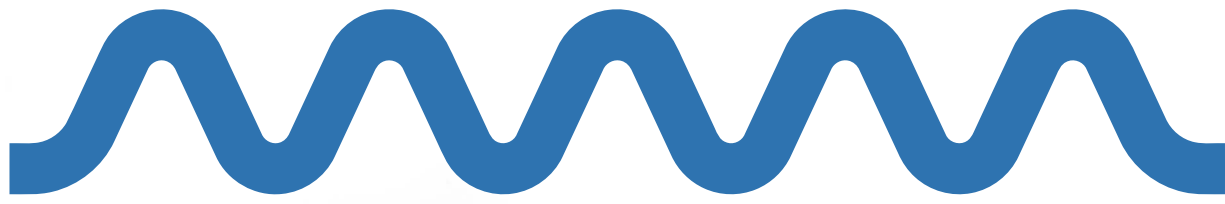


MICROWAVE AND RADIO-FREQUENCY TECHNOLOGIES GUIDE FOR FOOD APPLICATIONS

Together, we reinvent your processes with our
Microwave and Radio Frequency solutions since 1978





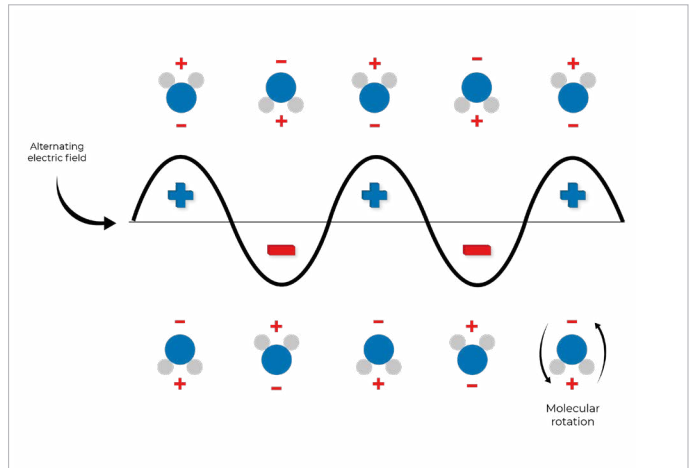
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HOW DO MICROWAVE AND RF WORK ?

Microwave and RF technologies are perfectly suited to improve thermal processes and to defrost, sanitize, cook, heat, and dry all kinds of foodstuffs thanks to their ability to heat quickly and homogeneously. These two technologies are complementary and they both have their advantages depending on the products to be treated.

MW and RF are heating technologies based on the dissipation of electromagnetic energy within the targeted product. The heating process is generated by the quick polarity reversal of the electromagnetic field which creates vibration and rotation of the polarized molecules inside the material. This phenomenon is made possible thanks to the dielectric loss properties of materials. As water molecules are highly polarized, RF and microwave technologies are very effective at heating up wet materials. Indeed, they have the ability to evaporate water rapidly and selectively from many materials.

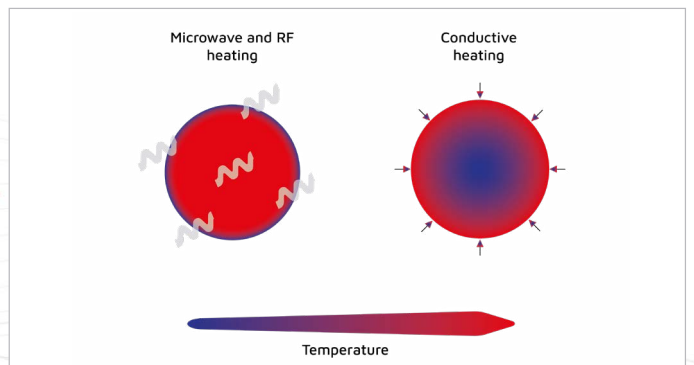


With a traditional heating solution heat is transferred by conduction from the outside to the center of the product. Microwave and radio frequency technologies heat the product uniformly: this is called volumetric heating.

Homogeneous heating

Unlike conventional solutions, where heat is transferred by convection or conduction from the outside to the product through its surface, microwave and RF heat the entire product mass directly and homogeneously. We call it "volumetric heating".

Thanks to these properties, SAIREM technology offers fast and reproducible results when used within industrial drying or food processing systems.



Almost instantaneous

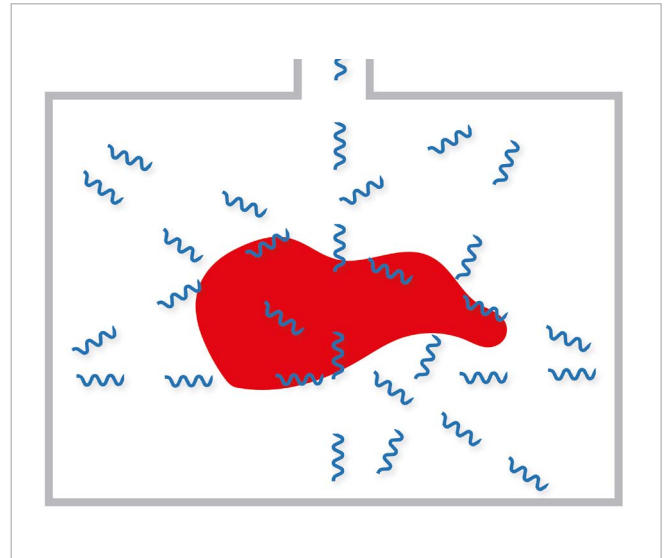
Microwave and radio frequency have the ability to heat thanks to the dielectric loss properties of materials. This phenomenon is caused by the vibration and rotation of polarised molecules inside the material, induced by the quick polarity reversal of the electromagnetic field (a million times per second).

Heat generation is almost instantaneous and allows for a perfectly controlled process thanks to rapid, uniform heating. Moreover, almost all the energy is transferred to the treated product, drastically reducing energy losses.

Microwave technology

Microwave energy is generated thanks to a microwave generator and must be guided by waveguides up to the cavity. Their wavelength varies between 10 cm and 30 cm depending on the frequency used. They are highly effective for treating different types of products at high speed, and in particular those which have an irregular shape, like pieces of meat for example.

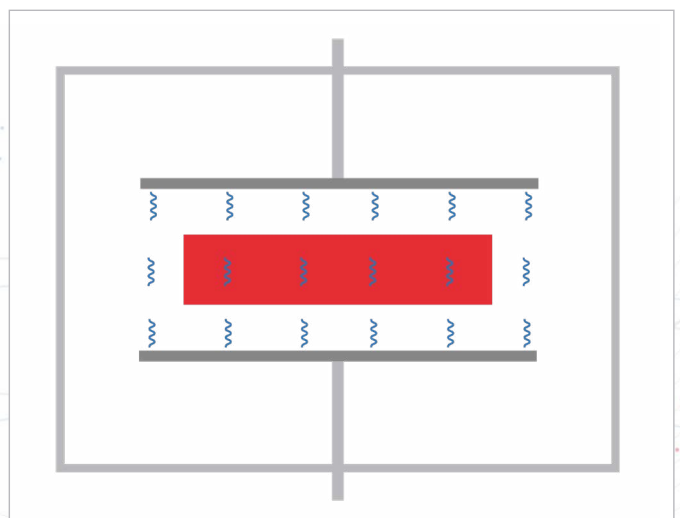
Thanks to their ability to heat uniformly, microwaves are often used to quickly heat or dry industrial material or foodstuffs. They are highly efficient for the pasteurization of liquid products and sanitizing operations.



Radio-frequency technology

Generated by a RF generator, radio frequency energy moves from one electrode to the other inside the cavity and passes through the treated material. This capacity makes them more effective on products of regular size and shape which are thus heated uniformly.

Thanks to its longer wavelength, around 10 m, radio frequency energy can penetrate deep into the material and thus heat thick products. It heats more slowly than microwaves and can be used to treat more delicate products which require gentle heating.



Some processes and products



Pasteurization of dates



Fruit drying



Beef tempering



Cocoa bean roasting



Insect drying



Fish block tempering



Spring roll cooking



Chicken tempering



Butter tempering



Jam pasteurization



Fruit tempering



Seed sanitizing



Dessert cooking



Vegetable tempering



Coffee bean roasting



Minced meat tempering



Fish thawing



Herb sanitizing



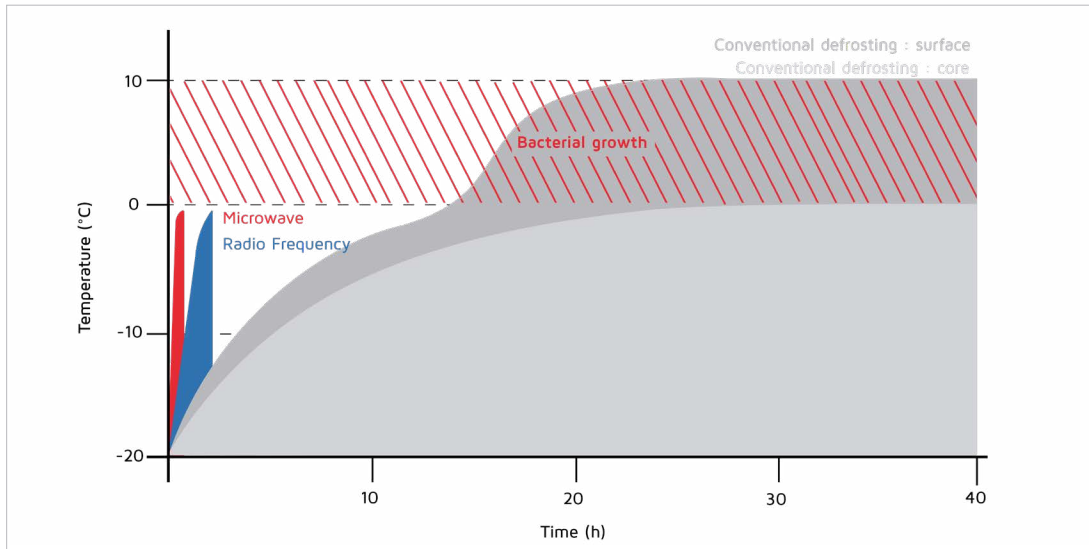
Pork tempering



Edible flower sanitizing

TEMPERING AND DEFROSTING

Defrosting and tempering by microwave or RF has many advantages compared to traditional processes :



Speed : while classical defrosting and tempering methods take hours or days to temper or defrost your product foods, microwave and radio-frequency technologies take from 3 to 20 minutes. In addition, there is no need to waste time unpacking your products. They can easily be tempered or defrost in their original packaging (plastic film, cardboard, plastic box, etc).

Savings : the speed and uniformity brought by the microwave and radio frequency processes minimize the product drip losses and degradation. By completely eliminating the weight losses caused by conventional defrosting methods (which can represent up to 8% of the ingredients to be transformed) you immediately improve your raw material yield. The payback can be as short as 6 to 12 months. In addition to saving money, you also save space thanks to the small footprint of our defrosting equipment. Our machines replace large tempering or defrosting rooms and eliminate the need for space to house the pallets waiting to temper slowly in the traditional way.

Safety : defrosting food products with a traditional method can take hours or even days, increasing the health risk. Thanks to the rapidity of microwave and RF tempering and defrosting processes, bacterial growth is limited. On demand, and for optimal food safety, our tunnels allow you to separate the incoming and outgoing product flows to avoid cross contamination. In addition, microwave and RF technologies are safe and SAIREM systems are closed and fitted with sensors to prevent microwave/RF leakage.

Quality : unlike some traditional methods, RF and microwave tempering and defrosting preserves all the organoleptic properties of your food products: color, weight, taste, vitamins, nutrients... Moreover, the temperature homogeneity of +/- 1 °C throughout the food block allows for better post processing of your products.

Meat and fish tempering

- Microwave and RF are perfectly adapted to thaw meat and fish products. These technologies work with all kinds of meat: beef, pork, poultry... They are effective on raw or processed products (like sausages for example).
- The temperature homogeneity of ± 2 °C throughout the food block allows for better post processing of your products.
- Microwave and RF tempering processes allow you to heat significant quantities of products, presented in the form of pieces or blocks of meat and fish, with or without packaging.
- This tempering process is extremely fast: you will be able to process several tens of tonnes of meat products in one day versus several days with traditional processes.
- Thanks to the speed and performance of the microwave and RF tempering process, bacterial development is significantly reduced. Your meat products are tempered in a totally safe way.
- Unlike classical tempering processes such as tempering chambers, microwave and RF processes **significantly prevent drip loss**. It's a very economical way to process your meat products.



Fruit and vegetable thawing

- The gentle heating process of RF and microwave technologies totally respect the organoleptic properties of fruits and vegetables: there is no oxidation or color change, no alteration in taste or texture and no nutrient loss. Your products remain attractive and healthy.
- Thanks to the speed of the process, bacteriological risks are greatly reduced. There is no risk of bacteriological development as there can be in a defrosting room.
- You save precious time by using the microwave or RF thawing process. Thanks to the rapidity of this solution, you will be able to temper your products in a few minutes rather than hours.



Defrosting butter

- Microwave technology is a good solution to defrost fatty food products such as butter. Indeed, the high fat content of this product makes it possible to defrost butter completely, up to $+4$ °C.
- We obtain a product that is homogeneously thawed and ready to be worked.



Our solutions*

* Actual capacity may depend on initial and final temperatures.

Batch tempering ovens



AMW200



AMW200 DUAL



AMW400

Power (kW)	10 kW	10 kW	60 kW
Capacity (kg/h)	Up to 400 kg/h	Up to 440 kg/h	Up to 1200 kg/h
Dim (LxWxH)	2.1 x 2.3 x 2.3 m	2.1 x 2.3 x 2.3 m	3.6 x 3 x 2.6 m

Microwave continuous flow tempering tunnels



TMW35



TMW75



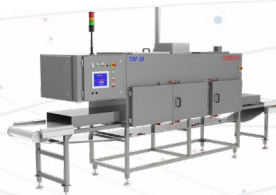
TMW150



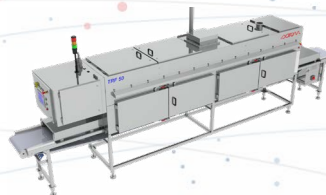
TMW225

Power (kW)	35 kW	75 kW	150 kW	225 kW
Capacity (t/h)	Up to 1.5 t/h	Up to 3 t/h	Up to 6 t/h	Up to 9 t/h
Dim (LxWxH)	7.9 x 1.8 x 1.9 m	9 x 1 x 2.4 m	12 x 1 x 2.4 m	15 x 1 x 2.4m

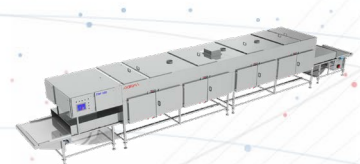
Radio frequency continuous flow tempering tunnels



TRF30



TRF50



TRF100

Power (kW)	30 kW	50 kW	100 kW
Capacity (t/h)	250 kg/h	400 kg/h	800 kg/h
Dim (LxWxH)	5.4 x 1.12 x 2 m	7 x 1.12 x 2 m	16.1 x 2.1 x 3.9 m

SANITIZATION AND DISINFESTATION

The process of sanitization and disinfestation using microwave and RF technologies consists in exposing the product to a microwave or radio frequency field during a short time within a temperature-controlled processing cavity. The temperature of the cavity, the intensity of the field and the process duration depend on the product to be treated and the parasite to be eliminated.

Eco-friendly process : The use of a sanitization process by microwave and radio frequency avoids the use of chemicals and thus meets the demand of suppliers and producers. This eco-friendly process is therefore **compatible with organic certification**. This sanitization and disinfestation solution is extremely quick, economical and particularly effective to destroy mold, bacteria, larvae and other insect colonies.

Selectivity : Thanks to the polar properties of water, microwaves and radio frequencies have the ability to heat water faster than many materials. In the case of spices and seeds, the MW and RF heat and destroy larvae and bacteria faster than the processed product due to their high water content. Consequently, parasites are eliminated and the properties of the treated product preserved.

The solutions developed by SAIREM offer an economic and efficient process for the sanitization or disinfestation of dried food and ingredients such as: flour, cereals, spices, lentils, beans, mushrooms, cocoa beans, nuts, seeds, cannabis, milk powder, ...

Sanitization by microwave and RF is well adapted for products like: seeds, dates, flour ...



Our solutions*



Batch Sanitizer



Continuous Flow Sanitizer



Liquids Sanitizer

Power (kW)	10 kW	16 kW	50 kW or 200 kW
Capacity (kg/h)	Up to 150 kg/h	Up to 250 kg/h	Up to 3 t/h
Dim (LxWxH)	2.1 x 2.3 x 1.9 m	6.7 x 1 x 2.3 m	1.8 x 1.7 x 2.2 m

* Higher capacity are availables

PASTEURIZATION AND STERILIZATION

Microwave or RF pasteurization is a high-speed process that can be carried out continuously. This solution has considerable logistical advantages, including product handling and production scheduling.

Rapidity : microwave and RF pasteurization is really quick and homogeneous to reduce microbial load at the core and the surface of the food simultaneously. This homogeneity is allowed by the microwave heating process and is more difficult to achieve with processes that generate conventional heat transmission (steam, hot air, hot water). Unlike traditional processes, the required pasteurization level is achieved in a matter of seconds instead of hours.



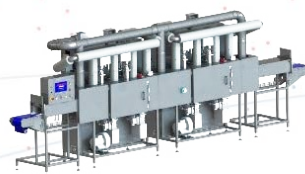
Quality : this process greatly reduces the risk of product degradation. Indeed, it keeps the organoleptic characteristics of your food product. Thanks to the speed of the process, the freshness of the product is preserved, even for heat-sensitive food. Microwave and radio frequency pasteurization are a good answer, capable of achieving these apparently conflicting requirements: fresh taste and safe food with a long shelf-life



Savings : unlike conventional pasteurization and sterilization systems, microwave and RF solutions allow significant savings in time, space and energy. It is a quick and economical heating process that transmits the energy directly into the product and avoids losses into the surrounding atmosphere.

Thanks to their heating properties, all kind of food products can be pasteurized and sanitized through microwave and RF: seeds, herbs, flowers, flour, ready-meals ...

Our solutions*



Continuous Flow Pasteurization



Liquids Pasteurization

Power (kW)	16 kW	50 kW or 200 kW
Capacity (kg/h)	300 kg/h	3.5 t/h
Dim (LxWxH)	6.7 x 1 x 2.3 m	1.8 x 1.7 x 2.2 m

* Higher capacity are availables

HEATING AND DRYING

Our equipment associate microwave or radio frequency with hot air, steam or vacuum, for excellent performances in various applications such as drying herbs and plants, fruits, vegetables, cereals, insects ...

Homogeneous heating : with microwave or RF drying, the process will occur at the same rate inside the product and on the surface, avoiding dilation and deformation.

Selective drying : with this process, you can dry a specific part of your product, without to damaging the final product properties or quality. Our machines are designed so that drying temperatures can be perfectly controlled, at atmospheric pressure or under vacuum.

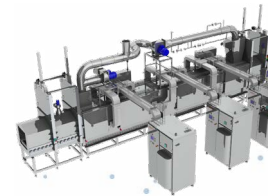
Fast and gentle : selective drying to the core of the product is quick and homogeneous while preserving the food's properties, as the microwaves and radio frequencies heat faster the water to be evaporated than the product itself.



Our solutions



Batch Drying



Continuous Drying

Power (kW)	10 kW	300 kW
Capacity (kg/h)	Up to 10 kg of water evaporated /h	Up to 300 kg of water evaporated /h
Dim (LxWxH)	2.1 x 2.3 x 1.9 m	11 x 2 x 4 m

RAPID COOKING

Microwave and RF technologies have many advantages when it comes to rapid cooking. This process allows you to cook your products evenly and may deliver results impossible to achieve with traditional cooking.

Precision and homogeneity : thanks to the power control offered by microwave technology, the cooking process is much more precise and adapts better to different products being treated. The generation of microwaves which pass through the product is ideal to achieve a homogeneous cooking on the surface and in the core of the product.

Process combination : for optimal results depending on your needs, microwave technology can be combined with complementary processes such as infrared, forced air or steam. SAIREM has years of experience in combining technologies and will be able to advise you to achieve the best results.

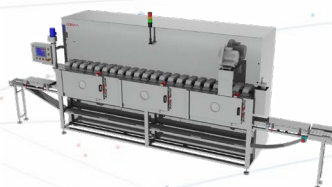
Time-savings : traditional cooking processes are made longer by the formation of a crust. By cooking the product evenly, microwave technology is much more efficient and above all much faster. The product cooks in a few minutes and is ready to use. It can also be simply preheated before being fried, for example.

Healthy way to cook : by cooking the product inside out and with no contact with hot elements, the level of fat can be considerably reduced. You can easily keep your recipes healthy by using microwave and RF cooking process.

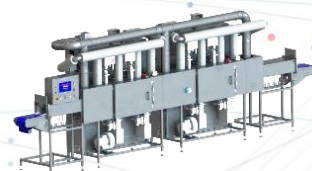
Products like flans and spring rolls, can benefit from microwave and RF cooking.



Our solutions



Continuous Cooking



Continuous Cooking

Power (kW)

44 kW

16 kW

Capacity (kg/h)

Up to 400 kg/h

Up to 150 kg/h

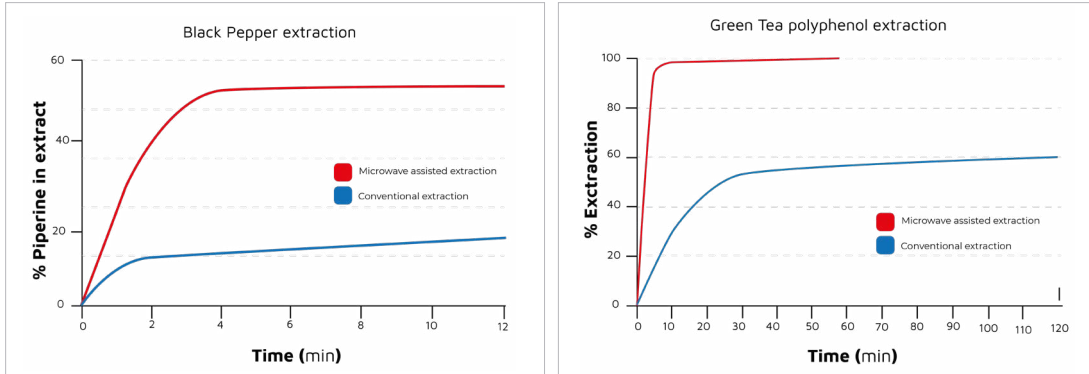
Dim (LxWxH)

6.6 x 1.3 x 2.4 m

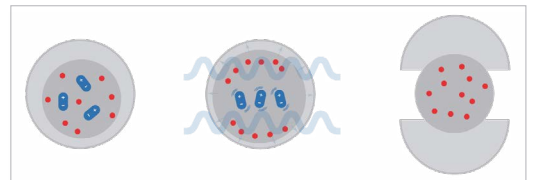
6.7 x 1 x 2.3 m

COMPOUNDS EXTRACTION

Microwave-assisted extraction offers several advantages over more traditional techniques, such as shorter extraction time, lower solvent use, higher compound extraction rates, and overall lower processing cost.



Selective process : microwaves have a low thermal effect on edible oils. They act selectively on the plant cells, vaporizing the water matrix, causing the breakage of the cells and directly releasing aroma in the microwave cavity. This leads to a high extraction rate while fully preserving the organoleptic and physical-chemical properties of the extracted product.



Improved yield : combined with a traditional solvent, microwave assisted extraction is very effective because it increases the extraction kinetics and thus the yield of the process. Our microwave solutions can process anything from a few kgs to several hundreds of kgs of product per hour, depending on your production rate.

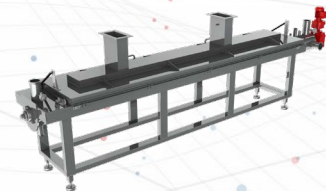


Microwave assisted extraction of essential oils can be done from all kinds of plants, flowers and herbs.

Our solutions



Lab-Scale Extraction



Industrial-Scale Extraction

Power (kW)

3 kW to 6 kW

72 kW

Dim (LxWxH)

1.1 x 0.7 x 1.5 m (3kW)

1.1 x 0.9 x 1.6 m (6kW)

5.5 x 1 x 1.3 m

ABOUT SAIREM



SAIREM is a world leader in industrial microwave and radio-frequency applications, with more than 5000 references in operation in 70 countries, from the standalone 200 W solid-state generator to the fully automated processing line delivering 700 kW.

Today, SAIREM offers the most advanced range of industrial microwave and radio frequency equipment for thermal processing and plasma generation.

Key figures



Created in 1978



60+ employees



5 000 machines
across 70 countries



8 nationalities
in our team



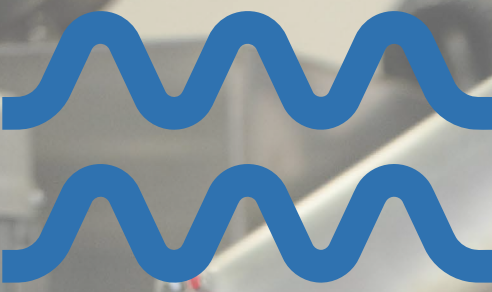
15M€ yearly turnover



90% export share



10% of total revenue
invested in R&D



CONTACT US !

welcome@sairem.com - www.sairem.com

