

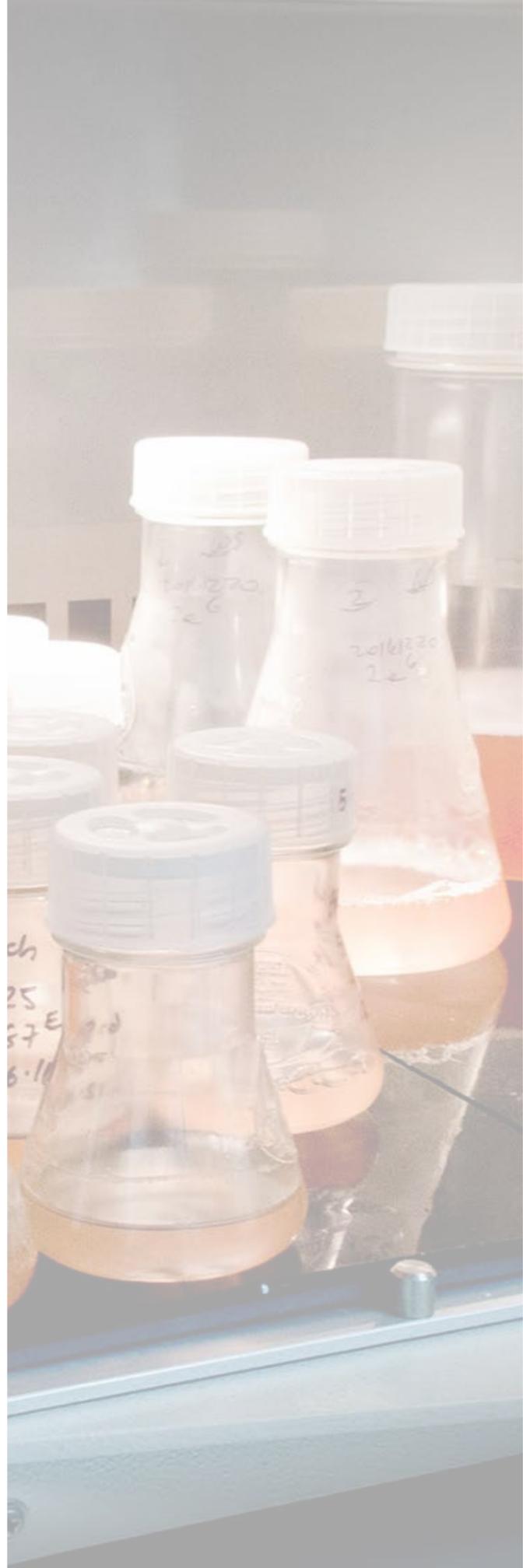


2091 Rutherford Rd., Suite 150
Carlsbad, CA 92008
info@htslabs.com
800 541.4792
760 757.8080
htslabs.com

TIC-PL-082-301 Rev. B

Cell Culture Solutions Optimum Growth® System

Insect & Mammalian Cell Growth



Optimum Growth® System

Insect & Mammalian Cell Growth

A Little About Thomson

- 1 Solutions At Work™
- 2 Open to Collaboration

Optimum Growth® System

- 3 An Introduction to the Optimum Growth® System
- 4 Optimum Growth® System Components

Optimum Growth® Flasks

- 5 An Introduction to Optimum Growth® Flasks
- 7 All Sizes Shake At The SAME Optimal Shake Speed
- 8 Space Saving More Volume
- 9 Fill Volume & Shake Speeds
- 10 Flask Clamp Compatibility
- 11 Optimum Growth® Flask FAQ's
- 13 Traditional vs Optimum Growth® Flasks
- 14 214% Yield Increase from Insect Cells
- 15 Consistent Expression from HEK293 Strains
- 16 Conclusion

Special Flasks

- 17 An Introduction to Optimum Growth® Special Flasks
- 17 Components For Closed Systems

Sampling Flasks

- 19 Several Options for Aseptic Sampling
- 20 Sampling In the Shaker

Multiport Optimum Growth® Flasks

- 21 Born As A Custom Product
- 22 Multiport Sizes

Transfer Caps

- 23 An Introduction to Transfer Caps & How They Work
- 25 Connecting a Vessel to an Inversion Transfer Cap
- 27 Connecting A Vessel to a Bidirectional Transfer Cap

Rapid Clear® Cap

- 29 Clarify 3L of Cell Culture In < 35 Minutes with No Centrifugation Required
- 30 Features & Benefits
- 31 Win Back Your Day
- 31 Less Components
- 32 A Comparison Rapid Clear® Cap to GE® Capsule Filters
- 33 Reduce Operating Costs by Increasing Efficiency & Minimizing the Number of Consumables Used
- 34 Quick & Easy to Use

Accessories

- 35 Flask Accessories
- 36 Laboratory Accessories

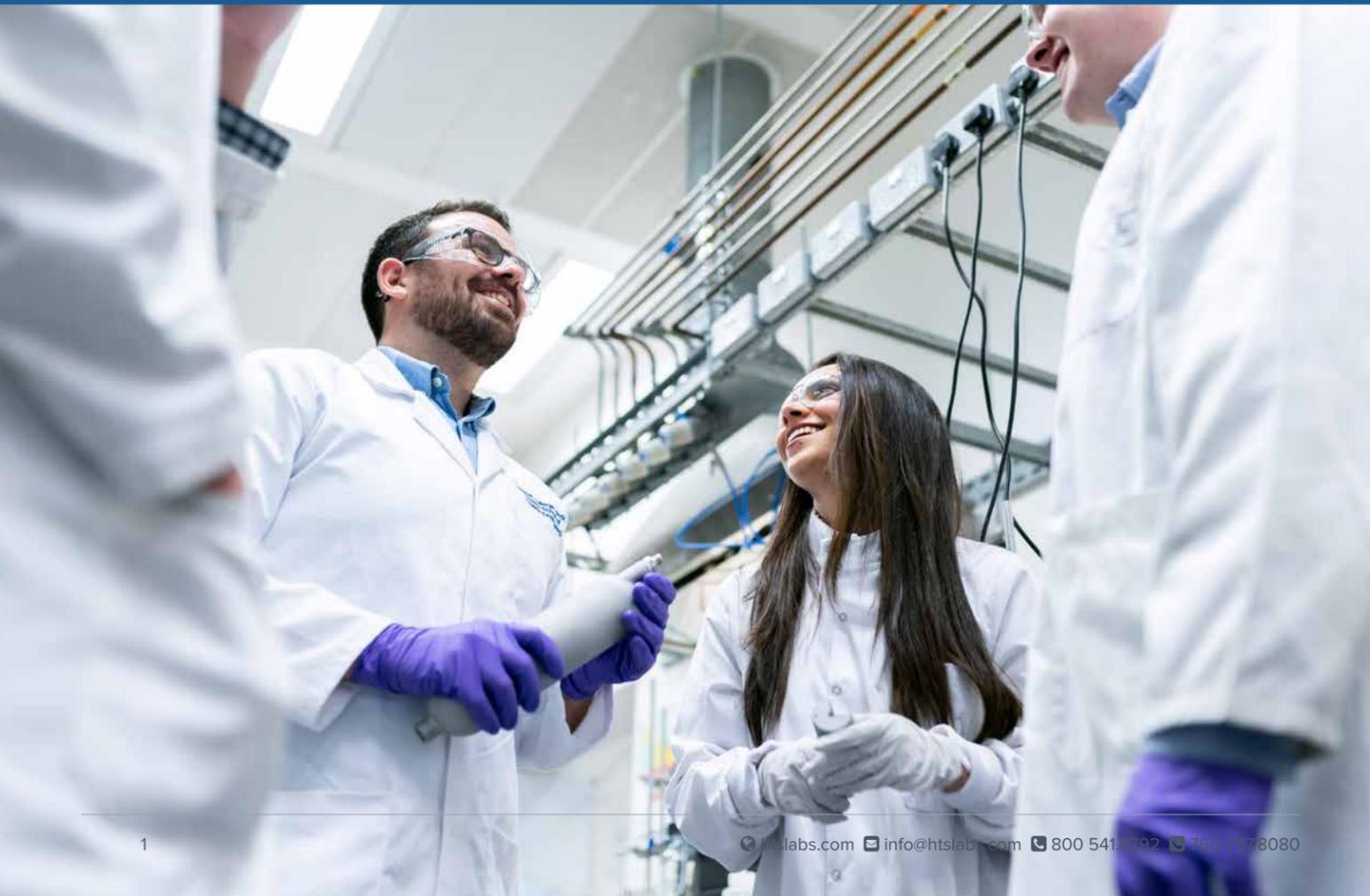
Part Numbers

- 37 Optimum Growth® Flasks
- 37 Optimum Growth® Sampling Flasks
- 37 Optimum Growth® Multiport Flasks
- 38 Inversion Transfer Caps
- 38 Bidirectional Transfer Caps
- 39 Rapid Clear® Cap
- 39 Inversion Transfer Cap Accessories
- 39 Optimum Growth® Flask Carriers
- 39 Optimum Growth® Vent & Solid Caps

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

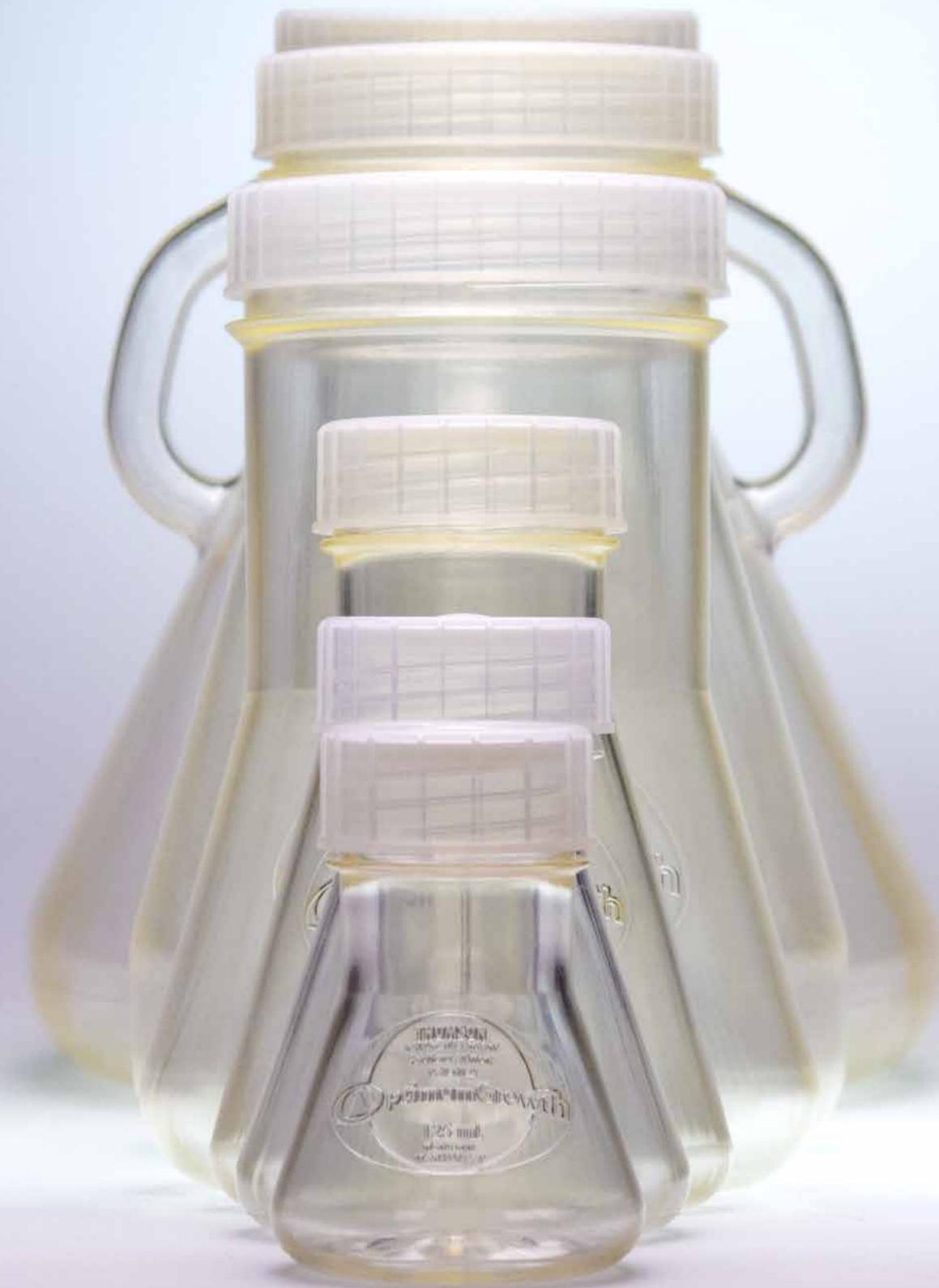
Thomson Optimum Growth® Flasks are designed for mammalian and insect cell culture, available in 125mL, 250mL, 500mL, 1.6L, 2.8L and our popular 5L volumes.

They are superior to traditional shake flasks due in part to the fact that they support a 40-50% 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 40-50% 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 140-150 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 For Mammalian, Hybridoma, Insect & Microbial

Optimum Growth Best Working Volume 40-50%

Working fill volume & shake speeds for Optimum Growth® Flasks for the best advertised results

| Flask Size | Working Volume | RPM in 1" 2" | Vol./Size ratio |
|------------|----------------|----------------|-----------------|
| 125mL-LE* | 15-40mL | 100-120 90 | 12-32% |
| 125mL | 50-63mL | 140-150 110 | 40-50% |
| 250mL | 100-125mL | 140-150 110 | 40-50% |
| 500mL | 200-250mL | 140-150 110 | 40-50% |
| 1.6L | 400-900mL | 140-150 110 | 40-56% |
| 2.8L | 1.0-1.4L | 140-150 110 | 40-50% |
| 5L | 2.0-2.5L | 140-150 110 | 40-50% |

*LE = Low Evaporation, small volume applications

Flask Clamp Compatibility

Clamp Compatibility Chart

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.

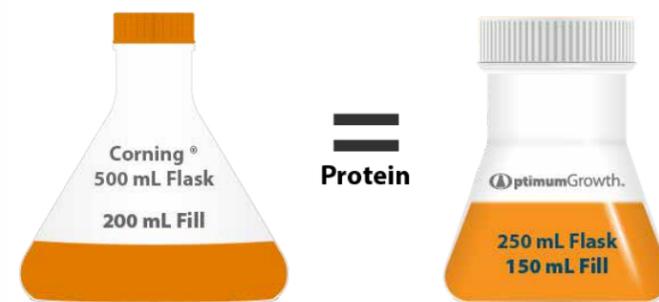
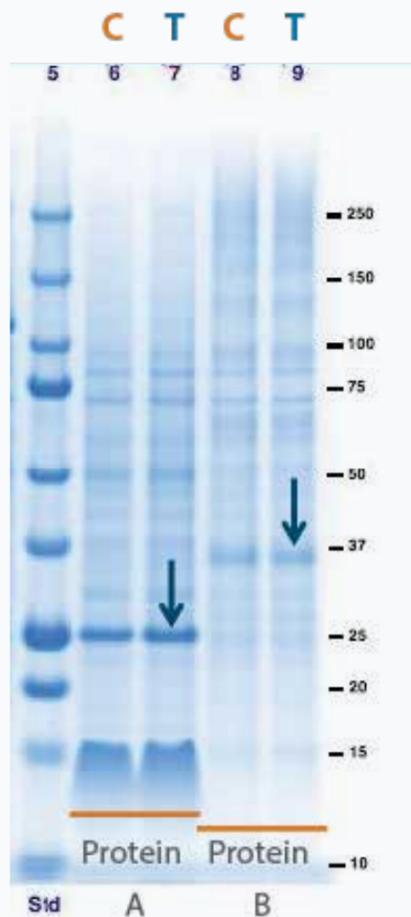
Thomson Instrument Company is not affiliated with Corning Life Sciences®, ThermoFisher, MilliporeSigma, Eppendorf®, INFORS HT®, Kuhner®, VWR®, Mirus or their product maxcyte



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



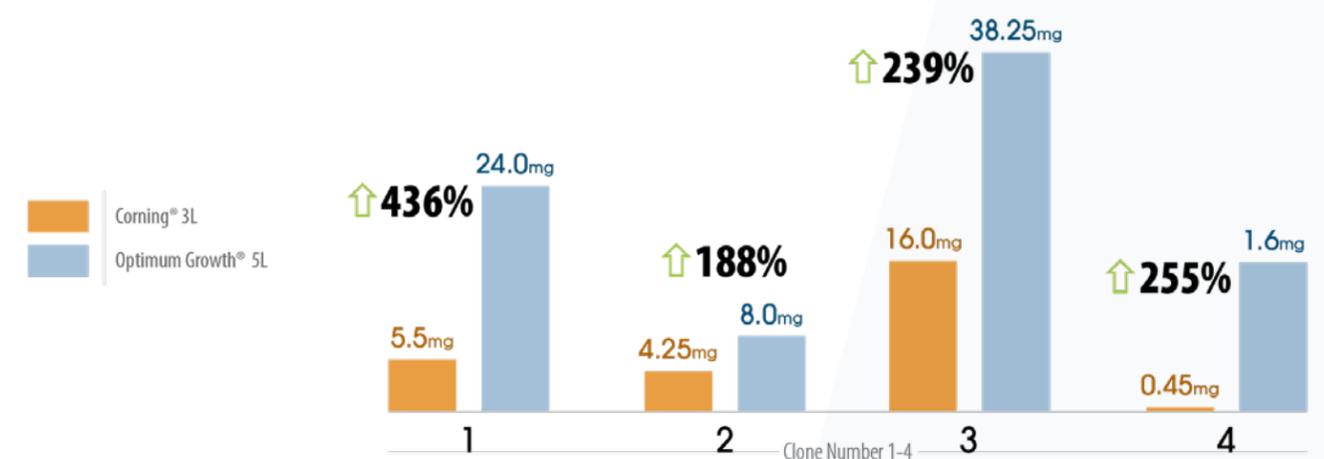
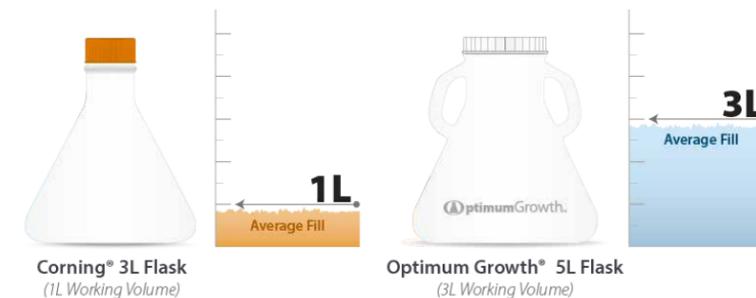
Conclusion

Thomson Optimum Growth® Flasks are equivalent to Corning® standard flasks in terms of expressed protein purity. However, with 40-50% 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

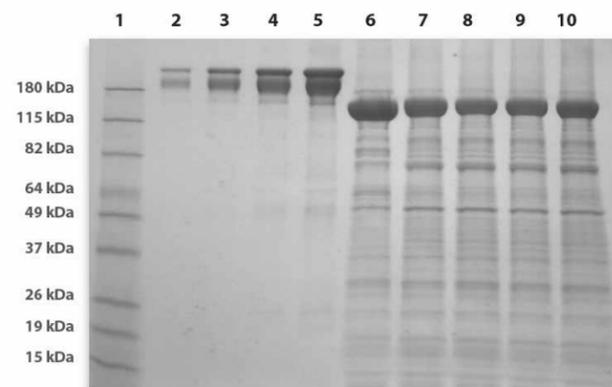
Four insect cell line clones cultured in Thomson 5L Optimum Growth® flasks and Corning® 3L shake flasks. In the figure below note the consistently higher protein yield with Optimum Growth® flasks over Corning®. Each flask has the same footprint but Thomson flasks operate with 3x higher fill volume.



Consistent Expression from HEK293 Strains

Thomson 5L Flasks Consistently Maximize Production of Your Best Expressers

Low Expressing Gel



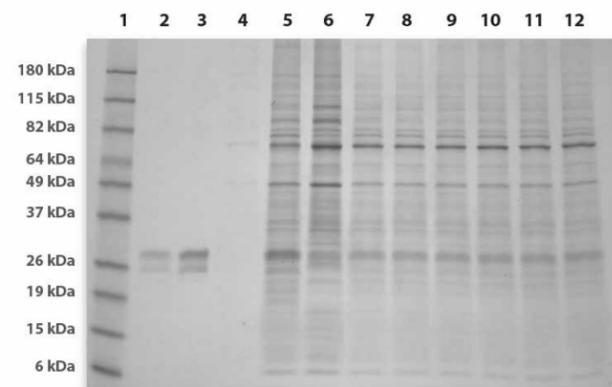
4-20% SDS-PAGE Quick Blue Stain Commassie Gel Expected MW of dimer 24.5 kDa
Estimated expression level ~10-20 mg/L

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

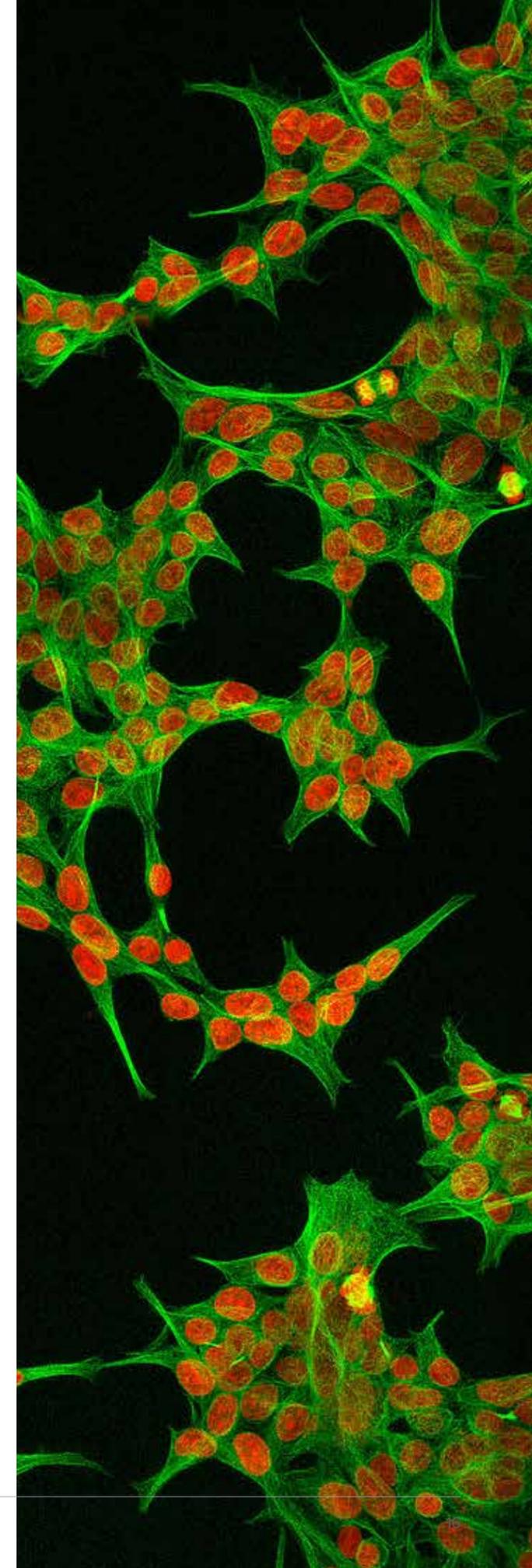
Conclusion

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.

Thomson Instrument Company is not affiliated with Corning® Life Sciences or their products



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



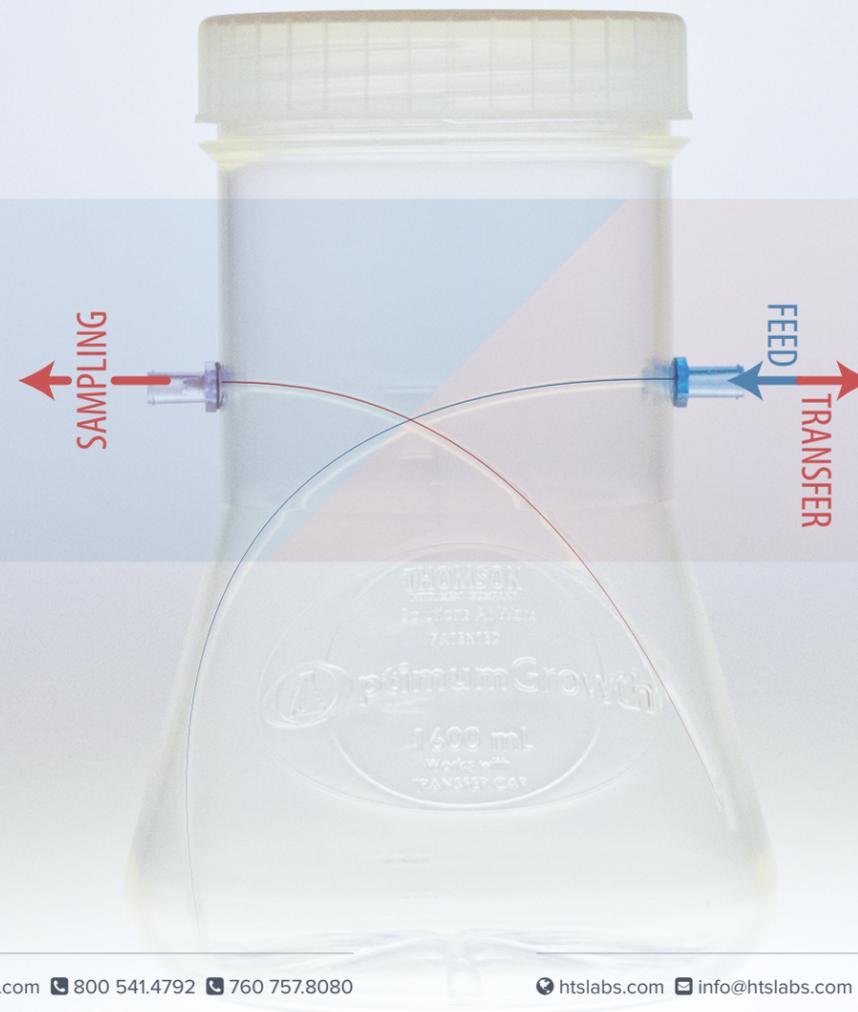
2.8L



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

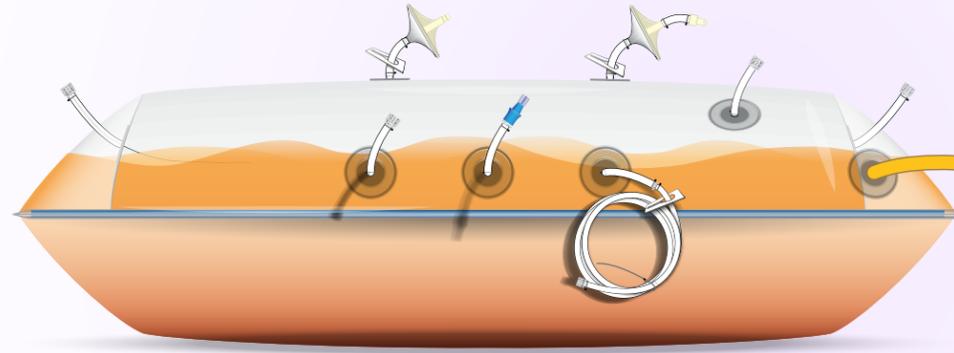


Transfer/Feed Side

- 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

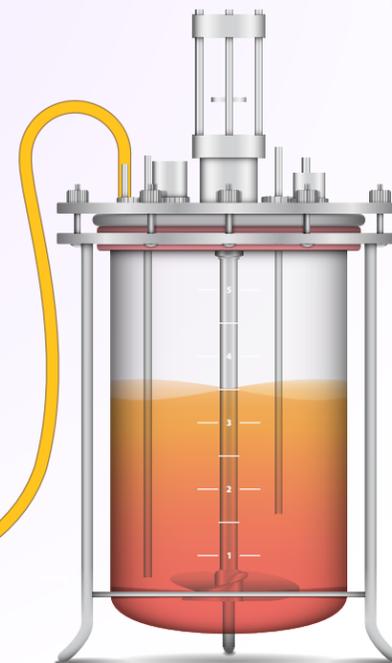
Stand & ring sold separately

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

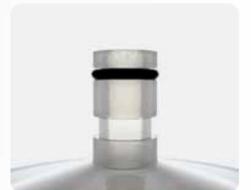
Inversion Transfer Caps are available in two configurations:

- 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

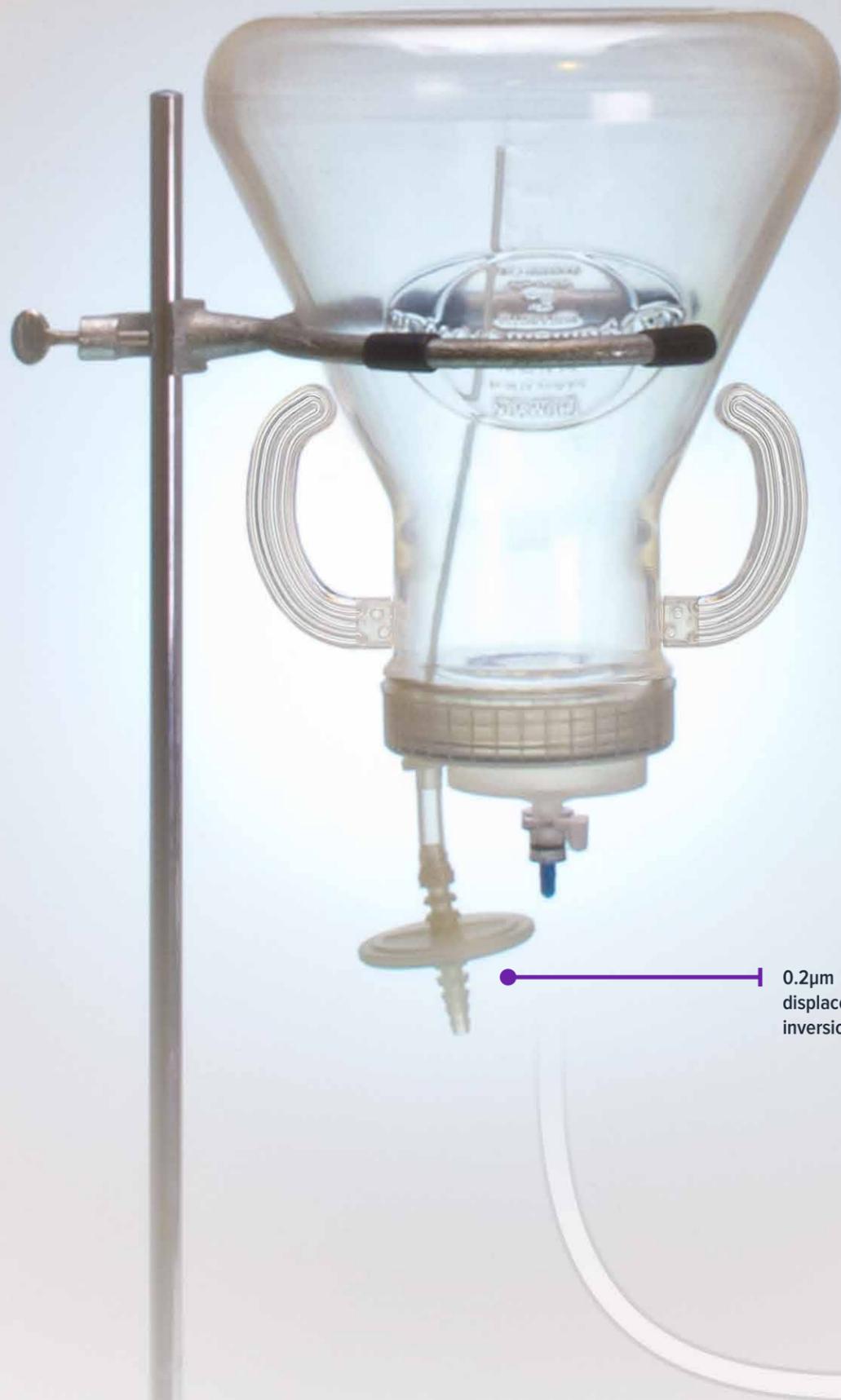


Male Luer Lock

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.

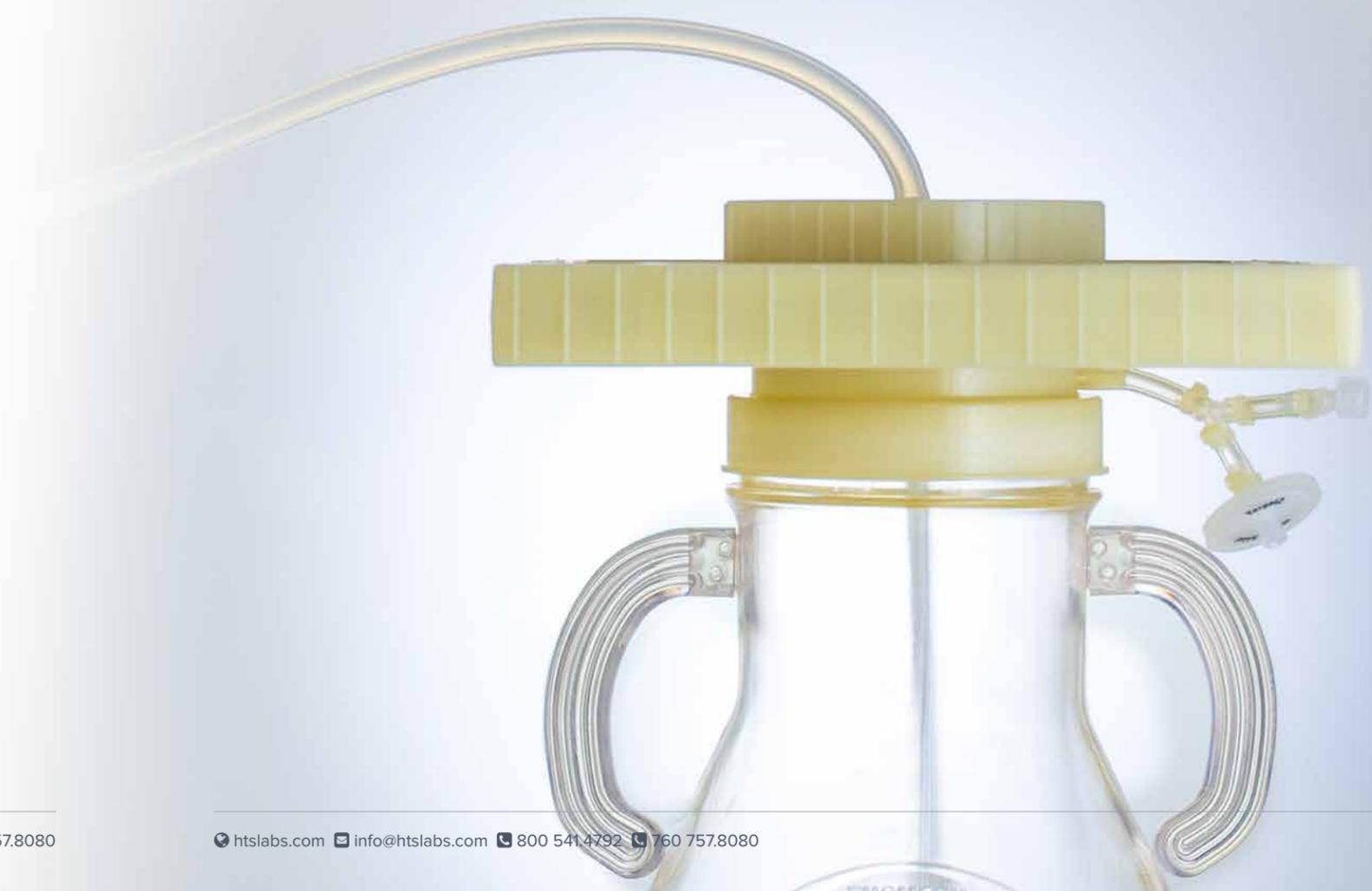
**Clarify 3L of Cell Culture
In < 30 Minutes with No
Centrifugation Required**

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 30 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

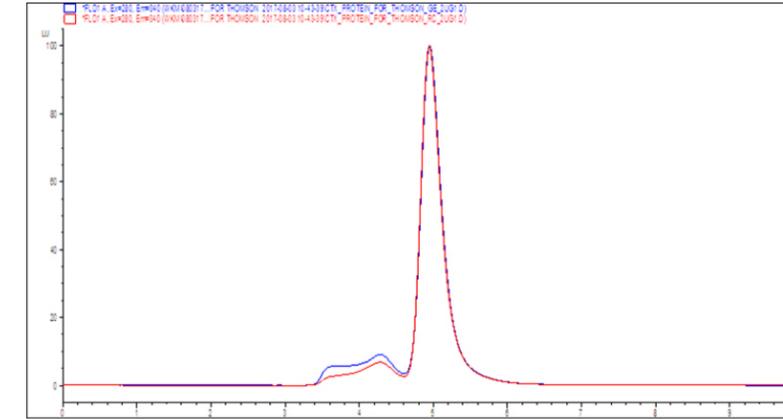


New Method

- 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



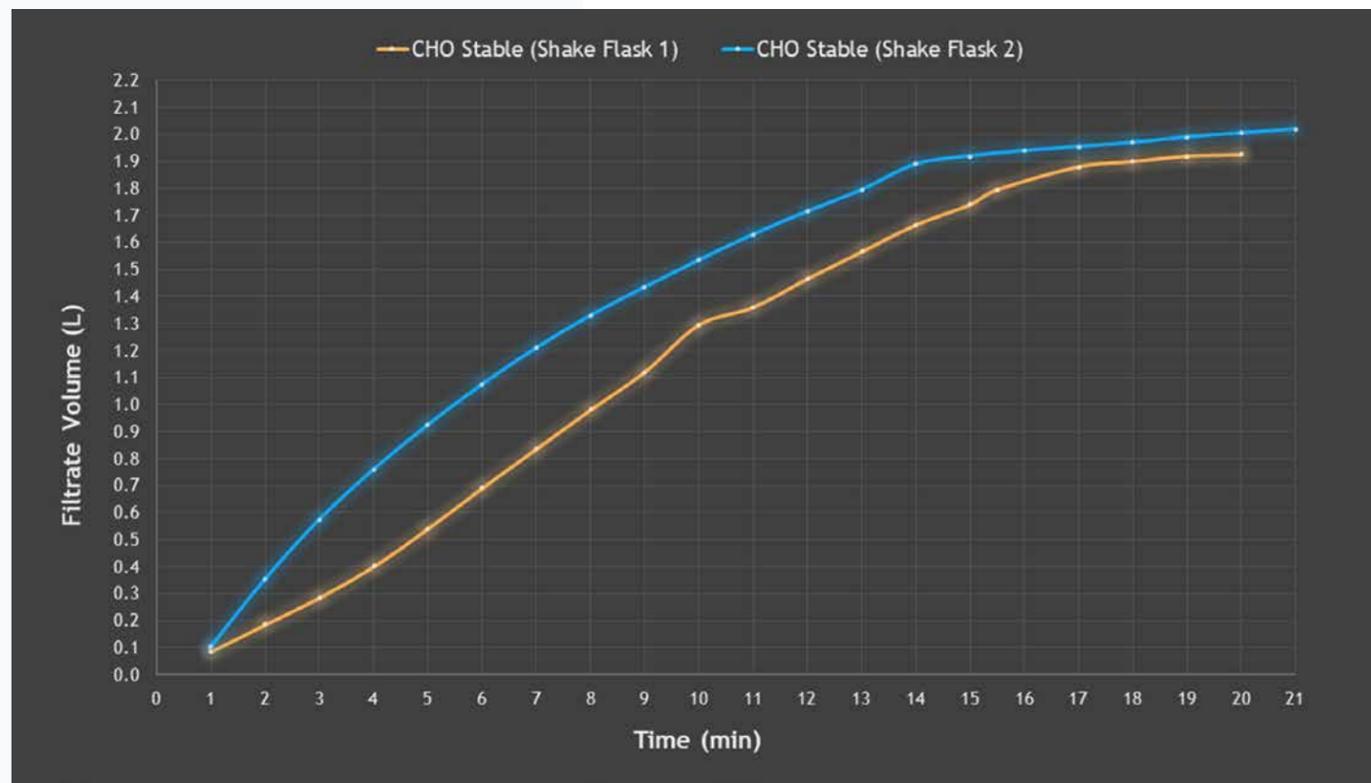
Reduce Operating Costs by Increasing Efficiency & Minimizing the Number of Consumables Used

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.

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



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

| 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-LE* | 125mL | 250mL | 500mL | 1.6L | 2.8L | 5L |
|------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Part # | 931110-11 | 931110 | 931111 | 931112 | 931113 | 931114 | 931116 |
| Top Style | threaded |
| Top | solid cap | vent cap | vent cap | vent cap | vent cap | vent cap | vent cap |
| Working Vol. | 15-40mL | 50-63mL | 100-125mL | 200-250mL | 400-900mL | 1.0-1.4L | 2.0-2.5L |
| Sterility (SAL) | 10 ⁻⁶ |
| Qty/Case | 50 | 50 | 50 | 25 | 12 | 6 | 4 |

*LE = Low Evaporation, small volume applications

Double Bagged Optimum Growth® Flask

| Flask Size | 125mL | 250mL | 500mL | 1.6L | 2.8L | 5L |
|------------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Part # | 931110-DB | 931111-DB | 931112-DB | 931113-DB | 931114-DB | 931116-DB |
| Top Style | threaded | threaded | threaded | threaded | threaded | threaded |
| Top | vent cap |
| Working Vol. | 50-63mL | 100-125mL | 200-250mL | 400-900mL | 1.0-1.4L | 2.0-2.5L |
| Sterility (SAL) | 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. | 50-63mL | 100-125mL | 200-250mL | 2.0-2.5L |
| 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 |

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. | 50-63mL | 100-125mL | 200-250mL | 400-900mL | 1.0-1.4L | 2.0-2.5L |
| 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 |
| Sample Tubing Volume | 163µL | 218µL | 313µL | 326µL | 358µL | 381µL |
| Transfer Tubing | Chemically resistant, heat sealable |
| Transfer Connection | Tube Fuse |
| Tubing Diameter | C-Flex® 16 |
| Tubing Length | 24" (609.6mm) |
| Air Filter Ventilation | 0.2µm PTFE vent filter |
| Sterility (SAL) | 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 |
| Tubing | Chemically resistant, heat sealable |
| Tubing Length | 24" (609.6mm) |
| Style | Threaded | Threaded | Threaded | Threaded | Threaded |
| Material | PP (polypropylene) |
| Air Filter Ventilation | 0.2µm PTFE vent filter |
| Sterility (SAL) | 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 |

