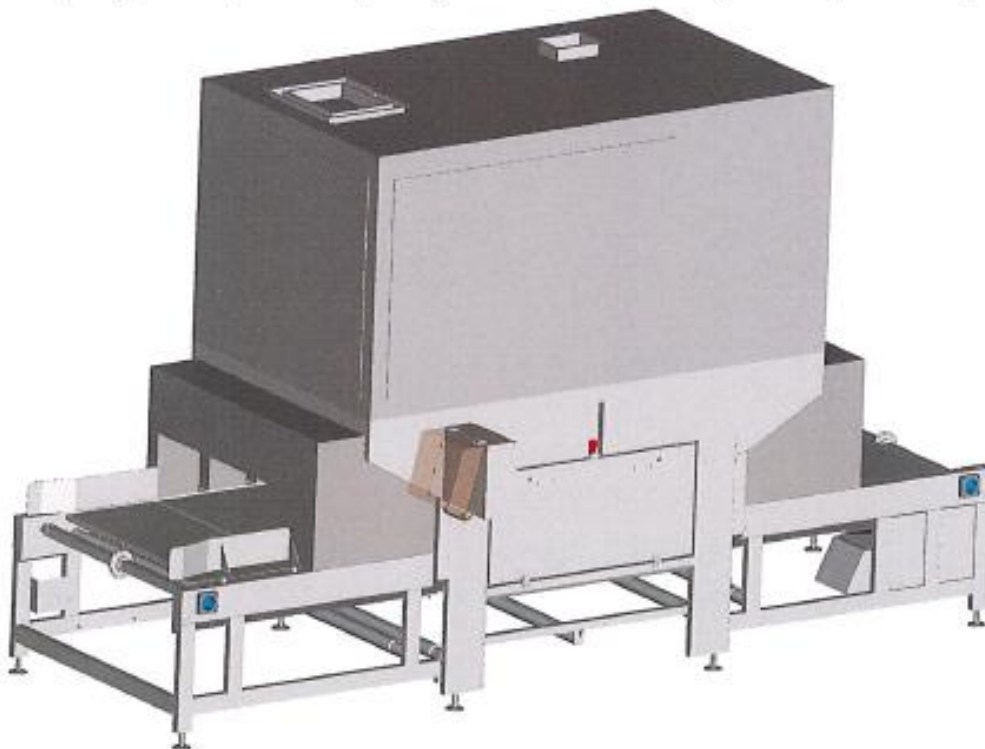


With reference to your kind enquiry, we are pleased to offer you, under the following terms of sale:

RADIO FREQUENCY DEFROSTING EQUIPMENT

STALAM type "RF 20 kW"

The machine is designed for the **continuous tempering - partial thawing** of blocks or IQF frozen raw materials for the food industry, which are compatible with the radio frequency technology, like meat (beef, pork, lamb, etc.), poultry (chicken, turkey, etc.), fish & seafood, fruit, vegetables, ready meals, dairy products, etc. either packaged or "naked", depending on the type of conveyor belt.



All information contained in this offer are confidential and cannot be used, reproduced or communicated to any third party without STALAM's prior written consent.

PRODUCT SPECIFICATIONS AND MACHINE PERFORMANCES

Product	Packaging & Block dimensions	Inlet & Outlet Temperature	Throughput
Blocks of salmon scrape meat	Carton + PE film 58x39x12 (h) cm, 21 kg Containing 3 blocks overlapped	From -18 °C to around -1.5/-0.5°C 20min	400 - 450 kg/h
IQF vegetables Paprika	Carton + PE film 26x39x26(h) cm, 10 kg	From -18 °C to around -4/-2°C 15min	500 – 550 kg/h
Pesto sauce	Carton + PE bag 36x20x20 (h) cm, 9 kg	From -18 °C to around -4/-2°C 20min	400 – 450 kg/h

Energy consumption :

Salmon scrape meat
580 x 390 x 120mm
From -18C to around -1C (as average final temperature)
75 – 85 kWh/ton

IQF vegetables paprika
From -18C to around -3C (as average final temperature)
55 – 65 kWh/ton

The RF power required will be about 40 to 50 kW to treat 1 ton of product per hour and raise its temperature from -20°C to -2°C (as an average), whereas it will take about 20 to 30 kW to raise the temperature of the same quantity of product from -20°C to -4°C (as an average).
No drip loss up to -2°C final product temperature.
The machine can process products having a max. thickness of 29 cm.
Production capacities can vary depending on the product type to be defrosted, its dimensions and weights and the final temperature required.

MAIN SPECIFIC FEATURES OF THE EQUIPMENT

- ❖ Radio Frequency at **27.12 MHz** that can be used for ISM (Industrial, Scientific, Medical) purposes without restrictions in all the world.
- ❖ Compliance with the **EN 55011** and **EN 12198** standards relating to electromagnetic emissions. Our equipment is fully compliant with the standards and requires no additional protective measures.
- ❖ Construction in AISI 304 **stainless steel** submitted to anticorrosion treatments (passivation, pickling) and shot-peening finish.
- ❖ Water protection level **IP65**: the external protection boxes of the RF generator are made of insulating sandwich-type panels with sheeting and bearing frame in AISI 304 stainless steel. Suitable small heaters are installed inside the protection boxes for preventing the condensation. The machine is fully washable and chemical detergents can be used. The control panel is protected with a Polycarbonate transparent cover against the water jet.
- ❖ The RF generator is **integrated** in the machine and placed on the top of the processing chamber.
- ❖ Air cooling system of the generator designed for exploiting all the nominal life of the triode.
- ❖ **Wide conveyor belt** (140 cm) made of certified food-grade rigid polypropylene (modular flat-top chain type) for minimising the maintenance costs; it is suitable for products packaged in materials (polymer film, cardboard, etc.) compatible with the radiofrequency technology.
- ❖ Built-in conveyor belt & tunnel **washing facilities** and full internal access for cleaning through the multiple side panel doors.
- ❖ **Touch-screen** Control Panel and Siemens **PLC** control system for multiple product recipes and fault diagnosis.

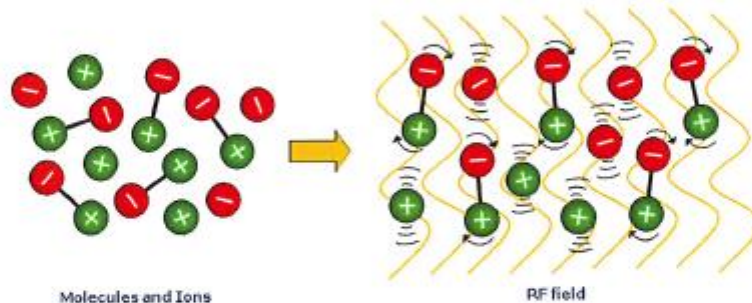
DESCRIPTION AND ADVANTAGES OF THE RF DEFROSTING METHOD

Radio Frequency defrosting

The traditional defrosting methods (air, water, etc.) introduce a number of difficulties directly related to the heat transfer mechanisms: slow process (hours, sometimes days); bacteria growth in the product; high drip loss (economic loss); deterioration of the product surface; batch processing (high handling costs, risk of breakage, bruising and other damages to the product due to such handling).

These drawbacks can be avoided thanks to the ability of radio frequency (RF) to rapidly generate heat volumetrically within the product. The heating process is fast, uniform and controlled, resulting in a significant reduction of drip losses. It also offers great flexibility in the production schedules and is the ideal solution for many tempering, softening and defrosting processes.

The product is placed on the machine's conveyor belt and is transferred through the RF unit (tunnel) passing between upper and lower metallic plates (electrodes). When the RF generator applies high frequency alternating voltage between these plates, the dipolar water molecules of the frozen product will vibrate and rotate in the attempt to align themselves according to the fast changing opposite plates polarities. This phenomenon causes intermolecular friction, which will in turn generate heat rapidly and uniformly within the whole product mass regardless of its size, weight, shape and thermal conductivity.



The amount of heat generated inside the product and the defrosting time are accurately controlled through the voltage applied on the electrode plates and the speed of the conveyor belt.

Benefits of the RF defrosting method.

- ❖ Defrosting is achieved in **minutes** rather than hours/days, even for large product blocks and, if necessary, directly inside packaging used for storage or retail distribution (carton boxes, polyethylene bags, etc.).
- ❖ The **processing speed** and **uniformity** minimise product degradation: **no drip loss**; no deterioration of organoleptic, chemical or physical properties; **no bacterial growth**; thus the very best product quality is preserved.
- ❖ Radio frequency defrosting can be carried out **continuously**, with significant logistical advantages in product handling and production scheduling. The production can be organised according to "just-in-time" criteria – a great advantage in case of sudden orders, last-minute changes in the order under processing, etc.
- ❖ Radio frequency equipment requires much **less floor space** compared to the traditional, large defrosting rooms or equipment; **overall processing costs** can also be reduced drastically compared to conventional techniques.

Main advantages of the RF 27.12 MHz vs. MW 915 MHz defrosting technology

- ❖ A simple but effective "rule of thumb" states that the non-ionizing electromagnetic waves (to which RF and MW belong to) can **penetrate** dense materials up to a depth of about 1/10 of their wavelength, that is **11 m for RF 27.12 MHz** and 32 cm for MW 915 MHz. It means that, whilst radio frequencies can easily heat up uniformly a product whose size is in the range of a meter, microwaves can penetrate only smaller layers, in the range of a few centimeters.
- ❖ The RF field is perfectly **uniform** between the electrodes; the product absorbs the RF energy evenly and diffusely, notwithstanding its shape and size consequently the risk of hot/cold spots is minimised. On the contrary, MW is irradiated into the process volume by a multiple point-source; the energy absorption by the product is a **random** (statistical) phenomenon which cannot be controlled accurately; an uneven treatment and **hot/cold spots** are common, especially when a batch machine is used. The turntable of the batch machine can only partially compensate this problem.
- ❖ The MW power is "emitted" in pre-determined quantities by the generator, while the RF power is just "made available" to the product:
 - contrary to MW, the RF power delivered is "**self-adjusting**" according to the actual product mass between the electrodes;
 - contrary to MW, the specific RF energy (Wh/kg) absorbed by the product does not depend on the quantity of product fed to the machine;
 - with RF the target product temperature is achieved **consistently and uniformly** irrespective of product flow;
 - with RF higher temperature targets can be attained **safely**.
- ❖ In the STALAM RF defrosters, the generator, its cooling system, the electrical board & controls, are all placed on the top of the process tunnel, suitably enclosed in an IP65 cubicle. Consequently, there is no need for a separate room or a "mezzanine" to place the generators and its ancillary devices & controls, as required by commercial MW defrosters (tunnel type).
- ❖ **Long inlet & outlet tables** combined with a **wide conveyor belt** that can accommodate a large quantity of product at once, do not require the continuous presence of the operator for the machine loading and unloading operations.
- ❖ Long life of the **triode**: **12,000 - 15,000 hours** vs. approx. 8,000 hours of the magnetron (MW).

DESCRIPTION AND TECHNICAL FEATURES OF THE MACHINE

Inlet and outlet heads

Made of a load bearing, heavy duty frame in stainless steel AISI 304. Complete with:

- . motorization, guiding/tracking rollers for the conveyor belt;
- . inlet and outlet tables in stainless steel rods;
- . inlet and outlet mouths in stainless steel, fitted with fully welded shielding structures.

Inlet and outlet heads length: inlet head 1.85 m (inlet table 0.85 m)*;
 outlet head 1.85 m (outlet table 0.85 m).

** +10 cm for the conveyor belt made of solid-surface reinforced polyester*

Conveyor belt

Made of certified food-grade rigid polypropylene modules for products with packaging only.

Width: 1.4 m.

It is guided by tracking and tensioning rollers; the driving roller is connected to a motor and related reduction gear; the speed is adjusted through a frequency inverter; it is provided with a high-speed facility for rapid emptying of the treatment cabinet and for off-line washing operations.

Automatic belt washing system.

Available on request:

- . conveyor belt made of solid-surface reinforced polyester for naked and packaged products.
- . block height detector.

Treatment cabinet

Made of a load bearing, heavy duty frame and sheeting, designed for easy washing and sanitation operations; all in stainless steel AISI 304. Complete with:

- . capacitive electrodes system in stainless steel, made up of interconnected parallel cylindrical rods, insulated with polyethylene sleeves, complete with tuning and voltage-balancing inductances;
- . total working surface: $1.5 \text{ m} \times 1.4 \text{ m} = 2.1 \text{ m}^2$;
- . lateral inspection doors, designed for easy and quick access to the cabinet;
- . motorised multi-position upper electrode for processing products with different height;
- . automatic pre-washing of the processing chamber.

Length of the cabinet: 2.0 m.

Radio frequency generator

Entirely designed and manufactured by STALAM for the specific industrial application, having high efficiency - about 70% energy conversion - and outstanding reliability. All components are easily and quickly accessible through the inspection doors. The external protection boxes (IP65) are made of insulating sandwich-type panels with sheeting and bearing frame in stainless steel AISI 304. Small heaters are installed inside the protection boxes to prevent the condensation.

Complete with:

- . feeding stage with maintenance-free air-cooled high voltage transformer, set of rectifying bridges, connection to the oscillating circuit through blocking capacitors; control and protection circuits;
 - . RF generator, of the lumped-components type, with class C oscillator fundamentally made up of: vacuum triode, LC resonant circuit, variable capacity coupling circuit for RF power adjustment; measuring and visualisation circuits;
- working frequency (I.S.M.): $27.12 \text{ MHz} \pm 0.6\%$;
- maximum RF output power rated: 20 kW;
- . air cooling system of the triode by means of forced air, including: centrifugal fan, air filters easily accessible for periodic cleaning or replacement, ducts to carry away the warm air from the triode; control and protection circuits.

Electrical services board and control panel

Electrical services board including electric and electronic components for control, command and protection.

Control, command and check-panel at the edge of the machine equipped with **Siemens S7-1200 PLC** and **Siemens Simatic HMI KTP900 "touch-screen" O/P**. Main functions:

- . "auto - manual" operation mode;
- . "on - off" RF power delivery, conveyor belt, ancillary equipment;
- . "+ / -" RF power adjustment;
- . alarms, fault diagnostic and management;
- . reset and emergency push buttons;
- . selection of tempering programmes / recipes with "save" and "recall" facilities for the automatic management of the tempering process for various products. Possibility to manually change the processing parameters: speed of the conveyor belt, height of the upper electrode, voltage between the electrodes.

Available on request:

- . *EWON for remote assistance.*

Components, safety features and compliance with international standards

All components used are of the best international makes and amply oversized to guarantee the highest level of reliability.

All safety protections are provided, such as inspection doors locked by means of blocking handles, stainless steel sealing strips, disconnection micro-switches of the high voltage circuits, special configuration of the inlet and outlet mouths preventing emissions of electromagnetic field.

All electric and electronic equipment complies with CEI - IEC / EN Standards. The high voltage and low voltage circuits are completely separated; all electro-mechanical components are assembled on panels and identified by number plates; the conductors are provided with terminals identified by specific numbering.

The machine is also equipped with electromagnetic interference suppression systems, in order to comply with specific regulations in force in the different countries.

The equipment is provided with the CE mark.

Size and weight of machine

Length: 5.70* m. Width: 2.00 m. Height: 3.53 m. Weight: about 4,100 kg.

** +10 cm for the conveyor belt made of solid-surface reinforced polyester*

Utilities required

<u>Electrical supply:</u>	three-phased 400 V $\pm$ 5%, 50 Hz $\pm$ 2% or other supply available at the buyer's facility Installed power: 32 kVA
<u>Water (for washing):</u>	min. 1 bar; max 15 bars; max 50°C for the conveyor belt
<u>Air (for cooling):</u>	uncompressed; Tmin 0°C, Tmax 40°C; at max power the dissipated power is 7-8 kW; ΔT = around 3-4°C

DOCUMENTATION SUPPLIED WITH THE EQUIPMENT

In English and Finnish

CE certification including Declaration of Conformity and Declaration of compliance

CE certification with 2006/42 EY/ Machine Directive

Before delivery Thomeko Oy will give report for Kokkikartano ones/month what is delivery schedule

Contractors liability reports from Thomeko and Stalam

Preliminary, one month after the order confirmation:

- . transport, handling and assembling instructions;

Definitive, upon commissioning:

- . electric drawings;
- . components list;
- . operation and maintenance instructions handbook.