



# The art of freezing fish

REFRIGERATION ENGINEERING BRINGS

A BLAST OF FRESH AIR TO THE ART OF FREEZING FISH

**B**last freezers are the most common type of freezer employed in the fishing industry. They are used to freeze fish and other food products ready for storage and can be found in fish processing plants and on board larger fishing vessels. Designed and purpose-built to suit individual requirements and operating conditions, each Blast Freezer is unique.

Refrigeration Engineering is part of the Realcold Group of Companies and has been designing and manufacturing complete refrigeration systems for the fish and meat processing industries throughout NZ and the Pacific islands for 50 years. Blast Freezers line up in their product range alongside carton chilling and freezing, IQF freezers and flake ice production.

As the marketing and technical manager of Refrigeration Engineering, Robbie Hunt says his company takes pride in its team of engineers who put together a design only after considering all factors of a particular project. He says the care taken results in the right system for each application. It's also important to engage good contractors to install, commission, test and maintain a Blast Freezer, and Robbie says his company has access to the best available in NZ and the South Pacific.

"Fishermen and fish processing companies need to understand that we are experts in the field," says Robbie. "Too often people invest up to \$100,000 in an air blast freezer and find it's not doing exactly what they want it to do, where if they'd spent \$120,000 they would have acquired something well suited to their needs."

Robbie says one of the real strengths of Refrigeration Engineering

is the way its strong technical department can accurately interpret a client's needs. He says too often a client will come in with specifications for a freezer that are too wide to be of much use and can lead to a freezer design that is inefficient and not to their requirements.

"They want a Blast Freezer to do a hundred different things but the client needs a specific brief for it to perform properly for them. We can educate them on what they need to bring to us," he says. Robbie says it's vital potential clients understand what a Blast Freezer is all about before they buy one.



# REFRIGERATION ENGINEERING'S GUIDE TO CHOOSING A BLAST FREEZER

## WHAT YOU SHOULD KNOW

The choice of Blast Freezer depends very much on the kinds and quantities of fish to be frozen and whether the operation is single shift or round-the-clock. It's also important to determine the exact freezing time of all the fish going into the freezer. This dictates the dimensions of the freezer and the capacity of the coolers and the refrigeration plant.

The precise style and layout of the freezer will often depend on the space available and on its location in relation to other steps in the process, such as filleting, packing and cold storage.

## TYPES OF BLAST FREEZER

There are several designs and arrangements of air blast freezers, but two main types: a continuous freezer and a batch freezer.

- The continuous freezer moves the fish through on conveyor or on trolleys against the flow of cold air. Fresh fish go in one end and release frozen fish out the other end. It works best for larger capacity processing plants engaged in mass production of standard packs with similar freezing times.
- A batch freezer keeps the fish in one spot on trolleys, pallets or rails and is more flexible as it can freeze a variety of different sized products often at the same time. It is the most common freezer for the local fishing industry and is used in smaller processing plants and on-board fishing boats.

## REFRIGERATION CAPACITY

Refrigeration capacity is often referred to in terms of motor horsepower, when in fact this is only a rough

guide. It can also be referred to in terms of kilowatts or quantity of fish frozen per day without specifying what is meant. Is it a 24 hour day or an 8 hour day? To avoid confusion, Refrigeration Engineering prefers to refer to the capacity of its Blast Freezers as an hourly rate in kilowatts of refrigeration.

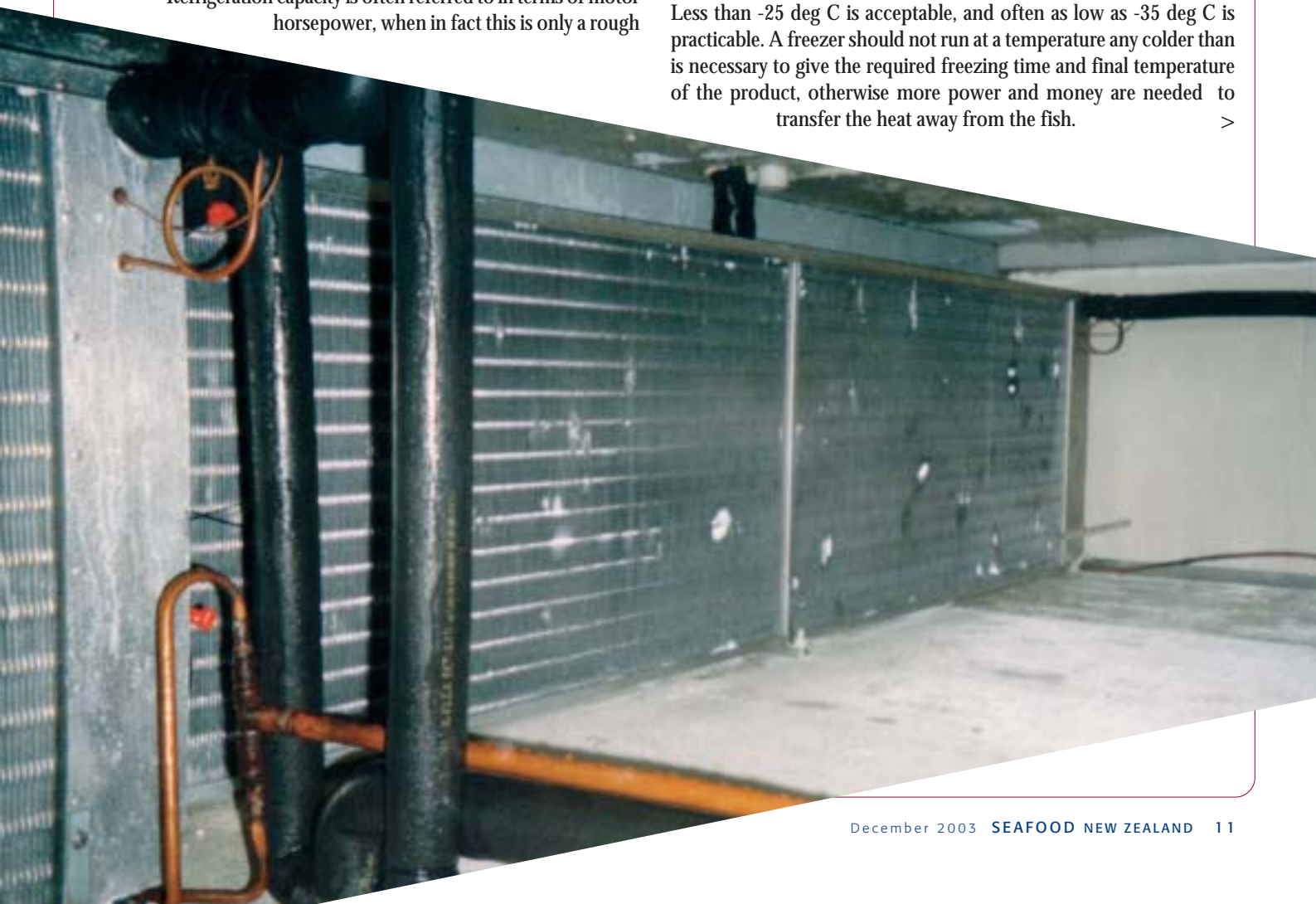
## AIR CIRCULATION AND AIR TEMPERATURE

Air is moved around a Blast Freezer using large fans. It's important to keep the air moving so it doesn't heat up too much when it transfers heat away from the fish while freezing them. Lights, fans, external air and equipment also heat up the air.

In a well-designed and well-operated freezer, the air speed over the fish should be about the same everywhere in the freezer and be neither too high nor too low. This ensures uniform freezing of the fish and the most efficient use of the freezer. It's important the freezer room is designed so the air flow resistance created by the fish in the freezer is spread evenly. This means the spaces between the trays or hanging fish should all be the same and the gaps around the trolleys or hanging fish should be as small as possible otherwise the air flow will take the path of least resistance and freezing will be inefficient.

If the total freezing time for the fish is only twenty minutes, a ten percent variation in freezing time for individual fish in one batch is not a concern. But if the freezing time is ten hours, the variation between fish in the same batch may not be acceptable.

Overall, the air temperature in a Blast Freezer should be cold enough to freeze fish as quickly as the code of practice recommends. Less than -25 deg C is acceptable, and often as low as -35 deg C is practicable. A freezer should not run at a temperature any colder than is necessary to give the required freezing time and final temperature of the product, otherwise more power and money are needed to transfer the heat away from the fish. >





### **FREEZER CAPACITY**

It is vital the internal dimensions of a Blast Freezer, the size of evaporators and the refrigeration plant are matched to a given product load.

For example, a particular Blast Freezer is designed to freeze two tons of fish an hour and the client's fish takes four hours to freeze. This means the freezer must have room for eight tons of fish at a time.

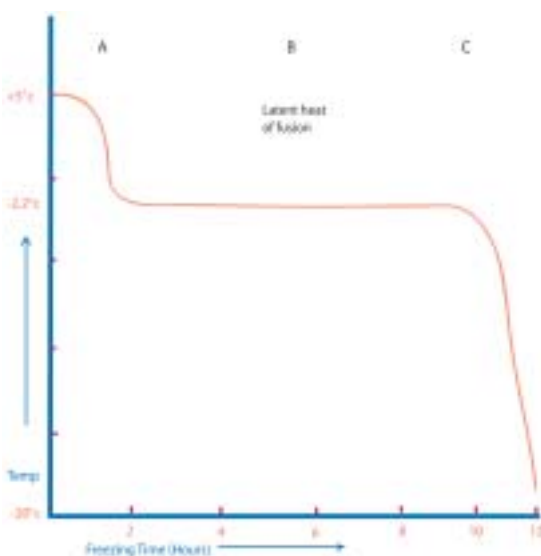
But if the same freezer is loaded with eight tons of a differently shaped fish that only takes two hours to freeze, the new freezing rate is four tons an hour and the freezer is greatly overloaded. On the other hand, if the Blast Freezer is filled with eight tons of fish that takes eight hours to freeze, the freezing rate is down to one ton an hour and the refrigeration equipment is running at very much below its design capacity.

When the freezer is overloaded, the air temperature will rise and freezing time will take longer. A seriously overloaded freezer may damage equipment and be a safety risk to staff. The immediate effect of under-loading is less serious, but the machinery working inefficiently will cost money in terms of operating costs and probable long-term damage.

### **FREEZING TIME**

As the freezing time of the fish and the output of the freezer are two of the main factors in deciding the size and capacity of the freezer and its equipment, then it's important to find out the freezing time of the fish product before design begins. This can be done by referring to known freezing times for the fish or by running trials on it.

Any kind of wrapping or packaging will lengthen the freezing time of the fish as the wrapper and the air caught between fish and



### **GRAPH ILLUSTRATING THE CHANGE IN PRODUCT TEMPERATURE THROUGH A TYPICAL FREEZING CYCLE IN AN AIR BLAST FREEZER**

- A Product enters the freezer at +5°C and, typically, after an hour of operation the fish temperature has been reduced to the freezing temperature of -2.2°C (the fusion temperature). The fish is still in a 'liquid' state.
- B The product is now at a temperature of -2.2°C in a 'liquid' state. The removal of heat from the product will change its state to a solid at -2.2°C as the molecules fuse together in a frozen state. This is the highest load in the cycle and, provided the criteria for effective blast freezers have been met, this latent heat of fusion will take 8 hours in this model.
- C The product is now in a 'solid' state at -2.2°C and all molecules have frozen. The temperature of the product is reduced to -20°C which, in this model, will take approximately 2 hours.

Note: An air temperature of -20°C to -35°C is required with a velocity of 4.5 m/sec to satisfy the hypothetical freeze time in this model.

## BUYER SPECIFICATIONS

The buyer should supply in writing all the information he has about his products, the proposed freezer, the site and the facilities available. This helps contractors supply a competitive tender and also allows for proper design of the Air Blast Freezer. Ideally the following information should be provided:

- 1 The kinds of fish to be frozen
- 2 The shape, size and method of packing each product
- 3 The expected freezing time of each product
- 4 Required daily output for each product in tons or kilograms
- 5 Normal working day in hours
- 6 The average product temperature required in the freezing section
- 7 The proposed method of loading products in the freezer
- 8 The type of air blast freezer required, with a sketch plan
- 9 The position of the freezer in the factory premises or boat with a sketch site plan
- 10 Availability of electricity and water supplies
- 11 The type of refrigeration condenser required, whether water or air cooled or evaporative
- 12 Availability of maintenance facilities.

wrapper have an insulating effect. The more effective the seal around the fish, the longer it will take to freeze. Freezing can be reduced considerably by leaving the lid off the box or the wrapping unsealed.

### DEFROSTING BLAST FREEZERS

Frost always accumulates on the evaporator in any air freezer and it must be removed regularly or it will impair efficiency. This happens by reducing the transfer of heat from the air to the evaporator, causing the air to warm up and restricting air flow through the freezer. Frost comes from the moisture in the fish when it evaporates and water vapour infiltrating from the warm air outside. Defrosting can be done by circulating hot gas through the coils of the evaporator or spraying water, brine or other liquid over the coils, or by electric heater elements which heat the coil and cause the ice to melt.

### CONDENSER SELECTION

Generally the type of condenser is determined by economics, the local climatic conditions and the cost and quality of the water supply. Where water is expensive, there are other options to consider including an air cooled condenser or an evaporative condenser. ■

## REFRIGERATION ENGINEERING LTD OFFICES

For further information on Blast Freezers or other refrigeration applications please contact [tech@realcold.co.nz](mailto:tech@realcold.co.nz), fax 64-9-526 5721 (attention technical department) or ring:

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