

# Aquafeed.

Production plants from a single source.



# Proven extrusion processes ...

## Integral element of the production process.

### **Extrusion of aquafeed**

In the production of aquafeed, it is important to ensure the ideal formulation of complete diet for food fish or ornamental fish. On the other hand, gentle processing into a product that can be preserved is crucial. The focus is on the extrusion process. As a cooking and shaping process, it has a lasting impact on the end product characteristics. The pretreatment and past treatment process steps also contribute to overall performance.

The single most important goal during production of fish feed is the creation of a complete diet which the animal can ingest and assimilate optimally. At the same time, such feeds should maintain the animal's health. This will maximize the conversion rate and the meat quality while minimizing the costs.

### **Blending and mixing, grinding**

The raw materials, which account for over 80% of the total production cost, are formulated and continuously optimized on the basis of commercial and nutritional criteria. A fine-grinding system reduces the raw component blend to an average particle size of about 100 to 250 microns. The blend is then conveyed pneumatically to the control sifter.

### **Control sifting**

A sifter especially suitable for processing finely ground, fatty fish feed formulations is required to eliminate insoluble substances such as bones, scales, sand, and fibers, which might clog die holes smaller than 1.5 to 2 mm. Bühler recommends a mesh aperture smaller than about 70% of the die hole diameter.

### **Extrusion process**

The extrusion process is essentially a cooking process during which the starch-containing components are decomposed and the proteins are denatured. Together with the other ingredients, a hydrophil yet waterstable matrix is created. The required heat is added mainly in the form of direct steam in the preconditioner. In the extruder, the mass preheated to about 95 °C is further heated by mechanical processing so

that temperatures of about 120 to 140 °C are achieved.

The patented "Density Control System" allows the steam pressure of the hot dough mass to be controlled while the mass is still inside the extruder. This enables the sinking or floating characteristics to be controlled across a wide range without compromising on the cooking degree. The energy released can be returned almost without any emissions to the conditioning stage.

### **Shaping/cutting**

The die hole geometry is crucial in the process, as the hot product melt has to be depressurized, shaped, and cut. Especially small die holes up to 0.6 mm require an optimized number of holes and a wear-resistant die plate. A movable cutting device allows the die holes to be controlled and the knives to be exchanged even during the process. Since a considerable volume of moisture is evaporated at this point, hot air addition and a good aspiration are needed in order to prevent condensation and agglomeration of the products.

### **Two-stage drying**

The hot and steaming product very rapidly releases the free surface moisture to the hot air stream. Once the surface has been dried, the drying action is limited by the diffusion rate inside the product, and the air stream can be reduced. Such a multi-stage drying process consists of a hot air conveying system and a fluid-bed dryer, followed by a belt or counter-current dryer. This process allows very fast, gentle, and non-deforming drying to the necessary final moisture content of 8 to 10% even of soft and sticky products.

### **Coating/cooling**

Usually, the dried extrudates are coated while still warm directly after the dryer. During this stage, it is possible to add fats, flavorings, attractants, colors, and even powdered ingredients. Depending on the temperature and the specific surface area of the extrudates, up to 12% liquids can be absorbed in the coating drum and the subsequent cooler. For higher oil quantities up to 40%, it is common practice to apply vacuum coaters/mixers.

## ...for high-value aquafeed. Varied characteristics in shape and color.



### **Micropellets**

Very small, accurately cut, floating or sinking pellets starting at 0.5 mm, for feeding all species.



### **Floating feeds**

Pellets with moderate protein and fat contents for feeding warm-water species such as tilapia, catfish, eels, etc.



### **Sinking feeds**

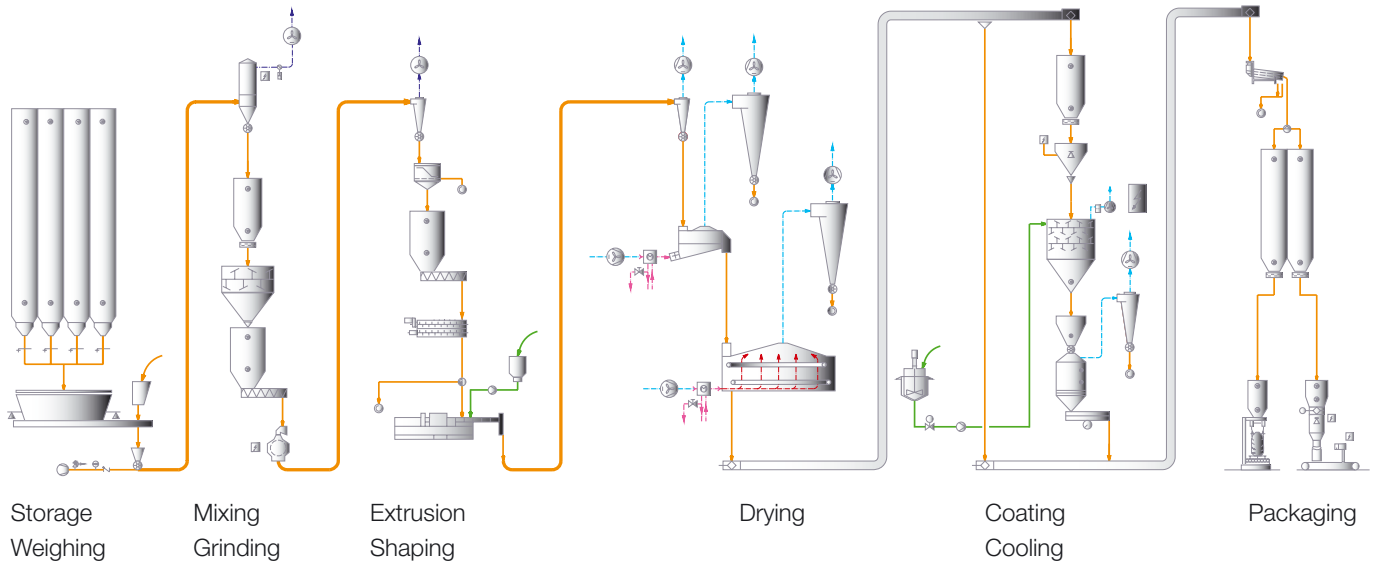
Pellets with high protein and fat contents, with a good water absorption rate and high water stability. Sink slowly in saline water. For feeding salmonides, sturgeons, and sea water fish such as yellow tail, sea bream, sea bass, etc.



### **Shrimp pellets**

Fast-sinking pellets which retain their elastic structure even after hours in the water.

# Integral customer solutions. From intake to shipping.



# Extensive range of services. From engineering to training.

## Extrusion pilot plant

The functional extrusion pilot plant supports practical development of new products, processes, and equipment, complementing scientific approaches to problem solutions. Various process stages can be simulated here either in isolation or in a wide variety of combinations.

## Engineering

Our project engineers will ensure smooth handling of your order, making sure our systems are seamlessly integrated in your production environment.

## Installation and start-up

The installation and start-up specialists of the Business unit "Pasta and Extruded Products" guarantee competent installation and construction site management and a smooth commissioning to start-up.

## Training of customer personnel

On your request Buhler offers you a personnel training on site also the opportunity to perform the training in our pilot plant. You take profit of the highly diversified program, executed by our specialists.

## Customer service

Our engineers and service specialists are available for on-site consulting, ensuring trouble-free operation of our equipment throughout its service life. This concept is supported by a worldwide, efficient spare parts service.

# Core elements from Buhler.

## The crucial process operations.

### **BCTC preconditioner**

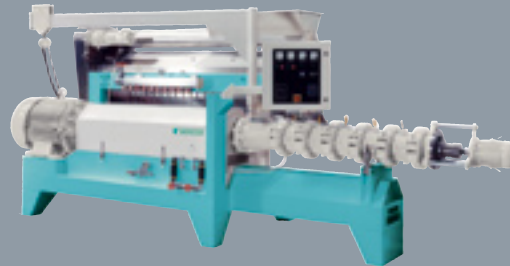
The preconditioning concept is based on the separation of the overall process into two stages: component mixing and retention to allow cooking.

The BCTC preconditioner is available in six sizes ranging from 100 to 1,600 liters capacity, with processing throughputs of 100 to 20,000 kg/h.



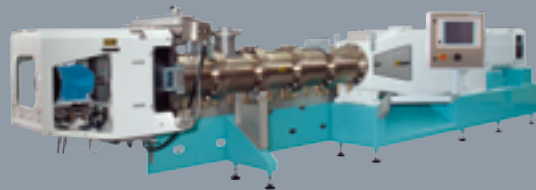
### **BASH single-screw extruder**

The BASH single-screw extruder is a cost-effective tool for cooking and shaping products which are normally direct-expanded. The machine is characterized by its adjustable process section, its various drive options, a number of accessories such as water-cooled or electrically heatable barrels, and its ease of operation.



### **BCTA twin-screw extruder**

The modular twin-screw extrusion system covers the entire capacity range, from laboratoryscale to high-capacity production machines. The process configuration of the machine is carefully matched to the specific application.



### **OTW fluid-bed dryer**

The continuous OTW fluid-bed dryer/cooler is excellently suited to the thermal treatment of cereal grains or of extrusion products with a size starting at 0.25 mm. The fluid bed, designed as a cross-flow heat exchanger, fluidizes the individual product particles and dries/coolers them gently and efficiently along the entire bed length.



### **DNTK belt-type dryer**

The DNTK belt-type dryer/cooler is applied for drying aquafeed and petfood products. Thanks to its modular design, it is possible to carefully match single-belt and twin-belt dryers to the required throughput rate.



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