What the state-of-the-art Technology "Proton Freezer" is,

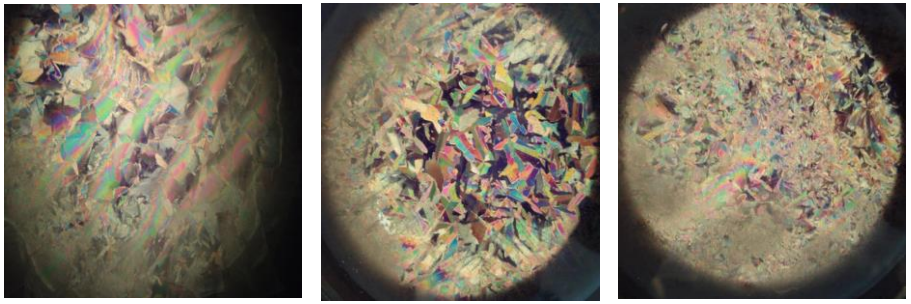
It is a hybrid freezing technology of magnet (equal magnetic flux density), the cold air and electromagnetic waves. With activating into ice nucleation while freezing, many ice nuclei are generated with tiny ice crystals. As a result, to prevent the destruction of food cells, reducing the amount of drip during thawing.

1. Magnet
2. E-magnetic wave
3. Cold air

→ No large grains of ice → Frozen without compromising the taste, freshness of food

Ice crystal polarization photo comparison

Grains of ice is larger → Grains of ice is smaller

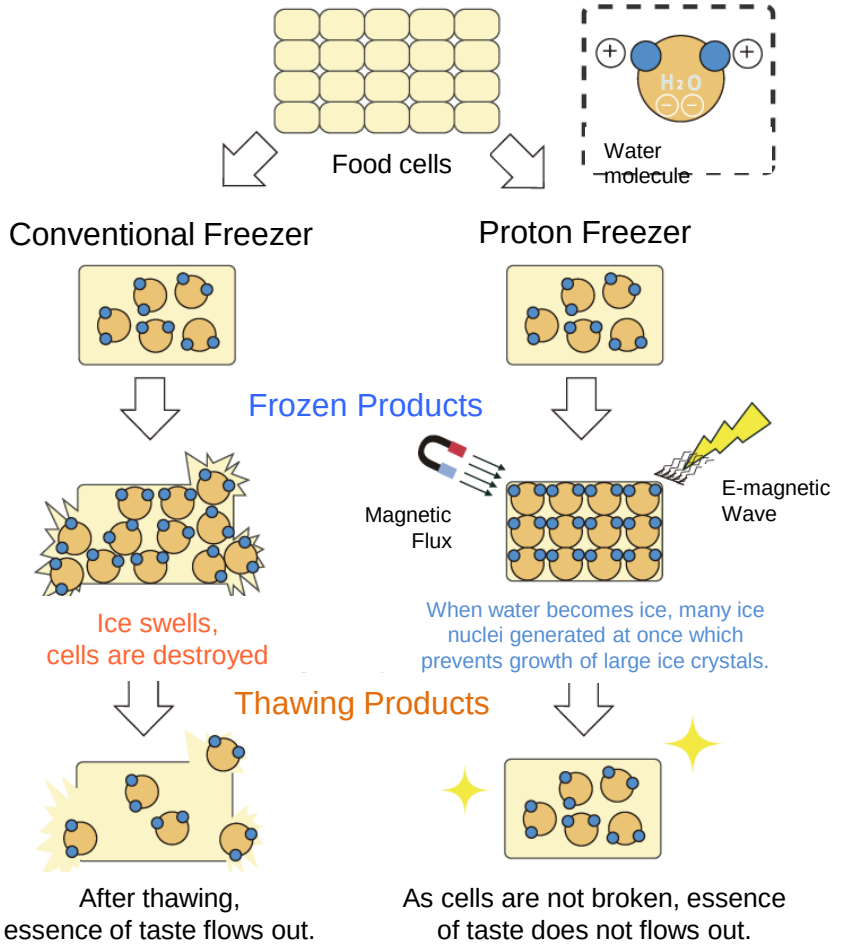


Slow freezing (−25℃) | Rapid freezing (−40℃) | Proton freezing(−40℃)

※Photo by Mizuno Tadahiko, CEO
Hydrogen Technology Application Development Co., Ltd.

Proton freeze : Much smaller "grain of ice:" it would be of ice crystals by Proton-freezer!

Presumptive model of Proton freeze

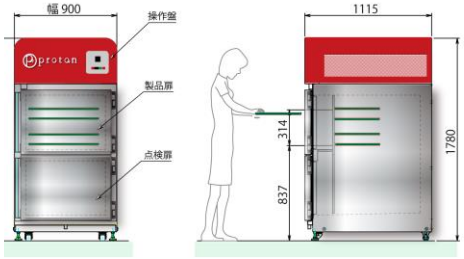


- Conventional freezing makes grains of ice larger, so the quality of foods is degraded after thawing.
- In order not to make grains of ice larger, it is conceived that many ice nuclei should be generated all at once so that growth of large ice crystals is prevented.

State-of-the-art Technology : Proton Freezer

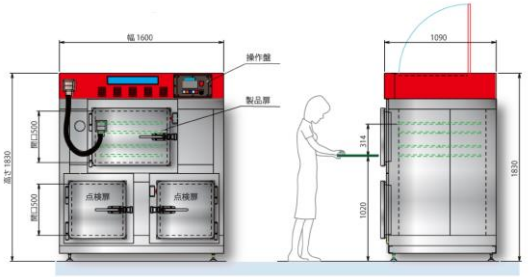
The basic lineup of 3 models can be selected according to the processing capacity and installation space conditions,
Spiral and Tunnel types are also available to provide for large-scale plants.
From restaurants in the town to huge food factories, Freshness is secured by "proton freezing machine".

Proton Chef (Pr.C-15)
W:900 × D:1115 × H:1780



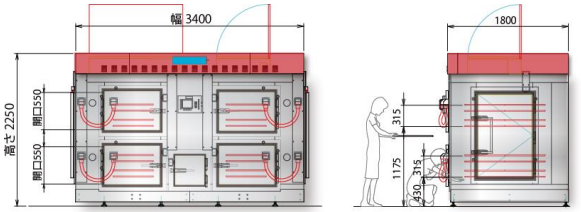
Compact size for kitchen of hotel and restaurant!

Proton Freezer (PF-30)
W:1600 × D:1090 × H:1830



Space-saving for production and processing of high-mix low-volume!

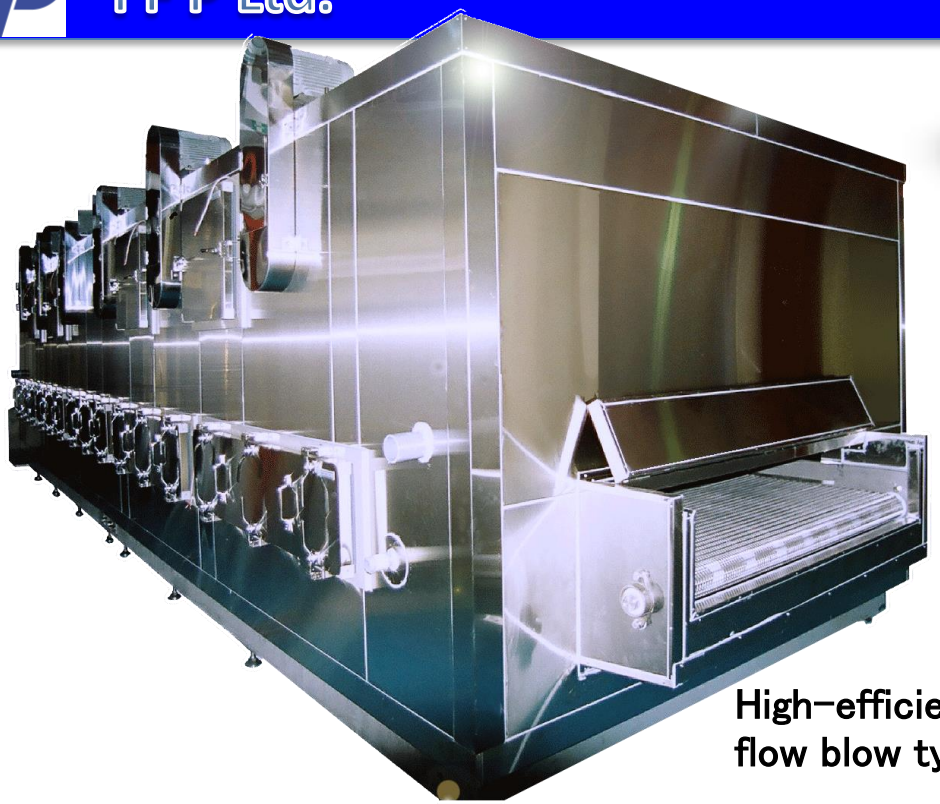
Proton Freezer(PF-150)
W:3400 × D:1800 × H:2250



Mass production for professional factory!

Inside photo

Operation Panel(BUR-150)



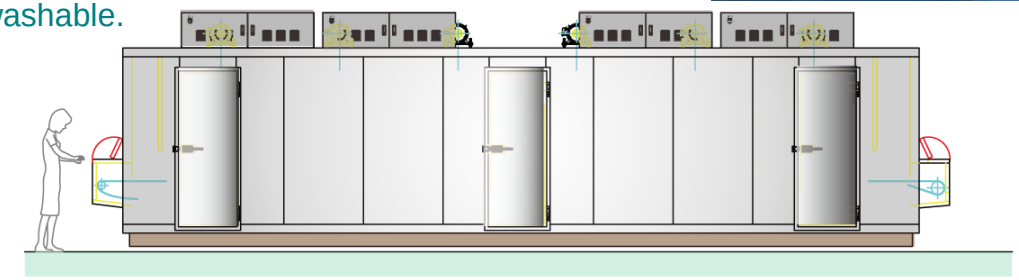
GO-STRAIGHT FREEZER

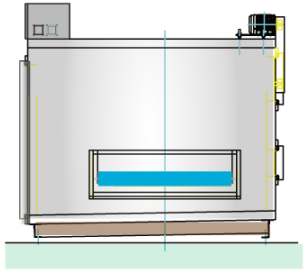
TU-350 model （350kg/h）
TU-500 model （500kg/h）

The unique state-of-the-art straight freezer with a proton function, which is only one in the world!

High-efficiency, high-speed flow blow type

- reducing the freezing time, and keeping the freshness intact.
- wind blowing from the slit more than 10m/s, and wider design that is easy to wash.
- While compact dimensions, a large amount of processing (300kg / H or more) is available.
- chamber, fans, cooler and blowing are washable.





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Tuna : Drip amount comparison

Proton Freezer (—40℃)	Conventional Freezer (—45℃)
	
Drip : 2%	Drip : 7%

Additive-free!
Amount of drip after thawing is much different on proton frozen!

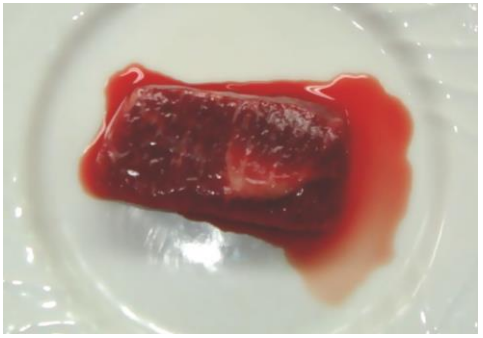
Horsemeat : Drip amount comparison

Proton Freezer (—35℃)

Drip : <1%

Conventional Freezer (—25℃)

Drip : >10%



What is Proton freezing? 1

With an effect of electromagnetic wave and equal magnetic flux density environment in ice nucleation, which generates many Nucleus and prevents the growth of large ice crystals.

■ “Proton freezer” is;

Paying attention to that water molecule is an electric dipole, “It is the machine that freezes better” by approach of the quantum-mechanical and electromagnetism.

The electric dipole is that oxygen of the water molecules is electrically charged to plus and hydrogen is minus, and they are electrically coupled to each other. Electricity of plus and minus is the same amount, which results as if they were Zero.

By utilizing a hint of this fact, we have created an electromagnetic wave transmission and equal magnetic flux density environment in the process of freezing. That is, “It is a machine that aims to freeze all new” to implement a new feature of mechanism for controlling the nucleation of water molecules“ onto conventional freezing equipment.

In addition, it is a completely different machine in terms of basic concepts, structure and control software from the one that is referred to as the magnetic field freezing equipment already in the market. Conventional freezer is developed by only focusing on an external environmental mechanism for the purpose of freezing equipment until now to increase the amount and speed of air flow, and to lower the temperature.

It is believed that there is a limit to better frozen state, because it is not a machine which pays attention to the water molecules occupying most of the food composition.

What is Proton freezing? 2

■ "Proton freezer" is;

designed for the purpose of achieving maximum protection against deterioration due to freezing, in order to restore almost its original state . Following improvement is confirmed as a result;

- reducing drip (taste, flavor, ingredient) of fish and meat.
- preventing cooked rice from getting white-waxed, success of frozen Sushi.
- suppressing water evaporation from confectionery.
- realizing special Japanese dishes prepared for the New Year (Osechi), and lunch box.

■ "Proton freezer" is;

a freezing machine equipped with state-of-the art technology enabling;

an inventive step to achieve
reproducibility(Better freezing results)
continuity (possible to obtain the same results, no matter when/who/where it is frozen)

■ "Proton freezer" actual customers distribution is;

Fisheries : 50%
Side dish, cooked rice : 25%
Livestock : 10%
Osechi: 10%
Other (Food for the elderly, vocational aid center, research, etc.): 5%

Model□ / Item□	Nitrogen freezing	Brine freezing	Air blast freezing (conventional system)	Proton Freezing (Air blast freezing)
Basic freezing method	To freeze materials by making external atmosphere (−196 ℃ nitrogen) to reach out from the outside	・Same as on the left (−40 ℃ brine)	・Same as on the left (−30 to −40 ℃ cold air)	・Same as on the left (−30 ~ −40 ℃ cold air) ・To give an energy onto food moisture for generating small crystals
Freezing method, classification	Nitrogen injection	Brine immersion	Cold air circulation	Cold air circulation Magnet Electromagnetic wave
Effect and Features	Freezing time is very fast	Freezing time is fast	Standard freezing time	Freezing time is very fast
	Drip is less	Drip is less	Drip is normal	Drip is extremely less
	Product degradation is less. There is a case of surface deterioration due to large temperature difference depending on a product	Product degradation is less	There is product degradation	Product degradation is very low
	High running costs About 50 yen to 70 yen / 1kg	Slightly higher running costs About 8 yen / 1kg ※ packing material cost consuming.	Average Running costs About 2 yen / 1kg	Average Running costs About 2 yen / 1kg
	Initials cheap Refrigerator is nor required	Initials cheap. Care needs to be alcohol concentration management.	Many water evaporation	Possible to freeze food that was thought to impossible freezing so far.

Comparison of freezing time

Studies on the freezing and storage technology of tuna

Quality changes in special freezing during storage of tuna

Conventional air-blast freezing machines using an electromagnetic field are developed and sold in order to improve the quality.
We tested these special freezers whether they can extend the black tuna frozen storage period.

Quality changes in special freezing in black tuna

Figure 7 shows a change in the chamber temperature and the core temperature at the time of freezing the black tuna blocks having a thickness of about 5cm, and Table 3 shows the freezing speed.
As a result, A company (Proton -40C) ranks as No.1 fastest freezer among others.

Table 3 : Freezing Speed

Freezing Method	Freezing speed
A company (-40C)	6.8cm/hr <= Proton
B company (-50C)	4.4cm/hr
C company (-30C)	3.7cm/hr
Blain Freezer (-30c)	3.5cm/hr

Tottori Institute of Industrial Technology

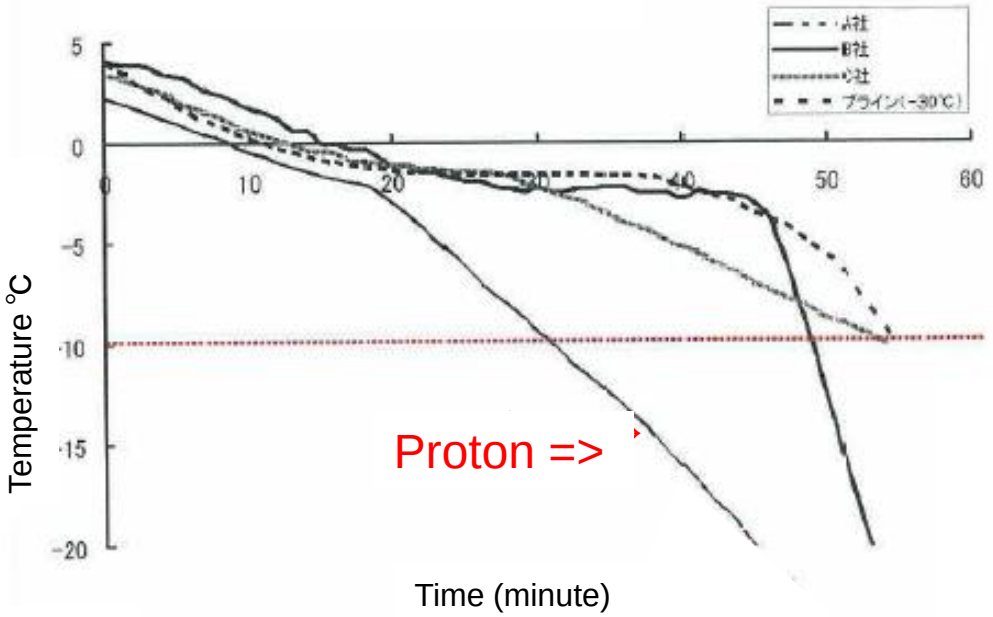


Fig 7 : Center temperature change of black tuna during freezing

Challenge to high-quality and quality retention by the Freezing technology

「Conventional freezing system + Production method」

Watery when frozen：Syneresis inhibitor

Discoloration of food：Antioxidant, Coloring

Food gets dried：Humectant

Bacterial count of food is a concern：Bacteriostatic agents, pH adjuster

Not delicious：Seasoning, additives, etc.

「High-grade freezing system + Cooking & Management technology」

Additive-free, cooked with only taste of the material, high quality is possible by combining the technology of cooking + management. This restaurant model is the "Proton dining" in Nara. Please visit "Proton dining" to experience the possibility of frozen food, and you may be asked to consider business development opportunities.

「Key of high-quality-freezing is how to Construct "defreezing technology", "cold-logistics" and "proper storage" 」

"Frozen locally – Thawed at consumption point", "Frozen in central kitchen and Thawed in the store " etc

To freeze, you need also know-how of thawing.

Stabilization of the low temperature logistics is also important, the leading frozen foods manufacturer has its own distribution network, but should be entrusted to the outside with the small and medium-sized company, there are a lot of trouble in transit.

There is also an example of using the additive to cope with temperature change, but the retention period is affected by the stability condition and storage temperature suitable for food characteristics.