EBOOK

What Can Cryogenic Freezing & Chilling Do for You?

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“Tasty, beautiful, healthy food. There’s never been a greater appetite for it.”

Frozen fresh – what consumers demand

Your customers desire meals and ingredients that don’t just look, taste and smell great, but retain their freshness. It really matters. Trends like conscious consumerism, healthy eating and local sources have raised expectations for what we eat and how we preserve it.

Yet some things haven’t changed. Frozen food is still big business. According to Grand View Research, the industry will grow to roughly $380 billion by 2027. Freezing and chilling are even more essential for diversifying stock, refining production and making sure little goes to waste.

You may already realize, however, that freezing and chilling solutions can tamper with freshness. At least, some of them can – the bulky, traditional choices.

Here we explore the alternative: cryogenic freezing and chilling. It can utterly transform what you offer to customers and their consumers. You might just be ready for it, right now.

Mechanical freezing

Over 80% of food is frozen or chilled with mechanical devices. But what happens during that process, exactly?

First, a compressor pumps a refrigerant – usually ammonia – through the storage space while a condenser chills it, extracting heat from the food. Expansion valves and evaporators turn hot liquid by-product back into gas, forming a closed-loop exchange system. In other words, it moves the refrigerant from one place to another, keeping temperature to the desired low levels.

There are tried-and-tested benefits to mechanical freezing, as the systems can have low operating expenses and are widespread. If you're a food producer, it's likely you own or are familiar with several models.

Yet mechanical refrigeration has several drawbacks, including:

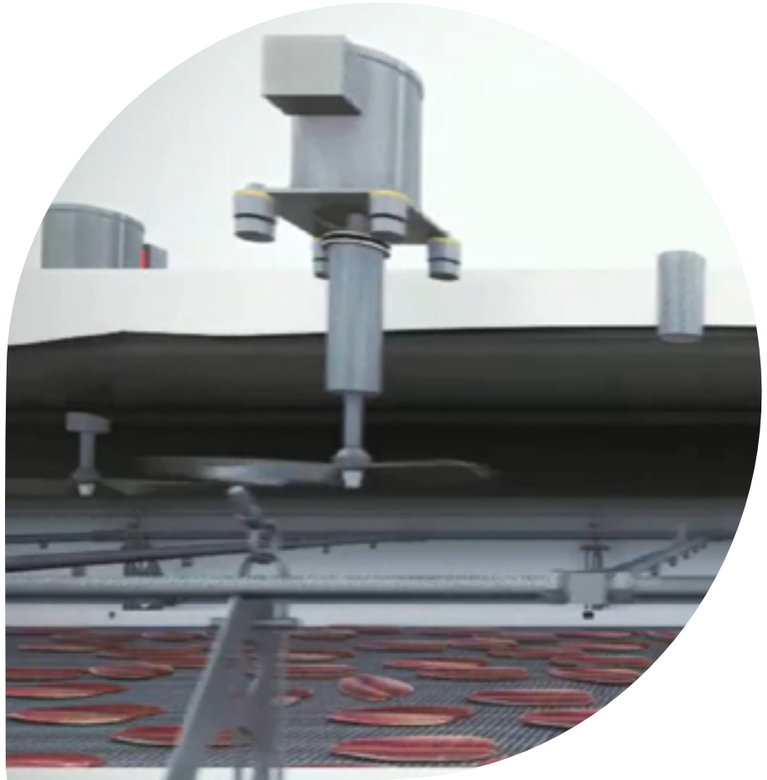
Weight and dehydration loss. Since air is constantly moving, it extracts more natural moisture from your products. They can become smaller, drier, tougher and less colorful.

Health risks. Mechanical freezers and chillers are relatively slow to take effect. This leaves your raw product exposed to warmer temperatures longer, which can lead to increased bacteria growth.

A larger energy footprint per pound of final product. Since they're subject to significant EPA regulations, and tend to lead to notable yield loss from quality reduction, mechanical devices aren't great for the environment.

Cryogenic freezing

This is the faster, more sustainable way to freeze or chill food. Since the 1970s, cryogenic technology has steadily advanced in food industry applications.



Instead of changing a refrigerant over and over in a closed cycle, it sprays or immerses a product directly in liquid nitrogen or carbon dioxide. Freezing can take seconds as tiny ice crystals form between the food cells. Gas is injected into one or multiple controlled zones, and cold vapor floods the freezer, evenly distributed for maximum preservation.

This offers more flexibility – specifically for products that should retain their shape for individual pieces, or more delicate items such as cake, cheese, pastry and sauce. You can preserve more food, faster, while keeping its natural qualities intact.

Looking closer, cryogenic freezing and chilling has five core advantages:

Preserves the taste, texture and color of food, as well as nutritional elements.

Conserves more of the original product weight.

Improves productivity which boosts throughput.

Reduces equipment maintenance time.

Supports compliance with health and safety standards – for both the food and your employees.

Each of these points can make a massive difference to your profits, performance and production line. Let's analyze them to thaw out the true value of cryogenics.

“Cryogenic freezing acts fast. With near-instant preservation, you’ll maximize the freshness that makes a product sell well in today’s market.”

Better flavors, textures, colors & aromas

The ice crystals are much smaller than those associated with mechanical methods. This limits cellular damage. Cells, after all, are finely organized – they exist in a microstructure, which can be torn apart when water expands. Since cryogenic techniques use dry ice or liquid nitrogen, that doesn’t happen. Everything from the tenderness of meat to the sharp smell of herbs remains as it was when it was first frozen or chilled. Nutrients and pigments don’t drain away either.

Additionally, because of the rapid freezing, the growth capacity for pathogens is greatly reduced. Enzymatic activity slows to a crawl. Your food stays pristine, vivid and pleasant to eat. And, you can extend shelf life while throwing less out, and selling more!

Less evaporation

The cost of the cryogen can be more than offset by gains in yield and quality.

Mechanical freezing relies, in part, on evaporation. However, decreasing a product's water weight will take some of its inherent moisture with it. Mechanical solutions dehydrate moist food by 15%. Though a seemingly small loss, for products with a high value (and desired freshness), the cost of the cryogen can be more than offset by gains in yield and quality.

Cryogenic options, on the other hand, extract around 0.25% of natural moisture. That means more juices, proteins, salts and sugars are retained. Customers and vendors can tell the difference. The food stays the size it's meant to be too, deliciously hydrated.

Some of the most sensitive goods to benefit from lower evaporation are:

Ground meats like burger patties, meatballs and sausages.

Filets and other careful cuts of fish, steak, lamb and chicken.

Cakes, tarts, cream products and other desserts.

Fresh fruit and vegetables that rely on natural moisture for much of their taste and shape.

> The ability to move additional products through your facility is a major benefit of cryogenics."

Higher productivity

When you freeze or chill food more rapidly, you're able to process more of it at once. This is a major benefit of cryogenics – the ability to move additional products through your facility.

This isn't only true for taking care of items at the end of the production cycle. You can also deploy cryogenic techniques across every stage of production, speeding up improved mixes, glazes and cooling requirements before packaging.

Box chillers, for instance, cool down any product as it's palletized, allowing you to stack and pack while temperatures drop towards the center of the pallet. Elsewhere, combo chillers "feather" dry ice for significant combo batches of raw product (say, a 2000 lb. box) during transportation or storage. Since both box and combo chillers automate the even and adjustable levels of dry ice snow as products move through your process, it allows the processor to chill and maintain the product temperature for shipping and storage without manual effort – improving consistency and quality, and saving labor. We also have flour chillers applying snow to flour in the pneumatic line, reducing heat in your mixing process, which improves the recipe.

And whereas mechanical freezing may demand an overnight stay, cryo lets you freeze and ship on the same day. Pack-off generally takes 15–30 minutes.

> Use of cryogenics also provides advantages to downstream production processes, potentially reducing downtime and/or allowing full production through your shifts."

More reliable machinery

The mixing and grinding action in any ground product contributes to increased heat load in that product. This increased heat load then contributes to protein extraction, which causes the product to become more sticky and also to lose its product definition. When this sticky product enters a former to create chicken nuggets or ground beef patties, it often tends to stick to the sides of the mold which will cause misshapen and unusable product causing it to be pulled off the line and put back into the process as rework. The reworked product is then subject to even more protein extraction (even stickier product) so your daily throughput is reduced each time one of these pieces is pulled from the line.

Cryogenics however, will help to reduce the heat load these products are exposed to, thus lowering the level of rework because the product temperature can be maintained, or even ideally lowered, so that your forming line runs consistently and consecutively without misshaped products.

With dry ice, there are no leaks or water seepage. Everyone can work more safely, while your accident rate may drop and stay that way.

Improved health & food safety

Traditional chilling carries a host of dangers at work. Your staff may be wary of carrying large, lumbering bags of ice from place to place, or avoiding pools of water they may not be able to see. Solid dry ice CO_2 (or SCO_2) is much safer. With dry ice there are no leaks or water seepage. Everyone can work more safely, while your accident rate may drop and stay that way.

SCO_2 is fantastic for chilling with an even distribution of snow. Box, combo and flour chillers have all been designed for ergonomic safety as well as their adaptable role in your production line. You can keep food at the ideal temperature while various preparations stir, cut, mix or pack, knowing the snow cover is evenly distributed for substantial hygiene concerns.

Cryogenic investments allow you to:

Introduce **non-slip, non-toxic freezing and chilling methods** that greatly reduce the chance of serious injury.

Avoid the critical temperature zone for bacteria – a major source of contamination for the food you keep and sell.

Reduce the surface areas for pathogens to take hold in your freezer. By design, cryogenic applications are simpler: they don't have fans or coils, and are much faster to clean. Likewise, there's less surface area for microorganisms to gain a foothold.

> Whether you're weighing up labor, uptime, sanitation or quality control a true Total Cost of Ownership is vital for every cryogenic investment."

Your simplest investment – a turnkey cryogenic offer

So, with all these benefits, why are cryogens not used throughout the food industry? The simple answer is: many people don't know enough about them. Or if they do, they're unsure of their full advantages. Uptime, throughput, production and processing flow are all improved by cryogenic solutions. The challenge is helping people realize what they have now and what they really stand to gain.

Whether you're weighing up labor, uptime, sanitation or quality control, a true Total Cost of Ownership is vital for every cryogenic investment. You must understand the material and fiscal strengths of this technology, with a vision of how you'll tweak and expand production in the future.

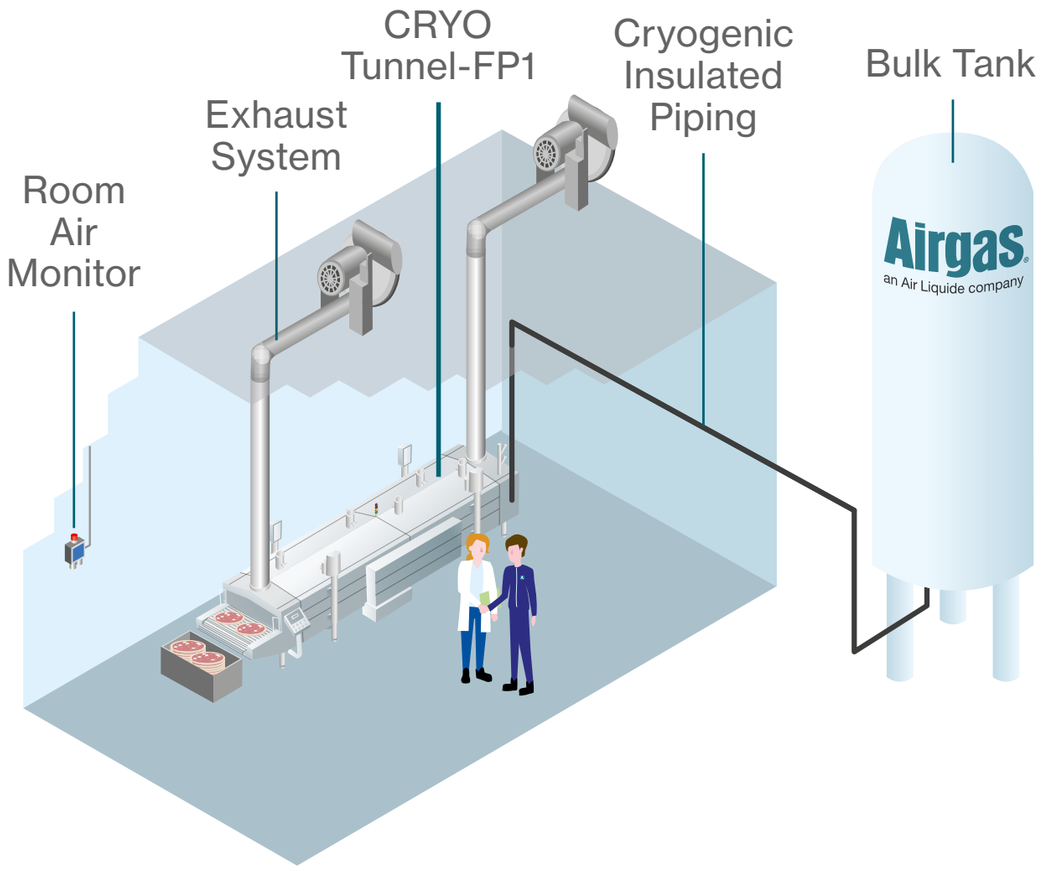
Aside from this, you may have concerns about integrating cryogenics with your system and facility. Setup is fairly straightforward – not to mention less expensive than mechanical devices – but keeping it running often requires engineering support. Plus, your processes may change quicker than expected. That's where we come in.

Comprehensive cryogenic support without the fuss or second guesses

With more than 40 years experience, Airgas is a leading name in cryogenic freezing and chilling for the food industry. We've built all of our equipment around businesses like yours. We're all about making cryo flex around you, rather than the other way around.

You can count on our team of engineers for a seamless experience. We'll start with a thorough review to understand your facility, evaluate your current process and assess your current and desired throughput to identify the cryogenic solution that is the best fit for you. Our team supports you from start to finish until your new system is thoroughly implemented into your operation.

Here's a glimpse of one our advanced freezing tunnels designed for improved hygiene and increased efficiency



What might cryo do for you?

It's a great question. For a quick example of cryogenics at work, see how we helped a large dessert brand improve their business.

Customer: An esteemed cookie dough supplier in the U.S.

Challenges:

- Improve efficiency, operations and sanitation with a pair of new freezers.
- Test for ideal size and efficiencies, before changing product parameters. One line needed to move the product on paper, rather than on-the-belt loading.
- Huge concern for throughput with available space.
- The dough is extremely sensitive to environmental conditions. This couldn't be overlooked.

Solutions:

- Oversaw construction and installation of two nitrogen tunnel freezers.
- Designed the piping and exhaust systems.
- Provided training, tuning and start-up support.

The customer had never explored cryogenic freezing before. It exceeded their expectations, opening up fresh opportunities.

What might yours be? With over 40 years of experience, patented technology and a team of global food experts with more than 1,200 worldwide references, we've worked with hundreds of food companies like yours to implement a precise chilling or freezing solution.

Don't put your ambition on ice. Call or message us for a custom quote.

Airgas®
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CONTACT US

800.282.1524 | askAES@airgas.com | Airgas.com

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