

Single-use fermentation

30 L HyPerforma Single-Use Fermentor

Available with enhanced or standard BPCs

Engineered to meet your specific microbial fermentation needs

Introduction

The Thermo Scientific™ HyPerforma™ Single-Use Fermentor (S.U.F.) and associated BioProcess Containers (BPCs) are designed to provide enhanced functionality, ease of use, and efficiency. The complete HyPerforma S.U.F. system consists of a fermentor tank and a Thermo Scientific™ HyPerforma™ Enhanced S.U.F. (eS.U.F.) BPC or a Thermo Scientific™ HyPerforma™ S.U.F. BPC. Both are 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. All HyPerforma S.U.F.s 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

- 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 compared to the standard 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
- Choose an open-architecture, ready-to-integrate system with choice of controllers, or configure and integrate a system with your specific controller requirements

Additional options may be reviewed with a Thermo Fisher Scientific sales representative and considered for customization to the standard mixer design.

Standard 30 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 30 L S.U.F. hardware offerings.

| Description | Cat. No. |
|---|--------------|
| Jacketed, AC motor, with 2-position vent filter bracket (no E-box) | SUF0030.9001 |
| Jacketed, AC motor, with 2-position vent filter bracket and 120 VAC E-box | SUF0030.9002 |
| Jacketed, AC motor, with 2-position vent filter bracket and 240 VAC E-box | SUF0030.9003 |

Design features

Refer to Figures 1 and 2 for the following descriptions:

1. Exhaust vent filter holder
2. Backup exhaust filter pinch clamp (optional)
3. Motor assembly with shield
4. Standard tool set: 3/8 in. x 150 in.-lb square torque wrench, load cell and motor cap lockout wrench
5. Drive shaft (stored)
6. Bleed valve
7. Leveling casters
8. 1/2 hp agitator motor
9. Stainless steel (type 304) outer support container with 3/8 in., dimpled water jacket
10. Bottom cutouts/pins for BPC attachment and alignment
11. Tri-clamp water inlet/outlet ports
12. Load cells (3, optional)

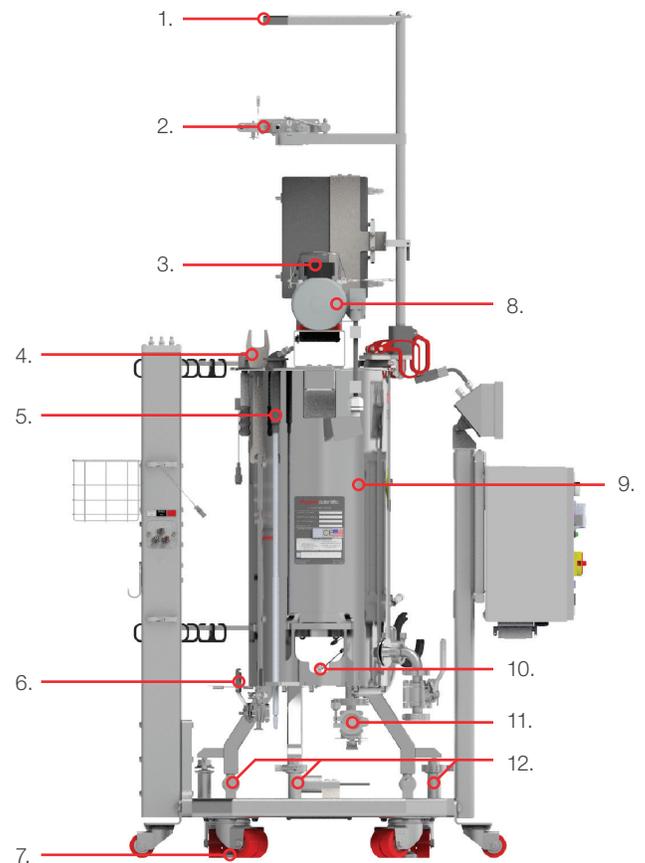


Figure 1. Back view of the HyPerforma S.U.F.

- 13. Electrical control panel (E-Box, optional)
- 14. S.U.F. BPC loading door and liquid sight window
- 15. Probe access windows
- 16. Probe hanger bracket
- 17. Cart assembly
- 18. Condenser (optional)
- 19. Bearing port receiver with clamp
- 20. Bottle management basket (optional)
- 21. Feed bag management hook (optional)
- 22. Cable/tubing management system (optional)

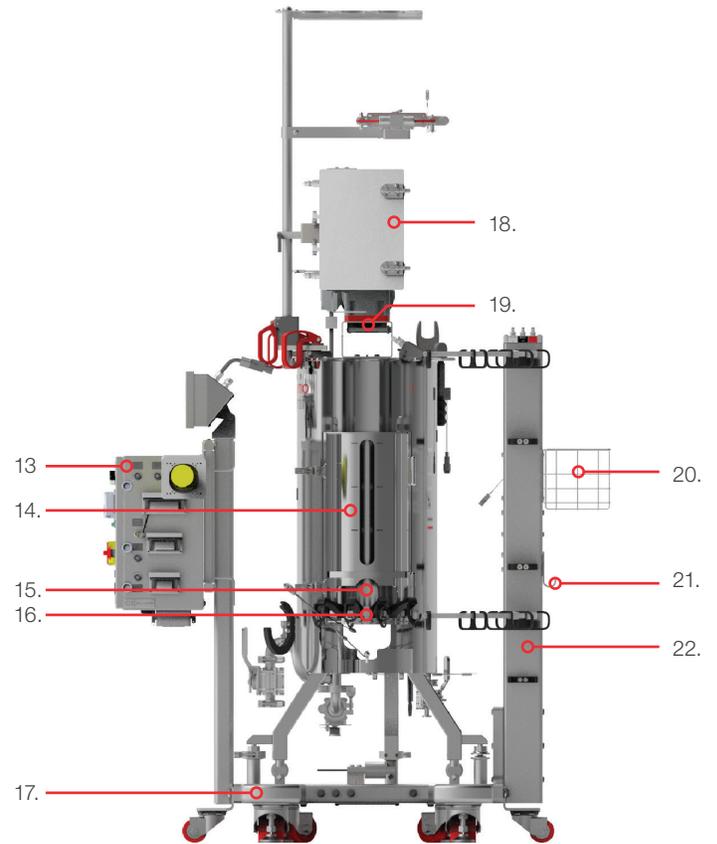


Figure 2. Front view of the HyPerforma S.U.F.

HyPerforma S.U.F. hardware dimensions and specifications

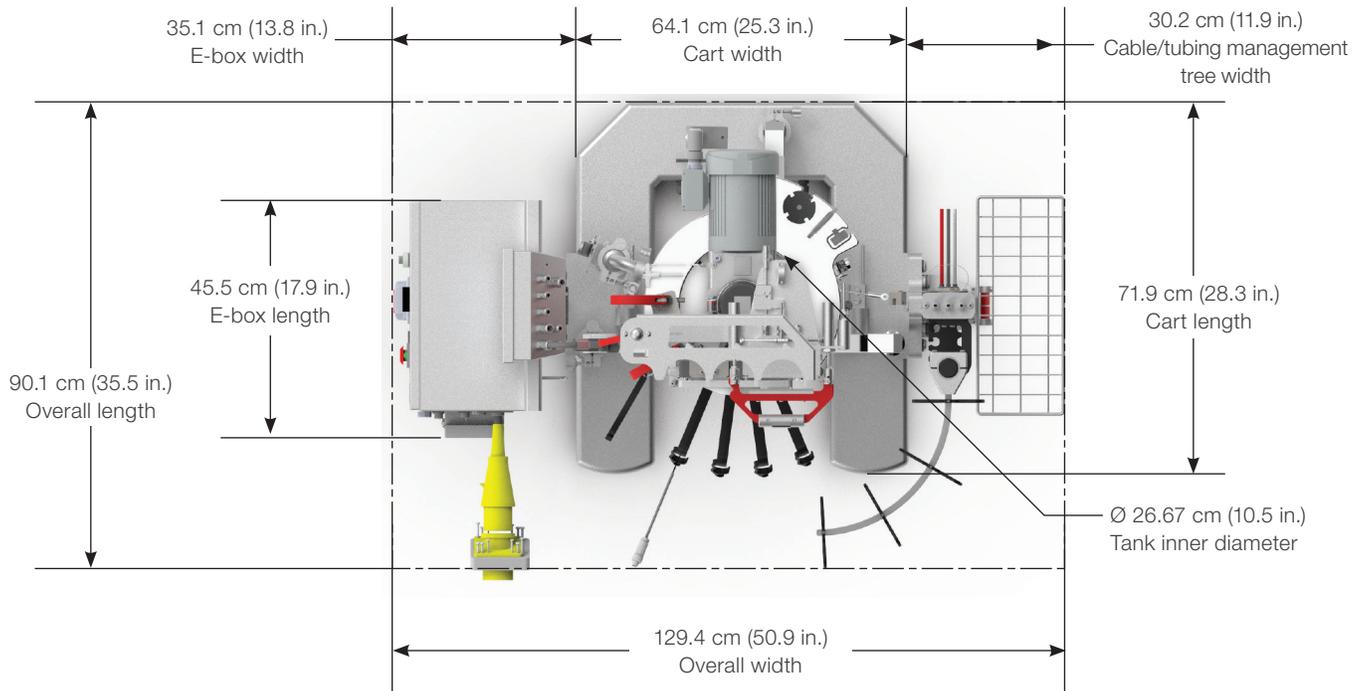


Figure 3. HyPerforma S.U.F. top-view dimensions.

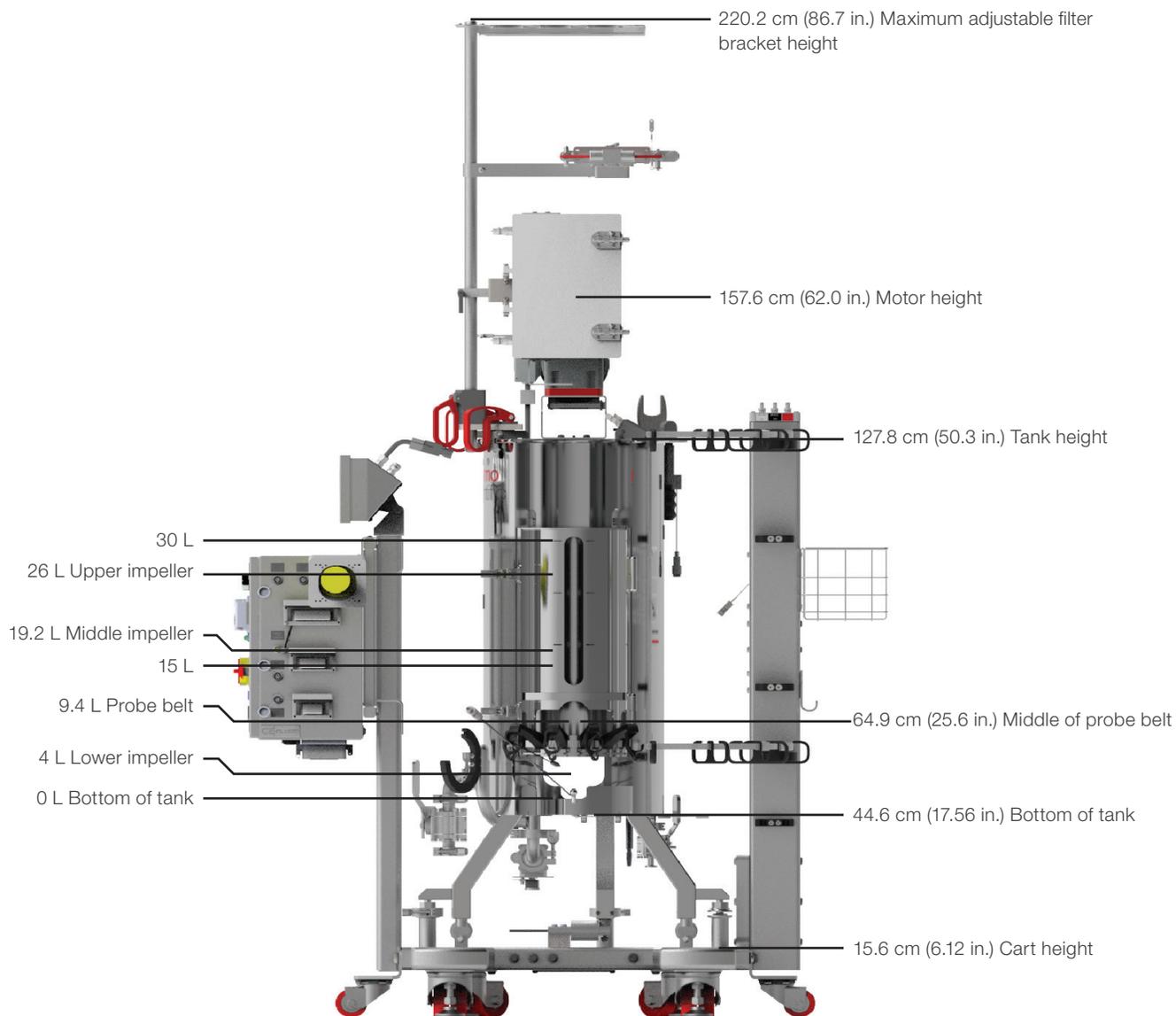


Figure 4. HyPerforma S.U.F. front-view dimensions.

Table 2. 30 L HyPerforma S.U.F. hardware specifications.

| | | 30 L HyPerforma S.U.F. | 30 L HyPerforma S.U.F. with HyPerforma eS.U.F. BPC |
|----------------------------------|--|---|--|
| Fluid jacket | Jacket area: half/full volume | 0.14/0.31 m ² (1.6/3.35 ft ²) | |
| | Jacket volume | 2.53 L | |
| | Jacket flow rate | 4.4 GPM at 1.82 bar (26.5 psi) | |
| | Process connection | 1 in. sanitary tri-clamp or quick connect | |
| | Nominal cooling load | 50 W/L minimum recommended | |
| | Approximate liquid heat-up time (2–37°C), half volume | 1 hr | |
| | Approximate liquid heat-up time (2–37°C), full volume | 1 hr 16 min | |
| Misc. | RTD or thermocouple, 3.18 mm (1/8 in.) OD | RTD: Pt-100 (standard) | |
| Outer support container | Overall width | 129.4 cm (50.9 in.) | |
| | Overall length | 92.6 cm (36.5 in.) | |
| | Height to top of vent filter bracket | 218.4 cm (86.0 in.) | |
| | Height to top of motor | 157.7 cm (62.1 in.) | |
| | Dry skid weight (mass) | 291.0 kg (641.5 lb) | |
| General | Electrical power supply requirement | 120/240 VAC, single phase, 20/10 A | |
| | Validated system reliability (minimum) | 0.9 at 90% confidence level | |
| | pH and DO probes—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 | 239 cm (94 in.) | |
| | Noise level | <70 dB at 1.5 m | |
| Recommended operating parameters | Operating temperature range | Ambient to 40 ± 0.1°C (104 ± 0.2°F) | |
| | Motor speed | 55–596 rpm ± 5 rpm | |
| | Volume range* | 6–30 L | |
| | Maximum bag pressure | 0.035 bar (0.5 psi) | |
| | Continuous operating time | 14 days** | |
| Reactor geometry | Rated liquid working volume | 30 L | |
| | Minimum liquid working volume | 6 L | |
| | Total reactor volume (liquid and gas) | 43 L | |
| | Vessel diameter | 26.6 cm (10.5 in.) | |
| | BPC chamber diameter | 29.7 cm (11.7 in.) | |
| | BPC chamber shoulder height | 85.1 cm (33.5 in.) | |
| | Liquid height at rated working volume | 57.1 cm (22.5 in.) | |
| | Fluid geometry at working volume (height:diameter ratio) | ~2:1 | |
| | Overall reactor geometry (height:diameter ratio) | 3:1 | |
| | Tank baffles | 4 | |

* Stirring should be maintained while TCU is operating; for eS.U.F. at 5:1 operation, maintain at 500 rpm to keep temperature well submerged

** Mixing at nominal volume only

Table 2. 30 L HyPerforma S.U.F. hardware specifications (continued).

| | | 30 L HyPerforma S.U.F. | 30 L HyPerforma S.U.F. with HyPerforma eS.U.F. BPC |
|---|---|--|--|
| Impeller | Quantity x blade count | 3 x 6 | |
| | Scaling (impeller diameter/tank diameter) | 1/3 | 1/2.38 |
| | Type | Rushton | Enhanced |
| | Diameter | 8.89 cm (3.5 in.) | 11.21 cm (4.41 in.) |
| | Calculated power number (N), averaged between 20% and 100% of rpm range | 4.6 | 2.5 |
| Motor | Agitation motor drive (type, voltage, phase), AC motor only | Induction, 208 VAC, 3-phase | |
| | Motor power rating (AC motor) | 372.85 W (0.5 hp) | |
| | Motor torque rating | 4.6 N-m (40.7 in.-lb) | |
| | Gear reduction* | 5:1 | |
| | Programmable VFD, remote panel interface, power faults auto-restart | Standard | |
| Motor communication methods (for external controller) | 0–10 V, 4–20 mA, Modbus™ | | |
| Agitation | Maximum rotational speed during gas sparging | 596 rpm | |
| | Power/volume ratio at maximum rotational speed | 2,270.5 W/m ³ (11.5 hp/1,000 gal) | 4,350 W/m ³ (22.1 hp/1,000 gal) |
| | Nominal agitation for best k _L a value | 596 rpm | |
| | Nominal tip speed | 279 cm/s | 350 cm/s |
| | Mixing flow direction | Radial flow | |
| | Agitation shaft orientation | Vertical | |
| | Overall drive shaft length | 96.26 cm (37.9 in.) | |
| | Operational drive shaft length | 77.36 cm (30.46 in.) | |
| | Drive shaft diameter | 1.27 cm (0.5 in.) | |
| | Drive shaft poly-sheath outside diameter | 2.54 cm (1.0 in.) | |
| | Impeller clearance from tank bottom (measured at midplane of impeller) | 8.9 cm (3.5 in.) | |

* If operated at 500 rpm to keep the probes in the upper probe belt submerged

30 L 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 | SV50988.04 |

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

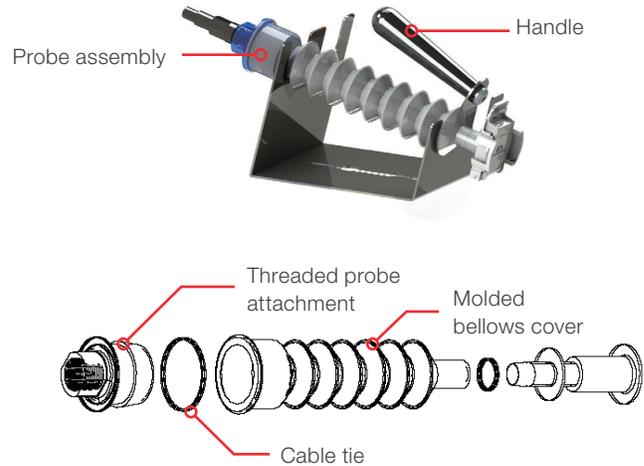


Figure 6. Autoclave tray and probe assembly.

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.

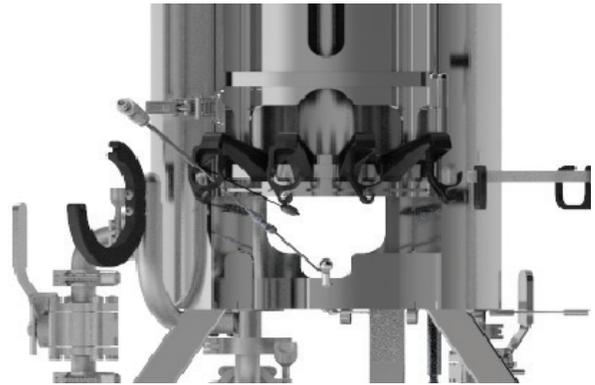


Figure 7. Probe clips.

Table 4. 30 L 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

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.

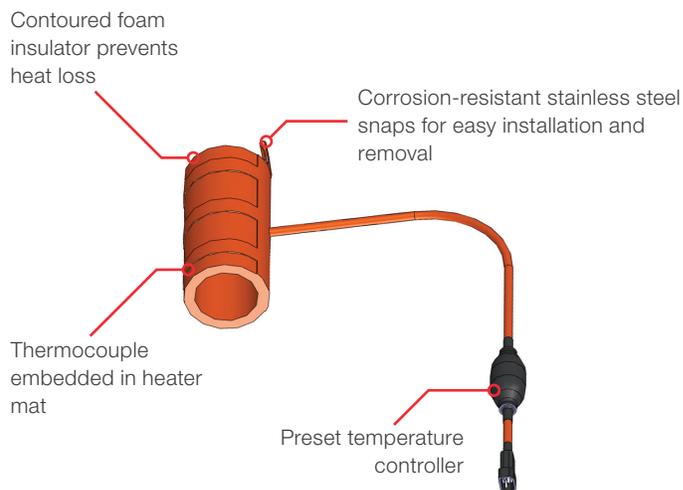


Figure 8. Vent filter heater.



Figure 9. Cable/tubing management system.

Table 5. Additional options.

| Description | Cat. No. |
|--|------------|
| 120 V 151 W vent filter heater with Binder 99-4217-00-07 controller connector, 6-pin | SV50191.72 |
| 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 |
| 30 L cable management system | SV50992.01 |
| 30 L bottle management system | SV50992.10 |
| 30 L feed bag management system | SV51006.03 |
| 30 L 120 VAC complete condenser system (TCU for condenser included) | SV51009.02 |
| 30 L 240 VAC complete condenser system (TCU for condenser included) | SV51009.03 |

Standard 30 L HyPerforma eS.U.F. BPC design

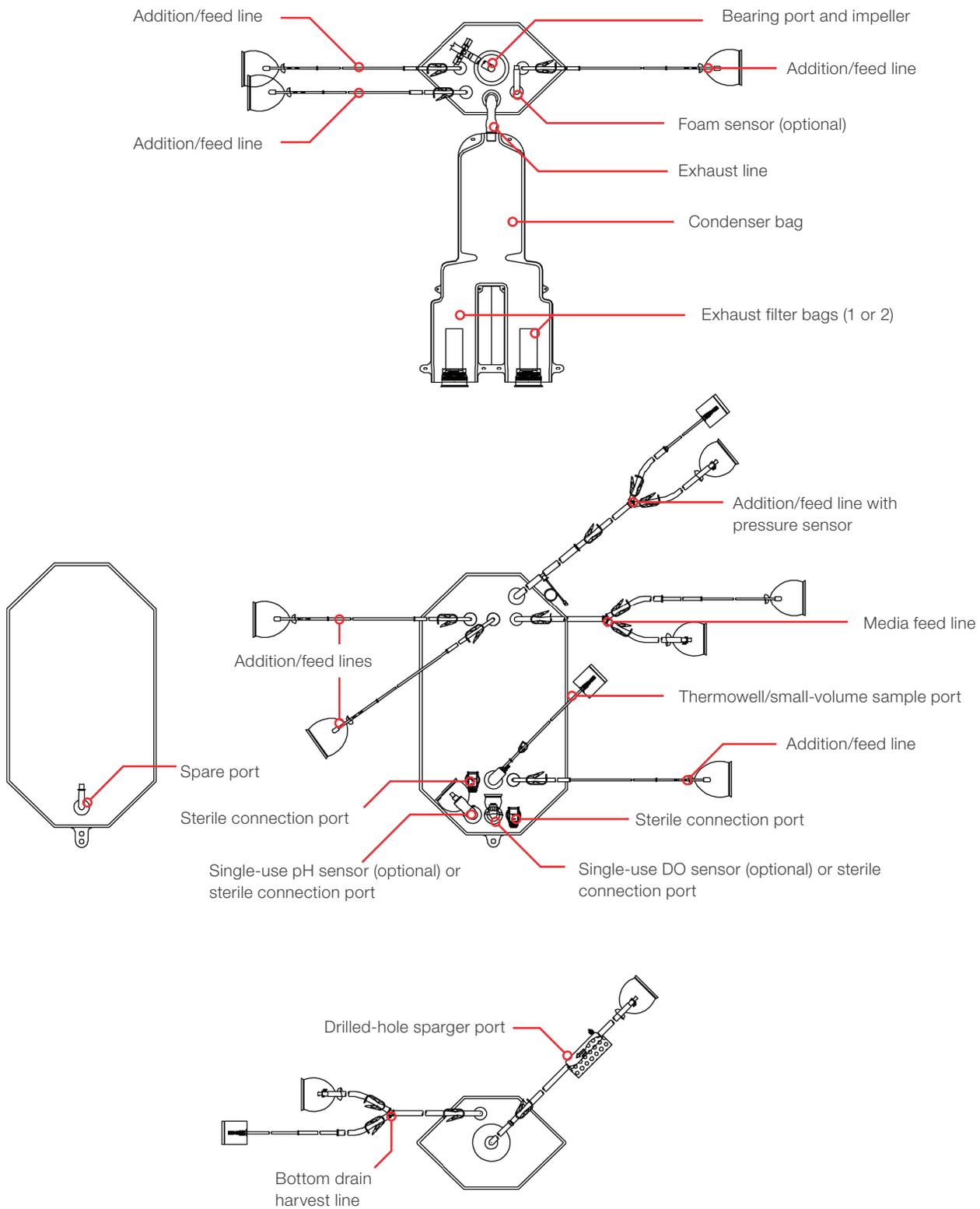


Figure 10. Components of an eS.U.F. BPC.

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 3 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 |
|--|-----------|------------|
| HyPerforma eS.U.F. BPC | | |
| Enhanced Single-Use Fermentor BioProcess Container, pH/DO sensor, foam sensor, LowFlow inlet, one 5-in. exhaust filter | Aegis5-14 | SUT00007 |
| HyPerforma S.U.F. BPC options | | |
| Mettler Toledo single-use pH and DO sensor, foam sensor, LowFlow inlet and one 5 in. exhaust filters, condenser | Aegis5-14 | SH31010.01 |
| | CX5-14 | SH31019.01 |
| Mettler Toledo single-use pH and DO sensor, foam sensor, LowFlow inlet and two 5 in. exhaust filters, condenser | Aegis5-14 | SH31010.02 |
| Traditional ports, foam sensor, low flow inlet and one 5 in. exhaust filter, condenser | CX5-14 | SH31036.01 |
| Traditional ports, foam sensor, high flow inlet and one 5 in. exhaust filter, condenser | CX5-14 | SH31037.01 |
| Traditional ports, foam sensor, LowFlow inlet and two 5 in. exhaust filters, condenser | CX5-14 | SH31038.01 |
| Traditional ports, HighFlow inlet and one 5 in. exhaust filter | CX5-14 | SH31039.01 |

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