

Fast, energy efficient freezing with plate freezers

For meat processors seeking a time and energy efficient solution to freezing their product, plate freezing offers an ideal solution.

In the 1990s, New Zealand based engineering company Milmeq pioneered the introduction of large scale plate freezing technology to the meat industry. Today the company designs, manufactures and installs the world's largest horizontal plate freezers.

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The most common method used worldwide for bulk freezing of meat is air blast freezing. Plate freezing provides an alternative solution that can halve the freezing time, significantly decrease energy consumption, reduce manual handling and enhance product shelf life compared with that seen in air blast freezing.

Plate freezers

Plate freezers feature refrigerant-filled plates which make direct contact with cartons of product to provide a rapid, energy efficient freeze.

The typical 48 hour freezing cycle of air blast freezers is reduced to 24 hours in plate freezers. This rapid freeze improves the refrigeration index (a measure of shelf life and a regulatory requirement), while the cycle time reduction reduces stock inventory and time to market.

Table 1. Freezing energy comparison between air blast freezing and plate freezing.

	48 hour air blast	24 hour plate freezer
Electrical energy used over freeze cycle (kWh)	17,345	6,592
Electrical energy per 1000 cartons frozen (kWh)	2,891	2,197
kWh per tonne frozen (7 day production) – Energy saving: 24%	106	81
kWh per tonne frozen (5 day production) – Energy saving: 30%	126	89

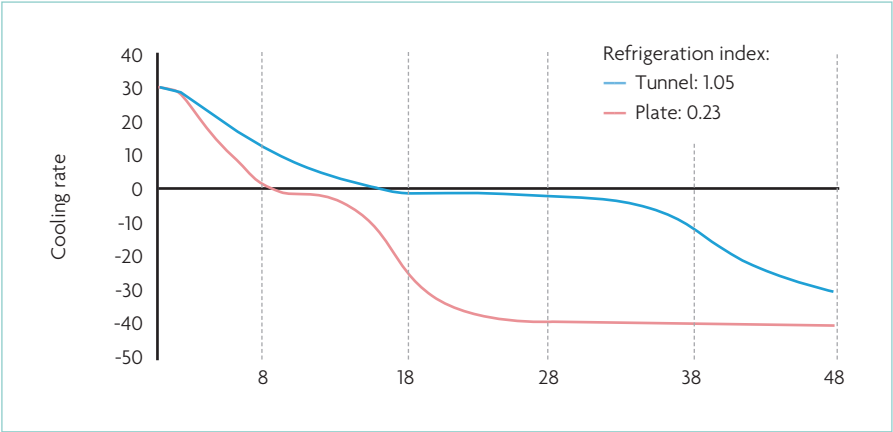


Fig. 1. Cooling rate comparison between a plate freezer and an air blast tunnel.

Fig. 1. shows the rapid cooling rate of plate freezers, providing a complete freeze within 24 hours, compared to the 48 hour timeframe of air blast tunnels, whilst also attaining a 10 degree lower temperature.

The efficient freezing cycle of plate freezers enables meat processors to reduce the electrical energy used to freeze their product. Replacement of a blast freezer with plate freezing typically provides energy savings of between 24-30%.

Another key benefit of plate freezing is the output of cartons with uniformly flat surfaces, which deliver space efficiencies in the palletising, container loading and distribution operations. Loading a greater number of cartons per container reduces producers' transportation costs as well as their carbon footprint, delivering approximately 15% reduction in empty container movements.

Milmeq produces plate freezers in a

horizontally stacked configuration, ideally suited to operations with a large throughput of cartons of a uniform size and shape. The plate freezers are custom designed, with capacity options typically ranging from 500 to 2,600 cartons.

Milmeq plate freezers are available in automatic, semi-automatic or manual configurations.

The fully automatic configuration features an integrated materials handling system providing a hands-free environment which improves operator safety, reduces handling and retention time, increases product throughputs and enhances inventory management.

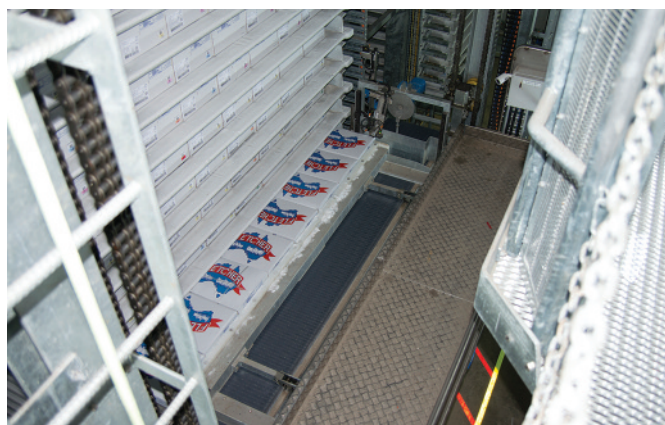
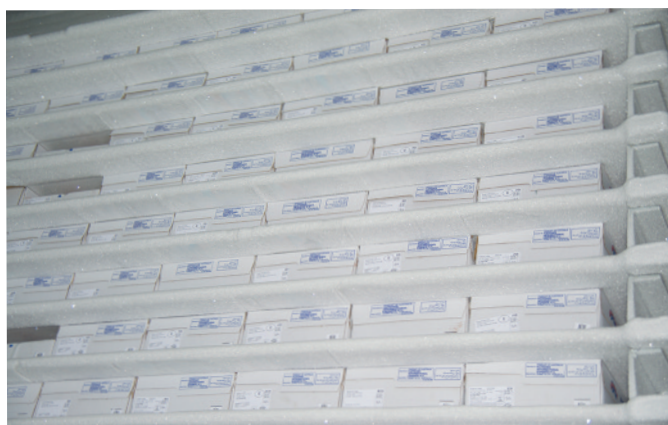
A key component of the plate freezer is a desiccant dehumidifier. A stream of very low dew point air provides a slight positive pressure to the plate freezer enclosure, minimising frost build-up on equipment and sensor surfaces, and reducing the need for defrost.

Ammonia (NH₃) refrigeration systems are typically utilised for large scale plate freezers, however they can be supplied with range of refrigerants including carbon dioxide (CO₂).

Single Station Opening model

Plate freezer technology is continually improving, with the latest innovation from Milmeq being the Single Station Opening

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Cartons being loaded into the Milmeq plate freezer at Fletcher International Exports and, right, the plate freezer in operation.

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(SSO) model. In this configuration, only one set of plates opens at a time to load or unload product, leaving the others closed to continue the freezing process.

The SSO model delivers up to 3.5 hours additional freezing time. Depending on production requirements, this can result in a greater product turnover or the plate evaporating temperature can be raised to gain a further reduction in energy consumption.

Milmeq CEO, Mike Lightfoot describes the SSO model as another world-first development that is reflective of the company's dedication to innovation.

"As with a number of the leading technologies we have pioneered over the years, I would anticipate that in time the SSO plate freezer will be recognised as setting the industry standard for the freezing of meat product," Mike said.

Case Study: Installation of plate freezers for Fletcher International Exports

Australian based company, Fletcher International Exports has recently installed three plate freezers at their Dubbo site.

Fletchers are Australia's most integrated processor and exporter of lamb and sheep meat products, exporting to over 90 countries around the globe. They operate two processing facilities, one located in Dubbo, New South Wales, and the other near Albany, Western Australia.

Previously at their Dubbo site Fletchers used a combination of two plate freezers and an air blast freezer to freeze their product. With plans to increase their production throughput, they needed a solution to increase their freezing capacity to match this.

Their main objectives were to achieve a faster freezing time for their hot boned products to minimise bacteria growth and maximise shelf life, decrease their energy consumption and input costs, and to free up the space currently occupied by the blast freezer in the centre of their



Frozen cartons being unloaded out of the Milmeq plate freezer and, right, using the control system.

processing plant for future extensions to their processing line.

The solution to this was to install three plate freezers, each with the capacity to freeze 2,300 cartons in a 24 hour cycle.

The plate freezers all featured Milmeq's latest design of lifting cradle with synchronised hydraulics, compact chain pusher technology and an independent servo drive to provide better control over speed and positioning of the cradle for loading and unloading cartons.

The third plate freezer featured the new innovation; the single station opening (SSO) function, which was specifically developed to meet Fletcher's requirements to reduce the temperature of their hot boned products as quickly as possible.

On the SSO model, only one set of plates opens at a time for loading cartons, rather than all plates opening at once. This means cartons are under contact with both plates sooner and provides three hours additional freezing time per day, resulting in Fletcher's being able to completely freeze their hot boned product within 21 hours.

"I would suggest that any new meat plant design should incorporate what I see as third generation [SSO] plate freezers," explains Fletcher's General Manager, Farron Fletcher.

Fletcher's are considering upgrading the other two plate freezers to SSO in the future. At that stage, it would be possible to increase the evaporating temperature of the plates in order to further decrease their energy requirements.

Another significant advantage they have seen since moving from blast freezing to plate freezing their product is the production of completely flat cartons. This means they can fit 10% more cartons per container leaving the distribution centre.

"The team at Milmeq share our pioneering spirit and have worked closely with us to bring our vision to life. Their plate freezers are enabling us to deliver a superior product to our customers as well as significant improvements to our bottom line. By installing the new plate freezers we have also been able to resolve production bottlenecks in the plant," added Farron. ■