

## Single-use fermentation

# 300 L HyPerforma Enhanced Single-Use Fermentor

## And 300 L HyPerforma Single-Use Fermentor

### Engineered to meet your specific microbial fermentation needs

#### Introduction

The Thermo Scientific™ HyPerforma™ Single-Use Fermentor (S.U.F.) and Thermo Scientific™ HyPerforma™ Enhanced Single-Use Fermentor (eS.U.F.) are designed to provide enhanced functionality, ease of use, and efficiency. The complete HyPerforma S.U.F. or HyPerforma eS.U.F. system consists of a fermentor tank and a Thermo Scientific™ HyPerforma™ S.U.F. BioProcess Container (BPC) or a Thermo Scientific™ HyPerforma™ eS.U.F. BPC, which is available in 30 L and 300 L sizes. The HyPerforma S.U.F. BPC features a 5:1 turndown ratio in Thermo Scientific™ Aegis™ 5-14 and CX5-14 film options. The HyPerforma S.U.F. and HyPerforma eS.U.F. maintain traditional stirred-tank fermentation design principles, including specific height-to-diameter ratios (3:1) and a top-driven impeller location that delivers optimum cell viability, performance, and scalability from process development through production.

#### HyPerforma S.U.F. hardware features

##### HyPerforma eS.U.F.

The 300 L HyPerforma eS.U.F. is designed with all of the same features as the HyPerforma S.U.F. with the added benefit of a 35% increase to the jacketed surface area for improved cooling capacity.



#### HyPerforma S.U.F.

- All units come standard with 4 probe hangers, a drive shaft, and a resistance temperature detector (RTD)
- Other features are available, such as condensers, load cells, vent filter heaters, cable/tubing management tree, and backup exhaust filter pinch clamp
- Complete mixing system with a water jacket for temperature control
- The drive shaft inserts into the BPC through the mixing drive motor and locks into the BPC agitator assembly

## Single-use BPC features

The S.U.F. BPC comes in two offerings: the HyPerforma eS.U.F. BPC and the HyPerforma S.U.F. BPC.

### HyPerforma eS.U.F. BPC

- Three enhanced impellers for a larger, more power-efficient impeller design
- Provides at least four times more oxygen delivery over the Rushton S.U.F. BPC
- Manufactured with industry-leading Aegis5-14 film
- Configurable to meet your process needs, including options for single-use sensing (dissolved oxygen (DO), pH, and pressure); various tubing options

### HyPerforma S.U.F. BPC

- The agitator assembly features three Rushton single-use (polyethylene) impellers with a bearing-and-seal assembly linked to an external mixer drive
- Gas control with a drilled-hole sparger and exhaust management system with options for multiple vent filters based on gas flow needs
- Integrally sealed ports in the S.U.F. BPC allow for additional line sets, single-use sensors, and sterile connections
- Manufactured with industry-leading Aegis5-14 film
- Configurable to meet your process needs, including options for single-use sensing (DO, pH, and pressure); various tubing options

### HyPerforma S.U.F. options

- Exhaust condenser unit and exhaust gas vent filter heater
- Integrated foam sensor
- Three load cells
- Cable/tubing management tree
- Process control system and optional electrical box for remote agitation control

## Standard 300 L S.U.F. hardware units

All units come standard with 4 probe hangers, a drive shaft, and an RTD. Other features are available, such as condensers, load cells, and cable/tubing management systems. For more information, see the “Configurable Hardware Options” topic in the user guide.

**Table 1. Standard 300 L S.U.F. hardware offerings.**

Description	Cat. No.
<b>HyPerforma eS.U.F.</b>	
Enhanced jacketed, 240 VAC, pinch clamp, condenser, two preset and two integrable 151 W vent heaters, and 4-position vent filter bracket	SUF0300.9100
<b>HyPerforma S.U.F.</b>	
Jacketed, AC motor, with 2-position vent filter bracket (no E-box)	SUF0300.9001
Jacketed, AC motor, with 2-position vent filter bracket and 240 VAC E-box	SUF0300.9002

## Design features

1. Exhaust vent filter holder
2. Backup exhaust filter pinch clamp (optional)
3. Motor assembly with shield
4. Bearing port receiver with clamp
5. Electrical control panel (E-Box, optional)
6. Probe hanger bracket
7. Leveling casters
8. 1/2 hp agitator motor
9. Standard tool set: 3/8 in. x 150 in.-lb square torque wrench, load cell and motor cap lockout wrench
10. Drive shaft (stored)
11. S.U.F. BPC loading door and liquid sight window
12. Probe access windows
13. Sliding motor assembly
14. Cable/tubing management system (optional)
15. Bottle management basket (optional)
16. Feed bag management hook (optional)
17. Tri-clamp water inlet/outlet ports
18. Cart assembly
19. Condenser (optional)
20. Stainless steel (type 304) outer support container with 3/8 in., dimpled water jacket
21. Bleed valve
22. Bottom cutouts/pins for BPC attachment and alignment
23. Load cells (3, optional)

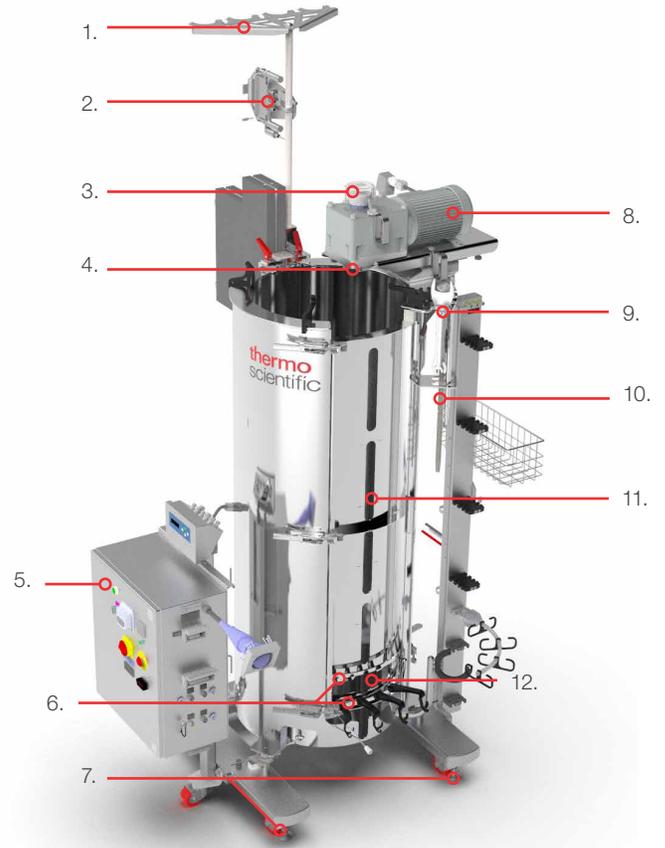


Figure 1. Front view of the HyPerforma S.U.F.

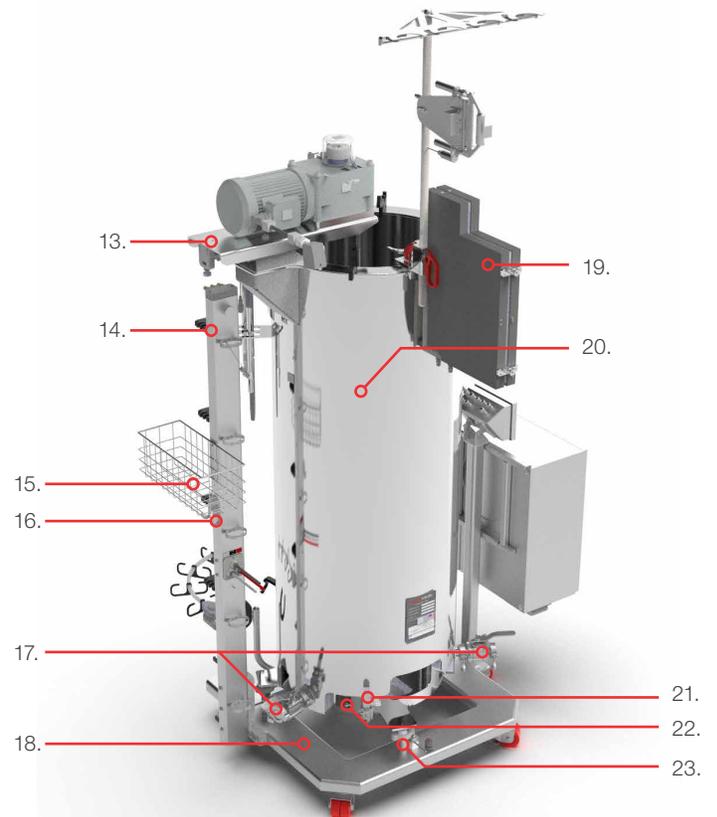


Figure 2. Back view of the HyPerforma S.U.F.

## HyPerforma S.U.F. hardware dimensions and specifications

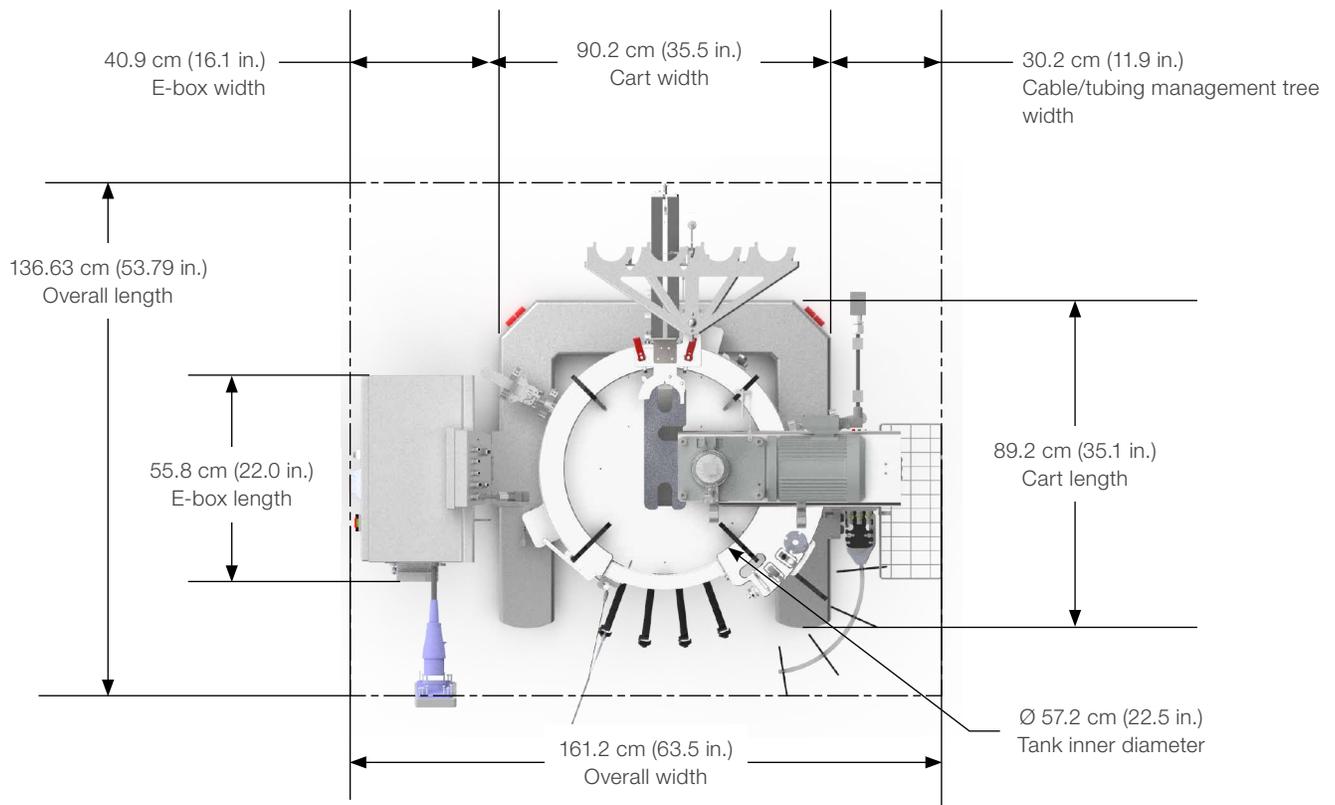


Figure 3. HyPerforma S.U.F. top-view dimensions.

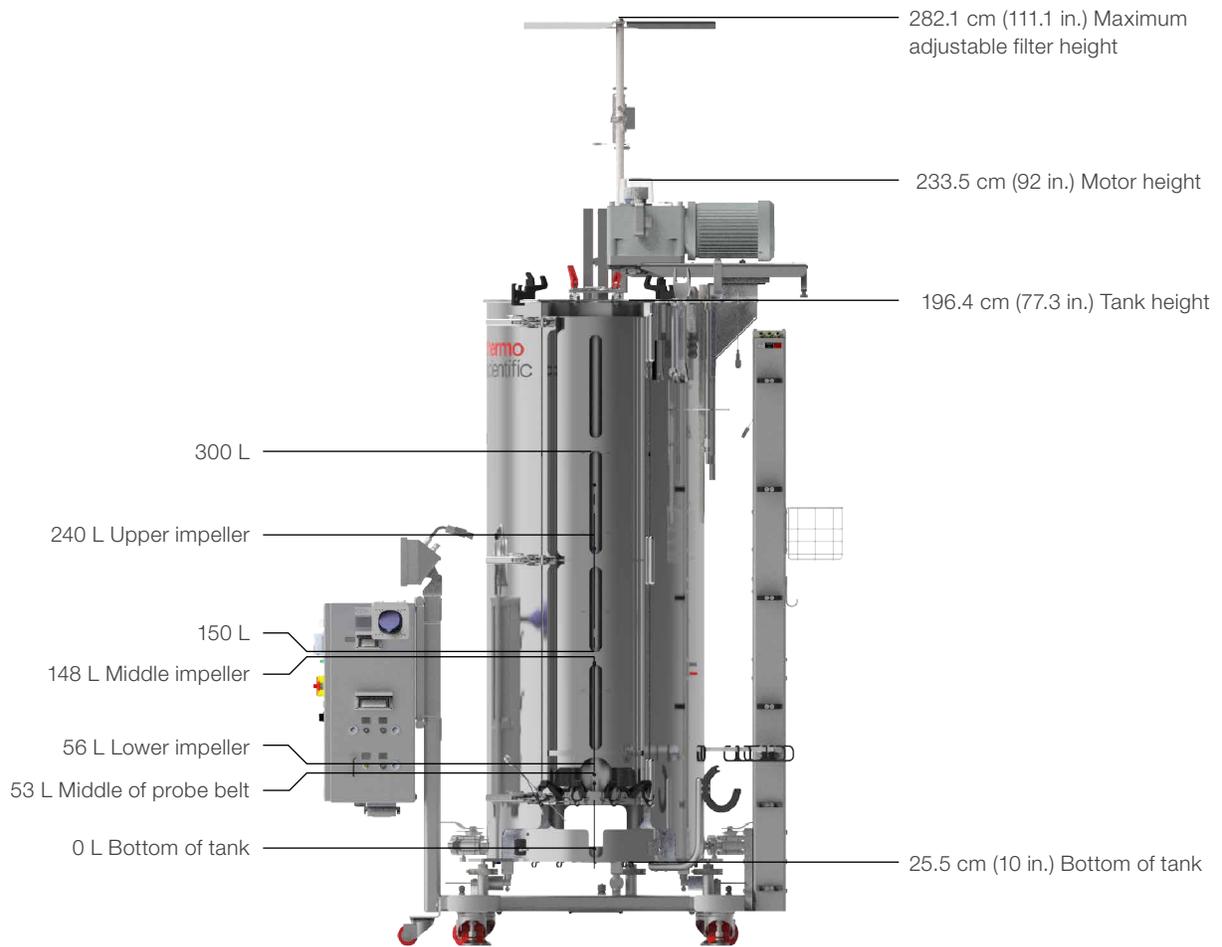


Figure 4. HyPerforma S.U.F. front-view dimensions.

Table 2. 300 L HyPerforma S.U.F. hardware specifications.

		300 L HyPerforma S.U.F.	300 L HyPerforma eS.U.F.
Fluid jacket	Jacket area: half/full volume	0.72/1.46 m <sup>2</sup> (7.77/15.8 ft <sup>2</sup> )	0.91/1.76 m <sup>2</sup> (9.79/18.9 ft <sup>2</sup> )
	Jacket volume	10.85 L	14.3 L
	Jacket flow rate	16.9 GPM at 2.27 bar (33 psi) depending on TCU pump	
	Process connection	1 in. sanitary tri-clamp or quick connect	
	Nominal heating/cooling load*	18,000 W heating; 24,000 W cooling	
	Approximate liquid heat-up time (10–42°C), full volume	1 hr 14 min	48 min
	Approximate liquid heat-up time (2–37°C), half volume with a 10 kW TCU	1 hr 18 min	
	Approximate cool-down time (42–10°C), full volume	1 hr 19 min	1 hr 3 min
Misc.	RTD or thermocouple, 3.18 mm (1/8 in.) outer diameter	RTD: Pt-100 (standard)	
Outer support container	Overall width	161.2 cm (63.5 in.) with E-box	
	Overall length	136.63 cm (53.79 in.)	
	Height to top of vent filter bracket	280.97 cm (110.62 in.) with condenser	283.51 cm (111.62 in.)
	Height to top of motor	232.9 cm (91.7 in.)	235.45 cm (92.7 in.)
	Height to top of tank	196.4 cm (77.3)	199.2 cm (78.42 in.)
	Dry skid weight (mass)	555 kg (1,223 lb)	579 kg (1,276 lb)
General	Electrical power supply requirement	240 VAC, single phase, 20 A	
	Validated system reliability (minimum)	0.9 at 90% confidence level	
	pH and DO probe—autoclavable type (Broadley James™, Hamilton™, Mettler Toledo™)	12 mm diameter x 215–235 mm insertion length x 13.5 PG thread	
	Minimum ceiling height required	296 cm (117 in.)	
	Noise level	<70 dB at 1.5 m	
Recommended operating parameters	Operating temperature range	Ambient to 42 ± 0.1°C (107.6 ± 0.2°F)	
	Motor speed**	35–375 rpm ± 5 rpm	334 ± 5 rpm
	Volume range	60–300 L	
	Maximum bag operating pressure	0.035 bar (0.5 psi)	
	Continuous operating time	14 days†	

\* Heating from –5 to 55°C and cooling from 55 to –5°C

\*\* If stirred at 200 rpm or greater, or if all probe ports are completely submerged (60 L)

† Mixing at nominal volume only

Table 2. 300 L HyPerforma S.U.F. hardware specifications (continued).

		300 L HyPerforma S.U.F.	300 L HyPerforma eS.U.F.
Reactor geometry	Rated liquid working volume	300 L	
	Minimum liquid working volume*	60 L	
	Total reactor volume (liquid and gas)	435 L	
	Vessel diameter	57.2 cm (22.5 in.)	
	BPC chamber diameter	68.8 cm (27.1 in.)	
	BPC chamber shoulder height	169.8 cm (66.9 in.)	
	Liquid height at rated working volume	123.2 cm (48.5 in.)	
	Fluid geometry at working volume (height:diameter ratio)	~2:1	
	Hold-up volume	>1.0 L	
	Overall reactor geometry (height:diameter ratio)	3:1	
	Tank baffles	4	
Impeller	Quantity x blade count	3 x 6	
	Scaling (impeller diameter/tank diameter)	1/3	1/2.38
	Type	Rushton	Enhanced
	Diameter	18.8 cm (7.4 in.)	23.6 cm (9.30 in.)
	Calculated power number (N), averaged between 20% and 100% of rpm range	3.9	~2:1
Motor	Agitation motor drive (type, voltage, phase), AC motor only	Induction, 208 VAC, 3-phase	
	Motor power rating (AC motor)	1,491.4 W (2 hp)	
	Motor torque rating	34 N-m (301 in.-lb)	
	Gear reduction*	5:1	
	Programmable VFD, remote panel interface, power faults auto-restart	Standard	Settings adjusted to limit rpm instead of shut off
Motor communication methods (for external controller)	0–10 V, 4–20 mA, Modbus™		
Agitation	Maximum rotational speed during gas sparging	375 rpm	335 rpm
	Power/volume ratio at maximum rotational speed	2,164.1 W/1,000 L (11 hp/1,000 gal)	~8 W/L
	Nominal agitation for best $k_L a$ value	375 rpm	334 rpm
	Nominal tip speed	369 cm/s	413 cm/s
	Mixing flow direction	Radial flow	
	Agitation shaft orientation	Vertical	
	Overall drive shaft length	173.1 cm (68.1 in.)	
	Operational drive shaft length	152.1 cm (59.9 in.)	
	Drive shaft diameter	1.9 cm (0.8 in.)	
	Drive shaft poly-sheath outside diameter	3.5 cm (1.4 in.)	
	Impeller clearance from tank bottom (measured at midplane of impeller)	18.8 cm (7.4 in.)	

\* If operated at 200 rpm to keep the probes in the upper probe belt submerged

## 300 L eS.U.F. and S.U.F. standard options

### Load cells

Load cells are typically radially mounted in sets of three. The mounting location varies slightly for each size in order to allow easy access to the bottom drain or sparging mechanisms and tubing.



Figure 5. Mettler Toledo MTB load cell.

Table 3. Load cell kit.

Description	Cat. No.
3x load cell with summing box without display	SV50988.03

### Autoclave tray and probe assembly

The autoclave tray holds the electrochemical probes and bellows in place during the sterilization process. Design elements include the following:

- Stainless steel
- Plastic carry handle for easy transport right out of the autoclave
- Probes positioned on 15% incline for greater probe and membrane longevity
- Probe bellows restrained from collapsing during sterilization
- Probe holder accommodates two probes

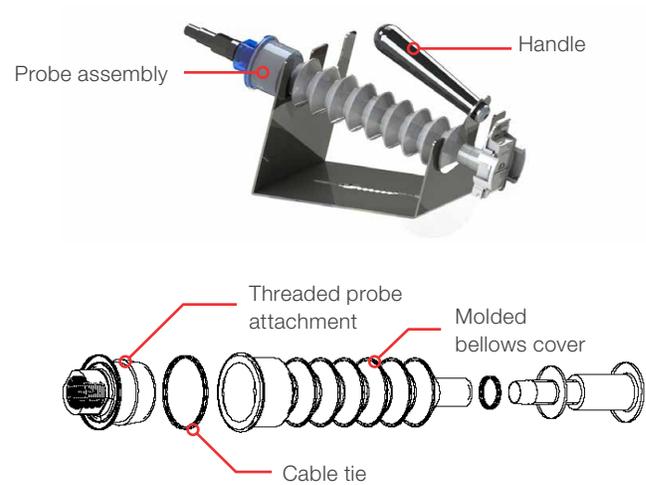


Figure 6. Autoclave tray and probe assembly.

### Probe clips

Probe clips are used to hold the probes in place on the S.U.F. tank. The independently movable probe clips hang on a thin brace above the probe port tank cutout and are held in place by an adjustable spring plunger. The probes are inserted into the clip mechanism and held in place by a half-spring clip.

### Heavy-duty tubing clamps

Heavy-duty clamps are used for pinching off line sets that are not in use in order to prevent process fluids from escaping. Prior to sterile probe insertion, tubing clamps must be in place to close off probe ports.

### Exhaust filter pinch clamp

The exhaust filter pinch clamp may be used to temporarily stop air flow to redundant exhaust filters.

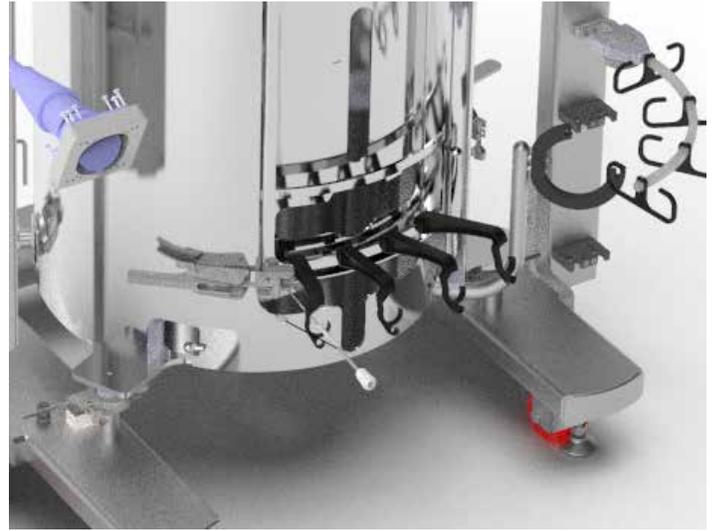


Figure 7. Probe clips.

Table 4. 300 L eS.U.F. and S.U.F. standard options.

Description	Cat. No.
Autoclave tray	SV50177.01
4 probe clips	SV50177.23
Heavy-duty tubing clamp (single)	SV20664.01
Heavy-duty tubing clamp (10-pack)	SV20664.04
Exhaust filter pinch clamp	SV50177E.16
Probe holder, plastic molded	SV50177P.01

### Vent filter heaters

The vent filter heater system consists of the following components:

- Heater
- Controller (optional)
- Power cord

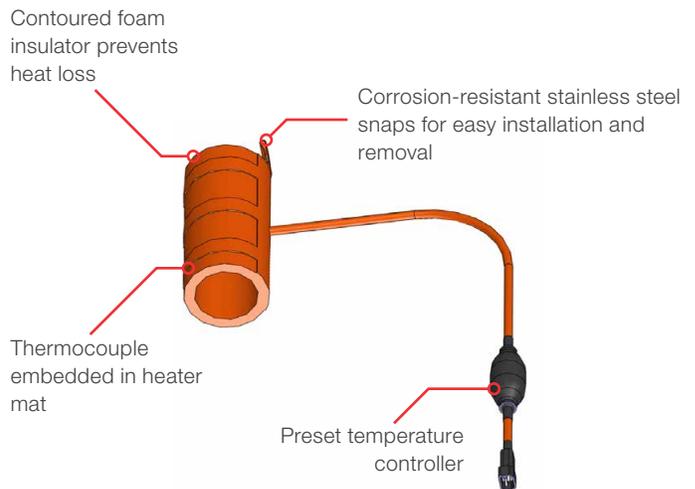


Figure 8. Vent filter heater.

### Cable/tubing management system

The cable/tubing management system includes the following components:

- Internal channel for sparger lines
- External channels for feed and base addition lines
- Harvest line hook
- Feed bag management hook
- Adjustable arm for external control power cable management

### Condenser system

The system efficiently condenses exhaust gases and transfers the condensate back into the fermentor, preventing vent filter blockage and reducing fluid loss due to evaporation.



Figure 9. Cable/tubing management system

Table 5. Additional options.

Description	Cat. No.
240 V 151 W vent filter heater with Binder 99-4217-00-07 controller connector 6 pin	SV50191.73
120 V 151 W vent filter heater with Nema 5-15 connector, preset 55°C bulb controller	SV50191.69
240 V 151 W vent filter heater with IEC connector, preset 55°C bulb controller	SV50191.70
300 L cable management system, left-hand configuration	SV51006.02
300 L cable management system, right-hand configuration	SV51006.03
300 L bottle management system	SV50992.10
300 L feed bag management system	SV51006.03
300 L 240 VAC complete condenser system (TCU for condenser included)	SV51009.03
Thermo Scientific™ Masterflex™ pump for 300 L systems (115 VAC/50 or 60 Hz, or 230 VAC/50 or 60 Hz)	SV50241.02

# 300 L HyPerforma eS.U.F. BPC standard design

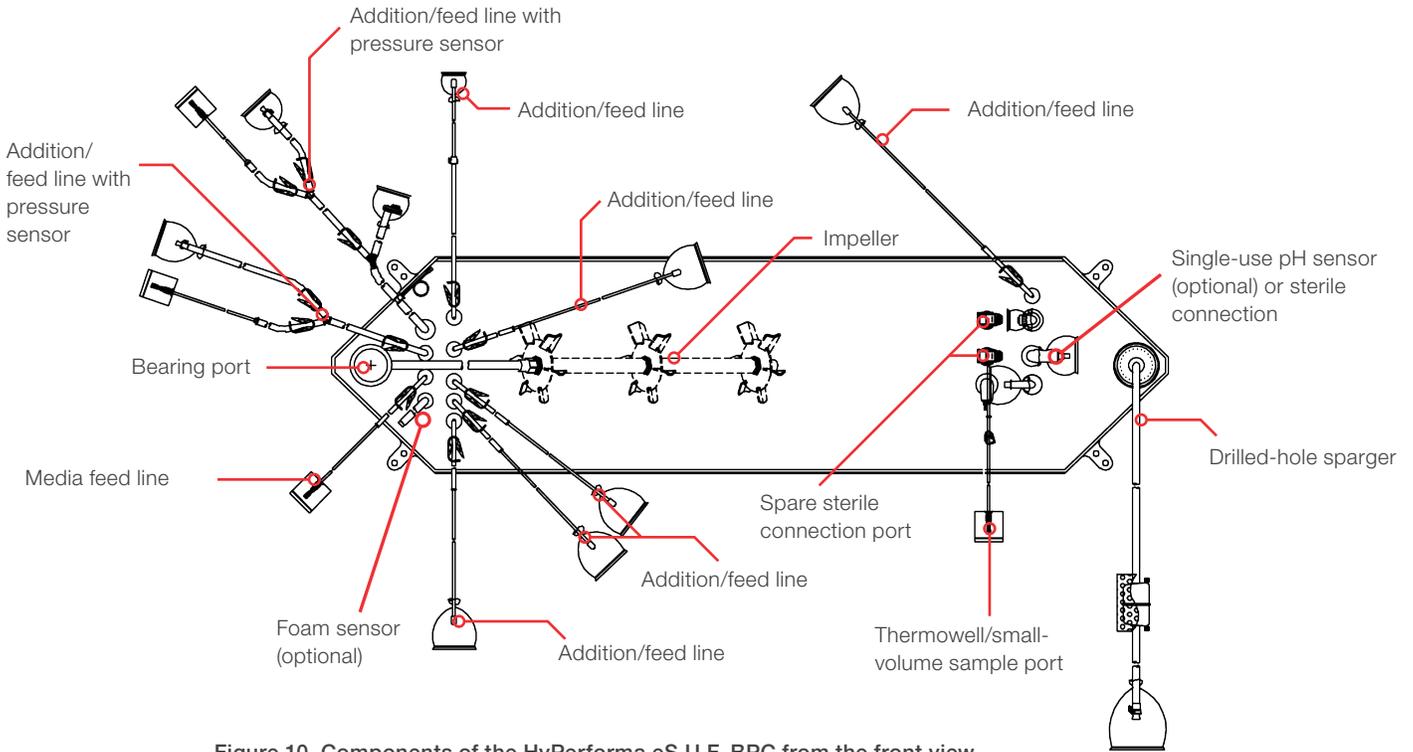


Figure 10. Components of the HyPerforma eS.U.F. BPC from the front view.

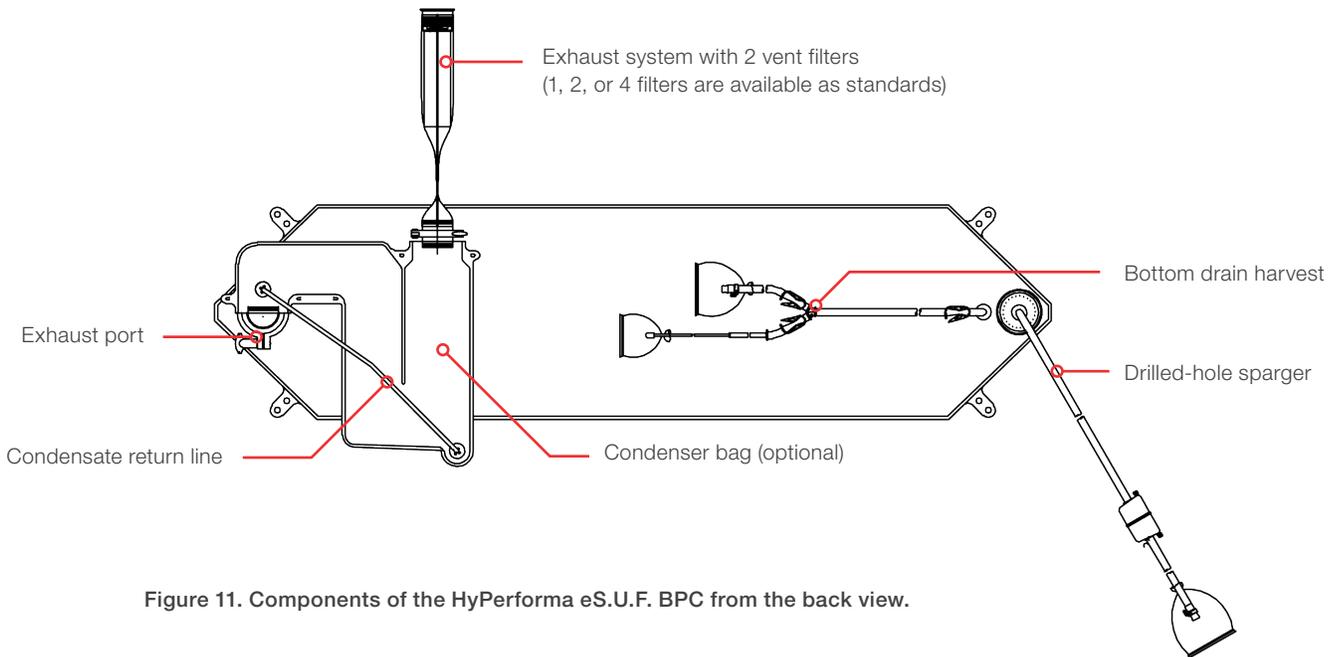


Figure 11. Components of the HyPerforma eS.U.F. BPC from the back view.

**Table 6. Custom products for the HyPerforma eS.U.F. BPC.**

Category	Options/capability	Notes
Tubing type	C-Flex™, platinum-cured silicone, PVC, PharMed™, PharmaPure™	More information available in the tubing selection guide
Tubing size	Ranges from 3.18 mm (1/8 in.) to 25.4 mm (1 in.) inner diameter in various lengths	More information available in the tubing selection guide
Connections	Luer, Colder Products Company (CPC) quick connects, SIP connectors, tri-clamp, Kleenpak™, SmartSite, Clave™, Lynx™ steam-to, CPC Steam-Thru™, Gore™ steam valve, Gore™ Mini TC, BioQuate, SterilEnz™, end plug	More information available in the connection system selection guide. Note: The only option for probe port connections is Kleenpak
Probe ports	Additional ports: second row of 4 ports	The reusable probe port connection uses a Kleenpak connector
Additional ports/lines (other than 2nd row of probe ports)	Limited engineer-to-order customization only	Dependent on location in bag and fit with hardware
Port sizes	Limited engineer-to-order customization only	Dependent on location in bag and fit with hardware (e.g., 1 in. inner diameter port on harvest line)
Rearrangement of lines on existing ports	Limited customization possible (e.g., moving sample/thermowell port to a probe tube port)	Dependent on location in bag and fit with hardware
Dip tube lines	Limited customization possible	Length cannot interfere with impeller and shaft
Filters on media and supplement inlets	Limited engineer-to-order customization only; choice of filters used to sterilize incoming media or supplements are available.	

**Note:** Not all options are available for all ports. It is not possible to customize port type, port location, chamber dimensions, or mixing assembly.

**Table 7. Packaging information.**

Outer packaging	Supplied flat-packed with two polyethylene outer layers
Label	Description, product code, lot number, and expiration date on outer packaging and shipping container
Sterilization	Irradiation (25–40 kGy) inside outer packaging
Shipping container	Durable cardboard carton
Documentation	Certificate of Analysis provided with each lot for each delivery

## Ordering information

Product	Film type	Cat. No
<b>HyPerforma eS.U.F. BPC</b>		
Enhanced Single-Use Fermentor BioProcess Container, pH/DO sensor, foam sensor, LowFlow inlet, two 10-in. exhaust filters	Aegis5-14	SUT00008
<b>HyPerforma S.U.F. BPC options</b>		
Mettler Toledo single-use pH and DO sensor, foam sensor, low flow inlet and two 10 in. exhaust filters, condenser	Aegis5-14	SH3101002
	CX5-14	SH31017.02
Mettler Toledo single-use pH and DO sensor, foam sensor, low flow inlet and four 10 in. exhaust filters, condenser	Aegis5-14	SH31009.03
Traditional ports, foam sensor, high flow inlet and one 10 in. exhaust filter, condenser	CX5-14	SH31030.01
Traditional ports, foam sensor, high flow inlet and two 10 in. exhaust filters, condenser	CX5-14	SH31030.02
Traditional ports, HighFlow inlet and one 10 in. exhaust filter	CX5-14	SH31030.04
Traditional ports, HighFlow inlet and two 10 in. exhaust filters	CX5-14	SH31030.03

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