



Solutions for  
**Breakfast  
Cereals.**

# Proven cooking and forming processes. Integral element of the production process.

Breakfast cereals are firmly established almost all over the world. In addition to a wide variety of forms, tastes and colors, they are expected today to also meet stringent nutritional quality and food safety requirements. A consistently high product quality, high operating reliability, and maximum efficiency are the most important requirements that state-of-the-art production systems must satisfy. To meet them, Bühler offers its customers a multitude of suitable system components plus the relevant expertise in product development, scale-up, engineering, plant design and construction.

## Raw materials reception and storage

Bühler supplies bulk reception and storage systems, Big Bag unloading stations, or manual intake hoppers with high-precision proportioning elements and reliable conveying systems, which offer flexible and hygienic handling of raw materials.

## Raw material blending and mixing

The recipe ingredients need to be mixed into a uniform blend. Different levels of automation cover functions such as product retracing or logging of production statistics according to specific needs, manpower requirements, or legislation.

## Extrusion processes

Extrusion is the most frequently used process for cooking and for complete or partial forming of cereal products. As an HTST (High Temperature Short Time) process, extrusion is a comparatively gentle process. As it uses a minimum of water, it is a low-energy process and therefore ecological as well as economical. Using steam and water, the premixed solids are fed into the preconditioner. They are partially heated almost to boiling temperature and precooked more or less intensively, depending on the water content and the selectable retention (dwell) time. If required, the taste-imparting substances are also added to the preconditioner stage in order to promote

aroma reactions as early as during this stage. This allows the raw materials to be cooked with the introduction of more or less mechanical energy as a function of the product. The water content and the temperature-versus-time profile can be precisely set. This enables accurately defined and consistent product qualities to be obtained within a broad variation range. Additional colorants, flavouring agents or mineral additives enhance the visual and taste-related attractiveness of the products as well as their nutritional value. When properly designed and validated, extrusion process is also an excellent kill step for bacteria which may be present in the raw, agricultural materials.

## Forming and cutting

Cutting can be accomplished directly at the die face or farther downstream in a separate cutter. Together with the process conditions prevailing inside the extruder, the suitable die hole geometry, the extrusion speed, and the cutting mode determine the form and texture of the product. Depending on the requirements, it is possible to extrude direct-expanded products with two- or three-dimensional forms or semi-finished pellets for subsequent indirect expansion. (Co-extruded) cereal pouches filled by filling mass systems can be neatly formed from the strand of product in a pillow cutter, producing leak-proof pillows.

## Traditional cooking

As a complement to the extrusion process, also traditional cooking stages can be integrated. Whole grain or coarse grain fractions can be cooked to the point with the necessary classification and involving minimum shearing. Batch cooking corn (maize), wheat or multi-grain products. Batch cooking offers the right alternative to the fully continuous process especially for corn (maize), wheat or multi-grain products.

## Cold-forming, flaking

Beside the cooking process with subsequent forming at the extruder die face, Bühler also offers two-stage cooking processes. In these, cooking and final forming are separately performed in two machines. Two common representatives for indirect expanded cereal processes are single-screw extrusion and flaking by rolls. Single-screw extrusion with vertical face cutting is applied for making high-precision products and/or

when high throughputs are involved. For rolled breakfast cereals, Bühler offers its industry proven flaking roller mills.

## Thermal treatment

Browning, expansion degree, texture, surface structure, trueness of form, storage stability, flavor, and numerous other characteristics are essentially controlled by thermal treatment. The functions of hot-air conveying, predrying, tempering, toasting, puffing, cooling, and final drying offer a multitude of solutions which must be carefully matched.

## Coating

Liquids metering and solids proportioning units allow the application of fat- or water-based solutions in combination with spices, nut slivers, etc. These systems guarantee a wide variety of solutions, thanks to heatable or coolable drum types.



## High-value breakfast cereals. Varied characteristics in shape and color.



### Direct-expanded cereals

Widespread traditional products as well as customized shapes. The process, for which a patent is granted, also allows simultaneous production of different colors. If required, products may also be spray-coated.



### Expanded flakes

Cornflakes or wheat, rice, and multigrain flakes etc. produced by the same processes: extrusion or traditional cooking. Spray-coating is also possible, e.g. with sugar syrup or dry ingredients such as nut slivers.



### Granola

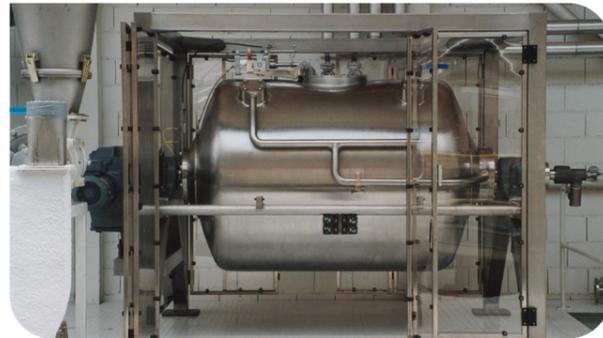
Granola is a Müsli blend coated with sugar and vegetable oil or fat. It is mixed with milk yoghurt and often with fruit jus or grated apples or other fresh fruits.

### Co-extruded cereals

Water- or fat-based fillings in direct-expanded cereal envelope. Very wide variety of shapes, surface structures, colors, and textures.



## Core elements from Bühler. The crucial process operations.



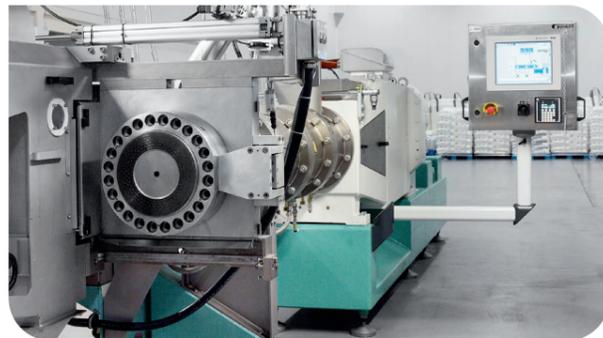
### Batch Cooker BSTC.

The BSTC is applied to processes including traditional (discontinuous) cooking of whole grain or coarse fractions. The compact rotary drum cooker is an all stainless steel construction. Its 1,700 l pressurized vessel is designed to receive batches of up to 800 kg. The component is installed as a complete module with fittings and a separate operator's panel. A PLC control system ensures accurate and stable process conditions over the entire automated cooking cycle.



### Preconditioner BCTC.

The preconditioning concept is based on a separation of the overall process into two stages: A highly efficient raw component mixing-steaming-heating unit and a retention unit with an adjustable residence time. Available in 6 sizes, the pre-conditioner can cover a wide range of process requirements with respect to residence time and throughput. Thus, the BCTC is especially suitable for indirect expanded products.



### Twin-Screw Extruder BCTA.

The modular twin-screw extrusion system offers highest flexibility for continuous mixing, cooking and forming steps. Fine mechanical engineering and an integrated PLC control system allow for stable process conditions. Moreover, the elaborate construction ensures easy adaptation to different products and processes. All together the BCTA series is an effective tool to meet today's but also future quality and production needs.

### PolyFlake BCFB.

When it comes to satisfying the most stringent product quality and throughput requirements in flaking grain and grain pellets into breakfast cereals and flakes, high-performance flakers are indispensable. PolyFlake produces flakes from extruded or boiled maize (corn), wheat, oats, multigrains and other raw grains, while meeting the most rigorous standards in terms of product quality, throughput capacity, hygiene, and ease of maintenance.



### Spraying Drum WAAA.

The spray drum is suitable for extruded products like breakfast cereals and snacks, as well as for pet nutrition and fish food. Liquids like sugar solutions, syrup, dyes, oils and fats can be added, along with fine and coarse-grained dry substances like powdered sugar, nut clusters, aromatics, vitamins and spices. The twin spray drum model is available as a shifting dual-drum system.





Drying Technology.

### **The Science Behind the Crunch.**

Crunchiness is a complex attribute, an auditory sensation that consumers expect and associate with their favorite cereals. From the mixing of grains for cooking or extrusion, to the control of moisture and texture in the final drying, Bühler helps cereal manufacturers master the morning meal.

The final processing stage is key to achieving the ideal sensory combination, keeping a flaked cereal, a puffed whole grain, or an extruded cereal crunchy for many mouthfuls. Bühler Aeroglide knows this step like no one else.

Bühler began building ready-to-eat cereal dryers in 1959 through its Aeroglide and FEC subsidiaries. Today, collaborations with multi-national cereal processors help refine designs with innovations that set standards for food safety, productivity, and sustainability.

# Coated Cereal Products. Ceres Plus.



## Uniform processing.

Coatings do more than appeal to consumer taste. They prevent moisture absorption and serve as a critical structural component that keeps a cereal crunchy.

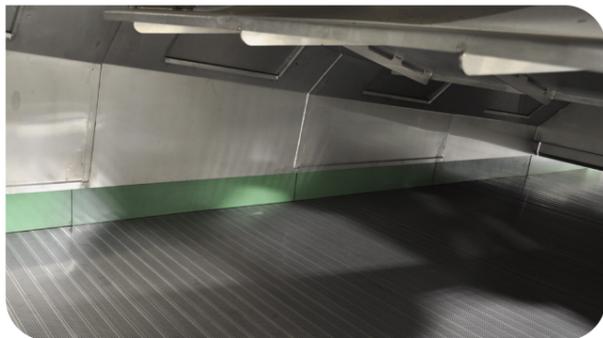
For coated applications, such as granola and sugar-coated cereals, the Ceres Plus promises customers a competitive edge with the most consistent air flow ever. A dual plenum configuration with symmetrical all up-flow air ensures moisture uniformity for coated product requirements.



## Clean operation with less downtime.

A 2B stainless steel open frame construction features TIG welding for an exceptionally clean interior. This, coupled with continuously welded doors that contain 100mm insulation, guard against moisture, minimizing potential growth areas for bacteria.

Even the hygienically designed support system makes cleaning quicker and easier by featuring a round tube design that puts fewer feet to the factory floor, eliminating inaccessible locations. It also makes installation quick and easy.



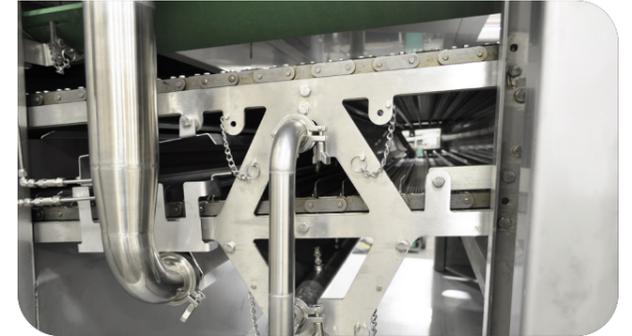
## Hygienically engineered.

Bühler knows coated cereal processors must remove sticky residue effectively with minimal downtime. That's why the Ceres Plus has dozens of features that help to ensure that the highest levels of hygienic requirements are being met, in dramatically reduced time compared to the standard.

## Continuous belt wash system.

The continuous belt wash system, located at each transfer, is self contained, and lets the operator easily clean the conveyor during production. The wash is followed by an air knife to dry the conveyor.

The Ceres Plus increases operational cleanliness with an insulated slab roof and floor that assist with water management, and bedplates with one-piece construction that reduce collection points for debris.



## Direct drive fan configuration.

The highest processing efficiencies can be achieved with a direct drive fan configuration. This means the ideal air volume can be selected by adjusting the fan speed with the variable frequency drive.

Because direct drive fans eliminate the belt, pulley, and guard of the belt-driven style fan, they are more energy efficient, more hygienic, run quieter, and require less maintenance.



## External burner box.

The burner box, external to the dryer, ensures the safest processing operation, keeping the burner flame separate from the product areas where it could come in contact with fines. This design also eliminates the possibility of flavor contamination, as no product particles can pass through the heat chamber.

Standard modules offer multiple heat/process zones, as well as independent ambient air and conditioned coolers, to match product quality and capacity requirements.



## Uncoated cereal products. **AeroDry multi-pass and multi-stage dryer.**

For extruded, flaked and direct expanded cereal applications, the multi-pass conveyor dryer is an ideal solution. The AeroDry uses zoned temperature control and alternating airflow to customize the thermal process and maximize the efficiency of heat/mass transfer, ensuring consistent product characteristics across the entire conveyor bed.



### **Unmatched moisture uniformity.**

Multi-stage configurations allow the product to be stacked deeper as it progresses through the drying cycle, resulting in longer retention times and more efficient and uniform drying. Even airflow with the dual plenum option provides unmatched moisture uniformity.



### **Highest production rates with the smallest floor space requirement.**

Plant owners with restricted floor space can double or triple production capacity with conveyor beds positioned one above the other in order to maximize capacity. These designs also set new standards in cleanability.



### **Sanitary design ensures a clean, food safe operation.**

Large doors and removable panels provide easy access. Dryer floors and roofs are pitched for easy cleaning, and continuously welded for maximum sanitation. Interior surfaces are sloped and smooth, so that product flow doesn't become a safety or sanitation risk. Hygienic doors provide continuously welded insulated door panels to prevent moisture from entering the panel. Clean-in-place systems help ensure the cleanest processing conditions.



# Toasted, puffed, expanded. AeroToast fluid bed toaster.



## The Right Color, Texture, and Taste.

Bühler Aeroglide's air impingement technology is the perfect drying solution when color, texture, and taste are critical factors.

Ideal for rapid expansion and coloring of flaked and puffed products, the AeroToast provides consistent and efficient performance and reliable production.



## Air Impingement Technology.

Using a high-velocity air impingement airflow during the conveying process, AeroToast gently agitates the product, creating a fluidized product bed that ensures uniform processing. Precise time and temperature controls make quick and simple work of achieving the required product characteristics.



## High Rate of Thermal Transfer.

Impingement technology allows a very high rate of thermal transfer, imparting taste, texture, and color changes rapidly and in a uniform fashion.

AeroToast features unique airflow configurations designed to maximize the toasting process.

## Custom plant configurations.

Heat source, recirculation and dust removal configurations can be easily adapted to a customer's operating conditions to assure quicker installation, better plant integration and lower plant operating costs. Customized design and configuration also help reduce operating costs. AeroToast offers customized conveyor bed options to suit the customer's specific product type and handling characteristics for best operational performance.



## Superior sanitation, energy savings.

The AeroToast has 100% fully welded internals for superior sanitation, and provides easy access for thorough cleaning. This is particularly important for processing ingredients that have sticky product characteristics. Energy savings are also achieved with a customized recirculated air design and accelerated heat transfer.

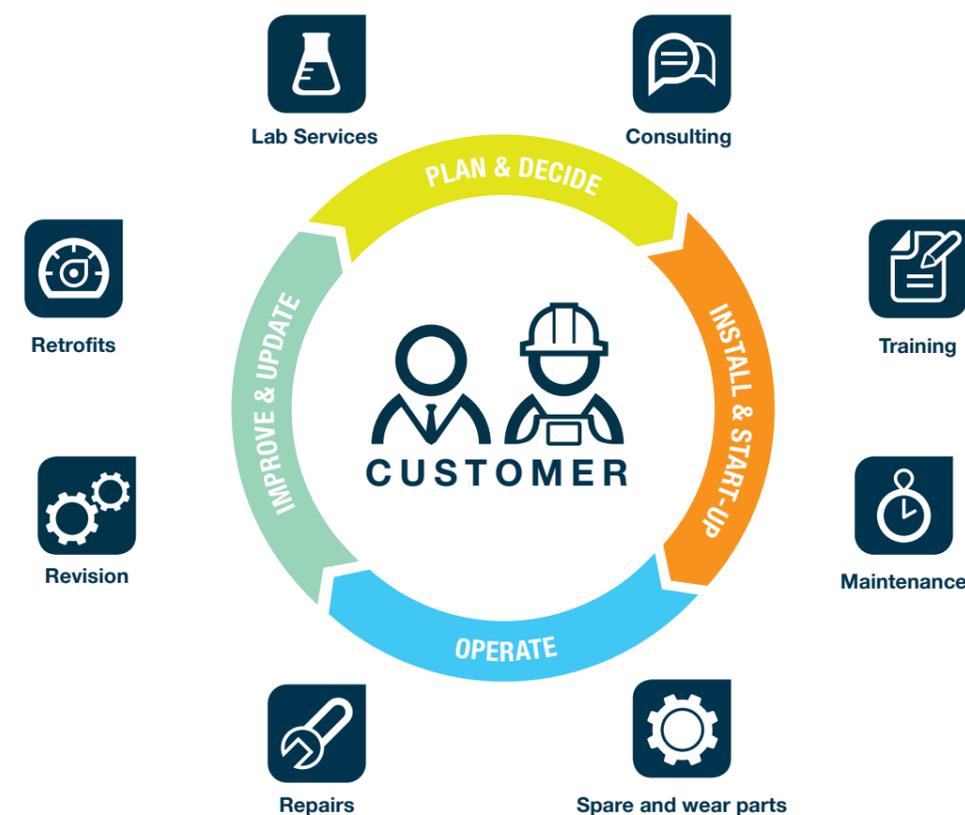


## Integrated cooling.

An integrated cooler provides a positive stop to the thermal process, maintaining the required product characteristics and preparing the cereal for packaging or any further downstream processes.



## Extensive range of services. From engineering to training.



### Lab Services

The laboratories offer a broad range of analyses and testing of food and technical materials in order to innovate processes and improve equipment for our customers.

### Spare and wear parts

Highest standards of reliability apply to original Bühler spare and wear parts. They are perfectly adjusted and ensure performance and production safety.

### Training

At Bühler training centers – or at any site worldwide – specially trained experts pass on their hands-on expertise and knowledge to customers' employees.

### Revision

Bühler evaluates, over-hauls, adjusts or renews customer installations, including Bühler and non-Bühler machines.

### Consulting

Strategic, plant performance, or energy consulting are just some of the consulting services to improve product quality, production processes and energy efficiency.

### Repairs

Dedicated to minimizing downtime in the event of an incident: Fast and reliable technical repair service via the Bühler eTicket or the Bühler Helpline – worldwide, 24/7.

### Maintenance

Packages are adjusted to fit production cycles to prevent downtime, loss in production efficiency or product quality, ranging from individual services to complete outsourcing of maintenance.

### Retrofits

With individual upgrades and conversion kits time-worn Bühler machines will perform to current standards of technology and efficiency.

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