

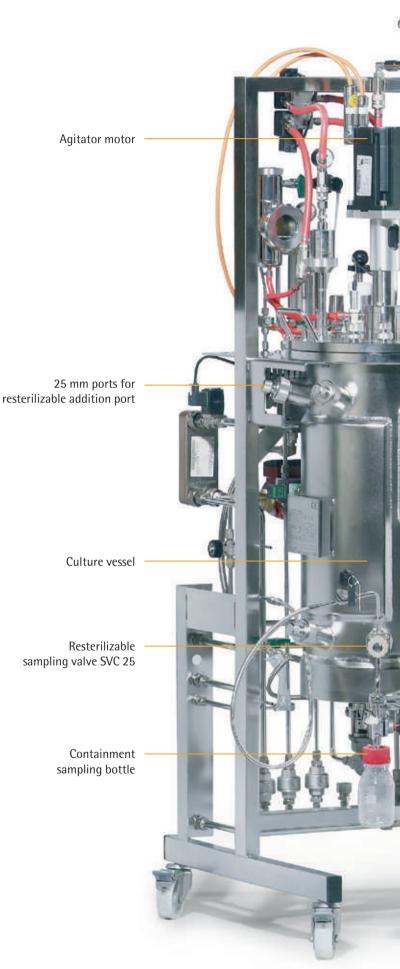
Biostat[®] Cplus The Stainless Steel Fermenter | Bioreactor for Your Laboratory



turning science into solutions

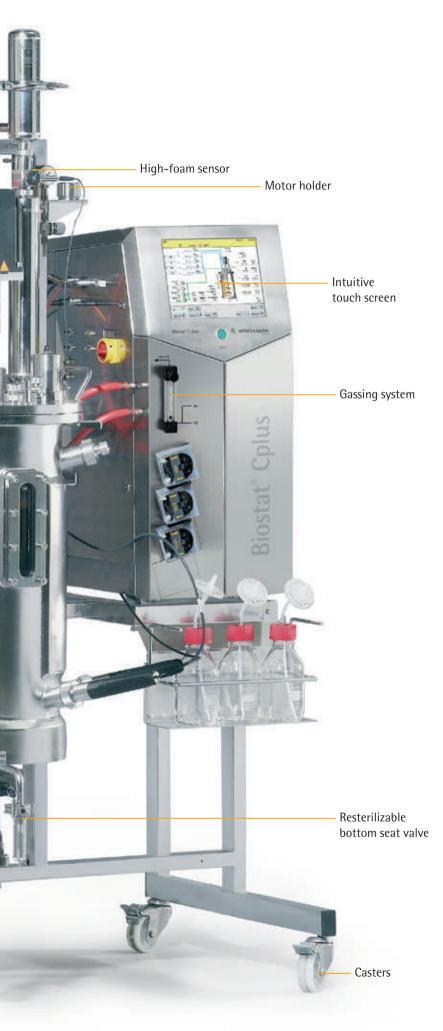
Biostat[®] Cplus System Concept

The Biostat[®] Cplus is a Sterilizable-In-Place (SIP) Fermenter | Bioreactor developed for the cultivation of microorganisms and cell cultures. Culture vessels with operating volumes of 5 L, 10 L, 15 L, 20 L and 30 L are available. The system can be flexibly integrated into your laboratory. The culture vessel can be sterilized with electro or steam heating. It can easily be moved to another location using casters under the supply unit. With more than a thousand installations worldwide, the Biostat[®] Cplus is the most successful stainless steel bioreactor of its class and is now available in the revised 3rd generation with DCU controller.



Typical Applications

- Process development for vaccine, recombinant protein and monoclonal antibody production
- Process development for biofuels and for the production of secondary metabolites
- Process strategy development in batch, fed-batch, continuous or perfusion operation
- Scale-up and scale-down experiments
- Small scale production for e.g., diagnostic antibodies
- High cell density fermentation
- Suspension cultures and adherent cell culture with microcarriers
- Cultivation of filamentous organisms



Your Advantages

Cost-effective integration into existing infrastructure, choice between electro or steam heating for operation and sterilization

DCU control unit with simple, intuitive touch screen operation

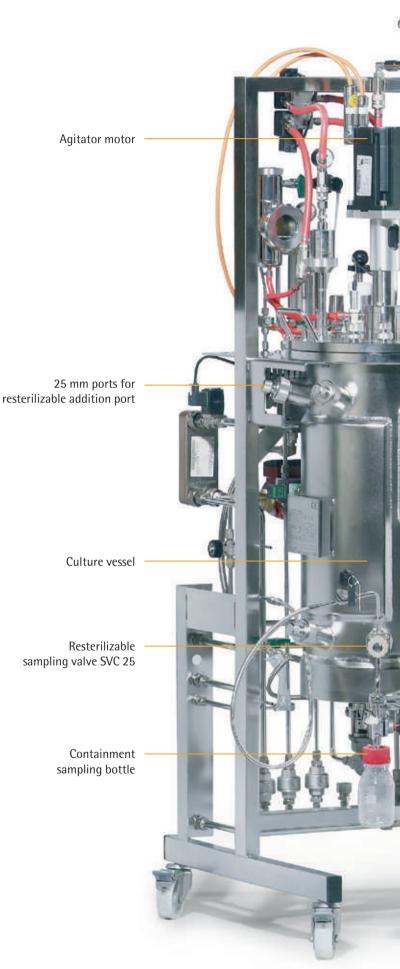
Attractive additional functions such as gravimetric feed control, advanced DO controller, and integrated offgas analyzer

Compact, mobile design saves valuable laboratory space

Maintenance-free agitator motor and automatic sequences for sterilization and pressure hold test ensure excellent safety

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Configurable Flexibility

The modular design allows individual system configuration in order to meet your application-specific requirements, from the basic configuration through to sophisticated equipment with e.g., resterilizable addition valve, automatic pressure control, containment sampling, integrated offgas measurement and much more.

Our application specialists are happy to support you and help configure your personal Biostat[®] Cplus for you.

Motor Holder

The motor holder is screwed to the frame. This helps you to position the motor easily and securely if the culture vessel needs to be opened.



Agitator Motor

The maintenance-free agitator motor provides low speeds for the gentle mixing of cell cultures and high speeds for the conduct of microbial high cell density cultivations. The motor is gearfree; therefore it works almost without a sound. It is easy to handle due to the small dimensions and low weight.

Lid Lifting Device

The lid lifting device enables the easy removal of the lid and allows for simple and safe handling during cleaning work or when changing culture vessel accessories.



Culture Vessel

Culture vessels with maximum operating volumes of 5 L, 10 L, 15 L, 20 L and 30 L, and a height | diameter ratio (H:D) of 2:1 or 3:1 (5 L only 2:1) are available. Various lid and side ports enable the simple integration of additional sensors or addition valves.

Sampling Valve SVC 25

The sampling valve SVC 25 is used for finely regulated sampling from the culture vessel. The SVC 25 can be resterilized with steam for repeated aseptic sampling. A containment extension kit is also available for sterile and aerosol-free sampling.

Resterilizable Addition Port APC

The APC is a resterilizable valve group for installation into the culture vessel, which provides a sterile, secure connection of additions into the culture vessel. Thanks to the APC it is possible to use the same port for inoculation of the sterile culture vessel and later in the process for adding a substrate. It is easy to resterilize, safe and cost-effective. In addition, the APC is the perfect interface for the connection of disposable bags such as Flexboy[®] or Flexel[®].

Casters

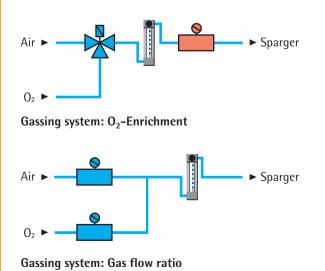
The casters mean that the system is completely mobile, whether this be for moving it to another laboratory or simply when cleaning the floor.

Biostat[®] Cplus Gassing Strategies

Flexible gassing options make the Biostat[®] Cplus a versatile tool for the most wide-ranging applications, from high cell density fermentation with high oxygen requirements through to cell culture with demanding gas mixing of up to four gases.

Microbial Applications

Various configurations allow for aeration with air or oxygen, as well as the traditional O_2 enrichment function. For anaerobic processes, the air inlet can also be used for nitrogen. Solenoid valves installed as standard in combination with a flow meter ensure a reliable gas supply. Optional mass flow controllers offer precise batching of the individual gases, as is needed for example for balancing studies in combination with exhaust analysis.



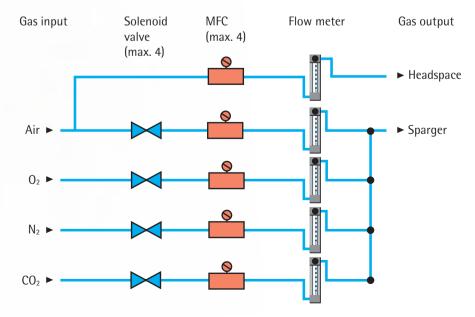
Cell Culture and Multi-Purpose Applications

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Five different gas paths, equipped with solenoid valves and flow meters or with up to four optional mass flow controllers provide the maximum level of flexibility and precision.



Gassing system: Additive flow

DCU Local Control

The DCU controller is one of the best proven, most secure and most flexible control solutions both in the upstream and in the downstream process. The DCU is the standard automation platform for our Biostat[®] bioreactors, SARTOFLOW[®] Crossflow filtration units, and FlexAct[®] configurable production solutions and is now also installed in the new Biostat[®] Cplus. In addition to the measurement and control tasks and the process control for the sterilization of the culture vessel, it is now possible to integrate up to four mass flow controllers and up to two scales or gravimetric feed controller. In addition, a pressure hold test sequence for the culture vessel and the "Advanced DO controller" is optionally available.

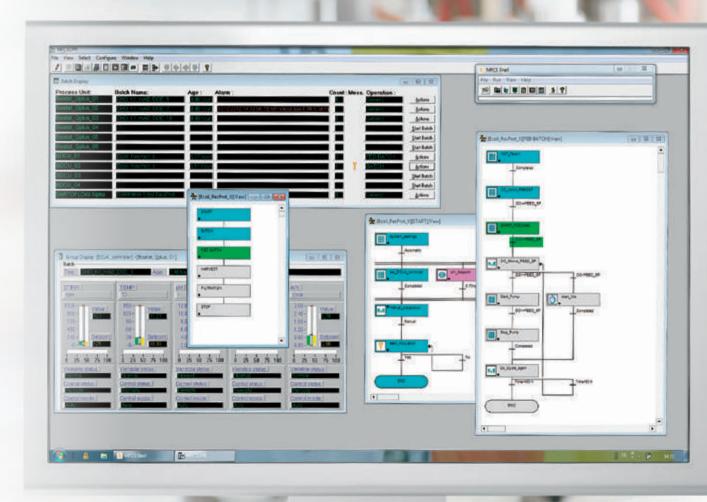
Advanced DO Controller

The advanced DO controller is optionally available for the Biostat[®] Cplus. In comparison with the conventional DO control cascade, the advanced DO controller supports the sequential and parallel operation of up to 5 slave controllers. The controller can be easily configured using the touch screen and results are graphically displayed as a polygonal curve, which is easily to understand. The result is maximum flexibility for optimum oxygen regulation in your process.



BioPAT[®] MFCS Superior Process Control

BioPAT[®] MFCS is the international standard software for the control of bio processes and related data recording. More then 25 years of experience has gone into the current version of BioPAT[®] MFCS. With more than 6,500 installations, it provides a reliable basis for your individual requirements. We supply the BioPAT[®] MFCS | DA version as standard with each bioreactor for data recording.



Overview of Basic Configurations MO: O₂ Enrichment

Package Overview

Culture vessel volumes	5 L	10 L	15 L	20 L	30 L
Basic configuration	RCP-M05L	RCP-M10L	RCP-M15L	RCP-M20L	RCP-M30L
Control unit		1	1	1	
Digital controller, color display with touch screen			٠		
Control capabilities					
Temperature, DO (multi-stage cascade controller), stirrer speed			•		
pH control via addition of acid and base			•		
Sequence for culture vessel sterilization (full sterilization)			•		
Maintenance-free, low-noise agitator motor			•		
Flow meter			•		
			•		
Solenoid valve for O_2 enrichment				Lucaulation (agid a	und boso)
Integrated peristaltic pumps			2 for pH	I regulation (acid a	ind basej
Process data recording					
BioPAT [®] MFCS DA			•		
Supply unit	Open frame d	esign			
Temperature control system	Closed loop sys	stem with recircula	tion pump and heat	t exchanger for he	ating and cooling
Installation set			٠		
Culture vessel		nless steel culture steel glass vessel	vessel with vertica)	I sight glass and t	top agitation
Stirrer shaft with single mechanical seal (SMS)			٠		
6-blade disk impeller	2	3	3	3	3
Stainless steel filter housing for aeration and exhaust incl. sterile filter			٠		
Pressure gauge -1 3 barg			٠		
Aeration tube with Ring-sparger			٠		
Exhaust cooler			٠		
4 Baffels (removable)			•		
I-Channel Sacova valve for needle free additions			•		
3-Channel Sacova valve for needle free additions			•		
Lamp for vessel illumination (not for 5L culture vessel)			•		
Storage bottles			2		
Resterilizable bottom seat valve for sampling and harvesting			•		
pH sensor, connection cable			•		
pO_2 sensor, connection cable			•		
Temperature sensor Pt 100			•		
Options					
Electric heating for culture vessel sterilization (full sterilization)			0		
and operation					
Weighing system for culture vessel			0		
Pressure hold test for culture vessel			0		
Mass flow controller for air and oxygen			0		
Lid lifting device 10–30 L			0		
Antifoam control via sensor			0		
Advanced DO controller			0		
Jp to two gravimetric feed controllers, accuracy 7 kg balance: 5 g/h, accuracy 60 kg balance: 50 g/h			0		
Redox measurement			0		
Turbidity measurement			0		
Resterilizable addition valve APC 19 and APC 25			0		
Qualification documents			0		
Up to two substrate controllers			0		
Integrated or external substrate pumps			0		
Sampling value SVC 25 (resterilizable)			0		

Overview of Basic Configurations CC: Additive Flow

Package Overview

Culture vessel volumes	5 L	10 L	15 L	20 L	30 L		
Basic configuration	RCP-C05L	RCP-C10L	RCP-C15L	RCP-C20L	RCP-C30L		
Control unit							
Digital controller, color display with touch screen			•				
Control capabilities							
Temperature, DO (multi-stage cascade control), stirrer speed			•				
pH control via addition of acid $ CO_2 $ and base			•				
Sequence for culture vessel sterilization (full sterilization)			•				
Maintenance-free, low-noise agitator motor			•				
Flow meter "Sparger"			• For ai	r, 0 ₂ N ₂ , CO ₂			
Flow meter "Overlay"	• For air						
Solenoid valves for gas mixing of air, O_2 , N_2 , CO_2	(Mass flow controller optional)						
Integrated peristaltic pumps				I regulation (acids			
Process data recording			- · · · p.				
BioPAT [®] MFCS DA			٠				
Supply unit	Open frame d	lecian					
		-	a nump and boat a	wahangar far haa	ting and appling		
Temperature control system	Closed loop sy	stem, recirculation	n pump and heat e	exchanger for nea	ting and cooling		
	looketod stai	nless steel oult		ical sight glass s	nd ton onitation		
Culture vessel		steel glass vess	-	ical signt glass a	nu top agitatioi		
Stirrer shaft with double mechanical seal (DMS)			٠				
Fluid buffer system DMS, compressed air pressurization			۰				
3-blade segment impeller			2				
Stainless steel filter housing for $2 \times aeration$ and exhaust incl. sterile filter			٠				
Pressure gauge –1 3 barg			٠				
Aeration tube with micro-sparger			٠				
Exhaust cooler			۰				
4 Baffels (removable)			٠				
1-Channel Sacova valve for needle free additions			٠				
3-Channel Sacova valve for needle free additions			•				
Lamp for vessel illumination (not for 5L culture vessel)			•				
Storage bottles			2				
Resterilizable floor bottom seat for sampling and harvesting			٠				
pH sensor, connection cable			٠				
pO2 sensor, connection cable			٠				
Temperature sensor Pt 100			۰				
Options							
Electric heating for culture vessel sterilization (full sterilization) and operation			0				
Weighing system for culture vessel			0				
Pressure hold test for culture vessel			0				
Culture vessel sterilization (empty and full sterilization)			0				
Lid lifting device 10–30 L			0				
Antifoam control via sensor			0				
Advanced DO controller			0				
Up to two gravimetric feed controllers,							
accuracy 7 kg balance: 5 g/h, accuracy 60 kg balance: 50 g/h			0				
Redox measurement			0				
Turbidity measurement			0				
Resterilizable addition valve APC 19 and APC 25			0				
Qualification documents			0				
Up to two substrate controllers			0				
ntegrated substrate pump			0				
Sampling value SVC 25 (resterilizable) ther accessories available.			0				

Biostat[®] Cplus – Technical Specifications

Technical Specifications

Culture ve	ssel volumes	5 L	10 L	15 L		20 L		30 L	
Dimensions $[W \times H \times D]$	["]	$35.4 \times 51.2 \times 27.6$	$39.4\times74.8\times29.5$	39.4 × 74	.8 × 29.5	39.4 × 7	4.8×29.5	39.4 × 7	4.8 × 29.
	[m]	0.9 × 1.3 × 0.7	$1.0\times1.9\times0.75$	1.0 × 1.9	× 0.75	1.0×1.9	9 × 0.75	1.0×1.9	9 × 0.75
Required door dimensions for	["]	31.5 × 51.2	31.5 × 78.7	31.5 × 78	3.7	31.5 × 7	78.7	31.5 ×	78.7
installation [W × H]	[m]	0.8 × 1.3	0.8 × 2	0.8 × 2		0.8 × 2		0.8 × 2	
System weight (approx.)	[kg]	130	210	215		215		230	
Ambient temperature relative hum (non-condensing)	idity	< 80º	% for temperatures up to) 31°C (87.8°l	F), decreasir	ng linearly <	< 50 % at 40	°C (104°F).	
Utilities requirements		Specification	Max.			ture vessel	volumes		
				flow	5 L	10 L	15 L	20 L	30 L
Process control air MO CC sparger overlay		4–6 barg 58–87 p class 2 (ISO 8573-1)	[L/min]	7.5 0.5/5	15 1/10	23 1.5/15	30 2/20	45 3/30	
O₂ MO sparger CC sparger		4 barg 58 psig, regi	[L/min]	7.5 0.5	15 1	15 1.5	30 2	45 3	
CO ₂ MO sparger CC sparger		4 barg 58 psig, regi	[L/min]	N A 0.5	N A 1	N A 1.5	N A 2	N A 3	
N ₂ MO sparger		4 barg 58 psig, regi	ulated, particle-free	[L/min]	NA	N A	NA	NA	NA
CC sparger					0.5	1	1.5	2	3
Utility steam		3 barg 29 psig, regi	ulated, particle-free	[kg/h]	7	15	15	15	15
Clean steam		2 barg 29 psig, regi	ulated, particle-free	[kg/h]	3	5	5	5	5
Coolant (supply line)		2 – 4 barg 29 – 58 p regulated, (15°C) pa	-	[L/min]	5	5	5	5	5
Coolant (return line)		2 barg (29 psig) und	er supply line	[L/min]	5	5	5	5	5
Condensate		Ambient pressure (n	nax. temp. 98°C)	[L/min]	1	1	1	1	1
Mains voltage (TNS net): 5 wire: 3 × phase, 1 × ground, 1 × ne	eutral		A, 400 VAC 50 Hz 16 A FI switch 3 × 30 mA						
Control unit	cuciui		ntroller, gassing system,	and up to 4	numps				
Control		Industry PC			I . I .				
Housing material		Stainless steel AISI 3	804						
Display operation		Touch panel 10" to	uch screen						
Interface to the host PC		Ethernet							
External inputs									
Scale connection		Maximum 2 × RS 23	32						
Analog inputs		Up to 3 (0 – 10 V)							
External substrate pumps		Up to 2 analog (0 – 1	10V)						
Gassing system									
Microbial application		0_2 enrichment or ga	s flow ratio; maximum t	otal flow rat	e: 1.5 vvm				
Cell culture application			mum aeration rate: Over			vm			
Dual use application			mum aeration rate: 1.5 v	, , ,					
Flow meter		Air calibrated; 4 bar							
Flow rates		0.6-60 mL/min up to							
Accuracy		+/- 4% FS							
Thermal mass flow controller		Air $ $ N ₂ , O ₂ or CO ₂							
Flow range		0.6-30 mL/min up t	o 1–50 L/min						
Accuracy		+/- 1% FS							
Integrated pumps			I + 2 × digital speed re	equlated)					
Pump head – for silicone hoses with wall thickness 1.6 mm 1/16"		Watson Marlow 102		, ,					
Available versions		Digitally controlled	(20 rpm) or speed-contro	olled (5–50 r	pm)				
Flow rates Hose internal diamete Flow rate: ml/revoluti		0.5 mm (1/50") 0.02	0.8 mm (1/32") 0.05	1.6 mm (0.22		3.2 mm 0.81	(1/8")	4.8 mm 1.66	(3/16")

	Open fra	me design							
Material surface roughness (product wetted parts)	Stainless	steel AISI 3	16L Ra ≤ 0.	8 µm (< 31.5	Ra)				
Temperature control system	Closed pressurized water temperature control system with recirculation pump, heat exchanger for cooling and heating, optional electric heating 8°C above coolant temperature up to 90°C up to 130°C								
Operation (operation sterilization):	8°C abov	e coolant te	mperature ι	µp to 90°C∣u	p to 130°C				
Heat exchanger (cooling stainless steel)	Stainless	steel, coppe	r soldered	stainless ste	el, copper so	oldered; Opti	on: Stainless	steel welde	d
Electric heating (option) 5L 10–30L	3 kW 6 k	<w .<="" td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></w>							
Culture vessel	5 L	10 L		15 L		20 L		30 L	
H:D ratio	2:1	2:1	3:1	2:1	3:1	2:1	3:1	2:1	3:1
Total volume	6.8 L	15 L	15 L	22 L	22 L	30 L	30 L	42 L	42 L
Working volume	5 L	10 L	10 L	15 L	15 L	20 L	20 L	30 L	30 L
Minimum operating volume*	1.6 L	4.5 L	3.5 L	5.5 L	4.5 L	7.7 L	5.5 L	9 L	7 L
Weight of culture vessel lid with attachments approx. [kg]	11	12	15	19	17	21	20	26	26
Permitted stirrer speed	20-	20-	20-	20-	20-	20-	20-	20-	20-
	1500	1500	1500	1000	1000	1000	1000	600	600
Motor power [kW]	0.5	0.8	0.8	0.8	0.8	1.2	1.2	1.2	1.2
Impeller to culture vessel diameter [6-blade disk impeller]	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Impeller to culture vessel diameter [3-blade segment impeller]	0.5	0.5	NA	0.5	NA	0.5	NA	0.5	NA
	1 × ports for stirrer 1 × ports for safety valve (for ASME 19 mm port) 4 × 19 mm ports (5 L and 10-3): 5 × 19 mm ports (10-2-30 L) 2 × orip								
	$2 \times qrip$		-2-30 LJ						
Upper port level (not for 5 L)	· ·	m ports	sk (only ASI	ME culture v	essel)				
	$3 \times 25 \text{ m}$ $1 \times \text{ports}$ $1 \times \text{lengt}$ $4 \times 25 \text{ m}$	m ports for burst di hwise view	sk (only ASM glass	ME culture v	essel)				
Upper port level (not for 5 L) Lower port level Bottom	$3 \times 25 \text{ m}$ $1 \times \text{ports}$ $1 \times \text{lengt}$ $4 \times 25 \text{ m}$ $1 \times \text{senso}$	m ports for burst di hwise view m port	sk (only ASM glass	ME culture v	essel)				
Lower port level	$3 \times 25 \text{ m}$ $1 \times \text{ports}$ $1 \times \text{lengt}$ $4 \times 25 \text{ m}$ $1 \times \text{senso}$	m ports for burst di hwise view m port or ports for l drain valve y line	sk (only ASM glass	ИЕ culture v	essel)				
Lower port level Bottom	3×25 m $1 \times ports$ $1 \times lengt$ 4×25 m $1 \times senso$ $1 \times floor$ $1 \times suppl$ $1 \times return$ Double-w	m ports for burst di hwise view m port or ports for l drain valve ly line n line	sk (only ASM glass Pt100 ess steel vess			sign and leng	1thwise view	glass, stirrei	r from top 5 L:
Lower port level Bottom Jacket Culture vessel design	3×25 m $1 \times ports$ $1 \times lengt$ 4×25 m $1 \times senso$ $1 \times floor$ $1 \times suppl$ $1 \times return$ Double-w Stainless	m ports for burst di hwise view m port or ports for l drain valve y line n line valled stainle steel glass	sk (only ASI glass Pt100 ess steel vese vessel		per floor des	sign and leng	thwise view	glass, stirrei	r from top 5 L:
Lower port level Bottom Jacket Culture vessel design Material (product wetted)	3 × 25 m 1 × ports 1 × lengt 4 × 25 m 1 × senso 1 × floor 1 × suppl 1 × retur Double-w Stainless Stainless	m ports for burst di hwise view m port or ports for l drain valve y line n line valled stainl steel glass steel AISI 3	sk (only ASI glass Pt100 ess steel vese vessel 16 L borosil	sel with Klöp	per floor des		thwise view	glass, stirrei	r from top 5 L:
Lower port level Bottom Jacket Culture vessel design Material (product wetted) Surface (product wetted) culture vessel attachements	$\begin{array}{l} 3\times25 \text{ m} \\ 1\times\text{ports} \\ 1\times\text{lengt} \\ 4\times25 \text{ m} \\ 1\times\text{senso} \\ 1\times\text{senso} \\ 1\times\text{suppl} \\ 1\times\text{return} \\ 0\text{ouble-w} \\ \text{Stainless} \\ \text{Stainless} \\ \text{Ra} \leq 0.5 \end{array}$	m ports for burst di hwise view m port or ports for l drain valve ly line n line valled stainle steel glass steel AISI 3 µm (≤ 19.7	sk (only ASI glass Pt100 ess steel vese vessel 16 L borosil Ra) Ra < 0.8	sel with Klöp icate glass I 3 µm (< 31.5	per floor des EPDM (FDA) Ra), electro	polished	thwise view		r from top 5 L:
Lower port level Bottom Jacket Culture vessel design Material (product wetted) Surface (product wetted) culture vessel attachements Culture vessel design Vessel Jacket	$\begin{array}{l} 3\times25 \text{ m} \\ 1\times\text{ports} \\ 1\times\text{lengt} \\ 4\times25 \text{ m} \\ 1\times\text{senso} \\ 1\times\text{senso} \\ 1\times\text{suppl} \\ 1\times\text{return} \\ 0\text{ouble-w} \\ \text{Stainless} \\ \text{Stainless} \\ \text{Ra} \leq 0.5 \end{array}$	m ports for burst di hwise view m port or ports for l drain valve ly line n line valled stainle steel glass steel AISI 3 µm (≤ 19.7	sk (only ASI glass Pt100 ess steel vese vessel 16 L borosil Ra) Ra < 0.8	sel with Klöp icate glass I 3 µm (< 31.5	per floor des EPDM (FDA) Ra), electro	polished			r from top 5 L:
Lower port level Bottom Jacket Culture vessel design Material (product wetted) Surface (product wetted) culture vessel attachements Culture vessel design Vessel Jacket Sensors measuring range readability	3×25 m $1 \times \text{ports}$ $1 \times \text{lengt}$ 4×25 m $1 \times \text{senso}$ $1 \times \text{senso}$ $1 \times \text{suppl}$ $1 \times \text{return}$ Double-w Stainless Stainless Ra ≤ 0.5 f 5L: -1- +	m ports for burst di hwise view m port or ports for l drain valve y line n line valled stainle steel glass steel AISI 3 μ m (\leq 19.7 l 2.5 barg @	sk (only ASM glass Pt100 ess steel vese vessel 16 L borosil Ra) Ra < 0.8 150°C; 10–3	sel with Klöp icate glass Ι 3 μm (< 31.5 30L: -1- +3	per floor des EPDM (FDA) Ra), electro	polished			r from top 5 L:
Lower port level Bottom Jacket Culture vessel design Material (product wetted) Surface (product wetted) culture vessel attachements Culture vessel design Vessel Jacket Sensors measuring range readability p02	3×25 m $1 \times \text{ports}$ $1 \times \text{lengt}$ 4×25 m $1 \times \text{lengt}$ 4×25 m $1 \times \text{senso}$ $1 \times \text{suppl}$ $1 \times \text{return}$ Double-w Stainless Stainless Ra ≤ 0.5 f 5L: -1- + Amperor	m ports for burst di hwise view m port or ports for l drain valve y line n line valled stainly steel glass steel AISI 3 $\mu m (\leq 19.7 \text{ I})$ 2.5 barg @	sk (only ASM glass Pt100 ess steel vess vessel 16 L borosil Ra) Ra < 0.8 150°C; 10–3 ic 0–100%	sel with Klöp icate glass Ι 3 μm (< 31.5 30L: -1- +3	per floor des EPDM (FDA) Ra), electro	polished			r from top 5 L:
Lower port level Bottom Jacket Culture vessel design Material (product wetted) Surface (product wetted) culture vessel attachements Culture vessel design Vessel Jacket Sensors measuring range readability pO2 pH	3×25 m $1 \times \text{ports}$ $1 \times \text{lengt}$ 4×25 m $1 \times \text{lengt}$ 4×25 m $1 \times \text{senso}$ $1 \times \text{suppl}$ $1 \times \text{return}$ Double-w Stainless Stainless Stainless Ra ≤ 0.5 5L: $-1- +AmperonGel-filled$	m ports for burst di hwise view m port or ports for l drain valve y line n line valled stainle steel glass steel AISI 3 μ m (\leq 19.7 I 2.5 barg @ netric or opt	sk (only ASI glass Pt100 ess steel vese vessel 16 L borosil Ra) Ra < 0.8 150°C; 10–3 ic 0–100% 1 pH	sel with Klöp icate glass I 3 µm (< 31.5 30L: -1– +3 1% 0.1%	per floor des EPDM (FDA) Ra), electro parg @ 150'	polished			r from top 5 L:
Lower port level Bottom Jacket Culture vessel design Material (product wetted) Surface (product wetted) culture vessel attachements Culture vessel design Vessel Jacket Sensors measuring range readability pO2 pH Foam level high foam	3×25 m $1 \times \text{ports}$ $1 \times \text{lengt}$ 4×25 m $1 \times \text{lengt}$ 4×25 m $1 \times \text{suppl}$ $1 \times \text{suppl}$ $1 \times \text{return}$ Double-w Stainless Stainless Stainless $\text{Ra} \le 0.5$ 5L: -1- + Amperoni Gel-filled Conductii	m ports for burst di hwise view m port or ports for I drain valve y line n line valled stainle steel glass steel AISI 3 $\mu m (\leq 19.7 I2.5 barg @netric or opt 2–12 0.0ve, stainless$	sk (only ASI glass Pt100 ess steel vese vessel 16 L borosil Ra) Ra < 0.8 150°C; 10–3 ic 0–100% 1 pH steel body v	sel with Klöp icate glass l 3 µm (< 31.5 30L: -1- +3 1% 0.1% with ceramic	per floor des EPDM (FDA) Ra), electro barg @ 150 insulation	polished			r from top 5 L:
Lower port level Bottom Jacket Culture vessel design Material (product wetted) Surface (product wetted) culture vessel attachements Culture vessel design Vessel Jacket Sensors measuring range readability pO2 pH Foam level high foam Temperature culture vessel temperature control system	$3 \times 25 \text{ m}$ $1 \times \text{ports}$ $1 \times \text{lengt}$ $4 \times 25 \text{ m}$ $1 \times \text{senso}$ $1 \times \text{floor}$ $1 \times \text{suppl}$ $1 \times \text{return}$ Double-w Stainless $\text{Ra} \le 0.5 \text{ m}$ 5L: -1 - + Amperom Gel-filled Conduction $\text{Pt100} \mid 0 -$	m ports for burst di hwise view m port or ports for I drain valve y line n line valled stainli- steel glass steel AISI 3 $\mu m (\leq 19.7 I2.5 barg @$ netric or opt 2–12 0.0 ve, stainless –150°C 0.1	sk (only ASI glass Pt100 ess steel ves vessel 16 L borosil Ra) Ra < 0.8 150°C; 10–3 ic 0–100% 1 pH steel body v C / Pt100 C	sel with Klöp icate glass 1 3 µm (< 31.5 30L: -1- +3 1% 0.1% with ceramic)-150°C 0.1	per floor des EPDM (FDA) Ra), electro barg @ 150 insulation	polished			r from top 5 L:
Lower port level Bottom Jacket Culture vessel design Material (product wetted) Surface (product wetted) culture vessel attachements Culture vessel design Vessel Jacket Sensors measuring range readability pO2 pH Foam level high foam Temperature culture vessel temperature control system pH redox	$3 \times 25 \text{ m}$ $1 \times \text{ports}$ $1 \times \text{lengt}$ $4 \times 25 \text{ m}$ $1 \times \text{senso}$ $1 \times \text{store}$ $1 \times \text{suppl}$ $1 \times \text{return}$ Double-w Stainless Stainless Ra $\leq 0.5 \text{ m}$ 5L: -1 - + Amperon Gel-filled Conductii Pt100 0- Gel-filled	m ports for burst di hwise view m port or ports for l drain valve y line n line valled stainly steel glass steel AISI 3 μ m (\leq 19.7 l 2.5 barg @ netric or opt 2–12 0.0 ve, stainless -150°C 0.1 -2000–20	sk (only ASI glass Pt100 ess steel vess vessel 16 L borosil Ra) Ra < 0.8 150°C; 10–3 ic 0–100% 1 pH steel body v C / Pt100 C 00 mV 1 m	sel with Klöp icate glass 1 3 µm (< 31.5 30L: -1- +3 1% 0.1% with ceramic)-150°C 0.1 V	per floor des EPDM (FDA) Ra), electro barg @ 150 insulation	polished			r from top 5 L:
Lower port level Bottom Jacket Culture vessel design Material (product wetted) Surface (product wetted) culture vessel attachements Culture vessel design Vessel Jacket Sensors measuring range readability pO2 pH Foam level high foam Temperature culture vessel temperature control system	$3 \times 25 \text{ m}$ $1 \times \text{ports}$ $1 \times \text{lengt}$ $4 \times 25 \text{ m}$ $1 \times \text{senso}$ $1 \times \text{sloor}$ $1 \times \text{suppl}$ $1 \times \text{return}$ Double-w Stainless Stainless Stainless Ra $\leq 0.5 \text{ j}$ SL: -1 - + Amperom Gel-filled Conductii Pt100 0- Gel-filled Piezoresis	m ports for burst di hwise view m port or ports for l drain valve ly line n line valled stainly steel glass steel AISI 3 μ m (\leq 19.7 l 2.5 barg @ hetric or opt 2–12 0.0 ve, stainless -150°C 0.1 -2000–20 stive sensor	sk (only ASI glass Pt100 ess steel vest vessel 16 L borosil Ra) Ra < 0.8 150°C; 10-3 ic 0-100% 1 pH steel body v C / Pt100 C 00 mV 1 m -0.5-2 [bat	sel with Klöp icate glass I 3 µm (< 31.5 30L: -1- +3 1% 0.1% with ceramic 0-150°C 0.1 V rg] 1 mbar	per floor des EPDM (FDA) Ra), electro barg @ 150 insulation C	polished °C -1- +4 t		c	r from top 5 L:

Sales and Service Contacts

For further contacts, visit www.sartorius-stedim.com

Netherlands

Poland

Sartorius Stedim Netherlands B.V.

Sartorius Stedim Poland Sp. z o.o.

LLC "Sartorius ICR" and LLC "Biohit"

filtratie.nederland@sartorius-stedim.com

Phone +31.30.60.25.080

Fax +31.30.60.25.099

ul. Wrzesinska 70

62-025 Kostrzyn

Phone +48.61.647.38.40

Fax +48.61.879.25.04

Russian Federation

Uralskaya str. 4, Lit. B

199155, Saint-Petersburg

Sartorius Stedim Spain, S.A.U.

Phone +7.812.327.5.327

Avda. de la Industria, 32

Phone +34.902.110.935

Fax +34.91.358.96.23

28108 Alcobendas (Madrid)

Sartorius Stedim Switzerland AG

Edificio PAYMA

Switzerland

U.K.

Ringstrasse 24 a

8317 Tagelswangen

Phone +41.52.354.36.36

Sartorius Stedim UK Ltd.

Blenheim Road, Epsom

Phone +44.1372.737159

Fax +44.1372.726171

Surrey KT19 9 QQ

Ukraine

LLC "Biohit"

Post Box 440 "B"

01001 Kiev, Ukraine

Phone +380.44.411.4918

Fax +380.50.623.3162

Longmead Business Centre

Fax +41.52.354.36.46

Fax +7.812.327.5.323

Spain

Europe

Germany Sartorius Stedim Biotech GmbH August-Spindler-Strasse 11 37079 Goettingen

Phone +49.551.308.0 Fax +49.551.308.3289

Sartorius Stedim Systems GmbH Robert-Bosch-Strasse 5 – 7 34302 Guxhagen

Phone +49.5665.407.0 Fax +49.5665.407.2200

France

Sartorius Stedim FMT S.A.S. ZI des Paluds Avenue de Jouques – CS 91051 13781 Aubagne Cedex

Phone +33.442.845600 Fax +33.442.845619

Sartorius Stedim France SAS ZI des Paluds Avenue de Jouques – CS 71058 13781 Aubagne Cedex

Phone +33.442.845600 Fax +33.442.846545

Austria

Sartorius Stedim Austria GmbH Modecenterstrasse 22 1030 Vienna

Phone +43.1.7965763.18 Fax +43.1.796576344

Belgium

Sartorius Stedim Belgium N.V. Leuvensesteenweg, 248/B 1800 Vilvoorde

Phone +32.2.756.06.80 Fax +32.2.756.06.81

Hungary

Sartorius Stedim Hungária Kft. Kagyló u. 5 2092 Budakeszi

Phone +36.23.457.227 Fax +36.23.457.147

Italy

Sartorius Stedim Italy S.p.A. Via dell'Antella, 76/A 50012 Antella-Bagno a Ripoli (FI)

Phone +39.055.63.40.41 Fax +39.055.63.40.526

America

USA Sartorius Stedim North America Inc. 5 Orville Drive, Suite 200 Bohemia, NY 11716 Toll-Free +1.800.368.7178

Argentina

Sartorius Argentina S.A. Int. A. Ávalos 4251 B1605ECS Munro Buenos Aires Phone +54.11.4721.0505 Fax +54.11.4762.2333

Fax +1.631.254.4253

Brazil

Sartorius do Brasil Ltda Avenida Senador Vergueiro 2962 São Bernardo do Campo CEP 09600-000 - SP- Brasil

Phone +55.11.4362.8900 Fax + 55.11.4362.8901

Mexico

Sartorius de México S.A. de C.V. Circuito Circunvalación Poniente No. 149 Ciudad Satélite 53100, Estado de México México

Phone +52.5555.62.1102 Fax +52.5555.62.2942

Asia | Pacific

Australia

Sartorius Stedim Australia Pty. Ltd. Unit 5, 7-11 Rodeo Drive Dandenong South Vic 3175 Phone +61.3.8762.1800

Fax +61.3.8762.1828

China Sartorius Stedim Biotech (Beijing) Co. Ltd. No. 33 Yu'an Road Airport Industrial Park Zone B Shunyi District, Beijing 101300 Phone +86.10.80426516 Fax +86.10.80426580

Sartorius Stedim (Shanghai) Trading Co. Ltd 3rd Floor, North Wing, Tower 1 No. 4560 Jinke Road Zhangjiang Hi–Tech Park Pudong District Shanghai 201210, China

Phone +86.21.68782300 Fax +86.21.68782332 | 68782882

Sartorius Stedim Biotech (Beijing) Co. Ltd. Guangzhou Representative Office Unit K, Building 23 Huihua Commerce & Trade Building No. 80 Xianlie Middle Road Guangzhou 510070

Phone +86.20.37618687 | 37618651 Fax +86.20.37619051

India

Sartorius Stedim India Pvt. Ltd. #69/2-69/3, NH 48, Jakkasandra Nelamangala Tq 562 123 Bangalore, India Phone +91.80.4350.5250 Fax +91.80.4350.5253

Japan

Sartorius Stedim Japan K.K. 4th Fl., Daiwa Shinagawa North Bldg. 8-11, Kita-Shinagawa 1-chome Shinagawa-ku, Tokyo, 140-0001 Japan

Phone +81.3.4331.4300 Fax +81.3.4331.4301

Malaysia

Sartorius Stedim Malaysia Sdn. Bhd. Lot L3-E-3B, Enterprise 4 Technology Park Malaysia Bukit Jalil 57000 Kuala Lumpur, Malaysia

Phone +60.3.8996.0622 Fax +60.3.8996.0755

Singapore

Sartorius Stedim Singapore Pte. Ltd. 1 Science Park Road, The Capricorn, #05-08A, Singapore Science Park II Singapore 117528

Phone +65.6872.3966 Fax +65.6778.2494

South Korea

Sartorius Korea Biotech Co., Ltd. 8th Floor, Solid Space B/D, PanGyoYeok-Ro 220, BunDang-Gu SeongNam-Si, GyeongGi-Do, 463-400

Phone +82.31.622.5700 Fax +82.31.622.5799

