



Snack pellet processing

Technology and processing lines

The new era of snacks

Pellets are the most versatile semi-finished ingredient in the snack industry.

Made by the extrusion of a wide variety of ingredients such as cereal flours, potato derivatives, legumes and so on, pellets are an excellent way to add value to simple ingredients.

The main features of snack pellets

Appealing

The colour, shape and expansion rate can be perfectly defined through extrusion, die or distance cutting, multilayer forming and so on, and this great variability fully meets the needs for innovative products and new trends in an otherwise static industry.

Palatable

The wide range of raw materials in combination with the processing parameters ensured by GEA's technologies allow the production of snacks with multiple textures: soluble, crunchy, crispy, vitreous, etc.

Health conscious

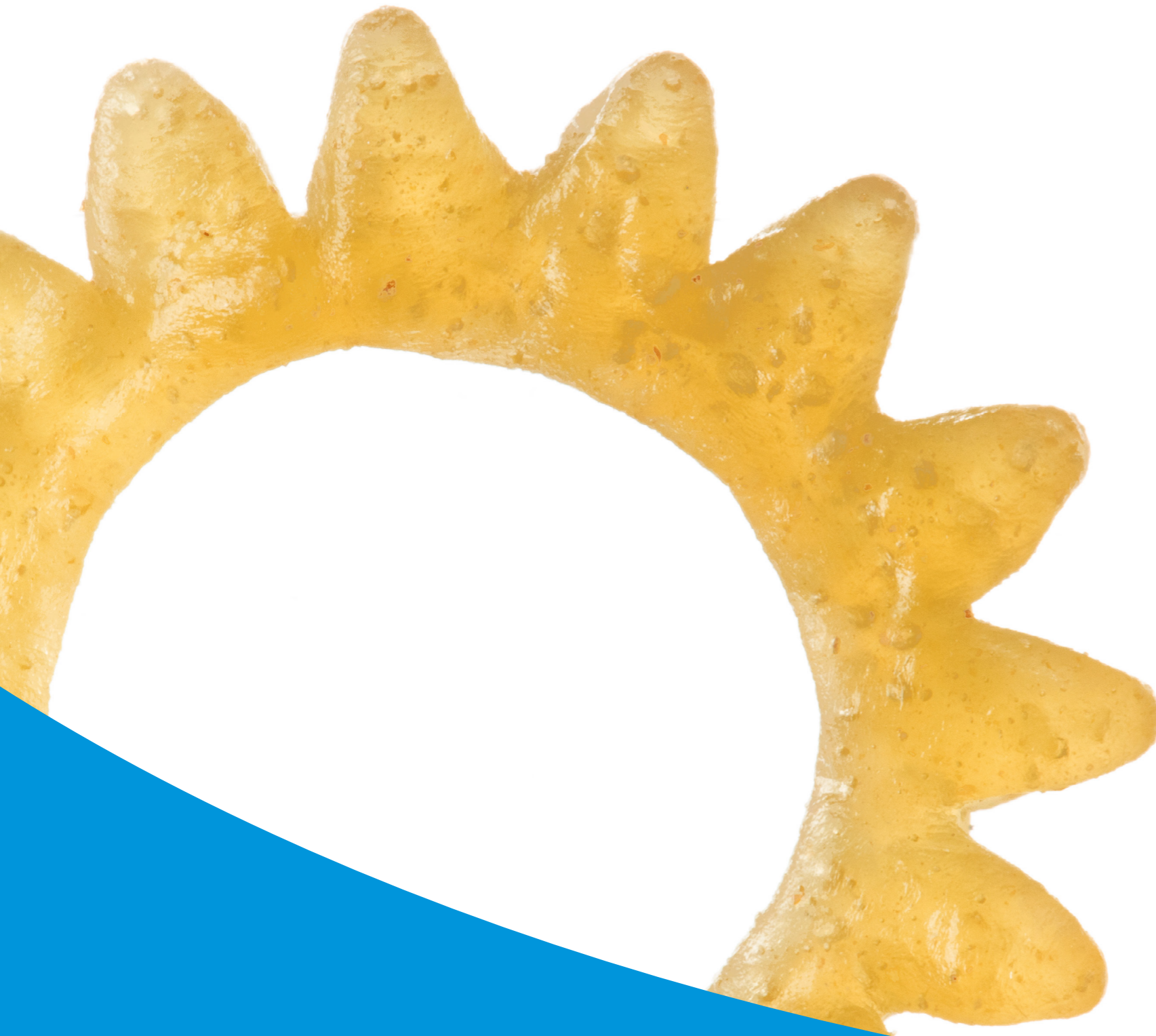
GEA processing lines can be designed to make pellets with less oil absorption, which can be roasted or baked with hot air, which can meet specific requirements such as low sodium, low carbohydrate, gluten-free, etc.

Durable

Pellets can be stored for a long time and still be fresh after processing, an excellent way to increase the lifespan of fresh ingredients.

Flexible

Pellets are a semi-finished product that can be converted into ready-to-eat snacks with unique combinations of flavours and tastes. Their high density, combined with their strength, are the key to economical global transportation which, coupled with easy, long-term storage and massive product expansion after thermal treatment, make them a borderless item that never loses its appeal.



Pellet extrusion technology

Pellet snacks are produced dried and semi-processed for easy storage and shipment and in a second phase are expanded, seasoned and packed.

Their peculiar capability of expanding is due to the presence of gelatinised or partially gelatinised starch in their matrix.

The water entrapped into the matrix, if heated rapidly above boiling point, evaporates thus creating an internal pressure; the gelatinised matrix itself becomes less viscous and keeps the water steam inside for a certain time, increasing its volume.

The volume of the product increases and it becomes rigid again due to lack of water: the result is a light, crunchy and pleasant snack.

The main advantages of pellet snack technology

- Well defined shapes compared to directly expanded products;
- wide choice of raw materials: potentially all starches containing raw materials can be utilised;
- large choice of shaping systems: from the most classical die-cut products to sheeted, double and multilayer products.

Many cooking systems have been used and are currently used to produce pellet snacks from unprocessed flours and starches, but the most efficient, internationally known and most commonly used one is the **extrusion cooking system**.

Forming extruders are used to shape the pellets after cooking, to make die-cut products or to extrude sheets or ribbons to be shaped and cut far from the die.

When the raw materials are already pre-cooked, as is the case with potato-based products, there is no need for the cooking step: this pellet production process is referred to as **cold extrusion**.

All raw materials requiring cooking are processed in the first extrusion-cooking step, followed by the shaping step of the cooked mass, which can be either the above-mentioned cold extrusion or any other system capable of giving a correct shape to the hot dough before drying.

By managing the process parameters of the extruders, it is possible to precisely control gelatinisation and thus obtain a sheet of the appropriate thickness for each type of finished product.



Snack pellet



Snack pellet expanded

Raw materials: impact of ingredients on the process

Different raw materials lead to different products

The main component for every pellet is starch, so, by extension, a pellet machine can handle every flour that contain a starch.

In terms of formulations, extruders are extraordinarily flexible, and every ingredient will add a distinctive feature to the snack's appearance, expansion and texture.

By varying parameters and raw materials, it is possible to define the colour of the snack, its opacity or gloss, crunchiness or smoothness, whether it has a bubbly surface or a melty texture, and so on.

There are few limitations: fat content — fat is a lubricating agent and affects not just the rancidity but also the friction factor;

fibres — excessive fibres ruin the texture;

water content — limited by the technology.

So, good ingredients for snack pellets are:

- All potato derivatives (flakes, granules, starch, modified starches)
- Tuberos flours like purple potatoes, yam, sweet potatoes
- Corn and derivatives
- Wheat and derivatives
- Rice

- Ancient grains
- Legumes in various proportion

Usually, pre-cooked flours can be used in pellet production processes, but are much more expensive.

GEA's process lines can handle both types of raw materials thanks to the use, or not, of cooking extruders.

Functional ingredients

A functional snack is a product in which a specific ingredient has been added to the formula to obtain a new function, such as health promotion or disease prevention.

It is characterised by specific nutritional properties with the aim of improving its consumption more as a food than as a snack.

A great advantage of pellet snack technology is the possibility of making formulas with peculiar characteristics such as high fibre content, multi-grain or multi-coloured.

The most commonly used nutritional ingredients are raw materials with a high protein content (of vegetable origin, derived from milk, protein concentrates/isolates) or containing a higher concentration of vegetable fibres (wholemeal flours).



Legume flours are used as raw materials in order to obtain snacks healthier and rich in protein and fibre.

Usually, pre-cooked flours can be used in pellet production processes, but are much more expensive. GEA's process lines can handle both types of raw materials thanks to the use, or not, of cooking extruders.

Snack pellets Applications

Wide range of snack solutions with different shapes, consistencies and raw materials.



Die-cut pellets



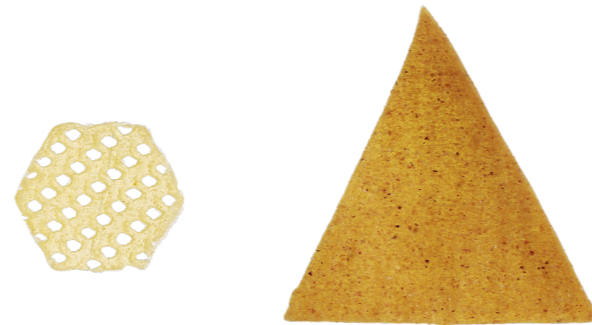
Laminated potato chips



3D pellets



Square shapes



2D pellets



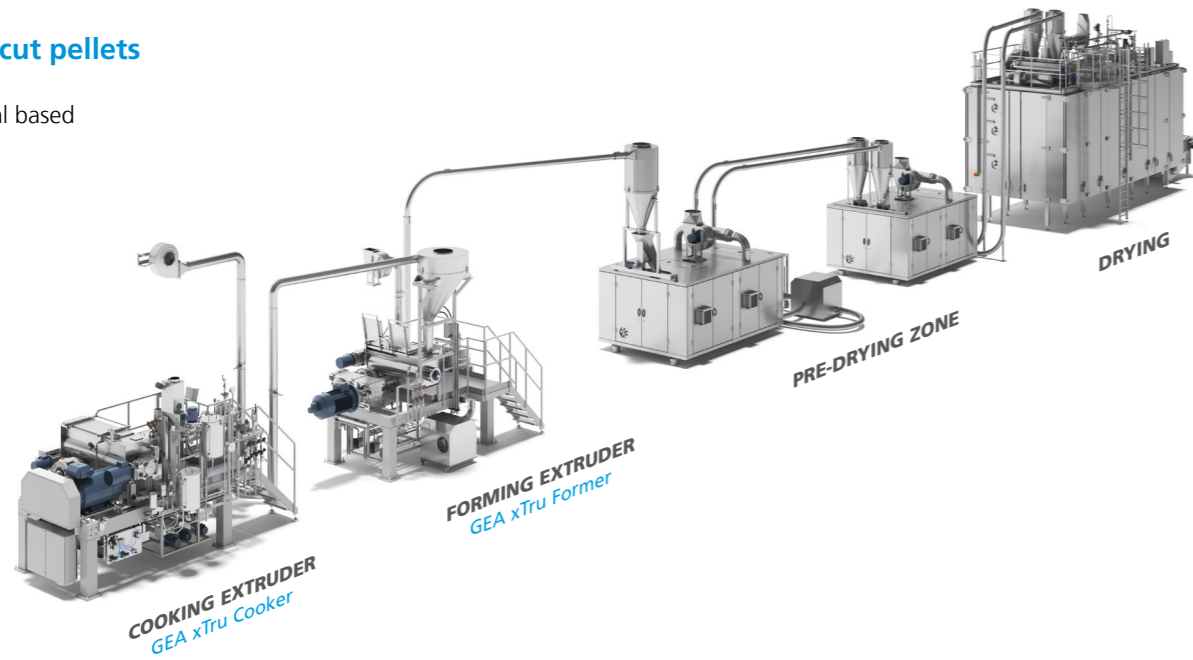
Punched pellets

TAILOR-MADE APPROACH
GEA accompanies its customers closely, supporting them with the creation and development of new products, and helping them to define shape, consistency, weight, taste and colours that better appeal to the consumer.

Snack pellets Processing lines

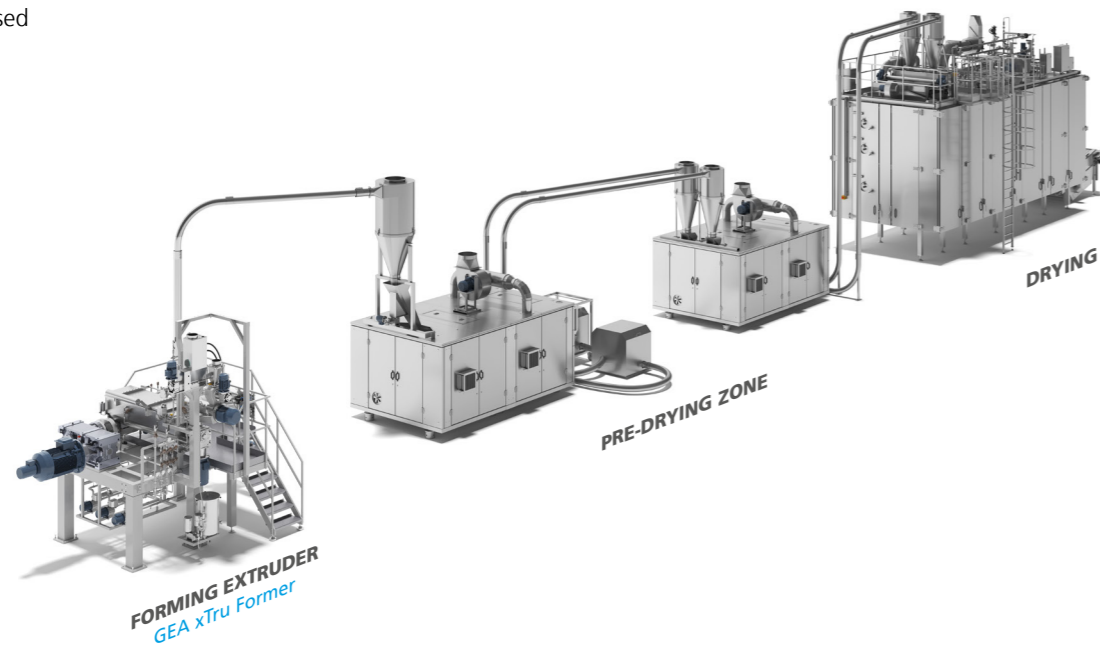
Die-cut pellets

Cereal based



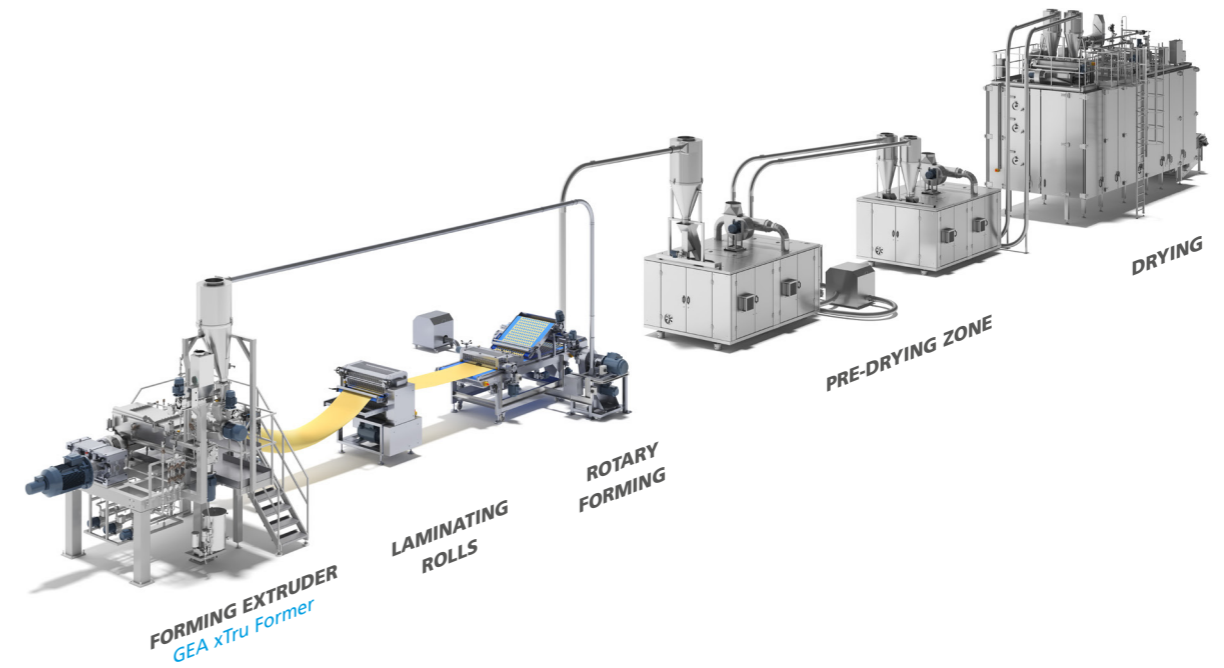
Die-cut pellets

Potato based



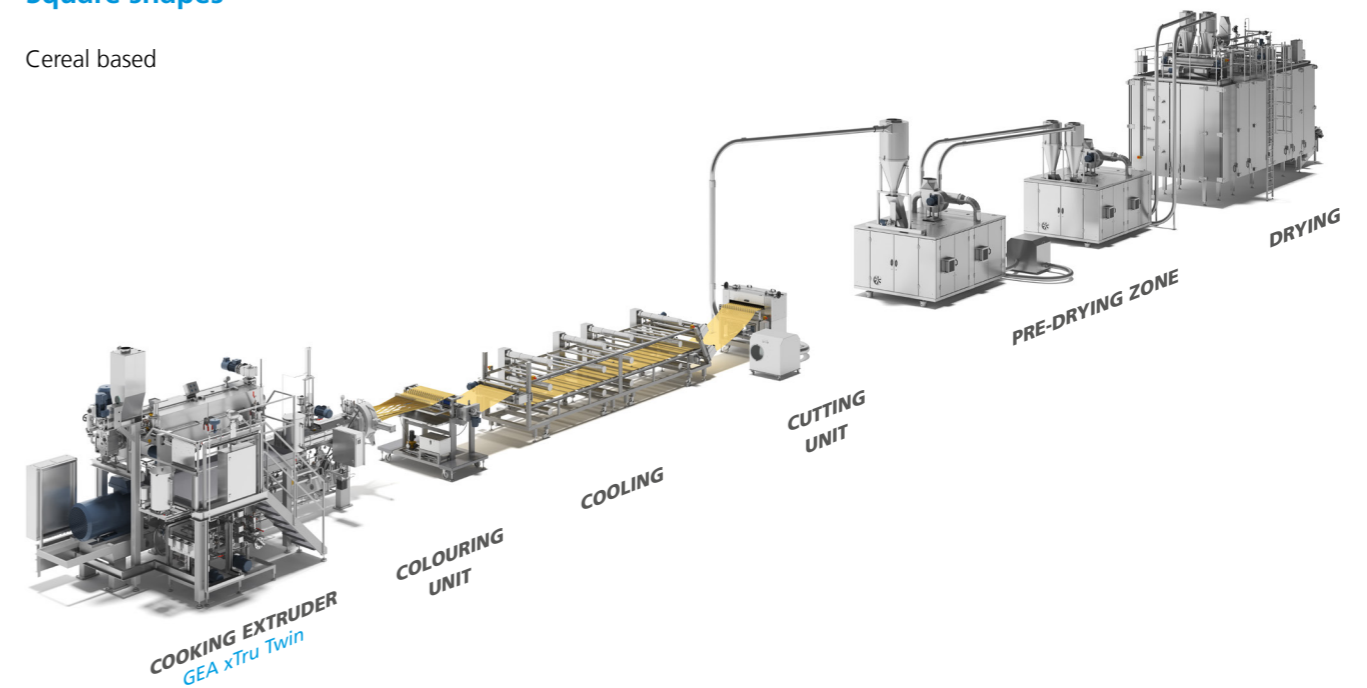
Laminated chips

Potato based



Square shapes

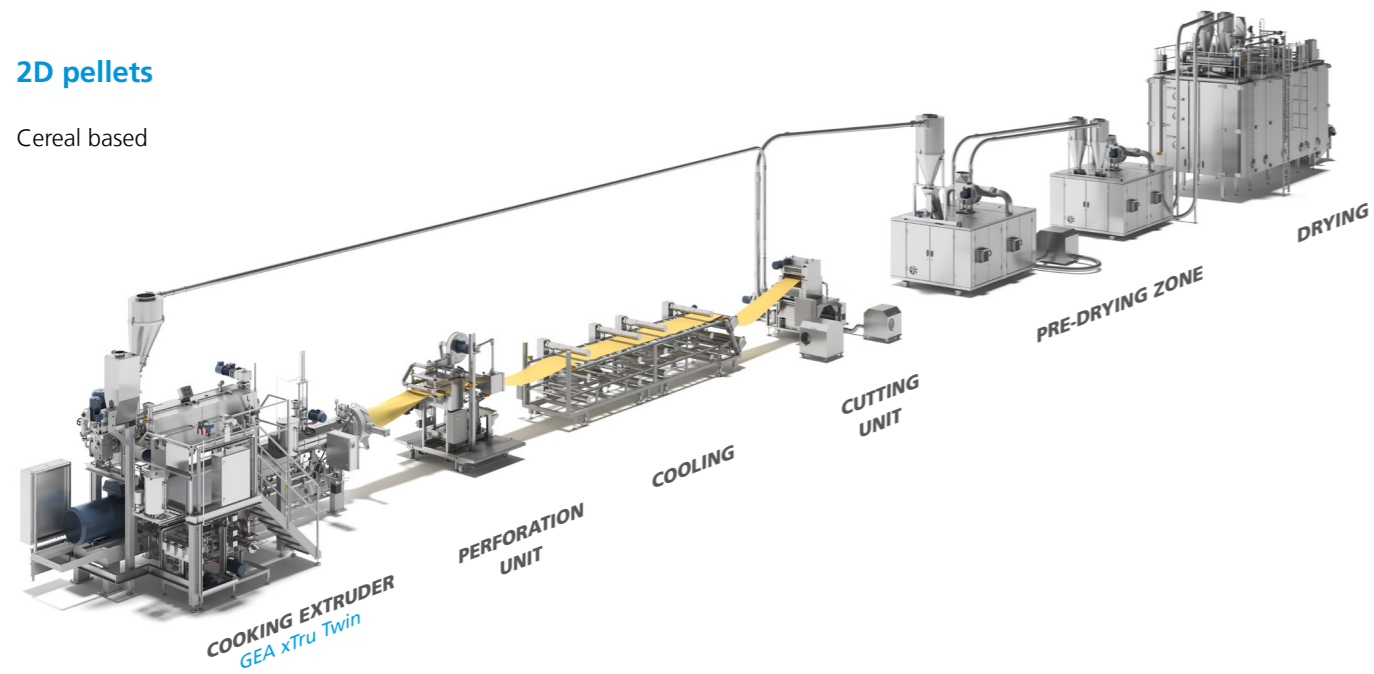
Cereal based



Snack pellets Processing lines

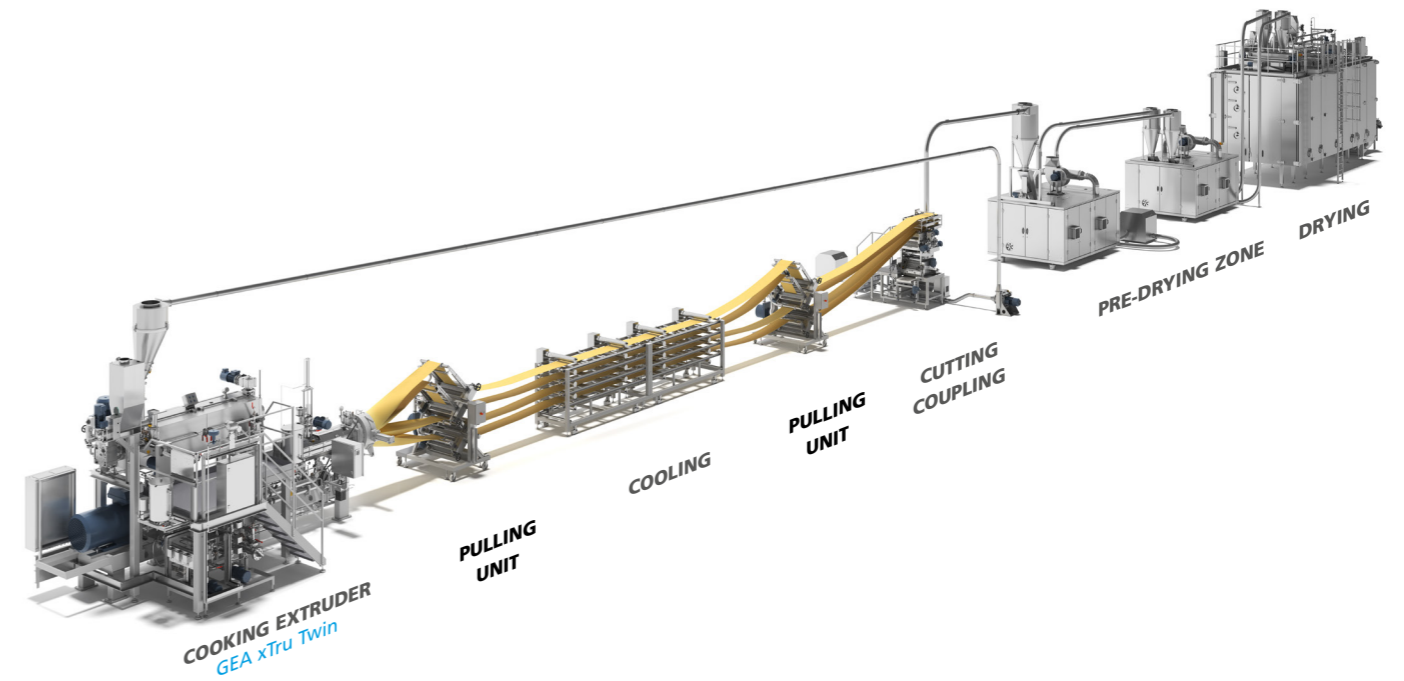
2D pellets

Cereal based



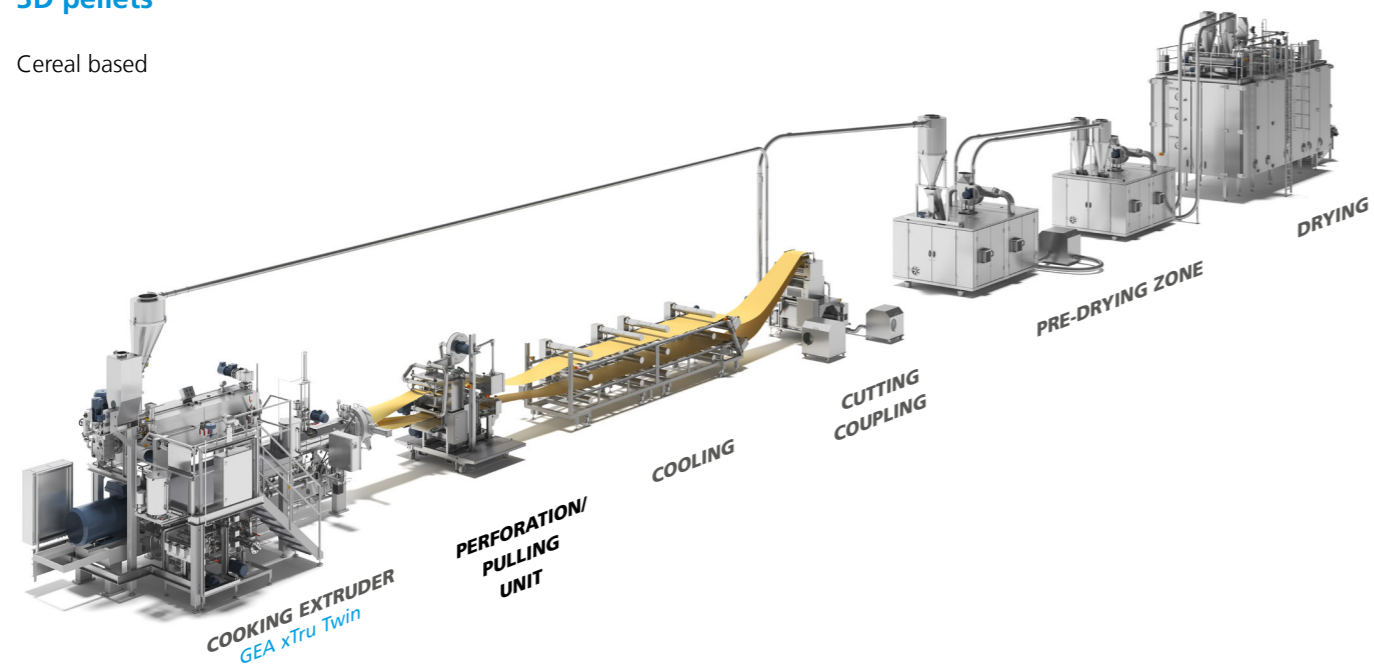
Multilayer pellets

Cereal based



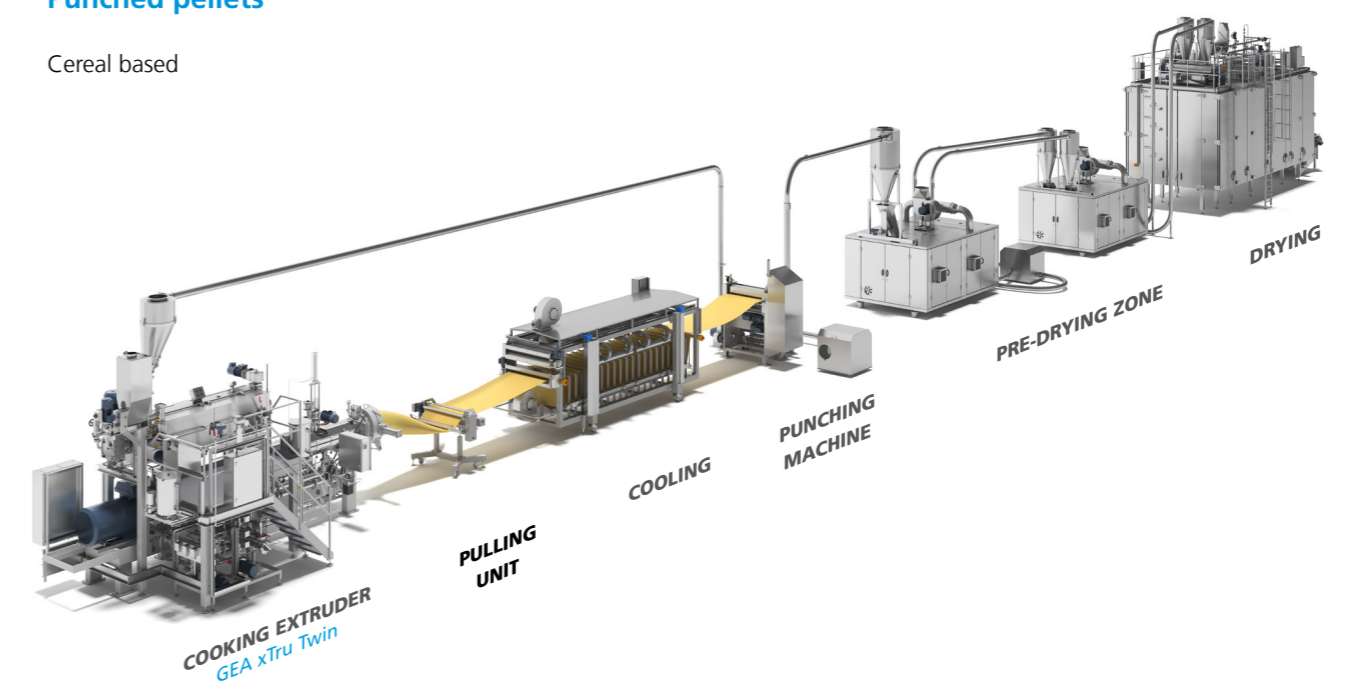
3D pellets

Cereal based



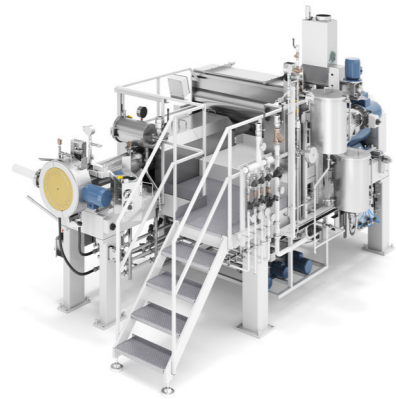
Punched pellets

Cereal based



Extruders

The core of our technology



GEA xTru Cooker

The single-screw cooking-extruder can automatically and continuously process a great variety of flours and cereal/potato starches, both mixed and in pure state.



GEA xTru Former

The single-screw forming extruder is designed for the extrusion and forming at controlled temperature of pre-gelatinised raw material and/or cooked doughs coming from a cooking-extruder.



GEA xTru Twin

The twin-screw cooking-extruder with higher cooking capacity and versatility, featuring enhanced process capabilities.

Hygiene, safety and strength:
the 3 key elements of GEA xTru
extruders

Hygiene

Parts in contact with the product, such as the single-shaft premixer, mixing tank and shaft with orientable paddles are made of stainless steel and can be easily disassembled for cleaning and sanitisation.

Safety

The machines are equipped with safety probes to get immediate feedback on any malfunctions; the drive system for the extrusion screw is equipped with a thrust bearing dimensioned with a wide safety margin and corresponding protection casing; the electrical plant is manufactured in compliance with EN60204-1 standards, including sensors and safety microswitches.

Strength

The extrusion screws are made of induction-hardened stainless steel, which offers high yield strength and good corrosion resistance. The supporting structures are made of carbon-painted steel, including a service platform for easy access and maintenance.



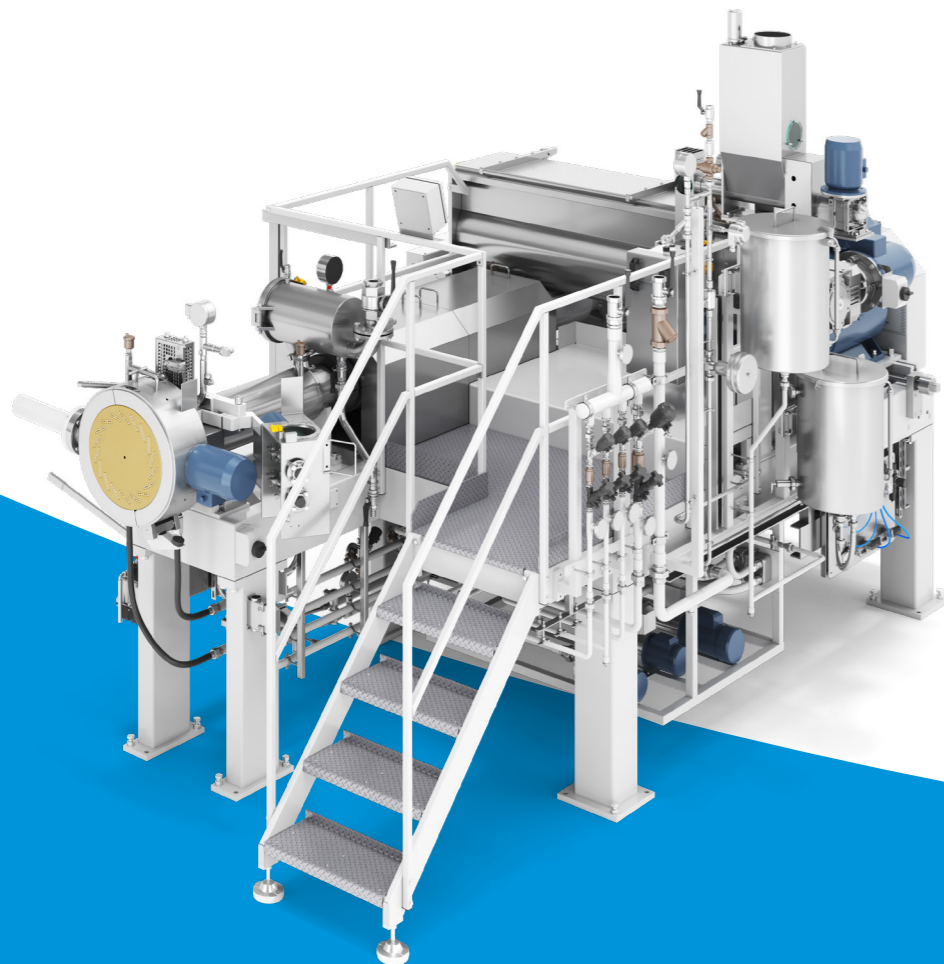
GEA xTru Cooker

The single-screw cooking-extruder that can transform any raw materials into high added value products.

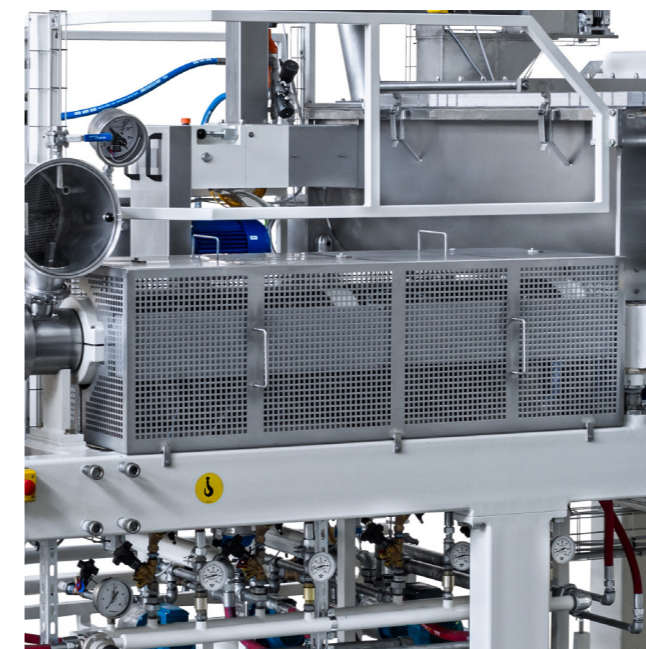
The great versatility of the extrusion-cooking process

After flour hydration and mixing, the forced feeder fills the cooking barrel, which can reach high temperatures thanks to the heaters surrounding the cylinder, as well as a conditioning unit that enables the right temperature profile required to cook specific kinds and blends of flours.

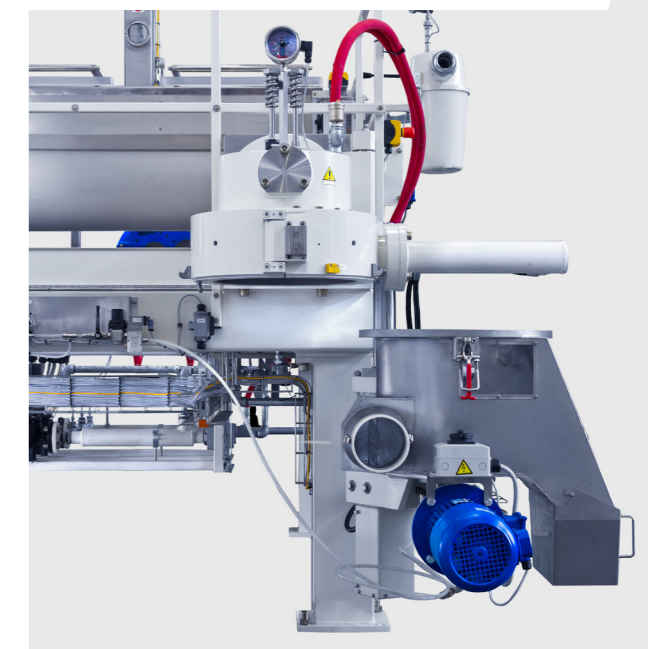
In a GEA xTru Cooker extruder, most of the energy required for cooking comes from a single fluid (super-heated water) that flows in jackets around the main barrel. This fluid is heated by electric resistance and its temperature is controlled with chilled water. Since it uses only one fluid, the system is more stable than technology with separate heating and cooling systems. In addition, the specific kneading/shear profiles of the cooking screw enable a long residence time for perfect cooking.



Model	Screw diameter mm	Capacity kg/h	Typical installed power kW	
			min	max
55	55	25	5.5	7.5
70	70	55	11	15
90	90	100	15	22
115	115	200	30	45
130	130	300	45	55
160	160	500	90	110
180	180	750	110	132
200	200	1000	160	200



Independent heating/cooling jackets for each single cooking stage.



Head and cutting group fixed to the extruder by mean of a heavy-duty hinge-type system.

GEA xTru Former

The single-screw forming-extruder for processing precooked raw materials.

Shaping by means of forming extrusion

GEA xTru Former is used for the extrusion and forming at controlled temperatures of potato-based raw materials, pre-gelatinised raw materials and/or cooked doughs coming from a cooking-extruder, using interchangeable dies and a suitable cutting system.

A wide range of products can be obtained by varying the process conditions, raw materials and dies.

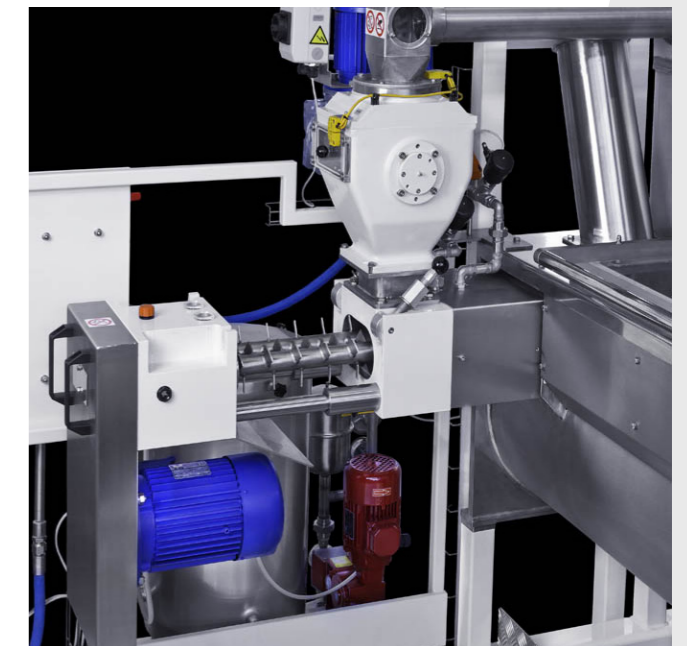
It can be used as a standalone machine for potato-based die-cut and laminated shapes, or used in combination with a cooking-extruder to make cereal-based die-cut shapes.



Model	Screw diameter mm	Capacity kg/h		Typical installed power kW
		standalone	with cooking-extruder	
55	55	25	25	4
70	70	50	55	9.2
90	90	100	100	15
115	115	200	200	22
130	130	300	300	30
160	160	500	500	55
180	180	750	750	75
200	200	1000	1000	90
218	218	1150	1350	110
240	240	1500	1800	132



Mixing tank ensures proper kneading and cooling time for the cooked dough.



High-speed premixer.

GEA xTru Twin

The twin-screw cooking-extruder with higher cooking capacity and enhanced process capabilities.

High cooking capability

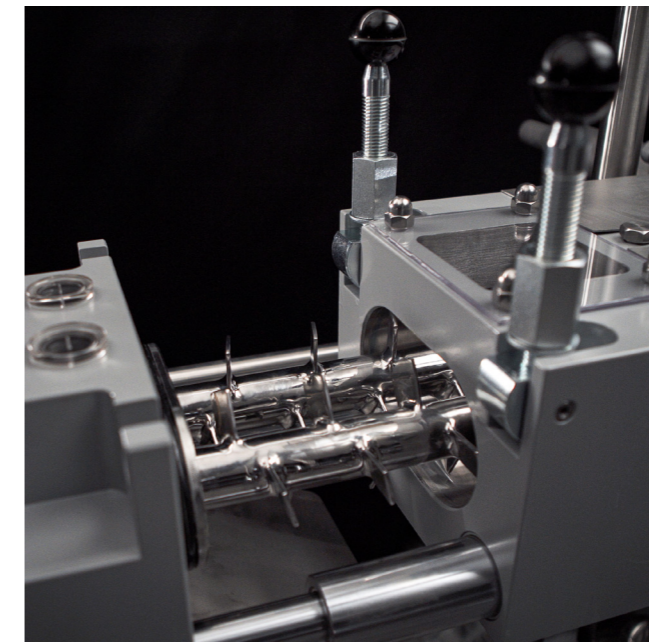
GEA xTru Twin extruder is equipped with two co-rotating screws that release a quantity of mechanical energy suitable to reach the gelatinisation levels necessary to process any raw material and product. In addition, the barrel is conditioned to give further energy to the extrusion of the dough.

High-capacity technology

The new high-capacity twin-screw extruders are able to increase productivity by up to 40%. GEA engineers have used their experience and know-how to increase the cross-sectional area, rotation speed and pitch of the screws on the new machines, while maintaining the extruder footprint and screw length. This also allows customers to upgrade existing machines without buying a new machine or changing their plant layout.



Model	Screw diameter mm	Capacity kg/h		Typical installed power kW	
		standard	HIGH-CAPACITY	min	max
42	42	80	/	30	37
58	58	200	/	90	110
70	70	400	550	132	160
92	92	1000	1400	230	315
112	112	/	1600	280	355
140	140	/	3000	500	710



High-speed premixer for perfect flour hydration.



Two co-rotating screws composed of modular sectors.

GEA xTru Twin series

Proven extrusion technology,
higher capacity,
higher efficiency,
higher profitability.

The GEA xTru Twin series of extruders adapts perfectly to any requirement or need: barrel and screw configuration are tailor-made and designed based on process requirements. As a result, every need in terms of production capacity, type of product or footprint is catered for with a xTru Twin extruder.

Two screws for multi-function extruders

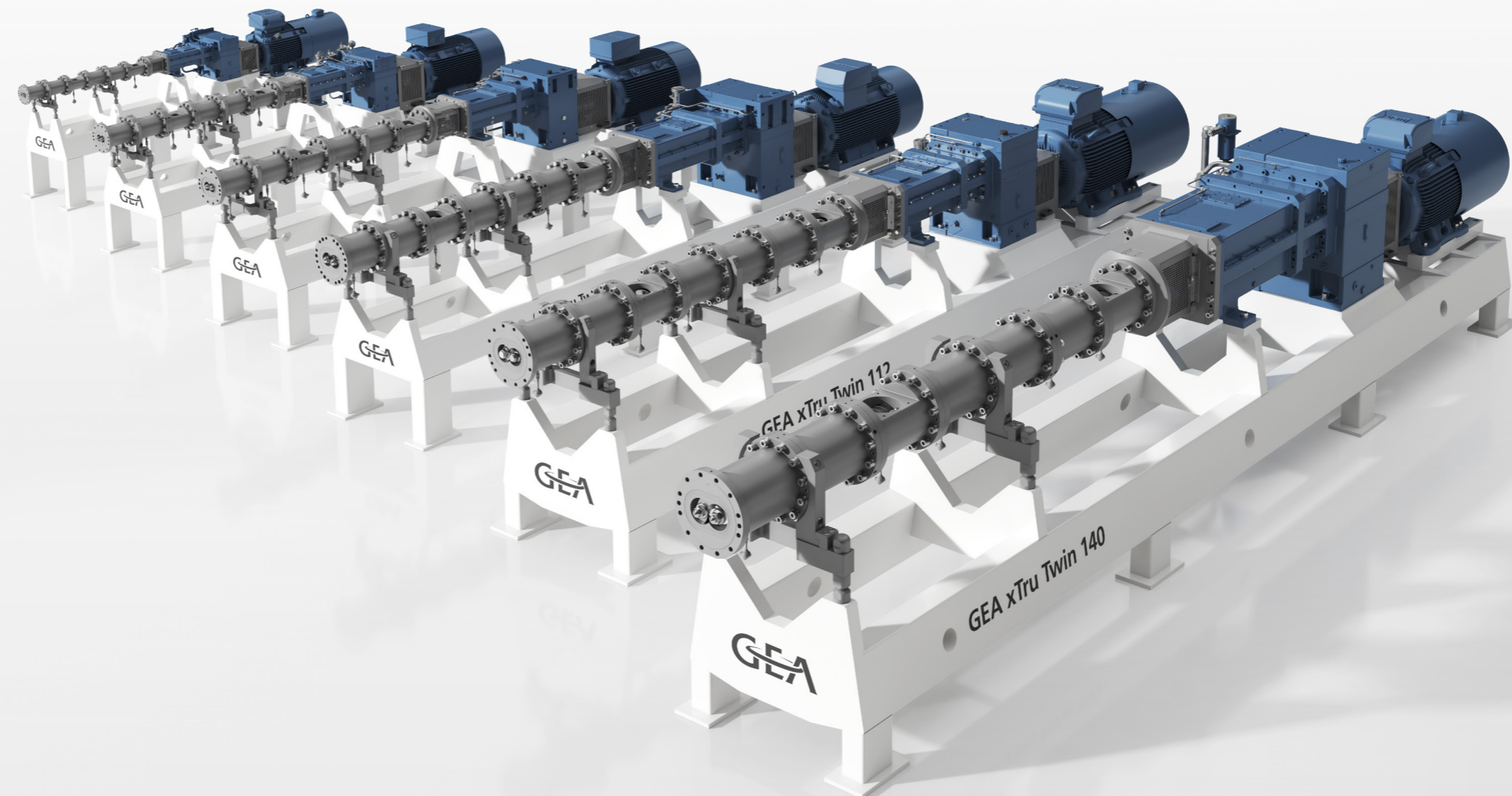
The co-rotating fully intermeshing screw assembly is composed of sectional modules with the following functions: forward and backward transport, mixing, feeding of additives, injection of liquids, de-gassing, cooking and forming.

Increased quality, hygiene and safety

The key features of the GEA xTru Twin range include: a high-speed premixer for perfect flour hydration; a large, curved mixing vessel that ensures correct water absorption and maintains the required hygiene levels; a vertical forced feeding screw to dose the dough into the cooking screw; a powerful variable speed motor equipped with safety clutch; and a double cascade gearbox with high torque delivering a high level of reserve power and safety.

Control system

The typical control system of xTru Twin extruders features a supervising unit monitoring all functions of the extruder from the dosage to the cutting unit, allowing for easy recipe management and displaying all variable of the process, such as raw material flows, extrusion torque, specific mechanical energy value, barrel temperatures and die pressure. The supervising system stores the values and allows data to be exported and managed with commonly available spreadsheet software.



Shaping technology

Sheeting and cutting

Sheet extrusion is a key step in obtaining a pellet with a homogeneous shape: by managing the process parameters of GEA xTru extruders, it is possible to precisely control the gelatinisation of the finished product, while the dies and integrated regulation system make it possible to change the thickness of the sheet directly at the head. Further along, rollers located at the die outlet help to stabilise or pull the sheet and maintain the desired thickness.

At this point the product is ready for cutting in any of three different ways:

- Square/rectangular snacks: longitudinal cut made by a slitter cutter and cross-cut made by a rotary cutter;
- Snacks with complex shapes consisting of one or more layers (2D/3D/Multilayers): we use a rotary moulder (Rotovario), made with a tempered steel roller on which the shapes of the final product are defined;
- Snacks with complex shapes containing holes inside: a punching system with a female/male mould is used.

Die-cut shaping

Forming takes place using a die located directly at the extruder head: the dough is formed by inserts that give it the desired shape, before a rotating cutter system chops the product to the desired length.

To obtain a precise cut and the desired product shape, it is essential to be able to manage the extrusion parameters with the utmost precision.

Products obtained through cold extrusion (such as potato-based products) are easier to cut, because their dough tends to be malleable and also less sticky due to being cold. Products made with cooking-extruders, on the other hand, are stretchier and warmer, which causes them to swell slightly.

As well as being completely configurable by setting the various process parameters, GEA xTru extruders are equipped with dies and inserts specially developed by the GEA Dies & Moulds department, as well as cutting systems designed for maximum precision and durability.

DIES AND INSERTS FOR SNACKS

In the GEA Dies & Moulds department, shapes and designs are fine-tuned to transform each project into a snack, while materials and processing are also perfected to ensure the long-lasting durability and accuracy of the dies and inserts.



ROTOVARIO
Rotary cutting unit for production of pellets from continuously extruded gelatinised sheets. Equipped with rollers capable of automatically aligning without operator intervention, thus ensuring speedy maintenance and changeovers.



The drying stage: superior quality and long shelf-life

During snack pellets production, the raw materials are usually processed using a relevant amount of moisture in order to obtain the required gelatinisation level as well as the correct rheological properties of the gelatinised material.

During the drying phase, excess process moisture is carefully removed in order to avoid negative effects, such as microbial growth or improper expansion during the frying or toasting phases.

In this way, correct control of the drying parameters helps to increase the shelf-life of the product, facilitating its transport and storage while also defining the expansion quality of the pellet.

The key parameters of drying technology

Generally a pellet drying line is composed of a series of separate equipment units, not only to physically separate the different ambient conditions, but also to easily handle the product.

Pre-drying > Drying > Stabilisation > Cooling

In order to define a correct drying line, the most important elements to take into consideration are:

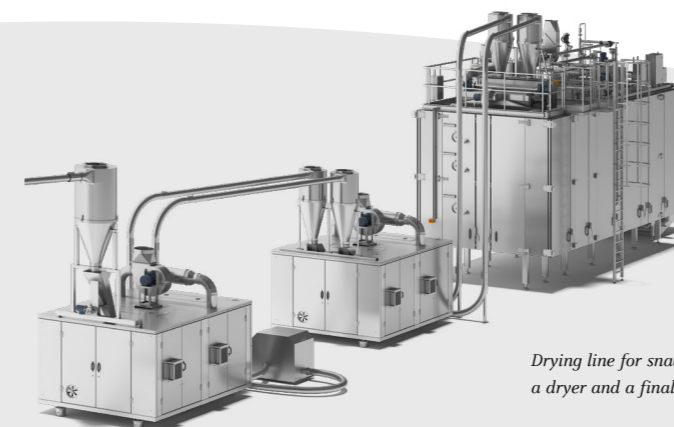
- **the stickiness of the pellets:** especially during the pre-drying stage, this can cause clumping and lump formation;
- **the shape and dimensions of the pellets:** e.g. square-shaped pellets with a flat surface are more likely to stick, and thick pellets require more time to extract the water;
- **preservation of the appearance of dried pellets:** it is important to avoid deformation and stress cracks within the pellets;
- **moisture distribution in dried pellets:** humidity control avoid irregularities during expansion.

The drying systems installed on GEA's snack processing lines allow all these elements and features to be kept under control through a precise and detailed definition of the drying parameters, including:

- air temperature and relative humidity;
- air ventilation in terms of air speed and distribution;
- handling and care of the product.

THE GEA HALLMARK OF EXCELLENCE

GEA dryers epitomise our quality standards and experience in food processing: high build quality and premium materials, innovative technology and accurate control systems for a superior finished product.



Drying line for snack pellets consisting of two pre-dryers, a dryer and a final cooler.

Snack pellet dryers

GEA manufacturing quality



Active thermal control

Moisture extraction and fresh air forced injection: GEA dryers can manage moisture by modulating extraction and injecting fresh air when needed. This provides accurate control regardless of environmental conditions, even in cold, hot, humid or dry weather.

Ventilation flow: the interlaced airflow, specific to our dryers, generates a pressurised zone between the product layers, forcing air to reach the upper and lower suction zones and creating an efficient combination of airflow through and around the product layer, improving the blowing efficiency of the circuit.

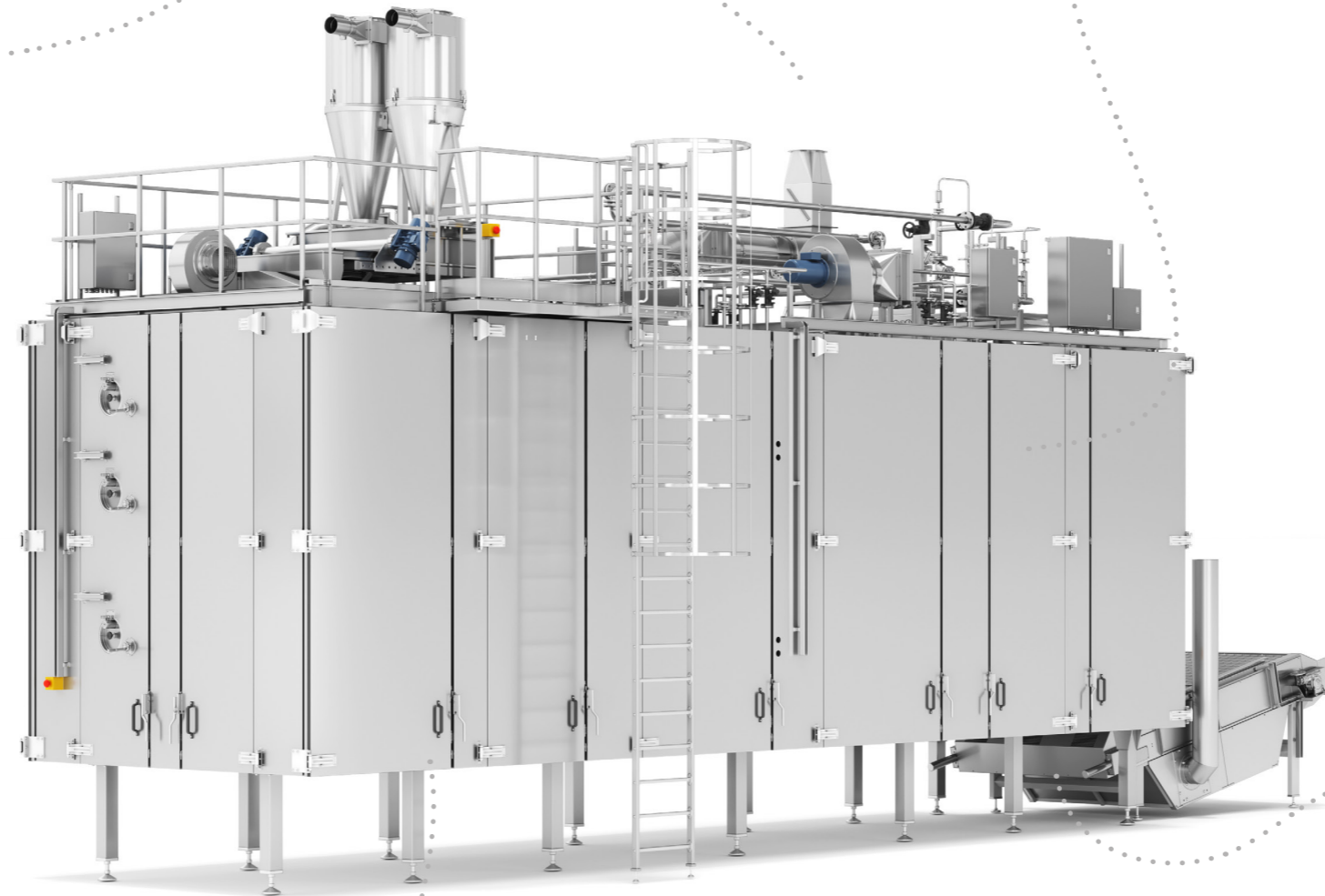
Modulation and coils: more modulation, ventilation and a greater coil surface, for higher efficiency.



Cleaning

Accessibility: fully opening panel dryers and hinged interior panels allow easy, quick and complete access to areas that require cleaning.

Product retention system: product transport mats used inside the dryer are carefully designed with a protective selvedge that prevents the product from falling to the ground, regardless of the strength of ventilation areas to be cleaned.



Proper insulation

Dryer panels: the doors made of thick stainless sheet steel are sturdy, thick and do not bend or bump. Built-in hatches ensure airflow only on the product and prevent heat exchange with the ambient air.

Door hinges and latches: our open/close system is actuated by means of a single door handle, which acts on a series of locking cylinders around the door perimeter. Doors can be opened or closed firmly, without tools and in a simple motion.

Air blade: a blast of cold air virtually stops the dryer intake, which would otherwise be an escape point for indoor air, and retains heat energy and the correct humidity.



Belt speed and residence times

Independent floor motion: each floor has its own independent motion thus allowing very careful management of the residence time for each floor and for the different products.

Our R&D fosters product development

Consulting, development of bespoke processes and products, a dedicated test centre and training courses at the service of our customers.

Teaming up with GEA means you benefit from the knowledge and experience we have accumulated over the years, and our Research and Development department is the ideal partner, sharing this know-how through the services of:

Consulting

- analysis of the customer's raw materials and assessment of their compatibility with production processes;
- advice regarding process lines, with technological assistance aimed at optimising and improving existing processes or evaluating alternative solutions;
- specific and specialised training for the customer's process line operators and maintenance personnel;
- definition and characterisation of the finished product with the aim of isolating the decisive characteristics for its manufacture;
- comparison between different finished products and tests on our pilot lines.

Development of bespoke recipes and formats

- development of raw material blends;
- testing and development of new formats;
- development and testing of innovative processes;
- collaboration with the customer on the development and manufacture of new products.

R&D test centre

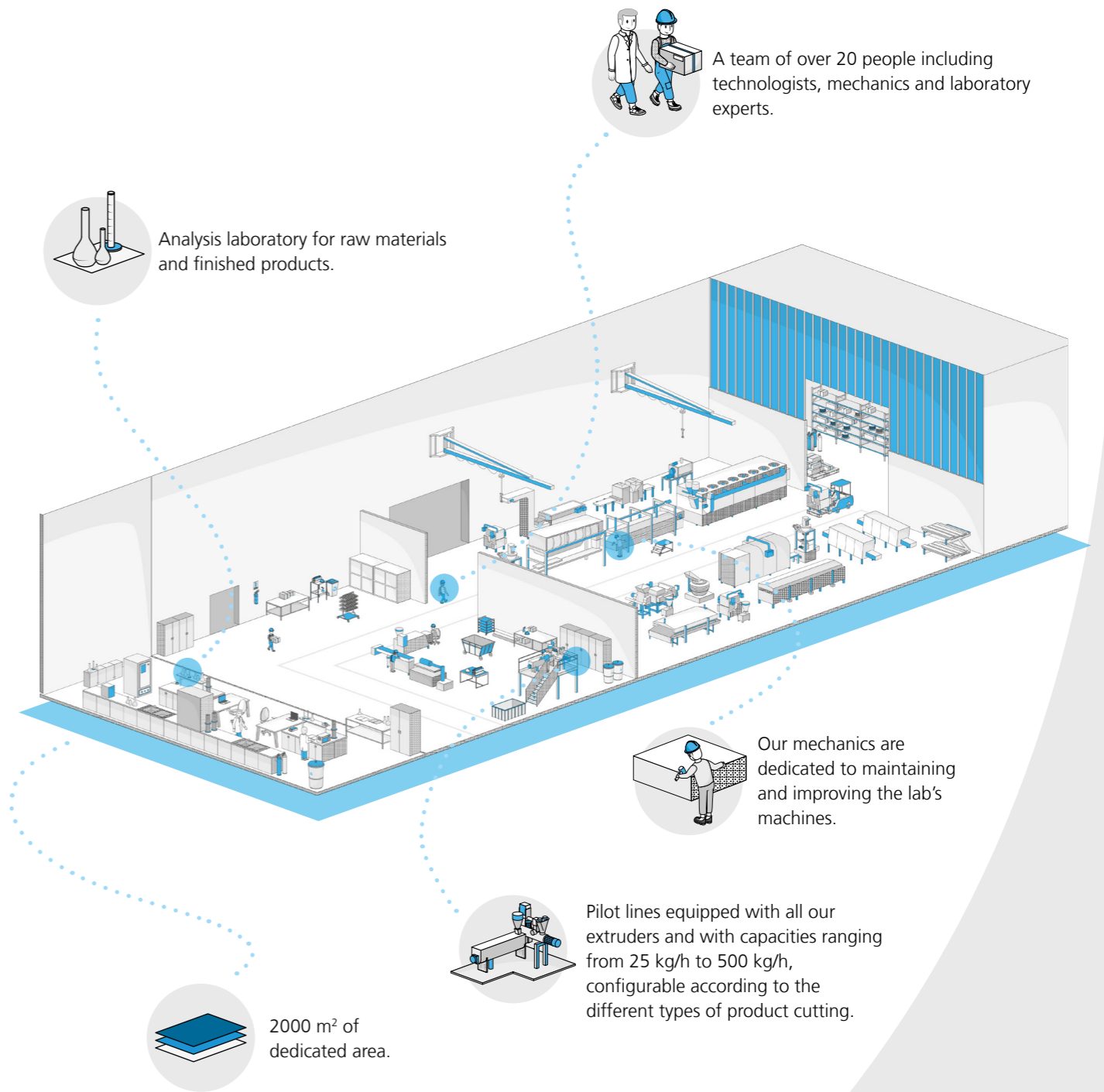
Development of new food products can be a costly and labour-intensive investment for many customers. The addition of complex formulations, detailed process design and plant validation can make it a daunting process for some customers to undertake alone.

To help achieve greater confidence in the safe and repeatable production of your food products prior to market release, GEA has built dedicated test centres, designed to aid development and trialling on a small scale before releasing for larger scale production.



Created with the aim of sharing knowledge and expertise on food production technology, the Food Tech Master is a series of professional training courses that we have run since the early 2000s. Each professional course offers in-depth technological expertise on the production process of the main pasta and snack pellets technologies.

R&D test centre





We live our values.

Excellence • Passion • Integrity • Responsibility • GEA-iversity

“Engineering for a better world” is the driving and energising principle connecting GEA’s workforce. As one of the largest systems suppliers, GEA makes an important contribution to a sustainable future with its solutions and services, particularly in the food, beverage and pharmaceutical sectors. Across the globe, GEA’s plants, processes and components contribute significantly to the reduction of CO₂ emissions, plastic use as well as food waste in production.

GEA is listed on the German MDAX and the STOXX® Europe 600 Index and also included in the DAX 50 ESG and MSCI Global Sustainability indexes.

[GEA Pasta, Extrusion and Milling Technologies](#)

[Pasta & Extrusion Technologies](#)

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