

HyPerforma 2:1 1,000 L Single-Use Bioreactor

The next generation of performance

The Thermo Scientific™ HyPerforma™ Single-Use Bioreactor (S.U.B.) provides enhanced functionality, ease of use, and efficiency. The complete HyPerforma S.U.B. system consists of a bioreactor tank and Thermo Scientific™ HyPerforma™ S.U.B. BioProcess Container (BPC), which is available in 50, 100, 250, 500, 1,000, and 2,000 L sizes with a 2:1 turndown ratio. The redesigned HyPerforma S.U.B. maintains traditional stirred-tank bioreactor design principles, including specific height-to-diameter ratios and optimized mixer location that deliver optimum cell viability, performance, and scalability from process development through production.

This data sheet provides information on the 1,000 L S.U.B. system, which includes the tank and standard S.U.B. BPC. The BPC utilizes dual-sparger configurations with a porous-frit sparger and drilled-hole or open-pipe sparger that have been rigorously tested to provide high $k_L a$ values and optimal CO₂ stripping for improved pH control and decreased foaming.

The S.U.B. system consists of the following components:

S.U.B. hardware unit—available in turnkey format

- Complete mixing system with water-jacketed vessel
- Drive shaft inserts into the S.U.B. BPC through the mixing drive motor and locks into the BPC agitator assembly

S.U.B. BPC—supplied sterile and ready to use

- Agitator assembly is a single-use (polyethylene) impeller with a bearing-and-seal assembly linked to an external mixer drive
- Dual gas spargers available with either drilled-hole or open-pipe sparger and standard porous-frit sparger
- Vent filter outlet for system exhaust



- Integrally sealed ports in the S.U.B. BPC allow for addition of sensor probes and line sets
- Available in Thermo Scientific™ CX5-14 Film and Thermo Scientific™ Aegis™ 5-14 Film options

System options—adaptable to your needs

- Optional electrical box for remote agitation control
 - Water-jacketed S.U.B.s require a separate external temperature control unit
- Exhaust gas vent filter heaters
- Load cells (standard on 1,000 and 2,000 L S.U.B.s)
- Cable management tree
- Process control system
- See Table 12 for auxiliary components for S.U.B. control management; choose an open-architecture approach or a turnkey, ready-to-use Thermo Scientific S.U.B. system

Standard S.U.B. hardware units

The 1,000 L standard S.U.B. hardware units are available with either a DC or AC motor. The standard Mettler Toledo™ FlexMount™ load cells allow for batch liquid-weight reading; three load cells are mounted with summing box on the S.U.B. hardware unit. These hardware units do not include other options listed in Tables 3–7. The base part number listed in Table 1 will change depending upon which options are chosen.

Design features

Front/top view

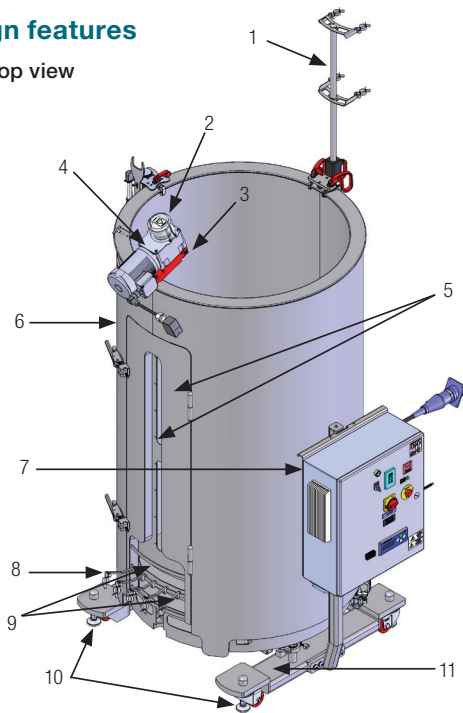


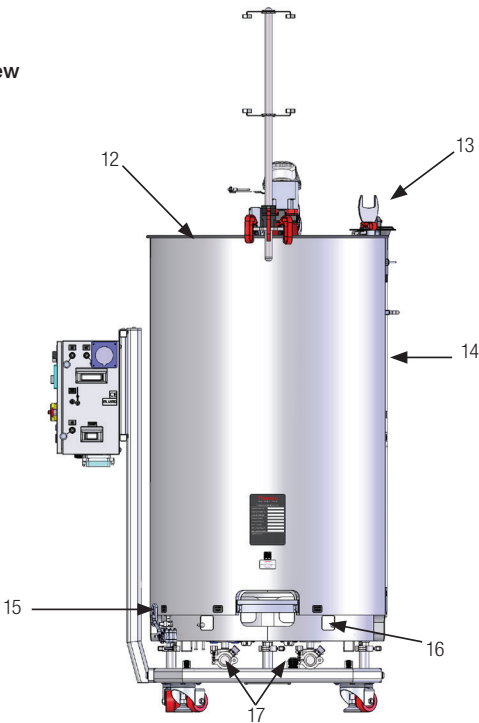
Figure 1. 1,000 L S.U.B. hardware unit with water jacket.

- 1. Exhaust vent filter holder
- 2. Mixing assembly with shield
- 3. Bearing port receiver with clamp
- 4. Mixer motor
- 5. Liquid sight windows
- 6. Drive shaft (stored)
- 7. Electrical control panel (optional)
- 8. Probe hanger bracket
- 9. Probe access windows

Table 1. 1,000 L standard S.U.B. hardware unit with casters (leveling feet) and load cells.

Description	Cat. No.
Water jacketed, DC motor	SUB1000.9002
Water jacketed, 240 VAC, AC motor	SUB1000.9008

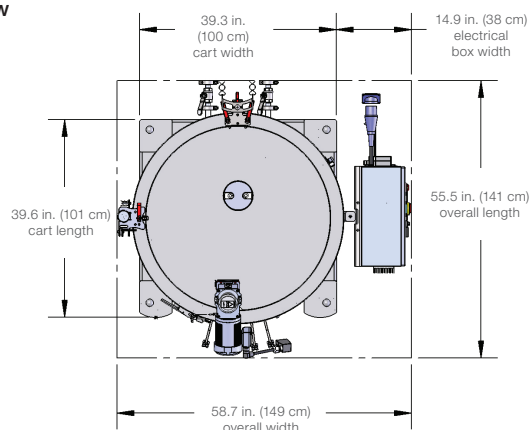
Back view



- 10. Leveling casters
- 11. Cart assembly
- 12. 3/8 in. dimpled water jacket
- 13. Standard tool set: 3/8 in. x 150 in.-lb square torque wrench; load cell and motor cap lockout wrench
- 14. Stainless steel outer support container
- 15. Bleed valve
- 16. Bottom cutouts/pins for BPC attachment and alignment
- 17. Quick-connect water inlet/outlet ports

Note: Load cells are standard only on 1,000 and 2,000 L S.U.B. hardware units.

Top view



Front view

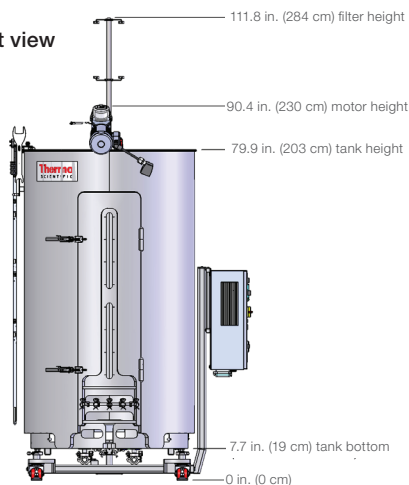


Figure 2. 1,000 L S.U.B. hardware unit dimensions.

Table 2. 1,000 L S.U.B. system specifications.

Specifications for water-jacketed systems with AC and DC motors		
		AC motor DC motor
Bioreactor geometry	Rated liquid working volume	1,000 L
	Minimum liquid working volume	500 L
	Total bioreactor volume (liquid and gas)	1,320 L
	BPC chamber diameter	95.9 cm (37.75 in.)
	BPC chamber shoulder height	200.7 cm (79 in.)
	Liquid height at rated working volume	142.2 cm (56 in.)
	Fluid geometry at working volume (height:diameter ratio)	1.5:1
	Overall bioreactor geometry (height:diameter ratio)	1.9:1
	Tank baffles	No
Impeller	Impeller (quantity x blade count)	1 x 3
	Impeller scaling (impeller diameter/tank diameter)	1/3
	Impeller blade pitch (angle)	45°
	Impeller diameter	32.1 cm (12.6 in.)
	Impeller calculated power number (N)	2.1
Agitation	Maximum mixing rate	20–110 rpm
	Nominal agitation rating (power/volume)	20 W/m ³
	Nominal agitation	50% working volume: 68 rpm 100% working volume: 86 rpm
	Nominal tip speed	287.6 ft/min (146.1 cm/s)
	Counterclockwise mixing flow direction	Down-pumping
	Agitation shaft resolved angle	19.6°
	Agitation shaft centerline offset	5.1 cm (2.0 in.)
	Overall drive shaft length	167.6 cm (66 in.)
	Drive shaft diameter	1.9 cm (0.75 in.)
	Drive shaft poly-sheath outside diameter	3.5 cm (1.4 in.)
	Impeller clearance from tank bottom	32.1 cm (12.6 in.)

Table 2. 1,000 L S.U.B. system specifications (continued).

Specifications for water-jacketed systems with AC and DC motors			
		AC motor	DC motor
Motor	Agitation motor drive (type, voltage, phase), AC motor only		Induction, 208 VAC, 3
	Agitation motor drive (type, voltage), DC motor only		–
	Motor power rating (AC motor)		Brushless, 48 VDC
	Motor power rating (DC motor)		0.5 hp (372.8 W)
	Motor torque rating		–
	Gear reduction		0.536 hp (400 W)
	Programmable VFD, remote panel interface, power fault auto restart		15:1
	Motor communication methods (for external controller)		Standard
Temperature control	Water jacket	Jacket area: full/half volume (ft ²)	
		Jacket volume	
		Jacket flow rate at 50 psi (3.4 bar)	
		Process connection	
		Nominal heating/cooling load (W)	
		Approximate liquid heat-up time (5–37°C)	
	Misc.	RTD or thermocouple, 1/8 in. (3.2 mm) OD	
Support container	Overall width		35.6/14.9
	Overall length		23.5 L
	Overall height		136 L/min
	Dry skid weight (mass)		1 in. sanitary tri-clamp
	Wet skid weight, rated working volume (mass)		10,000 W
General	Ceiling height required for drive shaft loading		6.4 hr
	Electrical power supply requirement (voltage, phase, current)		RTD: Pt-100 (standard)
	Tested system reliability (minimum)		143.8 cm (56.6 in.) with E-box
	pH and DO probe, autoclavable type (Applisens™, Broadley James™, Mettler Toledo™)		109.7 cm (43.2 in.)
	Noise level		139.2 cm (54.8 in.) with E-box
Recommended operating parameters	Operating temperature range		284 cm (112 in.)
	Motor speed		540 kg (1,190 lb)
	Volume range		1,540 kg (3,395 lb)
	Maximum BioProcess Container pressure		208–240 VAC, single, 30 A
	Continuous operating time		Dependent on controller

System options

Table 3 lists available options for the 1,000 L S.U.B.

- **Sparger support line (Figure 3)**—keeps gas lines in an upright position for optimal gas transfer
- **Heavy-duty tubing clamps (Figure 4)**—used for each probe port not in use, eliminating process fluid holdup
- **Sterile sampling manifolds**—available in 50 and 100 mL size for off-line sample retention
- **Bioreactor probe assembly (Figure 5)**—required for each sterile electrochemical probe insertion
- **Autoclave tray (Figure 6)**—aids in holding the probe assembly during the autoclave process
- **S.U.B. temperature sample port (Figure 7)**—provides off-line temperature probe calibration prior to system startup
- **Cable management tree (Figure 8)**—allows the end user to organize the S.U.B. BPC tubing lines for operator ease of use



Figure 3. Sparger support line.



Figure 4. Heavy-duty tubing clamps.



Figure 5. Bioreactor probe assembly.

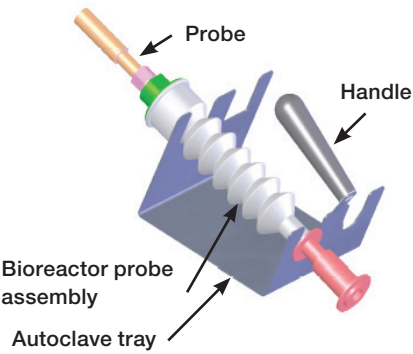


Figure 6. Autoclave tray for probe kits.



Figure 7. S.U.B. temperature sample port.



Figure 8. Cable management tree.

Table 3. 1,000 L S.U.B. system options.

Description	Cat. No.
Cable management tree	SV50992.04
Autoclave tray	SV50177.01
Bioreactor probe assembly (nonsterile for use in autoclave) with KPC connector	SH30720.01
Bioreactor probe assembly (nonsterile for use in autoclave) with AseptiQuik™ connector	SH30720.02
Sparger line support	SV50177B.14
Heavy-duty tubing clamp (each)	SV20664.01
Heavy-duty tubing clamps (10 pack)	SV20664.03
Sterile sampling manifold with Luer lock (each)	SH30845.01
Sterile sampling manifold with Luer lock (10 pack)	SH30845.02
S.U.B. temperature/sample port	SV20750.01

Additional information on autoclave tray:

- Fabricated from stainless steel
- Contains plastic carry handle for easy transport right out of the autoclave
- Positions probes on 15% incline for greater longevity
- Prevents probe bellows from collapsing during sterilization
- Accommodates two probes

Vent heaters

Vent heaters aid in reducing moisture buildup in exhaust filters from system off-gassing. Vent heaters are factory-preset at 50°C to allow condensation to return to the vessel. Recommended gassing strategies of the S.U.B. system are in the S.U.B. Validation Guide. Table 4 lists available vent heaters.

Table 4. Vent heater required for each exhaust filter on the S.U.B. BPC.

Description	Voltage	Controller	Cat. No.
Meissner™ 10 in. series 46 vent filter heater	120 VAC	Preset	SV50191.33
Meissner 10 in. series 46 vent filter heater	240 VAC	Preset	SV50191.34
Meissner 10 in. series 46 vent filter heater	120 VAC	Integrated	SV50191.47
Meissner 10 in. series 46 vent filter heater	240 VAC	Integrated	SV50191.48
Pall™ Kleenpak™ KA3 series 46 vent filter heater	120 VAC	Preset	SV50191.31
Pall Kleenpak KA3 series 46 vent filter heater	240 VAC	Preset	SV50191.32
Pall Kleenpak KA3 series 46 vent filter heater	120 VAC	Integrated	SV50191.45
Pall Kleenpak KA3 series 46 vent filter heater	240 VAC	Integrated	SV50191.46

Harsh mount load cell display

Required for remote weight readout from the Mettler Toledo™ summing box, various signal output options are provided for external control monitoring (Table 5). More information can be found in the Load Cell Data Sheet.

Table 5. Harsh mount load cell display options.

Description	Cat. No.
Mettler Toledo IND331 display, with analog interface (STD), 120 VAC U.S. line cord/plug	SV50177.291
Mettler Toledo IND331 display, with Allen-Bradley RIO interface, 120 VAC U.S. line cord/plug	SV50177.292
Mettler Toledo IND331 display, with DeviceNet interface, 120 VAC U.S. line cord/plug	SV50177.293
Mettler Toledo IND331 display, with Ethernet/IP and Modbus TCP interface, 120 VAC U.S. line cord/plug	SV50177.294
Mettler Toledo IND331 display, with Profibus interface, 120 VAC U.S. line cord/plug	SV50177.295

Spare parts

Table 6 lists the available spare parts of the 1,000 L S.U.B. systems.

Table 6. Available spare parts list.

Description	Cat. No.
DC motor	SV50237.22
AC motor	SV50237.19
Drive shaft	SV50177.39
RTD 120 in. with Bulgin connector	SV50177.363
Probe holders	SV50177.23
Autoclave tray (stainless steel with plastic carry handle)	SV50177.01
Adjustable filter bracket	SV50177.313

Standard 1,000 L dual-sparger S.U.B. BPC systems

Table 7 shows the available dual-sparger options for the 1,000 L S.U.B. BPC system in either configuration: open-pipe and porous-frit spargers (Figure 9, Table 9) or drilled-hole and porous-frit spargers (Figure 10, Table 10). Standard S.U.B. BPC packaging is shown in Table 8.

Table 7. Standard 1,000 L dual-sparger S.U.B. BPCs.

Film	Dual-sparger configuration	Cat. No.
CX5-14 film	Open-pipe and porous-frit spargers	SH30774.05
Aegis5-14 film	Open-pipe and porous-frit spargers	SH30972.05
CX5-14 film	Drilled-hole and porous-frit spargers	SH30985.05
Aegis5-14 film	Drilled-hole and porous-frit spargers	SH30999.05

Table 8. Standard 1,000 L S.U.B. BPC packaging.

Outer packaging	Supplied "flat-packed" Two polyethylene outer layers
Label	Description Product code Lot number Expiry 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

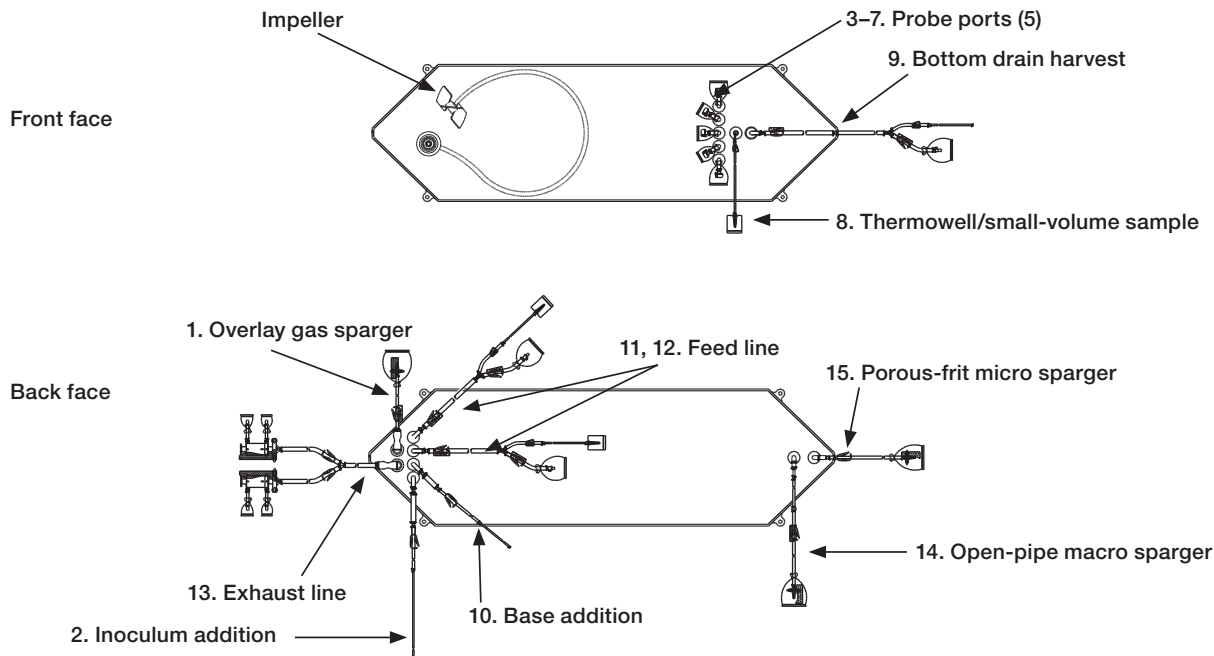


Figure 9. Standard 1,000 L dual-sparger S.U.B. BPC with open-pipe and porous-frit spargers.

Table 9. Specifications for the standard 1,000 L dual-sparger S.U.B. BPC with open-pipe and porous-frit spargers.

Line	Description	Tubing set (inner diameter x outer diameter x length)	End treatment
1	Overlay gas sparger	1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex™ tubing x 6 in. (15 cm)	Hydrophobic vent filter with Emflon™ II membrane
2	Inoculum addition	1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 84 in. (213 cm) reduced to 1/8 in. (3.2 mm) x 1/4 in. (6.4 mm) C-Flex tubing x 12 in. (30 cm)	SterilEnz™ pouch with injection site assembly, 3/8 in. MPC body
3-7	Probe ports (4)	1/2 in. (12.7 mm) tube ports	Pall™ Kleenpak™ aseptic connectors—KPCHT series (female)
8	Thermowell/small-volume sample	Thermowell adapter for 1/4 in. (6.4 mm) diameter 1/8 in. (3.2 mm) x 1/4 in. (6.4 mm) C-Flex tubing x 24 in. (60 cm)	SterilEnz pouch with injection site assembly
9	Bottom drain harvest	1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 60 in. (152 cm) reduced to 3/8 in. (9.5 mm) x 5/8 in. (15.9 mm) C-Flex tubing x 12 in. (30 cm) splits to 1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 12 in. (30 cm) reduced to 1/8 in. (3.2 mm) x 1/4 in. (6.4 mm) C-Flex tubing x 12 in. (30 cm) and 3/8 in. (9.5 mm) x 5/8 in. (15.9 mm) C-Flex tubing x 12 in. (30 cm)	Plugged 3/8 in. MPC insert
10	Base addition	1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 6 in. (15 cm) reduced to 1/8 in. (3.2 mm) x 1/4 in. (6.4 mm) C-Flex tubing x 84 in. (213 cm)	Plugged
11, 12	Feed lines	3/8 in. (9.5 mm) x 5/8 in. (15.9 mm) C-Flex tubing x 84 in. (213 cm) splits to 1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 12 in. (30 cm) reduced to 1/8 in. (3.2 mm) x 1/4 in. (6.4 mm) C-Flex tubing x 12 in. (30 cm) and 3/8 in. (9.5 mm) x 5/8 in. (15.9 mm) C-Flex tubing x 12 in. (30 cm)	SterilEnz pouch with injection site assembly, 3/8 in. MPC body
13	Exhaust line	1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 4 in. (10 cm) splits to 1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 10 in. (25 cm) and 1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 10 in. (25 cm)	(2x) Pall™ Kleenpak™ 0.2 µm exhaust vent filter
14	Open-pipe macro sparger	1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 3 in. (8 cm) reduced to check valve and 1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 72 in. (183 cm)	Hydrophobic vent filter with Emflon II membrane
15	Porous-frit micro sparger, 12 mm diameter (25 µm pores)	1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 6 in. (15 cm) reduced to check valve and 1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 72 in. (183 cm)	Hydrophobic vent filter with Emflon II membrane

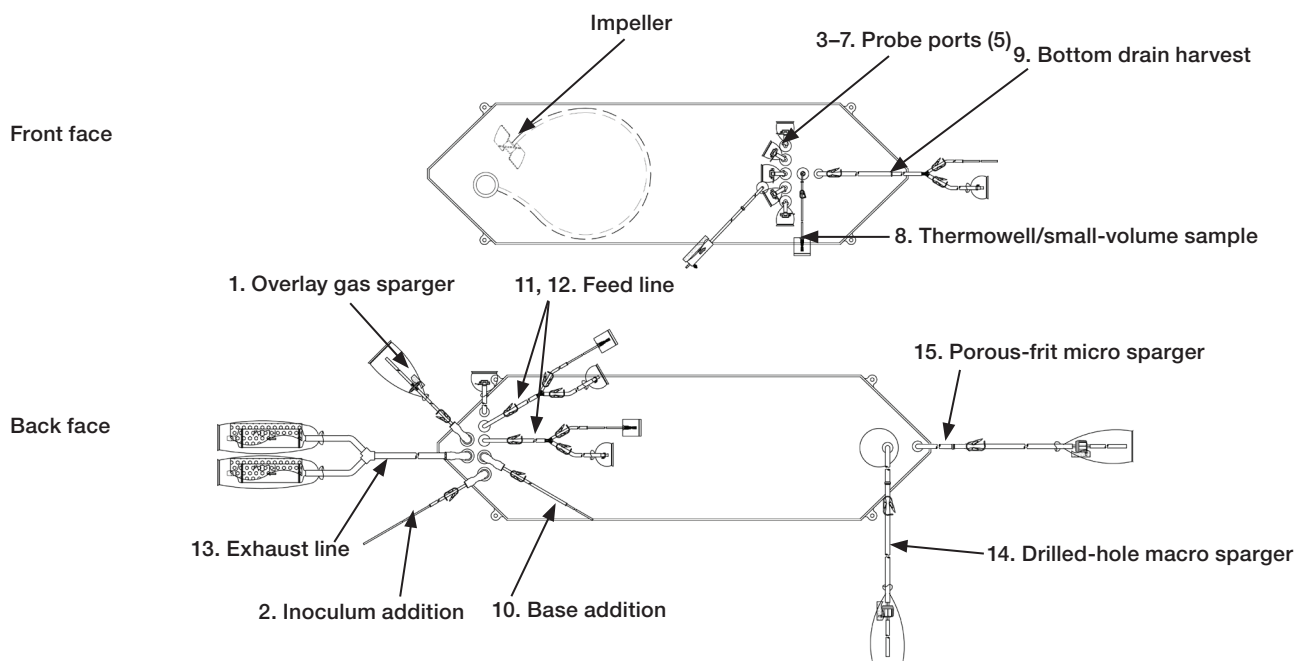


Figure 10. Standard 1,000 L dual-sparger S.U.B. BPC with drilled-hole and porous-frit spargers.

Table 10. Specifications for the standard 1,000 L dual-sparger S.U.B. BPC with drilled-hole and porous-frit spargers.

Line	Description	Tubing set (inner diameter x outer diameter x length)	End treatment
1	Overlay gas sparger	1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 6 in. (15 cm)	Meissner Steridyne™ 0.2 µm hydrophobic filter connected to 12 in. (30 cm) C-Flex tubing
2	Inoculum addition	1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 84 in. (213 cm) reduced to 1/8 in. (3.2 mm) x 1/4 in. (6.4 mm) C-Flex tubing x 12 in. (30 cm)	Plugged
3–7	Probe ports (5)	1/2 in. (12.7 mm) tube ports	Pall Kleenpak aseptic connectors—KPCHT series (female)
8	Thermowell/ small-volume sample	Thermowell adapter for 1/4 in. (6.4 mm) diameter 1/8 in. (3.2 mm) x 1/4 in. (6.4 mm) C-Flex tubing x 24 in. (60 cm)	SterilEnz pouch with injection site assembly
9	Bottom drain harvest	1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 60 in. (152 cm) reduced to 3/8 in. (9.5 mm) x 5/8 in. (15.9 mm) C-Flex tubing x 12 in. (30 cm) splits to 1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 12 in. (30 cm) reduced to 1/8 in. (3.2 mm) x 1/4 in. (6.4 mm) C-Flex tubing x 12 in. (30 cm) and 3/8 in. (9.5 mm) x 5/8 in. (15.9 mm) C-Flex tubing x 12 in. (30 cm)	Plugged 3/8 in. MPC insert
10	Base addition	1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 6 in. (15 cm) reduced to 1/8 in. (3.2 mm) x 1/4 in. (6.4 mm) C-Flex tubing x 84 in. (213 cm)	Plugged
11, 12	Feed lines	3/8 in. (9.5 mm) x 5/8 in. (15.9 mm) C-Flex tubing x 84 in. (213 cm) splits to 1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 12 in. (30 cm) reduced to 1/8 in. (3.2 mm) x 1/4 in. (6.4 mm) C-Flex tubing x 12 in. (30 cm) and 3/8 in. (9.5 mm) x 5/8 in. (15.9 mm) C-Flex tubing x 12 in. (30 cm)	SterilEnz pouch with injection site assembly, 3/8 in. MPC body
13	Exhaust line	1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 12 in. (30 cm) splits to 1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 6 in. (15 cm) and 1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 6 in. (15 cm)	(2x) Meissner™ UltraCap™ 0.2 µm hydrophobic filters connected to 6 in. (15 cm) C-Flex tubing
14	Drilled-hole macro sparger, 6.75 in. (17.1 cm) disk with 1,180 holes with a 0.018 in. (0.445 mm) diameter	3/8 in. (9.5 mm) x 5/8 in. (15.9 mm) C-Flex tubing x 3 in. (8 cm) connected to check valve and 3/8 in. (9.5 mm) x 5/8 in. (15.9 mm) C-Flex tubing x 97 in. (246 cm)	Meissner Steridyne 0.2 µm hydrophobic filter connected to 6 in. (15 cm) C-Flex tubing
15	Porous-frit micro sparger, 12 mm diameter (25 µm pores)	1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 6 in. (15 cm) reduced to check valve and 1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 95 in. (241 cm)	Meissner Steridyne 0.2 µm hydrophobic filter connected to 6 in. (15 cm) C-Flex tubing

Custom S.U.B. BPC options

Table 11 lists available custom 1,000 L S.U.B. BPC system options. Not all options are available for all ports. For additional information, please see the selection guides in the single-use products catalog.

Table 11. Custom 1,000 L S.U.B. BPC options.

Category	Options/capability	Notes
Tubing type	Thermoplastic elastomers: C-Flex, PharMed™, PharmaPure™ tubing Platinum-cured silicone PVC	More information is available in the Tubing Selection Guide
Tubing size	Ranging from 1/8 to 1 in. (0.318 to 2.54 cm) ID, in customer-specified lengths	More information is available in the Tubing Selection Guide
Connectors	Luers, quick-connects, SIP connectors, tri-clamp, aseptic connectors, sterile connectors, steam-to, steam-through, sample ports, plugs	More information is available in the Connector Selection Guide. Note: Reusable probe port connections use Kleenpak™ connector only
Probe ports	Additional ports: second row of five	The reusable probe port connection uses a Kleenpak connector only
Disposable sensors	Pressure sensor: PendoTECH and Finesse Solutions DO and pH: Finesse Solutions and PreSens pH: Mettler Toledo	Choice of qualified sensors available; PendoTECH pressure sensors come standard
Additional probe ports	Limited engineer-to-order customization only	Qualified location on second row of probe ports only
Port sizes	Limited engineer-to-order customization only	Dependent on location in BPC and fit with hardware (e.g., 1 in. (2.54 cm) port on harvest line)
Rearrangement of lines on existing ports	Limited customization possible (e.g., moving sample/thermowell port to a probe tube port, or swapping overlay inlet line with supplement line)	Dependent on location in BPC and fit with hardware
Sparger	Dual sparger (macro open-pipe or drilled-hole and micro porous-frit) standard	Sparger locations are fixed
Diptube lines	Limited customization possible	Length cannot interfere with impeller and shaft
Overlay and sparger line filters	Filter options available from standard component library	Choice of qualified filters available
Vent filters	Standard is Pall or Meissner 0.2 µm exhaust vent filter	Filters must be compatible with available vent filter heater configurations
Vent filter tubing length	Extended filter height above the S.U.B. BPC is made to order	Must be compatible with a vent filter bracket option
Filters on media and supplement inlets	Limited engineer-to-order customization only; choice of filters used to sterilize incoming media or supplements are available	Choice of qualified filters available

Table 12. Recommended S.U.B. parts list for first-time operators.

Description	Quantity	Cat. No./auxiliary part
S.U.B. hardware unit	1	Type to be configured
S.U.B. BPC	3	Type to be configured
Bioreactor probe assembly (nonsterile for use in autoclave)	12	SH30720.01
Heavy-duty tubing clamp	12	SV20664.01
Autoclave tray for autoclaving probe assemblies	1	SV50177.01
Auxiliary parts supporting the single-use bioreactor (supplied by end user or requested turnkey)		
Necessary for gas flow control, DO, and pH set points	1	Bioreactor control system
Autoclavable probe (13 mm x 13.5 PG thread with 195–235 mm insertion length)	*	DO probe
Autoclavable probe (13 mm x 13.5 PG thread with 195–235 mm insertion length)	*	pH probe
Tubing welder, steam-in-place system, sterilizer, or laminar flow hood	*	Sterile/aseptic connection
Used for fluid transfer between linesets on the containers	*	Stand-alone peristaltic pump
Necessary for water jacket temperature controls (not provided)	*	Temperature control unit (TCU)

* Quantity based on needs.

External controller options

The HyPerforma S.U.B. offers an open-architecture or turnkey system. An open-architecture system allows you to use any control system of your choice. The capital investment can be reduced by using a control system already utilized in your facility. A turnkey system is a ready-to-use, out-of-the-box system with a choice of dedicated controls from Finesse Solutions or Applikon. These systems work on PC, DeltaV, Allen-Bradley, or Siemens formats. Contact your local sales representative for more information.

Find out more at thermofisher.com/sub

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