

# Bioprocessing

## Application Note





---

# WHAT IS BIOPROCESSING AND WHY IS IT IMPORTANT?

Simply put, bioprocessing is a process by which complete living cells and/or their components, for example, bacteria, enzymes, etc. are used to create products for every day use. Bioprocessing is used to support biopharmaceutical drug development such as vaccines, therapeutic stem cell cultivation, or create chemicals such as biofuels.

Integral to biotechnology, bioprocessing is the basis of turning naturally occurring substances into useful industrial chemicals and medicines. Its use in creating next-generation biopharmaceutical products is becoming more and more popular.



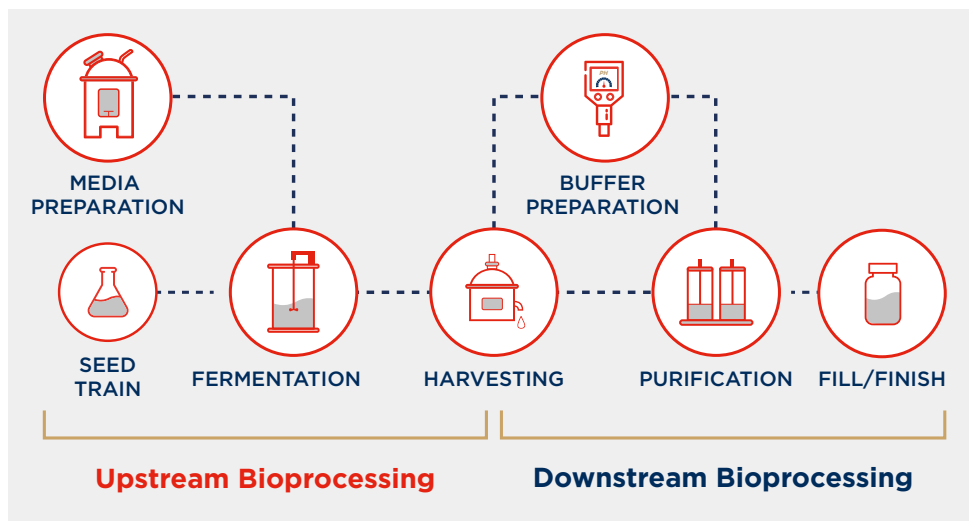
There are various processes included in bioprocessing, but generally two main stages are identified:

### 1. Upstream

At this initial stage, naturally sourced living material such as cells, bacteria or microbes used for a specific purpose are isolated and cultivated in bioreactors (fermenters).

### 2. Downstream

At this stage, the resulting cell mass grown in the upstream stage is retrieved, processed and placed in a fermentation broth. Here, it is purified, and then formulated into the final product fit for use.



## PERISTALTIC PUMPS ARE KEY TO BIOPROCESSING

Pumps are used to carry media in both upstream and downstream stages as well as throughout all the sub-processes involved at each stage. As the media used in bioprocessing is typically organic fluid, peristaltic pumps are integral part of the process because they can provide an accurate, stable and consistent flow rate to move delicate media such as shear-sensitive mammalian cells without disturbing its structure and/or concentration.

### The Advantages of Thomas Peristaltic Pumps

As an expert in peristaltic pumps, Thomas has been co-developing solutions with OEMs involved in the process of bioprocessing to evolve pump technology, and offer a wide range of peristaltic pumps that transfer liquid media with high accuracy, and at the flow rate required for any stage of bioprocessing; whether it's upstream or downstream.

Thomas' peristaltic pumps are dry-running, self-priming, reversible, and designed specifically for use with sensitive liquids in bioprocessing. They are easy to implement and maintain, and can be customized to the requirements of any bioprocessing stage. Most importantly, Thomas' peristaltic pumps support sterility of the fluid path with no risk of cross-contamination by utilizing disposable tube kits or endless tubing.

### Thomas Excellence and Wide Range of Peristaltic Pumps

Thomas' peristaltic pumps offer a wide range of sizes and capacities which equates to flow rates in the range from single drops of liquid to **3000 ml/min** that can be utilized for many media transfer tasks involved in bioprocessing.

They also offer unsurpassed flow stability allowing you to ensure high-quality bioprocessing to arrive at a final product of the highest quality. Most of the pumps feature a unique spring-loaded occlusion, which neutralizes differences in tube tolerances and therefore supports repeatability and your process stability.

### Single-use Tubing Eliminates Contamination

As contamination of the media is a concern in bioprocessing at every stage, Thomas' range of peristaltic pumps provide easy to use, replaceable single-use tubing that ensures that no cross-contamination occurs and your fluid path remains sterile.

Whether it's upstream or downstream, Thomas' peristaltic pumps provide accuracy, a stable flow rate, reliability and purity for all the fluid handling needs of bioprocessing; ensuring process stability for continuous daily use.

For an overview of the main processes involved in bioprocessing and the Thomas peristaltic pump that best fits each process, read on.



# THOMAS PERISTALTIC PUMPS ARE BUILT TO SATISFY BIOPROCESSING REQUIREMENTS



## MEDIA AND BUFFER PREPARATION

**Media** and **buffer** preparation are integral steps of bioprocessing; the former is the first step of the **upstream** stage where the media is transferred to the bioreactor, while the latter is introduced at the downstream stage to the mixture after the cells have been harvested.

### Requirements

- Depending on the media used, flexibility in terms of flow capacity.
- Accurate, consistent, and controlled flow for continuous operation.
- Single-use applicability with zero cross-contamination.



## FERMENTATION

**Fermentation** is the process of breaking down a substance to its simpler components in order to produce specific chemical and/or physical changes in the media. **Fermentation** occurs in vessels called Bioreactors (or Fermenters) that are designed to maintain an optimal environment for the organic material to be cultivated.

### Requirements

- Very accurate and gentle, controlled flow to maintain cell integrity.
- Precise handling of feed, acid, base and anti-foam fluids.
- Single-use applicability with zero cross-contamination.



## CELL HARVESTING

**Cell harvesting** is a critical step in connecting upstream media production with downstream purification, with the goal to recover the cells and cell debris efficiently and accurately without sacrificing the purity of the product. Transferring the media through filters relies on peristaltic pumps that offer flow accuracy and stability in a wide range of pressures and flow rates.

### Requirements

- Accurate, consistent, and gentle flow of delicate cell media.
- Single-use applicability with zero cross-contamination.



## PURIFICATION AND POLISHING

The **purification** process separates those contaminants that resemble the product very closely in their physical and chemical properties. This step utilizes very sensitive and sophisticated equipment that recover the product based on affinity, size exclusion, reversed phase chromatography, crystallization and fractional precipitation. The polishing process is the final step that results in packaging the end-product in a form that is stable, easily transportable and convenient. Methods used to “polish” the product include crystallization, desiccation, and lyophilization.

### Requirements

- Controlled, stable flow to feed media through filtration methods.
- Single-use applicability with zero cross-contamination.



# THOMAS' PUMP SOLUTIONS FOR BIOPROCESSING



## ETL500 SERIES

### DESCRIPTION

The ETL500 can be equipped with 7 different tube sizes ranging from 0.5 mm inner diameter (ID) up to 8.0 mm ID to offer maximum flexibility for your process.

- Extremely robust and almost wear-free tube change mechanism ensures operation like on day 1 – even after thousands of tube changes.
- Fail-safe tube loading mechanism avoids performance deviations.
- Adjustable dual spring-loaded occlusion improves the repeatability of flow rates between tube changes.

### NOTABLE FEATURES

- Adjustable spring-loaded occlusion
- Easy tube loading
- Robust open and closing mechanism
- 3 and 4 roller configuration

## ETL200 SERIES

### DESCRIPTION

The ETL 200 series is designed to provide a consistent gentle flow with the desired capacity of 0 to 60 ml/min.

For multi-use utilization, it uses a unique dual spring loaded mechanism with easy tube loading (ETL) to replace tubes with a single movement, and provide for a contact-less sterile fluid path.

### NOTABLE FEATURES

- Self-priming
- 4-roller and 6-roller versions
- Stepper motor
- Controller board on request

## SR10/30 SERIES

### DESCRIPTION

The SR10/30 series is designed to provide a consistent flow with the desired flow capacity of 0.26 to 80 ml/min.

### NOTABLE FEATURES

- Friction drive between motor shaft and rollers
- Compact design
- Self-priming
- Safe to run dry
- Maintenance free

At Thomas, we are ready to keep up with the evolving field of bioprocessing by providing you with reliable, compact and flexible peristaltic pumps that can be implemented in single-use, or stainless steel bioprocessing environments.

For more information on our range of peristaltic pumps suitable for bioprocessing, please visit us at [www.gd-thomas.com](http://www.gd-thomas.com), or [contact us](#)

## GENERAL CONTACT

### EMEA

**Gardner Denver Thomas GmbH**

Livry-Gargan-Str. 10  
82256 Fuerstenfeldbruck  
Germany

Tel: +49 8141 2280 0  
Fax: +49 8141 8892136  
thomas@irco.com

### AMERICAS

**Gardner Denver Thomas, Inc.**

1419 Illinois Avenue  
Sheboygan, WI 53081  
USA

Tel: +1 920 457 4891  
Fax: +1 920 451 4276  
thomas@irco.com

### ASIA PACIFIC

**Gardner Denver Thomas  
Pneumatic Systems (Wuxi) Co., Ltd.**

No. 1 New Dong An Road  
Shuofang Town  
Wuxi, Xinwu District  
Jiangsu 214142  
China

Tel: +86 510 6878 2258  
Fax: +86 510 6878 2200  
thomas@irco.com

### INDIA

**Gardner Denver Engineered Products India Private Limited**

Block No. 878, Opposite: Gallops Industrial Park  
Sarkhej-Bavla Road, Rajoda-Bavla  
Ahmedabad. Gujarat. 382220  
India

Tel: +91-2714-619300  
thomas@irco.com

**THOMAS** is a leading manufacturer of systems, compressors, vacuum, and liquid pumps for Original Equipment Manufacturers (OEMs) in the medical, laboratory, environmental and industrial sector.

With its experienced Engineering, Technical, and Operations staff and capabilities, Thomas designs and manufactures customized pressure and vacuum solutions that meet the precise needs of its customers. Backed by over 60 years of engineering excellence and innovation, and a global manufacturing network, Thomas stands out as the reliable choice for OEMs worldwide.

For more information, visit [www.gd-thomas.com](http://www.gd-thomas.com)

Please check out all our brands for your mission-critical flow control technologies:



**OEM Pumps**  
[www.gd-thomas.com](http://www.gd-thomas.com)



**Vacuum Pumps & Systems**  
[www.welchvacuum.com](http://www.welchvacuum.com)



**Syringe Pumps**  
[www.tricontinent.com](http://www.tricontinent.com)



**Lab Automation**  
[www.zinsser-analytic.com](http://www.zinsser-analytic.com)



**Syringes**  
[www.microsyringes.com](http://www.microsyringes.com)