

# HyPerforma DynaDrive Single-Use Bioreactor

The Thermo Scientific™ HyPerforma™ DynaDrive™ Single-Use Bioreactor (S.U.B.) is our latest advancement in S.U.B. technology; it offers better performance and is scalable to larger volumes than previous bioreactors. The complete HyPerforma DynaDrive S.U.B. system consists of a 500 L bioreactor tank and a Thermo Scientific™ HyPerforma™ DynaDrive™ BioProcess Container (BPC). This cube-shaped tank and unique stirred-tank design utilizes a novel drive train with multiple impellers. The mixing capability of the bioreactor is superior, which enables optimal mixing and mass transfer performance. The newly designed tank shape allows for mixing at very low volumes and has a turndown ratio of 20:1.

## Advantages of the 20:1 system

- Streamline bioprocesses by reducing seed vessel requirements and maximizing process vessel usage
- Start to seed vessels at 5% volume, then feed up to full volume
- Reduce cell transfers and associated adaptation
- Reduce the number of single-use BPCs used

This data sheet provides information on the HyPerforma DynaDrive 500 L S.U.B. system, which includes the tank and standard S.U.B. BPC. The BPC utilizes the novel impeller configuration and dual-sparger design (enhanced drilled-hole sparger (DHS) and porous-frit sparger) as well as a cross-flow sparger when operating at liquid volumes of 25 L or less. All sparger designs have been rigorously tested to provide high  $k_L a$  values and optimal CO<sub>2</sub> stripping for improved pH control and decreased foaming.



## HyPerforma DynaDrive S.U.B. components:

- Tank with casters and load cells
- AC motor with 20:1 gear ratio
- Ergonomically friendly lift mechanism to connect the drive train in the BPC to the motor
- Easy-loading BPC
- Door that opens completely
- Wide opening for sensor and ports
- Vessel, water-jacketed on three vertical sides and bottom
- Cable and tubing management adapters

## HyPerforma DynaDrive S.U.B. BPC

- Gamma-irradiated and ready to use
- Agitator (drive train) assembly consists of:
  - Top bearing/seal assembly connected to the agitation motor
  - Bottom blind-ported bearing assembly, connected to the bottom mount in the hardware
  - 3 x 2 modified pitched blade impellers
  - 1 x 2 bladed sweep impeller for agitation at low volumes
  - 2 flexible vertical cables used to connect all impellers, allowing for folding of the BPC before and after use
  - 5 stabilizing cross bars used to keep vertical cables in place
- Dual gas spargers
  - Enhanced DHS and frit sparger
- Cross-flow sparger to introduce gas as overlay when operating at 20% (100 L) or less of liquid volume
- Vent filter outlet for system exhaust
- Integrally sealed ports in the S.U.B. BPC allow for additional sensor probes and line sets
- Available in Thermo Scientific™ Aegis™5-14 film

## System options

- Electrical box for remote agitation control
  - HyPerforma DynaDrive S.U.B.s require a separate external temperature control unit
- Heaters for exhaust gas vent filters
- Process control system

See the ordering information for auxiliary components for S.U.B. control management.

## External bioprocess controller options

The HyPerforma DynaDrive S.U.B. offers an open-architecture or turnkey system. This allows you to use any control system of your choice. The capital investment can be reduced by using a control system already in your facility. These systems work on DeltaV™, Allen Bradley™, and Siemens™ formats. Contact your local sales representative for more information.



## HyPerforma DynaDrive S.U.B. hardware design elements (Figure 1)

1. Exhaust vent holder
2. Pneumatic motor lift
3. Motor
4. BPC lift mechanism
5. BPC top tab holders
6. 3/8 in. dimple jacket (side and bottom)
7. Liquid sight windows
8. Stainless steel (grade 304) outer support container
9. Motor lift controller (turned to the side)
10. Vessel handle bars
11. Probe access windows
12. Probe hanger bracket
13. Load cells
14. Cart assembly
15. Leveling casters

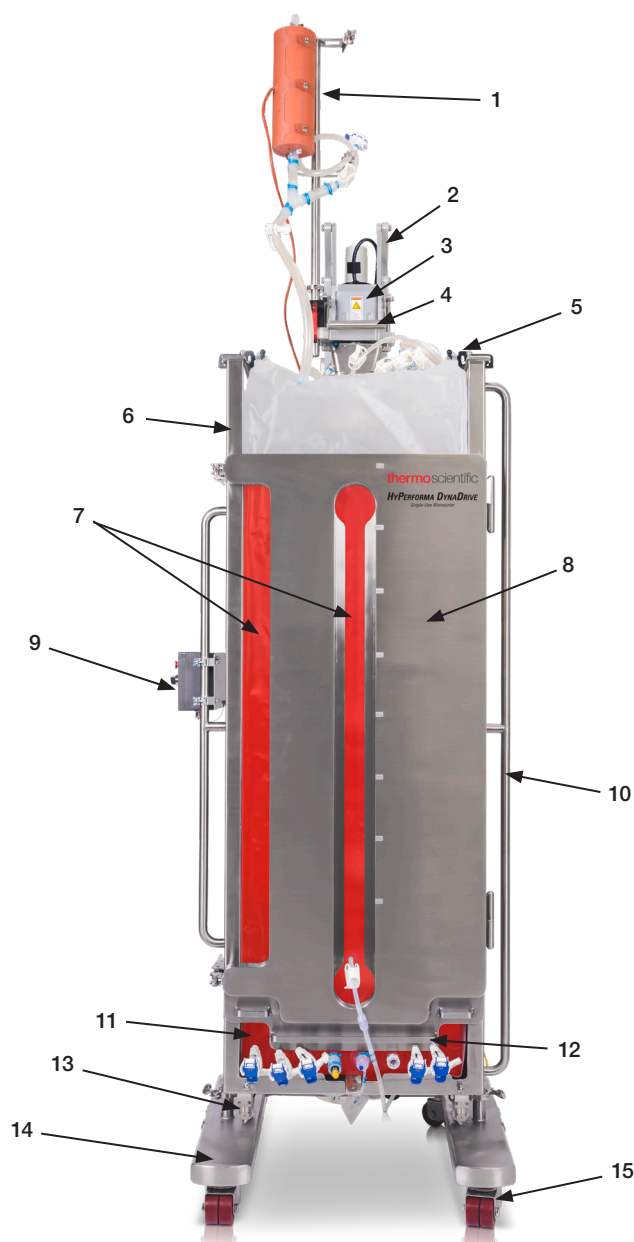
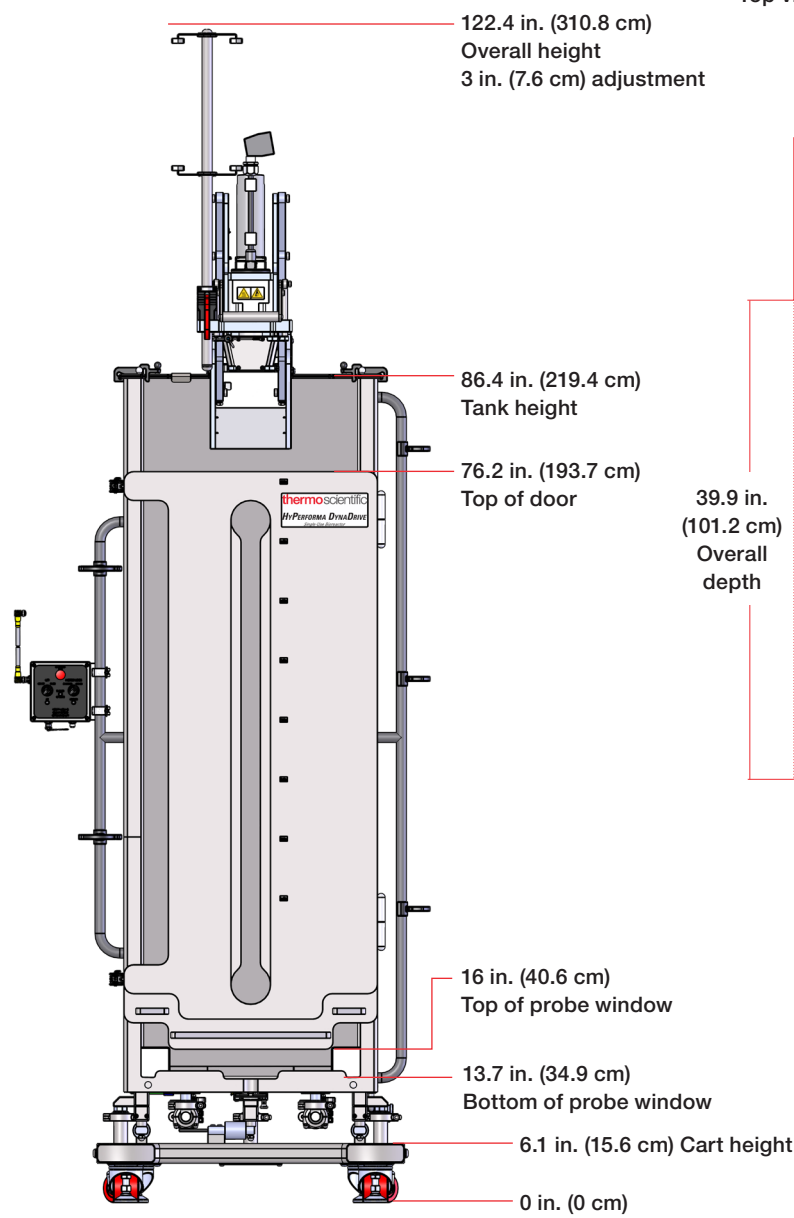


Figure 1. 500 L HyPerforma DynaDrive S.U.B. hardware design elements.

HyPerforma DynaDrive S.U.B. hardware specifications (Figure 2)

Front view



Top view

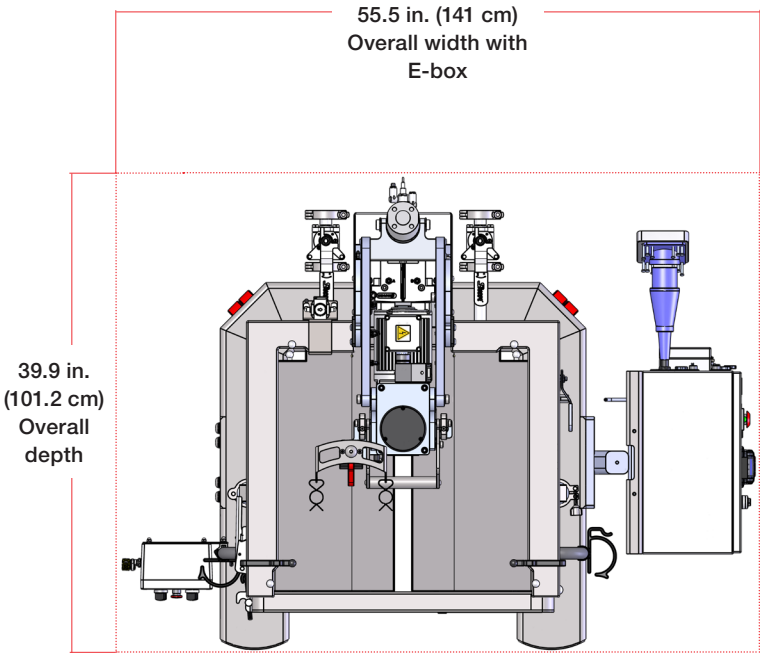


Figure 2. 500 L HyPerforma DynaDrive S.U.B. hardware specifications.

**Table 1. Technical specifications of standard 500 L HyPerforma DynaDrive S.U.B. hardware.**

Specifications		
Bioreactor geometry	Rated liquid working volume	500 L
	Minimum liquid working volume	25 L
	Total reactor volume (liquid and gas)	586 L
	BPC chamber diameter	63.4 cm (24.9 in.)
	BPC chamber shoulder height	186.69 cm (73.5 in.)
	Liquid height at rated working volume	158.75 cm (62.5 in.)
	Fluid geometry at working volume (height:diameter ratio)	2.5:1
	Overall reactor geometry (height:diameter ratio)	2.5:1
General	Electrical power supply requirement (voltage, phase, current)	120/240 VAC, single, 20/10 A
	pH and dissolved oxygen (DO) probes, autoclavable type, single-use options also available	12 mm diameter x 215–235 mm insertion length x 13.5 PG (pipe) thread
	Noise level	<70 dB at 1.5 m
Impeller	Impeller (quantity x blade count)	3 x 2 modified pitch blade, 1 x 2 sweep impeller
	Impeller scaling (impeller diameter/tank diameter)	0.37
	Impeller diameter	22.9 cm (9.03 in.)
Agitation	Agitation speed range of variable-frequency drive (VFD)	35–120 rpm $\pm$ 1.5 rpm or 1% of set point, whichever is greater
	Recommended minimum during cell culture agitation (at all volumes)	>50 rpm
	Nominal tip speed	60 cm/s (118 ft/min)
Motor	Agitation motor drive (type, voltage, phase), AC motor only	Induction, 208 VAC, 3-phase
	AC motor power rating	400 W (0.5 hp)
	Motor torque rating	5.6 Nm (76 in.-lb.)
	Gear reduction	20:1
	Programmable VFD, remote panel interface, power fault auto-restart	Standard
	Motor communication methods (for external controller)	0–10 V, 4–20 mA
	Motor lift power supply requirements	24 VDC, 90 psi of air
Temperature control	Jacket area: full/10% volume	0.51 m <sup>2</sup> (5.5 ft <sup>2</sup> )/0.06 m <sup>2</sup> (0.65 ft <sup>2</sup> )
	Jacket volume	13.6 L
	Jacket flow rate at 3.4 bar (50 psi)	71 L/min
	Process connection	1.5 in. sanitary tri-clamp or quick connect fitting
	Recommended heating/cooling load (W)	5,000 W
	Approximate liquid heat-up time (5–37°C), 10% volume with Thermo Scientific™ ThermoFlex™ 2500 chiller temperature control unit (TCU)	1 hr
	Approximate liquid heat-up time (5–37°C), 100% volume with ThermoFlex 2500 chiller TCU	3 hr
	Resistance temperature detector (RTD) or thermocouple, 3.18 mm (1/8 in.) OD	RTD: Pt-100 (standard)
Support container	Overall width	141 cm (55.5 in.) with optional E-box 103.2 cm (40.6 in.) without E-box
	Overall length	111.8 cm (44 in.)
	Overall height	310.8 cm (122.4 in.)
	Dry skid weight (mass)	479.9 kg (1,058 lb) with optional E-box 446.78 kg (985 lb.) without E-box
	Wet skid weight-rated working volume (mass)	978.85 kg (2,158 lb.) with optional E-box 945.74 kg (2,085 lb.) without E-box
Recommended operating parameters	Operating temperature range	Ambient to 40°C $\pm$ 0.5°C (104°F $\pm$ 0.9°F) (with optional E-box)
	Motor speed	35–120 rpm
	Volume range	25–500 L
	Maximum BPC pressure	34 mbar (0.5 psi)



## System options

Available S.U.B. system options for the 500 L size are listed in the ordering table on the last page.

- **Probe assembly (Figure 3)**—offers innovative design to package user-supplied pH and DO probes for sterilization, and to aseptically connect them to the BPC. The probe assembly includes an aseptic connector, molded bellows cover, and threaded probe adapter.
- **Autoclave tray for probe kits (Figure 4)**—aids in holding the electrochemical probes and bellows in place during the autoclave sterilization process. Additional features of the autoclave tray include the following:
  - Fabricated from stainless steel
  - Plastic carry handle for easy transport right out of the autoclave
  - Positions probes on 15% incline for greater probe/membrane longevity
  - Can restrain probe bellows from collapsing during sterilization
  - Accommodates two probes
- **Double probe clips (Figure 5)**—for holding probes and sensors from both rows of probe ports.
- **Heavy-duty tubing clamp (Figure 6)**—used for each probe port not in use, eliminating process fluid holdup.
- **S.U.B. temperature sample port (Figure 7)**—provides *in situ* temperature monitoring during culture process.
- **Load cells (Figure 8)**—Mettler Toledo™ Flexmount™ load cells, used to determine the weight of the contents of an S.U.B., are optional for all standard HyPerforma™ DynaDrive™ S.U.B. systems. Load cells arrive uncalibrated. The load cell manufacturer or a qualified technician should calibrate these systems on site.
- **Cable management adapter.**
- **Sterile sampling manifolds**—available in 50 and 100 mL sizes for offline sample retention.
- **Tubing management clips (Figure 9)**—snap onto the side handles and assist in organizing tubing.
- **Foam probe (Figure 10)**—the foam probe is used to monitor the level of foaming during the cell culture process; to use this, plug the optional foam sensor wire into the port at the top of the BPC and place the foam probe into the foam probe holder.



Figure 3. Probe assembly.

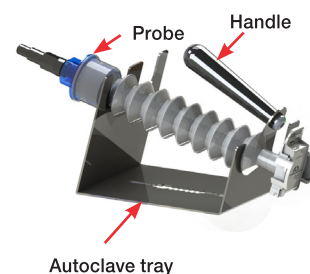


Figure 4. Autoclave tray and probe assembly.



Figure 5. Double probe clip.



Figure 6. Heavy-duty tubing clamp.



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



Figure 8. Load cells.



Figure 9. Tubing management clip.

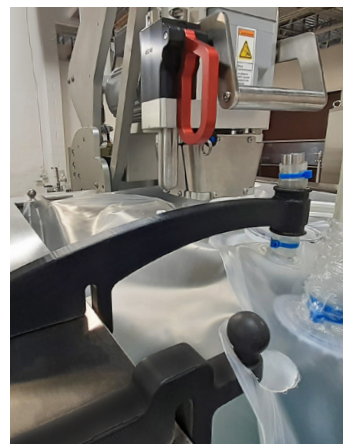


Figure 10. Foam probe in holder.

Vent heaters

Vent heaters aid in reducing moisture buildup in exhaust filters from system off-gassing. Vent heaters are factory-preset at 50°C, allowing for condensation to return to the vessel.

Spare parts

Spare parts are for standard reference only; configured S.U.B. tank drawings will be provided with a spare parts list specific to the S.U.B. tank ordered.

HyPerforma DynaDrive S.U.B. BPCs

All BPCs are constructed with Aegis5-14 film.

BPC packaging

Description	Details
Outer packaging	Supplied “flat-packed” with two polyethylene outer layers
Label	Description, product code, lot number, and 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 (CoA) provided with each lot for each delivery

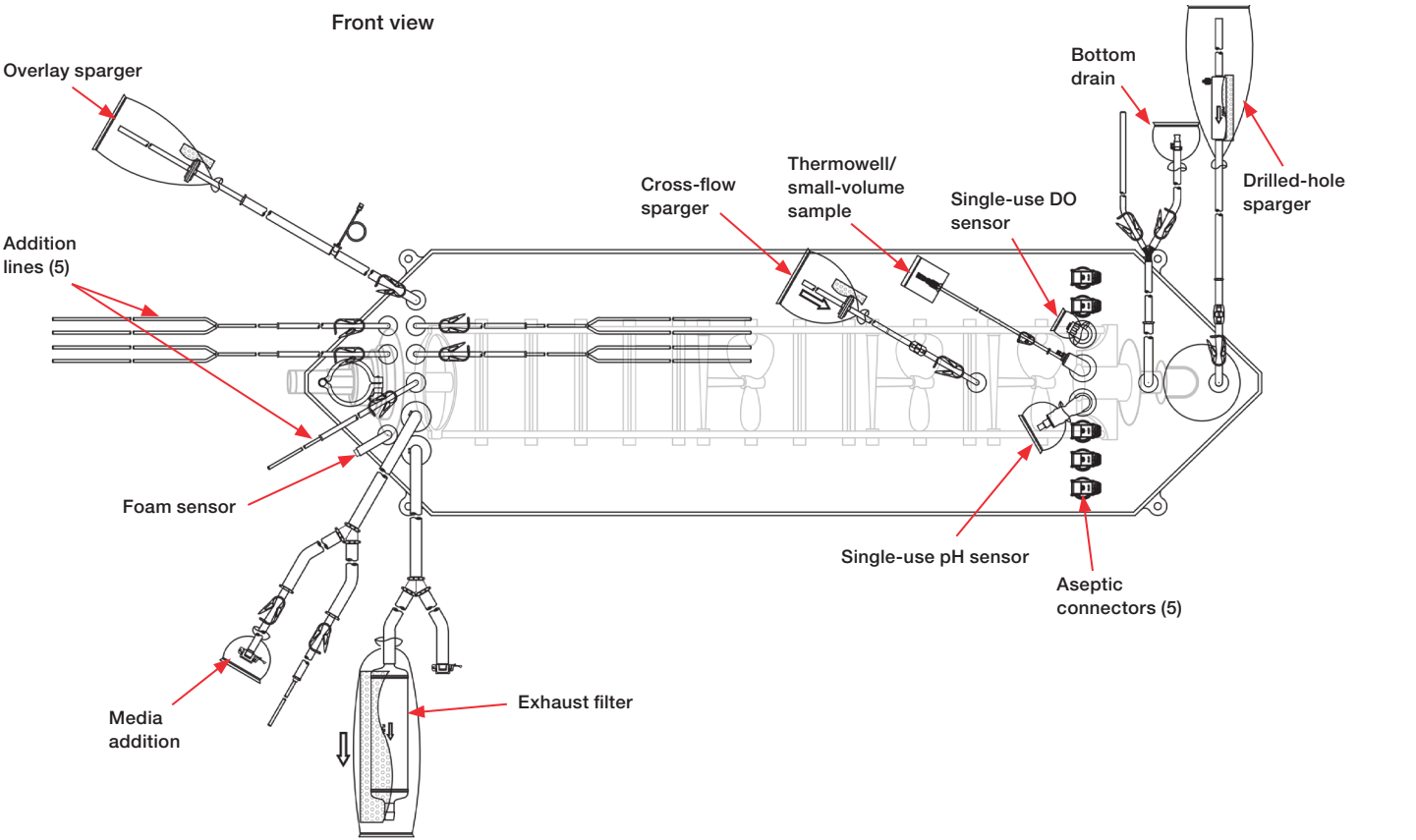


Figure 11. 500 L HyPerforma DynaDrive S.U.B. standard BPC.

## Ordering information

Product	Quantity	Cat. No.
500 L HyPerforma DynaDrive S.U.B. hardware unit (with casters and load cells, and ready for controller integration)	1	DDB0500.1011
500 L HyPerforma DynaDrive S.U.B. Standard BPC (Aegis5-14 film)	1	SH31193.01
<b>System options</b>		
Autoclave tray (stainless steel with plastic carrying handle)	1	SV50177.01
Bioreactor probe assembly with CPC AseptiQuik™ connector (nonsterile for use in autoclave)	12	SH30720.02
Heavy-duty tubing clamp (single)	1	SV20664.01
Heavy-duty tubing clamp (10-pack)	10	SV20664.04
Sterile sampling manifold with luer lock (single)	1	SH30845.01
Sterile sampling manifold with luer lock (10-pack)	10	SH30845.02
120 VAC, 99.6 W, Meissner 10 in. series 46 vent filter heater, integrated, M12–4 pin connector (used when integrated with controller)	1	SV50191.47
240 VAC, 99.6 W, Meissner 10 in. series 46 vent filter heater, integrated, M12–4 pin connector (used when integrated with controller)	1	SV50191.48
Double probe holders	1	SV51256.01
Adjustable filter bracket	1	SV50177.313
Foam probe holder	1	SV51253.02
BPC tab holders (top)	1	SV51254.01
Cable router	1	SV51255.01

## Auxiliary components (supplied or requested by end user)

Description	Cat. No.
Bioreactor control system: necessary for feed strategies, gas flow, DO, and pH control	Contact your sales representative for options
DO probe*: autoclavable probe (13 mm x 13.5 PG thread with 195–235 mm insertion length)	
pH probe*: autoclavable probe (13 mm x 13.5 PG thread with 195–235 mm insertion length)	
Sterile/aseptic connection: tubing welder, steam-in-place, sterilizer, or laminar flow hood	
Stand-alone peristaltic pump: used for fluid transfer between linesets on the containers	
Temperature control unit (TCU): necessary for temperature controls (not provided)	

\* Standard BPCs come with one single-use Hamilton™ pH probe and one single-use Hamilton™ DO probe. Other probes will need to be requested if the user determines that redundancy is required.

Find out more at [thermofisher.com/dynadriv](https://thermofisher.com/dynadriv)

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