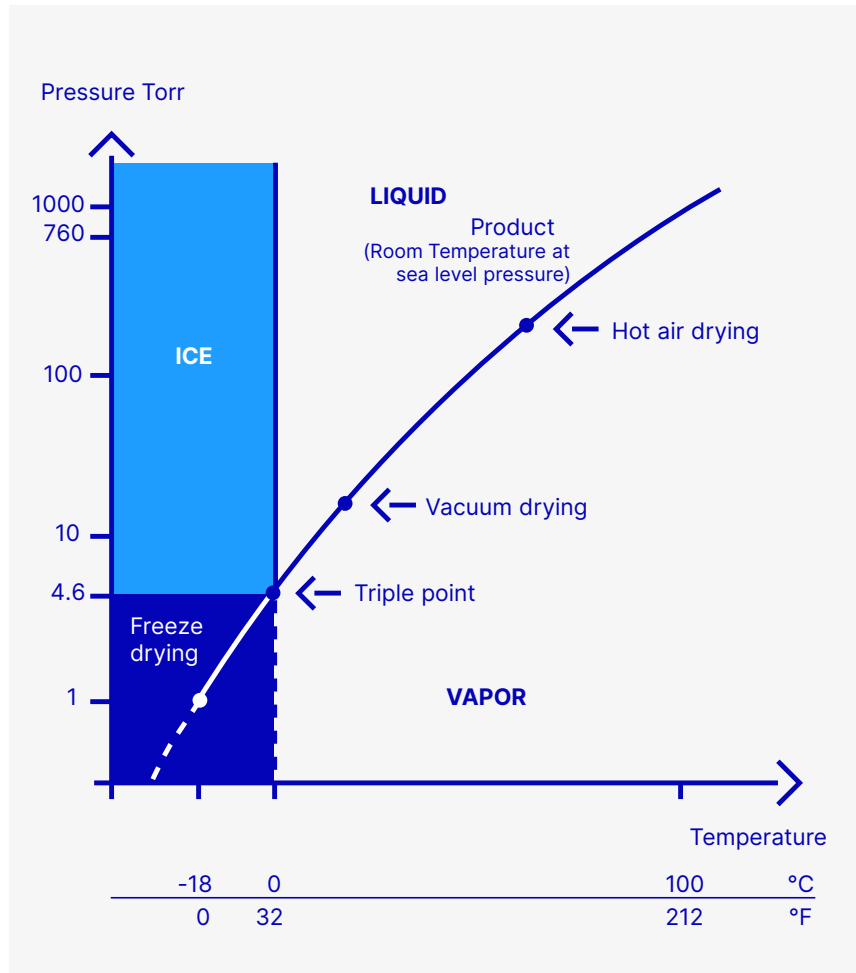


FREEZE DRYING

RAY® plants for the food industry



Freeze drying the RAY® way



Water phase diagram

In our RAY® freeze dryers, frozen products are dried at temperatures below -18°C . No thawing of the product takes place and its quality is preserved.

Meeting market demands

As consumers, we want a choice of prepared foods that look and taste as good as fresh foods, and are healthy, easy to prepare, and safe to store without refrigeration. Freeze drying allows manufacturers to meet these expectations by retaining the natural look, flavor and consistency of different types of fresh foods, while preserving key nutrients, including carbohydrates, proteins, vitamins and minerals.

- The freeze drying process results in stable products with a long shelf life.
- Freeze dried products are durable at room temperatures, eliminating the need for complicated cold chain distribution logistics.
- The low weight and easy handling of freeze dried products reduces shipping costs dramatically.

RAY® freeze drying plants from GEA have been designed to give you great results with a wide range of product types, including fish, meat, fruits and vegetables, coffee and herbs.

The RAY® batch freeze drying systems complement our CONRAD® freeze dryer for continuous processing. Whichever system you choose, GEA freeze drying technology is universally designed to help preserve product structure, flavor, color, and the integrity of nutritional components. We believe that our RAY® systems offer a cost-effective freeze drying solution that can generate the highest quality products on the market.

Key advantages

GEA is one of the world's most experienced designers and manufacturers of freeze drying plants, and we offer our customers reliable freeze drying plants that are backed by decades of technological and process expertise. Our aim is to configure user-friendly, versatile systems that can help you create market-winning products and stay ahead of the competition.

The RAY® freeze dryer technology is designed so that you can:

- Minimize product loss
- Reduce energy and labor costs
- Optimize plant reliability

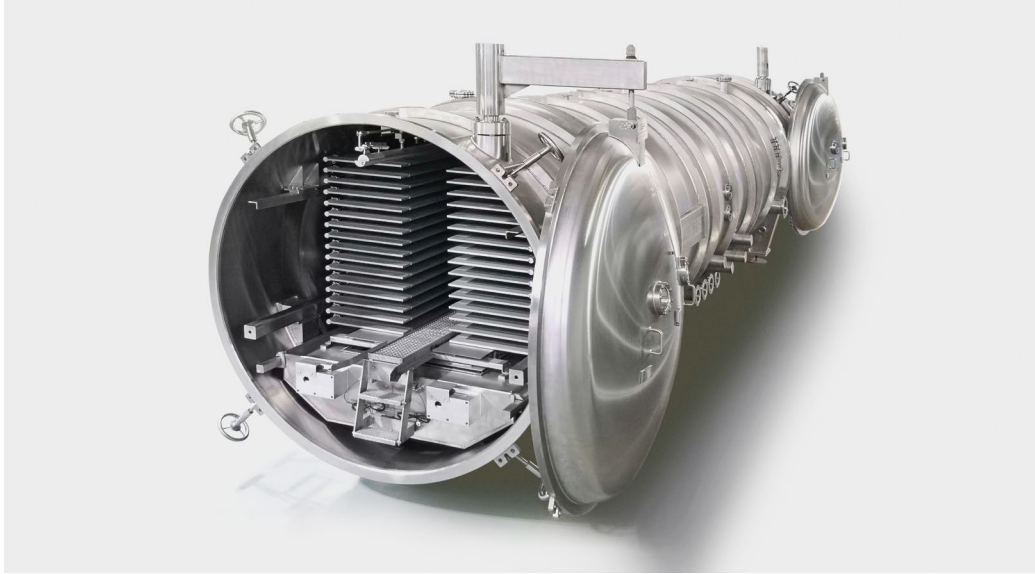
RAY® freeze dryers in the real world



GEA offers a full range of plant services worldwide – from integrated solutions to key components that can help to make your freeze drying process more profitable. We've worked with customers worldwide to develop a comprehensive range of RAY® freeze drying plants, and we can help you to select and configure the technology that will let you confidently process a wide range of products. We also offer our wealth of process and market insight to support your product research and feasibility studies.

Our customers have shown how GEA RAY® technology can help to support growth, diversification, and reduce food waste. The winning combination of GEA knowhow and RAY® technology was instrumental in helping one food packaging company diversify into freeze drying fish, meats and ready meals, and separately enabled local farmers in remote regions of Turkey generate high value freeze dried fruits and vegetables from surplus crops.

RAY® batch dryers



Modular and efficient:
The RAY® Batch Dryers.

Refined efficiency

We've used our detailed knowledge of the freeze drying process to develop RAY® systems that we believe will give you an optimum freeze drying, process, with efficiency and economy built in.

Some of the key features of the RAY® equipment include:

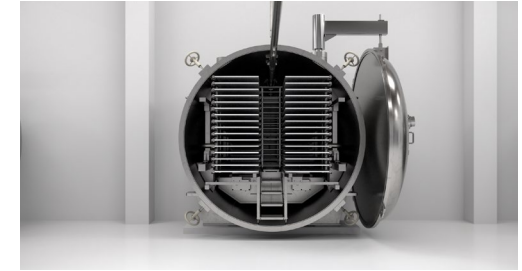
- Fast and uniform drying
- High sublimation capacity
- Negligible product loss (less than 0.1%)
- State of the art support systems
- Flexible and efficient design
- Simple and reliable operation
- Easy access for cleaning and maintenance.

Modular design

RAY® freeze dryers from GEA are designed as modular systems, with cabinet, heating plates and vapor condensers built as separate, individual units. The modular design gives you a number of advantages during installation and operation, including fast set up on delivery, so you can get production under way without delay. Dryer assembly can commonly be carried out by local subcontractors.

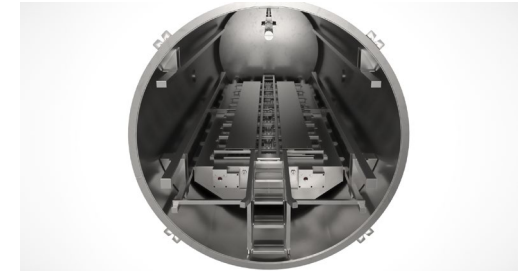
Heating plate module

Twin stacks of heating plates designed for RADIANT drying. The heating plates are made of anodized aluminium.



Vapor condenser module

Built-in condenser with GEA's unique automatic de-icing system. The condenser is made of stainless steel.

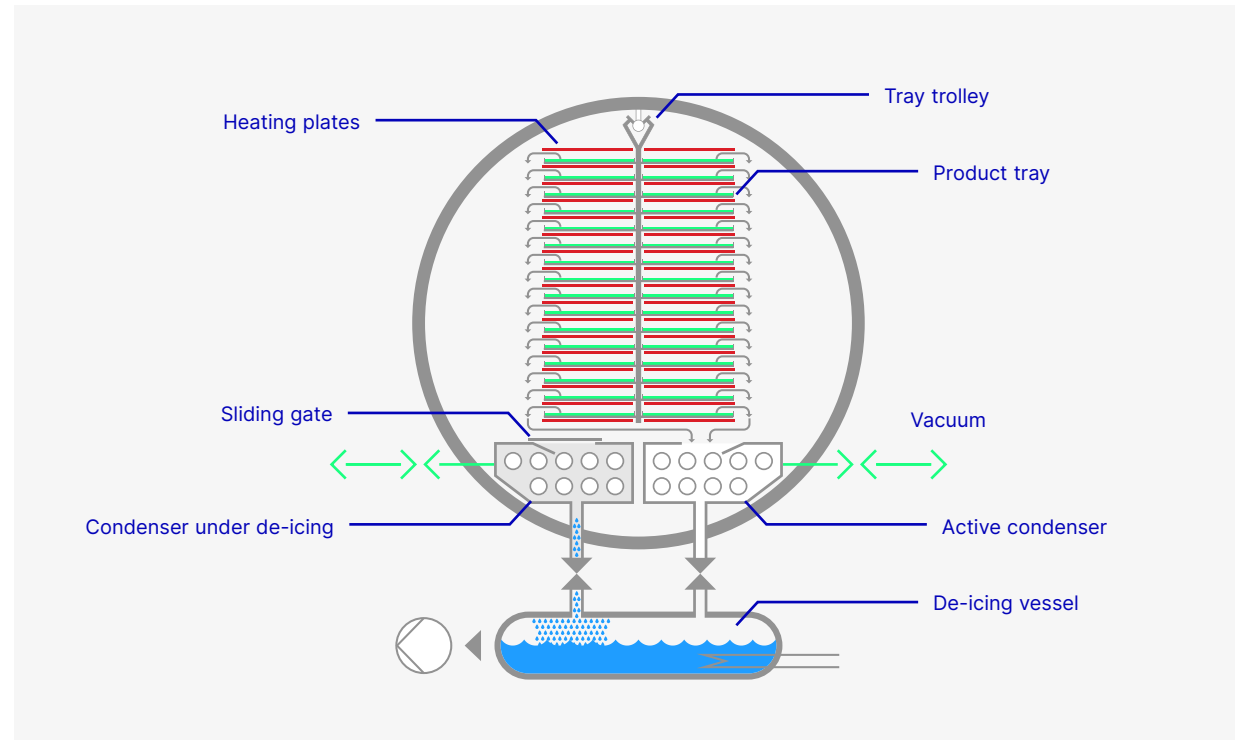


Cabinet module

Cylindrical vessel with door at one end for loading and unloading. All connections with auxiliary systems are located at the rear end.



Taking the headache out of de-icing



RAY® technology for smaller volumes

The smaller RAY® (2, 8, 16, 24, 50) cabinets feature a de-icing system based on water flushing. The condenser is flushed through with pre-heated water at the end of every freeze drying cycle. This results in ice in the condenser melting within 10 minutes, and the water is then simply drained. This method, which is ideal for these smaller systems, is simple in operation, and low on investment cost.

Larger RAY® systems with CDI

The larger RAY® (75, 100, 125, 150) cabinets incorporate our fully automated, continuous de-icing (CDI) system. During de-icing the condenser chamber is closed off from the de-icing vessel. Vapor at 25°C from the de-icing vessel then condenses on the cold condenser surface, melting the ice. The condenser is cooled to operating temperature, resulting in condensation of any remaining vapor.

As the vapor condenses the pressure in the condenser is also decreased until operating vacuum is achieved, eliminating vacuum loss at switch-over between vapor condenser chambers.

The ice layer on the condenser coils is kept to a depth of 5 mm (1/5") or less. This allows for a negligible temperature difference over the ice and relatively low energy consumption by the refrigeration plant.

The CDI system is designed to achieve:

- Constant condenser capacity
- High freeze drying capacity per square meter of tray surface, as the ice is being removed continuously
- Fast changeover between batches, because there is no need to perform de-icing between batches
- Higher overall profitability for large-scale freeze drying processes, thanks to faster drying times, faster changeover, and reduced energy costs for the refrigeration plant

Complete plant

- **Tunnel freezing/frost storage**

One 8-hour preparation shift can provide sufficient product for 24 hours of freeze drying. Freezing is by the “first in/first out” principle.

- **Transport by overhead rail**

Trolleys carry the product trays from freezing, through freeze drying, to emptying. It’s a simple, hygienic, and safe system.

- **RAY® freeze dryer**

Fully automated control of the drying cycle for each batch. Just close the door and press the button. Freeze dryers can run overnight, with minimal supervision.

- **Heat supply system**

Temperatures are carefully controlled for optimized drying, from below freezing (brine) or room temperature (cooling water) up to 130°C.

- **Vacuum system**

Dependent on the RAY® model, process vacuum can typically be reached in less than 12 minutes. Time to vacuum can be reduced even further for products with special requirements, such as those with a low freezing point.

- **De-icing**

The RAY® freeze dryers use either water flushing, or the GEA continuous de-icing (CDI) system. Which system is used will depend on the model.

- **Refrigeration system**

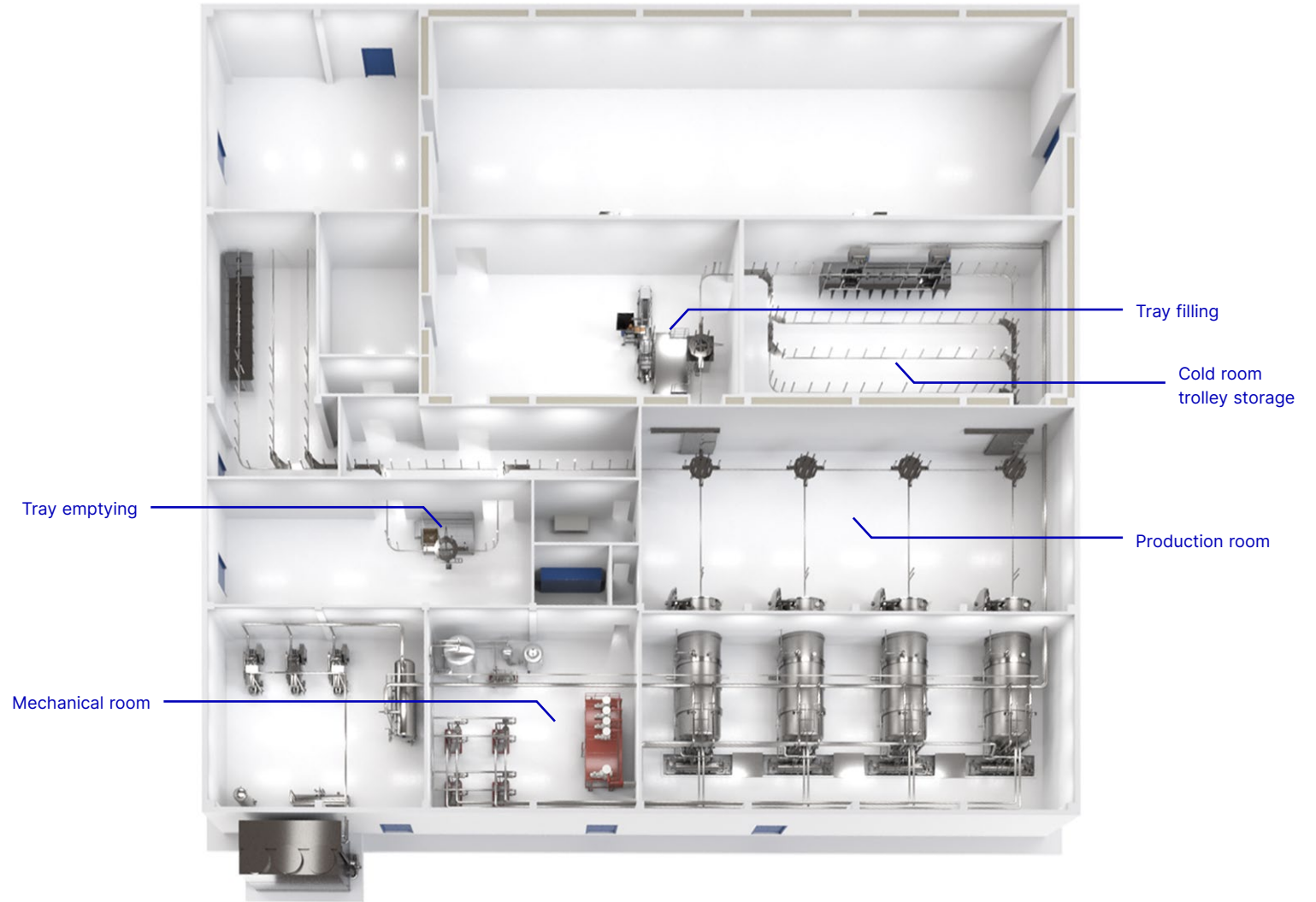
GEA can supply systems that incorporate highly efficient refrigeration compressors, and we also offer heat pump solutions that can enable significant energy savings.

- **PC/PLC control system**

The RAY® system is supplied with a complete industrial control system, including recipe facilities and full batch reporting. The GEA Codex® automation solution not only ensures safe operation, high product quality, improved performance, data management and value extraction, it also provides global service support for your control system.

Typical capacities	1	2	8	16	24	50	75	100	125	150
Effective tray area (m ²)	0.8	1.5	7.6	15	23	45	68	91	114	136
Max. Sublimation capacity (kg H ₂ O/hour)	1.7	3	17	34	50	100	150	200	250	330
Typical input capacity solids 15% (kg/24 hours)	20	39	190	380	570	1125	1780	2375	2375	3723
Output capacity (kg/24 hours)	3	6	28	56	84	175	275	370	370	576
Freeze drying, WxL1 (m ²)	N/A	N/A	50	60	80	100	100	200	220	300
Freezing+cold storage, WxL2 (m ²)	N/A	N/A	15	20	30	40	40	70	80	100

Plant layout



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