



Alternative Protein
Solutions

**Meat substitutes
with high-moisture
extrusion**


Revolutionary extrusion applications. Solutions for a wide range of novel products.

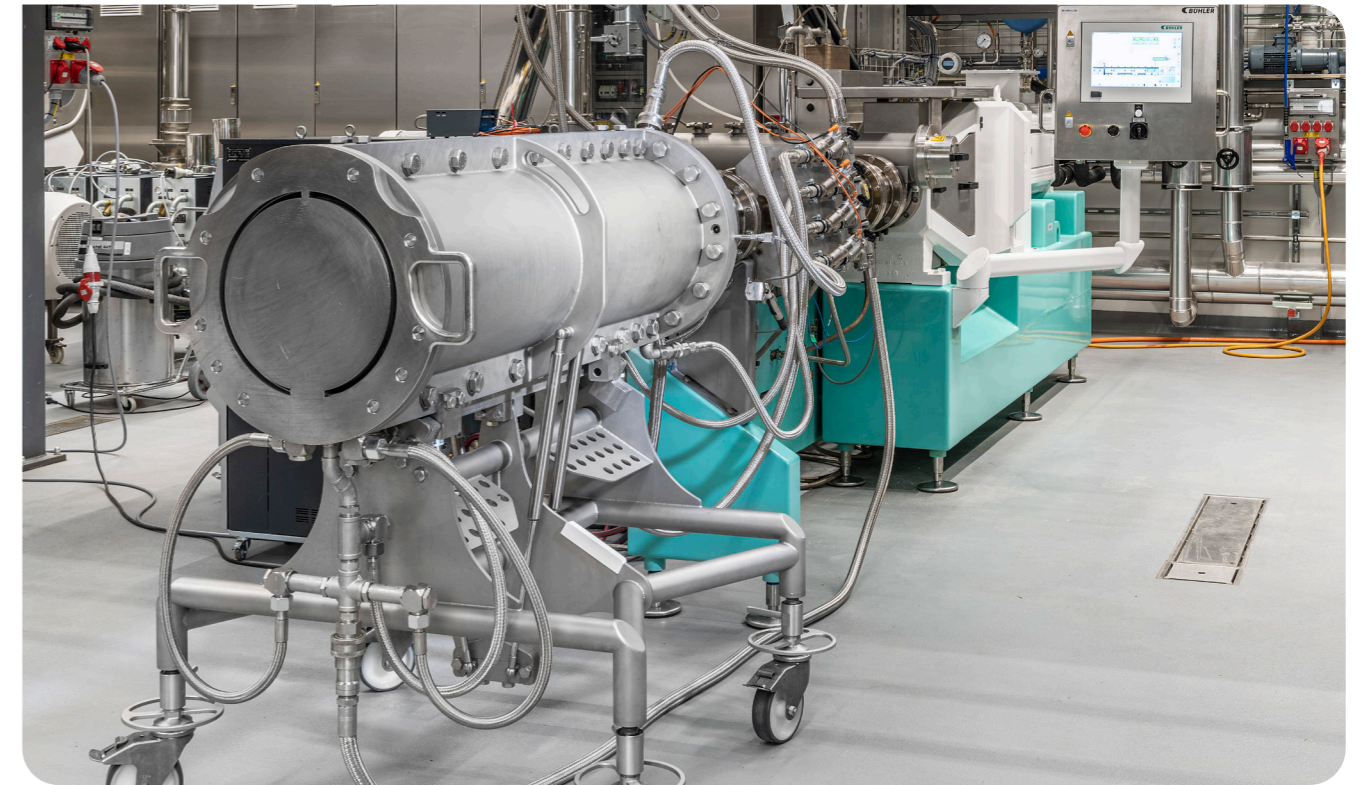
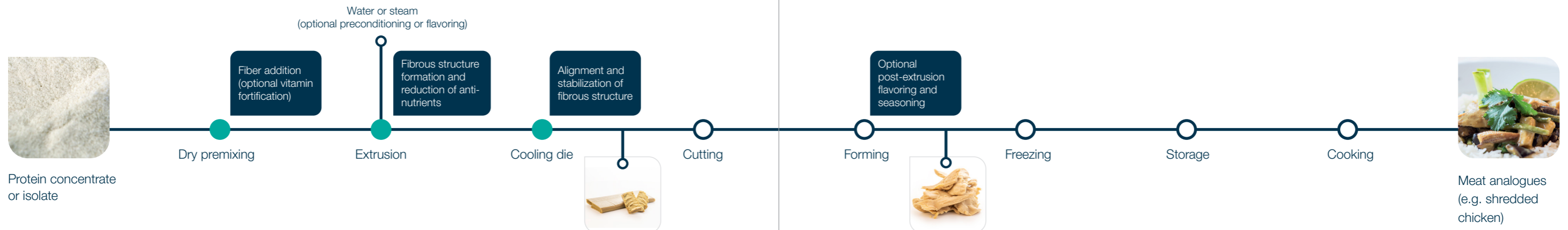
We are the market's leading extrusion solution provider for food products. One of the many products that can be made on our extrusion lines are textured proteins used for meat substitutes, made of plant-based proteins for instance. Their fiber structure, color, texture, and taste are similar to actual meat. With the high-performance cooling die in combination with an extruder, it is possible to produce wet-textured proteins based on soy, pulses, oilseeds and many more raw materials at throughputs of up to 1000 kg/h.

High-moisture extrusion for wet-textured products.

High-moisture extrusion of high-protein flours is an efficient process to obtain textures such as chicken, beef, fish, or seafood. Typically, they have water contents of 50 to 70%. The extruded product is cut into chicken nuggets, pulled chicken, pulled pork, fish fingers, or other meat-like formats.



 Bühler technology



With our extrusion solution, you can re-texture plant-based proteins into meat or fish substitutes.

Wide range of production capabilities.

The PolyCool cooling die can be easily used for various protein sources such as soy, pulses, oilseeds as well as newer ingredients such as microalgae or insects. This offers you the flexibility to achieve fish- or meat-like textures.

Hygienic design maximizes food safety.

The hygienic design and excellent accessibility to all of the product contact areas allows fast and easy cleaning between trials for maximizing hygiene standards.

Solution provider along the protein value chain.

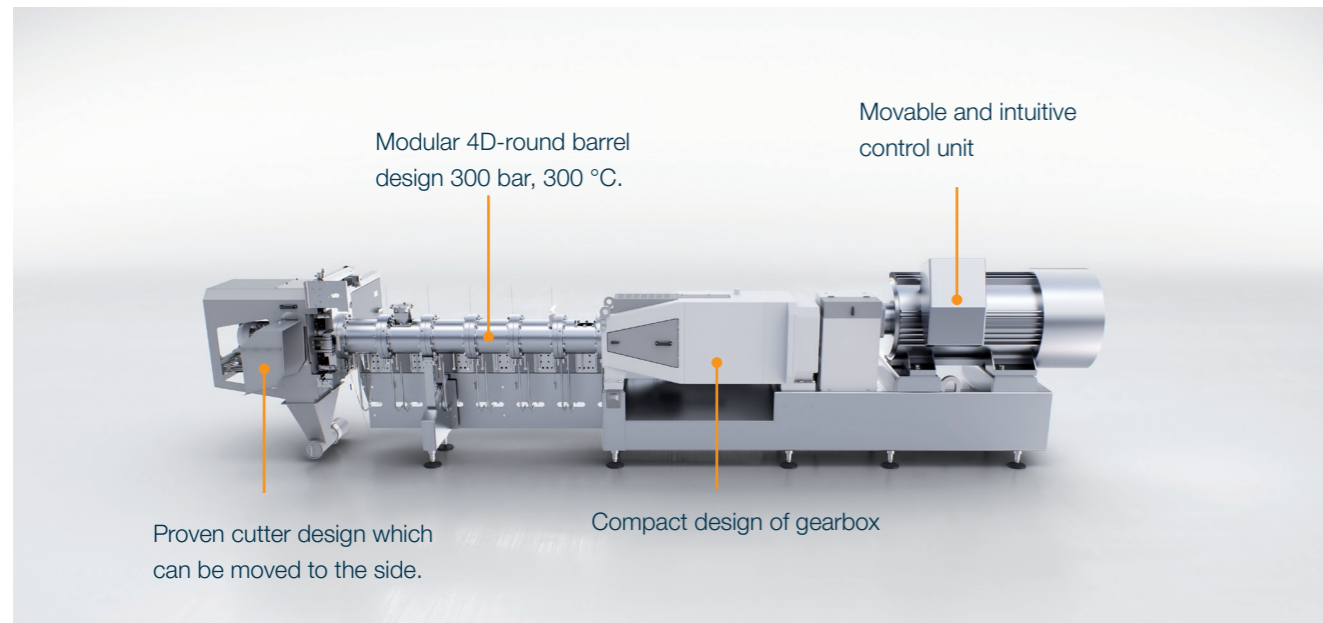
We can develop both sustainable and cost-effective solutions for large-scale protein processors that cover the whole value chain. With this holistic process knowledge, reliable machines and large-scale performance, Bühler can be viewed as the market leader from bean to burger.

High performance.

The PolyCool 1000 enables the production of products in different shapes and structures while meeting the standards required by industrial-scale production with throughputs of 1000 kg of wet texturised products per hour.

PolyTwin™ – multi-function twin-screw extruder. Economical solution for numerous industries.

This modular twin-screw extrusion system covers the entire capacity range from laboratory scale to high-capacity production rates. The process configuration of the machine is carefully matched to the specific application. With this twin-screw technology, new ingredients such as plant-based proteins like soy, pulses, vegetables, oilseeds or novel single-cell proteins can be used with highest flexibility.



User-friendly automation system for efficient and safe production.

The PolyTwin™ is equipped with a user-friendly and intuitive touch-screen control system. Safety circuits prevent damage due to improper use. Emergency situations will lead to fully automatic selfstopping of the extruder.

For quality and food safety reasons the control contains important functions as logging and trending of actual and historical data. With the user management, event log of user interaction and logging of quality relevant data it contains some required functionalities of the FDA21CFR part 11.



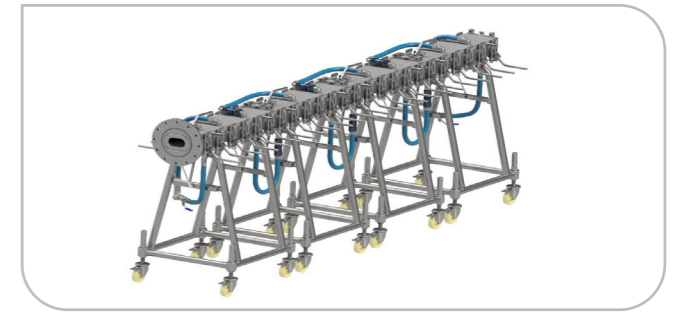
PolyCool – high-performance cooling die. Ideal for making high-moisture products.



PolyCool 50

PolyCool 50 is the excellent solution for research purposes and product developments with a throughput of 50 kg/h. This throughput enables the investigation of different product formulas and process parameters without requiring enormous amounts of raw materials. Our cooling die is designed to mimic meat- and fish-like textures.

- +** **Throughput**
- 50 kg/h (depending on product)
- 🔧** **Purpose**
- Research and laboratory scale
- 💧** **Cleaning**
- Cleaning tool with spray nozzle
- ★** **Features**
- Multiple cooling zones variable lengths
- Multiple sensor options

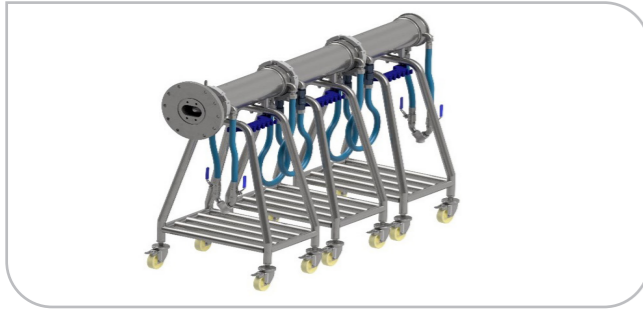


PolyCool 200

The PolyCool 200 is a flat channel cooling die composed of two segments to produce up to 200 kg/h of wet textured proteins. The segments are placed on individual trolleys to ensure easy handling and good accessibility for cleaning. The slot size is 150mm x 15mm and is therefore the solution with the thickest end product in the cooling die portfolio.

- +** **Throughput**
- 200 kg/h (depending on product)
- 🔧** **Purpose**
- Small/medium size production with thicker product of 15mm
- 💧** **Cleaning**
- Easy in modules individually moveable and cleanable
- ★** **Features**
- Mid capacity flat slot cooling die
- Slot with 15mm thickness
- Modular

Core elements in Alternative Protein production. Higher throughput. Higher quality.



PolyCool 350

The PolyCool 350 is the smallest of the round shaped cooling dies. The standard configuration includes three segments, which enables a production capacity of up to 350 kg/h and results in scaleable product characteristics for next sizes like PolyCool 500 and 1000.

+ **Throughput**
- 350 kg/h (depending on product)

🏭 **Purpose**
- Medium size production – smallest round shaped cooling die

💧 **Cleaning**
- Easy in modules individually moveable and cleanable
- Unit for easy cleaning procedure

★ **Features**
- Mid capacity round shaped cooling die
- Modular



PolyCool 500

Our high-performance PolyCool 500 matches the standards of medium industry scale production with the ability to deliver throughputs of about 500 kg/h, for different ingredients and novel textures. Thanks to its streamwise, hygienic wing door design and its excellent accessibility, the PolyCool is easy to maintain and maximizes food safety.

+ **Throughput**
- 500 kg/h (depending on product)

🏭 **Purpose**
- Medium/large-scale industrial production

💧 **Cleaning**
- Easy-access wing door design

★ **Features**
- High-throughput industrial solution
- Individual cooling circuits
- Industrial solution for all applications

Designed to enhance efficiency. The crucial processes for top quality.



PolyCool 1000

The PolyCool 1000 allows, for the first time, a throughput of more than 1000 kg per hour. The individual cooling circuits can be controlled independently. This high-throughput cooling die can withstand pressure of up to 50 bar. It cools the extrudate down from some 150 °C to below boiling point. The cooling die has an electropolished surface and meets all hygienic design standards.

+ **Throughput**
- 1000 kg/h (depending on product)

🏭 **Purpose**
- Large-scale industrial production

💧 **Cleaning**
- Easy to clean and electropolished surface

★ **Features**
- Individual cooling circuits
- Withstand pressure of up to 50 bar

⚠️ **Important**
- Only available for human consumption



PolyCool Cutter 500/1000

The Cutter for cooling dies can be used with PolyCool 500 and PolyCool 1000. The continuously slow turning blade cuts the product sheet into strips for easier further down stream processing of chunks, strips, pulled or chopped products. The cutter control requires a small extension of the extruder control. This also includes the safety interlockings.

+ **Throughput**
- 1000 kg/h (depending on cooling die)

🏭 **Purpose**
- Cutting after PolyCool 500 or 1000

💧 **Cleaning**
- Mounted on a Hygienic Design frame on rolls
- Can be moved into a washing area for wet cleaning

★ **Features**
- Cutting of the product stream into stripes for better handling
- Safe and constant production thanks to extruder-control integration

The next generation of meat substitutes. Protein Aeration Technology.

In last years the following five key drives that food companies should address when formulating plant-based meat alternatives has identified. They are taste, nutrition, clean label, protein source and variety. The meat substitutes should be an exact replacement of items like beef, pork, beef, poultry, and seafood. How we get there? With our latest innovation Protein Aeration Technology you will create the next generation of meat substitutes.

What is Protein Aeration Technology?

Via using Protein Aeration Technology, gas is injected into the extruder to create a microporous structure in the product. When the product leaves the cooling die, a gas expansion is achieved inbetween the protein fibers. This helps to generate biting properties and mouthfeel closer to meat or fish. Another benefit of the new porous structure is the higher volume and the lower density of the product, which reduces raw material costs. Furthermore, the increased number of pores allows more flavor absorption and helps to create a tasty meat substitute. The new Aeration Technology does not only affect the taste of the product it changes as well the color. It makes a lighter color, which perfectly looks the same as chicken.



Protein Aeration Technology increase the microporous structure in the product.



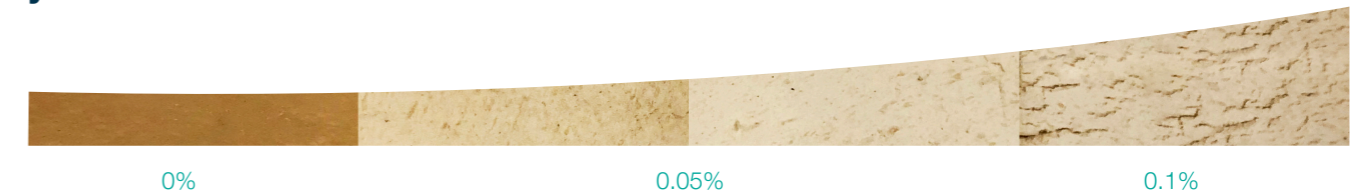
Without Protein Aeration Technology



With Protein Aeration Technology (0.05% gas injection)

Protein Aeration Technology. Added value in product characteristics.

Protein Aeration Technology change color and texture according to your needs.



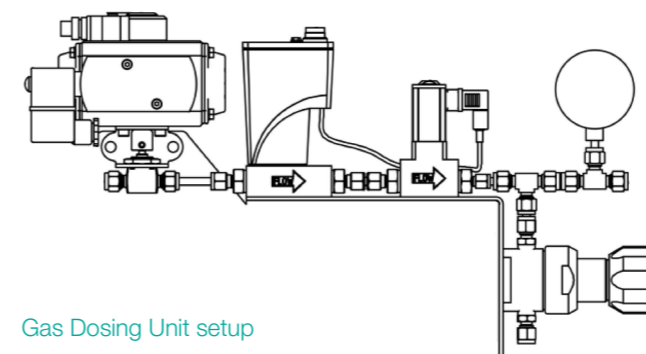
This unique novel textures can be adjusted by the amount of gas and allows a very flexible adjustment from a color change only towards softer textures like in seafood and fish substitutes. Protein Aeration Technology is new on the market and can help to improve the acceptance of meat substitutes. It is exclusively offered for all Bühler Extrusion Systems.

Benefits

- Final product has higher volume and lower density
- Lighter color
- Biting properties are more meat-like
- Increased porosity can enhance flavour absorption
- Can be installed on all new and existing Bühler extruders

Financial benefits

- Up to 10% product volume increase
- Premium product
- Reduction of raw material costs



Gas Dosing Unit setup





Bühler solutions creating a sustainable food future

Our industrial-scale Extrusion Solution enables re-texturing of plant proteins into high-quality, tasty meat or fish substitutes. Adjust the texture, shape, color and flavor of products to benefit from the clear market shift to a more plant-based diet – fueled by health, sustainability, and ethical concerns. With our extensive customer service that covers the entire life cycle of our protein lines, and our application centers worldwide, we are more than just service providers: We are lifetime partners. As a leading solution provider along the whole protein value chain, we believe we have a responsibility – and to offer an opportunity – to make a difference.

Service for demanding customers. Available worldwide, reliable and fast.

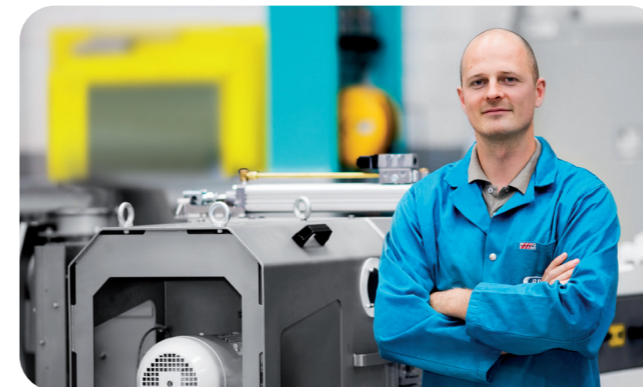


We offer you advice on how to improve your plant, what equipment to buy, and how to plan a future investment strategy.



Consulting and engineering

During the comprehensive consulting phase, we come to understand your requirements in detail to deliver complete solutions that will advance your sustainability. Our highly experienced experts help you decide what equipment to invest in so as to control the risks and improve the efficiency of your plant. With our decades of experience in engineering and executing extrusion solutions along the whole protein value chain, we can be viewed as the market leader from bean to burger.



Customers can rely on Bühler when it comes to service and maintenance of their systems.



Customer service

Highly trained service staff in 140 countries worldwide provide on-site advice and support. Bühler is quickly on site whenever customers need good service. Whether maintenance, spare parts, retrofits, repairs, overhauls, or digital services are involved – our services extend the lifetime of your system, minimize downtime, and increase your productivity.



Manage your installed machines and get detailed information and documentation for all machines.

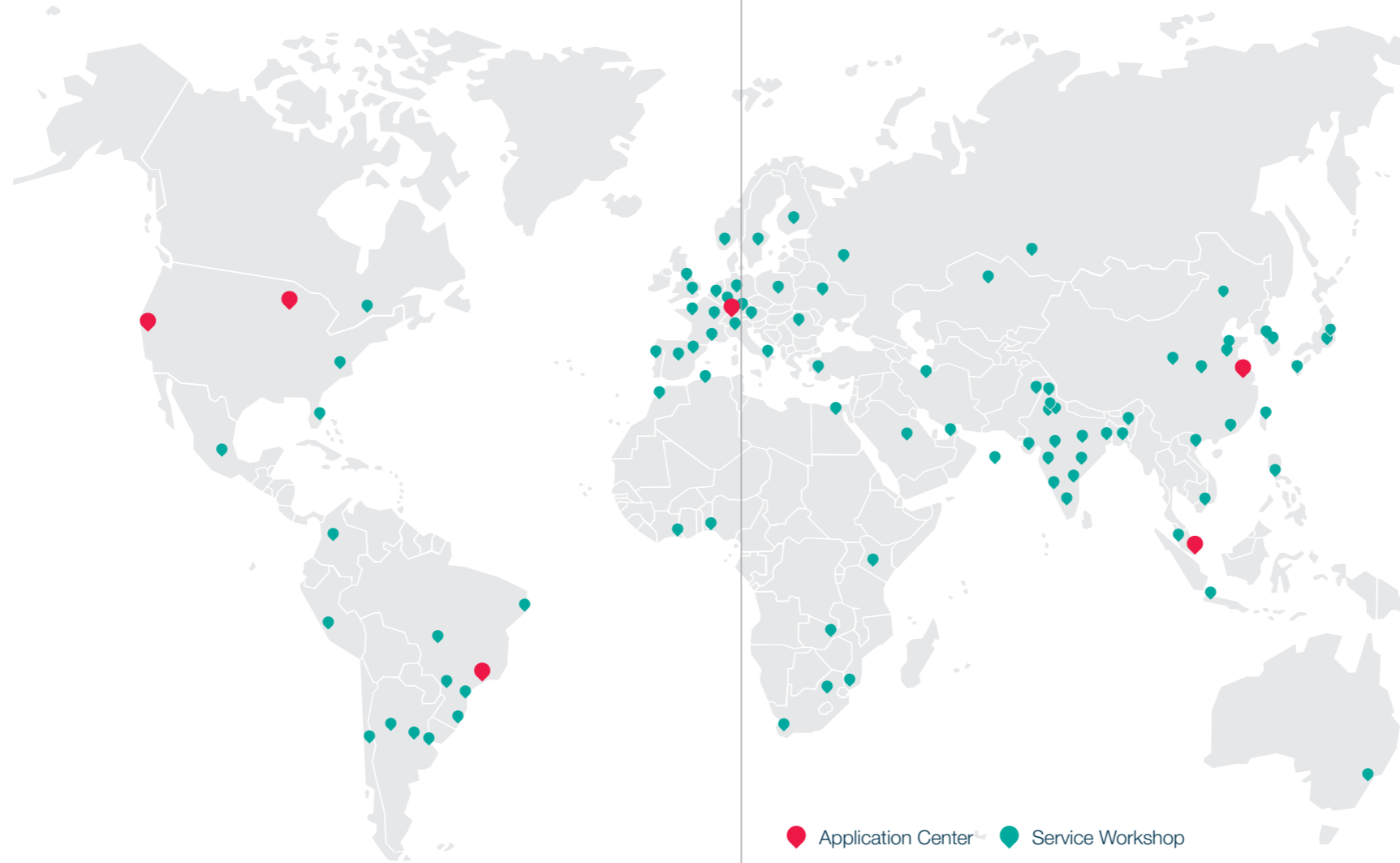


Powerful platforms to boost productivity and yield

Improve the performance of your production plant with Bühler's digital services. Use the myBühler customer portal to access maintenance and customer service online on a 24/7 basis. Choose from a wide range of our digital services, all running on our IoT platform, Bühler Insights, to improve productivity, analyze product quality, or monitor and control your plant when you are on the move.

Global expertise.
Local presence.
A lifetime of customer service.

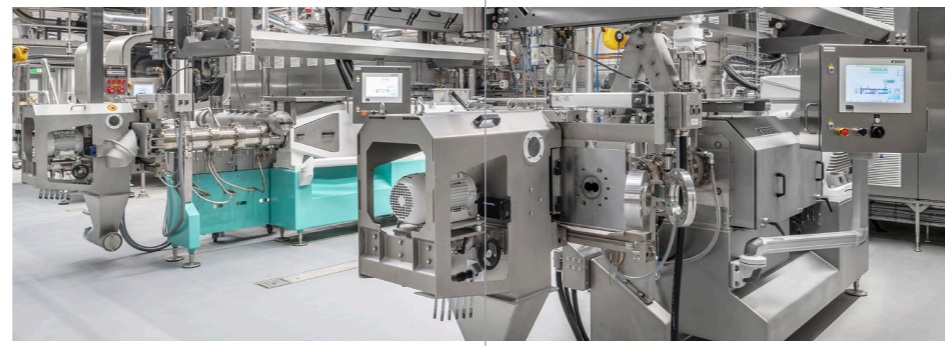
Bühler customer service provides assistance not only to keep your machines, plants and facilities running at a high operational level, but also to prolong lifetime, thus maximizing return on investment. You can test new products, shapes, recipes, textures, flavors, technologies and optimize your production process on fully equipped production lines and laboratories at our Application Centers world wide.



- With specialist manufacturing and service locations all around the world, our support engineers and technicians are never far away, ready to help you solve issues or take a proactive role in improving the overall performance of your facility.
- Join a seminar or let us train you in person. We run several workshops a year for theoretical and hands-on training. These can also be conducted at the Application Centers or at your production site.
- Work across multiple application centers to optimize all processes through the production line (e.g. grain technology and milling solutions) and develop end to end solutions.



Food Application Center, Minneapolis, USA



Extrusion Application Center, Uzwil, Switzerland



Protein Innovation Center, Singapore



MISTA, San Francisco, US



Tropical Food Innovation Lab, Campinas, Brazil



Nutrition Application Center, Changzhou & Wuxi, China



For more information
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