# Freeze Drying

CONRAD™ plants for the
food and beverage industries

GEA engineering for a better world

gea.com

# Fresh, convenient, value-added – freeze drying with unique advantages

We live in unique times. Never before has there been such variety in food. And never before has the quality of that food been under such scrutiny.

## Food for our times

Food for modern families should be convenient, nutritious, delicious, and devoid of additives, preservatives, and artificial colors. Freeze drying fits the bill perfectly.

A freeze dried product retains its original nutritional value, texture, product shape, and taste. It is the fresh product with just the water removed – and nothing added.

No wonder consumers prefer freeze dried products. They represent the ultimate in 21st century convenience, with none of the goodness taken out.

## Freeze drying

Freeze drying is the drying of an already deep-frozen product in a vacuum below the triple point. The vacuum allows the ice to turn directly into vapor without first passing through the water stage, in a sublimation process. This ensures that the product retains most of its original shape, color, taste, and nutrients.

## Advantages of profit

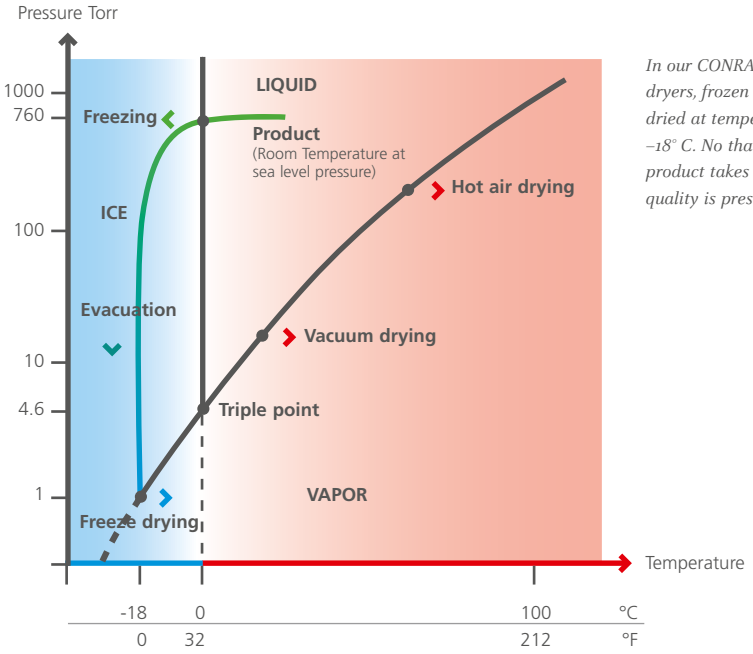
Freeze dried products have other advantages too: they have uniform, high quality; a very long shelf life; require no refrigeration during storage; they are lightweight, making them easy and inexpensive to transport; and they reconstitute quickly and completely with the addition of water.

That is why freeze dried products are in such great demand and why the freeze drying process is able to add significant value to a wide range of food products including: vegetables; fruit and berries; meat and seafood products; prepared meals including baby food, TV dinners, camping provisions, and military rations; and beverages such as tea and coffee. Coffee is by far the biggest single freeze dried food commodity in the world today.

### FREEZE DRYING FACTS

3,000 kg of frozen strawberries will result in 300 kg freeze dried berries. The same amount of chicken will give 1,000 kg of dried product.

## Water phase diagram




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

## Benefits of freeze drying

- Retains, to the greatest possible extent, the original shape, color, taste, texture and nutrients
- Instant rehydration
- Lightweight for easy handling and transportation
- No refrigeration needed during transportation and storage
- Long shelf life

## Products created with freeze drying

- Coffee, tea and other extracts and liquids
- Vegetables, fruit and berries
- Meat and seafood products
- Prepared meals
- Milk products
- Dyes, pharmaceuticals, pigments and enzymes
- And many more

# CONRAD™ freeze drying

## One process – a world of products

The Atlas CONRAD™ freeze drying process from GEA is designed for high volume processing of high-added-value products. The drying process is fundamentally the same for any type of product, but the way in which different products are prepared for drying varies considerably.

## Preparation

Products for freeze drying fall into three basic categories: liquids, Individually Quick Frozen (IQF) products and combined products. Liquids include coffee, tea, juices and other extracts. IQF products include segments of, or whole fruit, berries, seafood, meat and vegetables. Combined products include soup blocks, rice dishes, baby foods, camping foods, etc.

## FREEZE DRYING FACTS

Approx 2.2 - 2.5 kg of green coffee beans
result in 1 kg of freeze dried instant coffee.

## The challenge of liquid processing

Preparation for the freeze drying of liquids is the most complex part of the process. First, the liquids must be treated to achieve the required density and color characteristics. The concentrate is then frozen slowly on a CAB (Continuous Air Blast) freezer, or alternatively more quickly on an Atlas Rota-freeze or in other freezing devices for obtaining a solid frozen form. The product is then granulated and sieved to produce granules of optimum size depending on requirements.

The granules are loaded onto the CONRAD™ trays to pass through the freeze dryer. Everything is weighed to ensure the correct volume on each tray for perfect freeze drying. The trays are automatically loaded using specially developed tray feeders to secure a uniform and accurate filling.

## IQF and combined products

IQF products are loaded by weight or volume directly onto the CONRAD™ trays before passing through the CONRAD™.

Combined products are normally loaded into special plastic molds placed into the CONRAD™ trays - defining the block size of the product. Freezing takes place in a tray freezer prior to the further automatic transport into the CONRAD™.

Each product has to be prepared carefully to ensure it retains its original characteristics and to meet the requirements of the finished product.

# CONRAD™ benefits

### Overall benefits

- Continuous production
- Economical operation
- 98% efficiency
- Low maintenance costs
- Low maintenance requirements

The internal vapor condenser, with built-in de-icing system, is the unique feature of all Atlas freeze dryers. The benefits: it saves space, it is more reliable, it does not cause the loss of product, and it uses less energy compared with external condenser systems.

### Space saving

The special vapor condensers are optimized and built into the side of the drying chamber.

### More reliable

The condenser system does not rely on large external vacuum valves with pressure drops that are difficult to secure. Using the internal system, de-icing is performed under vacuum avoiding the need to seal the chamber against large pressure differentials.

### Low product loss

No product abrasion and low vapor velocities within the dryer guarantee as little as 0.1% product loss during the process.

### Low power consumption

De-icing under vacuum, rather than at atmospheric pressure, eliminates the need to re-establish vacuum. This, combined with optimal vapor flow conditions, reduces energy consumption by up to 40% compared with competing freeze drying technology.

### Design

The Atlas CONRAD™ cabinet is made in a special high-quality coating and is further available in a stainless steel execution. This is all in accordance with customer requirements as well as further regulations and standards prevailing within the specific industries.

### CONRAD™ ECO

For further optimizing of the energy consumption of the CONRAD™, an ECO version is offered, with a larger diameter and increased condenser surface, giving an energy saving of up to 10% on the refrigeration system.

## MORE THAN JUST A PLANT

GEA has the process know-how and industry expertise to be more than just your supplier – we can become your partner. Our research facilities are at your disposal for pilot freeze-drying tests of all food and related products.

## Capacity examples for CONRAD™ – Continuous freeze drying plants

| | Type CONRAD™ | | | | | | |
|---|---|---|---|---|---|---|---|
| | **200** | **300** | **400** | **500** | **600** | **2x500** | **2x600** |
| **Extracts with 45% dry matter** | | | | | | | |
| Capacity input (kg/h) | 474 | 711 | 948 | 1,186 | 1,423 | 2,371 | 2,845 |
| Capacity output (kg/h) | 220 | 330 | 440 | 550 | 660 | 1,100 | 1,320 |
| **Output kg/24h** | **5,280** | **7,920** | **10,560** | **13,200** | **15,840** | **26,400** | **31,680** |
| **Extracts with 25% dry matter** | | | | | | | |
| Capacity input (kg/h) | 313 | 469 | 625 | 781 | 937 | 1,563 | 1,874 |
| Capacity output (kg/h) | 81 | 121 | 161 | 201 | 241 | 403 | 482 |
| **Output kg/24h** | **1,933** | **2,900** | **3,867** | **4,833** | **5,800** | **9,667** | **11,600** |
| **Solids with 15% dry matter** | | | | | | | |
| Capacity input (kg/h) | 170 | 256 | 341 | 426 | 511 | 852 | 1,022 |
| Capacity output (kg/h) | 26 | 40 | 53 | 66 | 79 | 132 | 158 |
| **Output kg/24h** | **632** | **948** | **1,264** | **1,580** | **1,896** | **3,161** | **3,792** |

# The CONRAD™ process

The CONRAD™ process is fully automatic throughout and requires only minimal staff for continuous operation. All movement and process parameters are carefully controlled, monitored and logged with the most modern PLC/PC system.

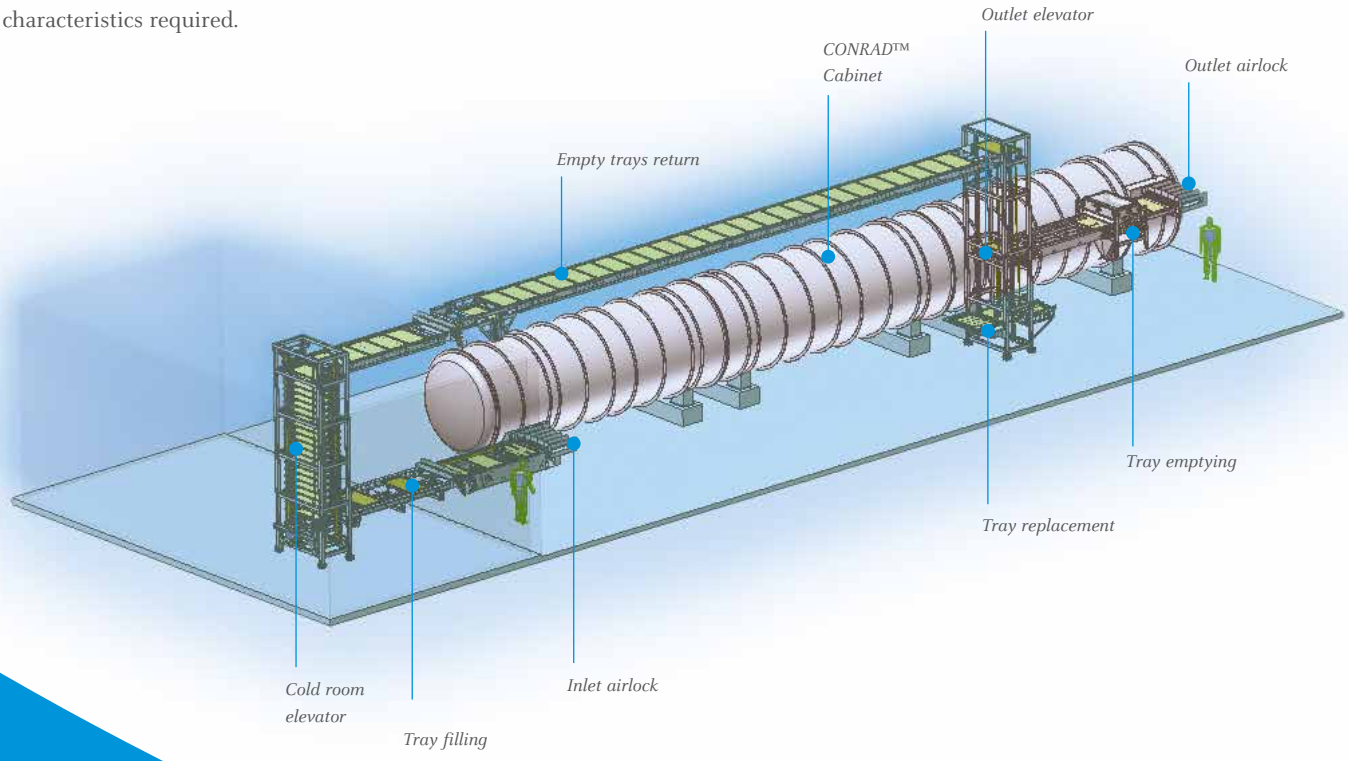
Trays with frozen product are loaded into the dryer through an efficient airlock system to an inlet elevator inside the CONRAD™ chamber.

When the elevator has a full stack of product trays, the entire stack is pushed into the first drying zone. More stacks follow and are pushed in turn through the various subsequent drying zones of the dryer – each adjusted to provide the drying characteristics required.

When trays arrive at the dryer exit elevator they are unloaded, again through an airlock, and the product emptied from the trays.

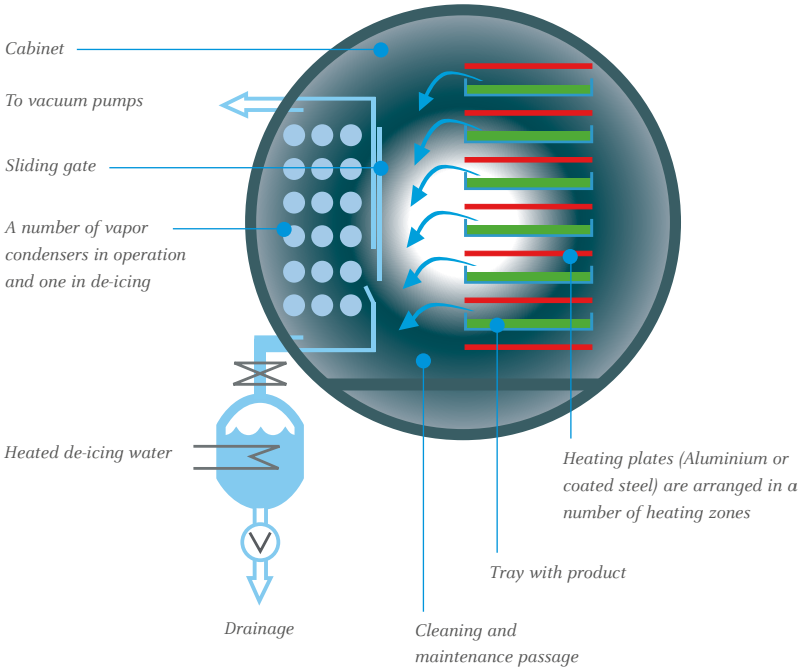
## The CDI System

The vapor from the freeze drying process is collected on the special Atlas condensers. In order to ensure a continuous process, all Atlas CONRAD™ dryers are equipped with a Continuous De-Icing (CDI) System that enables automatic de-icing of the condensers with no loss of operating vacuum.



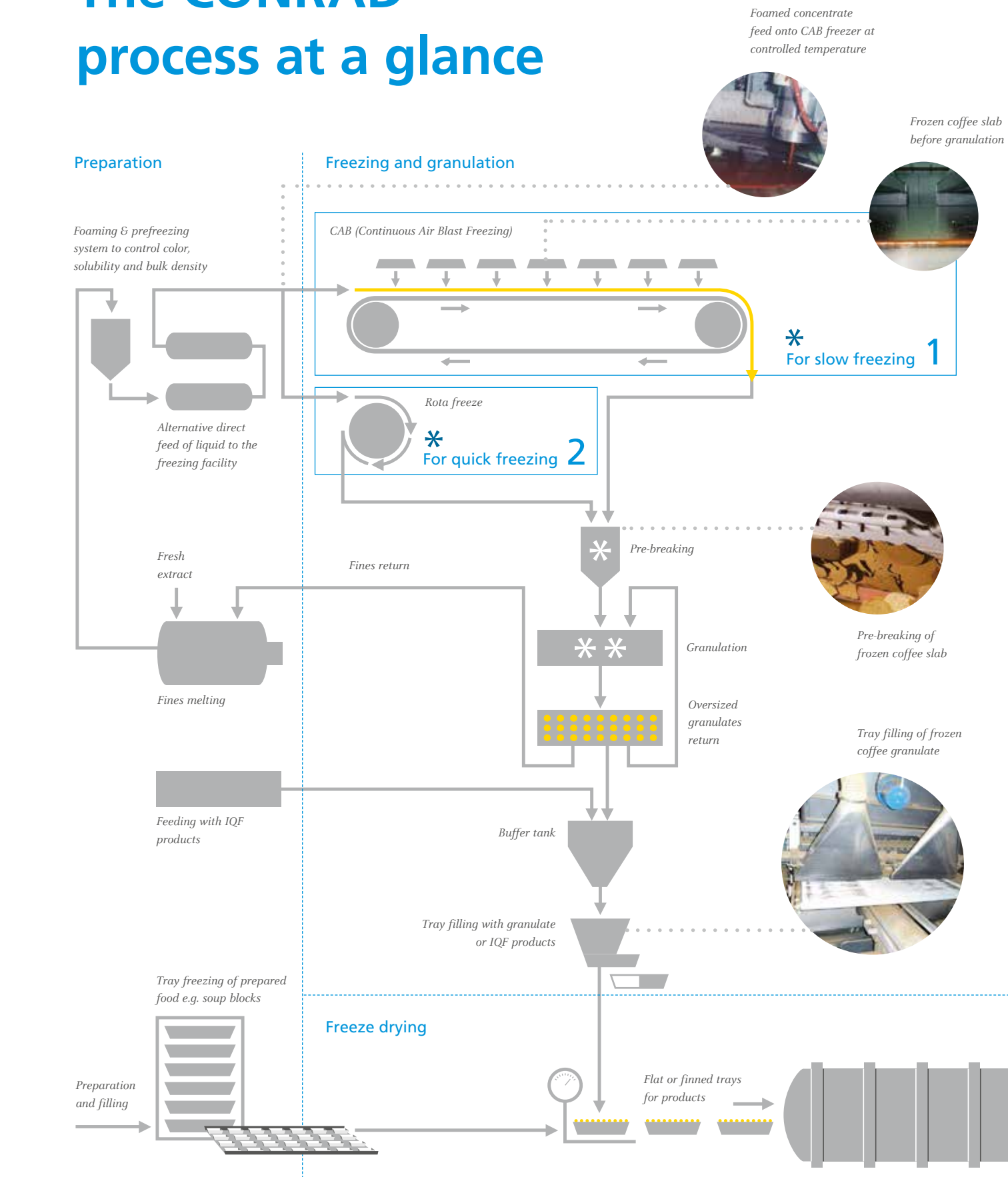

## FREEZE DRYING FACTS

Up to 30,000 30 x 40 mm soup blocks can be freeze dried per hour in one single CONRAD™ 500.



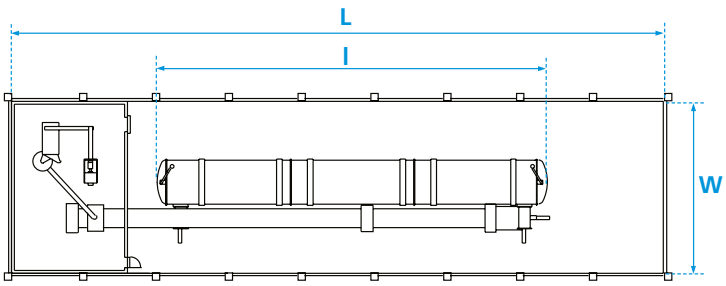

GO TO NEXT PAGE FOR FULL PROCESS AND SYSTEM SCHEMATICS

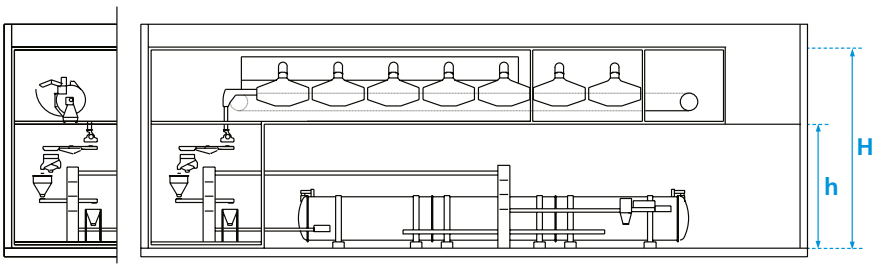
# The CONRAD™ process at a glance

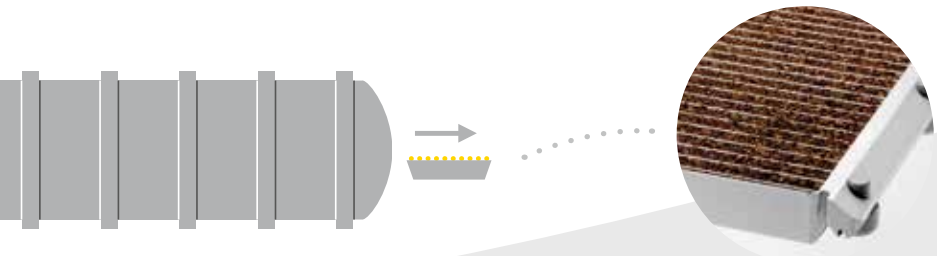


## CONRAD™ systems dimensions

| Type | 200 | 300 | 400 | 500 | 600 | 2x 500 | 2x 600 |
|---|---|---|---|---|---|---|---|
| L (m) | 35 | 40 | 40 | 45 | 50 | 45 | 50 |
| l (m) | 13 | 17.5 | 22.5 | 27 | 31.5 | 27 | 31.5 |
| W (m) | 12.5 | 12.5 | 12.5 | 12.5 | 12.5 | 23 | 23 |
| H (m) | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| h (m) | 8 | 8.5 | 9 | 9 | 9 | 9 | 9 |



*Finned tray with coffee granules*

## We live our values.

Excellence • Passion • Integrity • Responsibility • GEA-versity

GEA Group is a global engineering company with multi-billion euro sales and operations in more than 50 countries. Founded in 1881, the company is one of the largest providers of innovative equipment and process technology. GEA Group is listed in the STOXX® Europe 600 Index.

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