

THOMSON
INSTRUMENT COMPANY

SOLUTIONS AT WORK™

 **OptimumGrowth™**

TIPS & TRICKS FOR CHO & HEK

5L

2.8L

1.6L

250mL

500mL

125mL



THOMSON
MADE IN USA

Thomson Cell Culture Solution

Thomson Instrument Company was founded in 1970 to service the needs of the growing life sciences industry. It remains a family run business with a long history of product innovation making its products in the USA. Thomson has worked with its customers to design products that outperform the competition by introducing unique design features that add functionality to an otherwise static product market. In particular, Thomson has reinvented shake flasks that are used for culturing E. coli and mammalian cells for recombinant DNA and protein production. These changes are reviewed in Dr. Bruecher's article, "Evolution of Shake Flask Technology. Novel product

Introductions Offer Advantages By Increasing DNA and Protein Production."¹

The advantages of Thomson Optimum Growth™ Flasks (patented) can be attributed to a fairly simple principal of good mixing and high oxygen transfer rate helping cells grow to higher densities. Increased aeration is achieved through a proprietary baffle design along with a large diameter neck and gas permeable cap.

The innovation in Thomson's Optimum Growth™ product line does not end with a single flask. Thomson has worked with its customers to

reduce the footprint of its flasks in such a way that they maximize space in the most commonly used cell culture incubators.

In the tradition of evolving to fit customer needs, Thomson has introduced a line of companion products that work along with the Optimum Growth™ Flasks. These include caps, lids & ports that allow the sterile transfer of fluid into and out of the flasks. Current cell culture processes often involve longer culture durations that require both sampling over time and batch feeds. Thomson products support these existing workflows and help to streamline the process wherever possible.








Optimum Growth™
Flasks

Optimum Growth™
Transfer Caps

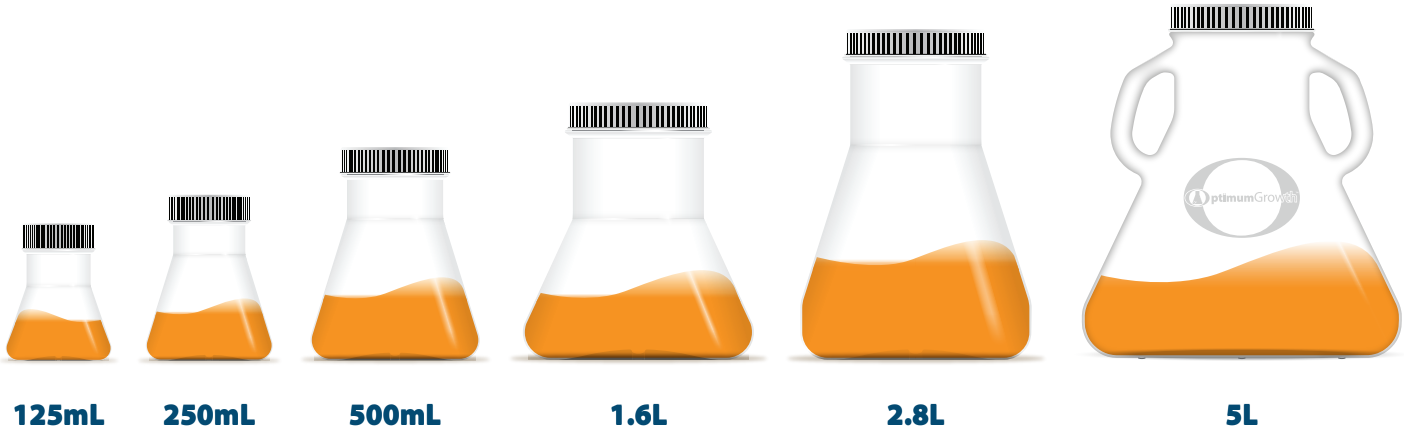
Optimum Growth™ Pre-
assembled Flasks

¹<http://www.genengnews.com/gen-articles/evolution-of-shake-flask-technology/5579/>



Page Number	Product	Cell Growth	Aseptic Gravity Transfer	Aseptic Pump Transfer	Sampling	Feeding	0.2µm PTFE Vent Cap	Sterile
4	 <p>Optimum Growth™ Flasks Available in 125mL - 5L for insect & mammalian cell growth.</p>	•					•	•
15	 <p>Inversion Transfer Caps Gravity transfer from 1.6L - 5L Optimum Growth™ Flasks, bags or bioreactors. Removing the peristaltic pump from the process reduces stress on cells during transfer.</p>		•				•	•
18	 <p>Bidirectional Transfer Caps 1.6L – 5 L flasks to transfer to flask for the sterile transfer to flasks, bags or bioreactors with peristaltic pump can also be used to feed flask during cultivation.</p>			•		•	•	•
20	 <p>Sampling Flasks Available in 125mL - 500mL & 5L flask sizes. Provides simple aseptic way to sample cells in the shaker.</p>	•			•		•	•
23	 <p>Multiported Optimum Growth™ Flasks Available in 1.6L & 5L with ports for aseptic transfer, feeding & sampling during cultivation.</p>	•	•	•	•	•	•	•

Optimum Growth™ Flasks

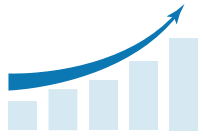


**Optimum Growth™ Flasks have
0.2µm PTFE Vent Caps**

Key Features

- Baffles designed for High Aeration & Low Shear
- Same Footprint as Comparable Fernbach Flask
- Less Foaming than Disposable Fernbach
- Transfer Cap connects directly to Wave Bags™ & bioreactors with Quick Connect or tube fusing
- .2µm Vented Cap
- Individually Packaged and Sterilized

Optimum Growth™ Flask Specifications						
Flask Size	125mL	250mL	500mL	1.6L	2.8L	5L
Part #	931110	931111	931112	931113	931114	931116
Image						
Description	Optimum Growth™ 125mL Flask w/ Vent Cap - Sterile	Optimum Growth™ 250mL Flask w/ Vent Cap - Sterile	Optimum Growth™ 500mL Flask w/ Vent Cap - Sterile	Optimum Growth™ 1.6L Flask w/ Vent Cap - Sterile	Optimum Growth™ 2.8L Flask w/ Vent Cap - Sterile	Optimum Growth™ 5L Flask w/ Vent Cap - Sterile
Qty/Case	50	50	25	12	6	4



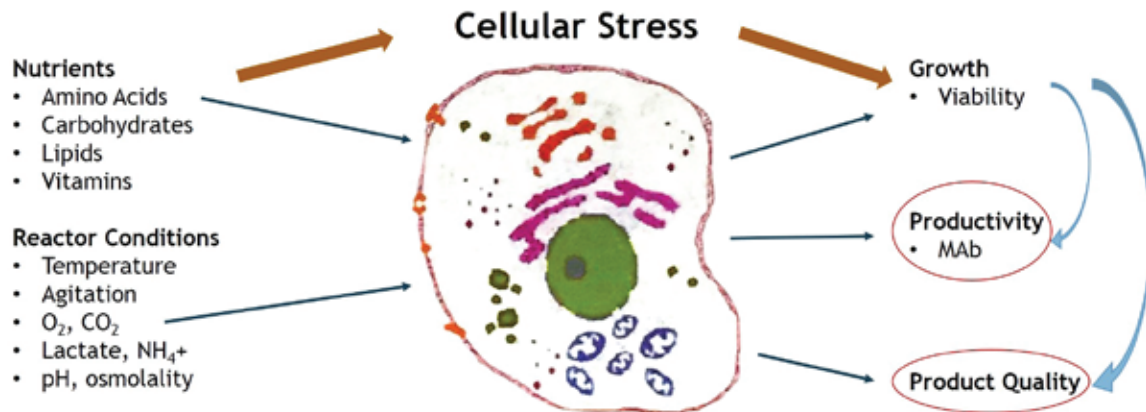
Scalability with Optimum Growth™ Flasks

Thomson Optimum Growth™ Flasks are designed in a way that protein production will scale consistently across all sizes, unlike any other shake flasks on the market. Additionally, these flask features allow for consistent shake speeds from the 125mL up to 5L flasks.



Consider the Health of Your Cells:

Complex Cellular Systems

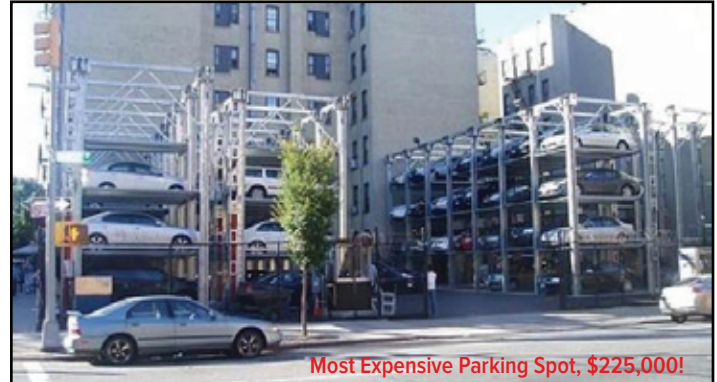


Comparison of 293 & CHO Cell Line Traits for Transient Expression

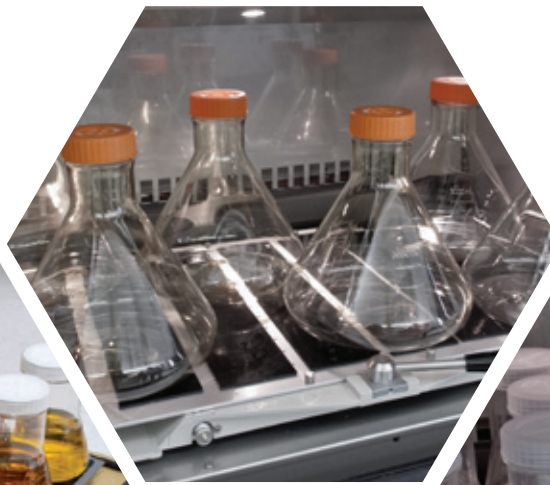
Characteristic	293	CHO
Tolerance to culture stress	Best	
Ability to shift from growth to expression		Best
Speed of expression	Best	
Duration of expression		Best
Stability of transfection complexes	Best	
Lower amount of DNA needed		Best
Flexibility of protocol		Best
Benefit of batch feeds		Best

Space Saving More Volume

Optimum Growth™ Flasks Give Excellent Growth with Space Saving Capability



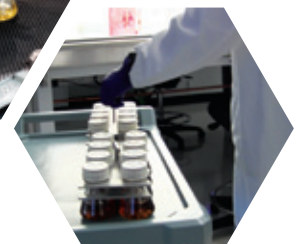
6 x Corning® 3L Total
Volume 6L/Shaker

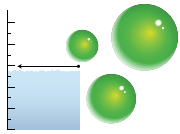


18 x 1.6L Optimum
Growth™ Flasks for
Total Volume
16.2L/shaker



17 x Optimum Growth™
1.6L Flasks Total
Volume 15L/Shaker





Fill Volumes & Shake Speeds

For all tables | 1" = 25mm | 2" = 50mm

CHO Stable Cells, CHO Transient, HEK 293 Transient		
Flask Size	Best Fill Volume	*RPM in 1"/2"
125mL	63mL	150 / 110
250mL	150 mL	150 / 110
500mL	250mL	150 / 110
1.6L	900mL	150 / 110
2.8L	1.4L	150 / 110
5L	2.0L-3.0L	120 / 90

Initial ExpiCHO™ Fill Volume CHO Transient		
Flask Size	Best Fill Volume	*RPM in 1"/2"
125mL	50mL	150 / 110
250mL	100mL	150 / 110
500mL	150mL	150 / 110
1.6L	400mL-750mL	150 / 110
2.8L	900mL-1.2L	150 / 110
5L	1.2L-1.6L	150 / 110

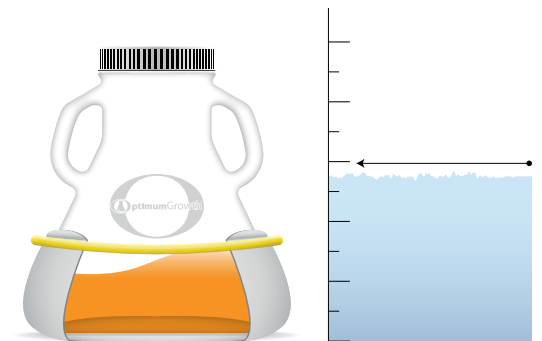
Insect Cells		
Flask Size	Best Fill Volume	*RPM in 1"/2"
125mL	63mLs-75mL	150 / 110
250mL	150 mL	150 / 110
500mL	250mL	150 / 110
1.6L	900mL	150 / 110
2.8L	1.4L	150 / 110
5L	2.0L - 3.0L	135 / 90

Hybridoma Cells		
Flask Size	Best Fill Volume	*RPM in 1"/2"
125mL	36mL	70 / 50
250mL	75mL	70 / 50
500mL	150mL	70 / 50
1.6L	480mL	70 / 50
2.8L	1.4L	120 / 90
5L	2L	120 / 90

Minimum Fill Volume CHO Stable Cells, CHO Transient, HEK 293 Transient		
Flask Size	Best Fill Volume	*RPM in 1"/2"
125mL	24mL	120 / 90
250mL	50 mL	120 / 90
500mL	100mL	120 / 90
1.6L	400mL	100 / 80
2.8L	900mL	100 / 80
5L	1.2L	90 / 70

Final Volumes after ExpiCHO™ feeds CHO Transient		
Flask Size	Best Fill Volume	*RPM in 1"/2"
125mL	63mL (6.5mL feed)	150 / 110
250mL	120mL (10mL feed)	150 / 110
500mL	180mL (15mL feed)	150 / 110
1.6L	700mL-900mL (100mL feed)	150 / 110
2.8L	1.1L-1.4L (150mL feed)	150 / 110
5L	1.4L-2.0L (200mL feed)	150 / 110

Microbes/E. coli		
Flask Size	Best Fill Volume	*RPM in 1"/2"
125mL	63mL	250 / 150
250mL	125 mL	250 / 150
500mL	250mL	250 / 150
1.6L	900mL	250 / 150
2.8L	1.4L	250 / 150
5L	2.0L-3.0L	250 / 150



Optimum Growth™ Flask FAQs

What have people done successfully to change vessels from Spinner flasks & Roller bottles to Optimum Growth™ Flasks (patented)?

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 shake speeds of the first 1-2 passages (See chart with Minimum Fill Volume Speeds). The addition of up to 1% of surfactant (ThermoFisher Pluronic, PN 24040032 or MilliporeSigma Simethicone, PN 59920C) to the media may be needed. Spinner Flasks and Roller Bottles have lower shear than Shake Flasks. Once the cells have adjusted to the flasks, recommended speeds will work well.

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 (SF-9, SF-21, High Fives, Trichoplusia ni)?

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

What clamps and shakers work best with the Optimum Growth™ Flasks?

Optimum Growth™ Flasks are designed to shake in 1" or 2" orbit shakers. Sticky tape or rug gripper pad is recommended for under 170 rpm. Our 125mL, 250mL and 500mL flasks will work with standard shake flask clamps. The 1.6L and 2.8L flasks will need special clamps. The 5L flask will fit a standard 2.8L or 3L Fernbach shake flask clamp.

Are the Optimum Growth™ Flasks single use?

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

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 bag, Wave Bioreactor®, BIOFLO®/CELLIGEN® Bioreactor, Applikon® Bioreactor, etc.). Inversion Transfer Caps simply use the power of gravity to facilitate transfer, thus maintaining higher culture viability than pumping methods. Bidirectional Transfer Caps simply 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. Please see the website htslabs.com for more details.

When seeing high cell death and a large amount of foam; what is causing this? What about cell clumping issues?

Cell death and foaming in the Optimum Growth™ Flasks is most frequently due to cell shearing. This is caused by a lack of surfactant or anti-foam in the media. Adding up to 1% surfactant will reduce the foaming and increase cell viability.

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, one can add in additional pluronic (ThermoFisher PN 24040032). The recommended range of pluronic to add is 0.05 gm/L to 0.2 gm/L. Up to 1% simethicone from MilliporeSigma (PN 59920C) can also be used. Either of these methods can work to reduce foaming and restore high culture viability.

Can I use the Expi293™ system with your flasks?

This system is extremely robust, and can handle a lot of shear stress. We recommend our standard speeds and fill volumes. Many of our customers are growing up to 1.1L of cells in our 1.6L Optimum Growth™ Flasks at 150 rpm.

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.

The Optimum Growth Flasks™ are hard to remove from the sticky pad. What do we do?

The sticky pads from Infors/Kuhner are known for sticking too well to the flasks. Some suggestions from people who find it too sticky:

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 tape: See: Walmart, Sears, Bed Bath and Beyond, local hardware store, or rug store.

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 ExpiCHO-S™, Expi293F™ and other high titer systems. ExpiFectamine™ 293 works very well with our flasks, and is extremely stable system. ExpiFectamine™ CHO has a much higher transfection efficiency than PEI or any system, but requires a lower amount of DNA (we recommend no higher than 0.5ug/mL). Using ExpiFectamine™ CHO with higher amounts of DNA does drop the cell viability greatly. We feel that the transfection reagent could be reduced by >25% and still result in extremely high efficiencies. The CHO cells are hardy but high levels of transfection reagent will cause a decrease in viability. We have seen a >15% drop in viability in certain situations. We are still working on a final ExpiCHO™ protocol, but we do see issues of viability/titer after transfection. Please check our website, htslabs.com for updates.

Electroporation: Most often used method for large scale, >1L transfection. Unfortunately, electroporation is not as useful for multiple transfections at one time. It can be used for small scale transfection, but not used as regularly with our customers. 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.



Optimum Growth™ 2.8L Flasks fit 12 per shaker



Optimum Growth™ 250mL Flasks with XPICHO & HEK293 Cells in shaker

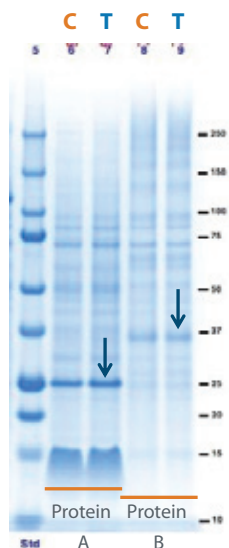
Thomson Instrument Company is not affiliated with ThermoFisher, MilliporeSigma, GE Healthcare Life Sciences, BIOFLO®, CELLIGEN®, Applikon®, Infors, Kuhner, Walmart, Sears, Bed Bath and Beyond, Kuhner or their products

Data for 125 - 500mL

Corning® vs Optimum Growth™ Flasks

2 Membrane Proteins Expressed

Data provided by Genentech part of the Roche Group



Corning® – 500mL flask, 200mL culture

Thomson – 250mL flask, 150mL culture

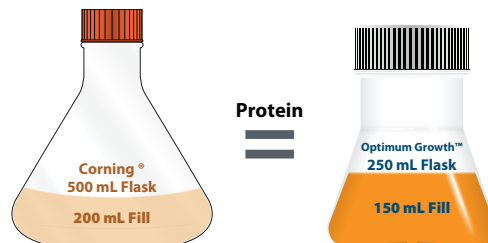
4mL samples purified over Ni NTA

Protein A – Membrane protein of moderate expression, 34kDa

Protein B – Membrane protein of low expression, 45kDa

12µL of elution resolved on a coomassie gel

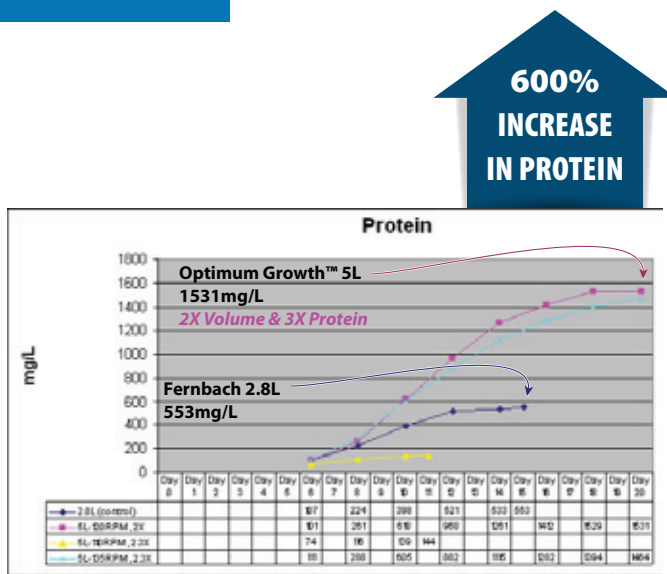
Conclusion: Thomson flasks work at least as good as Corning® standard.
Improved working volume / flask volume ratio when using Thomson.



Same Footprint-Double Volume

Optimum Growth™ 5L (3L Media)

vs Nalgene® Nunc 2.8L (1.5L Media)



Thomson Instrument Company is not affiliated with Corning Life Sciences®, Nalgene Nunc® or their products.

Regular Shake Flask vs. Thomson Shake Flask

Lake Pharma

Background Information

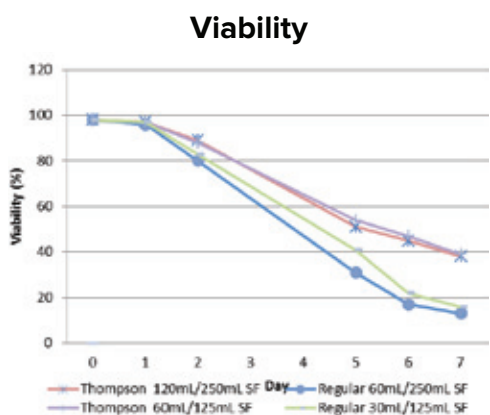
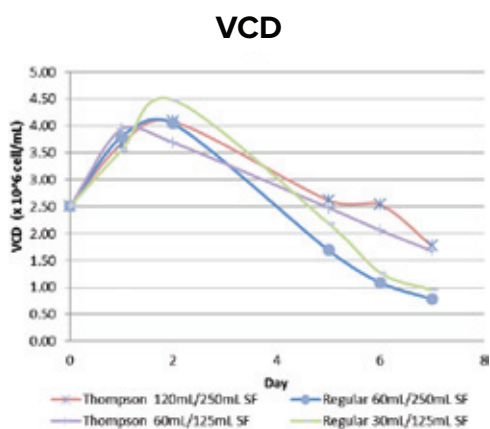
The purpose of this study was to compare the Regular shape SF with Thomson SF for cell growth and impact on protein yield.

Conditions

HEK-293 Transient production— seeded at 2.5×10^6 cells/mL and incubated at 37°C , 5% CO_2 . Supplemented with feed on day 1. Cells were harvested on day 7.

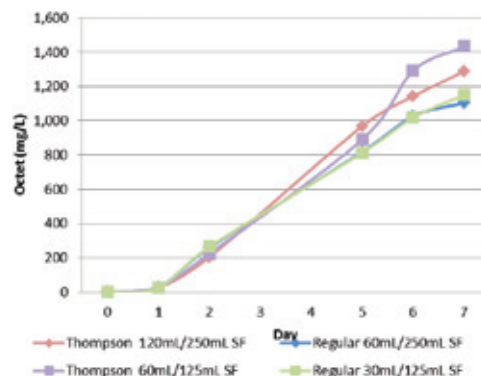
CHO Stable pool production— seeded at 0.8×10^6 cells/mL and incubated at 37°C , 5% CO_2 . Supplemented with feed and glucose as needed. Temperature shift to 32°C on day 5. Cells were harvested on day 14.

293 transient production results: Case 1



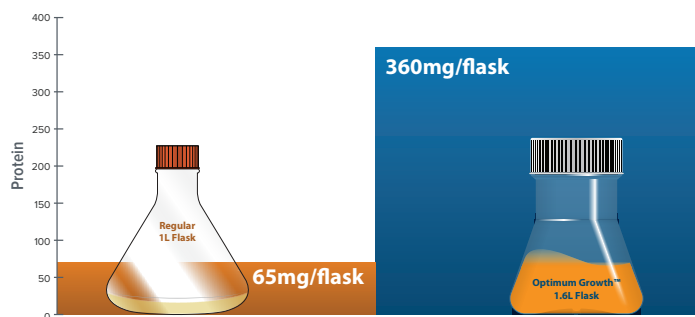
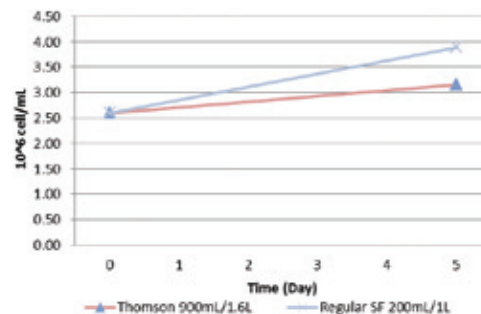
Double the Volume with Thomson Optimum Growth™ Flasks

Protein Titer

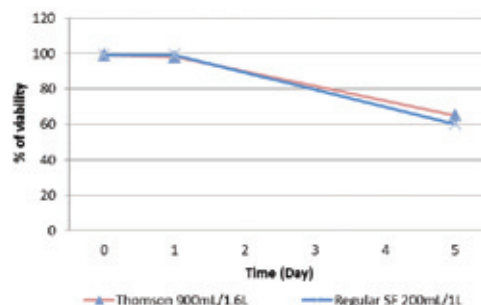


293 transient production results: Case 2 900mL(WV)/1.6L Thomson vs 200mL(WV)/ Regular SF1L

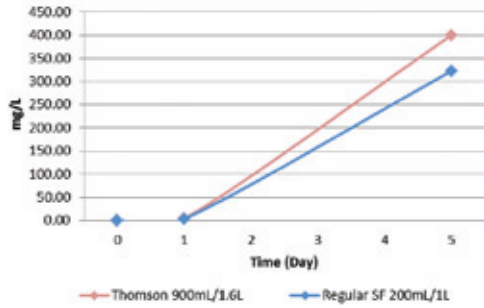
VCD



Culture Cell Viability

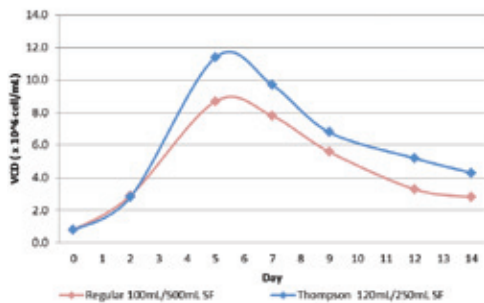


Protein Yield

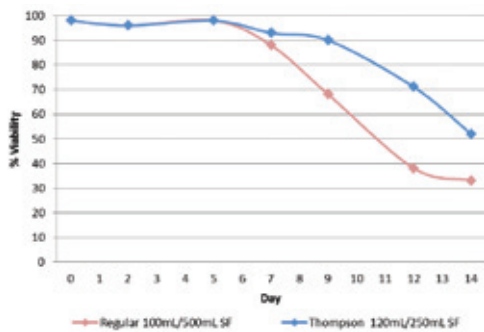


CHO stable pool production results

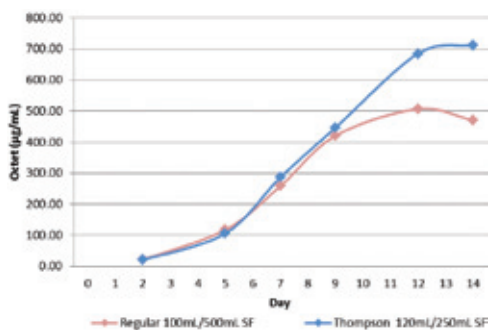
VCD



Culture Viability



Protein Titer



Conclusion

Transient protein expression (293)

- Both type of flasks support comparable peak VCD
- Thomson SF maintained higher VCD and viability
- Thomson SF boost protein yield more than 20%

Stable pool protein expression (CHO)

- Thomson SF supported higher PCD (11.4 vs 8.7 x 10⁶ cell /mL)
- Thomson SF maintained higher culture VCD and viability
 - Extended culture life for 2 days if based on the harvesting criteria
- Thomson SF results 50% titer increase



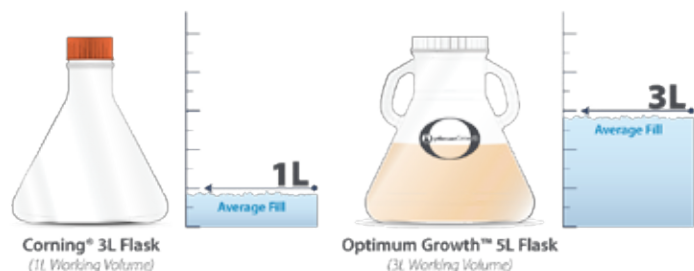
Optimum Growth™ 125mL Flasks in a shaker for cell line development



Optimum Growth™ 250mL Flasks with XPICHO & HEK293 Cells in shaker

Thomson Instrument Company is not affiliated with Lake Pharma, Infors or their products.

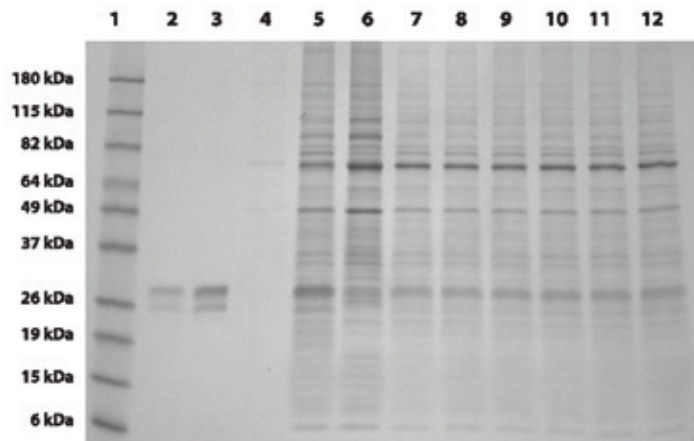
High & Low Expressing Proteins in HEK293 Cells



Low Expressing Gel

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

1. Benchmark Pre-Stained Protein Ladder
2. Purified protein, 100 ng control
3. Purified protein, 200ng 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

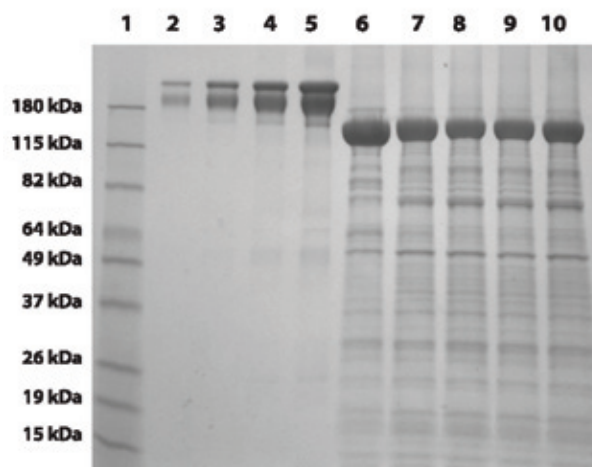


4-20% SDS-PAGE Quick Blue Stain Commassie Gel
Expected MW of dimer 24.5 kDa Estimated expression level ~10-20 mg/L

High Expressing Gel

Thomson 5L flasks are consistently able to maximize production of your best expressers. This gel shows equal bands from 3 replicates of a high expressing protein, producing approximately 300 mg/L.

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

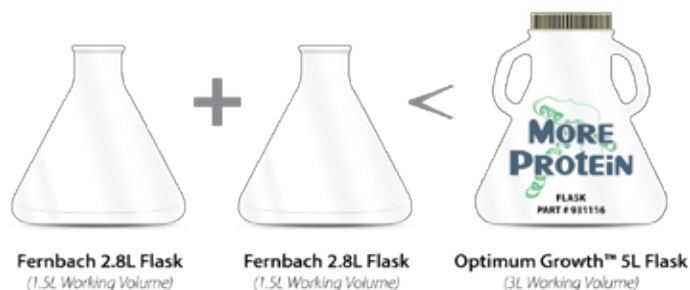


4-20% SDS-PAGE Quick Blue Stain Commassie Gel
Expected MW of dimer 159.4 kDa Estimated expression level ~300 mg/L

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

Inversion Transfer Cap For 1.6L – 5L



The Sterile Inversion Transfer Caps (patented), allow for the simple aseptic transfer of media or cells to cell bags, bioreactors, or flasks (from all manufacturers).

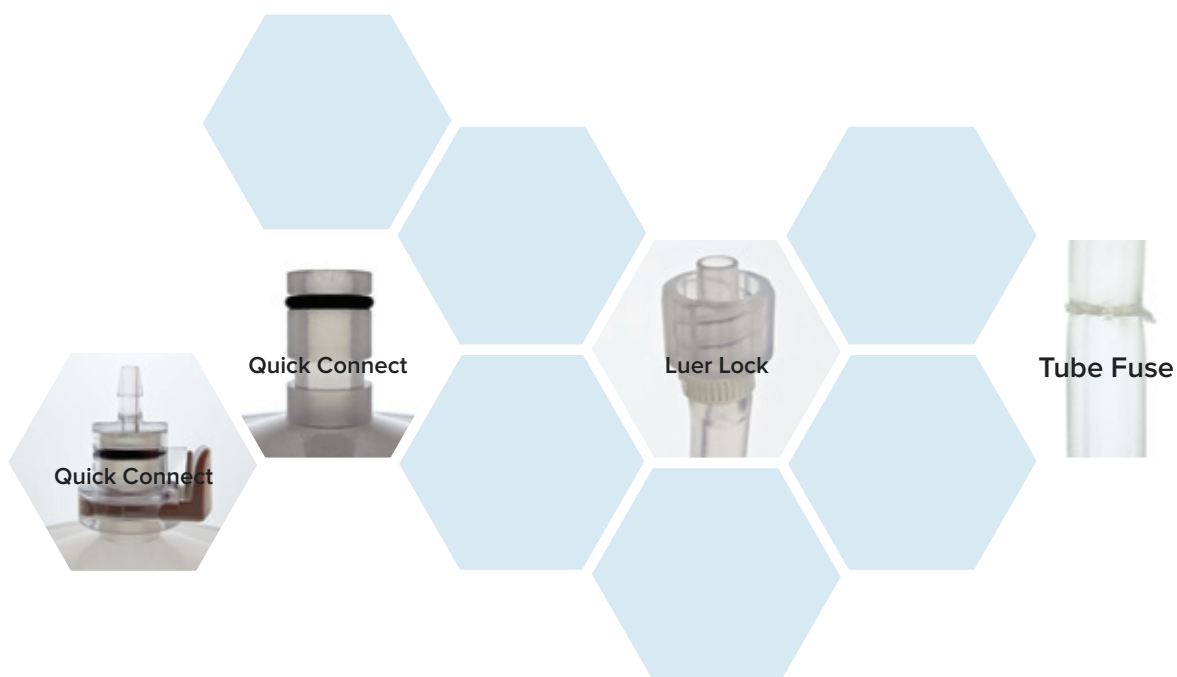
The Inversion Transfer Cap works with the 1.6L and 5L Thomson Optimum Growth™ Flasks (patented). Simply, replace the culture cap with the Transfer Cap and connect to your vessel of choice.

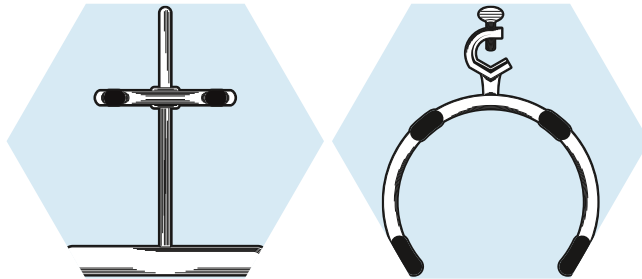
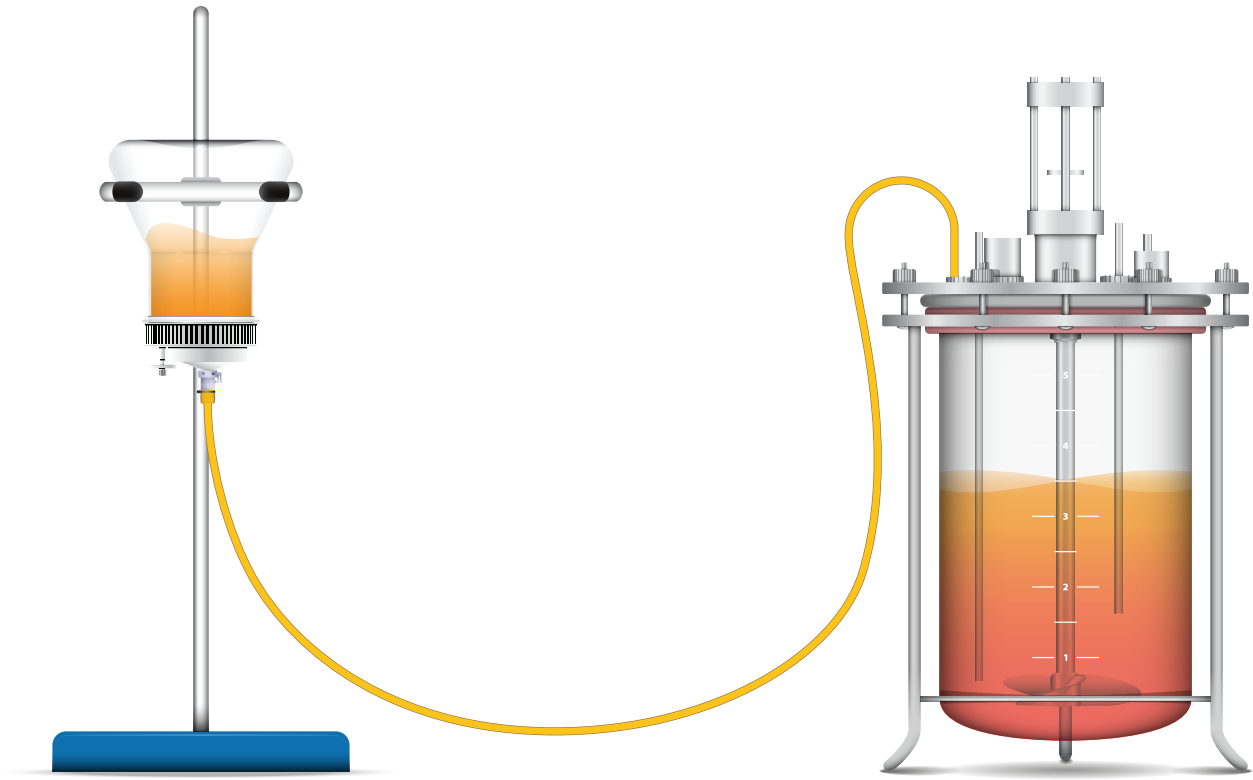
How to Transfer?

To transfer, invert the Optimum Growth™ Flask and let gravity do the rest. The Optimum Growth™ Flask and Transfer Cap System eliminates the need to transfer cells to an intermediate flask for scale up. Inversion or gravity feed has the lowest shear force of any transfer method available.

The Inversion Transfer Cap in conjunction with the 1.6L and 5L Thomson Optimum Growth™ Flasks (patented) product line can be used for reagent addition, seeding of larger bioreactors cell bags, or other liquid media transfers.

Connection Options










Inversion Transfer Cap Accessories				
Flask Size	1.6L	1.6L	5L	5L
Part #	931609	931700	931606	931607
Image				
Description	Stand with Ring for Inverting Optimum Growth™ 1.6L Flask to use w/1.6L Inversion Transfer Caps	Ring Only for Inverting Optimum Growth™ 1.6L Flask reqires a 22" stand	Stand with Ring for Inverting Optimum Growth™ 5L Flask to use w/5L Inversion Transfer Caps	Ring Only for Inverting Optimum Growth™ 5L Flask requires a 22" stand
Stand Height	22"	n/a	22"	n/a
Ring Diameter	5"	5"	7"	7"
Qty/Case	1	1	1	1

Inversion Transfer Cap Specifications

Flask Size	1.6L	1.6L	1.6L	1.6L
Part #	931706	931710	931705	931708
Image				
Description	Inversion Transfer Cap for Optimum Growth™ 1.6L Flask, 7/16" Male Connection - Sterile	Inversion Transfer Cap for Optimum Growth™ 1.6L Flask, with 2' C-Flex 16 Tubing with Luer Lock - Sterile	Inversion Transfer Cap for Optimum Growth™ 1.6L Flask, 2' C-Flex 16 (1/4") Tubing - Sterile	Inversion Transfer Cap for Optimum Growth™ 1.6L Flask, 2' C-Flex 24 Tubing - Sterile
Tubing Connection	7/16" (11.1mm) Barb	Tube Fuse/Female Luer Lock	Tube Fuse	Tube Fuse
Tubing Diameter	n/a	C-Flex 16 ID: 1/8" (3.1mm), OD: 1/4" (6.35mm)	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)
Tubing	n/a	Chemically resistant, heat sealable, flexible	Chemically resistant, heat sealable, flexible	Chemically resistant, heat sealable, flexible
Tubing Length	n/a	24" (609.6mm)	24" (609.6mm)	24" (609.6mm)
Top Style	Threaded	Threaded	Threaded	Threaded
Cap Material	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)
Sterility	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶
Air Filter Ventilation	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter
Qty/Case	4 or 20	4 or 20	4 or 20	4 or 20

Inversion Transfer Cap Specifications

Flask Size	5L	5L	5L	5L	5L
Part #	931594	931596	931616	931595	931598
Image					
Description	Inversion Transfer Cap for Optimum Growth™ 5L Flask, 1/4" Barb Connection - Sterile	Inversion Transfer Cap for Optimum Growth™ 5L Flask, 7/16" Male Connection - Sterile	Inversion Transfer Cap for Optimum Growth™ 5L Flask, with 2' C-Flex 16 Tubing with Luer Lock - Sterile	Inversion Transfer Cap for Optimum Growth™ 5L Flask, 2' C-Flex 16 (1/4") Tubing - Sterile	Inversion Transfer Cap for Optimum Growth™ 5L Flask, 2' C-Flex 24 Tubing - Sterile
Tubing Connection	1/4" (6.35mm) Barb	7/16" (11.1mm) Barb	Tube Fuse/Female Luer Lock	Tube Fuse	Tube Fuse
Tubing Diameter	n/a	n/a	C-Flex 16 ID: 1/8" (3.1mm), OD: 1/4" (6.35mm)	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)
Tubing	n/a	n/a	Chemically resistant, heat sealable, flexible	Chemically resistant, heat sealable, flexible	Chemically resistant, heat sealable, flexible
Tubing Length	n/a	24" (609.6mm)	24" (609.6mm)	24" (609.6mm)	24" (609.6mm)
Top Style	Threaded	Threaded	Threaded	Threaded	Threaded
Cap Material	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)
Sterility	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶
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
Qty/Case	4 or 20	4 or 20	4 or 20	4 or 20	4 or 20

Bidirectional Transfer Cap For 1.6-L – 5L

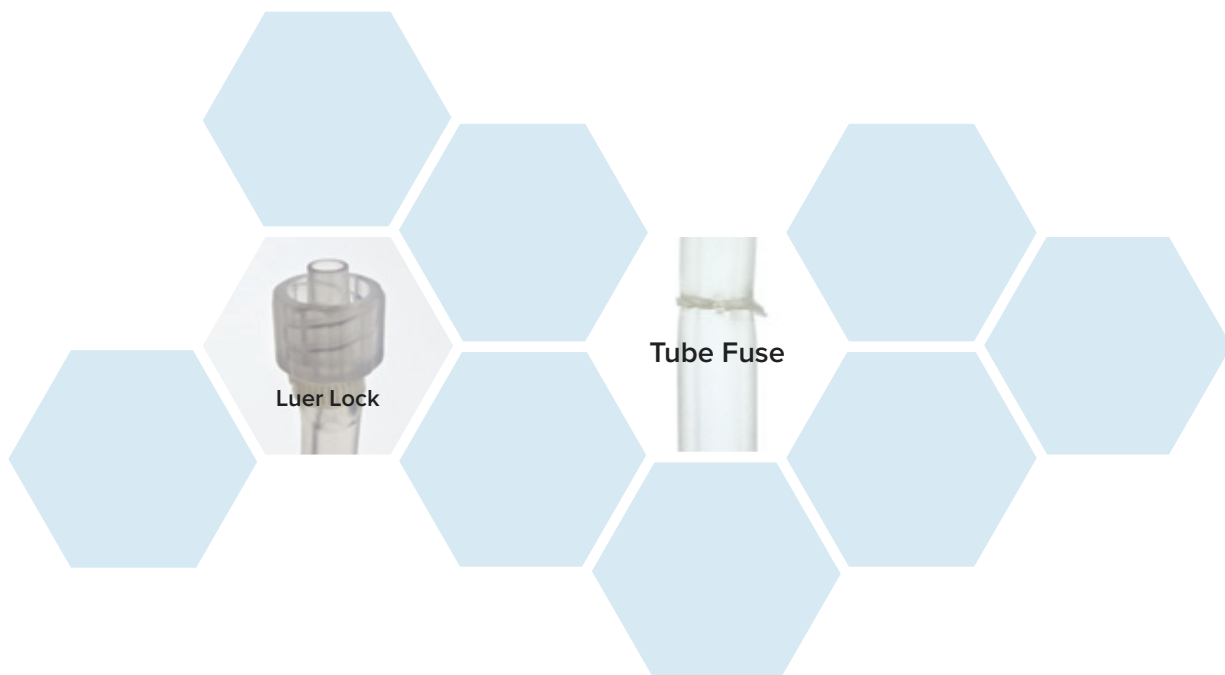
The Sterile Optimum Growth™ Bidirectional Transfer Caps (patented) with downstem, allow for easy aseptic transfer of media or cells into and/or out of cell bags, bioreactors, and flasks (from all manufacturers).

The Bidirectional Transfer Cap with downstem works with the 1.6L and 5L Thomson Optimum Growth™ Flasks (patented) and your peristaltic pump. Simply, replace the culture cap with the Transfer Cap and connect to your vessel of choice.

How to Transfer or Feed

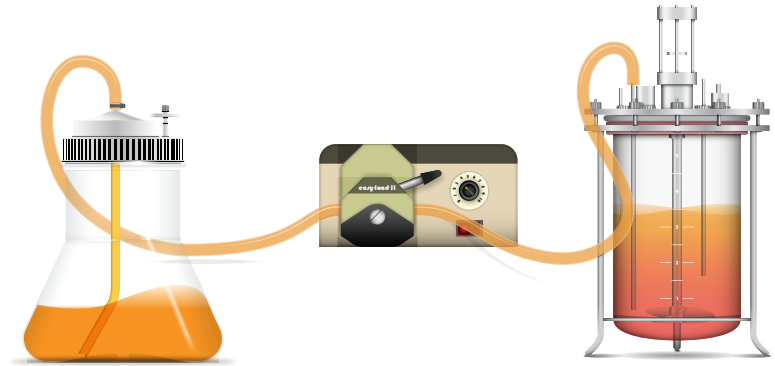
1. Replace with Bidirectional Transfer Cap
2. Connect to your receiving vessel by Tube Fusing or using our Luer Lock option
3. Place the silicone tubing in the peristaltic pump head
4. Liquid can then be pumped either into or out of the flask

Connection Options



Optimum Growth™ Flasks (patented) in conjunction with the Transfer Cap System eliminates the need to move cells to an intermediate transfer for scale up or seed cultures. The ability to pump into the Optimum Growth™ Flask (patented) makes filling with media from a bulk source a simple aseptic method. The Transfer Cap in conjunction with the Thomson Optimum Growth™ Flask (patented) product line can be used for reagent addition, seeding of larger bioreactors or cell bags, pumping of media into flasks from large drums or bags of media, and other liquid media transfers into and out of bioreactors.

The Optimum Growth™ Flasks come in multiple sizes of 125mL, 250mL, 500mL, 1.6L, 2.8L and our popular 5L.



Bidirectional Transfer Cap Specifications				
Flask Size	1.6L	1.6L	5L	5L
Part #	931702	931704	931618	931614
Image				
Description	Bidirectional Transfer Cap for Optimum Growth™ 1.6L Flask, 2' Tubing with Luer Lock - Sterile	Bidirectional Transfer Cap for Optimum Growth™ 1.6L Flask, 2' C-Flex 16 (1/4") tubing - Sterile	Bidirectional Transfer Cap for Optimum Growth™ 5L Flask, 2' Tubing with Luer Lock - Sterile	Bidirectional Transfer Cap for Optimum Growth™ 5L Flask, 2' C-Flex 16 (1/4") tubing - Sterile
Tubing Connection	Tube Fuse/Luer Lock	Tube Fuse	Tube Fuse/Luer Lock	Tube Fuse
Tubing Diameter	C-Flex 16 ID: 1/8" (3.1mm), OD: 1/4" (6.35mm)	C-Flex 16 ID: 1/8" (3.1mm), OD: 1/4" (6.35mm)	C-Flex 16 ID: 1/8" (3.1mm), OD: 1/4" (6.35mm)	C-Flex 16 ID: 1/8" (3.1mm), OD: 1/4" (6.35mm)
Tubing	Chemically resistant, heat sealable, flexible	Chemically resistant, heat sealable, flexible	Chemically resistant, heat sealable, flexible	Chemically resistant, heat sealable, flexible
Tubing Length	24" (609.6mm)	24" (609.6mm)	24" (609.6mm)	24" (609.6mm)
Top Style	Threaded	Threaded	Threaded	Threaded
Cap Material	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)
Sterility	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶
Air Filter Ventilation	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter	0.2µm PTFE vent filter
Qty/Case	8	8	8	8

Sampling Flask w/ Vented Cap



The Sampling Cap is ventilated for cultivation and has a one way valve allowing for sampling of cells while the flasks remain in the shaker eliminating the removal to the hood from the shaker, reducing contamination.

The Sampling option is available for the 125mL, 250mL, 500mL & 5L Optimum Growth™ Flasks.



Sample Flasks have ventilated caps for optimum aeration during cultivation.



Comparison of Old vs Thomson Sampling Method

OLD Sampling Method:

1. Remove flask from shaker
2. Spray down flask before putting in the hood
3. Placing flask in the hood
4. Removing cap
5. Take sample
6. Replace cap
7. Put back in shaker

Thomson Improved Sampling Method:

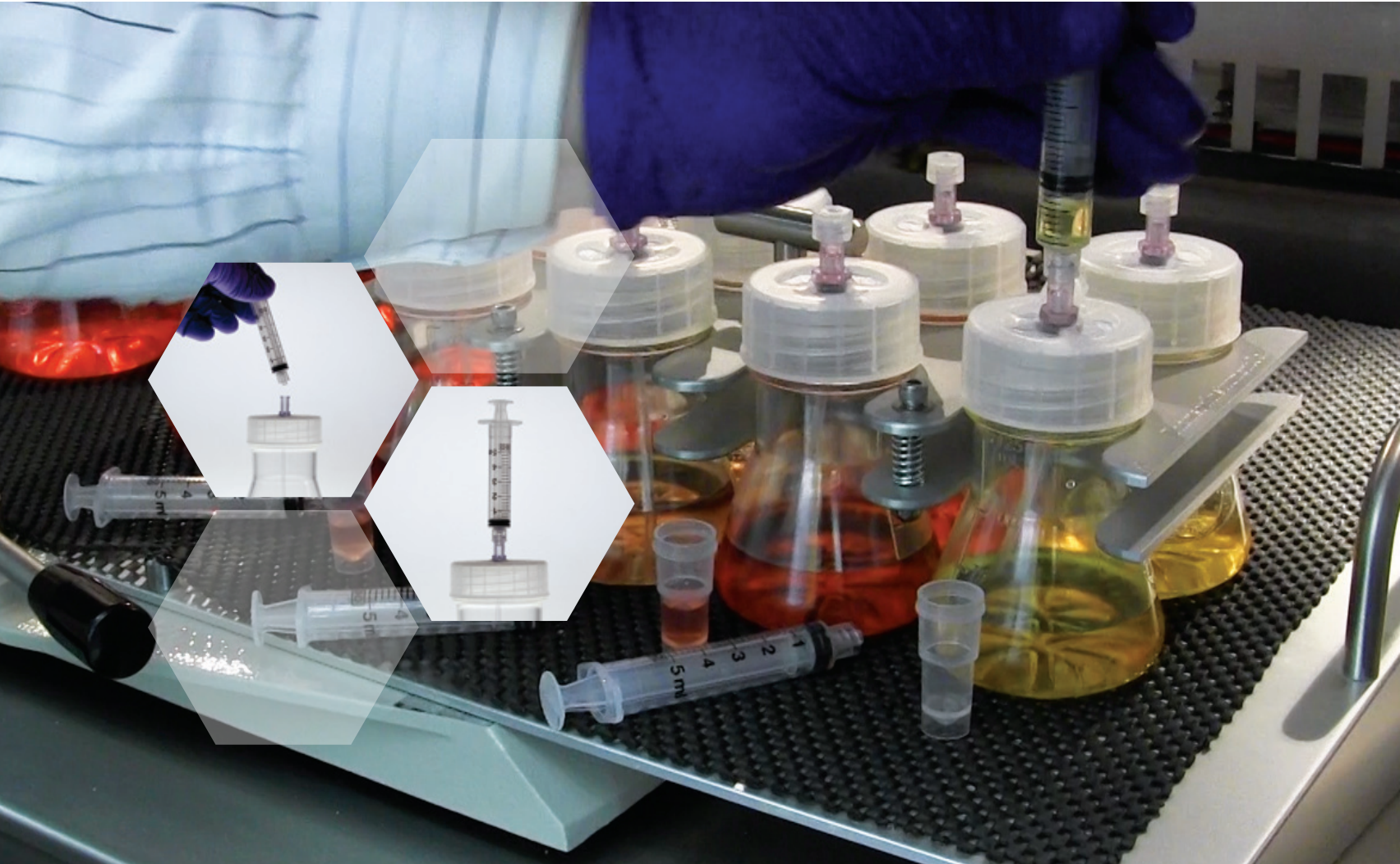
1. Sample flask while in the shaker







Sampling 16 Flasks = 16 minutes per day



Thomson Method 16 flasks in 16 minutes



Sampling Flask w/ Vented Cap Specifications

Flask Size	125mL	250mL	500mL	5L
Part #	931110-SP	931111-SP	931112-SP	931116-Port
Image				
Description	Optimum Growth™ 125mL Flask, w/ Sampling Port - Sterile	Optimum Growth™ 250mL Flask, w/ Sampling Port - Sterile	Optimum Growth™ 500mL Flask, w/ Sampling Port - Sterile	Optimum Growth™ 5L Flask, w/ Sampling Port - Sterile
Flask Connection	Male Luer Lock	Male Luer Lock	Male Luer Lock	Male Luer Lock
Tubing Connection	n/a	n/a	n/a	n/a
Tubing Diameter	n/a	n/a	n/a	n/a
Tubing	n/a	n/a	n/a	n/a
Tubing Length	n/a	n/a	n/a	n/a
Top Style	Threaded	Threaded	Threaded	Threaded
Cap Material	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)	PP (polypropylene)
Sterility	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶	10 ⁻⁶
Air Filter/Ventilation	0.2µm PTFE for cultivation & pressure relief	0.2µm PTFE for cultivation & pressure relief	0.2µm PTFE for cultivation & pressure relief	0.2µm PTFE for cultivation & pressure relief
Qty/Case	50	50	25	4

Multiported Optimum Growth™ Transfer & Feed Flask



The multiported flask is completely aseptic, making it the perfect start for initial seed cultures that seed bioreactors in multiple stages of clinical drug production. Other uses for the Multiported Optimum Growth™ Flasks include keeping cell lines alive and other manufacturing functions.

The Multiported Optimum Growth™ Flask was born out of necessity from biopharmaceutical companies requiring a completely aseptic process. These Multiported Flasks have replaced the need for bags to start seed cultures for the inoculation of bioreactors.

- Sterile tube fuse inoculation
- Consistent ability to do multiple day additions
- 1-way valve sampling allowing for a simple use in a shaker.
- Eliminated the need for under 20L cell bags
- Replaces current process requiring tube fusing for inoculation.
- Consistently allows for multiple day additions.
- Aseptic 1-way sampling valve.
- Allows for simple use within a shaker
- Great for aseptic manufacturing; never any opening needed preventing potential contamination.

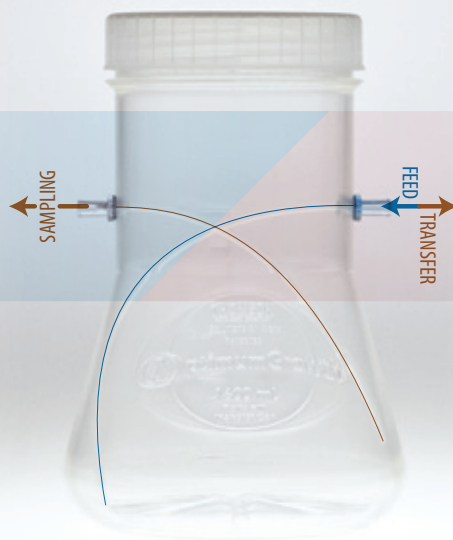


5L TRT Flask, Transfer/Feed side



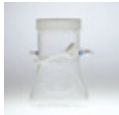

5L TRT Flask, Sample port side

A one way sample port allows safe sampling of cells while the flasks remain in the shaker.







A two way port allows feeding of media during growth and transfer to bioreactor for seeding a larger production growth.




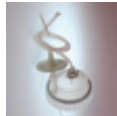
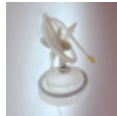
Multiported Optimum Growth™ Transfer & Feed Flask Specifications

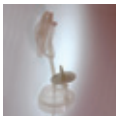
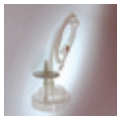
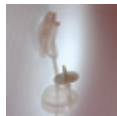
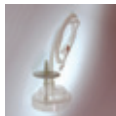
Flask Size	1.6L	5L
Part #	931113-PORT-TRT	931116-PORT-D-TRT
Image		
Description	Multiported Optimum Growth™ 1.6L Flask w/ Bidirectional Transfer/Feed & Sampling Ability	Multiported Optimum Growth™ 5L Flask w/ Bidirectional Transfer/Feed & Sampling Ability
Flask Connection	Male Luer Lock	Male Luer Lock
Tubing Connection	n/a	Tube Fuse
Tubing Diameter	n/a	C-Flex 16 ID: 1/8" (3.1mm), OD: 1/4" (6.35mm)
Tubing	n/a	Chemically resistant, heat sealable, flexible
Tubing Length	n/a	24" (609.6mm)
Top Style	Threaded	Threaded
Cap Material	PP (polypropylene)	PP (polypropylene)
Sterility	10 ⁻⁶	10 ⁻⁶
Air Filter Ventilation	0.2µm PTFE vent filter	0.2µm PTFE vent filter
Qty/Case	12	4

Part Numbers & Specifications





Optimum Growth™ Flask Specifications						
Flask Size	125mL	250mL	500mL	1.6L	2.8L	5L
Part #	931110	931111	931112	931113	931114	931116
Image						
Description	Optimum Growth™ 125mL Flask w/ Vent Cap - Sterile	Optimum Growth™ 250mL Flask w/ Vent Cap - Sterile	Optimum Growth™ 500mL Flask w/ Vent Cap - Sterile	Optimum Growth™ 1.6L Flask w/ Vent Cap - Sterile	Optimum Growth™ 2.8L Flask w/ Vent Cap - Sterile	Optimum Growth™ 5L Flask w/ Vent Cap - Sterile
Qty/Case	50	50	25	12	6	4

Inversion Transfer Cap Specifications				
Flask Size	1.6L	1.6L	1.6L	1.6L
Part #	931706	931710	931705	931708
Image				
Description	Inversion Transfer Cap for Optimum Growth™ 1.6L Flask, 7/16" Male Connection - Sterile	Inversion Transfer Cap for Optimum Growth™ 1.6L Flask, with 2' C-Flex 16 Tubing with Luer Lock - Sterile	Inversion Transfer Cap for Optimum Growth™ 1.6L Flask, 2' C-Flex 16 (1/4") Tubing - Sterile	Inversion Transfer Cap for Optimum Growth™ 1.6L Flask, 2' C-Flex 24 Tubing - Sterile
Qty/Case	4 or 20	4 or 20	4 or 20	4 or 20



Inversion Transfer Cap Specifications					
Flask Size	5L	5L	5L	5L	5L
Part #	931594	931596	931616	931595	931598
Image					
Description	Inversion Transfer Cap for Optimum Growth™ 5L Flask, 1/4" Barb Connection - Sterile	Inversion Transfer Cap for Optimum Growth™ 5L Flask, 7/16" Male Connection - Sterile	Inversion Transfer Cap for Optimum Growth™ 5L Flask, with 2' C-Flex 16 Tubing with Luer Lock - Sterile	Inversion Transfer Cap for Optimum Growth™ 5L Flask, 2' C-Flex 16 (1/4") Tubing - Sterile	Inversion Transfer Cap for Optimum Growth™ 5L Flask, 2' C-Flex 24 Tubing - Sterile
Qty/Case	4 or 20	4 or 20	4 or 20	4 or 20	4 or 20

Bidirectional Transfer Cap Specifications				
Flask Size	1.6L	1.6L	5L	5L
Part #	931702	931704	931618	931614
Image				
Description	Bidirectional Transfer Cap for Optimum Growth™ 1.6L Flask, 2' Tubing with Luer Lock - Sterile	Bidirectional Transfer Cap for Optimum Growth™ 1.6L Flask, 2' C-Flex 16 (1/4") tubing - Sterile	Bidirectional Transfer Cap for Optimum Growth™ 5L Flask, 2' Tubing with Luer Lock - Sterile	Bidirectional Transfer Cap for Optimum Growth™ 5L Flask, 2' C-Flex 16 (1/4") tubing - Sterile
Qty/Case	8	8	8	8

Sampling Flask w/ Vented Cap Specifications



Flask Size	125mL	250mL	500mL	5L
Part #	931110-SP	931111-SP	931112-SP	931116-Port
Image				
Description	Optimum Growth™ 125mL Flask, w/ Sampling Port & Vent Cap - Sterile	Optimum Growth™ 250mL Flask, w/ Sampling Port & Vent Cap - Sterile	Optimum Growth™ 500mL Flask, w/ Sampling Port & Vent Cap - Sterile	Optimum Growth™ 5L Flask, w/ Sampling Port & Vent Cap - Sterile
Qty/Case	50	50	25	4

Multiported Flask w/ Vented Cap Specifications

Flask Size	1.6L	5L
Part #	931113-PORT-TRT	931116-PORT-D-TRT
Image		
Description	Multiported Optimum Growth™ 1.6L Flask w/ Bidirectional Transfer/Feed & Sampling Ability	Multiported Optimum Growth™ 5L Flask w/ Bidirectional Transfer/Feed & Sampling Ability
Qty/Case	12	4

Accessories

Optimum Growth™ Accessories

Flask Size	125mL	250mL
Part #	1212900	1212905
Image		
Description	8 Position Carrier for Optimum Growth™ 125mL Flask (931110) 8 Position Carrier for Optimum Growth™ 250mL Flask (931111)	
Flask Capacity	8	8
Dimensions	10.75" x 5"	13.4" x 6"
Qty/Case	1	1

Inversion Transfer Cap Accessories

Flask Size	1.6L	1.6L	5L	5L
Part #	931609	931700	931606	931607
Image				
Description	Stand with Ring for Inverting Optimum Growth™ 1.6L Flask to use w/1.6L Inversion Transfer Caps	Ring Only for Inverting Optimum Growth™ 1.6L Flask requires a 22" stand	Stand with Ring for Inverting Optimum Growth™ 5L Flask to use w/5L Inversion Transfer Caps	Ring Only for Inverting Optimum Growth™ 5L Flask requires a 22" stand
Qty/Case	1	1	1	1



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