

A Steam-Free Revolution: Sustainable Pasteurization Solutions for Juices and Purees



Sustainability and innovation

With global environmental concerns at an all-time high, **the agri-food industry is poised to make significant contributions to sustainability**. In the fruit and vegetable sector, food safety is paramount, and pasteurization plays a crucial role. Historically, steam has been the primary energy source for pasteurization since the Industrial Revolution. Despite advancements to cleaner combustion methods, such as using natural gas, steam generation still represents a significant carbon footprint.



**Delivering Innovations
for a Sustainable Future**



The Need for Sustainable Alternatives

There is an urgent need to develop sustainable methods for producing safe food while reducing environmental impact. An ideal solution would create a green circular process with a zero overall energy balance. Renewable energy sources, such as solar power, offer a promising path forward.

At JBT, we have successfully combined various technologies to design a machine that uses photovoltaic solar energy for pasteurization instead of steam.

JBT Sterideal™ Coil Heat Exchanger

The **JBT Sterideal™ Coil** system is a smart solution with a long history of application in the dairy industry. It has been extended to juices and beverages, including high viscous products, **with over 50 years of trusted experience**. This system offers high thermal regeneration efficiency, achieving 85% as standard and up to 93% excluding de-aeration. The coil system improves uniform heat transfer by up to 30% compared to straight tubes due to the Dean effect, which enhances mixing and heat transfer in curved pipes.

KEY ADVANTAGES

HIGH THERMAL EFFICIENCY



Thermal regeneration efficiency of 85% and up to 93%

ENHANCED HEAT TRANSFER



Improving heat transfer efficiency by 30% compared to traditional straight tubes

COMPACT DESIGN



LOWER OPERATIONAL COSTS



Our Sterideal Coil Heat Exchanger is FDA approved, ensuring the highest standards of safety and quality.



JBT Sterideal™ Coil Heat Exchanger

The **Coil system** has a **small and compact footprint** and eliminates the need for indirect steam-superheated water-product heat exchange, allowing for faster and more accurate temperature control. Additionally, the system features low operating costs, with minimal parts to overhaul and reduced product losses. It ensures **maximum aseptic safety** due to fewer gaskets and high-pressure resistance. The system's design safeguards temperature on parallel tubes and features a fully welded product channel in the shell-and-tube heat exchanger, providing ultimate product safety and full traceability.

The system also boasts FDA approval, maintaining product fibers and particles within their dedicated tubes. This ensures **minimal product damage** and **better product quality** with gentle particle handling. The system's unique and enhanced heat transfer results in optimal product quality, making it ideal for processing at higher product pressures.





The **JBT Sterideal™ Ohmic Heater** utilizes the electrical resistance of food to generate heat quickly and efficiently. The heating speed is impressive, with a 10°C/second heating rate compared to the typical 0.5°C/second rate of conventional tube heat exchangers. This **rapid heating** results in **shorter cooking times**, preserving the organoleptic properties of food such as color, texture, and taste, while retaining nutritional value. The product undergoes minimal structural damage, providing excellent processed quality in minimal operating time. Research indicates no protein denaturation at high temperatures when using ohmic heating. The technology volumetrically heats the entire mass of the food material, providing a homogeneous treatment and eliminating issues of overheating liquid foods containing large particles. Additionally, it is not subject to fouling, as there is no hot wall, and does not damage particles as conventional heat

exchangers do. The technology offers significant quality advantages for products with dices, liquid eggs, fruit and vegetable juices, purees, concentrates, isotonic/energy drinks, and soups and sauces with fish and meat. When combined with holding and traditional cooling, the system is ideal for aseptic treatment of high and low acid products. The modular, compact, and **flexible system ensures high energy efficiency of 92-95%, reduced maintenance costs, and extreme flexibility to process various products, including viscous and particulate ones.** Although the operating costs of ohmic heating (electricity) are higher than those of conventional steam-based systems, using green renewable sources for electricity can offset this, resulting in higher product quality.



KEY ADVANTAGES

SPEED AND EFFICIENCY



QUALITY PRESERVATION



MINIMAL STRUCTURAL DAMAGE



NON-FOULING DESIGN

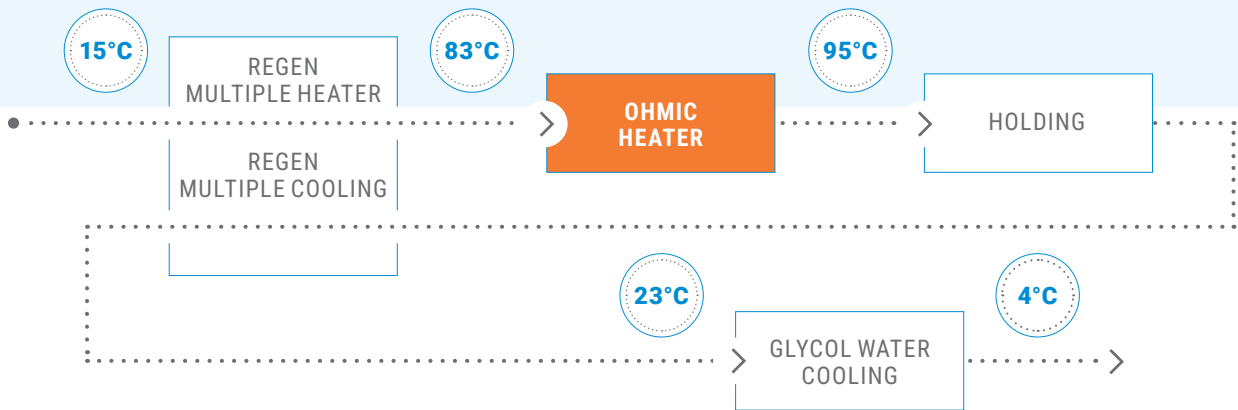


Combining Technologies for Sustainable Pasteurization

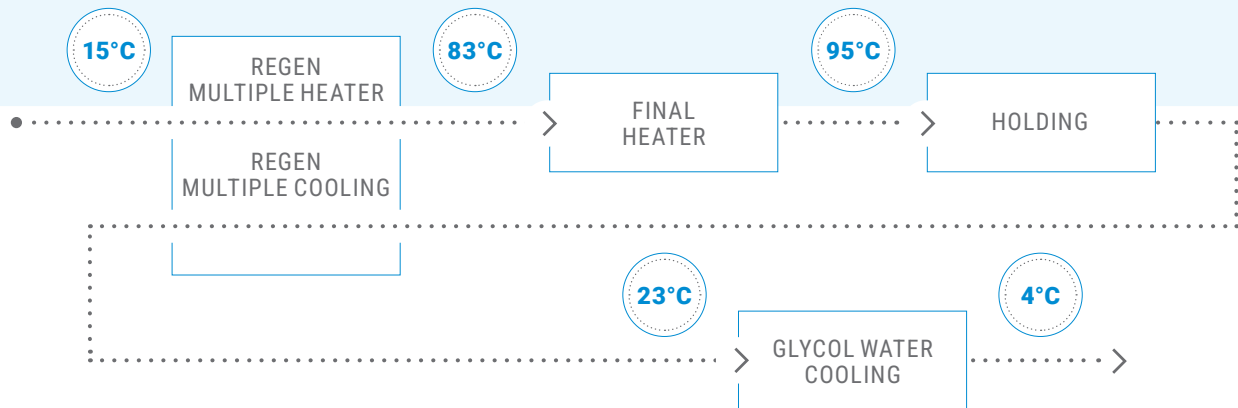
At JBT, we have **integrated the JBT Sterideal™ Coil Heat Exchanger with the JBT Sterideal™ Ohmic Heating Technology** to create a machine that eliminates the need for steam in pasteurizing juices and purees. This combination leverages the high thermal regeneration efficiency of the Coil and the rapid heating power of the Ohmic Heater.



COIL + OHMIC PASTEURISER - DIRECT REGENERATION (PRODUCT-PRODUCT)



COIL PASTEURISER - DIRECT REGENERATION (PRODUCT-PRODUCT)



In this configuration:

- ✓ **Energy Efficiency:** Only 15% of the heating energy is needed from the Ohmic Heater due to the Coil's regenerative preheating capacity.
- ✓ **Precision Control:** The system allows precise temperature management and product integrity, ideal for aseptic processing.



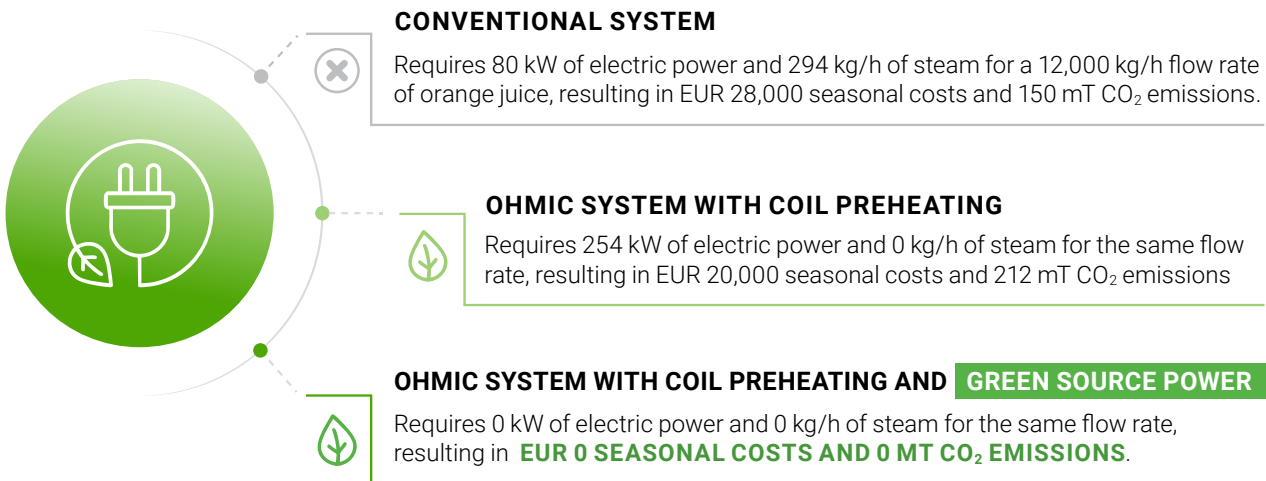
Operational Cost Comparison

A case study comparing the operational costs of Ohmic Heating versus Conventional Steam Heat Exchangers is outlined below, based on real industrial energy costs (Spain, May 2024).

For the **conventional pasteurizer**, with a flow rate of 12,000 kg/h of orange juice and a required heating power of 142,500 kCal/h, the steam consumption is 294 kg/h at 8 barg saturated and dry live steam, with a steam cost of EUR 36 per 1,000 kg of steam; the electric motor power requirement is 80 kW, with an electricity cost of EUR 0.038 per kWh. The running cost is EUR 14 per hour, leading to EUR 28,000 for a 2,000-hour season. The equivalent greenhouse gas emissions (CO₂ footprint) per season would be 150 mT CO₂.

In contrast, the **Coil + Ohmic** Pasteurizer, with the same flow rate and required heating power, has an ohmic efficiency of 92-95%, resulting in an electric power requirement of 174 kW, which added to the electric motor power becomes 254 kW. With electricity costing EUR 0.038 per kWh, the running cost is EUR 10 per hour, totaling EUR 20,000 for a 2,000-hour season. The equivalent greenhouse gas emissions (CO₂ footprint) per season would be 212 mT CO₂.

Energy costs vary by country and customer contracts with utility companies, which can affect the relative costs of Ohmic versus steam heating. However, if the Ohmic Heater uses **renewable energy sources such as photovoltaic solar panels**, running costs as well as CO₂ footprint could be zero.





Advantages of the Zero Emission Pasteurizer

In a scenario where renewable energy sources are utilized, the advantages of this system include eliminating the use of fossil fuels, utilizing green source electrical energy, and achieving zero heating energy costs with self-produced electricity.

If the infeed temperature is higher than the output temperature, no cooling energy is required, resulting in

almost zero running costs and a zero CO₂ footprint. This innovative approach makes the concept of a "Zero Emission Pasteurizer" a reality, representing a significant step forward in creating sustainable food processing solutions that meet the highest standards of food safety and quality while minimizing environmental impact.

KEY ADVANTAGES

NO FOSSIL FUELS



GREEN ENERGY INTEGRATION



MINIMAL RUNNING COSTS



ZERO CO₂ FOOTPRINT



Conclusion

The concept of a Zero Emission Pasteurizer represents a significant milestone in sustainable food processing. **By combining renewable energy sources with innovative technologies like the Coil Heat Exchanger and Ohmic Heating, JBT offers a solution that meets stringent food safety standards while significantly reducing environmental impact.** This development marks a transformative step for the food industry, aligning with global sustainability goals while enhancing product quality and operational efficiency.



COUNT ON JBT TO **HELP PROTECT YOUR INVESTMENT**

The profitability of your business depends on the performance, reliability and availability of your equipment. Our global team of experts are ready to provide technical advice/service, application adjustments, food safety advice, or productivity recommendations.

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