

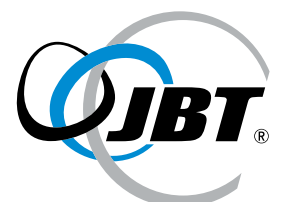
“A story of ensuring consistent product quality and food safety while producing at the lowest cost”

JBT In-Container Sterilization Technology

The reputation of your brand is only as good as the quality of your products. Producing the best possible quality is one thing; making sure that your production is done at the highest level of efficiency and at ever lower cost is quite another. To effectively address new consumer needs, packaging trends and opportunities in the market, you need a processing system which can be adjusted or extended and, at the same time, offers you the best economic proposition.

JBT sterilizers are perfectly geared to your specific products, production facilities and market requirements, allowing you to stay ahead of your competition.

In this JBT white paper we look closer into the JBT in-container sterilization technology offering.





Driving demand for shelf life extension, consistent product quality & food safety

Demand for shelf-stable food is growing. Changing consumer lifestyles have led time-constrained consumers to look for convenient, quick-to-prepare meal solutions. In developed countries where the demand for convenience products is growing, packaged food products account for an even larger share of total food expenditures among consumers.

Modern consumers are moving away from heavily processed foods in favor of products that appear fresh and natural. Foods that utilize chemical preservatives, high salt or acid levels, and heavily heated processed foods, are under particular pressure from changing consumer preferences.

Consumers are also demanding a wider range of healthy, nutritious and flavorful products in a variety of container types. Steel cans, retort pouches, plastic bowls and bottles, glass bottles and jars, and plastic cans and trays now offer food processors a wide range of options to create new and unique brands. Retailers respond with fervor to this demand and expand their product range, urging manufacturers for longer shelf-life and an expanded offering of convenient container types.

Packaging appearance and shape play a major part in marketing's search for ways and means of making fast-moving consumer goods more attractive to consumers and retailers. Ultimately, it is up to food processors to deliver high quality output and put safety controls in place, consistently and continuously. Demand for processing flexibility is at issue, as is the demand for consistent product quality and food safety while producing at the lowest cost per unit.



In-Container Sterilization

Driving demand for long life, consistent product quality and food safety, sterilization by means of heat is one of many technologies applied to preserve food quality and to improve the shelf life of packaged foods. Alternative techniques include UHT-processing and aseptic filling (for liquid products) and chilling and freezing (for liquid and/or solid products).

Sterilized food processing lines come in two fundamental approaches: aseptic lines and in-container lines.

In an *aseptic line*, a sterile container is filled with sterile product in a sterile environment. It is a continuous process typically limited to liquid products with or without small particles. Aseptic products may be found in the chilled or unchilled section of the supermarket.

In-container sterilization, on the other hand, is another proven technology that renders low acid food products shelf-stable (pH > 4.5). An unsterile container is filled and sealed with unsterile product in an unsterile environment. The product is then sterilized inside the container as it passes through the sterilization processing line.

Putting the heat on

Although product formulation plays an important role in retorted products, it is the thermal process that ultimately affects the finished product quality. The accurate design of the thermal process for your particular product is the starting point in your search for the most appropriate sterilizer to meet your specific product requirements.

Thermal process design: Product safety first

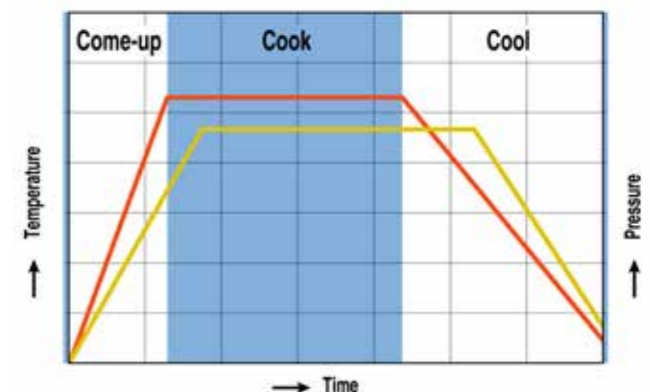
The goal of retort processing is to obtain commercial sterilization by the application of heat. While the thermal process is designed to destroy or render inactive spoilage organisms, certain bacteria may survive the process, so the product is safe under normal conditions of storage, but not necessarily sterile. In order to ensure commercial sterility,

the entire food mass in the container must undergo the required temperature for the required time. However, extended exposure to heat affects the quality of the finished product. The higher the temperature, the faster the microorganism kill rate, and thus the shorter the required exposure time.

Most retorted products will benefit from a high-temperature, short-time process.

Another perspective to consider is heat transfer within the product container; that is, the time it takes to reach the thermal processing temperature (the come-up time) at the coldest point in the container. It stands to reason that different container shapes and types require different thermal designs.

In the retort process, the heat must be transferred through the wall of the container to the product. Different types of packaging also have different thermal conductivity values: metal has the highest and plastic the lowest. Other critical factors to consider are the headspace in the container, the viscosity of the product and the initial temperature of the product before entering the retort. Lastly, does the product need agitation? Indeed, some products benefit from agitation during the thermal process for improved convection heating and better protection of the product nearest the outside from 'burning' at higher temperatures.





Catching up with JBT in-container sterilization technology

Agitation can speed up the heat transfer in products that flow by moving the air bubble through them that is created by the headspace. Without this bubble, there is little, if any, advantage in using an agitating system for solid packed foods.

To conclude, there are two aspects in determining the optimal thermal process: we understand the resistance of a particular organism in order to determine the amount of heat needed to kill it; and, we must determine how much heat is transferred to the product in the container in the thermal process. Bridging the two perspectives gives us the required thermal process.

Thermal process design: A scheduled temperature/pressure process

During the sterilization process, pressure inside the product container increases due to the expansion of the product, increased vapor pressure and the heating of air in the headspace. To maintain container integrity this phenomena must be compensated for by overpressure in the come-up, cook and cool stages.



For JBT, a well-performing in-container sterilization system relies on an advanced processing principle with a unique sterilization control system that provides a consistent, optimal and efficient thermal processing system under full management control.

Our guiding principles in this matter are consistent product quality and absolute food safety, while processing at the lowest cost per unit.

JBT customers achieve this set of values through different technical developments inherent in JBT sterilizers.

JBT offers complete turn-key solutions for in-container sterilization lines

JBT is a leading global solutions provider to the food processing industry. We have a long history and extensive track record in in-container sterilization of packaged foods. Our sterilizers are renowned for their outstanding and consistent temperature distribution.

Our global Research & Technology Centers assist you in developing and validating your thermal process and packaging techniques to achieve consistent product quality, food safety and extended shelf life.

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Batch retort sterilizer or continuous sterilizer?

There are two types of sterilization processing lines: batch retort sterilizers and continuous sterilizers.

Batch retort sterilizers process product containers in baskets or crates. A steady flow of containers moves onto an accumulation table to a basket loader. The filled baskets form a train of product and are moved into a retort vessel for thermal processing. Once the cycle is complete, the baskets leave the retort vessel and are unloaded onto a conveyor for further handling.

Retorts can easily be configured to handle a large range of container types and process a wide array of product recipes. Batch retort sterilizers offer high product and container flexibility, since the retorts are recipe-driven for each cycle. Today's batch retorts can be configured to run multiple processes to afford food processors maximum flexibility.

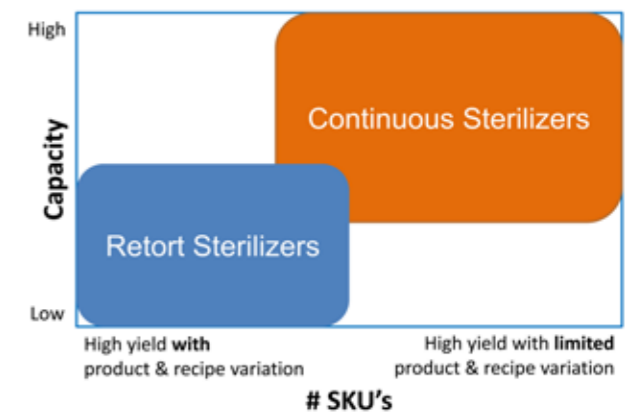
Continuous Rotary Pressure Sterilizers and Continuous Hydrostatic Sterilizers, on the other hand, process a constant steady flow of containers in a continuous way. This system ensures the continuous infeed, processing and discharge of the product containers.

By means of container guides, containers move through a series of shells or towers to pre-heat, cook, pressure cool and cool each single container in the system.

Continuous sterilizers are typically used for high volume products of a similar container type or size. These sterilizers permit short time, high temperature cooking and rapid, efficient cooling in an automatic, continuous operation. Every container is cooked and cooled in the same manner and receives exactly the same thermal process for consistent product quality. Reduced processing time helps preserve the product's natural flavor, nutrients and appearance.

Generally speaking, continuous sterilizers offer enhanced reproducibility and consistency at a lower cost per unit produced.

A batch retort sterilizer, on the other hand, frequently offers more product, container and process flexibility.





JBT Batch Retort Sterilizers Ensuring consistent product quality and proven food safety

Retorts can easily be configured to handle a wide range of container types and process a wide array of product recipes. Batch retorts offer high product and container flexibility, since the retorts are recipe-driven for each cycle. Batch No. 1 can be peas in a can, Batch No. 2 can be sauce in a pouch and batch No. 3 can be a beverage in a glass bottle. Today's batch retorts can be configured to run multiple processes to afford food processors maximum flexibility.

Automating the basket staging, delivery, and loading/unloading results in an Automated Batch Retort System (ABRS). From the crate loader the filled crates are transported to a batch-loading area where a full retort load is composed. A shuttle car then brings this load to one of the retorts and the load is automatically transferred into it. Once the sterilization cycle is complete, the loads are pushed back onto the shuttle car and subsequently transported to the batch unloading area. In such a set-up, the control systems of the individual functions in the retort line are synchronized by an advanced communication system.

Automated retort rooms can lower labor costs and increase throughput. Utilizing basket readers for basket tracking allows the system to monitor the sterilization status of each batch of product and facilitates digital record-keeping for quality control and regulatory review.

Let's take a closer look at JBT's technical developments installed on batch retort sterilizers

The Steam Water Spray™ Process

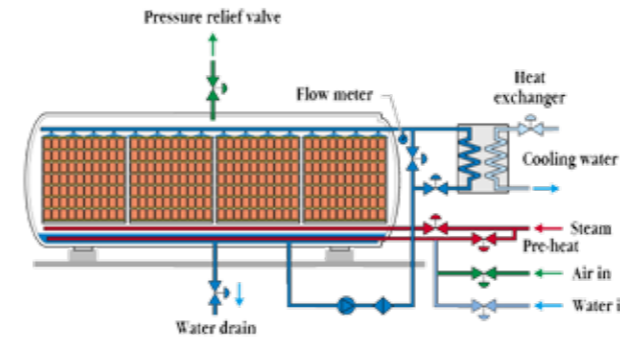
The steam water spray technology is standard installed on static and agitating JBT batch retorts.

Steam is directly injected in the bottom of the retort for quick and uniform temperature come-up. Water sprays running over the entire shell length intensively mix steam and water and create homogeneous temperature distribution. The key to the steam water spray functionality is the ability to pump the process water and spray it turbulently throughout the retort. The water re-enters the shell through specially designed nozzles that 'atomize' it into very small droplets or vapor. The spray pattern from the nozzles is conical, which creates overlapping spray patterns throughout the retort and virtually leaves no dead spots. This technology ensures uniform thermal treatment of all containers while providing an efficient counterbalance to the pressure created inside the packaging.

Highly sensitive temperature and pressure probes, high quality proportional control valves and P&ID control loops ensure accurate process control during the entire sterilization cycle. For maximum product safety, retorts are equipped standard with an absolute flow meter and analog water level control probe.

The Steam Water Spray process enables microcooling. This controlled and gentle transition from sterilization to cooling avoids thermal shock or uncontrolled pressure drop. For some particular product types, the turbo-cool option increases cooling capacity resulting in reduced cooling time and higher throughput.

JBT batch retorts equipped with steam water spray technology are considered to offer the highest degree of versatility for all types of packaging designs.



Energy Recovery Systems

JBT Steam Water Spray retorts can be equipped with energy savings systems to save water, water treatment chemicals and energy.

Reduced process water volume

To reduce process water volume, the retort can be equipped with an optional suction pipe that allows lower water levels during processing. This significantly reduces the amount of process water and, therefore, reduces the steam consumption and the load on the cooling tower.

Process water pre-heating

Another optional process water pre-heat system saves energy and ensures consistent process delivery for warmer hot-filled products. How does it work? Heat from the hot cooling water is recovered to pre-heat the cold process water before the start of the sterilization process.

Indirect heating through a steam-water heat exchanger

Instead of direct steam injection, the recirculating process water passes through a steam/water heat exchanger. This allows the condensate to be recovered and returned to the boiler, avoiding the costly make-up and preheating of the boiler feed water.



Based on following container and processing conditions, we can calculate reduction in boiler water and steam consumption, and potential cost savings.

Specifications and assumptions

- Product: non-carbonated beverage
- Can: Ø52 x 104 mm - 180ml (= 180g)
- Process 75 min
- Preheat: 3 min
- Come-up: 12 min
- Cook: 30 min
- Cool: 30 min
- Hot-fill: 70°C
- Sterilization t°: 121°C
- Process water t°: 35°C
- Material handling time: 10 min - Total cycle time: 85 min
- 28,980 containers/retort
- Production: 7,200 h/yr - Net production: 6,500 h/yr (90%)
- Number of cycles/yr/retort: 4,575 - Number of retorts: 4
- Cost of steam: 68€/ton
- Cost of (hot) boiler feed water: 30€/ton

Calculation of savings

REDUCED PROCESS WATER VOLUME

The reduction in process water volume is estimated at 650 liters. This results in a reduction in steam consumption of ~ 100 kg/cycle.

PROCESS WATER PREHEATING

Process water is heated from 35 to 95°C using energy from the hot cooling water. Total heat recovered from the cooling water is ~ 308,000kJ.

INDIRECT HEATING

Indirect heating recovers the condensate as boiler feed water.

Assuming that both reduced process water volume and process water preheating are implemented, the net steam consumption drops by 25%.

SAVINGS

- Steam consumption per cycle: 237 kg
- Value per year per retort: 237 x 4575/1000 x €68 = €73,730
- Total value for 4 retorts: €294,920
- Boiler feed water per cycle: 690 kg
- Value per year per retort: 690 x 4575/1000 x €30 = €94,700
- Total value for 4 retorts: €378,800

Total annual saving: > €680.000





SuperAgi™ The ultimate in thermal processing flexibility

The compact and innovative design of the SuperAgi vessel generates particularly attractive benefits for food processors as the new design ensures less utility consumption per unit produced. How does it work? In a conventional retort vessel with a conventional basket of 954 x 954 x 909 mm and a heavy tubular structured drum, the shell measures 1,800 mm. In the SuperAgi, the light perforated plate drum closely links to the basket - with spray pipes integrated in the drum thereby the vessel measures only 1,500 mm. The narrow fitted drum enables top clamping of the basket, ensuring high holding capacity for a large range of container types. The smaller diameter of the vessel and the narrower void between drum and shell generate savings in steam, compressed air and cooling/ process water with minimal F₀ differences.

Excellent temperature distribution Utility consumption gains

The new design also ensures better heat distribution in static or agitating mode via a process water delivery method. The system pumps water to the spray pipes integrated in the drum through a rotary coupling located inside the shell. As such, process water follows the product, eliminating shear effect and ensuring deeper water penetration into the load. The offset nozzle configuration provides even water distribution for the whole container surface area. This innovative water spray technology results in superior temperature distribution and significant energy and cooling water savings.

Furthermore, the unique spray concept allows operation at high rpm (up to 20) while still achieving excellent temperature distribution.

Since the useful life cycle of a retort is a minimum of 25 years, energy and water savings are of particular relevance to lower production cost per retorted container.

Multi-process capability

The SuperAgi is available in steam water spray and full or partial water immersion modes, offering full container and process flexibility. Water immersion for high RPM processing and containers that require buoyancy. Partial Immersion for tight-pack rigid containers with minimal water channeling capability. By combining different process modes in one single machine, every package/product combination gets the most economical and gentle process

Consistent process delivery

High temperature processes have shorter process times. This entails the need for accurate process control. A deviation in time, pressure or temperature when processing

at high temperature for only a short time becomes a more critical issue. In the same way, the cooling process also affects the quality and safety of the finished product.

Each JBT retort in a process room is equipped with a local controller with touch screen that monitors the sterilization program and allows interventions during the retort process. JBT's Log-Tec® thermal process controls generally monitor the retort system, consisting of one or more batch retorts, on a central host PC. They execute self-diagnostics and check all field devices and sensors prior to start-up. Log-Tec control systems also automatically control and record temperature deviations without operator intervention. Optional on-line lethality tracking software allows process deviation correction on the basis of F₀ calculation.

JBT Log-Tec® thermal process controls incorporate a central host PC for easy supervision of the retort installation. Process recipes are edited and managed on this host PC. Process data is safely stored in encrypted format and access to the various functions of the host system is password protected.

The comprehensive Log-Tec process ensures exact repetition of programmed sterilization profiles, such as programmed temperature ramps in the come-up and cooling phases, temperature overshoot at start of cook etc., reducing F₀ spread.

JBT Log-Tec software generated process records meet HACCP requirements and are unconditionally accepted by the FDA and USDA.

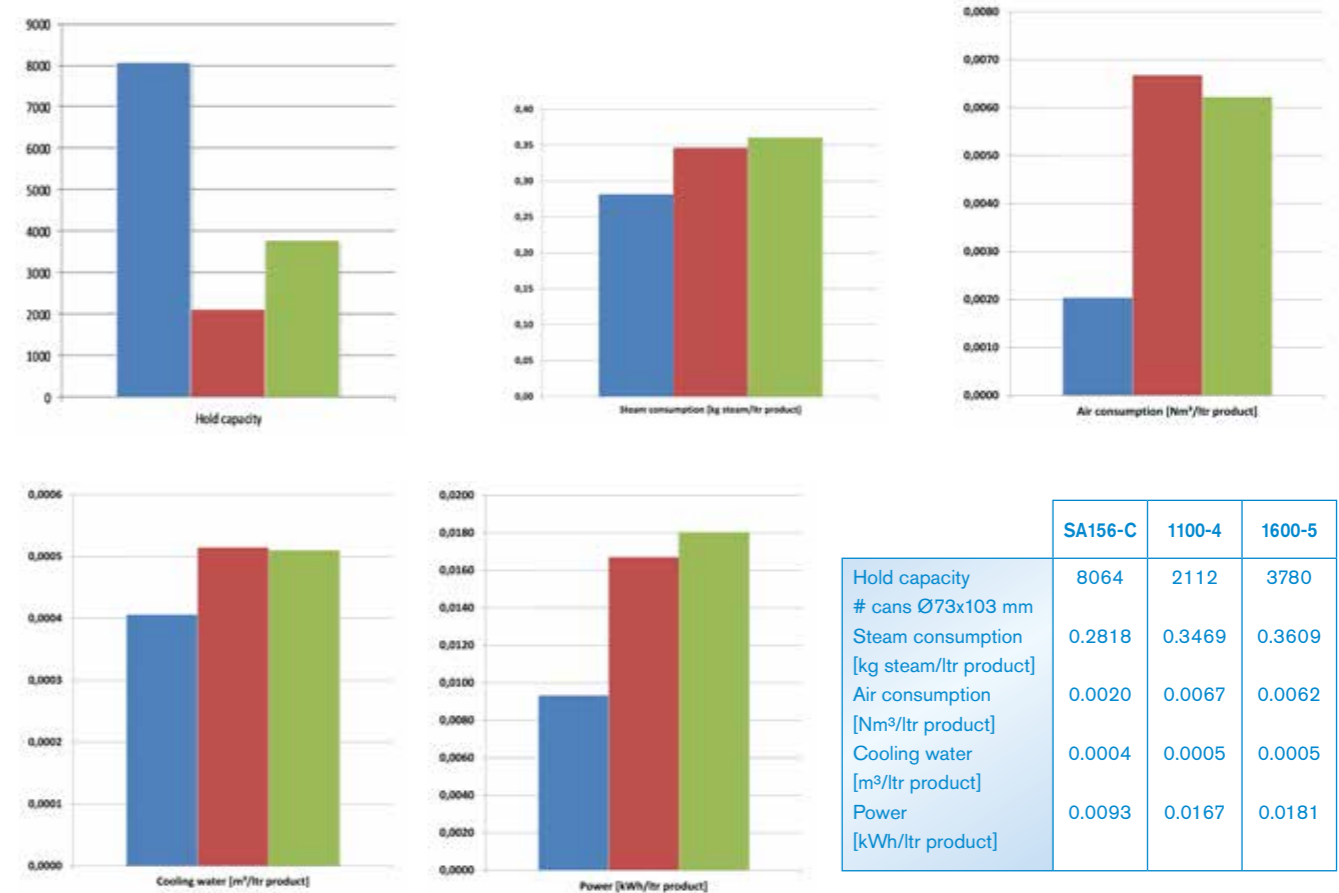
With over 9,000 systems supplied and over 95 years of in-container sterilization know-how, JBT has developed a deep understanding of your market.

We are more than willing to share our experience with you in the form of advice and calculation of high quality solutions at the lowest cost per unit produced.

For a no commitment meeting with a JBT sterilization expert to have a closer look at your specific product requirements, simply e-mail us at:

hello@jbt.com

Utility consumption example. SuperAgi™ SA156-C model versus conventional 1100-4 and 1600-5 retorts



Conventional design

SuperAgi



Basket: 954 x 954 x 906
Drum: 1610 mm outside
Shell: 1800 mm inside

Basket: 954 x 954 x 909
Drum: 1450 mm outside
Shell: 1500 mm inside



Agitating Retorts: SuperAgi™

MODEL	DIAMETER	NO. OF BASKETS OR TRAY STACKS	BASKET DIMENSIONS (W X L X H)	CAPACITY PER RETORT (1/2 kg can: Ø73 x 110 mm) (15oz. 300x407)	CAPACITY PER RETORT (450g pouch: 200 x 140 x 30 mm) (15oz. 8" x 5" x 1"1/4)
SA151	1500 mm	1	~ 990 x 990 x 940 mm	1176 cans	480 pouches
SA154	1500 mm	4	~ 990 x 990 x 940 mm	4704 cans	1920 pouches
SA155	1500 mm	5	~ 990 x 990 x 940 mm	5880 cans	2400 pouches
SA156	1500 mm	6	~990 x 990 x 940 mm	7056 cans	2880 pouches



Static Retorts

MODEL	DIAMETER	NO. OF BASKETS OR TRAY STACKS	BASKET DIMENSIONS (W X L X H)	CAPACITY PER RETORT (1/2 kg can: Ø73 x 110 mm) (15oz. 300x407)	CAPACITY PER RETORT (450g pouch: 200 x 140 x 30 mm) (15oz. 8" x 5" x 1"1/4)
A142	1400 mm	2	~ 990 x 990 x 945 mm	2852 cans	960 pouches
A144	1400 mm	4	~ 990 x 990 x 945 mm	5376 cans	1920 pouches
A146	1400 mm	6	~ 990 x 990 x 945 mm	8064 cans	2880 pouches
A166	1600 mm	6	~ 1150 x 1120 x 1070 mm	12852 cans	4620 pouches
A186	1800 mm	6	~ 1260 x 1290 x 1220 mm	17280 cans	7488 pouches



Automated Batch Retort Systems

The trend in food processing is to move away from small retort vessels to larger shells to improve efficiency, lower costs and provide greater product safety. Larger vessels imply larger baskets that cannot be handled manually due to their bulk and weight.

The need to handle these enormous baskets opens the way for Automated Batch Retort Systems or ABRS. ABRS refers to the fully automated integration of all hardware designed for transportation of baskets from loader station to sterilization retorts and from there on to an unload station and packaging area. The global handling system can be monitored by a basket/pallet tracking system.

Loading and unloading systems

With over 20 years of experience in the field, JBT offers a wide range of solutions for the loading/unloading of glass, metal, flexible and semi-rigid containers in baskets or trays destined for sterilization in autoclaves. JBT counts on experienced, dedicated partners in the design of baskets, layer pads and loading/unloading hardware.

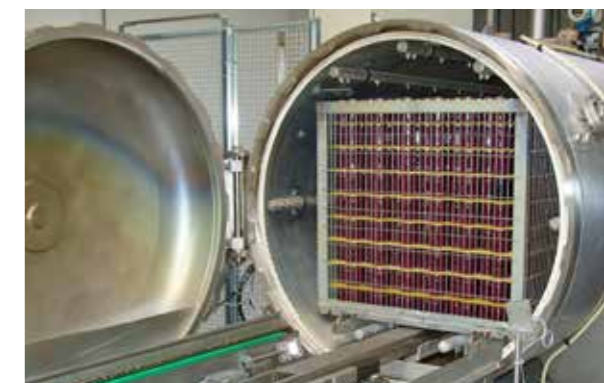
The range of JBT loaders and unloaders extends from semiautomatic systems for low outputs (1–1.5 layers/minute) to fully automated systems for high-speed requirements (over 5 layers/minute).

Equipment is entirely made of stainless steel. Modular solutions allow the plant to be easily adapted to the customer's spatial needs and the type of basket(s) used.

In a semiautomatic loading/unloading system, the plastic layer-pad is placed/removed by the operator. All other operations are automatic once this manual action is completed.



Transport system using fixed conveyors



Transport system using a shuttle



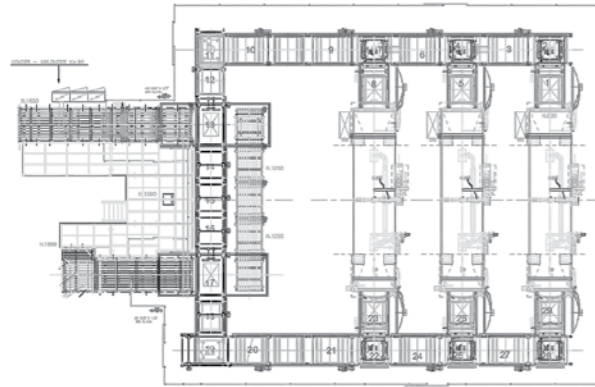
Transport system using AGVs



Transport systems

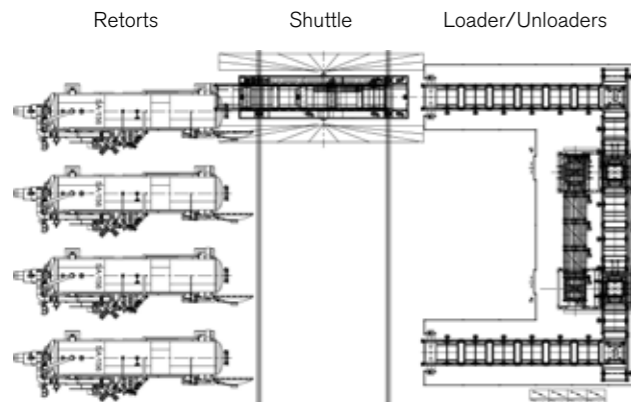
Different alternatives are available to transport full/empty baskets to/from the retorts: by fixed conveyor, shuttle on rails or automated guided vehicles (AGV).

All JBT retorts can be ordered with resident, internal conveyors for automated basket loading/unloading. Conveyors are made of stainless steel and are designed to integrate with external conveyors.



Loaded baskets feed the retorts by a fixed conveyor (double-door vessels)

The shuttle is an automated basket delivery system that delivers and collects batches. The shuttle is integrated with the conveyor system of the loader/unloader.



Loaded baskets feed the retorts by a shuttle on rails (single-door vessels)

The JBT automated guided vehicle (AGV) is a system that operates without track. A short conveyor section is mounted on the AGV that docks with the loader to pick up baskets for retorting. A fleet of conveyor-deck AGVs transports baskets from the loader conveyors to the batch retorts for high temperature cooking. Once the sterilization

cycle is complete, the retort opens automatically and an AGV is sent for unloading. An AGV is ordered to remove the baskets and deliver them to the unloader or a buffer conveyor. AGVs also transport empty baskets to and from the buffer conveyors.

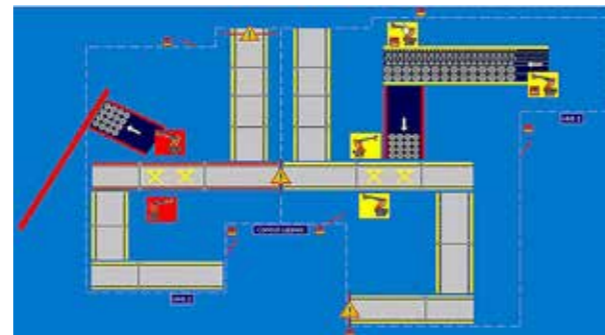
An AGV Manager Host Software system coordinates all vehicle movements and communicates with plant production software to facilitate basket movement.

Basket/Pallet Tracking System (BTS)

The entire operation of an ABRS depends on a well performing tracking system for the baskets and product process batches..

BTS not only coordinates all movements of baskets, but also records all data and monitors pre-process dwell time deviations. The eyes of the BTS are the barcodes that identify the baskets in key locations of the process while they move along: loading (fill time for dwell time tracking), in the retort, process start and end, and unload. BTS flags any anomaly (e.g. baskets with a different product, unsterilized or wrong product at unloader, etc.). In that case, a QC privilege is needed to release the product that has been flagged.

Screen visualization provides a good system overview, so that only a small number



Continuous Rotary Pressure Sterilizer
“Practice makes perfect”

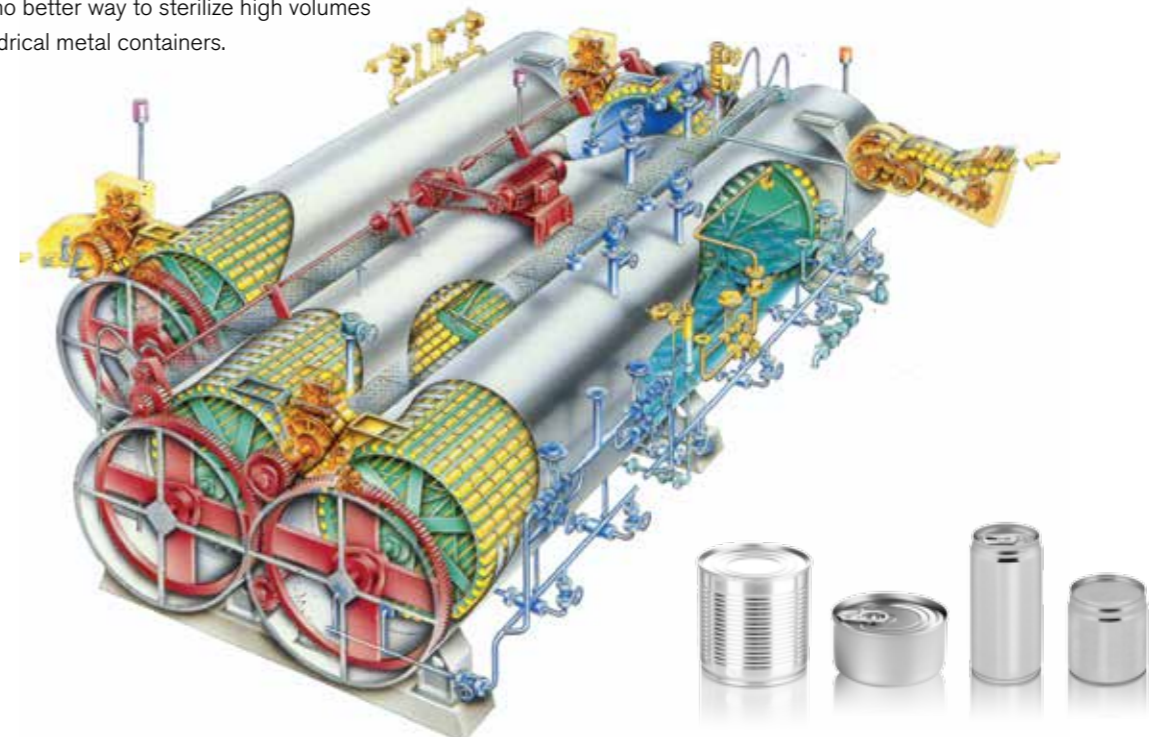
Since 1921, more than 7,500 JBT Continuous Rotary Pressure Sterilizers have been placed into production around the world. An estimated 100 billion food cans are produced globally every year to preserve a broad range of ready meals, vegetables, soups, sauces, milk, noncarbonated beverages, etc. More than 50% of the world's canned foods are sterilized on the JBT Rotary Pressure Sterilizer.

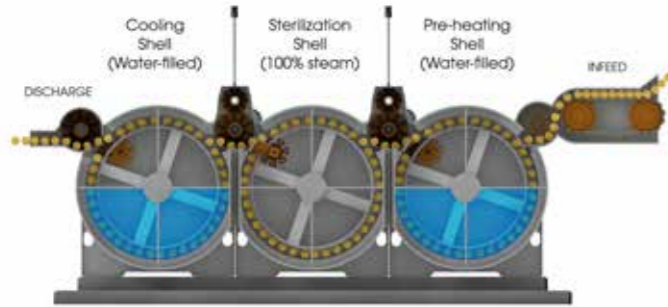
Year-by-year JBT has advanced the rotary sterilizer technology to offer high, consistent product quality at the lowest cost per unit produced. Today's rotary pressure sterilizer technology allows processors to handle traditional and modern, stackable, lightweight and easy open-end cans.

There simply is no better way to sterilize high volumes of foods in cylindrical metal containers.

Some of the products currently processed in JBT Rotary Pressure Sterilizers:

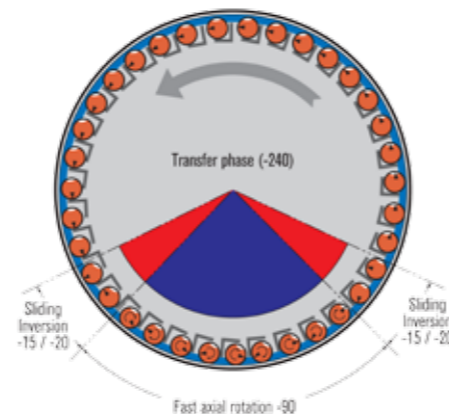
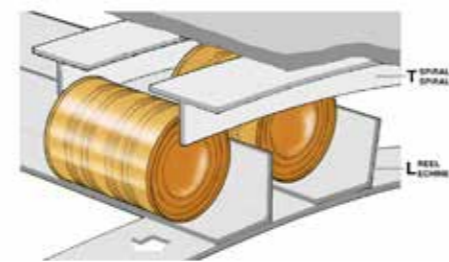
- ✓ Fruit
- ✓ Ready meals
- ✓ Pastas
- ✓ Sauces
- ✓ Seafood
- ✓ Soups
- ✓ Nutritional drinks
- ✓ Infant formula
- ✓ (Evaporated) milk
- ✓ Cream
- ✓ Vegetables
- ✓ Vacuum packed corn
- ✓ Mushrooms
- ✓ Pharmaceuticals
- ✓ Meats
- ✓ Juices
- ✓ Rice based foods
- ✓ Congee





A simple and extremely efficient operating principle

Closed cans enter the sterilizer directly from the closing machine with minimum waiting time. A feed device delivers the cans into the revolving reel of the first vessel. The reel, working in conjunction with the stationary spiral, advances the cans through the vessel. Cans never stand still. The continuous spiraling motion and rotation of the container through the vessel provide an even cook to every container. Every can is treated individually and undergoes exactly the same thermal process. At the end of the cooking process the cans are transferred to a water filled cooling vessel where a similar process efficiently cools them.



The Continuous Rotary Pressure Sterilizer agitates the can, permitting short-time, high-temperature cooking and rapid, efficient cooling in an automatic, continuous operation. For each turn of the reel, the can undergoes a 3-phase movement cycle. This intermittent axial agitation induces convection heating and results in faster cooking and cooling of the product.

Take a look at the 3D animation on the working principle of the JBT Continuous Rotary Pressure Sterilizer on the JBT website.
<https://www.jbtc.com/foodtech/products-and-solutions/products/pasteurizers-and-sterilizers/rotary-cookers/pressure-sterilizer>



The lowest cost per unit produced
High and consistent product quality and food safety

To meet the industry's need for reduced energy and water consumption, ever-lower cost per unit produced and high, consistent product quality and safety, JBT relentlessly advances the rotary sterilizer technology. These innovations allow canners to address new consumer needs, packaging trends and market opportunities in the most effective and cost efficient way possible.

Low labor cost

The JBT Continuous Rotary Sterilizer offers important advantages to substantially lower labor cost. Cans are directly transferred from the seamer to the rotary sterilizer and automatically transferred through cooker and cooler shells. All critical machine functions are displayed on a centralized control system. Machine operation is completely automated. Moreover, multiple rotary sterilizers can be supervised by only one operator.

A new, optional menu-driven control system offers automatic start-up and an optional process recipe change-over, further reducing labor requirements and virtually eliminating the risk of human error. Finally, JBT provides turnkey installation and start-up services with detailed operator training classes.

High reliability and availability

Reduced machine maintenance

Since 1921, JBT has continuously improved the Continuous Rotary Pressure Sterilizer technology to ensure and further improve sustained, trouble-free operation. The application of high-grade materials, the application of high quality, proven designs and the smart use of new technologies go a long way to ensure maximum reliability, equipment availability and low and easy maintenance.

An optional automatic grease lubrication system allows full automatic lubrication of the machine. JBT offers a broad range of food-grade lubricants specifically designed for the JBT Continuous Rotary Pressure Sterilizer. In a production

environment that is becoming ever more demanding, the JBT low-wear rotary transfer valves, newly designed reel and automatic shell deflection monitoring system (optional) assure even longer machine life and lower maintenance costs. JBT's corrosion control experts also help customers to maximize the life of their shells.

Low energy and water consumption

Small carbon footprint

The rotary sterilizer operates in a continuous, steady state mode and offers the highest line efficiency and availability and the lowest steam, water, air and electricity consumption per unit produced. Faster heat penetration, resulting from continuous product agitation and higher processing temperatures, drastically reduce the processing times required.

An optional venting supervision system makes it easy for operators to verify proper functioning of the vents on the cooling shells, reducing energy consumption. A ceramic insulating safety coating enhances operator safety, reduces energy losses and provides protection against external corrosion.



Optional JBT Heat Recovery System



An optional energy recovery system recovers heat from the cooler in the pre-heater to drastically reduce the overall steam consumption and lower cooling water loss. The optional automatic start-up and recipe changeover feature avoids operator error and assures consistent, energy, air and water efficient machine start-up and change-over from one process recipe to another. The menu-driven control system puts the machine automatically in "Eco Mode" (optional) during extended interruption of supply of cans, minimizing energy and water consumption.

Product uniformity
High product quality and safety

Every can is cooked and cooled in the same manner and receives exactly the same thermal process for consistent product quality. Reduced processing time helps preserve the natural flavor, nutrients and appearance of the product.

High processing speed

Higher line speeds require either more shells or shells with a larger holding capacity. To be able to offer the most cost-effective solution for each application, we have added extended length and larger diameter shells to our portfolio.

Gentle container handling

Gentle mechanical handling greatly minimizes can damage. This makes the system particularly suitable for processing not only traditional but also modern lightweight, stackable cans with conventional or easy-open ends. Also double necked-in sleeved or labelled cans can be processed on JBT's latest generation of Continuous Rotary Pressure Sterilizers.

Modern process control system

JBT provides various PLC-based options for controlling rotary lines. The options include a touchscreen Operator Interface. The screens are menu-driven and include a process overview, operator controls for local P&ID tuning, a customized recipe management system and diagnostic screens for troubleshooting. The Operator Interface also includes displays for current and previous alarms. Other customized features can be provided on demand, such as trend graphs and detailed troubleshooting.



Small footprint and easy installation

This system requires a limited industrial floor space considering a production process up to 1,500 containers per minute (90,000 cph). Apart from the limited footprint, the installation of a Continuous Rotary Pressure Sterilizer in most cases does not require any major modifications to the building available. Moreover, the equipment and the process control system are fully tested at the JBT facility before shipping, resulting in a virtually trouble-free startup.

Product and container flexibility

JBT engineers have developed specific systems to enhance product and container flexibility for canners. Multi spirals (Twin-Triple-Quattro are available) allow high-speed processing.

Two, three or four cans go through the entire process in parallel. In addition, delicate products can be run with high output levels: by reducing the rotation speed of the shell, the product is subjected to less agitation, therefore keeping a consistent quality. Multi spirals allow also multiple products/can sizes to be processed simultaneously in one single unit.

With a double can handling system, two short cans or one taller can with roughly the same can diameter and with lengths in the approximate ratio of 2:1 can be processed together in the same spiral.

Two-grade feed and discharge and multiple infeed systems allow the processing of different cans with different cooking times without having to implement change-overs or to speed up the machine, or reducing cooling time.

Line Layout Flexibility

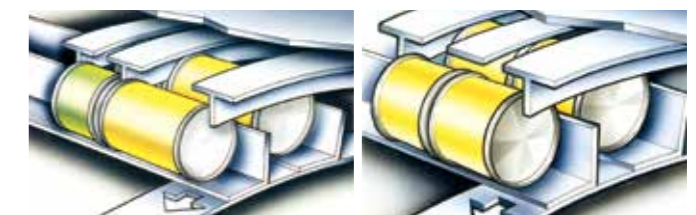
Depending on the thermal process of a particular product or can format, JBT engineers a custom-fit configuration to ensure product uniformity and quality. When multiple cooking or cooling vessels are required for longer processes or special preheating requirements, the vessels can be directly connected or located independently. Many shell configurations are possible, from 2 to 7 shells. Our modular and, therefore, flexible design allows for easy future modifications of an existing system by adding vessels.

By way of illustration, we explain two cases where a JBT customer had to make a choice between a Continuous Rotary Pressure Sterilizer or an Automated Batch Retort System (ABRS) for a new factory project, or for the replacement of an existing Automated Batch Retort room.

In both cases JBT received the process requirements and detailed operational costs/utilities consumptions to perform a cost-benefit analysis.

Single Can Combinations	
A1 211 x 400 (68,5 x 101,5 mm)	& E1-UT 300 x 401-408,75 (76,2 x 103,2-116 mm)
UT 300 x 408,75 (76,2 x 116 mm)	& A21/2 401 x 411 (103 x 119 mm)
1/2E 300 x 405 (75,5 x 109,5 mm)	& 1/1E 400 x 411 (102 x 119 mm)
A21/2 401 x 411 (103 x 119 mm)	& 16oz 404 x 700 (108 x 178 mm)

Double Can Combinations	
Double Can (DC)	Single Can
1/4 DC 300 x 207 (75,5 x 62 mm)	& 1/2 300 x 405 (75,5 x 109,5 mm)
8 oz DC 300 x 208 (76,2 x 63,5 mm)	& UT 300 x 408,75 (76,2 x 116 mm)
1/2 Basse DC 401 x 206 (103,2 x 64 mm)	& 1/1E 400 x 411 (102 x 119 mm)
1/1E DC 400 x 411 (102 x 119 mm)	& 3/2 400 x 615 (102 x 176 mm)



Asymmetrical twin spiral

Double can handling





JBT Hydromatic® Continuous Hydrostatic Sterilizer

In its most basic configuration, a hydrostatic continuous sterilizer consists of four sections or "legs", each with a height of up to twenty meters. The first leg serves as a preheating section, in which a hydrostatic column serves as an inlet lock. The second tower comprises the sterilizing section, where the product is heated to the requisite sterilization temperature with the help of steam. The sterilization temperature is directly related to the pressure of the saturated steam. By varying the pressure, the temperature can be controlled. After leaving the sterilizing section, the product carrier ascends through the hydrostatic cooling leg.

With the pressure gradually decreasing and the product gradually cooling, spray water jets provide additional cooling. Sterilization time and temperature are infinitely variable between generous limits within the Hydromatic® Sterilizer process concept.

To go through the hydrostatic sterilization process the product containers are loaded into carriers. The carriers are closed during the entire process for full protection of the packaging. At the end of the process the product containers are automatically unloaded for further container handling. Loaders/unloaders and carriers are custom-fit designed to suit specific product requirements and required throughput capacity. Glass and HDPE bottles, for example, are fully protected throughout the sterilizing process by an ingenious carrier design with individual pockets for each bottle.



Multiple process modes for a product-fit process configuration

Depending on the range of your products, packaging sizes and process range, a further increase of the flexibility of the Hydromatic Sterilizer may be provided with a baffle wall allowing for multiple process modes. A baffle wall is a configuration whereby the hydrostatic cooling leg can be transferred from one position to the other, thus varying the holding capacity of the sterilizing section. Each Hydromatic Sterilizer is configured from well-proven components, linked together to form a tailor made solution based on a detailed analyses of your current and future needs and expectations while ensuring the best possible return on your investment.



Anything goes ...

With its high capacity and very low production costs the Hydromatic Continuous Sterilizer is used to process, in the safest possible way, any product in a wide variety of packaging. The Hydromatic Sterilizer gives added shelf life to many applications including ready meals, baby food, vegetables, meat, fish, pet food, soup, low-acid drinks, dairy products, soy drinks, etc.

BABY FOOD

This type of product is usually packed in small decorated cans or glass jars with PT-closure requiring an overpressure process. This is achieved with a system configuration using twin hydrostatic towers. A specially designed soft-touch system handles the jars with extreme care at speeds up to 1200 jars/min.



VEGETABLES AND MEAL COMPONENTS



You will find many Hydromatic Sterilizer systems in daily use in these industries, from the processing of seasonal vegetables to formulated bean products or complete R.T.S. meals, packed in a variety of metal containers, glass jars or alike.

LONG-LIFE SOY DRINKS

The worldwide consumption of soy milk is growing strongly. Long-life soy milk is often packed in portion size glass bottles. The high market demand and relatively small bottle volume result in the need for high-capacity production lines. JBT markets a range of Hydromatic Sterilizer systems dedicated to the soy milk industry.



SOUP

The Hydromatic Sterilizer forms the heart of most canning lines for world-famous brands in the processed soup industry. High and medium systems are used both in dedicated operations and in flexible lines requiring many (auto-mated) product and process change-over's in each working shift.



PET FOOD

Hydromatic Sterilizers are used by leading manufacturers in the pet food industry all over the world. The Hydromatic Sterilizers system provides the most economical solution for the range of cans (from the smallest one-portion cat food can to the largest size of dog food cans). The system design is in full harmony with the requirements typical for the industry, such as high line speed and round-the-clock operation. A special version of the Hydromatic Sterilizer is available for lightweight aluminum tubs (trays), using a special handling system and so-called hanging carriers, whereby the tubs are always kept upright, in combination with an overpressure process configuration.



FISH AND MEAT

JBT provides tailor-made solutions to the fish and meat industries, both characterized by a wide variety of often beautifully decorated packaging types. For conical cans, JBT uses a specially designed loading and unloading system as well as special product carriers with individual pockets and a 'visor' to protect the packages throughout the process.



LOW-ACID DRINKS

Low-acid drinks (often fruit or dairy based) may be filled in glass or plastic bottles or in printed cans with an easy-open lid. The Hydromatic Sterilizers family covers solutions for all these packages.



LONG-LIFE DAIRY PRODUCTS

Hydromatic Sterilizers for dairy applications are usually part of a 2-stage process, whereby the product is pre-sterilized prior to filling into the bottle. This involves that just a mild treatment (High Temperature, Short Time or HTST) is required, resulting in a product with a long shelf life and a great taste! The range covers any conceivable





Cost-Effective and Flexible

application from long-life milk in standard glass bottles to many kinds of formulated drinks in attractively shaped plastic (HDPE) bottles.

FLEXIBLE PACKAGING

Hydromatic Sterilizers are also capable of handling a wide variety of flexible packages. Whether your product requires a tub, pouch or tray, our systems can sterilize the varying designs of flexible packaging.

Hydrostatic continuous sterilizers have a reputation of being high efficiency-high capacity machines for 'main stream' food products. It may then come as a surprise to you that 50% of the continuous sterilizers supplied by JBT are employed for the processing of up-market products

packed in odd-shaped metal cans, glass jars or bottles, lightweight plastic packages, soft aluminum tubs and alike.



This means that JBT also possesses a wealth of experience concerning specialized processing and handling

concepts including: super still cook for sensitive products; soft touch handling systems; overpressure processing and overpressure cooling for flexible containers/closures, etc.

Overpressure Sterilization

Most of the new generations of packages are more 'sensitive' regarding process conditions than traditional packages. This is mainly due to the materials used: plastic, very thin metal and sensitive closures. The process requirements for packages like trays, tubs, glass jars, plastic pots and plastic bottles have in common that an overpressure process is needed. This means that an additional pressure is required during the process. For overpressure sterilization the Hydromatic® applies either a mixture of steam and compressed air (effectively homogenized by a powerful fan system) or superheated water in an environment of compressed air. In both cases the pressure can be controlled independently from the temperature.



Pressure Cooling Option

With modern easy open ends and/or peelable foil lids an optional overpressure cooling system protects the integrity of the packages, by managing the pressure differential during the cooling phase.



Production cost of 'everyday' products manufactured in large quantities must be done at the highest possible level of efficiency and at the lowest cost. These requirements fit perfectly with the main characteristics of the JBT Hydromatic Sterilizer.

On the other hand, serving the market for high value-added products involves quite a variation in recipes and processes, in different packages and relatively small production batches. This market segment requires your system to be flexible in terms of packaging type and size, change-over capabilities and alike

The JBT Hydromatic Sterilizer is the obvious solution for the sterilization of both medium and large production volumes.

Consistent Processing Quality

The hydrostatic design means a consistent high process quality from the first to the last package in a batch. Each and every package in a production run is processed exactly alike and the continuous, automatic operation prevents the occurrence of under- or over-processing.

A comprehensive management information system gives instant access to all production and process data. Among others, it includes a Product Monitoring and Registration System. This P.M.R. system is an ingenious system for monitoring the product in the Continuous Sterilizer on the basis of dwell time, temperature and events during the process as it provides a superb visual tool for the operator indicating the actual product status per group of packages. The control system also includes a recipe memory in which the various process parameters and alarm limits for the relevant processes are stored. A recipe is activated from the touch screen. The Hydromatic Sterilizer will auto-configure itself to the recipe selected, define the right temperature and pressure settings and adjust the handling speeds. Machine downtime as a result of product change-over will be reduced to a bare minimum and virtually eliminate the risk of human error.

Reduction of packaging cost

The unique process design and balanced pressure, combined with a soft touch package handling system that protects your packages from start to finish will, in most cases, help you to reduce the packaging costs.

Small footprint and efficient logistics

The Hydromatic Sterilizer requires only 10 to 25% percent of the floor space other sterilizing systems do! This and a continuous flow of product packages mean much easier in-plant logistics without any risk of mix-up of processed and unprocessed product.

Efficient and totally reliable

The Hydromatic Sterilizer has been designed to ensure sustained, trouble-free operation for many years. The application of high-grade materials and sophisticated systems goes a long way to ensuring maximum efficiency, reliability and ease of maintenance.

Flexible

The Hydromatic Sterilizer is a very flexible system that can be easily adjusted to the other recipes and packaging sizes, types or shapes within the range of your products. The built-in flexibility can be further exploited by adding optional components when you should change over to an entirely new product, new packaging or a new process at any time in future.

Lowest cost per unit

The JBT Hydromatic Sterilizer is an advanced continuous sterilizing system which offers the lowest possible cost per unit. This results from the incredible efficient and fully automatic operation, the energy-efficient design and the long service life and low maintenance costs. With an optional Automatic Start-up & Shut-down system the machine can either fill, pressurize or start itself up automatically without any operator.

Energy and water savings

Inherent to the unique design, a high level of water recirculation and heat regeneration is achieved, therefore, energy and water usage are extremely low. The Hydromatic Sterilizer reduces the processing cost of your product and helps you to achieve your sustainability goals at the same time.



CASE 1: Evaporated Milk - Line

3 Shell Rotary Sterilizer vs. Automated Batch Retort System

This JBT customer was performing a comparative study for a new plant to process canned evaporated milk in the Middle East.



This configuration requires a floor space of 13,4 m x 5 m or approximately 70 sqm.

The budget for this configuration amounts 2.400.000€. An optional heat recovery system amounts to an additional investment of 290.000€.

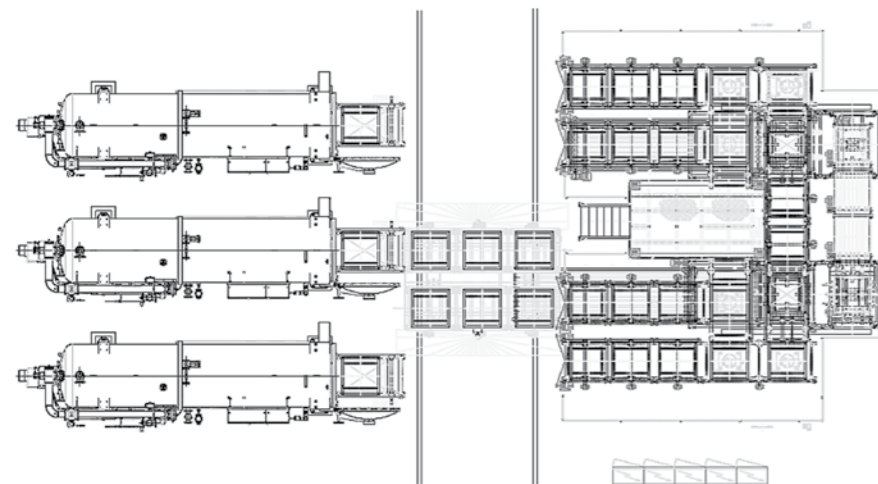
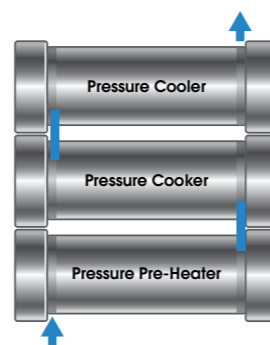
To produce - in a fully automated process - the same volume with batch retorts, the following Automated Batch Retort System is needed:

System	Item	Budget
Batch Retorts	3 x SuperAgi 156	1.200.000 €
Ancillary Equipment	Baskets & layer pads	55.000 €
Load / unload Equipment	Loader / Unloader + Shuttle	875.000 €
		2.130.000 €

Container specifications:	Ø63 x 63 mm - 170 ml per can Non-stackable cans Conventional and easy-open ends
Line speed:	800 cans per minute
Annual production:	39 168 metric tons 230.400.000 cans/year
Annual production time:	4.800 hours/year

3-Shell Dual Spiral	Shell 1: Pressure Pre-Heater	Shell 2: Pressure Cooker	Shell 3: Pressure Cooler
Shell diameter (mm)	1481	1481	2 x 71
# cans per turn	56	56	2 x 71
# turns per shell	2 x 71	2 x 71	2 x 71
Shell holding capacity	2 x 3 976	2 x 3 976	2 x 3 976
Transfer time at 2x400 cpm	9.4 min.	9.4 min.	9.4 min.
Shell length (meter)	12.5 m	12.5 m	12.5 m

This ABRS configuration requires a floor space of 15 m x 33.5 m or 500 sqm compared to 70 sqm for a 3-shell Rotary Pressure Sterilizer.



The following tables display a detailed comparison of the operation cost between a JBT Continuous Rotary Pressure Sterilizer and an ABR system for this particular case.

	Rotary Pressure Sterilizer	ABRS	Saving (units)	Annual Saving	Assumptions
Manpower (operator/shift)	0,25	1	0,75	€ 90.000	25 €/hr
Steam [kg/kg product]	0,21	0,285	0,075	€ 117.504	40 €/ton
Cooling Water [Liter/kg product]	0,1569	0,6127	0,4558	€ 35.706	2 €/m³
Electricity [kWh/hr]	19	174	155	€ 111.600	0,15 €/kWh
Air [Nm³/hr]	59	149	90	€ 10.800	0,025 €/Nm³
Maintenance Cost (Equipment) [€/year]	15 000	45 000	30 000	€ 30.000	
Maintenance Cost (Building) [€/year]	5 250	37 500	32 250	€ 32.250	
				TOTAL ANNUAL SAVING	€ 427.860

The next table displays the total annual savings in operation cost when the optional Heat Recovery System is added to the 3-shell configuration.

	Rotary Pressure Sterilizer	ABRS	Saving (units)	Annual Saving	Assumptions
Manpower (operator/shift)	0,25	1	0,75	€ 90.000	25 €/hr
Steam [kg/kg product]	0,11	0,285	0,175	€ 274.176	40 €/ton
Cooling Water [Liter/kg product]	0,0472	0,6127	0,5655	€ 44.299	2 €/m³
Electricity [kWh/hr]	25	174	149	€ 107.280	0,15 €/kWh
Air [Nm³/hr]	59	149	90	€ 10.800	0,025 €/Nm³
Maintenance Cost (Equipment) [€/year]	15 000	45 000	30 000	€ 30.000	
Maintenance Cost (Building) [€/year]	5 250	37 500	32 250	€ 32.250	
				TOTAL ANNUAL SAVING	€ 588.805





CASE 2: Mushroom – Line

2-shell Rotary vs. Automated Batch Retort System

This JBT customer was performing a comparative study for overhauling an existing Automated Batch Retort Room. For canned mushrooms.

Container specifications:	Ø 73 x 109 mm – 400 g Ø 64 x 100 mm – 290 g Conventional 3-piece cans
Line speed:	350 cans per minute
Annual production:	34 776 metric tons 100 800 000 cans/year
Annual production time:	4.800 hours/year



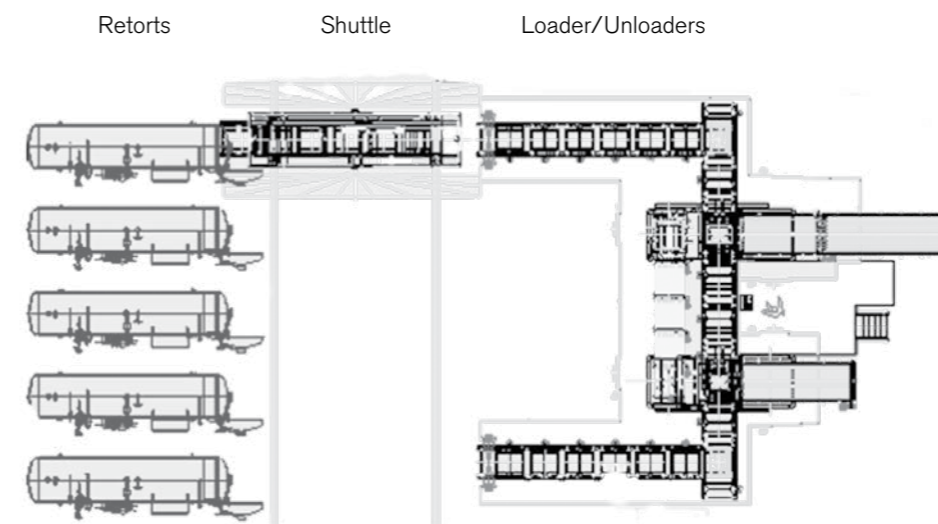
This configuration requires a floor space of 7.5 m x 5.5 m or approximately 40 sqm.

The budget for this configuration amounts 1.506.500€.

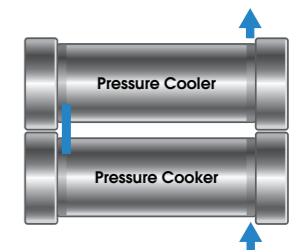
To produce - in a fully automated process - the same volume with batch retorts, the following Automated Batch Retort System is needed:

2-Shell	Shell 1: Pressure Cooker	Shell 2: Pressure Cooker
	Shell diameter (mm)	1481
# cans per turn	49	49
# turns per shell	43	43
Shell holding capacity	2 107	2 107
Transfer time at 2x400 cpm	6 min.	6 min.
Shell length (meter)	6.6 m	6.6 m

System	Item	Budget
Batch Retorts	5 static retorts	940.000 €
Ancillary Equipment	Baskets & layer pads	55.000 €
Load / unload Equipment	Loader / Unloader + Shuttle	875.000 €
		1.870.000€



This ABRS configuration requires a floor space of 15 m x 31.5 m or approximately 475 sqm compared to 40 sqm for a 2-shell Rotary Pressure Sterilizer.

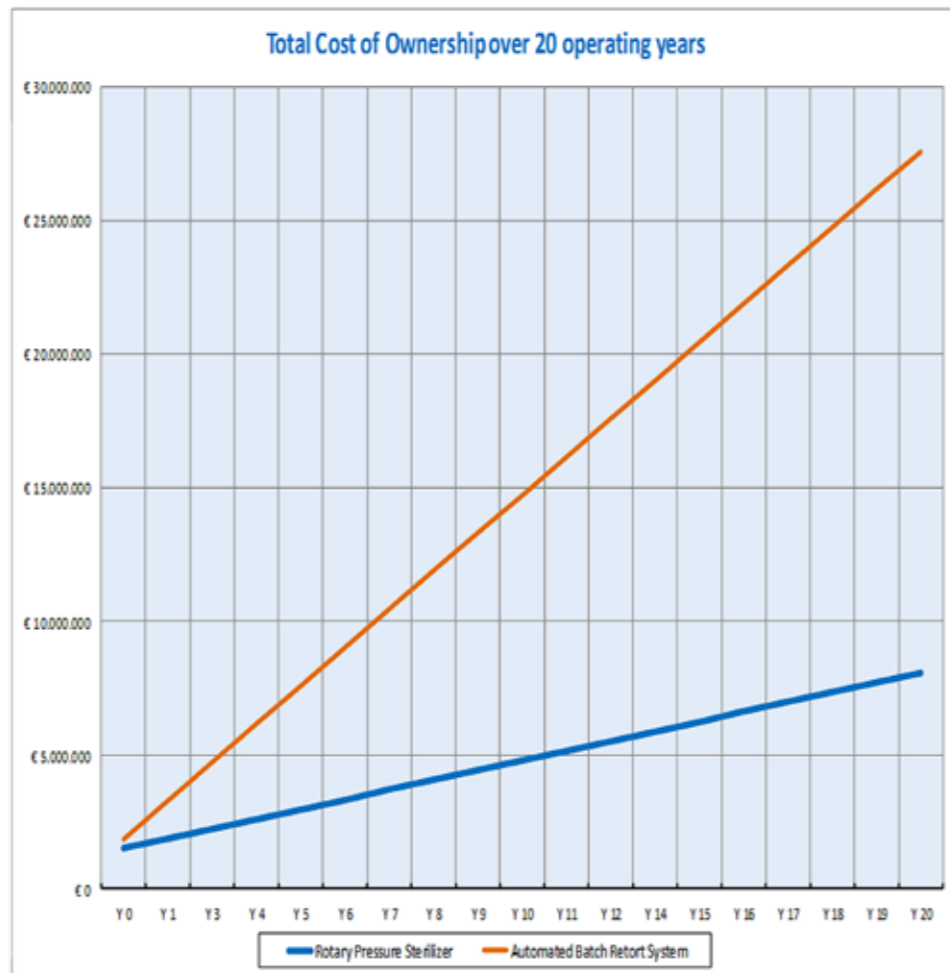


The following table displays a detailed comparison of the operation cost between a JBT Continuous Rotary Pressure Sterilizer and an ABR system for this particular case.

	Rotary Pressure Sterilizer	ABRS	Saving (units)	Annual Saving	Assumptions
Manpower [operator/shift]	0,25	1	0,75	€ 90.000	25 €/hr
Steam [kg/kg product]	0,21	0,324	0,114	€ 158.579	40 €/ton
Cooling Water [Liter/kg product]	0,1850	0,3616	0,1767	€ 12.288	2 €/m³
Electricity [kWh/hr]	14	174	160	€ 115.200	0,15 €/kWh
Air [Nm³/hr]	40	91	51	€ 6.120	0,025 €/Nm³
Maintenance Cost (Equipment) [€/year]	15 000	45 000	30 000	€ 30.000	
Product Savings *	2,5%	0,0%	2,5%	€ 652.050	0,75 €/kg
TOTAL ANNUAL SAVING			€ 1.064.237		

Product Savings

Edible mushrooms are difficult raw materials for the processing industry. Given the presence of various enzymes, mushrooms need a preliminary treatment to prevent adverse changes in color, sensory quality and to minimize weight loss during sterilization. Afterwards, when the mushrooms are canned and sterilized in a batch retort at 121°C for 20 minutes, they easily lose 15 to 20% of their net weight. While making the canned mushrooms shelf-stable with a Rotary Pressure Sterilizer, higher process temperatures are set during a shorter process time (HTST) resulting in 2,5% less weight loss.



CASE: Soy Milk - Line

4-tower Hydromatic Sterilizer vs. Automated Batch Retort System

This JBT customer was performing a comparative study for a new plant in Thailand to process bottled soy milk.

Container specifications:	Glass bottles Ø60 x 200 (300ml)
Line speed:	500 bottles per min. (30.000 bph)
Annual production:	54 000 metric tons 180 000 000 bottles/year
Annual production time:	6.000 hours/year



This ABRS configuration requires a floor space of approximately 400 sqm compared to 80 sqm for a Hydromatic Sterilizer.

Hydromatic serie:	ZCS 1,2-4/127-F29/224 Z Sterilizer for dairy products CS Continuous Sterilizer 1,2 Maximum working pressure [bar] in the sterilization tower 4 Machine configuration with 4 towers Carrier- and chain pitch is 127 mm 127 F= code bottles 29 bottles per carrier F29 for max bottle diameter Ø62mm 224 # of carriers in sterilization section
Sterilization time:	13 min.
Sterilization temp:	122 °C
Filling temp:	13 °C

INVESTMENT		
	ABRS	Hydromatic
Equipment Installed on plant site	€ 2.223.000	€ 3.041.935
Building Floor space [74,75 €/m²]	€ 189.901	€ 37.980 €
Other (incl. foundation)	€ 65.000	€ 115.000
Total	€ 2.477.901	€ 3.194.915

This configuration requires a floor space of 80 sqm. The budget for this configuration amounts € 3.041.935.

To produce the same volume in a fully automated process with batch retorts, the following Automated Batch Retort System is needed:

OPERATIONAL COSTS (per year)		
	ABRS	Hydromatic
Utilities		
Steam (t) [60,71 €/ton]	€ 573.682 €	€ 344.209
Water (m³) [1,92 €/cu m]	€ 63.419	€ 51.728
Electricity (kW) [0,10 €/kWh]	€ 50.027	€ 23.450
Air (Nm3) [0,02 €/nm3]	€ 5.165	€ 598
Utilities		
Labor (h)	€ 154.489	€ 77.245
Maintenance annual (parts)	€ 67.724	€ 26.545
Total	€ 914.507	€ 523.775

System	Item	Budget
Batch Retorts	3 x static retorts	1.190.000 €
Ancillary Equipment	Batches & layer pads	108.000 €
Load / unload Equipment	Loader / Unloader + Shuttle	925.000 €
		2.223.000 €



COUNT ON JBT TO HELP PROTECT YOUR INVESTMENT

JBT's greatest value in PRoCARE® services comes from preventing unexpected costs through smart, purposeful, and timely maintenance based on unmatched knowledge and expertise. PRoCARE service packages are offered as a maintenance agreement in various service levels, depending on your production and cost management requirements.



JBT LIQUID FOODS

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