, In vitro, USP <87> for cytotoxicity	
Bacterial Endotoxin		Aqueous extracts exhibit < 0.25 EU/ml as established by Limulus Amebocyte Lysate (LAL) Test as per USP <85>	
Non Fiber Releasing		Passes test as per USP and comply with USFDA 21 CFR Part 210.3(b)(6) for fiber release	
TOC and Conductivity		Meets the WFI requirements of USP for TOC <643> and Conductivity <645> after a specified minimal flush	
pH Compatibility		Compatible with pH range of 1 - 10	
Extractables with WFI		Passes NVR test as per USP <661>	
Indirect Food Additives		Comply with USFDA 21 CFR Part 177.1520	
Oxidizable Substances		Passes test as per USP <1231>	
Quality Management System		ISO-9001 Certified	
USFDA		DMF No. 015554	

Specifications

Datasheet

0.1µm *AseptiCap KS* (with Prefilter)

Construction					
Membrane		0.1 µm Hydrophilic PES			
Upstream Membrane (in case of *AseptiCap KS-γ*)		0.2 µm or 0.45 µm Hydrophilic PES			
Support Layers		Polyester			
Plastic parts		Polypropylene			
Integrity Testing/ Retention					
Bubble Point		≥ 31psi with 50% IPA/ Water solution			
Bacterial Retention		LRV> 7 for *Acholeplasma laidlawii* ATCC 23206 per cm^2 of filter area			
		LRV> 7 for *Brevudimonas diminuta* ATCC 19146 per cm^2 of filter area as per ASTM F 838-05			
Size					
Size		1″	2″	5″	8″
Effective Filtration Area (Nominal)		250cm^2	500cm^2	1000cm^2	2000 cm^2
Clean Water Flow Rate @ 10 psi with ½″ Hose Barb Connection		1.3 lpm	2.5 lpm	4.8 lpm	6.5 lpm
Dimensions (End to End)	1½″ Sanitary Flange I/O	91 mm	110 mm	161 mm	211 mm
	½″ Hose Barb I/O	90 mm	112 mm	164 mm	215 mm
	1½″ Sanitary Flange Inlet ½″ Single Step Hose Barb Outlet	-	111 mm	162 mm	212 mm
	¾″ Sanitary Flange I/O	91 mm	103 mm	155 mm	205 mm
Operational Radius (with Vent/ Drain)		30 mm	65 mm	65 mm	65 mm
Vent and Drain		1/4″ Hose Barb with Silicone "O" rings			
Operational					
Max. Operating Temperature		80 °C @ < 30 psi (2 Kg/cm^2)			
Max. Differential Pressure		60 psi (4 Kg/cm^2) @ 30 °C			
Sterilization	By Gas	Sterilizable by Ethylene Oxide			
	By Autoclave	Autoclavable at 125 °C for 30 minutes, 25 Cycles. Can not be in-line steam sterilized			
Shelf Life		3 year after EO sterilization			
Assurance					
Toxicity		Passes Bioreactivity test, In Vivo, as per USP <88> for Class VI plastics			
Cytotoxicity		Passes Biological Reactivity Tests, In vitro, USP <87> for cytotoxicity			
Bacterial Endotoxin		Aqueous extracts exhibit < 0.25 EU/ml as established by Limulus Amebocyte Lysate (LAL) Test as per USP <85>			
Non Fiber Releasing		Passes test as per USP and comply with USFDA 21 CFR Part 210.3(b)(6) for fiber release			
TOC and Conductivity		Meets the WFI requirements of USP for TOC <643> and Conductivity <645> after a 3 liter flush			
pH Compatibility		Compatible with pH range of 1 - 10			
Extractables with WFI		Passes NVR test as per USP <661>			
Indirect Food Additives		Comply with USFDA 21 CFR Part 177.1520			
Oxidizable Substances		Passes test as per USP <1231>			
Quality Management System		ISO-9001 Certified			
USFDA		DMF No. 015554			

Specifications

Datasheet

0.1µm *AseptiCap KS* (with Prefilter)

Construction					
Membrane		0.1 µm Hydrophilic PES			
Upstream Membrane (in case of *AseptiCap KS-γ*)		0.2 µm or 0.45 µm Hydrophilic PES			
Support Layers		Polyester			
Plastic parts		Polypropylene			
Integrity Testing/ Retention					
Bubble Point		≥ 31psi with 50% IPA/ Water solution			
Bacterial Retention		LRV> 7 for *Acholeplasma laidlawii* ATCC 23206 per cm^2 of filter area			
		LRV> 7 for *Brevudimonas diminuta* ATCC 19146 per cm^2 of filter area as per ASTM F 838-05			
Size					
Size		5″	10″	20″	30″
Effective Filtration Area (Nominal)		3000cm^2	6000cm^2	12000cm^2	18000 cm^2
Clean Water Flow Rate @ 10 psi with 1½″ Sanitary Flange Connection		8 lpm	17 lpm	29 lpm	45 lpm
Max. Air Diffusion Flow (@ 50psi (3.51 Kg/cm^2) with water)		≤ 15 ml/min	≤ 29 ml/min	≤ 58 ml/min	≤ 87 ml/min
Dimensions (End to End) Inline Capsule Filters	½″ Single Step Hose Barb I/O	217 mm	332 mm	607 mm	882 mm
	1½″ Sanitary Flange Inlet ½″ Single Step Hose Barb Outlet	203 mm	332 mm	607 mm	882 mm
	1½″ Sanitary Flange I/O	207 mm	326 mm	601 mm	876 mm
Operational Radius (with Vent/ Drain)		78 mm	78 mm	78 mm	78 mm
Vent and Drain		1/4″ Hose Barb with Silicone "O" rings			
Operational					
Max. Operating Temperature		80 °C @ < 30 psi (2 Kg/cm^2)			
Max. Differential Pressure		60 psi (4 Kg/cm^2) @ 30 °C			
Sterilization	By Gas	Sterilizable by Ethylene Oxide			
	By Autoclave	Autoclavable at 125 °C for 30 minutes, 25 Cycles. Can not be in-line steam sterilized			
Shelf Life		3 year after EO sterilization			
Assurance					
Toxicity		Passes Bioreactivity test, In Vivo, as per USP <88> for Class VI plastics			
Cytotoxicity		Passes Biological Reactivity Tests, In vitro, USP <87> for cytotoxicity			
Bacterial Endotoxin		Aqueous extracts exhibit < 0.25 EU/ml as established by Limulus Amebocyte Lysate (LAL) Test as per USP <85>			
Non Fiber Releasing		Passes test as per USP and comply with USFDA 21 CFR Part 210.3(b)(6) for fiber release			
TOC and Conductivity		Meets the WFI requirements of USP for TOC <643> and Conductivity <645> after a 3 liter flush			
pH Compatibility		Compatible with pH range of 1 - 10			
Extractables with WFI		Passes NVR test as per USP <661>			
Indirect Food Additives		Comply with USFDA 21 CFR Part 177.1520			
Oxidizable Substances		Passes test as per USP <1231>			
Quality Management System		ISO-9001 Certified			
USFDA		DMF No. 015554			

Ordering Information

Datasheet

0.1 µm *AseptiCap KS* 25mm PES Membrane Capsule filter

Type	Code
AseptiCap KS (0.45 µm Upstream)	IKSX
AseptiCap KS (0.2 µm Upstream)	IKS1

Size	Code
25mm	06

Pore Size	Code
0.1µm	36

Inlet/Outlet	Code
Female Luer Lock	M
Male Luer Slip	N
⅛" Hose Barb	H
¼" Hose Barb	B

X	X

Sterility	Code
Non Sterile	1
EO Sterile	2

Pack Size	Code
100	04

Example:

IKSX	06	36	MN	X	X	1	04

0.1 µm *AseptiCap KS* 50mm PES Membrane Capsule filter

Type	Code
AseptiCap KS (0.45 µm Upstream)	VKSX
AseptiCap KS (0.2 µm Upstream)	VKS1

Size	Code
50mm	10

Pore Size	Code
0.1µm	36

Inlet/Outlet	Code
¼" SHB	B
¾" Sanitary Flange	S

X	X

Sterility	Code
Non Sterile	1
EO Sterile	2

Pack Size	Code
12	08

Example:

VKSX	10	36	BB	X	X	1	08

Note: Inlet/Outlet Connections and Pack Sizes available with different diameter filters as follows:

Connections Available		
Inlet/Outlet	**25mm**	**50mm**
1/4" - 3/4" Stepped Hose Barb	X	√
3/4" Sanitary Flange	X	√
Female Luer Lock	Inlet Only	X
Male Luer Slip	Outlet Only	X
1/8" Hose Barb	√	X
Male Luer Lock	Outlet Only	X
¼" Hose Barb	√	X

Pack Size Available		
Pack Size	**25mm**	**50mm**
12/Pack	X	√
100/Pack	√	X

Ordering Information

Datasheet

0.1 µm *AseptiCap KS* PES Membrane Capsule filter

Type	Code
AseptiCap KS (0.45 µm Upstream)	DKSX
AseptiCap KS (0.2 µm Upstream)	DKS1

Size	Code
1″	51
2″	52
5″	53
8″	57

Pore Size	Code
0.1µm	36

Inlet/Outlet	Code
¼″ SHB	A
½″ Hose Barb	D
1½″ Sanitary Flange	E
¾″ Sanitary Flange	S
Quick Connector	J
½″ Single Step Hose Barb	Q
Female luer lock	U
Male luer slip	W
3/16″ Hose Barb	N
3/8″ Hose Barb	I

X

Bell	Code
Yes*	B
No Bell	X
Bell with cover	C

Sterility	Code
Non Sterile	1
EO Sterile	2

Pack Size	Code
1	01

***Bell is available with**
- ½″ HB outlet connections in 1″, 2″, 5″ and 8″ capsule filters
- ¼″ SHB outlet connection in 1″ capsule filters only

Example:

DKSX	57	36	DD	X	X	1	01

Note: Inlet/Outlet Connections available with different Sizes/Length as follows:

Inlet/Outlet	Size/Length			
	1″	2″	5″	8″
¼″ Stepped Hose Barb	√	√	√	√
½″ Single Step Hose Barb	X	√	√	√
½″Hose Barb	√	√	√	√
1½″ Sanitary Flange	√	√	√	√
¾″ Sanitary Flange	√	√	√	√
Quick Connector	√	√	√	√
Female Luer Lock	√	√	√	√
Male Luer Slip	Outlet Only	X	X	X
3/16″ Hose Barb	√	√	√	√
3/8″ Hose Barb	X	√	√	√

Bell at Outlet Available with (Size/Outlet)
1″ / ¼″ SHB
1″, 2″, 5″, 8″/ ½″ HB

0.1 µm *AseptiCap KS* PES Membrane Large Capsule filter

Type	Code
AseptiCap KS (0.45 µm Upstream)	LKSX
AseptiCap KS (0.2 µm Upstream)	LKS1

Size	Code
5″	53
10″	54
20″	55
30″	56

Pore Size	Code
0.1µm	36

Inlet/Outlet	Code
½″ Single Step Hose Barb	Q
1½″ Sanitary Flange	E
3/8″ Hose Barb	I
1″ Hose Barb	Z

X

Inline/T-Line	Code
Inline	X
T-Line*	T

Sterility	Code
Non Sterile	1
EO Sterile	2

Pack Size	Code
1	01

Example:

LKSX	54	36	EE	X	T	1	01

***T-line is not available in 5" Capsule filter**

***T-line Capsule filter are available with 1½″ Sanitary Flange I/O connection only**

Note: Inlet/Outlet Connections available with different Sizes/Length as follows:

Inlet/Outlet	Inline				T-Line		
	5″	10″	20″	30″	10″	20″	30″
½″ Single Step Hose Barb	√	√	√	√	X	X	X
1½″ Sanitary Flange	√	√	√	√	√	√	√
3/8″ Hose Barb	√	√	√	√	X	X	X
1″ Hose Barb	X	√	√	√	X	X	X

Advanced Microdevices Pvt. Ltd.
20-21, Industrial Area, Ambala Cantt-133 006, INDIA
Tel : +91-171-2699290, 2699471
E-mail : info@mdimembrane.com
Website : www.mdimembrane.com