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TIC-PL-082-301 Rev. A

Cell Culture Solutions Optimum Growth® System

Insect & Mammalian Cell Growth



Optimum Growth® System

Insect & Mammalian Cell Growth

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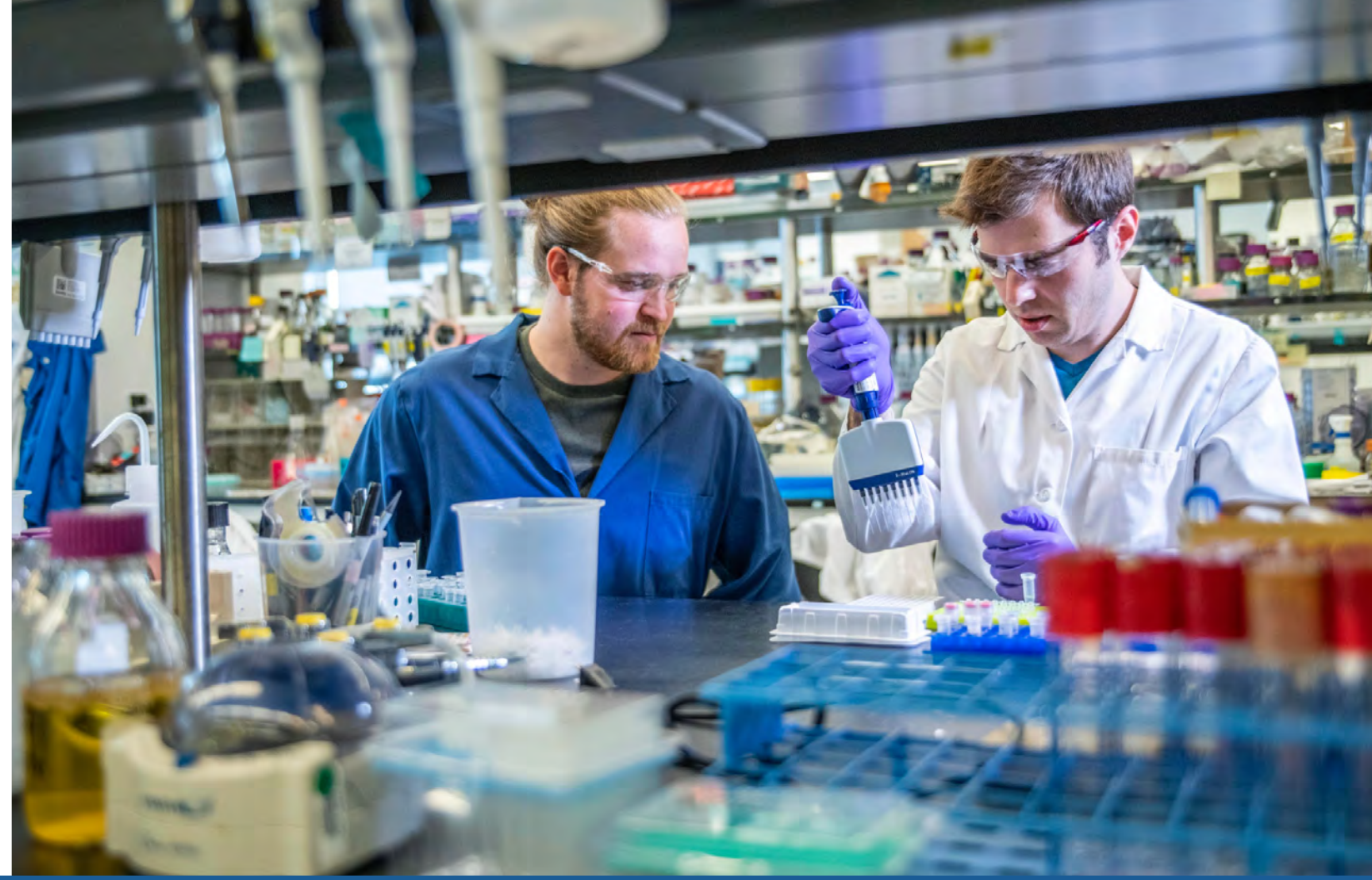
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A Little About Thomson

SOLUTIONS AT WORK™

Thomson sells innovative single-use Solutions At Work™, our mission is to provide technical expertise while partnering with our customers to deliver practical scientific innovations enabling scientific advancements in pharmaceutical, biotech, environmental/food, toxicology/forensics, and contract manufacturing industries.



Open to Collaboration

INNOVATIVE PRODUCT LINE

Scientists around the world are discovering new ways to use Thomson Filter Vials. Whether testing pharmaceuticals, performing toxicology, or testing for drugs of abuse Thomson Filter Vials have proven to be indispensable tools for sample prep when using HPLC, GC, LC-MS, or GC-MS, methodologies.

Thomson offers a full line of shake flasks and accessories with above-average yields and higher working volumes, designed specifically for insect/mammalian, or microbial/E. coli cells based on an understanding and experience of lab operations.

Our well-plate catalog continues to grow and provide the highest quality plates, ready for robotics, cell culture, synthesis, or analysis.

SINGLE StEP® Empty Columns are ready for the addition of sorbents or resins depending on the application.

If you have unique needs or need a new product please reach out to us. We look forward to collaborating with you.

An Introduction to the Optimum Growth® System

The Optimum Growth® System consists of high efficiency shake flasks, specialty shake flasks, transfer caps and the Rapid Clear® Cap for cell culture clarification prior to protein purification. The modular design of the Optimum Growth® System allows components to be used interchangeably and assures that small scale bioprocessing projects can remain GMP-compliant.



SHAKE FLASKS

Higher working volumes and improved aeration increase efficiency for expansion of mammalian cells, insect cells, *E. coli* and other microbial cells



SPECIALTY SHAKE FLASKS

Feed / transfer and sampling ports enable our specialty flasks to serve as an aseptic system and mini-bioreactor, while also increasing working volume, aeration and mixing rates



TRANSFER CAPS

For seeding larger bags and fermenters, as well as filling flasks with media from a bulk source, providing time and cost savings to keep your lab operations running smoothly



RAPID CLEAR® CAP

Quickly and efficiently clarify cell culture media directly from the Thomson 5L Optimum Growth® shaker flask without the need for centrifugation



Optimum Growth® Flasks

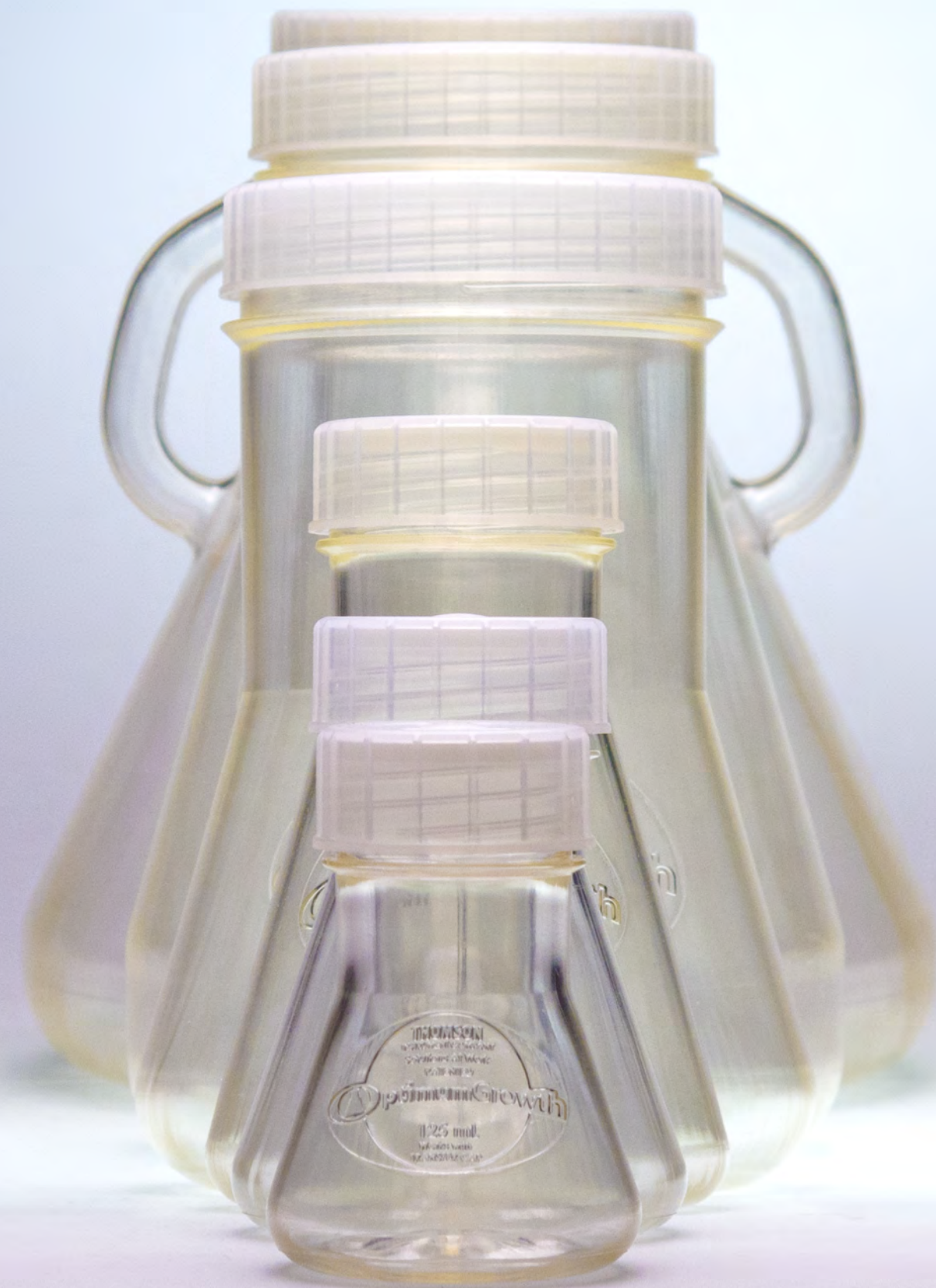
Thomson Optimum Growth® Flasks are designed for mammalian and insect cell culture, available in 125mL, 250mL, 500mL, 1.6L, 2.8L and our popular 5L volumes.

They are superior to traditional shake flasks due in part to the fact that they support a 50-60% fill volume, versus traditional flasks fill volume of 33%.

By holding up to 2x more media Optimum Growth® Flasks greatly increase shaker cabinet efficiency.

Key Features

- Baffles designed for high aeration and low shear to maintain cell viability
- Same footprint as comparable Fernbach flask but with a 50-60% fill volume
- Less foaming than disposable Fernbach potentially eliminates additives
- 0.2µm Vented Cap simultaneously maintains high gas exchange and sterility
- Transfer Cap option connects directly to cell bags or bioreactors with multiple connection options
- Scalable flask line allows more flask sizes to be shaken on the same shaker, improving efficiency and flexibility versus other products
- Individually packaged and sterilized for immediate use



All Sizes Shake At The SAME Optimal Shake Speed

Maximize Shaker Space Efficiency

Thomson Optimum Growth® Flasks in all sizes shaking at an optimal shake speed of 120 rpm on a 1" (2.54cm) throw shake platform.



Virtually every square inch of platform space is utilized

Space Saving More Volume
Optimum Growth® shake flasks
combine conditions for excellent cell
growth with space saving capability



18 x 1.6L Optimum Growth® Flasks Total Volume
16.2L/Shaker

|||



12 x Optimum Growth® 2.8L Flasks Total Volume
16.8L/Shaker

>>



6 x Corning® 3L Total Volume
6L/Shaker

Fill Volumes & Shake Speeds

CHO Stable, & Transient, HEK293 Transient , Hybridoma

Recommended

Recommended fill volume & shake speeds for Optimum Growth® Flasks. To achieve the advertised results with our Optimum Growth® flasks it is recommended to follow these guidelines.

Flask Size	Recommended Fill	Recommended RPM 1" (2.54CM) 2" (5.08CM)
125mL	63mL	150 110
250mL	150mL	150 110
500mL	250mL	150 110
1.6L	900mL	150 110
2.8L	1.4L	150 110
5L	2.0L	120 90

Working

Although the following data guidelines will produce acceptable results, the advertised results for Optimum Growth® Flasks are achieved using the recommended fill volume & shake speeds.

Flask Size	Working Volume	Working RPM Range 1" (2.54CM) 2" (5.08CM)
125mL	24-75mL	120-150 90-110
250mL	100-150mL	120-150 90-110
500mL	175-250mL	120-150 90-110
1.6L	0.4-1.1L	120-150 90-110
2.8L	0.9-1.6L	120-150 90-110
5L	1.7-3.2L	120-150 90-110

Insect Cell lines

Recommended

Recommended fill volume & shake speeds for Optimum Growth® Flasks. To achieve the advertised results with our Optimum Growth® flasks it is recommended to follow these guidelines.

Flask Size	Recommended Fill	Recommended RPM 1" (2.54CM) 2" (5.08CM)
125mL	63mL	150 110
250mL	150mL	150 110
500mL	250mL	150 110
1.6L	900mL	150 110
2.8L	1.4L	150 110
5L	2.0L	135 95

Working

Although the following data guidelines will produce acceptable results, the advertised results for Optimum Growth® Flasks are achieved using the recommended fill volume & shake speeds.

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125mL	24-75mL	120-150 90-110
250mL	100-150mL	120-150 90-110
500mL	175-250mL	120-150 90-110
1.6L	0.4-1.1L	120-150 90-110
2.8L	0.9-1.6L	120-150 90-110
5L	1.7-3.2L	120-140 90-110

Microbes / E. coli

Working

For Microbes & E. coli cell growth we recommend using our Ultra Yield® Flask system of products. However, single-use Optimum Growth flasks can also be used for microbial cell culture. Presented here are the working fill volume & shake speeds when using Optimum Growth flasks.

Flask Size	Working Volume	Working RPM Range 1" (2.54CM) 2" (5.08CM)
125mL	63mL	250 150
250mL	125mL	250 150
500mL	250mL	250 150
1.6L	900mL	250 150
2.8L	1.4L	250 150
5L	2.5L	250 150

Flask Clamp Compatibility

Clamp Compatibility

Refer to the chart below to find the appropriate flask clamp compatible with your shaker.

Flask Size	Eppendorf®	Infors Ht®	Kuhner®	Fisher Scientific®	Vwr®
125mL	M1190-9001	12202	SM310125	11-676-013	57019-676
250mL	M1190-9002	12203	SM310250	11-676-014	57019-678
500mL	M1190-9003	12204	SM310500	11-676-015	57019-682
1.6L	n/a	12205	SM311600	n/a	n/a
2.8L	ACE-2000S	12251	SM312800T	11-676-018	57019-686
5L	ACE-5000S	12209	SM313000F	236028	57019-696



Optimum Growth® Flask FAQs

What have people done successfully to change vessels from Spinner flasks & Roller bottles to Optimum Growth® Flasks?

Cells adapted to Spinner Flasks and Roller Bottles can be easily transitioned to Optimum Growth® Flasks. Adjusting existing cultures from different formats to Optimum Growth® Flasks requires reducing the volume and shake speeds of the first 1-2 passages*. The addition of up to 1% of surfactant** to the media may be needed due to spinner flasks and roller bottles having lower shear than shake flasks. Once the cells have adjusted to the shake flasks, recommended speeds will work well.

* See chart with fill volumes and shake speeds.

** ThermoFisher Pluronic, p/n 24040032 or Sigma Aldrich, EX-CELL® Antifoam, p/n 59920C

Why do Optimum Growth® Flasks work better than other disposable flasks (non-baffled or baffled) for mammalian cell lines (CHO, HEK293, etc.) & insect cell lines (Sf9, Sf21, High Five™, Trichoplusia ni)?

Optimum Growth® Flasks are patented shake flasks designed for high aeration and low shear mixing. Optimum Growth® Flasks achieve high aeration due to a unique baffle design that has been optimized for mammalian and insect cell lines. They provide enhanced gas exchange with low shear mixing, which can increase yields significantly when combined with both nutrient enriched media and proper pH balance.

Are the Optimum Growth® Flasks single-use?

Yes, the Optimum Growth® Flasks are designed for single-use and are not autoclavable. They are competitively priced compared to disposable bioreactors or shake flasks from other manufacturers.

What are the Transfer Caps that go along with the Optimum Growth® Flasks?

Inversion & Bidirectional Optimum Growth® Transfer Caps (patented) allow for a quick stress free cell transfer between flask and downstream vessel (Optimum Growth® Flasks, cell culture bags, bioreactors, etc.). Inversion Transfer Caps use the power of gravity to facilitate transfer, thus maintaining higher culture viability than pumping methods. Bidirectional Transfer Caps use a standard pump to transfer culture and/or media and come in a wide variety of tubing sizes. Transfer Caps come with multiple types of end fittings; quick connect, luer lock, and tube fusing. See our transfer caps page for more details.

High cell death and a large amount of foam and/or cell clumping issues?

Cell death and foaming in the Optimum Growth® Flasks is usually due to cell shearing. Adding up to 1% surfactant will reduce foaming and increase cell viability without stressing the cells.

How can you best use media from ThermoFisher such as F17 and its derivatives?

FreeStyle™ F17 Expression Medium contains lower amounts of pluronic than other comparable medium. Cells grown in this media may

experience more shear stress due to the lower amount of surfactant. To avoid this, add in additional pluronic (ThermoFisher p/n 24040032). The recommended range of pluronic is 0.05 gm/L to 0.2 gm/L. Up to 1% Sigma Aldrich, EX-CELL® Antifoam, p/n 59920C can also be used. Either of these methods usually will work to reduce foaming and restore high culture viability.

What can I do if the doubling time for my cell culture is longer than expected when using the Optimum Growth® Flasks?

This varies between cell types and strains, as well as with environmental conditions. If the doubling time for your culture is taking longer than expected or desired in the Thomson Optimum Growth® Flasks, we recommend increasing the shake speed beyond our recommended speeds by 10 to 20 rpm. The reason for the increased doubling time is that the oxygen transfer rate maybe lower with higher fill volumes, and the increase in speed will compensate for this.

Disposable shake flasks are hard to remove from the sticky pad. What do we do?

1. Spray ethanol on the sticky pad until you reach the desired stickiness. Ethanol will lower the bonding strength, as will any alcohol.
2. Some people use rug gripper pads on top of the sticky pad.

Which transfection reagent works best with CHO & HEK293 cells?

We see that there are three classes of transfection reagents that have varying efficiencies:

Class	Example	Efficiency of Transfection
Polymers	PEI	< 65%
Cationic Liposomes	Lipofectamine™	70-95%
Electroporation	Maxcyte®	> 96%

Polymers/PEI: The most common transfection reagent used in the market. It is inexpensive but may not lead to as high of a transfection rate and requires higher DNA quantities. Commonly used for all small and large scale transfections.

Cationic Liposomes/Lipofectamine™: This class of transfection reagents is highly efficient and is commonly used in CHO-S, 293F and other high titer systems. Cationic Liposomes work well with our flasks. We have seen consistent transfection with great viability from TransIT-Pro®. This used with CHOgro® from Mirus in 24 well plates (2.5mL), small scale flasks, and production in Optimum Growth® Flasks (50mL-2.5L) have given scalable usable results.

Electroporation: Most often used method for large scale, >1L transfection. Unfortunately, electroporation is not as useful for multiple transfections at one time. Customer feedback shows that stabilizing the cells with a 1%-1.2% addition of surfactant (pluronic/PF68) 30 minutes after transfection leads to higher titers and viability.

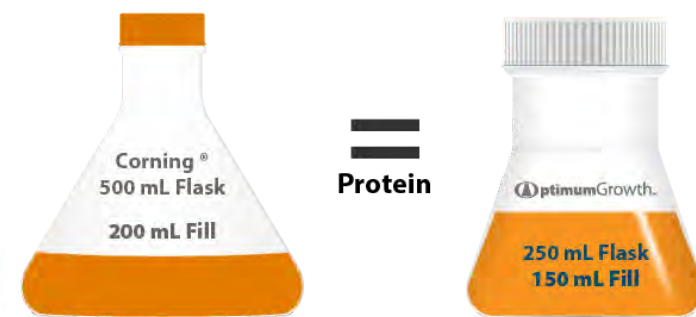
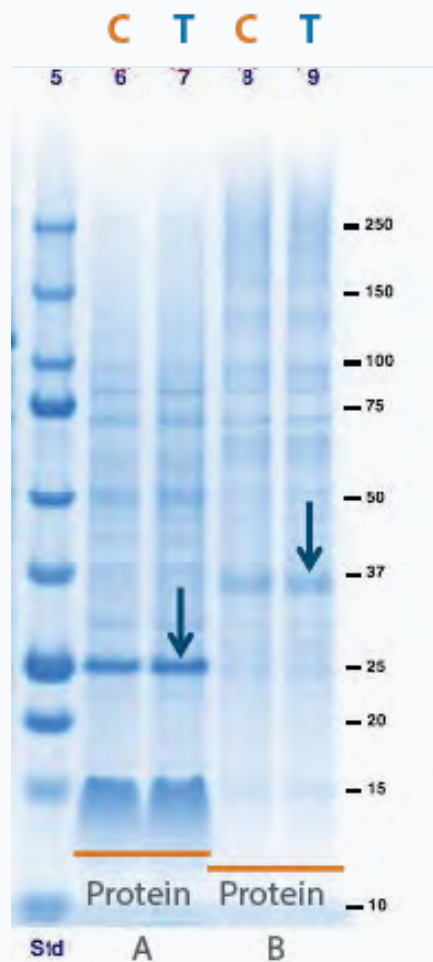
Thomson Instrument Company is not affiliated with Corning Life Sciences®, ThermoFisher, MilliporeSigma, Eppendorf®, INFORS HT®, Kuhner®, VWR®, Mirus or their product maxcyte



Traditional vs Optimum Growth® Flasks

Comparison of Two Expressed Membrane Proteins

- Corning® – 500mL flask, 200mL culture
- Thomson – 250mL flask, 150mL culture
- 4mL samples purified over Ni-NTA
- Protein A – Membrane protein of moderate expression, 34kDa
- Protein B – Membrane protein of low expression, 45kDa
- 12µL of elution resolved on a coomassie gel



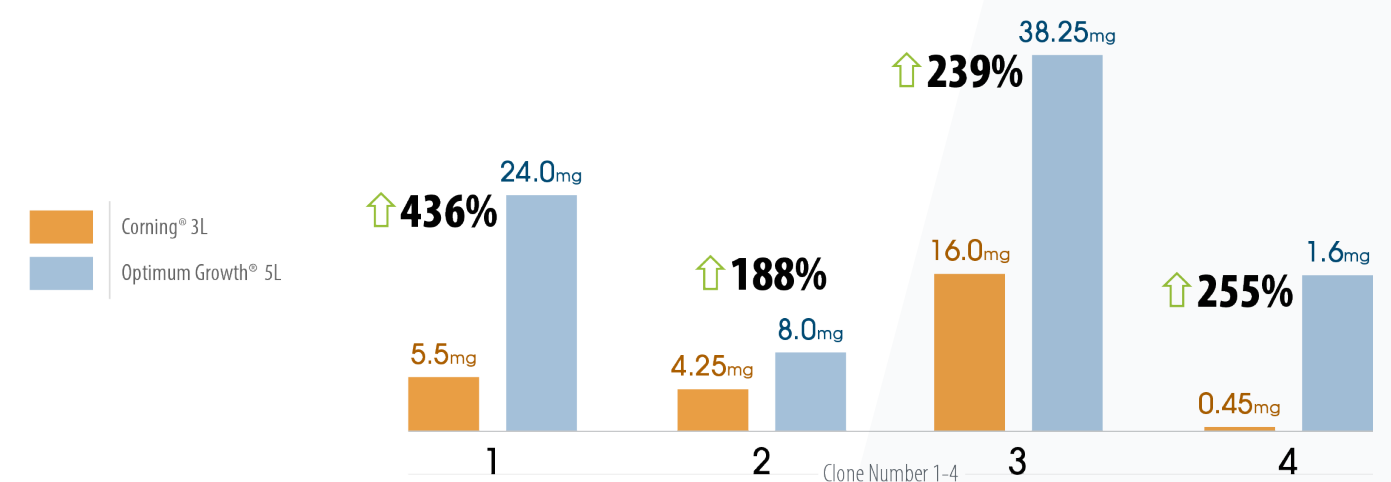
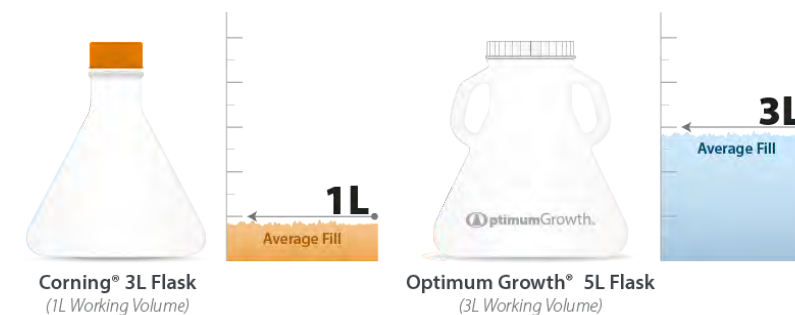
Conclusion

Thomson Optimum Growth® Flasks are equivalent to Corning® standard flasks in terms of expressed protein purity. However, with 50-60% fill volume, Optimum Growth® flasks can generate a far greater total protein yield per flask.

214% Yield Increase from Insect Cells Protein Production/Flask

Data supplied by New York Structural Genomics Research Consortium

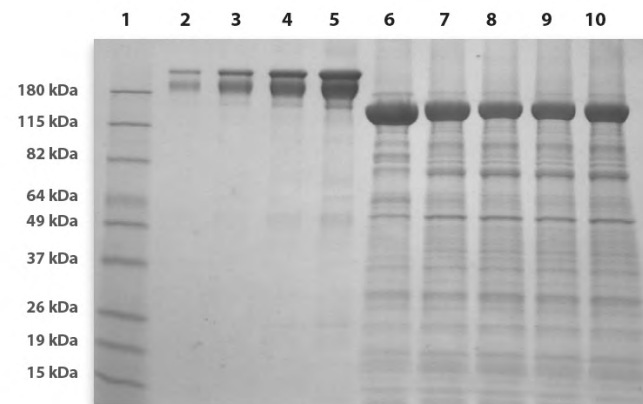
Four insect cell line clones cultured in Thomson 5L Optimum Growth® flasks and Corning® 3L shake flasks. In the figure below note the consistently higher protein yield with Optimum Growth® flasks over Corning®. Each flask has the same footprint but Thomson flasks operate with 3x higher fill volume.



Consistent Expression from HEK293 Strains

Thomson 5L Flasks Consistently Maximize Production of Your Best Expressers

Low Expressing Gel



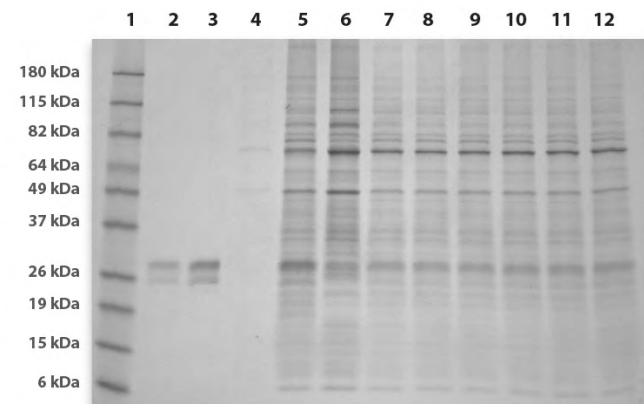
4-20% SDS-PAGE Quick Blue Stain Commassie Gel Expected MW of dimer 24.5 kDa
Estimated expression level ~10-20 mg/L

This gel shows equal bands from 5 replicates of a low expressing protein, producing roughly 10 to 20 mg/L.

Gel Key

1. Benchmark Pre-Stained Protein Ladder
2. Purified protein, 100 ng control
3. Purified protein, 200 ng control
4. Untransfected cells, -ve control
5. +ve control
6. +ve control
7. Protein of interest, 5L Combined Flasks #1-5
8. Protein of interest, 5L Flask #1
9. Protein of interest, 5L Flask #2
10. Protein of interest, 5L Flask #3
11. Protein of interest, 5L Flask #4
12. Protein of interest, 5L Flask #5

High Expressing Gel



4-20% SDS-PAGE Quick Blue Stain Commassie Gel Expected MW of dimer 159.4 kDa
Estimated expression level ~300 mg/L

This gel shows equal bands from 3 replicates of a high expressing protein, producing approximately 300 mg/L.

Gel Key

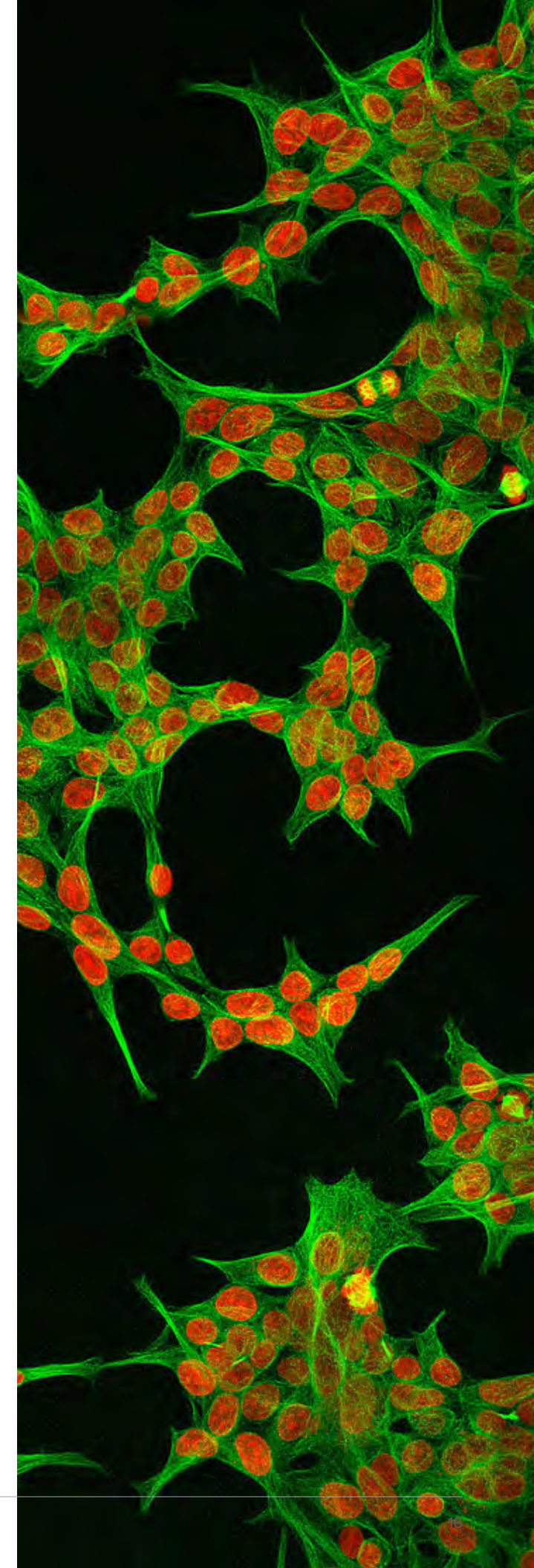
1. Benchmark Pre-Stained Protein Ladder
2. Purified mAb 100 ng control
3. Purified mAb 250 ng control
4. Purified mAb 500 ng control
5. Purified mAb 1000 ng control
6. +ve control
7. Protein of interest, 5L Flask #1
8. Protein of interest, 5L Flask #2
9. Protein of interest, 5L Flask #3
10. Protein of interest, 5L Combined Flasks #1-3

Conclusion

Thomson Optimum Growth® Flasks not only ensure consistent expression from HEK293 strains, they can also increase shaker capacity.

With the same footprint as a typical Corning® 3L flask and a culture volume of up to 3L, the Optimum Growth® 5L Flask may increase production 200%, if not more, in the same space (this is construct dependent).

Most constructs express at higher levels in the Optimum Growth® 5L flasks. This makes one Optimum Growth® 5L equivalent to, if not greater than, two 3L flasks.



Optimum Growth[®] Special Flasks

Components For Closed Systems

Thomson Optimum Growth[®] Special Flasks were designed for the unique needs of small- to medium-scale bioprocessing applications.

Sampling Flasks

Optimum Growth[®] Sample Flasks with one-way sampling valves that help reduce viable cell count sampling times

Key Feature

- Eliminate the need to remove flask caps & allow aseptic sampling on the benchtop

Multiport Flasks

Optimum Growth[®] Multiport Flasks serve as closed systems with feed/transfer and sampling ports

Key Features

- Feature feed/transfer ports for seeding larger bioreactors or for batch feeding medium sized cultures
- Both aseptic sampling valves & feed/transfer ports make the 1.6L, 2.8L and 5L flasks a closed system that does not need to be opened



Sampling Flasks

Four Optimum Sizes



125mL



250mL



500mL



5L

Sampling In the Shaker

Thomson's improved sampling method allows you to sample directly in the shaker without the need to remove caps or use a deteriorating needle septum.

1. Open shaker
2. Attach syringe to sampling port and withdraw the sample
3. Remove syringe & close shaker

Several Options for Aseptic Sampling

Optimum Growth® Flasks provide several options for aseptic sampling in all flask sizes. The 125mL, 250mL, and 500mL Optimum Growth® Flasks have an optional 1-way valve in the vented sample cap. The 5L Optimum Growth® Flask has an optional 1-way valve in the side of the flask.

Vented Sampling Caps

The Vent Cap of the Optimum Growth® Sampling Flask incorporates a 1-way valve that only allows media to flow out of the flask. This eliminates contamination and allows for aseptic sampling of cells while the flasks remain in the shaker or on the benchtop, eliminating the need for transfer to the hood from the shaker.

Optimum Growth® Sampling Flasks come with a 0.2µm PTFE vented cap for optimum aeration during cultivation. The Thomson vented caps create a safe aseptic barrier from harmful contaminants, while the large surface area creates an optimum air exchange for cell growth.



Multiport Optimum Growth® Transfer & Feed Flasks

Developed as a Custom Product

The Multiport Optimum Growth® Flask was developed out of the need for biopharmaceutical companies to ensure the elimination of contamination risk. The multiport flasks allows for completely closed system aseptic processing.

Steps Include:

1. Addition of media to the flask
2. Inoculation
3. Feeding
4. Sampling

Sized From 125mL to 5L



125mL



250mL



500mL



1.6L



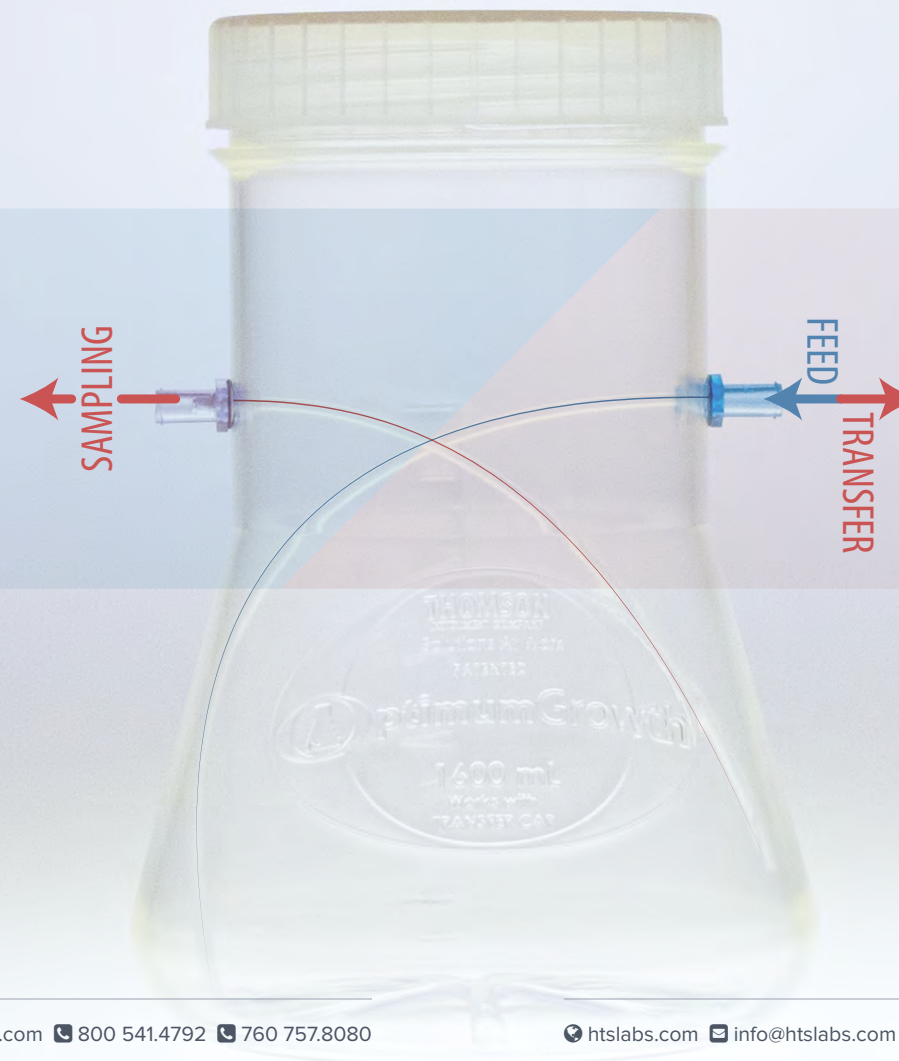
2.8L



5L

Sample Port Side

- Allows viable cell count sampling while the flask remains in shaker or on benchtop
- No need to decontaminate and open the flask cap
- Ensures contamination-free processing

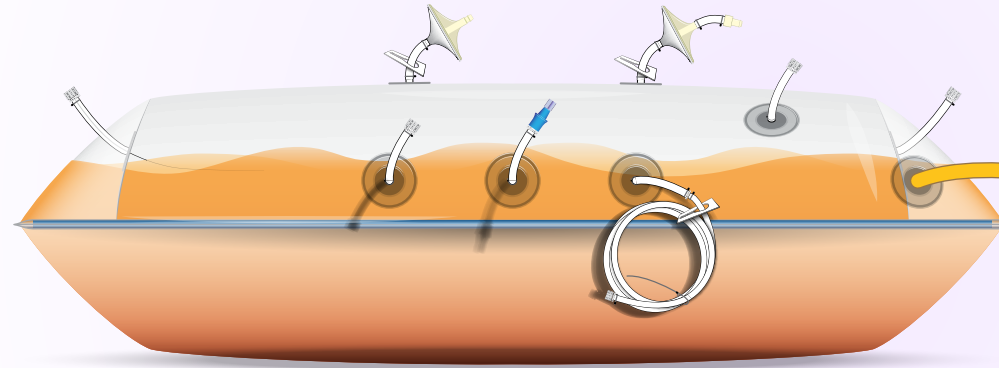


Transfer/Feed Side

- Tube fusing for media addition, inoculation, feeding
- Transfer to larger vessel maintaining sterility
- Eliminates the need to inoculate using expensive and awkward cell bags
- Contamination-free processing by never needing to open the flask cap

An Introduction to Transfer Caps & How They Work

Thomson Transfer Caps are used with our Optimum Growth® 1.6L, 2.8L & 5L flasks for aseptic transfer of cells or media into any vessel. Transfer Caps eliminate the need to move cells to an intermediate vessel for scale-up or to seed cultures. Transfer caps enable reagent addition, seeding of larger bioreactors or cell bags, and media transfer.

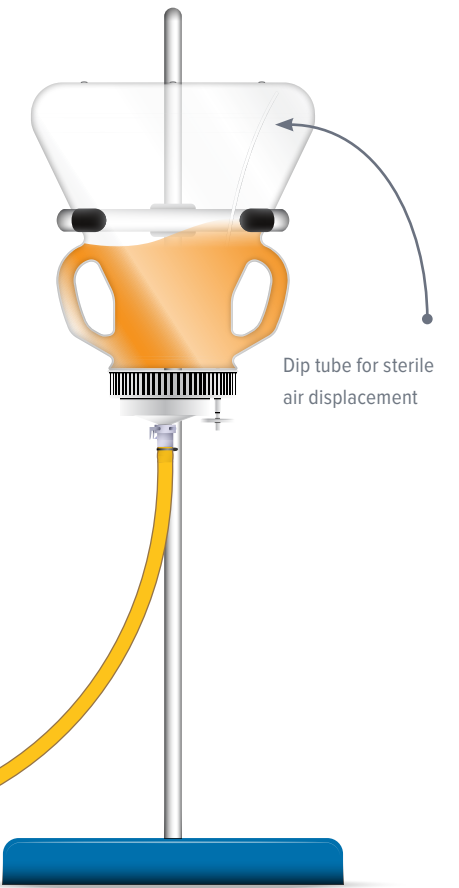


Inversion Transfer Caps

Utilize Gravity Feed for Simple Aseptic Transfer of Media or Cells

Key Features

- Gravity feed keeps cells stress free
- Dip tube attached to 0.2µm syringe filter provides aseptic air displacement
- Configurations include with & without attached tubing to accommodate a variety of vessel connections
- C-Flex® 16 & 24 tubing sizes available for tube fusing



Dip tube for sterile air displacement

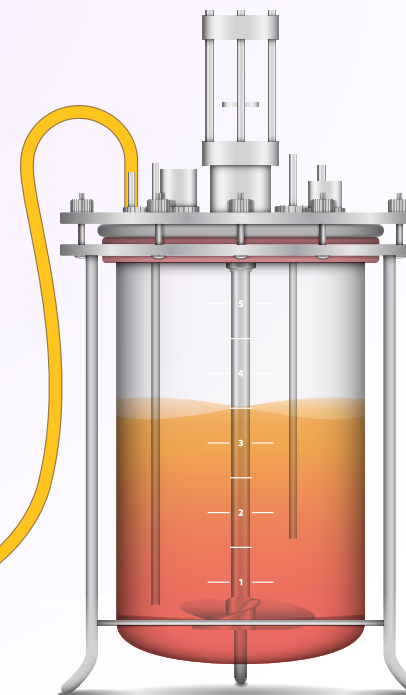
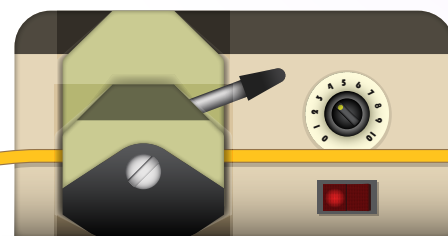
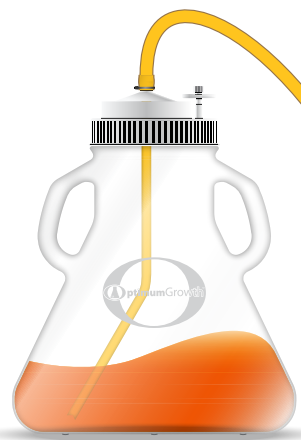
Stand & ring sold separately

Bidirectional Transfer Caps

Utilize a Peristaltic Pump for Easy Aseptic Bidirectional Transfer of Media or Cells

Key Features

- Equipped with 2' of 1/4" OD C-Flex® 16 tubing for pumping, ending with either a plug or male Luer lock
- Downstem allows for bidirectional transfer
- 0.2µm PTFE syringe filter provides aseptic air displacement while pumping



C-Flex® 16 ID: 1/8" (3.1mm), OD: 1/4" (6.35mm)
C-Flex® 24 ID: 3/16" (4.76mm), OD: 7/16" (11.1mm)

Connecting a Vessel to an Inversion Transfer Cap

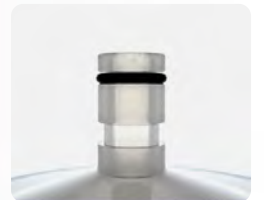
Inversion Transfer Caps are available in two configurations:

- Without tubing
- With tubing in either C-Flex® 16 or 24

For Vessels That Include Their Own Tubing and Connections



1/4" OD Barb Quick Connect



7/16" OD Male Quick Connect

For Vessels That Include a Female Luer Lock Connection



Male Luer Lock

For Vessels That Include C-Flex® 16 or 24 for Tube Fusing



Tube Fuse



0.2µm PTFE filter allows aseptic air displacement with dip tube during inversion transfer

C-Flex® 16 ID: 1/8" (3.1mm), OD: 1/4" (6.35mm)

C-Flex® 24 ID: 3/16" (4.76mm), OD: 7/16" (11.1mm)

Connecting A Vessel to a Bidirectional Transfer Cap

Bidirectional Transfer Caps configurations:

- C-Flex® 16 with plug on terminus for tube fusing
- C-Flex® 16 with male luer lock on terminus



Tube Fuse

For Vessels That Already Include C-Flex® 16 for Tube Fusing



Male Luer Lock

For Vessels That Already Include a Female Luer Lock Connection

C-Flex® 16 ID: 1/8" (3.1mm), OD: 1/4" (6.35mm)

Rapid Clear® Cap

Revolutionary Technology in Downstream Processing

The Thomson Optimum Growth® System of products expanded into downstream processing with a revolutionary new technology that allows high speed clarification of cellular material. Thomson developed the Rapid Clear® Cap to address the needs of scientists to quickly and efficiently clarify cell culture media directly from the Thomson 5L Optimum Growth® shaker flask without the need for centrifugation.

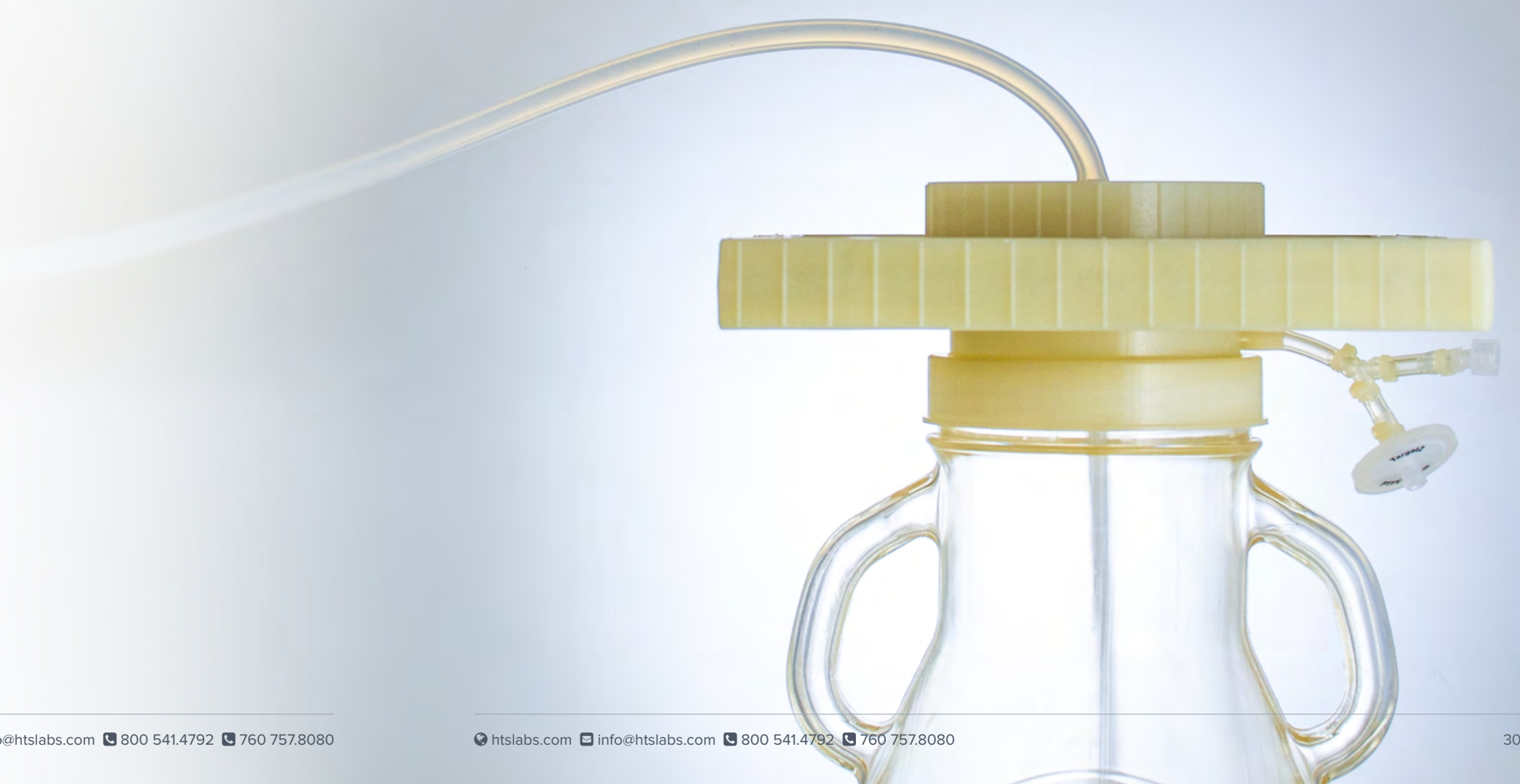
**Clarify 3L of Cell Culture
In < 35 Minutes with No
Centrifugation Required**

Key Features

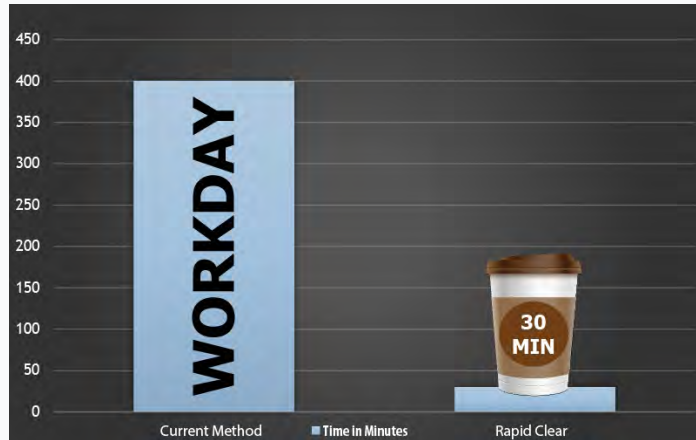
- Depth filtration with a 0.2µm final pore size eliminates multiple filtration steps and in most cases centrifugation
- Significant time savings versus traditional spin down technique
- Cell culture clarification of low or high density cultures of CHO stable, CHO transient, HEK293, hybridoma, and other mammalian cell lines
- Eliminates transfer steps: The Rapid Clear® Cap screws directly onto the Optimum Growth® Flask
- Secondary cap attaches to a new Optimum Growth® Flask or to a storage container with a Luer lock
- Solid Caps are also available for long-term storage of clarified media in the 2.8L or 5L receiving flask

Key Benefits

- Save time, clarify 3L of cell culture in less than 35 minutes – with no centrifugation required!
- Reduce consumables used by up to 90%
- Walk away convenience and safety – minimize endotoxin exposure



Win Your Day Back With Faster Filtration!



Time In Minutes

Clarify your cultures in under 30 minutes



CHO & Hek293 Filtration

Quick cell harvest for mammalian cells

Less Components Equals Less Waste



Current Method

- 4 x filter funnels
- 6 x containers
- Centrifugation Needed

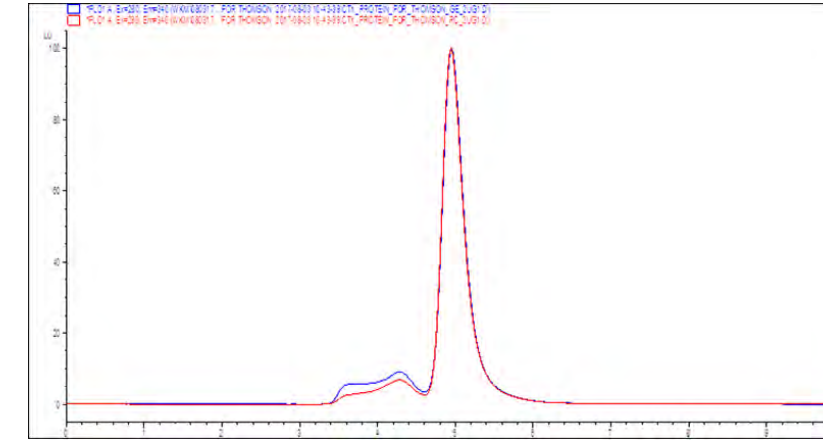


New Method

- 1 x Optimum Growth® Flask
- 1 x Rapid Clear® Cap

A Comparison Rapid Clear® Cap to GE® Capsule Filters

HPLC was utilized to quantitate intact protein for each of the purified solutions. The Rapid Clear® System yielded a slightly higher quantity of intact IgG, than the GE® capsule columns.



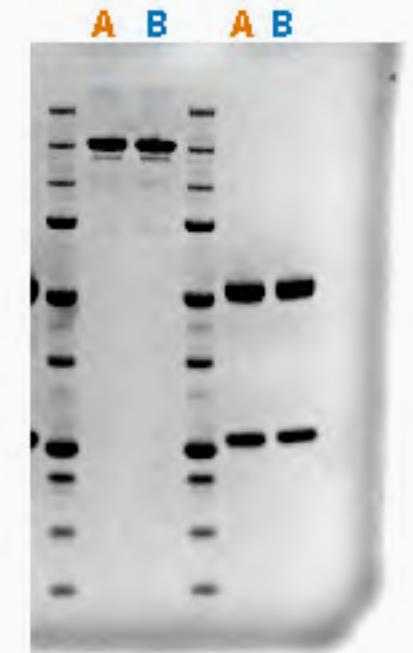
HPLC comparison of the purified IgG. The Rapid Clear® Cap 3000 is the red line and GE® the blue line

Both GE® and Rapid Clear® clarified IgG were run on an SDS Page gel for comparison: Lanes 1 & 4 are molecular weight standard ladder; Lanes 2&3 are non-reduced; lanes 5&6 are reduced.

- 1 ug of post proA protein per lane
- Both Reduced and Non-reduced samples
- 4-12% Bis Tris Gel from Life Tech
- Run in MES buffer @ 200 V for 30 minutes
- Stained with Safe Stain
- Ladder is Precision Plus from Biorad

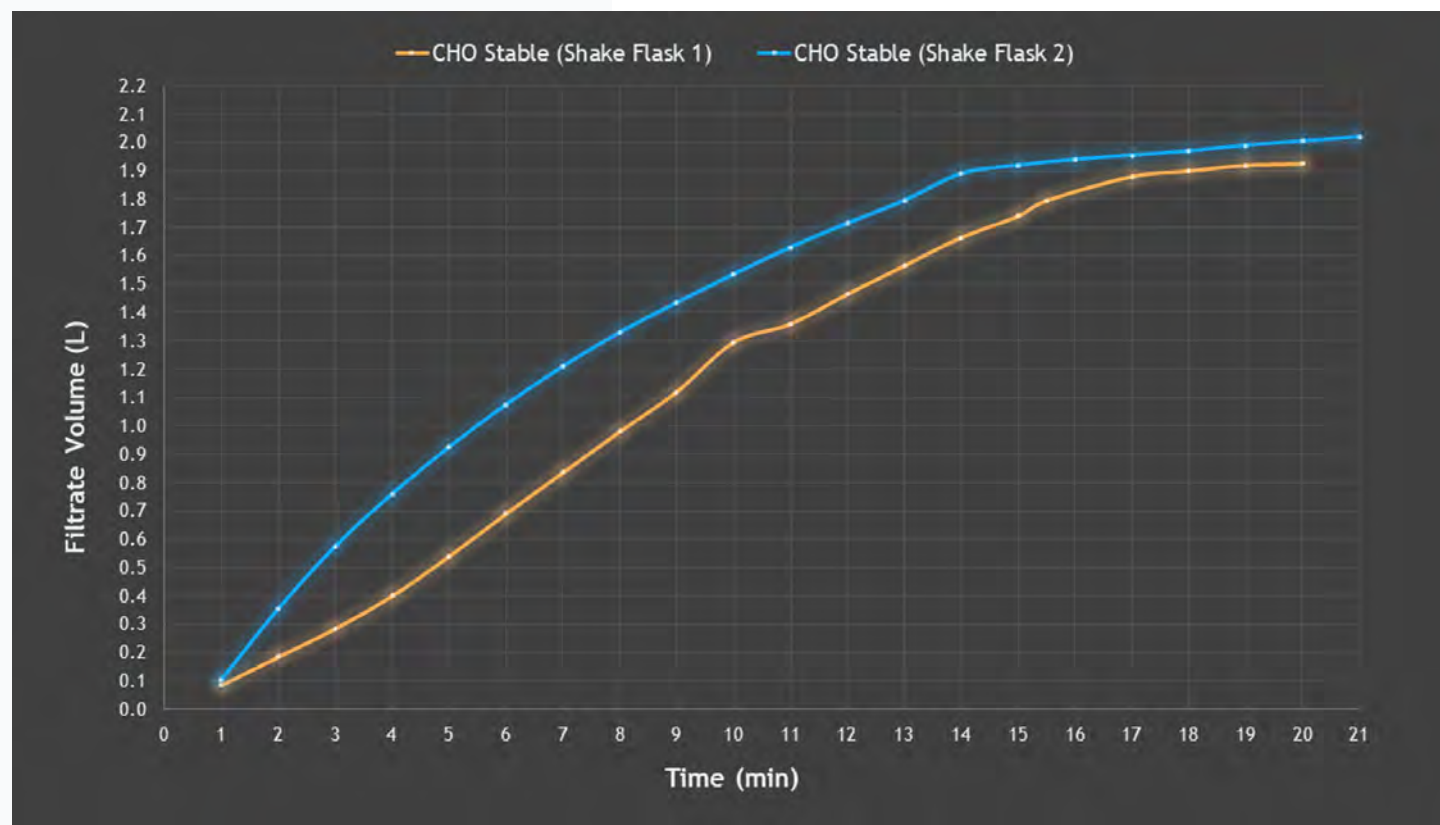
A= GE® filtered material

B= Rapid Clear® filtered material



Reduce Operating Costs by Increasing Efficiency & Minimizing the Number of Consumables Used

When producing biologics, cell yield, viability and effective clarification are critical. Thomson's patented Optimum Growth® Flask design facilitates good mixing and high gas exchange rates to produce high density yields of viable cells. Thomson has used its expertise in filtration to develop the Rapid Clear® Cap 3000 to speed up the clarification process. This innovation reduces operating costs by increasing efficiency and minimizing the number of consumables used.



Duplicate 3L CHO Stable cell cultures were clarified using the Rapid Clear® 3000. This graph compares the volume clarified over 21 minutes.

Quick & Easy To Use

Using the Rapid Clear® Cap 3000 is quick and easy. Once the mammalian or insect cell culture is ready for clarification, simply remove the vent cap and replace it with the Rapid Clear® Cap 3000. The chart provides the approximate time*** to clarify cell cultures based on cell type, viability and volume to be filtered. The higher the viability the faster the filtration.

- Grow cells in a 2.8L or 5L Optimum Growth® Flask
- Transfer the flask to a hood to replace the Vent Cap with the Rapid Clear® Cap
- Replace the Vent Cap on the receiving 1.6L, 2.8L, or 5L Optimum Growth® Flask with the receiving cap that comes with the Rapid Clear® Cap
- Remove from hood and place tubing in the pump head, see pump recommendations***
- Tilt the flask slightly and run the pump at maximum speed until only a few hundred mL remain
- Add 400mL of PBS to the Optimum Growth® Flask to ensure all the culture has been filtered and transferred to the new flask

CELL LINE VIABILITY	99%-70%		69%-50%		49%-40%		39%-0% SPIN FOR 7MIN @ 4000G*	
	VOLUMN (L)	TIME (MIN)	VOLUMN (L)	TIME (MIN)	VOLUMN (L)	TIME (MIN)	VOLUMN (L)	TIME (MIN)
CHO Stable without Feed	3.0	18	2.5	18	2.0	20	3.5****	35****
CHO Stable, 1 to 2 Feeds	2.0	18	2.0	18	1.5	35		
CHO Stable, 2+ Feeds	Spin for 7 min @ 4000g; ≤3L volume ****							
HEK293 (FreeStyle™ & Expi293)	3.0	18	3.0	23	3.0	25	3.5****	35****
CHO Transient	3.0	18	2.5	18	1.5	35		
ExpiCHO	3.0	18	2.5	18	1.0	18		

* For low viability cultures, (< 39%), centrifuge for 7 minutes prior to clarifying with the Rapid Clear® Cap.

** This chart was created from results generated in customer labs.

*** All data was generated using a Cole-Parmer pump (pump drive p/n EW-07554-90, pump head p/n EW-77200-62)

**** Cell cultures that received 2+ feeds will require spinning to minimize potential clogging

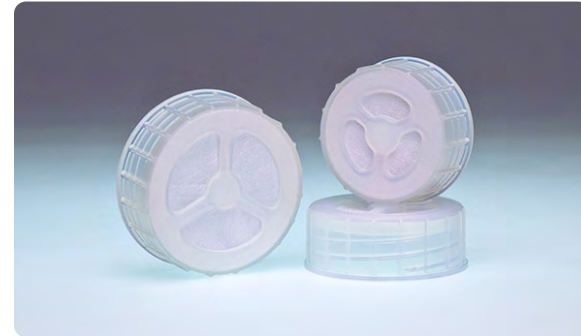
Flask Accessories

Caps For Sealing, Breathing & Exhaust



Bioreactor Exhaust Cap

When used with the Optimum Growth® 1.6L flask and connected to your bioreactor this cap provides a dry aseptic pressure release system



Solid & Vented Caps

Available for all Optimum Growth® flasks. Solid storage and vented caps keep your clarified media sterile until ready for processing

Laboratory Accessories

Fixtures For Handling Optimum Growth® Flasks & Transfer Caps In The Lab



Ring Stands & Rings

For suspending your Optimum Growth® Flask and Inversion Transfer Cap at the correct height above the receiving vessel



Optimum Growth® Flask Carriers

For the Optimum Growth® 125mL and 250mL flasks, carriers hold up to 8 flasks at a time and aid in transport to and from the shaker, while sampling in the hood and when left in the shaker to maximize spacing efficiency between flasks



Accessories

Thomson carries a number of accessories for the Optimum Growth® Flask series. Accessories add to the ease-of-use and functionality of Optimum Growth® Flasks and Transfer Caps

Part Numbers

Optimum Growth® Flask

Flask Size	125mL	250mL	500mL	1.6L	2.8L	5L
Part #	931110	931111	931112	931113	931114	931116
Top Style	threaded	threaded	threaded	threaded	threaded	threaded
Top	vent cap	vent cap	vent cap	vent cap	vent cap	vent cap
Working Vol.	24-75mL	100-150mL	175-250mL	0.4-1.1L	0.9-1.6L	1.7-3.2L
Sterility (SAL)	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶
Qty/Case	50	50	25	12	6	4

Optimum Growth® Sampling Flasks

Flask Size	125mL	250mL	500mL	5L
Part #	931110-SP	931111-SP	931112-SP	931116-PORT-E
Working Vol.	24-75mL	100-150mL	175-250mL	1.7-3.2L
Sample Connection	Male Luer Lock	Male Luer Lock	Male Luer Lock	Male Luer Lock
Top Style	Threaded	Threaded	Threaded	Threaded
Top	Sampling Vent Cap	Sampling Vent Cap	Sampling Vent Cap	Vent Cap
Sample Tubing Vol.	163µL	218µL	313µL	381µL
Air Filter Ventilation	0.2µm PTFE*	0.2µm PTFE*	0.2µm PTFE*	0.2µm PTFE*
Sterility (SAL)	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶
Qty/Case	50	50	25	4

*For cultivation & pressure relief

Optimum Growth® Multiport Flasks

Flask Size	125mL	250mL	500mL	1.6L	2.8	5L
Part #	931110-DP	931111-DP	931112-DP	931113-PORT-TRT	931114-PORT-TRT	931116-PORT-TRT-F
Working Vol.	24-75mL	100-150mL	175-250mL	0.4-1.1L	0.9-1.6L	1.7-3.2L
Top Style	Threaded	Threaded	Threaded	Threaded	Threaded	Threaded
Top	dual port vent cap	dual port vent cap	dual port vent cap	vent cap	vent cap	vent cap
Sample Connection	Male Luer Lock	Male Luer Lock	Male Luer Lock	Male Luer Lock	Male Luer Lock	Male Luer Lock
Sample Tubing Volume	163µL	218µL	313µL	326µL	358µL	381µL
Transfer Tubing	Chemically resistant, heat sealable	Chemically resistant, heat sealable	Chemically resistant, heat sealable	Chemically resistant, heat sealable	Chemically resistant, heat sealable	Chemically resistant, heat sealable
Transfer Connection	Tube Fuse	Tube Fuse	Tube Fuse	Tube Fuse	Tube Fuse	Tube Fuse
Tubing Diameter	C-Flex® 16	C-Flex® 16	C-Flex® 16	C-Flex® 16	C-Flex® 16	C-Flex® 16
Tubing Length	24" (609.6mm)	24" (609.6mm)	24" (609.6mm)	24" (609.6mm)	24" (609.6mm)	24" (609.6mm)
Air Filter Ventilation	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter
Sterility (SAL)	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶
Qty/Case	30	40	15	12	6	4

C-Flex® 16 ID: 1/8" (3.1mm), OD: 1/4" (6.35mm)

Inversion Transfer Caps

Flask Compatibility	1.6L & 2.8L Optimum Growth®	1.6L & 2.8L Optimum Growth®	1.6L & 2.8L Optimum Growth®	1.6L & 2.8L Optimum Growth®
Part #	931706-4	931710-4	931705-4	931708-4
Tubing Included	no	yes	yes	yes
Connection	7/16" (11.1mm) Male Quick Connect	Male Luer Lock	Tube Fuse (plug on terminus)	Tube Fuse (plug on terminus)
Tubing Diameter	n/a	C-Flex® 16	C-Flex® 16	C-Flex® 24
Tubing	n/a	Chemically resistant, heat sealable	Chemically resistant, heat sealable	Chemically resistant, heat sealable
Tubing Length	n/a	24" (609.6mm)	24" (609.6mm)	24" (609.6mm)
Style	Threaded	Threaded	Threaded	Threaded
Material	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)
Air Filter Ventilation	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter
Sterility (SAL)	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶
Qty/Case	4	4	4	4

Inversion Transfer Caps

Flask Compatibility	5L Optimum Growth®	5L Optimum Growth®	5L Optimum Growth®	5L Optimum Growth®	5L Optimum Growth®
Part #	931594-4	931596-4	931616-4	931595-4	931598-4
Tubing Included	no	no	yes	yes	yes
Tubing Connection	1/4" (6.35mm) Barb	7/16" (11.1mm) Quick Connect	Male Luer Lock	Tube Fuse (plug on terminus)	Tube Fuse (plug on terminus)
Tubing Diameter	n/a	n/a	C-Flex® 16	C-Flex® 16	C-Flex® 24
Tubing	n/a	n/a	Chemically resistant, heat sealable	Chemically resistant, heat sealable	Chemically resistant, heat sealable
Tubing Length	n/a	n/a	24" (609.6mm)	24" (609.6mm)	24" (609.6mm)
Style	Threaded	Threaded	Threaded	Threaded	Threaded
Material	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)
Air Filter Ventilation	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter
Sterility (SAL)	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶
Qty/Case	4	4	4	4	4

Bidirectional Transfer Caps

Flask Compatibility	1.6L Optimum Growth®	1.6L Optimum Growth®	2.8L Optimum Growth®	5L Optimum Growth®	5L Optimum Growth®
Part #	931702-8	931704-8	931804-8	931618-8	931614-8
Tubing Included	yes	yes	yes	yes	yes
Tubing Connection	Male Luer Lock	Tube Fuse (plug on terminus)	Male Luer Lock	Male Luer Lock	Tube Fuse (plug on terminus)
Tubing Diameter	C-Flex® 16	C-Flex® 16	C-Flex® 16	C-Flex® 16	C-Flex® 16
Tubing	Chemically resistant, heat sealable	Chemically resistant, heat sealable	Chemically resistant, heat sealable	Chemically resistant, heat sealable	Chemically resistant, heat sealable
Tubing Length	24" (609.6mm)	24" (609.6mm)	24" (609.6mm)	24" (609.6mm)	24" (609.6mm)
Style	Threaded	Threaded	Threaded	Threaded	Threaded
Material	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)
Air Filter Ventilation	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter
Sterility (SAL)	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶
Qty/Case	8	8	8	8	8

C-Flex® 16 ID: 1/8" (3.1mm), OD: 1/4" (6.35mm)

C-Flex® 24 ID: 3/16" (4.76mm), OD: 7/16" (11.1mm)

Rapid Clear® Cap

Flask Compatibility	2.8L & 5L
Part #	788116
Tubing Connection	Transfer Cap
Tubing Diameter	Size 15 silicone tubing, ID: 3/16" (4.76mm), OD: 7/16" (11.1mm)
Tubing	Chemically resistant, flexible
Tubing Length	48" (1219.2mm)
Material	PP (polypropylene)
Sterility (SAL)	10 ⁻⁶
Qty/Case	4

Inversion Transfer Cap Accessories-Ring & Stands

Flask Compatibility	1.6L & 2.8L Optimum Growth®	1.6L & 2.8L Optimum Growth®	5L Optimum Growth®	5L Optimum Growth®
Part #	931609	931700	931606	931607
Stand Height	22"	n/a ring only	22"	n/a ring only
Ring Diameter	5"	5"	7"	7"
Qty/Case	1	1	1	1

Optimum Growth® Flask Carriers

Flask Compatibility	125mL	250mL
Part #	1212900	1212905
Flask Capacity	8	8
Dimensions	10.75" x 5"	13.4" x 6"
Qty/Case	1	1

Optimum Growth® Vent Caps

Flask Compatibility	125mL	250mL	500mL	1.6L, 2.8L & 5L
Part #	899110	899111	899112	899116
Membrane	PTFE	PTFE	PTFE	PTFE
Pore Size	0.2µm PTFE	0.2µm PTFE	0.2µm PTFE	0.2µm PTFE
Sterility (SAL)	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶
Qty/Case	50	50	25	24

Optimum Growth® Solid Caps

Flask Compatibility	1.6L, 2.8L & 5L
Part #	899600-B
Sterility (SAL)	10 ⁻⁶
Qty/Case	24

