

# Techfors

The Techfors pilot scale bioreactor offers a customized solution for bioprocesses on a production scale. Each Techfors pilot scale bioreactor is designed individually according to your needs. Therefore, the specifications listed in the following represent the standard configurations and are not exhaustive.



## Dimensions

*Please note that the information on dimensions are only approximate values without optional components. As each Techfors is individual, the specifications may differ.*

Dimensions base unit	75 L	150 L	300 L	750 L
Width, mm	1300	1300	1550	2020
Depth, mm	1120	1250	1430	1850
Height (without CIP), mm	2560	2560	3530	4120
Height (with CIP), mm	2975	2975	3650	4450

## Vessel

Vessel sizes and dimensions				
Total volume (TV), L	75	150	300	750
Max. working volume, L	50	100	200	500
Min. working volume, L	12	20	35	87
Total volume vessel jacket, L	4.2	10.5	17.6	31
Height, mm <sup>1)</sup>	984	1200	1600	2079
Inside diameter, mm	316	411	500	688
Ratio H/D	3.1:1	2.9:1	3.2:1	3.0:1

<sup>1)</sup> without top plate and bottom valve

Materials		
Parts in contact with medium	Material	AISI 316L
	Surface roughness	Ra ≤ 0.6 µm, electropolished
Parts not in contact with medium	Material	AISI 304
	Surface roughness	Ra ≤ 1.2 µm, electropolished
O-Rings <sup>1)</sup>	EPDM	
Gaskets <sup>1)</sup>	EPDM/PTFE	

<sup>1)</sup> all product wetted membranes are FDA approved

Limits		
Temperature range	Vessel	-10 °C to +150 °C
	Vessel jacket	-10 °C to +150 °C
Pressure range	Vessel	-1 bar to +4 bar <sup>1)</sup>
	Vessel jacket	-1 bar to +3.5 bar

<sup>1)</sup> all pressures refer to overpressure (bar(g)) unless stated otherwise.

Bottom valve (harvest valve)	
Actuator	Pneumatic
Process connection	Tri-Clamp 1" (ASME-BPE 2009)
Sample valve	
Actuator	Manual
Process connection	Ingold nozzle, ID = 25 mm

## Vessel Ports

Vessel top plate ports		Quantity acc. to total volume			
		75 L	150 L	300 L	750 L
19 mm with Rd28x1/8 (e.g. sensors, push valves, manometer, etc.)		9	9	9	12
Tri-Clamp 1-1/2" (exit gas, pressure safety device)		2	2	2	---
Tri-Clamp 1-1/2" (optional CIP system)		2	2	2	2
Tri-Clamp ISO DN25 (pressure safety device)		---	---	---	1
Tri-Clamp 2-1/2" (exit gas)		---	---	---	1
Ingold nozzles and other ports		Quantity acc. to total volume			
		75 L	150 L	300 L	750 L
Vessel upper section					
Tri-Clamp (headspace and sparger gassing)	ISO DN10	2	2	---	---
	ISO DN15	---	---	2	---
	ISO DN25	---	---	---	2
Ingold nozzle, ID = 25 mm, G1-1/4", horizontal (e.g. feed lines)		2	2	2	2
Vessel jacket					
Ingold nozzle, ID = 25 mm, G1-1/4", angled (15°) (sensors)		4	4	4	4
Ingold nozzle, ID = 25 mm, G1-1/4", horizontal (e.g. sample valve)		1	1	1	1

## Stirrer

General			
Drive			Bottom drive
Sealing			Double mechanical seal (SiC/Carbone)
Direction of rotation of stirrer shaft			Clockwise (top view)
Range rotation speed <sup>1)</sup>	Motor type		Servo drive
	75 L		60 min <sup>-1</sup> to 1000 min <sup>-1</sup>
	150 L		60 min <sup>-1</sup> to 850 min <sup>-1</sup>
	300 L		60 min <sup>-1</sup> to 700 min <sup>-1</sup>
Accuracy measurement and control	750 L		60 min <sup>-1</sup> to 500 min <sup>-1</sup>
	at ≤ 1000 min <sup>-1</sup>		± 5 min <sup>-1</sup>
at > 1000 min <sup>-1</sup>			1 % setpoint

<sup>1)</sup> Rotation speed ranges apply in liquid with viscosity similar to water, with or without gassing.

Impellers				
Type	Rushton impeller, 6 blades			
Material	AISI 316L, Ra 0.8 µm, electro-polished			
Quantity	3			
Dimensions impellers [mm]			75 L	150 L
	A	105	132	150
	B	21	26	30
	C	26	33	42
			750 L	
			230	
			45	
			60	

## Gassing System

General specifications		
Gas entry		Ring sparger
Gas(ses)		Air Air + O <sub>2</sub> Air + N <sub>2</sub> Air + O <sub>2</sub> + N <sub>2</sub> Additional gas: CO <sub>2</sub>
Accuracy measurement and control	at ≤ 150 L min <sup>-1</sup>	± 2 % FS
	at > 150 L min <sup>-1</sup>	± 3 % FS
Gassing strategy variant Standard		
Gas flow control		1 MFC
Gas mix control (only relevant for multi-gas configurations)		1 solenoid valve per gas
Gassing strategy variant High End		
Gas flow control		1 MFC per gas
Gas mix control (only relevant for multi-gas configurations)		via MFCs
Mass Flow Controllers (MFC)		
Vessel sizes: 75 L, 150 L, 300 L (CO <sub>2</sub> )	Type	Red-y smart series, Hi-Performance
	Dynamic	1:100
Vessel sizes: 300 L (other than CO <sub>2</sub> ), 750 L	Type	Bürkert 8626
	Dynamic	1:50
Control ranges MFCs in L min <sup>-1</sup>		
Vessel size		Air, O <sub>2</sub> , N <sub>2</sub> CO <sub>2</sub>
75 L TV	1 to 100	0.5 to 50
150 L TV	2 to 200	1 to 100
300 L TV	8 to 400	2 to 200
750 L TV	20 to 1000	10 to 500
Filter		
75 L and 150 L	Type filter housing	Advanta Junior AGT
	Type filter element	Emflon II, Polypropylen
	Retention rate	0.2 µm
300 L and 750 L	Type filter housing	PGT 5"
	Type filter element	Emflon PFR 5"
	Retention rate	0.2 µm

## Temperature Control System

Heating	Standard	Steam heating via house steam supply
	Option	Steam generator (→ Page 5)
Cooling	Standard	Tap water / cooling water system (on site)
	Options	Switching from tap to chilled water (automatic or via manual ball valves)
		Chiller (→ Page 5)
Sterilisation		Automatic with steam
Sensor	Vessel	Pt100 class A, 1/3 DIN
	Temperature control system	Pt100 class B, 1/3 DIN
Temperature range	Sterilisation	110 °C to 125 °C
	Cultivation 1)	10 °C to 79 °C
Accuracy measurement and control (cultivation)	at ≤ 60 °C	± 0.3 °C
	at > 60 °C	± 0.5 °C
Heating circuit	75 L to 300 L	Closed loop water circuit
	750 L	Open loop water circuit

1) at 4 °C cooling media temperature and 25 °C ambient temperature

## Exit Gas System

Components		
Exit gas cooler	Material	Stainless steel
Filter	Type filter housing (with CIP)	PGT 5"
	Type filter housing (without CIP)	PLI 5"
	Type filter element	Emflon PFR 5"
	Retention rate	0.2 µm
Steam trap	Type	Thermal steam trap
	Material	Stainless steel

## Antifoam Control

Sensor	Conductive
Control	Peristaltic pump <i>Antifoam</i>
Display	0 (no foam) / 100 (foam)

## pH Control

General	
Control	Peristaltic pumps <i>Acid and Base</i>
Control range	pH 2 to 12
Accuracy measurement	pH ± 0.1
Measurement system HAMILTON (digital)	
Sensor type	Easyferm Plus ARC
Measurement range	pH 0 to 14
Measurement system METTLER (digital)	
Sensor type	InPro 3253i, ISM
Measurement range	pH 0 to 12
Measurement system METTLER (analog)	
Sensor type	405-DPAS-SC-K8S/120
Measurement range	pH 2 to 12

## pO<sub>2</sub> Control

General	
Control via cascade	Stirrer, gas flow, gas mixture (addition of O <sub>2</sub> )
Control range	0 %sat. to 100 %sat.
Accuracy measurement	± 1 %
Measurement system HAMILTON (digital)	
Sensor type	Visiferm DO ARC / RS485-ECS
Measurement range	0 %sat. to 300 %sat.
Measurement system METTLER (digital)	
Sensor type	InPro6860i, ISM
Allowed temperature range	0 °C to 60 °C
Measurement range	0 %sat. to 285 %sat.
Measurement system METTLER (analog)	
Sensor type	InPro 6820/25/080
Measurement range	0 %sat. to 150 %sat.

## Pumps

### Integrated Pumps

General		
Type		Peristaltic pump with 4-roll pump head 114DV
Quantity digital		3 (Acid, Base, Antifoam)
Quantity analogue	Standard	1 (Feed)
	Option	2 (Feed 2 and Feed 3)
Rotation speed digital (fixed speed)		200 min <sup>-1</sup>
Rotation speed analogue (adjustable within range of 0 % to 100 %, increment 0.1 %)		0 min <sup>-1</sup> to 200 min <sup>-1</sup>
Accuracy		± 5 min <sup>-1</sup>
Pump hoses	Sizes (ID)	0.5 mm to 4.8 mm
	Wall thickness	1.6 mm

Flow rates in mL min <sup>-1</sup> (values valid for new marprene pump hoses)		
Inside diameter hose	1 % speed	100 % speed
0.5 mm	0.038	3.917
1.6 mm	0.26	27.2
3.2 mm (Standard)	0.85	84.97
4.8 mm	1.7	172.2

### External Pumps (Option)

A: Masterflex L/S Cytoflow, 3-roll pump head  
 B: Watson Marlow 120U  
 C: Watson Marlow 323U/D2

	A	B	C
Max. rotation speed, min <sup>-1</sup>	600	200	400
Setting range, %	0 to 100	0 to 100	0 to 100
Increment, %	0.1	0.1	0.1
Min. flow rate, mL min <sup>-1</sup>	0.06	0.002	0.09
Max. flow rate, mL min <sup>-1</sup>	3400	190	2000

## Vessel Pressure Display (Manometer)

Connection	19 mm port in top plate
O-ring material	EPDM
Measurement range	-1 bar to 4 bar

## Pressure Safety

Safety valve vessel	Type	Clean service spring-loaded safety valve
	Response pressure	4 bar
Rupture disc vessel	Type	Sanitary rupture disc with or without indicator
	Response pressure	4 bar
Safety valve temperature control circuit	Type	Standard safety valve, angle type, spring-loaded
	Response pressure	3.5 bar

## Operating Panel

HMI	17" colour touch screen
Protection	IP 66

## Steam Generator (Optional)

*A: Variant 15 kW*  
*B: Variant 20 kW*  
*C: Variant 30 kW*  
*D: Variant 45 kW*  
*E: Variant 60 kW*

	A	B	C	D	E
Power, kW	15	20	30	45	60
Max. steam power, kg h <sup>-1</sup>	21	27	41	63	82
Suitable for vessel volume, L	75	75, 150	150, 300	300, 750	750
Heating phase approx., min	60	45, 60	45, 105	75, 210	180
Mains supply	400 V (± 5 %) / 50/60 Hz				

## Chiller (Optional)

*A: Variant 4 kW*  
*B: Variant 7 kW*  
*C: Variant 11 kW*

	A	B	C
Max. cooling capacity, kW	4	7	11
Suitable for vessel volume, L	75, 150	150, 300	300, 750
Mains supply	400 V / 3 Ph. / 50 Hz 230 V / 3 Ph. / 60 Hz		

## Level Detection (Optional)

Sensor	Conductive, mounting depth adjustable
Display	0 (no liquid) / 100 (liquid)

## Turbidity Measurement (Optional)

Sensor type	ASD25-N
Optical path lengths	OPL01 (highest cell densities) OPL05 (higher cell densities) OPL10 (lower cell densities)
Measurement range absorption	0 CU to 4 CU

## Exit Gas Analysis (Optional)

	CO <sub>2</sub>	O <sub>2</sub>
Ranges, Vol. %	BlueInOne Ferm	0 to 10 1 to 25
		0 to 10 1 to 50
		0 to 25 1 to 25
	BlueInOne Cell	0 to 10 0 to 100
	BlueVary (cartridge ZrO <sub>2</sub> )	0 to 10 0.1 to 50
	BlueVary (cartridge eC)	0 to 25 0 to 25 0 to 10 0 to 100

Sensor accuracy	BlueInOne Ferm, BlueInOne Cell	< ± 0.2 % FS, ± 3 % of value
BlueVary CO <sub>2</sub>	± 3 % of value, ± 0.2 % of range; ± 5 % of value, ± 0.5 % of range for 50 % range	± 3 % of value, ± 0.2 % of range; ± 5 % of value, ± 0.5 % of range for 50 % range
BlueVary O <sub>2</sub> (eC and ZrO <sub>2</sub> )	± 3 % of value, ± 0.2 % of range	± 3 % of value, ± 0.2 % of range
Sensor drift	BlueInOne Ferm, BlueInOne Cell	< ± 2 % value / year
BlueVary		0.2 % value / month

## pCO<sub>2</sub> Measurement (Optional)

Sensor type	InPro5000i, ISM (digital)
Transmitter type	M400
Measurement range	0 hPa to 1000 hPa

## Redox Measurement (Optional)

Measurement system HAMILTON digital	
Sensor type	Easyferm Plus ORP ARC
Measurement range	-1500 mV to +1500 mV
Accuracy	± 10 mV
Measurement system METTLER analogue	
Sensor type	Pt4805-DPAS-SC-K8S
Measurement range	-2000 mV to +2000 mV
Accuracy	± 10 %

## Pressure Control (Optional)

Sensor	Piezo-resistive pressure transmitter
Measurement range	-1 bar to 3 bar
Control	Proportional valve with electronic open-loop control
Control range	0 bar to 1.5 bar
Accuracy measurement and control	± 0.1 bar

## Weight Measurement (Optional)

Sensor type	Bending rod load cell
Quantity	75 L to 300 L
	750 L
Accuracy measurement	± 1 % FS (total volume)

## Foam Detection Exit Gas (Optional)

Sensor	Conductive
Display	0 (no foam) / 100 (foam) with alarm
Action	Alarm <i>High foam detected</i> is triggered, gassing is switched off

## CIP System (Optional)

*Note: The CIP system is available either as an integrated option or as a mobile unit, the INFORS HT TechCIP. The specifications below apply to both variants. Additionally, the TechCIP is equipped with four wheels, a control unit with touchscreen and two peristaltic pumps.*

Pump	
Type	Stainless steel centrifugal pump
Shaft seal	Simple mechanical seal

Conductivity sensor		
Sensor type		Conducell 4USF ARC
Measurement range		1 $\mu$ S cm <sup>-1</sup> to 300000 $\mu$ S cm <sup>-1</sup>
Accuracy	at $\leq$ 100000 $\mu$ S cm <sup>-1</sup>	± 3 %
	at > 100000 $\mu$ S cm <sup>-1</sup>	± 5 %

Spray Balls		
Quantity		2
Diameter		25 mm

## Balances (Option)

A: Mettler MA6002  
B: Mettler MA32001L

C: Kern FKB 6K0.02-B  
D: Kern DS 30K0.1-A

	A	B	C	D
Max. capacity, kg	6.2	32.2	6	30
Readability, g	0.1	0.1	0.02	0.1
Power supply	100 to 240 V, 50/60 Hz, 0.3 A			

*Note: In order to use one of the supported balances, the balance must be prepared and configured by INFORS HT.*

## Lifting Device for Vessel Top Plate (Optional)

Manual lifting device	Manual lifting device with pulley block integrated into the frame.
Automatic lifting device	Electronic lifting device. Rotates the top plate to 90°.

## Peripherals (Optional)

Resterilisable feed line	Allows a sterile connection between the bioreactor and a container for the sterile addition of liquid.
Resterilisable transfer line	Allows a sterile connection between the bioreactor and an external tank to transfer the liquid from/to the bioreactor.

## Operating Conditions

Ambient temperature	5 °C to 35 °C
Ambient humidity	20 % to 90 %
Altitude operating location	max. 2000 m.a.s.l
Pollution degree as per EN 61010-1	2
Minimum distance	150 mm

## Various

Sound pressure	< 70 dB (A)
IP rating instrumentation cabinet	IP43

## Electrical Connection and Power Values

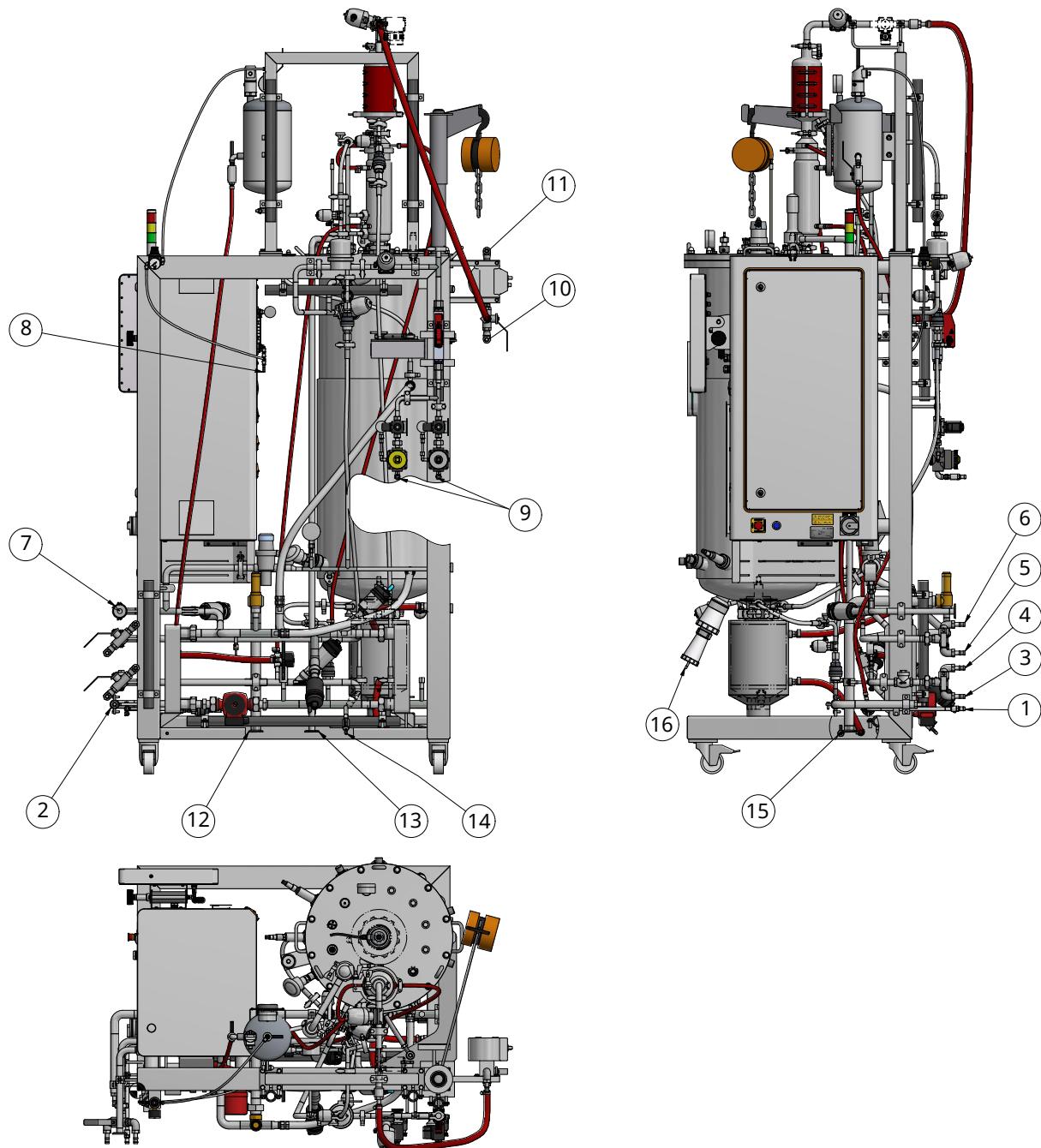
Bioreactor	
Mains voltage (3 phases L1, L2, L3 + N (neutral) + PE (earth))	400 V (± 5 %)
Mains frequency	50 Hz or 60 Hz
Max. rated current	16 A
Leakage current	> 3.5 mA
Drive system (only for vessel 750 L)	
Mains voltage (3 phases L1, L2, L3 + N (neutral) + PE (earth))	400 V (± 5 %)
Mains frequency	50 Hz or 60 Hz
Max. rated current	32 A

## Interfaces

9-pin D-SUB, RS232	Balance input
USB 2.0	Backups/service purposes
Ethernet, RJ45	To integrate the device into a network

## Connections/Utilities

*Note: The following illustration and the information on the connection values correspond to a typical configuration of a device with a total volume of 150 L. The specifications may vary depending on the size and project-specific customizations.*



Pos.	Connection	Connection type	Pressure	Requirements
1	Not contaminated condensate	Hose nozzle DN 13	No backpressure	<ul style="list-style-type: none"> <li>■ Drains must be heat resistant (max. 100 °C).</li> <li>■ Contaminated liquids must be drained safely and disposed of in an environmentally friendly manner.</li> </ul>
2	Contaminated condensate	Hose nozzle DN 13	No backpressure	
3	Tap water in	Hose nozzle DN 13	2.5 bar to 4.0 bar	<ul style="list-style-type: none"> <li>■ <math>\text{CaCO}_3</math> concentration 0 mmol L<sup>-1</sup> to 1.5 mmol L<sup>-1</sup></li> </ul>
4	Chilled water in (Option)	Hose nozzle DN 13	2.5 bar to 4.0 bar	
5	Tap water out	Hose nozzle DN 13	No backpressure	<ul style="list-style-type: none"> <li>■ Temperature resistant up to 100 °C.</li> </ul>
6	Chilled water out (Option)	Hose nozzle DN 13	No backpressure	<ul style="list-style-type: none"> <li>■ Backpressure must not exceed 1.0 bar <math>\Delta p</math>.</li> </ul>
7	Clean steam in	Tri-Clamp DN 15	2.5 bar to 2.7 bar	<ul style="list-style-type: none"> <li>■ Steam must be dry at the specified operating pressure and with the correct flow rate for the size of the bioreactor to be sterilised.</li> <li>■ Clean steam quality and can pass through a 5 micron filter.</li> </ul>
8	Instrument air	Hose nozzle DN 6	6.0 bar to 7.0 bar	<ul style="list-style-type: none"> <li>■ Air must be free of oil, dry and neutral (recommended pre-filter 5 <math>\mu\text{m}</math>).</li> </ul>
9	Gas in (air and other gases)	Hose nozzle DN 13	4.0 bar to 6.0 bar	<ul style="list-style-type: none"> <li>■ Gases must be dry, clean and free of oil and dust; (recommended pre-filter: 10 <math>\mu\text{m}</math>).</li> <li>■ Recommended compressed air quality as per DIN ISO 8573-1: Class 1,2,3,4</li> </ul>
10	Exit gas	Hose nozzle DN 13	No backpressure	<ul style="list-style-type: none"> <li>■ Must be dissipated securely with a suitable, gas-tight hose.</li> </ul>
11	Gas analysis (Option)	Hose nozzle DN 13	No backpressure	
12	Safety valve (Temp.-system)	Tri-Clamp DN 25	No backpressure	<ul style="list-style-type: none"> <li>■ The safety valve line must have no, or at most a backpressure of 10 % of the set pressure.</li> </ul>
13	Safety valve (Vessel)	Tri-Clamp DN 15	No backpressure	<ul style="list-style-type: none"> <li>■ The safety valve line must have no, or at most a backpressure of 15 % of the set pressure.</li> </ul>
14	Emptying valve (Temp.-system)	Hose nozzle DN 8	No backpressure	
15	Emptying valve (Frame)	Hose nozzle DN 8	No backpressure	
16	Harvest-/Sample valve	Hose nozzle DN 35	-	
n. A.	CIP inlet (WFI) (option)	Tri-Clamp DN 15	max. 3.0 bar	<ul style="list-style-type: none"> <li>■ WFI, Water for Injection</li> </ul>
n. A.	Waste water CIP (option)	Tri-Clamp DN 20	No backpressure	<ul style="list-style-type: none"> <li>■ Temperature resistant up to 80 °C.</li> </ul>
n. A.	Water in steam generator (option)	Hose nozzle DN 13	2.5 bar to 4.0 bar (15 kW and 20 kW) 3.0 bar to 6.0 bar (30 kW, 45 kW and 60 kW)	<ul style="list-style-type: none"> <li>■ <math>\text{CaCO}_3</math> concentration 0 mmol L<sup>-1</sup> to max. 0.53497 mmol L<sup>-1</sup></li> </ul>
n. A.	Emptying steam generator (option)	Hose nozzle DN 13	No backpressure	

**eve<sup>®</sup>**

eve<sup>®</sup> is a platform software for planning, execution and analysis of bioprocesses. eve<sup>®</sup> allows you to record bioprocess data and store it in a central database. The software offers workflows from simple bioprocesses to the planning and execution of complex strategies with various phases.

eve<sup>®</sup> makes it possible to generate and store bioprocess knowledge. Various libraries for storing information on organisms and culture media are available. Thanks to soft-sensors, additional knowledge can be generated.

In addition to INFORS HT products, biotech machines and analysis devices from third-part manufacturers can be connected. This makes it possible to holistically control, monitor and analyse bioprocesses using a single software.

eve<sup>®</sup> is installed on a centralised server. Access takes place via a browser, no client side installation is required. Bioprocess data is therefore available directly via the browser and independent of the operating system.

Various packages of the software are available. This makes it possible to adapt it to the individual needs and requirements of its users. eve<sup>®</sup> (in the premium version) is also suitable for working in a validated environment as per FDA CFR 21 Part 11.