

HyPerforma 2:1 2,000 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 2,000 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 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 a water-jacketed vessel
- Drive shaft inserts into the S.U.B. BPC through the mixing drive motor and locks into the BPC agitator assembly
- Load cells

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
- Optional condenser system
- Exhaust gas vent filter heaters
- Load cell displays
- Cable management tree
- Process control system
- Mobile stairs
- 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

2,000 L standard S.U.B. hardware units are available with a water jacket only with either a DC or AC motor. The Mettler Toledo™ FlexMount™ load cells allow for batch liquid-weight reading. Three load cells are mounted with summation box on the S.U.B. hardware unit. These hardware units do not include other options listed in Tables 3–7. Base part numbers listed in Table 1 will change depending upon which options are chosen.

Table 1. 2,000 L standard S.U.B. hardware.

Description	Cat. No.
Water jacketed, DC motor	SUB2000.9002
Water jacketed, 240 VAC, AC motor	SUB2000.9008

Design features

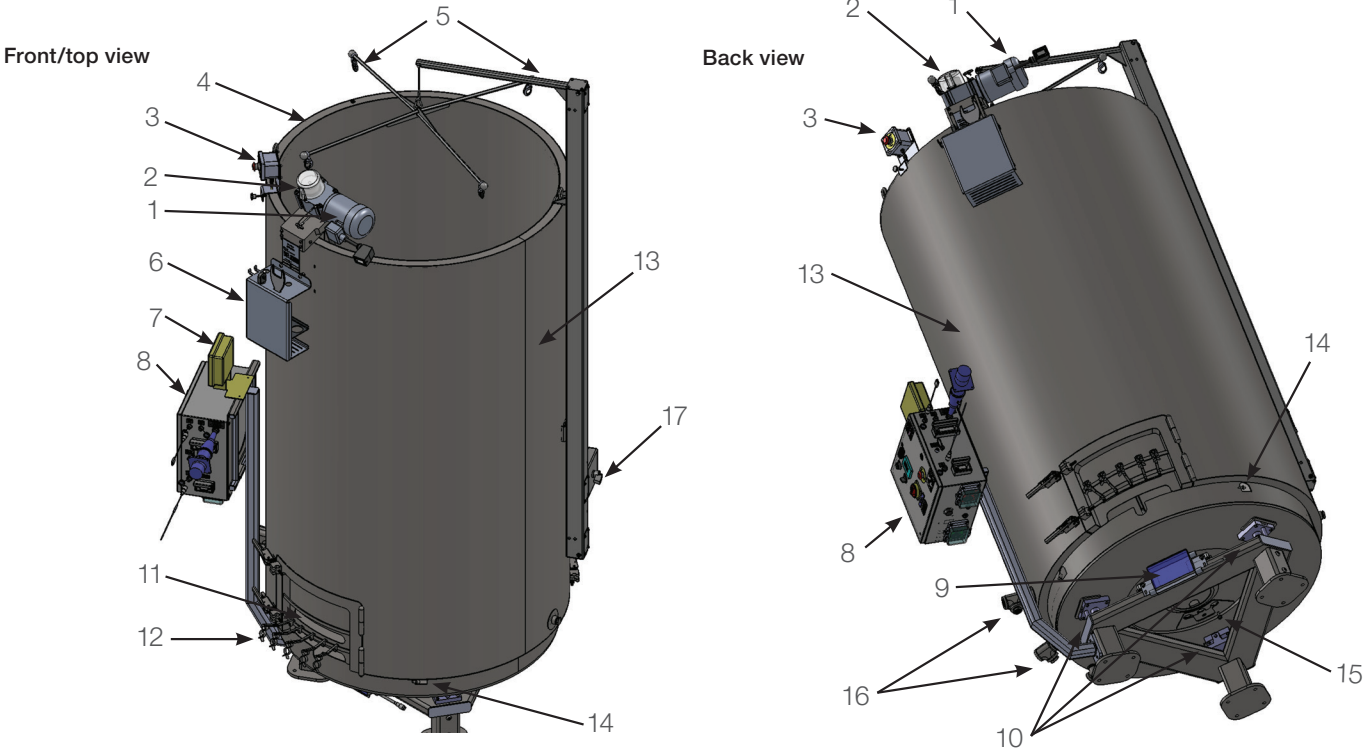


Figure 1. 2,000 L S.U.B. hardware unit with water jacket.

1. Mixer motor

2. Mixing assembly with shield

3. Auxiliary E-stop assembly

4. Stainless steel outer support container

5. Bag lift assembly

6. Standard tool set

7. Load cell display

8. Control panel

9. Load cell summation box
10. Load cells (3)

11. Probe access window

12. Probe clips

13. Water jacket

14. Bottom cutouts for BPC alignment

15. Sparge access plate

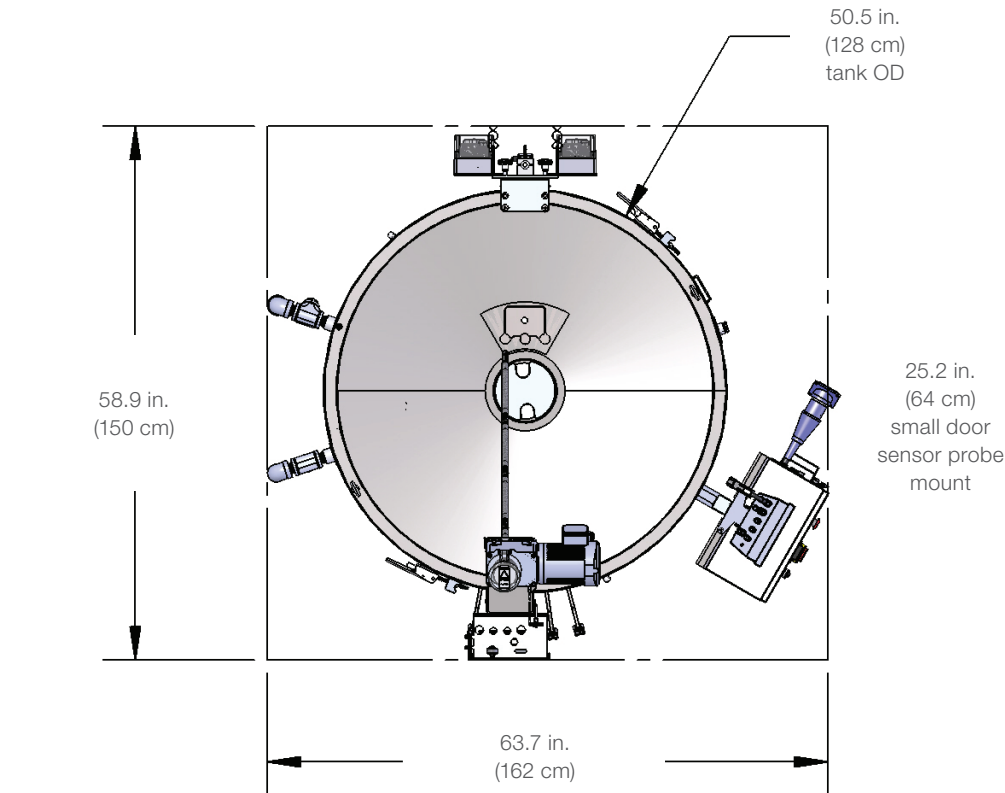
16. Jacket quick-connect couplings

17. Pneumatic bag lift control

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

Design features

Top view



Front view

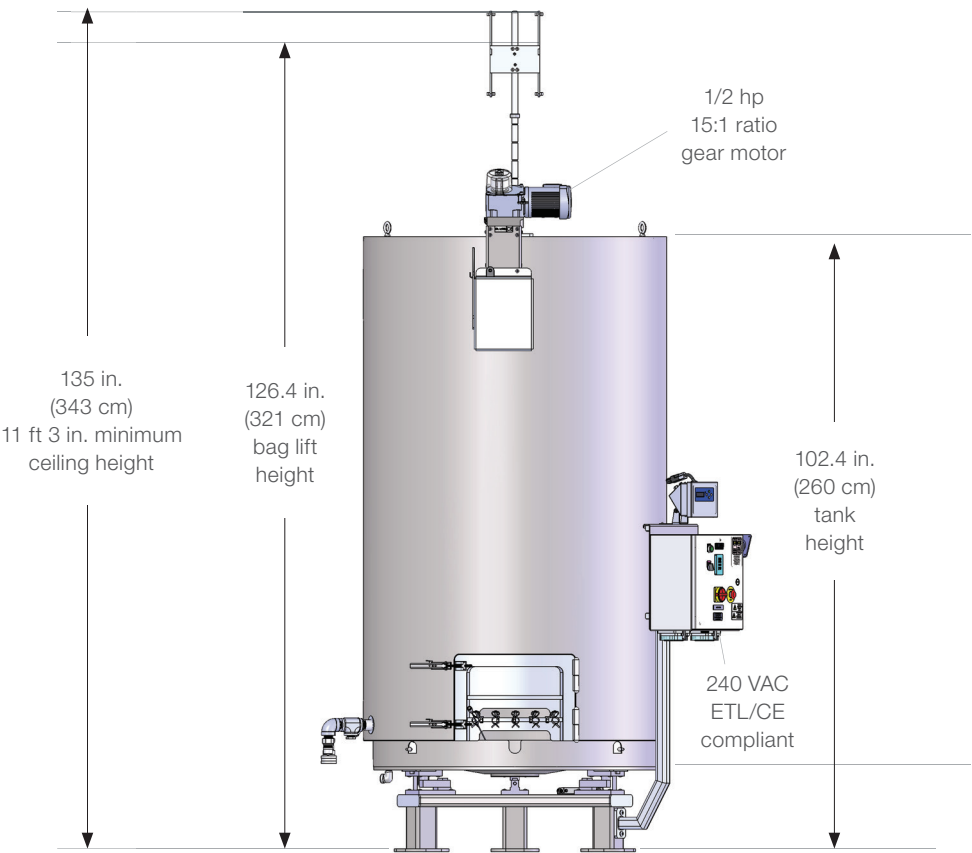


Figure 2. 2,000 L S.U.B. hardware unit dimensions.

Table 2. 2,000 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	2,000 L	
	Minimum liquid working volume	1,000 L	
	Total bioreactor volume (liquid and gas)	2,575 L	
	BPC chamber diameter	119.4 cm (47 in.)	
	BPC chamber shoulder height	229.9 cm (90.5 in.)	
	Liquid height at rated working volume	178.7 cm (70.4 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	39.8 cm (15.7 in.)	
	Impeller calculated power number (N)	2.1	
Agitation	Maximum mixing rate	Standard: 20–75 rpm Custom: up to 95 rpm above 90% working volume only	
	Nominal agitation rating (power/volume)	20 W/m ³	
	Nominal agitation	50% working volume: 60 rpm 100% working volume: 75 rpm	
	Nominal tip speed	154.9 cm/s (305 ft/min)	
	Counterclockwise mixing flow direction	Down-pumping	
	Agitation shaft resolved angle	19.6°	
	Agitation shaft centerline offset	6.7 cm (2.6 in.)	
	Overall drive shaft length (two-piece and four-piece)	210.6 cm (82.9 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	39.8 cm (15.7 in.)	
Motor	Agitation motor drive (type, voltage, phase) AC motor only	Induction, 208 VAC, 3	–
	Agitation motor drive (type, voltage) DC motor only	–	Brushless, 48 VDC
	Motor power rating (AC motor)	0.5 hp (372.8 W)	–
	Motor power rating (DC motor)	–	0.536 hp (400 W)
	Motor torque rating	27.7 N-m (245 in.-lb)	–
	Gear reduction	15:1	20:1
	Programmable VFD, remote panel interface, power fault auto restart	Standard	–
	Motor communication methods (for external controller)	0–10 V, 4–20 mA, ModBus	–

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

Specifications for water-jacketed systems with AC and DC motors				
			AC motor	DC motor
Temperature control	Water jacket	Jacket area: full/half-volume	67.1/53.9 ft ²	
		Jacket volume	44 L	
		Jacket flow rate at 50 psi (3.4 bar)	75 L/min	
		Process connection	1 in. male national pipe thread (NPT) nipple provided with Hansen™ quick-connect check valves	
		Nominal heating/cooling load (W)	18,000 W	
		Approximate liquid heat-up time (5–37°C)	4 hr	
	Misc.	RTD or thermocouple, 1/8 in. (3.18 mm) OD	RTD: Pt-100 (standard)	
Support container	Overall width		179.7 cm (70.5 in.) with E-box	148.5 cm (58.5 in.)
	Overall length		171.4 cm (67.5 in.)	
	Overall height		321 cm (126.4 in.)	
	Dry skid weight (mass)		962.1 kg (2,121 lb)	
	Wet skid weight, rated working volume (mass)		2,962.1 kg (6,530 lb)	
General	Ceiling height required for 2-piece driveshaft loading		381 cm (150 in.)	
	Ceiling height required for 4-piece driveshaft loading		353.06 cm (139 in.)	
	Electrical power supply requirement (voltage, phase, current)		208–240 VAC, single, 10 A	Dependent on controller
	Tested system reliability (minimum)		0.9 at 90%	
	pH and DO probe, autoclavable type (Applisens™, Broadley James™, Mettler Toledo™)		12 mm diameter x 215–235 mm insertion length x 13.5 PG thread	
	Noise level		< 70 dB at 1.5 m	
	Minimum acceleration and deceleration rate		60 seconds	
Recommended operating parameters	Operating temperature range		Ambient to 40 ± 0.1°C (104 ± 0.2°F)	
	Motor speed		Standard: 20–75 rpm Custom: up to 95 rpm above 90% working volume only	
	Volume range		1,000–2,000 L	
	Maximum BioProcess Container pressure		0.5 psi (0.03 bar)	
	Continuous operating time		21 days mixing time at nominal volume only	

System options

Table 3 lists available S.U.B. system options for the 2,000 L size.

- **Autoclave tray (Figure 3)**—aids in holding the probe assembly during the autoclave process
- **Sparger support line (Figure 4)**—keeps gas lines in an upright position for optimal gas transfer
- **Heavy-duty tubing clamps (Figure 5)**—used for each probe port not in use, eliminating process fluid holdup
- **Sterile sampling manifolds**—available in 50 and 100 mL sizes for off-line sample retention
- **Mobile stairs (Figure 6)**—facilitates access to the bioreactor for top-mount drive shaft loading; the 2,000 L S.U.B. requires a platform for top-mount drive shaft loading (customer may provide their own solution)
- **Bioreactor probe assemblies (Figure 7)**—required for each sterile electrochemical probe insertion
- **S.U.B. temperature sample port (Figure 8)**—provides off-line temperature probe calibration prior to system startup
- **Condenser system (Figure 9)**

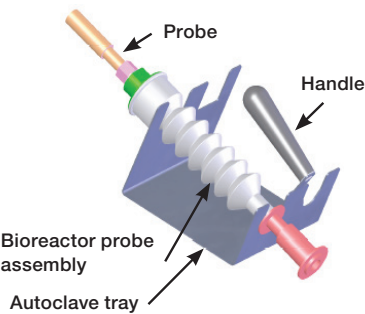


Figure 3. Autoclave tray for probe kits.

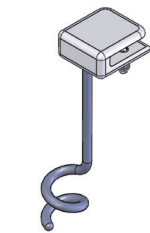


Figure 4. Sparger support line.



Figure 5. Heavy-duty tubing clamps.



Figure 6. Mobile stairs.



Figure 7. Bioreactor probe assembly.



Figure 8. S.U.B. temperature sample port.

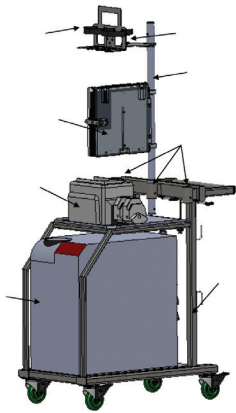


Figure 9. Condenser system.

Table 3. 2,000 L S.U.B. system options.

Description	Cat. No.
Complete condenser system (120 V) including cart, chill plate and mounting post with filter brackets, TCU, and pump	SV50232.01
Complete condenser system (240 V) including cart, chill plate and mounting post with filter brackets, TCU, and pump	SV50232.02
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	SV50177.65
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 each)	SH30845.02
S.U.B. temperature/sample port	SV20750.01
Mobile stairs	SV50935.01

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.

Note: Vent heater is not required if condenser system is purchased.

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	SV50177.306
Mettler Toledo IND331 display, with Allen-Bradley RIO interface, 120 VAC U.S. line cord/plug	SV50177.307
Mettler Toledo IND331 display, with DeviceNet interface, 120 VAC U.S. line cord/plug	SV50177.308
Mettler Toledo IND331 display, with Ethernet/IP and Modbus TCP interface, 120 VAC U.S. line cord/plug	SV50177.309
Mettler Toledo IND331 display, with Profibus interface, 120 VAC U.S. line cord/plug	SV50177.310

Spare parts

Table 6 lists the available spare parts of the 2,000 L S.U.B. systems.

Table 6. Available spare parts list.

Description	Cat. No.
DC motor	SV50237.22
AC motor	SV50237.19
Drive shaft	SV50177.155
RTD 120 in. with Bulgin connector	SV50177.363
Probe holders	SV50177.23
Autoclave tray (stainless steel with plastic carry handle)	SV50177.01

Standard 2,000 L dual-sparger S.U.B. BPC systems

Table 7 shows the available dual-sparger options for the 2,000 L S.U.B. BPC system in either configuration: open-pipe and porous-frit spargers (Figure 10, Table 9) or drilled-hole and porous-frit spargers (Figure 11, Table 10). Standard S.U.B. BPC packaging is shown in Table 8.

Table 7. Standard 2,000 L dual-sparger S.U.B. BPCs.

Film	Dual-sparger configuration	Condenser	Cat. No.
CX5-14 film	Open-pipe and porous-frit spargers	No	SH30774.07
CX5-14 film	Open-pipe and porous-frit spargers	Yes	SH30774.08
CX5-14 film	Drilled-hole and porous-frit spargers	Yes	SH30985.07
CX5-14 film	Drilled-hole and porous-frit spargers	No	SH30985.08
Aegis5-14 film	Open-pipe and porous-frit spargers	No	SH30972.07
Aegis5-14 film	Open-pipe and porous-frit spargers	Yes	SH30972.08
Aegis5-14 film	Drilled-hole and porous-frit spargers	Yes	SH30999.07
Aegis5-14 film	Drilled-hole and porous-frit spargers	No	SH30999.08

Table 8. Standard 2,000 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

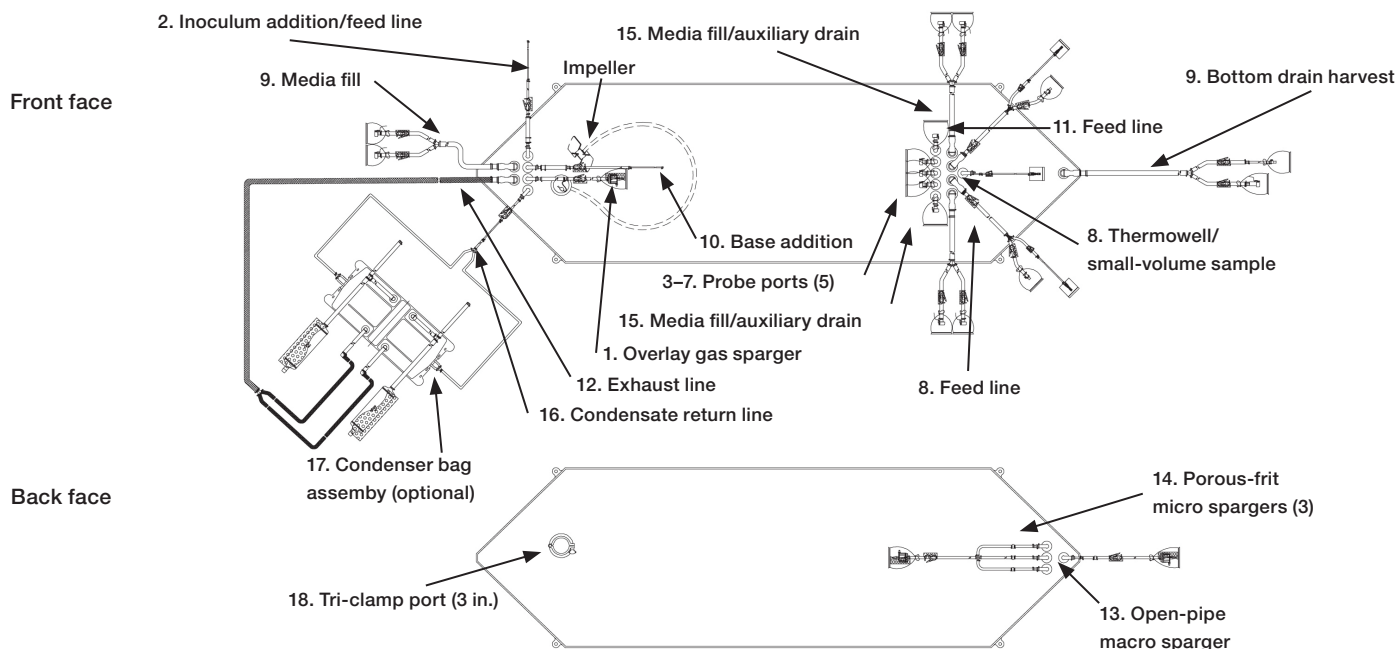


Figure 10. Standard 2,000 L dual-sparger S.U.B. BPC with open-pipe and porous-frit spargers. Available with or without the condenser assembly.

Table 9. Specifications for the standard 2,000 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	1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex™ tubing x 4 in. (10 cm) reduced to 3/8 in. (9.5 mm) x 5/8 in. (15.9 mm) C-Flex tubing x 84 in. (213 cm)	Kleenpak™ Emflon™ II capsule and pressure transducer
2	Inoculum addition/feed line	1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 3 in. (8 cm) reduced to 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
3-7	Probe ports (5)	1/2 in. (12.7 mm) tube ports	Pall™ Kleenpak™ aseptic connectors (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	3/4 in. (19.1 mm) x 1 in. (25.4 mm) C-Flex tubing x 48 in. (122 cm) splits to 1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 24 in. (61 cm) reduced to 1/4 in. (6.4 mm) x 3/8 in. (9.5 mm) C-Flex tubing x 12 in. (30 cm) and 1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 24 in. (61 cm)	1/4 in. MPC insert and Pall™ Kleenpak™ connector (male)
10	Base addition	1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 3 in. (8 cm) reduced to 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
11	Feed 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)	SterilEnz pouch with injection site assembly and 3/8 in. MPC body
12	Exhaust line	Condenser bag assembly (optional)	—
13	Open-pipe macro sparger	1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 72 in. (183 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)	Kleenpak Emflon II capsule
14	Porous-frit micro spargers (3, 12 mm diameter (25 µm pores))	(2x) 12 mm PDVF porous sparge inserts connected to 1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 6 in. (15 cm) converge to one 1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 72 in. (183 cm)	Kleenpak Emflon II capsule
15	Media fill/auxiliary drain	3/4 in. (19.1 mm) x 1 in. (25.4 mm) C-Flex tubing x 84 in. (213 cm) splits to 1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 24 in. (61 cm) and 1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 24 in. (61 cm)	Pall Kleenpak connectors (female)
16	Condensate return line	Condenser bag assembly (optional)	—
17	Condenser bag assembly	Condenser bag assembly (optional)	—
18	Tri-clamp port (3 in.)	NA	Gasket, end cap, and clamp

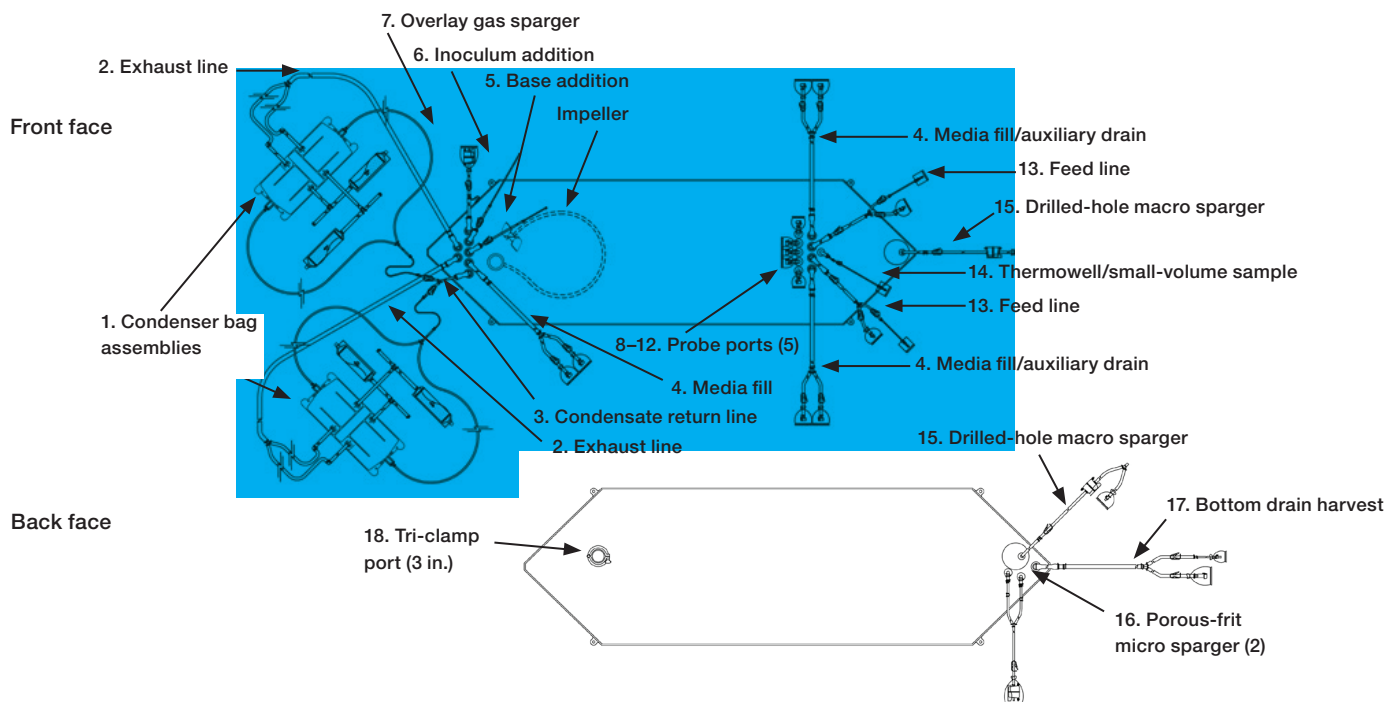


Figure 11. Standard 2,000 L dual-sparger S.U.B. BPC with drilled-hole and porous-frit spargers. Available with or without condenser assemblies.

Table 10. Specifications for the standard 2,000 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	Condenser bag assemblies (2)	Condenser bag assembly (optional)	–
2	Exhaust lines (2)	Condenser bag assembly (optional)	–
3	Condensate return line	Condenser bag assembly (optional)	–
4	Media fill/auxiliary drain lines	(3x) 3/4 in. (19.1 mm) x 1 in. (25.4 mm) C-Flex tubing x 84 in. (213 cm) splits to 1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 24 in. (61 cm) and 1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 24 in. (61 cm)	Pall Kleenpak aseptic connectors (female)
5	Base addition	1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 3 in. (8 cm) reduced to 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
6	Inoculum addition/feed line	1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 3 in. (8 cm) reduced to 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
7	Overlay gas sparger	1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 4 in. (10 cm) reduced to 3/8 in. (9.5 mm) x 5/8 in. (15.9 mm) C-Flex tubing x 84 in. (213 cm)	Kleenpak Emflon II capsule and pressure transducer
8–12	Probe ports (5)	1/2 in. (12.7 mm) tube ports	Pall Kleenpak aseptic connectors (female)
13	Feed lines	(2x) 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)	SterilEnz pouch with injection site assembly and 3/8 in. MPC body
14	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. (61 cm)	SterilEnz pouch with injection site assembly
16	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)	(2x) Meissner™ Steridyne™ 0.2 µm hydrophobic filter
17	Bottom drain harvest	3/4 in. (19.1 mm) x 1 in. (25.4 mm) C-Flex tubing x 48 in. (122 cm) splits to 1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 24 in. (61 cm) reduced to 1/4 in. (6.4 mm) x 3/8 in. (9.5 mm) C-Flex tubing x 12 in. (30 cm) and 1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 24 in. (61 cm)	1/4 in. MPC insert and Pall Kleenpak connector (male)
18	Tri-clamp port (3 in.)	NA	Gasket, end cap, and clamp

Custom S.U.B. BPC options

Table 11 lists available custom 2,000 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 2,000 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	To be designed
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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