

HyPerforma 2:1 50 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) for the 50 L size with a 2:1 turndown ratio. The upgraded HyPerforma S.U.B. maintains traditional stirred-tank bioreactor design principles, including specific height-to-diameter ratios and optimized mixer location that deliver optimum performance for cell density, viability, and scalability from process development through production.

This data sheet provides information on the 50 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.

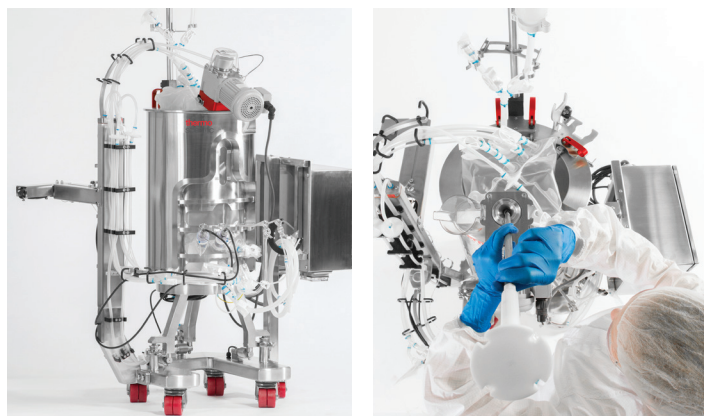
The S.U.B. system consists of the following components:

S.U.B. hardware unit—available in open-architecture or integrated format

- Complete mixing system with a choice of water jacket or resistive heater
- 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
- Exhaust (vent) filter



- 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 agitation control
 - Temperature may be controlled from electrical box on S.U.B.s with resistive heater
 - Water-jacketed S.U.B.s require a separate external temperature control unit
- Exhaust gas vent filter heaters
- Load cells
- 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 50 L standard S.U.B. hardware units are available in the following configurations (Table 1).

- Water jacket with DC motor
- Water jacket with AC motor
- Resistive heater with DC motor
- Resistive heater with AC motor

Additional options are listed in Tables 3–7.

Design features

Side view

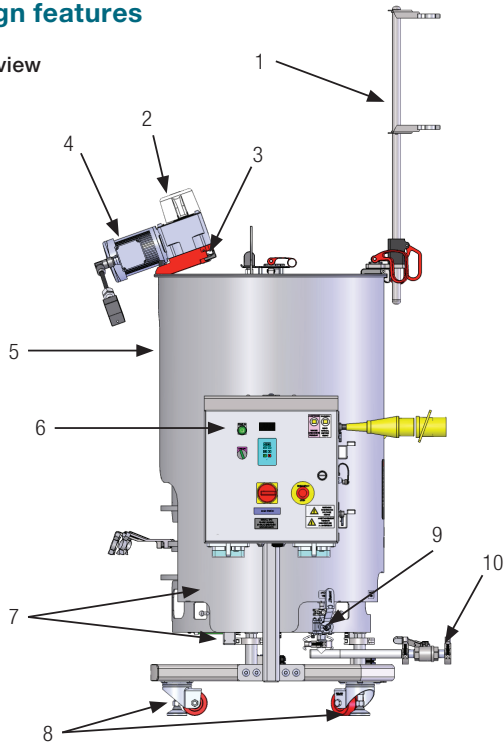


Table 1. 50 L standard S.U.B. hardware unit with casters (leveling feet).

Description	Cat. No.
Resistive, DC motor	SUB0050.9001
Water jacketed, DC motor	SUB0050.9002
Resistive, 120 VAC, AC motor	SUB0050.9003
Water jacketed, 120 VAC, AC motor	SUB0050.9004
Resistive, 240 VAC, AC motor	SUB0050.9005
Water jacketed, 240 VAC, AC motor	SUB0050.9006

Front view

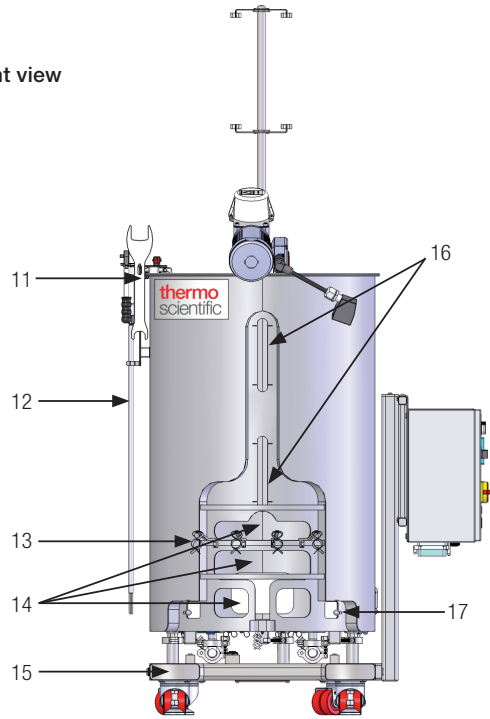


Figure 1. 50 L S.U.B. hardware unit with water jacket or resistive heater.

1. Exhaust vent filter holder
2. Mixing assembly with shield
3. Bearing port receiver with clamp
4. Mixer motor
5. Stainless steel (304) outer support container
6. Electrical control panel (optional)
7. Water jacket (3/8 in. dimpled) or resistive blanket (side and bottom)
8. Leveling casters
9. Bleed valve (water jacketed models only)
10. 1.5 in. tri-clamp water inlet/outlet ports (water jacketed models only)
11. Standard tool set: 3/8 in. x 150 in.-lb square torque wrench; load cell and motor cap lockout wrench
12. Drive shaft (stored)
13. Probe hanger bracket
14. Probe access windows
15. Cart assembly
16. Liquid sight windows
17. Bottom cutouts/pins for BPC attachment and alignment

Note: Load cells are available as optional components.

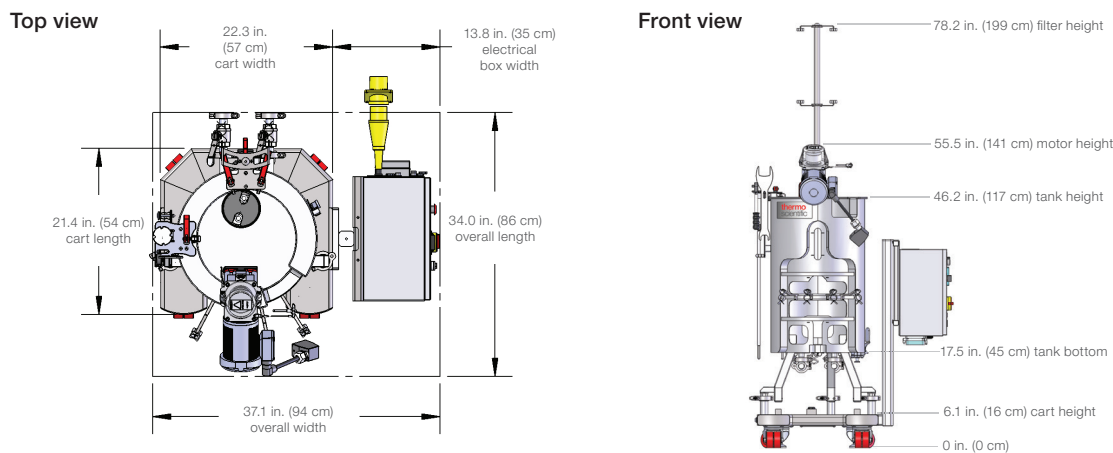


Figure 2. 50 L S.U.B. hardware unit dimensions.

Table 2. 50 L S.U.B. system specifications.

Specifications for AC and DC motors, resistive and water jacketed					
		AC motor		DC motor	
		Resistive	Water jacketed	Resistive	Water jacketed
Bioreactor geometry	Rated liquid working volume	50 L			
	Minimum liquid working volume	25 L			
	Total bioreactor volume (liquid and gas)	65.5 L			
	BPC chamber diameter	34.9 cm (13.75 in.)			
	BPC chamber shoulder height	80 cm (31.5 in.)			
	Liquid height at rated working volume	52.1 cm (20.5 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	11.11 cm (4.375 in.)			
	Impeller calculated power number (N)	2.1			
Agitation	Maximum mixing rate	30–200 rpm			
	Nominal agitation rating (power/volume)	20 W/m³			
	Nominal agitation	50% working volume: 145 rpm 100% working volume: 183 rpm			
	Nominal tip speed	103.9 cm/s (204.6 ft/min)			
	Counterclockwise mixing flow direction	Down-pumping			
	Agitation shaft resolved angle	19.6°			
	Agitation shaft centerline offset	1.9 cm (0.75 in.)			
	Overall drive shaft length	76.2 cm (30 in.)			
	Drive shaft diameter	1.27 cm (0.5 in.)			
	Drive shaft poly-sheath outside diameter	2.54 cm (1 in.)			
	Impeller clearance from tank bottom	11.75 cm (4.63 in.)			

Table 2. 50 L S.U.B. system specifications (continued).

Specifications for AC and DC motors, resistive and water jacketed						
			AC motor		DC motor	
			Resistive	Water jacketed	Resistive	Water jacketed
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)		0.25 hp (186.4 W)		–	
	Motor power rating (DC motor)		–		0.268 hp (200 W)	
	Motor torque rating		82 in.-lb (9.5 N-m)		–	
	Gear reduction		10:1			
	Programmable VFD, remote panel interface, power fault auto restart		Standard		–	
	Motor communication methods (for external controller)		0–10 V, 4–20 mA, ModBus		–	
Temperature control	Resistive heater	Programmable PID temperature controller	Standard	–	Standard	–
		Solid state relay (discrete voltage signal)	24–240 V AC/DC	–	24–240 V AC/DC	–
		Heater power rating (total)	455.7 W	–	455.7 W	–
		Heater power rating (sides)	360 W	–	360 W	–
		Heater power rating (bottom)	95.7 W	–	95.7 W	–
		Approximate liquid heat-up time (5–37°C)	4.32 hr	–	4.32 hr	–
	Water jacket	Jacket area: full/half volume (ft²)	–	4.4/2	–	4.4/2
		Jacket volume	–	2.4 L	–	2.4 L
		Jacket flow rate at 50 psi (3.4 bar)	–	136 L/min	–	136 L/min
		Process connection	–	1.5 in. sanitary tri-clamp	–	1.5 in. sanitary tri-clamp
		Nominal heating/cooling load (W)	–	500 W	–	500 W
		Approximate liquid heat-up time (5–37°C)	–	1.7 hr	–	1.7 hr
	Misc.	RTD or thermocouple, 1/8 in. (3.18 mm) OD	RTD: Pt-100 (standard)			
Support container	Overall width		94.2 cm (37.1 in.) with E-Box		56.5 cm (22.25 in.)	
	Overall length		84.3 cm (33.2 in.) with E-Box		77 cm (30.3 in.)	
	Overall height		198.6 cm (78.2 in.)			
	Dry skid weight (mass)		134.3 kg (296 lb)	115.7 kg (255 lb)	134.3 kg (296 lb)	115.7 kg (255 lb)
	Wet skid weight, rated working volume (mass)		184.2 kg (406.2 lb)	165.7 kg (365.2 lb)	184.2 kg (406.2 lb)	165.7 kg (365.2 lb)
General	Ceiling height required for drive shaft loading		213.4 cm (84 in.)			
	Electrical power supply requirement (voltage, phase, current)		120/240 VAC, single, 20/10 A		Dependent on controller	
	Tested system reliability (minimum)		0.9 at 90%			
	pH and DO probe, autoclavable type (Applisens™, Broadley James™, Mettler Toledo™, Finesse™)		12 mm diameter x 215–235 mm insertion length x 13.5 PG (pipe) thread			
	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		30–200 rpm			
	Volume range		25–50 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 options for the 50 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 mL size for off-line sample retention
- **Load cells (Figure 5)**—Mettler Toledo™ FlexMount™ load cells allow for reading of batch liquid weight; three load cells are mounted with summing box on the S.U.B. hardware unit
- **Bioreactor probe assembly (Figure 6)**—required for each sterile electrochemical probe insertion
- **Autoclave tray (Figure 7)**—aids in holding the probe assembly during the autoclave process
- **S.U.B. temperature sample port (Figure 8)**—provides off-line temperature probe calibration prior to system startup
- **Cable management tree (Figure 9)**—allows the end user to organize the S.U.B. BPC tubing lines for operator ease of use

Table 3. 50 L S.U.B. system options.

Description	Cat. No.
Cable management tree	SV50992.01
Load cell with summation box, without display	SV50988.01
Autoclave tray	SV50177.01
Kleenpak™ bioreactor probe assembly	SH30720.01
AseptiQuik™ bioreactor probe assembly	SH30720.02
Sparger line support	SV50177B.19
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

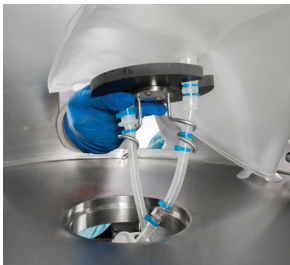


Figure 3. Sparger support line.



Figure 4. Heavy-duty tubing clamps.

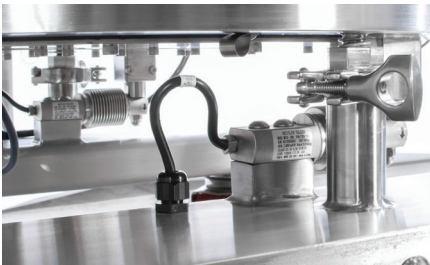


Figure 5. Load cells.



Figure 6. Bioreactor probe assembly.

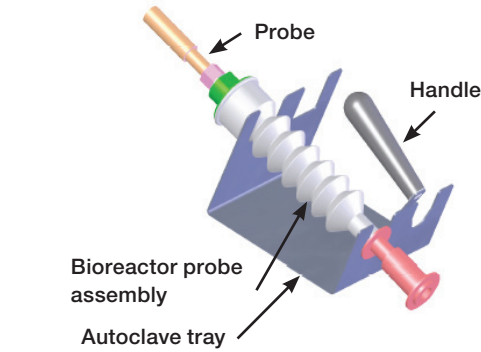


Figure 7. Autoclave tray for probe kits.



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



Figure 9. Cable management tree.

Vent heaters

Vent heaters aid in reducing moisture buildup on exhaust filters from system off-gassing. Vent heaters are factory preset at 50°C to allow for 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	Cat. No.
100–120 VAC, power cord, for Pall KA3 filter	SV50191.11
200–240 VAC, power cord, for Pall KA3 filter	SV50191.13
100–120 VAC, for Meissner 10 in. filter, United States and Japan	SV50191.16
200–240 VAC, for Meissner 10 in. filter, United Kingdom	SV50191.17
200–240 VAC, for Meissner 10 in. filter, Europe CEE 7/7	SV50191.18
200–240 VAC, for Meissner 10 in. filter, IEC320 power cord	SV50191.19

Harsh mount load cell display

Required for 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 50 L S.U.B. systems.

Table 6. Available spare parts list.

Description	Cat. No.
DC motor	SV50237.07
AC motor	SV50237.16
Drive shaft	SV50177.34
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 50 L dual sparger S.U.B. BPC systems

Table 7 shows the available dual sparger options for the 50 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 50 L dual sparger S.U.B. BPCs.

Film	Dual sparger configuration	Cat. No.
CX5-14 film	Open-pipe and porous-frit spargers	SH30774.01
Aegis5-14 film	Open-pipe and porous-frit spargers	SH30972.01
CX5-14 film	Drilled-hole and porous-frit spargers	SH30985.01
Aegis5-14 film	Drilled-hole and porous-frit spargers	SH30999.01

Table 8. Standard 50 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

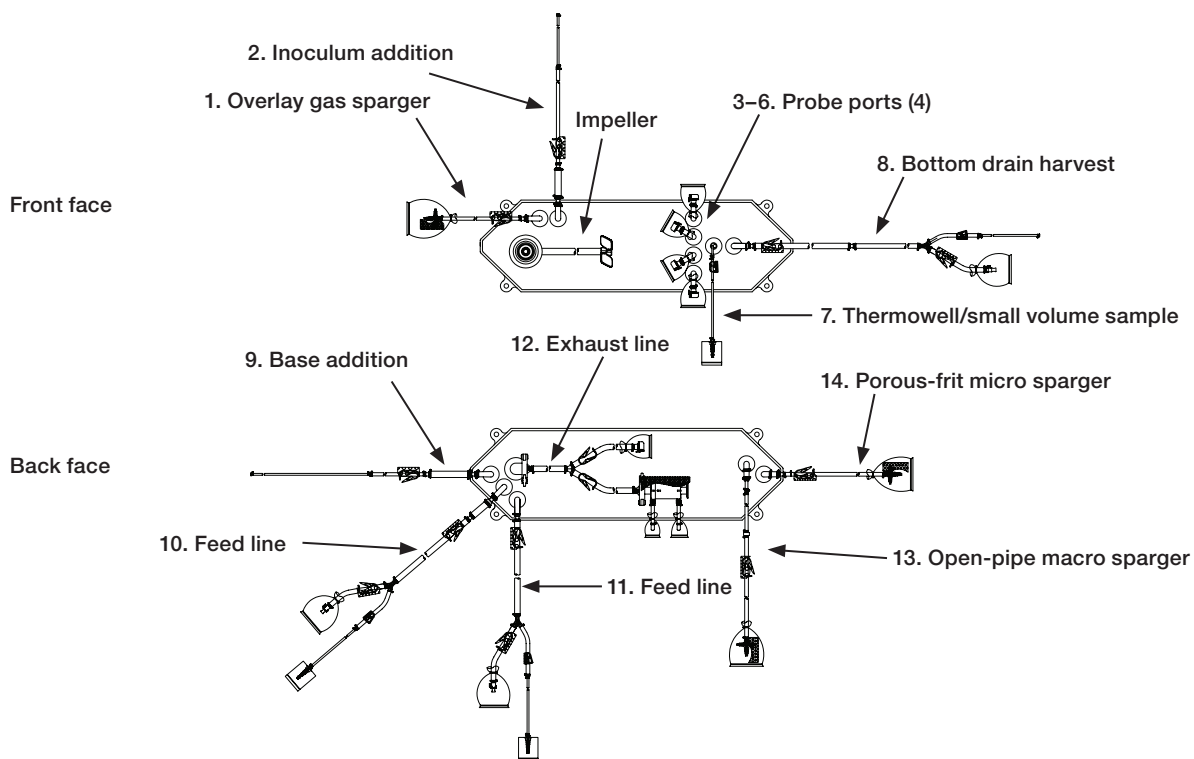


Figure 10. Standard 50 L dual-sparger S.U.B. BPC with open-pipe and porous-frit spargers.

Table 9. Specifications for the standard 50 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)	0.2 µm hydrophobic vent filter with Emflon™ II membrane
2	Inoculum addition	1/4 (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 60 in. (152 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
3–6	Probe ports (4)	1/2 in. (12.7 mm) tube ports	Kleenpak aseptic connectors—KPCHT series (female)
7	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 18 in. (46 cm)	SteriEnz™ pouch with injection site assembly
8	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
9	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 60 in. (152 cm)	Plugged
10, 11	Feed lines	3/8 in. (9.5 mm) x 5/8 in. (15.9 mm) C-Flex tubing x 60 in. (152 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)	SteriEnz pouch with injection site assembly, 3/8 in. MPC body
12	Exhaust line	1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 6 in. (15 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 10 in. (25 cm)	Kleenpak aseptic connector—KPCHT series (female) Kleenpak 0.2 µm exhaust vent filter
13	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) connected to check valve and 1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 48 in. (122 cm)	0.2 µm hydrophobic vent filter with Emflon II membrane
14	Porous-frit micro sparger	1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 6 in. (15 cm) connected to check valve and 1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 48 in. (122 cm)	Hydrophobic vent filter with Emflon II membrane

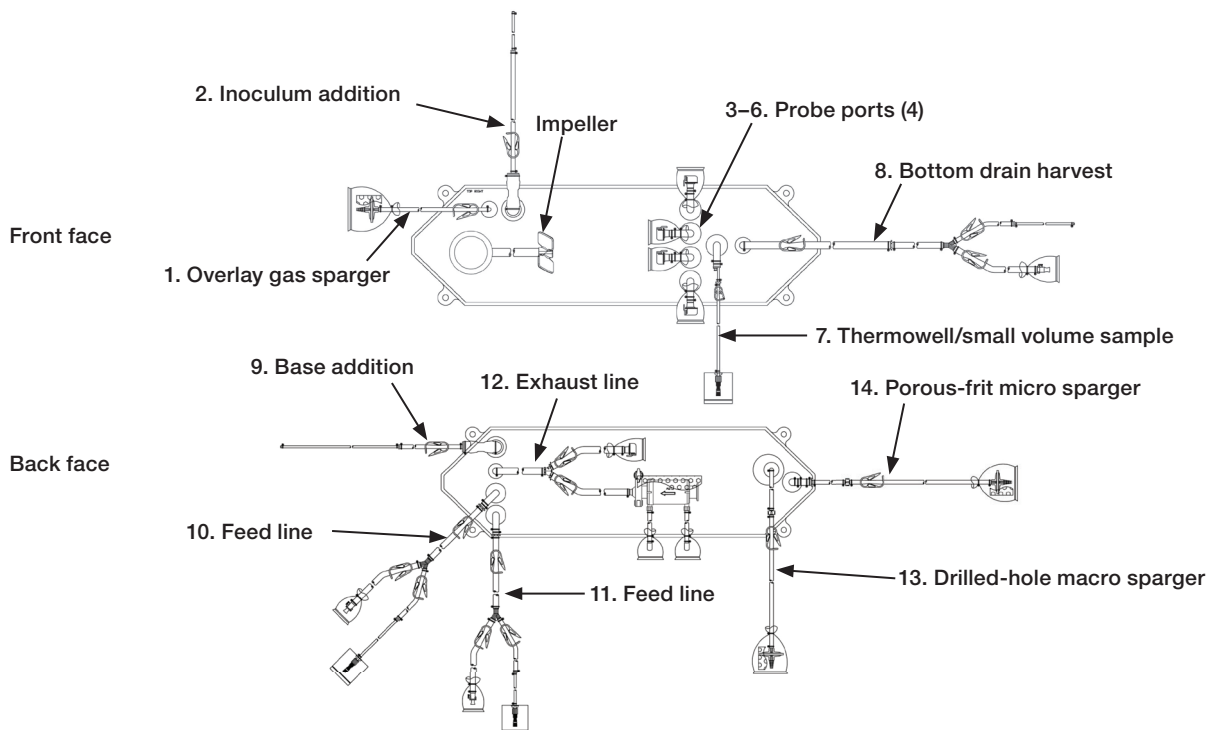


Figure 11. Standard 50 L dual-sparger S.U.B. BPC with drilled-hole and porous-frit spargers.

Table 10. Specifications for the standard 50 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)	Hydrophobic vent filter with Emflon II membrane, connected to 6 in. (15 cm) C-Flex tubing
2	Inoculum addition	1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 60 in. (152 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
3-6	Probe ports (4)	1/2 in. (12.7 mm) tube ports	Kleenpak aseptic connectors—KPCHT series (female)
7	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 18 in. (46 cm)	SteriEnz pouch with injection site assembly
8	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
9	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 60 in. (152 cm)	Plugged
10, 11	Feed lines	3/8 in. (9.5 mm) x 5/8 in. (15.9 mm) C-Flex tubing x 60 in. (152 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)	SteriEnz pouch with injection site assembly, 3/8 in. MPC body
12	Exhaust line	1/2 in. (12.7 mm) x 3/4 in. (19.1 mm) C-Flex tubing x 8 in. (20 cm) connected 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 10 in. (25 cm)	Kleenpak aseptic connector—KPCHT series (female) Kleenpak 0.2 µm exhaust vent filter
13	Drilled-hole macro sparger 3.5 in. (8.9 cm) disk with 360 x 0.178 mm (0.007 in.) holes	1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 3 in. (8 cm) connected to check valve and 1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 38 in. (97 cm)	Meissner Steridyne™ 0.2 µm hydrophobic filter connected to 6 in. (15 cm) C-Flex tubing
14	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) connected to check valve and 1/4 in. (6.4 mm) x 7/16 in. (11.1 mm) C-Flex tubing x 35 in. (89 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 50 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 50 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 four	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
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/sut

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