STALAM
Radiofrequency Microwave Infrared

SEAFOOD

Rapid Defrosting with
Radio Frequency

BENEFITS OF THE RF TEMPERING & THAWING METHOD

- defrosting is achieved in minutes rather than hours or days, even for large product blocks and, if necessary, directly inside packaging used for storage (carton boxes, polyethylene bags, etc.);
- the processing speed and uniformity minimise the risk of product degradations: no-drip loss; no deterioration of organoleptic, chemical and physical characteristics; no bacterial growth. Thus the very best product quality is preserved;
- The high processing speed of the radio frequency defrosting can be carried out continuously, with significant logistics 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.

RADIO FREQUENCY DEFROSTING

In the fish processing industry, more than half of the raw material utilised is frozen: squid, mackerel, shrimps, prawns, mussels, calamari, ...etc.
Seasonal fluctuations in the availability of fresh fish are a serious impediment to the continuous operation of processing plants: it is possible in principle to regulate fish supply discontinuities by freezing, without significantly impairing the quality of the final product.

When fish has to be processed, it is often first tempered or defrosted using conventional methods available. These methods introduce a number of difficulties directly related to the heat transfer mechanisms:

- heat transfer is an intrinsically slow mechanism and, the larger the size of product, the longer is the time necessary for the defrosting process; this introduces a long delay between the removal of the fish from the cold stores and the next processing stage;

- since bacteria survive at negative storage temperatures, in the slow defrosting process there is a considerable opportunity for bacteria growth in the product;

- proportionally high drip losses may result from lengthy defrosting time, causing changes in the product texture and leading to an immediate and significant economic loss;

- it is not possible to speed up the defrosting process by increasing the heating fluid temperature, as this could cause severe deterioration of the product surface;

- a long defrosting time makes it unavoidable to carry out the process discontinuously (batch operation), resulting in high handling costs; besides, breakage, bruising and other damages to the product may result from such handling;

The drawbacks of conventional defrosting methods described above can be avoided using radio frequency (RF) fields to rapidly generate heat volumetrically within the product. The heating process is uniform and controlled, resulting in a significant reduction of drip losses. RF heating method offers flexibility in the production scheduling and is the ideal solution for many tempering, softening and defrosting processes.

How does the radio frequency defrosting method work?

The fish blocks or other packages are placed on the machine's conveyor belt and are transferred through the RF unit (tunnel) passing between an upper and lower metallic plates. These plates (also called electrodes) form an electrical capacitor and the product in between the plates becomes the dielectric element of that capacitor. The electrode plates are connected to a radio frequency generator oscillating at a frequency of about 27 million cycles per second.

When the RF generator supplies high frequency alternating voltage between the capacitor plates, the dipolar water molecules of the frozen fish 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 defrosting time are accurately controlled through the voltage applied on the electrode plates and the speed of the conveyor belt.

SPECIFICATIONS

Construction in stainless steel AISI 304 / 316 with anti corrosion (passivation, pickling) treatment for even the most demanding environments.

Intralox belt in polyethylene with open structure for easy cleaning.

Integrated belt washing system, automatic pre-cleaning devices of the tunnel and complete internal access for cleaning through the multiple side panel doors.

PLC control system for multiple product recipes.

PRODUCTION CAPACITIES

Production capacities can vary depending upon the type of product to be defrosted and the final temperature required. Here below an example:

Fish: frozen **squid** to be tempered from **–18°C** to **–2°C**
Size of machine: **single module 75 kW_{RF}.**
Max power output: **75kW_{RF}**
Max power input: **120 kVA**
Production Capacity: **up to 1.250 kg/hr**

MACHINE SIZE

STALAM Radio Frequency machines are available in module sizes from 10 kW_{RF} to 105 kW_{RF} for defrosting food products. Multiple modules can be combined to increase the production capacity. If production capacities increase, an additional module is easily added to an existing system to increase the production volume.

RF Power (kW_{RF})	Length (mm)	Width (mm)	Height (mm)	Belt width (mm)	Additional module length (mm)
10/20/30/40	6000 to 8000	1800	3400	1200	2000 to 4000
50/60/75/ 85/105	8000 to 10000	2400	3400	1800	4000 to 5000

- **Emperor**
- Half fish 25 kg
- From -20°C to -6 / -3°C in 20 minutes

- **Squid**
- Block 12 kg
- From -20°C to -4 / -1°C in 20 minutes

- **Mackerel**
- Block 25 kg
- From -20 °C to -4 / -1 °C in 20 minutes

- **Shrimp**
- 2 bags 500 g/each in cardboard box
- From -20 °C to -4 / -1°C in 15 minutes

- **IQF Squid**
- 2 bags 500 g/each in cardboard box
- From -20 °C to -4 / -2°C in 15 minutes

- **Seafood**
- 6 bags 270 g/each in cardboard box
- From -20°C to -5 / -3°C in 10 minutes

- **Breaded Prawns**
- 20 trays 230 g/each in cardboard box
- From -20°C to -5 / -2°C in 10 minutes

- **Pangasius**
- IQF fillets
- From -20°C to -2 / +1°C in 10 minutes

- **Pangasius**
- IQF fillets in 900 g bags
- From -20°C to -2 / 0°C in 8 minutes

- **Calamari**
- IQF rings
- From -20°C to -5 / -3°C in 10 minutes

- **IQF Scallops**
- 4 bags 250 g/each in cardboard box
- From -20°C to -5 / -4°C in 15 minutes

- **Mussels**
- 2 bags 500 g/each in cardboard box
- From -20°C to -4 / -2°C in 10 minutes

- **Salmon Fillets**
- Block 8 kg
- From -20°C to -2 / 0°C in 40 minutes

- **Salmon**
- Whole fish approx 3 kg
- From -20°C to -3 / 0°C in 16 minutes
- From -20°C to -2 / 0°C in 30 minutes

- **Tuna Chunks**
- Vacuumed bag approx. 2 kg
- From -18°C to -6 / -4°C in 25 minutes

- **Sardine**
- Block 10 kg
- From -20°C to -3 / -1°C in 25 minutes

- **IQF Shrimps**
- Cardboard box 10 kg
- From -18°C to -3 / 0°C in 18 minutes

- **Cooked Crawfish Tail Meat**
- 2 kg bags in cardboard box (12 kg in total)
- From -18°C to -1 / +2°C in 20 minutes

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