ThermoFisher SCIENTIFIC

HyPerforma Single-Use Bioreactor (S.U.B.) Family

Trusted, proven performance

thermo scientific

Experience consistent and reliable bioprocessing results

Industry-proven technology for mammalian cell culture

Widely adopted for process development, clinical trials, and current good manufacturing practice (CGMP) cell culture bioproduction, Thermo Scientific™ HyPerforma™ Single-Use Bioreactors (S.U.B.) have earned customer trust for nearly 20 years. These bioreactors feature a tank equipped with a specially designed single-use Thermo Scientific™ BioProcess Container (BPC). The ability to replace the BPC after each run helps minimize contamination risks and significantly reduces changeover time compared to traditional stainless-steel bioreactors.

The complete line of HyPerforma S.U.B.s offers consistent performance and scalability from process development through commercial manufacturing.

Key features include:

- Trusted—Large global install base
- Scalable—50, 100, 250, 500, 1,000, and 2,000 L sizes with a 5:1 turndown ratio to help support your seed train
- Flexible—Small footprint, with several models on leveling casters to help reduce the need for expensive buildouts
- Robust BPCs—Made from Thermo Scientific™ Aegis™ 5-14 films, which are engineered to help meet the most demanding requirements of your bioproduction process
- Easy to operate—Thermo Scientific™ HyPerforma™ Bioprocess Controllers feature a touchscreen NEMA interface and redundant sensor control mechanisms

Consistent performance

Ergonomic and elegant tank design

The HyPerforma S.U.B. is highly functional and designed to meet CGMP requirements. The S.U.B. tanks provide operator ergonomics, a small footprint, and the easy cleaning capabilities associated with an open-cart frame.

- Helps save precious lab space with a minimized vessel footprint
- Offers easier access to harvest lines with open-frame design
- Tank floor design helps to reduce hold-up volumes
- Simple bag loading with a vertical access door (available on 500, 1,000, and 2,000 L sizes; electromechanical hoist provided on 2,000 L model)
- Pneumatic overhead motor lift assembly on 1,000 and 2,000 L sizes is used to lower/raise the motor, drive shaft, and impeller assembly to enable operation at both the 5:1 and 2:1 positions; helps ensure proper mixing across the full range of volumes

Efficient and fast

The water jacket design allows for fast heat-up and cool-down times, reducing process cycle time. The bottom water-jacketed systems increase surface area, improving heat transfer from low-volume cultures.

- Optimal precision load cells and standard sight-volume indicators allow you to keep your processes running efficiently
- DC motor includes encoder feedback for improved RPM accuracy and is ground-fault circuit-interrupter (GFCI)–compatible
- 3/8 in. dimple jacket improves flow rate through the water jacket for higher-performance temperature control
- Graduated sight-volume indicators accommodate visual volume references at a glance

Explore
the HyPerforma S.U.B.
by taking a virtual tour

5:1 S.U.B. drives efficiency

Benefits of an improved turndown ratio

Improving the turndown ratio leads to greater productivity, time savings, and cost efficiency through:

- Streamlining of bioprocesses by minimizing seed-vessel requirements and maximizing process-vessel usage
- Seed vessels running at 20% volume: fill to larger volume (>40%) after 1–2 days
- Lowering hardware and single-use bag requirements
- Reducing cell transfers and associated adaptation
- Running with as low as 10 L of working volume in the 50 L bioreactor and 400 L working volume in the 2,000 L bioreactor

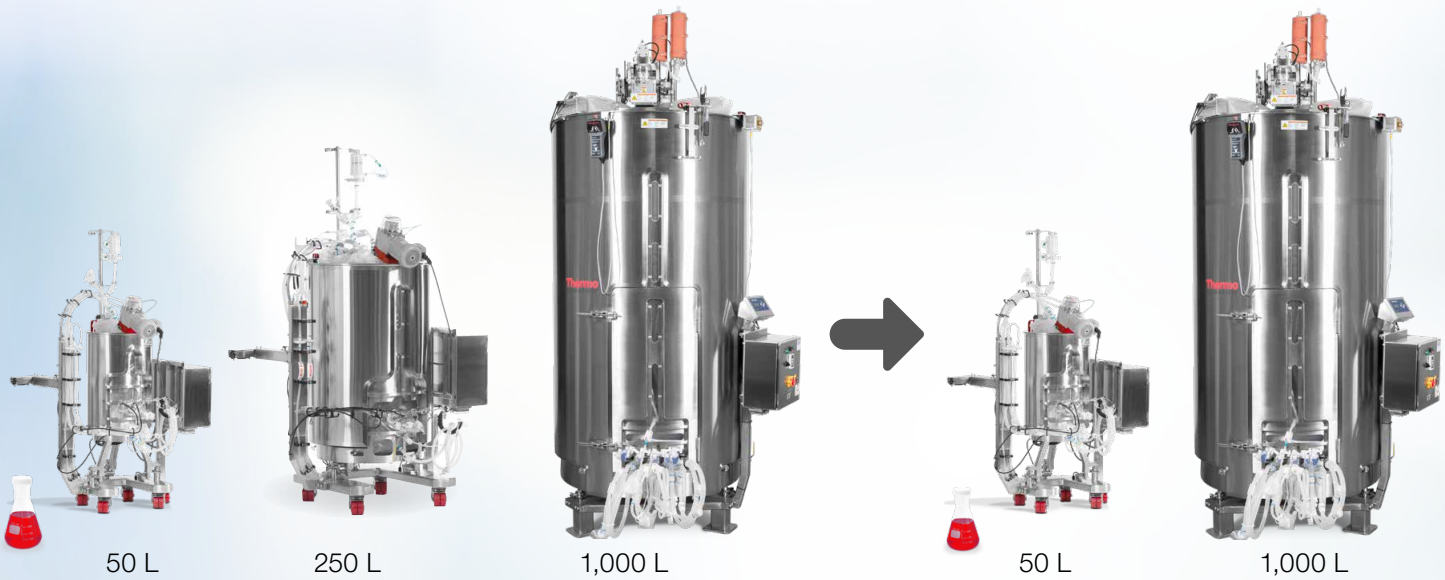
Organized and ergonomic

Effectively manage the process of setting up and maintaining the S.U.B. with the following standard features:

- Dedicated and adjustable tool holder keeps necessary tools available for convenience and ease
- Load cell lockout clamps maneuver the S.U.B. easily utilizing a tri-clamp device
- Universal filter bracket easily adjusts to various heights and positions on the vessel and facilitates single or dual filters in either 6 in. and/or 10 in. filter sizes

Additional options available

- Cable management system provides greater organization of electrical cables, tubing, and line sets, and makes the unit easier to clean
- Line labels provide rapid identification of tubing lines



2:1 scale-up approach

5:1 scale-up approach

Enhancements and applications

Continuing enhancements for greater HyPerforma S.U.B. performance

The HyPerforma S.U.B. with a 5:1 turndown ratio was designed for improved performance compared to legacy systems to help meet the ever-evolving needs of the bioprocessing industry. Standard hardware and bioprocess container configurations were developed based on feedback from industry experts to offer outstanding performance.

Modifications for improved performance within demanding applications

For even greater performance, enhanced application-specific designs were developed for fed-batch, perfusion, and adherent cell cultures. Modification of select hardware and bioprocess container components were made for higher mixing power and mass transfer in demanding applications. Standard bioprocess containers are available for enhanced application-specific hardware designs.

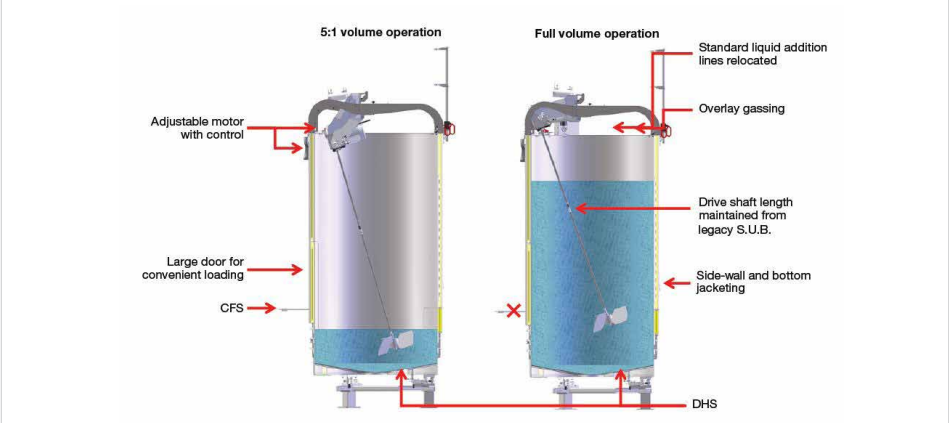


Figure 1. Hardware and BPC changes to the 1,000 and 2,000 L S.U.B. An adjustable overhead motor mount allows the motor, drive shaft, and impeller assembly to lower (5:1 position) and raise (2:1 position) into and out of the S.U.B hardware. This allows for optimal mixing across a wide range of volumes cross-flow sparger.

Cell lines that have been used in the HyPerforma S.U.B. system

- CHO
- NS0
- HEK 293
- BHK 21
- Hybridomas
- PER.C6
- MDCK
- Vero

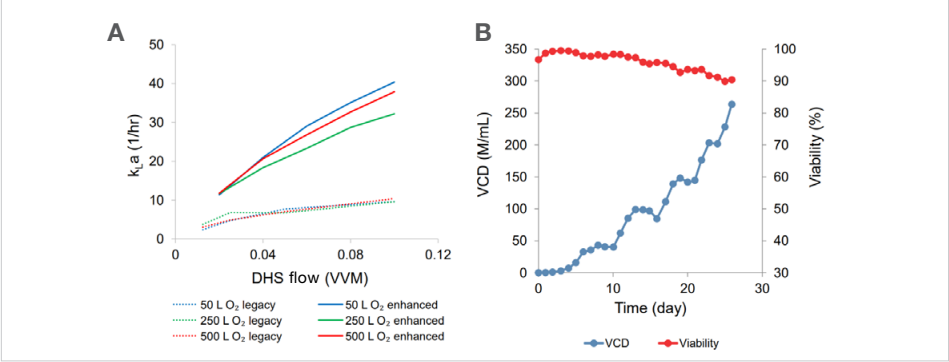


Figure 2. (A) Apparent k_La (measure of the efficiency of oxygen transfer from the gas phase to the liquid phase) plotted with respect to O_2 flow rate in vessel volumes per minute (VVM) for an enhanced (solid) and legacy (dashed) S.U.B. **(B) Performance of enhanced S.U.B. throughout a 25-day perfusion cell culture.**

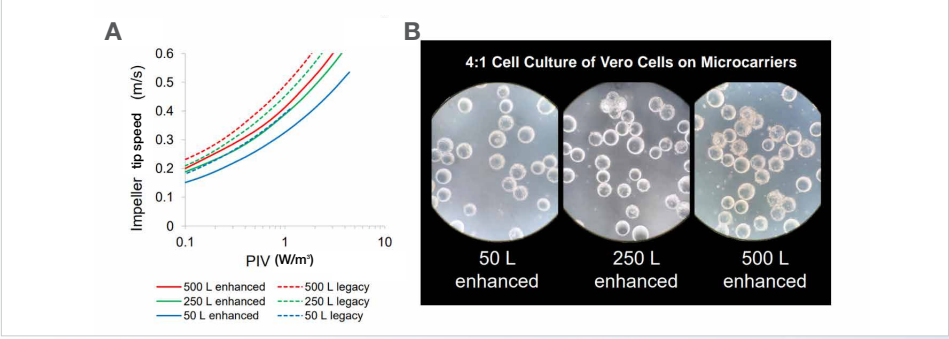


Figure 3. (A) Impeller tip speed in the enhanced (solid) and legacy (dashed) S.U.B. (B) Low tip speed of enhanced S.U.B. impeller helps reduce damage to cells and microcarriers power input per volume.

Enhance your bioprocessing with BPCs

Quality and performance

The BPCs for the HyPerforma S.U.B. are available with our proprietary Aegis5-14 film. This film has biocompatibility and low cytotoxicity, to support healthy cell growth with popular cell lines including CHO, hybridomas, HEK 293, BHK 21, NS0, PER.C6, MDCK, Vero, and more.

BioPhorum Operations Group (BPOG) L&E testing guidelines have been met for all components used in HyPerforma BPCs.

Key benefits

We can address your specific applications with either standard or customized configurations. The standard designs are configured for a variety of applications, while the custom designs are for customer-specific applications. Standard BPC designs are available across all sizes and hardware configurations (enhanced and standard). These designs offer supply redundancy, improved lead times, and a more streamlined ordering process.

The key benefits of our BPCs include:

- Compatibility with an expansive portfolio of single-use and reusable probes for process monitoring and analytics
- Integrated single-use agitator (impeller): the off-center design leads to exceptional mixing times with no vortex formation
- Antifoam sensing technology
- Utilization of a patented crossflow sparger for high k_La at lower seed volumes; scalable to full-volume cultures with a drilled-hole sparger

Help prevent leaks with the unique Thermo Scientific™ BioTitan™ Retention Device

- 360° complete seal comes standard on all HyPerforma S.U.B. BPCs (seals identified by red ovals in the image above)
- Helps reduce waste: less bubble wrap
- Simplified setup: out of the box and into production

Controller choices

HyPerforma S.U.Bs. are compatible with controllers from various suppliers. However, for optimal performance, we recommend using them with a **Thermo Scientific™ HyPerforma™ G3Lite or G3Pro Bioprocess Controller**. Both controllers feature touchscreens and **Thermo Scientific™ TruBio™ BioProcess Control Software** with the advanced Emerson™ DeltaV™ Live user interface package for fully scalable control from R&D to production.

- Conforms to regulatory requirements for use in CGMP compliant processes
- Multifeed dosing functionality available to scale from small to large doses with high precision
- Can be used with Emerson™ DeltaV™ Batch control system and Emerson™ DeltaV™ Manufacturing Execution System for a fully automated manufacturing system

Key features of TruBio BioProcess Control Software include:

- Save and load process control strategies at any time
- Create control strategies for media mixing and buffer preparation
- Ability to calibrate sensors and pumps from the user interface

	HyPerforma G3Lite Bioprocess Controller	HyPerforma G3Pro Bioprocess Controller
Recommended for:	• Process development • Clinical manufacturing	• Clinical manufacturing • Commercial production
Volumes	50–2,000 L	50–2,000 L
Key features	• Modular configurations • Touchscreen • Redundant pH and DO sensors	• Dual cart option • Flexible probe configurations • Redundant sensor control • Touchscreen NEMA interface for easy data entry and control

Looking for a controller for smaller volumes?

Try the Thermo Scientific™ HyPerforma™ G3Lab Controller for volumes ≤50 L, including bench-scale glass bioreactors and the 5 L Thermo Scientific™ DynaDrive™ S.U.B.

Specifications

S.U.B. hardware specifications

	50 L	100 L	250 L	500 L	1,000 L	2,000 L
Liquid working volume	50 L	100 L	250 L	500 L	1,000 L	2,000 L
Minimum liquid working volume	10 L	20 L	50 L	100 L	200 L	400 L
Total reactor volume (not working volume)	65.5 L	120 L	316 L	660 L	1,320 L	2,575 L
Fluid geometry at working volume (height:diameter ratio)	1.5	1.5	1.5	1.5	1.5	1.5
Overall reactor geometry (height:diameter ratio)	1.9	1.9	1.9	1.9	1.9	1.9
Impeller (quantity x blade count)	1 x 3	1 x 3	1 x 3	1 x 3	1 x 3	1 x 3
Mixing rate range	30–200 RPM	30–200 RPM	30–150 RPM	30–150 RPM	20–110 RPM	20–75 RPM

S.U.B. hardware dimensions and weights

	Tank overall (W x L x H)	Jacketed tank weight: dry/wet (at full working volume)
50 L	66.1 x 88.8 x 198.8 cm (26.0 x 35.0 x 78.3 in.)	160.3 kg (353.4 lbs) 210.3 kg (463.6 lbs)
100 L	72.1 x 95.7 x 202.0 cm (28.4 x 37.7 x 79.5 in.)	197.9 kg (436.4 lbs) 297.9 kg (656.9 lbs)
250 L	71.9 x 124.3 x 215.8 cm (28.3 x 48.9 x 85.0 in.)	256.8 kg (566.2 lbs) 506.8 kg (1,117.4 lbs)
500 L	94.3 x 142.2 x 250.7 cm (37.1 x 56.0 x 98.7 in.)	523.6 kg (1,154.5 lbs) 1,023.6 kg (2,256.8 lbs)
1,000 L	111.2 x 154.6 x 284.1 cm (43.8 x 60.8 x 111.8 in.)	712.3 kg (1,570.4 lbs) 1,712.3 kg (3,775.0 lbs)
2,000 L	147.9 x 157.1 x 341.7 cm (58.2 x 61.9 x 134.5 in.)	1,246.5 kg (2,748.0 lbs) 3,246.5 kg (7,157.2 lbs)

- Filter bracket, height is adjustable. Maximum heights, are included in this table.
- System options including a cable management tree and electrical box will add to the system weights and dimensions listed in this table.
- All weights and dimensions are approximate measurements. Design request accruals will be presented.

Knowledgeable and comprehensive product support

Our global field-based customer experience team is available for local installation and technical support. A process development team is also available for cell culture support, providing trusted knowledge on cell growth and troubleshooting. We can provide you with additional support documentation upon request.

Global redundant supply chain

Ensuring supply chain security is crucial for achieving optimal productivity. Our teams have established a robust and responsive global manufacturing network for single-use technology (SUT).

Thermo Scientific BPCs and fluid transfer assemblies (FTAs) are available off the shelf or with minimal lead times to support your manufacturing requirements. These products consistently meet or surpass our stringent standards, independent of manufacturing site.

Ordering information

Standard S.U.B. configurations		
Description	**Size**	**Cat. No.**
50 L HyPerforma S.U.B., jacketed, 5:1 turndown ratio, standard, 120 V	50 L	SUB0050.9500
50 L HyPerforma S.U.B., jacketed, 5:1 turndown ratio, standard, 240 V		SUB0050.9501
100 L HyPerforma S.U.B., jacketed, 5:1 turndown ratio, standard, 120 V	100 L	SUB0100.9500
100 L HyPerforma S.U.B., jacketed, 5:1 turndown ratio, standard, 240 V		SUB0100.9501
250 L HyPerforma S.U.B., jacketed, 5:1 turndown ratio, standard, 120 V	250 L	SUB0250.9500
250 L HyPerforma S.U.B., jacketed, 5:1 turndown ratio, standard, 240 V		SUB0250.9501
500 L HyPerforma S.U.B., jacketed, 5:1 turndown ratio, standard, 120 V	500 L	SUB0500.9500
500 L HyPerforma S.U.B., jacketed, 5:1 turndown ratio, standard, 240 V		SUB0500.9501
1,000 L HyPerforma S.U.B., jacketed, 5:1 turndown ratio, standard, 120 V	1,000 L	SUB1000.9500
1,000 L HyPerforma S.U.B., jacketed, 5:1 turndown ratio, standard, 240 V		SUB1000.9501
2,000 L HyPerforma S.U.B., jacketed, 5:1 turndown ratio, standard, 120 V	2,000 L	SUB2000.9500
2,000 L HyPerforma S.U.B., jacketed, 5:1 turndown ratio, standard, 240 V		SUB2000.9501

Standard S.U.B. BPC configurations		
Description	**Size**	**Cat. No.**
5:1 S.U.B. BPC with single-use sensors, Aegis 5-14 film, standard	50 L	SUT00094.01
5:1 S.U.B. BPC without single-use sensors, Aegis 5-14 film, standard		SUT00095.01
5:1 S.U.B. BPC with single-use sensors, Aegis 5-14 film, standard	100 L	SUT00094.02
5:1 S.U.B. BPC without single-use sensors, Aegis 5-14 film, standard		SUT00095.02
5:1 S.U.B. BPC with single-use sensors, Aegis 5-14 film, standard	250 L	SUT00094.03
5:1 S.U.B. BPC without single-use sensors, Aegis 5-14 film, standard		SUT00095.03
5:1 S.U.B. BPC with single-use sensors, Aegis 5-14 film, standard	500 L	SUT00094.04
5:1 S.U.B. BPC without single-use sensors, Aegis 5-14 film, standard		SUT00095.04
5:1 S.U.B. BPC with single-use sensors, Aegis 5-14 film, standard	1,000 L	SUT00094.05
5:1 S.U.B. BPC without single-use sensors, Aegis 5-14 film, standard		SUT00095.05
5:1 S.U.B. BPC with single-use sensors, Aegis 5-14 film, standard	2,000 L	SUT00094.06
5:1 S.U.B. BPC without single-use sensors, Aegis 5-14 film, standard		SUT00095.06

Ordering information

Application-specific, enhanced S.U.B. configurations		
Description	**Size**	**Cat. No.**
Enhanced S.U.B. for Perfusion	50, 100, 250, 500 L	Contact us
Enhanced S.U.B. for Microcarriers	50, 100, 250, 500 L	Contact us
Enhanced S.U.B. for Fed-Batch	50, 100, 250, 500 L	Contact us

Application-specific, enhanced S.U.B. BPC configurations		
Description	**Size**	**Cat. No.**
Enhanced S.U.B. BPC for Perfusion (ATF)	50 L	SH31170.01
Enhanced S.U.B. BPC for Perfusion (TFF)		SH31173.01
Enhanced S.U.B. BPC for Perfusion (ATF)	100 L	SH31144.01
Enhanced S.U.B. BPC for Perfusion (TFF)		SH31171.01
Enhanced S.U.B. BPC for Perfusion (ATF)	250 L	SH31143.01
Enhanced S.U.B. BPC for Perfusion (TFF)		SH31172.01
Enhanced S.U.B. BPC for Perfusion (ATF)	500 L	SH31142.01
Enhanced S.U.B. BPC for Perfusion (TFF)		SH31169.01
Enhanced S.U.B. BPC for Microcarriers	50 L	SH31150.01
Enhanced S.U.B. BPC for Microcarriers	100 L	SH31150.02
Enhanced S.U.B. BPC for Microcarriers	250 L	SH31150.03
Enhanced S.U.B. BPC for Microcarriers	500 L	SH31150.04
Enhanced S.U.B. BPC for Fed-Batch	50 L	SH31151.01
Enhanced S.U.B. BPC for Fed-Batch	100 L	SH31152.01
Enhanced S.U.B. BPC for Fed-Batch	250 L	SH31153.01
Enhanced S.U.B. BPC for Fed-Batch	500 L	SH31154.01

Ordering information

HyPerforma S.U.B. system options and auxiliary components	
Description	**Cat. No.**
Autoclave tray for probe assemblies	SV50177.01
Probe assembly with CPC AseptiQuik connector	SH30720.02
Heavy-duty tubing clamp (1) SV20664.01	SV20664.01
Heavy-duty tubing clamp (10-pack) SV20664.04	SV20664.04
Sterile sampling manifold with Luer lock (1) SH30845.01	SH30845.01
Sterile sampling manifold with Luer lock (10-pack) SH30845.02	SH30845.02
DO probes	Contact us
pH probes	Contact us
ABER biomass measurement probes	Contact us
Stand-alone peristaltic pumps	Contact us
Temperature control unit	Contact us

A complete list of startup, routine, and critical spare parts is available for the HyPerforma S.U.B. product line. Please reach out to your sales representative or email our customer experience specialists at ussc2.servicesupport@thermofisher.com for the document.

Discover more at thermofisher.com/sub