



# WHITE PAPER

## **ASEPTIC PROCESSING WHILE MAINTAINING PRODUCT INTEGRITY**

Published by Marlen

## INTRODUCTION

Aseptic processing and packaging is one of the most dynamic areas of food processing. Although invented in the middle of the twentieth century, recently a panel of food technologists and scientists from the Institute of Food Technologists (IFT) with the intention of identifying leading food processing and packaging achievements advised that *“Aseptic processing is the most significant food science development in the last 50 years.”*

The most basic definition of aseptic processing is the independent sterilization of the product followed by filling and sealing (packaging) in sterile containers in a sterile environment. Also known as high-temperature-short-time (HTST) processing, more and more processors are realizing the benefits of aseptic processing and packaging. Therefore, the number of processors utilizing this technology has significantly increased. With the recent advent of the U.S. Food and Drug Administration approval of aseptic processing of food products containing particulate matter, we expect this method of food processing to explode with activity. Marlen pumps facilitate this and fulfill one of the most critical areas of the process.

## THE PROBLEM

In addition to extending the life of shelf stable products, processors must protect heat-sensitive products such as produce, soups, sauces and baby food from microbial degradation. Until recently, continuous thermal aseptic processing solutions using ultra-high temperatures were not approved by the U.S. Food and Drug Administration, forcing processors to use low acid canned food (LACF) methods that compromised the nutritional and organoleptic properties of the food products.

## HISTORY

The metering pump is one of the most critical areas of an aseptic processing system. Thermal destruction of pathogenic microorganisms is a time-temperature relationship. In a continuous aseptic processing system, the food product must be held for a specific amount of time at a designated temperature to insure destruction of unwanted bacteria. The time and temperature cannot deviate below these set parameters; otherwise, complete destruction of the microorganisms will not result, and food spoilage will occur. To ensure an accurate time at a set temperature, the flow through the aseptic processing system cannot be variable; it must be accurate and consistent.

Many aseptic processing systems utilize rotary positive displacement pumps as the metering pump. A few aseptic processing systems utilize centrifugal pumps at the metering pump and control flow by means of a backpressure valve. All rotary positive displacement and centrifugal pumps are designed to slip. The degree of slip is directly related to:

- Processing temperature
- Processing pressure
- Viscosity of the product or water being pumped
- Age and wear of the moving parts within the pump

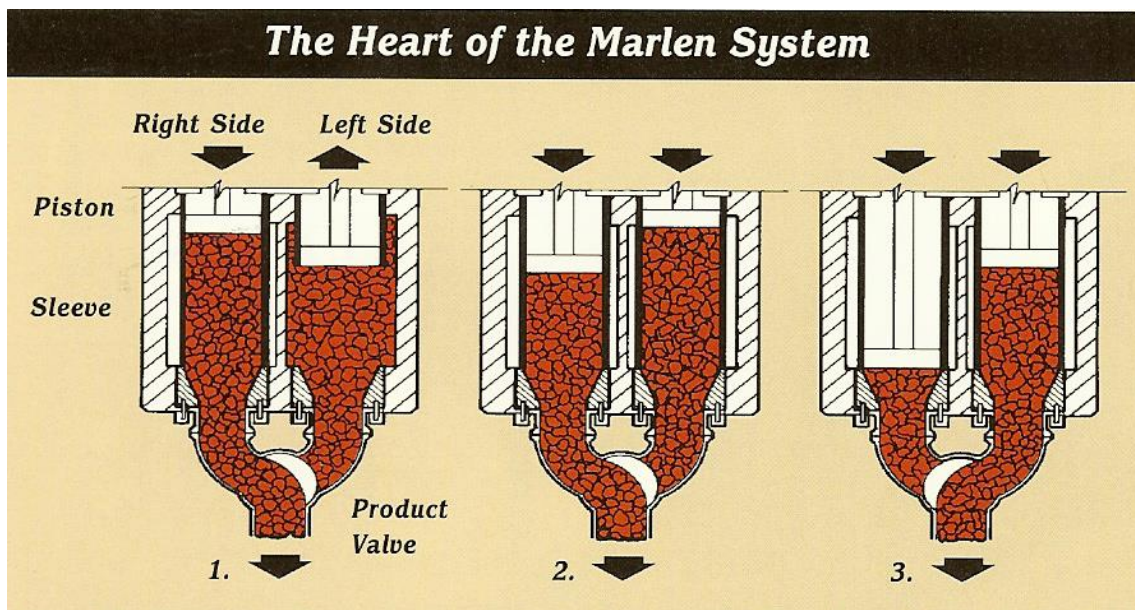
Therefore, the use of rotary positive displacement or centrifugal pumps as metering pumps in aseptic processing systems introduces variability to the very critical flow of the product through the system. This makes the mutually critical temperature control of product that much more difficult.

## SOLUTION

In an effort to deliver a consistent and accurate flow, Marlen took a different approach to metering/timing. Through the use of a reciprocating piston pump, Marlen's system is specifically designed not to slip under any variable conditions, including changes in temperature, viscosity and pressure. This results in an ideal solution for consistent delivery of product through an aseptic processing system, facilitating temperature control and destruction of unwanted microorganisms. Although initially more expensive than alternative pumps, the cost of a Marlen pump in an aseptic processing system is almost always offset through:

- Reduced down time due to variations in temperature control, due to changes in viscosity, pressure, initial temperature, etc.
- Simplified pre-sterilization to product changeover
- Less product loss as a result of variations in temperature and flow control
- Zero slippage
- Ease of operation
- Less maintenance
- Peace of mind knowing you have the most advanced technology available in your aseptic processing system

The Marlen pump consists of two hydraulically driven reciprocating pistons. Piston diameter is selected based on production requirements. These pistons are housed in two cylindrical sleeves within the pumping chamber. The pumping of the product alternates from one piston to the other. The below diagram depicts that as the right piston is pumping forward (step 1), the left piston and sleeve retract. This retracting action makes a void, creating a strong suction that draws the product into the pumping chamber areas ahead of the sleeve. The left sleeve then moves forward to trap the product and seals against the outlet. Next, the left piston begins its forward movement to compress the product to the same pressure as used for pumping (step 2). As the right piston nears the end of its pumping stroke, the product valve shifts to open flow from the left side and blocks the flow to the right side (step 3). The right side can now retract and reload the same as the left side did in step 1. During front valve shifting, there is no change in product flow as the front valve opens on one side and simultaneously closes on the other.



## **SOLUTION (continued)**

### **Patented Pre-Sterilization Recirculation System Option**

The Marlen pump has another very important feature with its pre-sterilization recirculation system (PSRS) option that facilitates the operation of an aseptic processing system. PSRS includes the addition of valves and controls to add pre-sterilization and recirculation of water at any time, at the same flow rate as the product being processed even though there is generally a considerable difference in viscosity between product and the water being recirculated.

It is axiomatic that an aseptic processing system must be pre-sterilized prior to processing product. This pre-sterilization is generally accomplished by circulating superheated water through the system for a prescribed period of time. The heat exchangers that are used to heat the product are generally used to heat the water for pre-sterilization of the system. The metering pump for the system is many times used for circulating the pre-sterilization water. In other cases, an auxiliary centrifugal pump is often used. In either case, the transition from sterilization water to product is considerably more difficult due to differences in viscosity and flow rate.

If a rotary positive displacement pump is used as the metering pump and this pump is used to circulate the pre-sterilization water, (due to differences in viscosity of the water and the product to be processed), the pump will likely be operated at a higher rpm to obtain the pressure needed to reach the superheated water temperature to affect sterilization. After the system has been deemed sterile, the product must immediately follow the sterilization water. When the product enters the timing pump, the flow rate will increase affecting the temperature control system. Unless this flow rate is compensated for with the temperature control system, a drop in temperature may occur resulting in a loss of sterility and downtime to start the re-sterilization process.

If an auxiliary centrifugal pump is used for circulation of the water for pre-sterilization there is the added cost of pumps, motors, valves and controls to the aseptic system, and the associated difference in flow rate between the pre-sterilization water and the product to be processed. This makes temperature control more difficult. Additionally, measures must be taken to insure there is no bacteria laden air plug pocket in the piping when switching between the pre-sterilization water and the product to be processed. This air plug could adversely affect the sterility of the system and product.

Marlen makes aseptic processing considerably easier with the addition of its patented PSRS which incorporates automatic water control valves, allowing the processor to pump water through the system at the same rate and pressure as the product to be processed, all with zero slip.

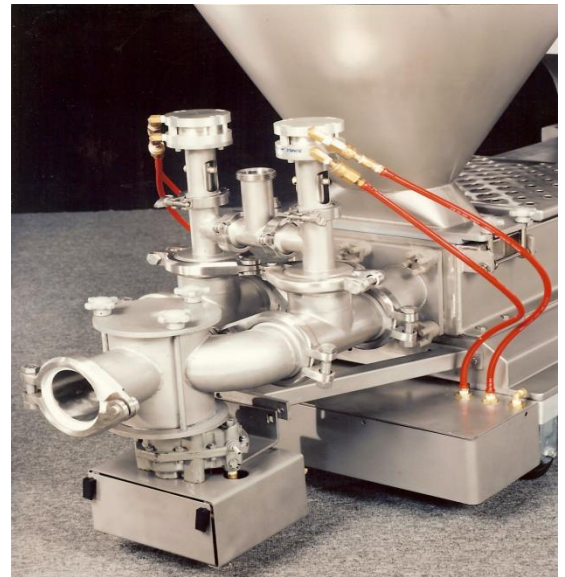
The advantages of Marlen's PSRS option include:

- Establishing flow rate during sterilization cycle
- Ease of immediate change between water and product
- Ability to flush the system between products
- Maintaining sterility during temporary shutdowns
- Purging the system of the product to minimize product loss
- Flushing the system in preparation of cleaning-in-place (CIP) at the end of the shift

## SOLUTION (continued)

### Patented Pre-Sterilization Recirculation System Option - Valving

Pictured at right are the two valves that allow water to be introduced and pumped through the system at the same flow rate as the product to be processed. When the PSRS system is activated, both sleeves around the pistons remained closed; however, the pistons continue to operate. While one piston is pushing the water through the system, the other piston is loading water into the sleeve by means of the respective water valve. The closed sleeves ensure the product to be processed is separated from the water being pumped. After the system has been deemed sterile the PSRS is inactivated. On the very next cycle, the sleeve opens and allows product to be filled into the sleeve. The product immediately follows the sterilization water through the system at the same flow rate, completely eliminating the possibility of a contaminated air pocket. All that is required of the temperature control system is a minor adjustment for differences in the specific heat setting of the water and the specific heat of the product being processed.



### Aseptic Processing of Food Products Containing Particulates

Since the early 80s, the Marlen pump has been used as a metering pump in aseptic processing systems, especially for those applications in which maintaining particulate identity is critical. Unlike a rotary positive displacement pump, there are no rotors or impellers for the product to pass around small inlet and outlet ports through which the product maneuvers. The product in a Marlen pump is sucked or gravity filled into a 4-inch to 8-inch diameter sleeve, then gently pushed through the aseptic system versus through a positive displacement pump which alters or damages the product.

ASEPTICALLY PROCESSED  
CONDENSED TOMATO  
VEGETABLE SOUP WITH MARLEN



SOUP DRAINED TO DEMONSTRATE  
RETENTION OF PRODUCT INTEGRITY  
POST-PROCESSING



## SUMMARY

It is important to find a trusted partner with the experience and reputation to deliver all that is promised; a partner who is as reliable as the equipment they install and service. Marlen pumps are known for delivering products through aseptic processing systems with less damage than other pumps on the market, resulting in the highest product quality possible post-aseptic processing.

### **About Marlen**

Recognized as a global manufacturer of highly engineered food processing equipment and systems, Marlen designs and builds innovative solutions for the food processing industry. Our premium products have long set the standard for quality and performance in vacuum stuffing and pumping, portioning, size reduction, thermal processing, and food handling. Marlen is a Duravant Company.