



# *iTec swiss ATEXTRUDER ATE*

## **Ingtec Technik AG in a nutshell**

Ingtec Technik AG is an innovative Swiss engineering company, operating globally in the field of specialised construction applications, covering a wide scope.

Our main focus is on batch and continuous mixing and kneading technology for ambitious tasks like high viscosity products.

We are a powerful team of experienced engineers, which excels in inventing genius and heavy mechanical construction.



We achieve maximum flexibility and customer orientation by co-operation with preferred partners for the production of complex and large machines, components, and entire plants. Those long-term partnerships are built on mutual trust, the craftsmanship and excellence in manufacturing of our partners. We also set value on state of the art production facilities, highest quality standards and meticulous quality control.

***ANLAGENBAU - MASCHINENBAU - INGENIEURTECHNIK***



## Ingtec Technik AG in a nutshell 2



Our top quality machines and plants are employed in sensitive industries like the automotive and aerospace industry. Also the defence industry relies on our products in the manufacturing of state of the art systems.

Ingtec Technik AG is proud to be among the chosen few world-class suppliers in our business.

We also offer our services as general contractors in planning, design and assembly of entire plants. Our services include the construction of the machines, process automation, raw material handling and post processing steps.

We can cover greenfield development or we can implement our equipment solutions into existing infrastructures.

With our swiss-made technology you achieve superior quality for your products. Do not hesitate to challenge our performance and contact us with your special construction application.



## Batch or Continuous Processing?



Mixing is one of the most widespread technological process. Whenever planning equipment for a mixing process, the first decision for the user to take is which processing principle should apply. Batch-wise or continuous processing.

Traditionally we are used to batch processing. But especially mixing tasks are often designed as continuous processes.

Some basic criterions, which may help to decide which technology is suited best for a given task:



	Batch		Continuous	
Process Flexibility	++	Excellent – Multi-Purpose Plant	-	Dedicated Equipment
Product Quality	-	Fluctuating	+	Constant
Raw Material Supply	+	Simple	-	Complex
Large Scale Production	-	More difficult with scale	++	Excellent
Slow Processes	+	Suitable	-	Difficult
Set-up Time	-	For each batch	+	Only once per run
Processed Volume	-	= Batch Size	+	Small
Application of Energy	-	Low	+	High
Investment	+	Low	-	High
Manpower	-	High	+	Low
Process Automation	+	Low Level	-	High Level
Start-Up/Shut-Down Procedure	+	Short	-	Complex
Maintenance	+	Relatively simple	-	Complex
Safety	-	More difficult with scale	+	Excellent



## The open-design Atextruder for continuous processing: Operating Principle

Let us have a look how the Atextruder works: The mixing process of materials is exclusively performed in the gap of two adjacent, **counter-rotating rollers**, the nip. The **gap** can be adjusted in a range **between 500 µm and 5000 µm** on both ends of the rollers.

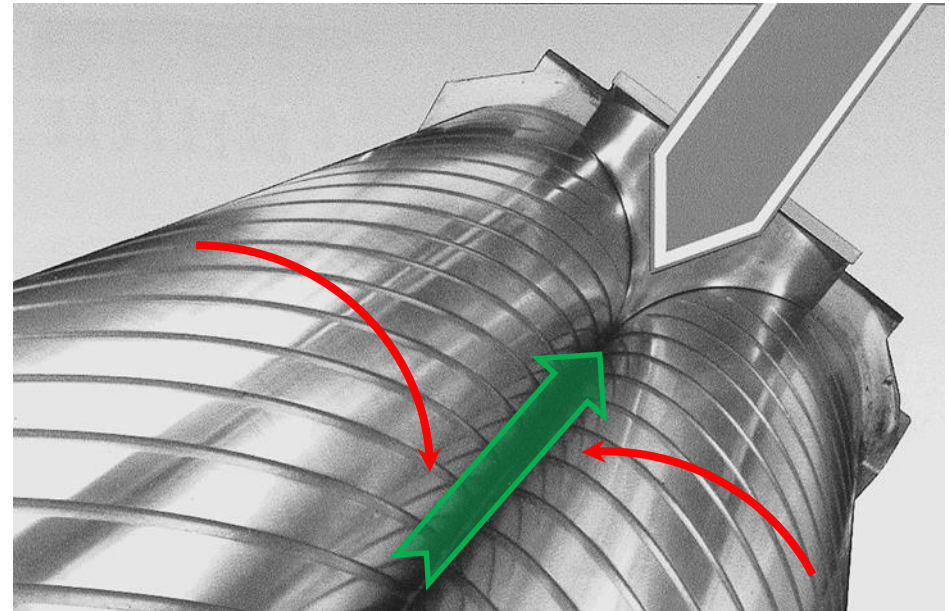
Direct contact of the hardened surfaces of the rollers with each other is excluded by the design of the Atextruder. Both rollers are fitted with several tread-like grooves, which push the material from the feeding to the discharge area.

In the standard version, the **temperature of the rollers** can be controlled individually. If desired, we can also provide versions with two independent temperature zones of both rollers, enabling even more process flexibility.

Also the **rotation speed of the rollers** can be set individually.

Solid raw materials may be dispensed by **gravimetric feeders** and transported to the Atextruder by means of vibration conveyors. Paste –like materials will be dispensed by screw pumps. Liquid raw materials may be introduced by feed pumps.

In contrast to conventional extruders, the different types of **feeders can be placed at any desired position along the rollers**. The open design is not restricted by the fixed positions of the ports of an conventional extruder barrel. The output of the feeders simply needs to be placed in the nip zone of the rollers.



Rotation of the rollers and material flow



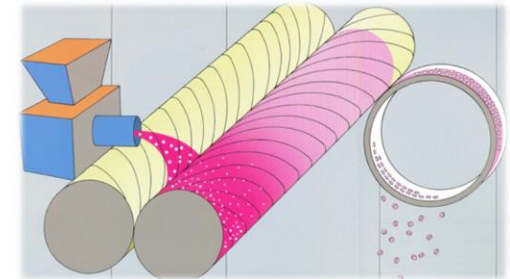
## The open-design Atextruder for continuous processing: Overview

The Atextruder is a versatile tool for the processing various materials. Any demanding mixing task, which stretches conventional continuous technology to its limits, can often be implemented successfully on the Atextruder.

Continuous

- **compressing**
- **melting**
- **homogenising**
- **dispersing**
- **compacting**
- **granulation**

of materials ranging from medium to high viscosity is where this new technology excels.



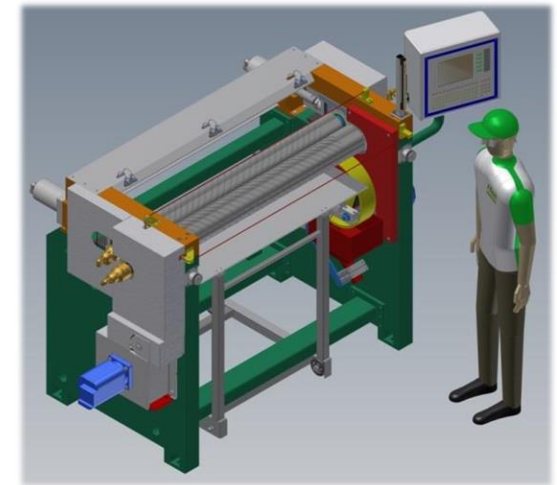
The process temperature can be controlled within a range of 20° to 230° C or higher (special design up to 280° C).

The Atextruder is also very useful as open continuous reactor for chemical products, like polymeric 2K systems of medium to high viscosity.

Continuous

- **degassing**
- **drying**
- **temperature treatment**

are operations, the Atextruder is capable of.

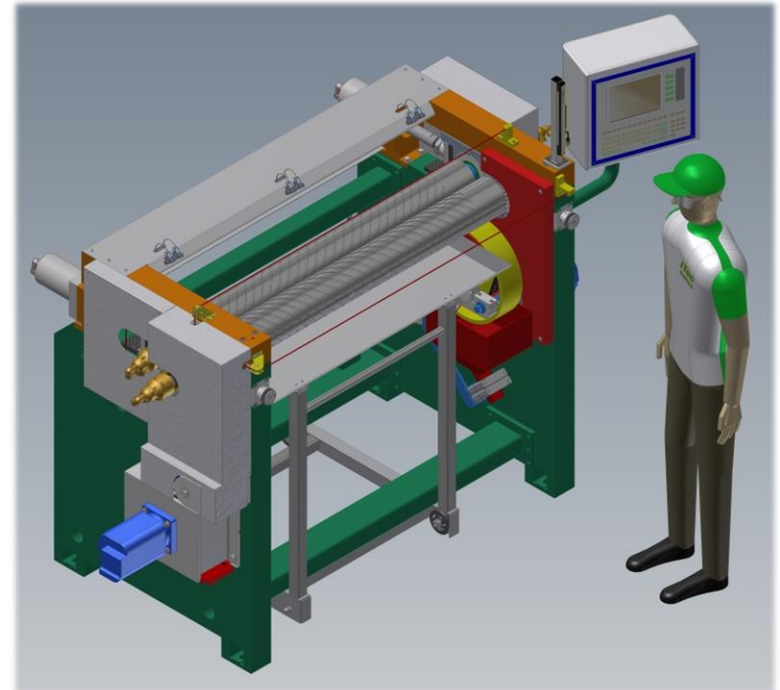




## The open-design Atextruder for continuous processing: Overview

Compared to conventional extrusion the iTec Atextruder benefits from the following advantages:

- **Open construction** leading to **good accessibility of the processed good**, no closed containment
- **Continuous** operation, easy visual monitoring of the running process
- **Flexible** process design, not limited by the rigid position of ports, arranged on a fixed outer barrel
- **Homogenisation** of the processed material by shear in the gap of the rollers
- **Variable adjustment** of various process parameters: Roller speed, gap, gap gradient, temperature and temperature gradient
- **Minimal abrasion**: Shear is applied to the product in the gap of the rollers only
- Reproducible **product quality** and **increased efficacy** of the kneading process
- Only **small amounts of material** are present on the machine **during processing**, contributing to a very low hazard potential and **minimal waste fractions**
- **Lower down times** and **reduced non-conformity costs** in production and especially in R&D

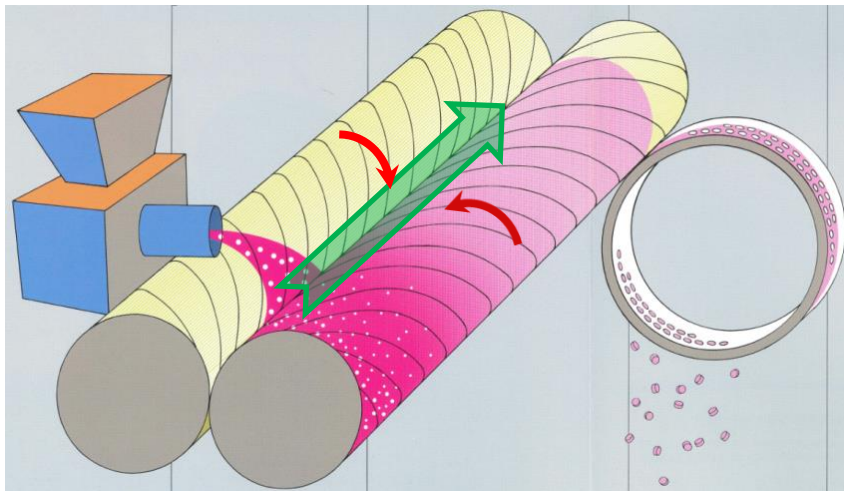




## The open-design Atextruder for continuous processing: Operating Principle

When the process parameters are well established, driven by temperature and rotation speed differences between the two rollers, a thin layer of the mixing good, the “felt”, adheres to the front or “feed” roller. The back or “conveying” roller is only in contact with the kneading good in the nip zone and stays other ways clear of the product. This also contributes to the easy operation, maintenance, handling and cleaning of the Atextruder.

The total amount of material felt, present on the feed roller is, depending on the material, the size of the Atextruder model and the pre-set gap of the rollers Very small, approx. between 0.5 to 25 kg.



Overall scheme of the process

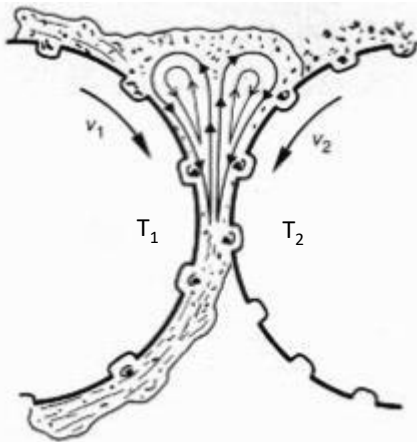


Product felt on front roller



## The open-design Atextruder for continuous processing: Operating Principle

The material on the rollers is forced to pass through the gap between the rollers. In the nip, usually a small amount of material will accumulate, before being forced through. This zone of turbulence enhances the mixing process. This is also, where new materials are introduced to the process. The nip zone applies shear and kneads raw materials into the existing product felt. homogenising it on the way downstream.



Kneading process



Zone of turbulence at the nip

The helical grooves on the rollers are pushing the product towards the discharge zone of the machine. Along its way downstream, the material will pass through the nip several hundred times. Each passing will cause intensive kneading, dispersion of solids, reduction of particle sizes, homogenising the product. The dwell time is influenced by the length of the rollers and their speed of rotation.

At the output zone of the Atextruder, the product is yielded by various instruments like a strip cutter or directly pressed into granules.

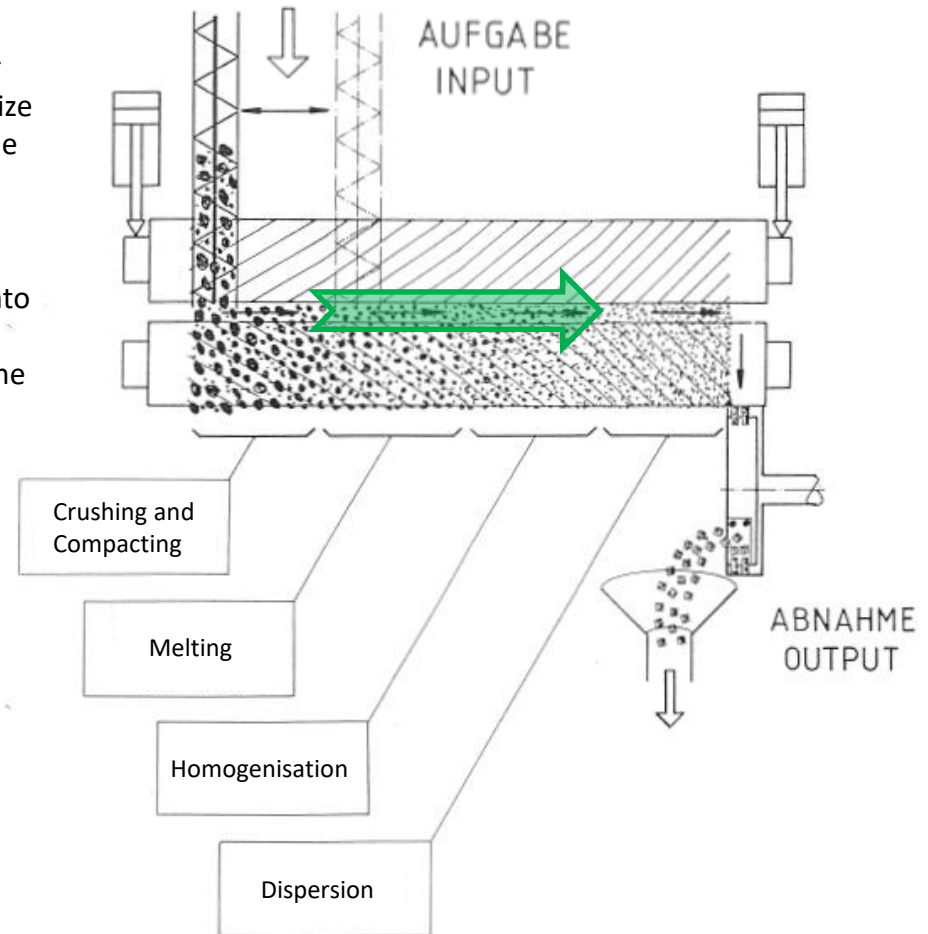
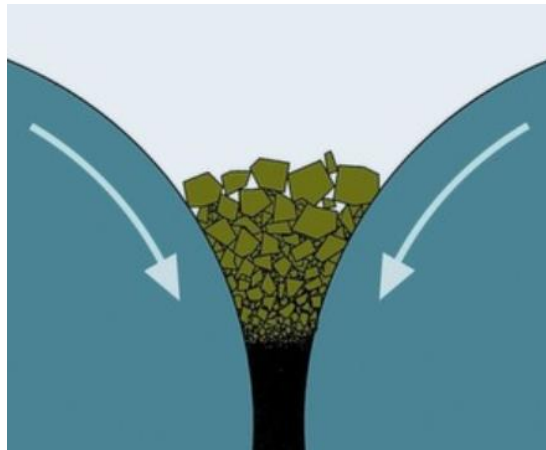


## The open-design Atextruder for continuous processing: The Process

If desired, the sharp edged grooves of the rollers may cut larger lumps of starting materials into smaller pieces. The maximum size of such lumps depends on the properties of the material and the calibre of the rollers.

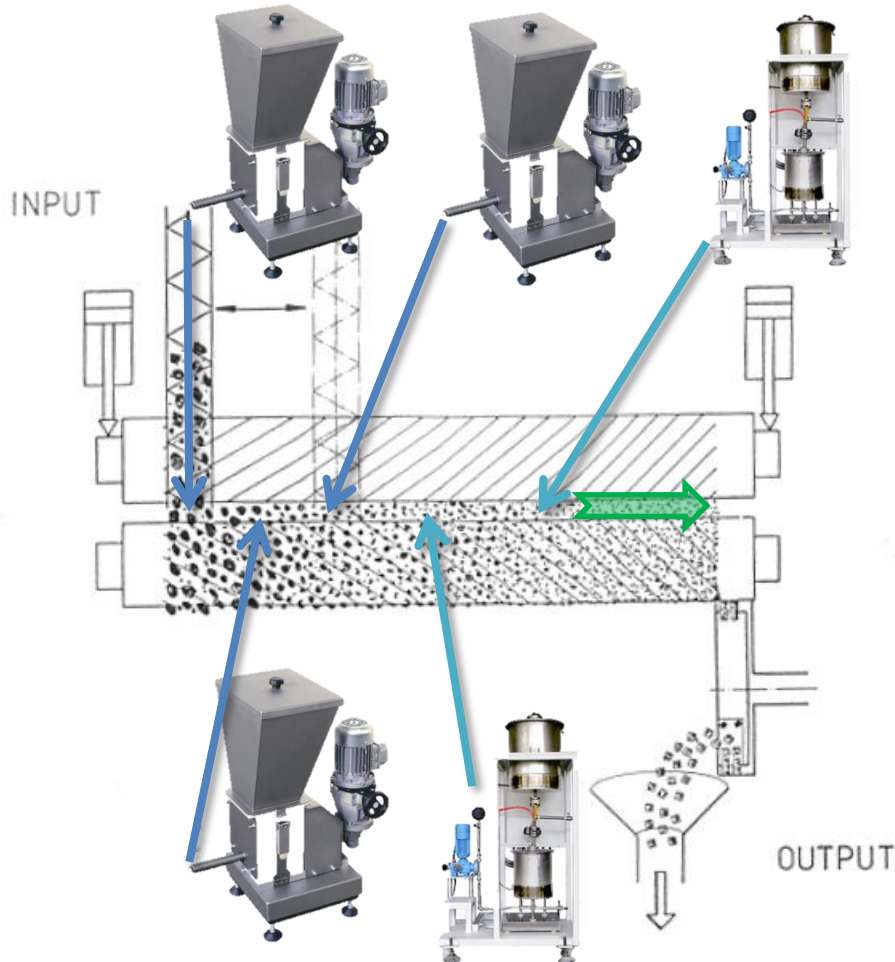
Strong shear forces in the gap of the two rollers further disintegrate the pieces. Fine grain materials are pressed into the nip region by the groves of the conveying roller and incorporated into the felt successively, while being compacted and degassed.

Polymeric materials may be melted by heating the rollers and the induced shear.





## The open-design Atextruder for continuous processing: Raw Material Feeding



During the mixing process along the nip zone of the rollers, additional feed streams of raw materials like fillers, fibres, pigments or additives may be added at any suitable point. The number and types of feeders is basically unlimited when stacking the feeders in space.

**Solids** may be handled by vibrators, single or double screw feeders, depending on their flowing behaviour.

All kind of **liquids** are fed by appropriate liquid feeders.

Ingtec Technik AG can provide high accuracy feeding technology and raw material handling on request. We also provide entire control systems for the required process automation.



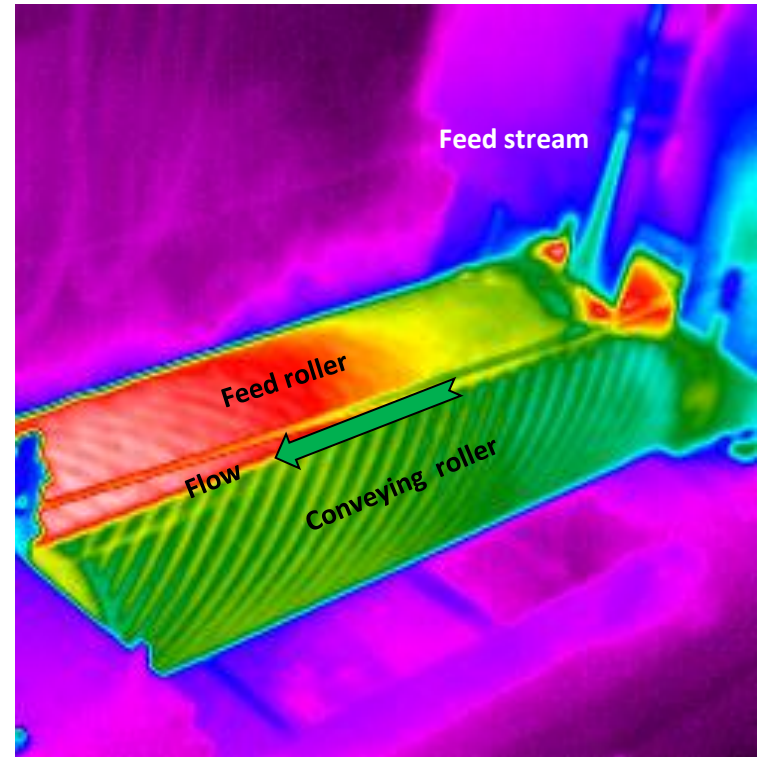
## The open-design Atextruder for continuous processing: Temperature Control

Even in the standard version of the Atextruder, fitted with individual temperature zone for each roller, the temperature of the product can be controlled very effectively.

The IR image on the right shows a product introduced to the Atextruder relatively cold and heating up by friction and shear on the way downstream.

Choosing suitable temperature levels of the conveying and the feed roller enables the formation of the product felt on the feed roller. The temperature applied to the mixing good helps to establish optimum product viscosity.

Owing to the design of the rollers and the small amount of mixing good present on the machine at one time, a steady state is achieved after a short running time and product changes or cleaning procedures are therefore easy and short. Waste fractions are reduced to an absolute minimum. Simply removing the felt from the feed roller often does the job.



Red is hot, blue and purple are cold

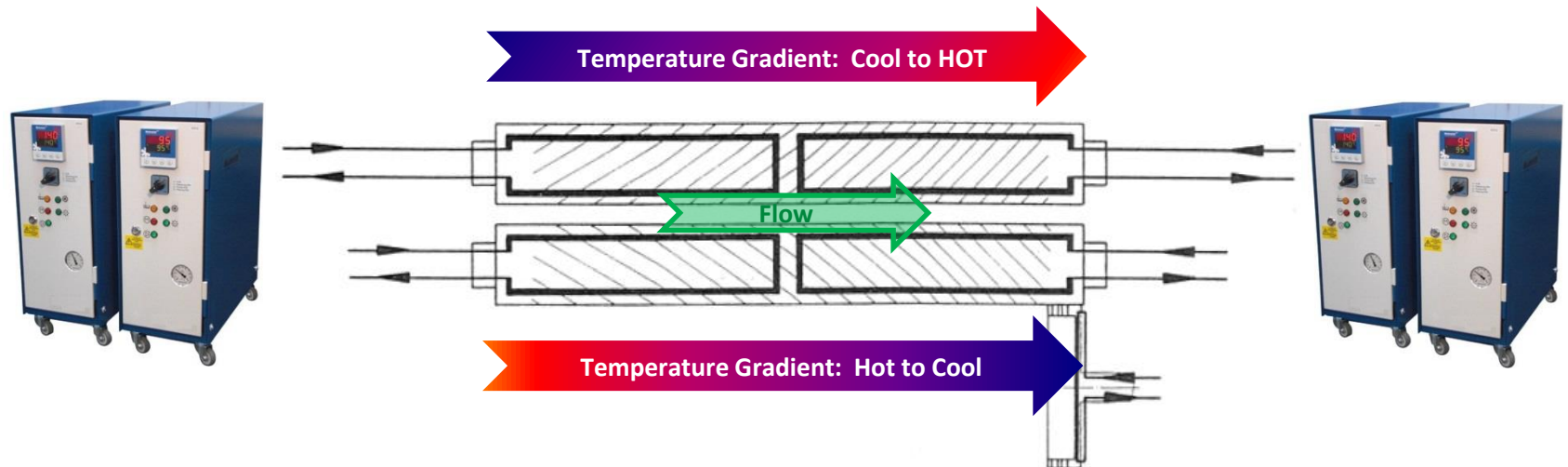


## The open-design Atextruder for continuous processing: Temperature Control

When rollers with two independent heating zones are chosen, the product can be submitted to **temperature gradients** during processing.

For instance heating in the first zone (E.g. melting, homogenisation and dispersion of solids) and cooling down in the second section (to get ready for granulation and post processing/storage). With up to 4 independent heating units, the temperature gradient can also be reversed (cool to hot), if desired.

Heat, generated by induced shear and friction of the Atextruder process can be controlled by the heating units. Fitted like this, the Atextruder can manage the temperature of the product very exactly and protect it against overheating. As the amount of material on the massive, thermostatted rollers is very small, the heat exchange is very effective.

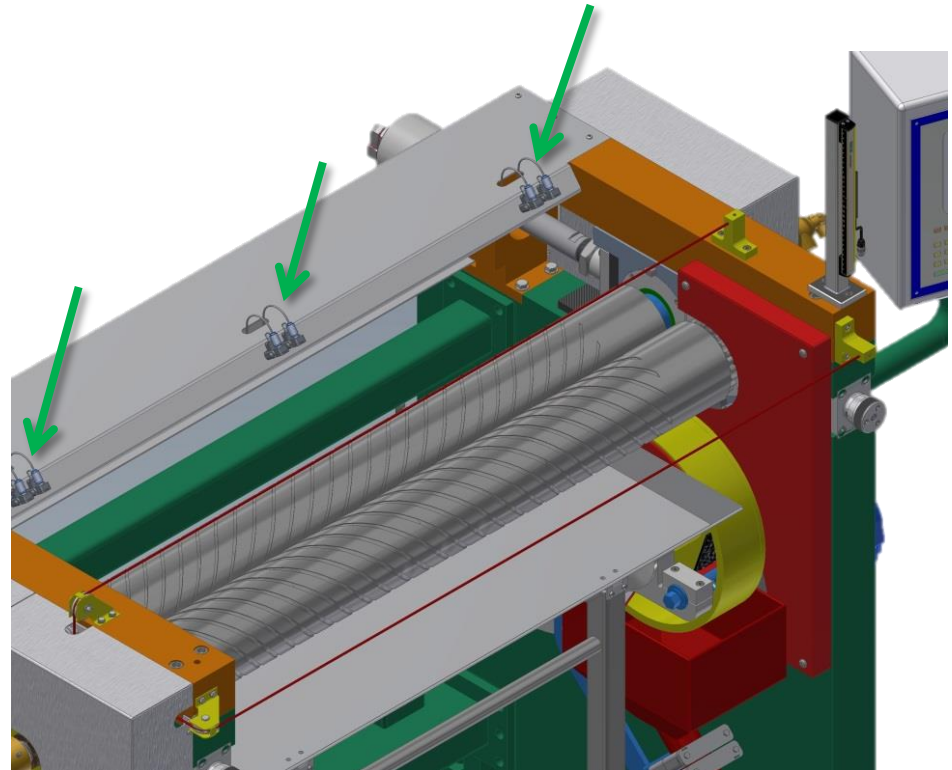




## The open-design Atextruder for continuous processing: Temperature Control

During the process, the temperature of the product felt is constantly monitored by touchless IR sensors, which are positioned along the rollers.

The temperature of the thermo transfer fluid is also constantly monitored at the in- and outlet of the temperature zones. This enables precise heat management. The control system can detect if, for instance by shear and friction or by unwanted decomposition reactions, heat is generated and control the temperature accordingly.





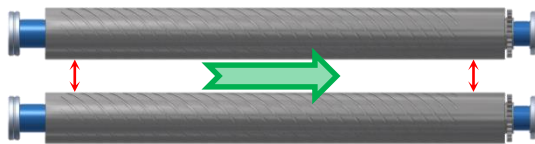
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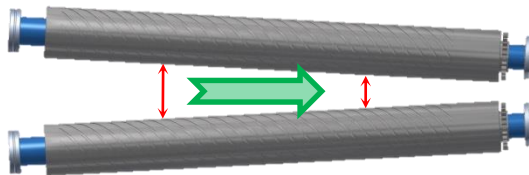
## The open-design Atextruder for continuous processing: The Gap

The gap between the rollers is controlled by robust high precision positioning devices at both ends of the rollers. This allows to operate the rollers parallel with constant gap. It is also feasible to run the rollers with increasing or decreasing gap, if the mixing task requires it.

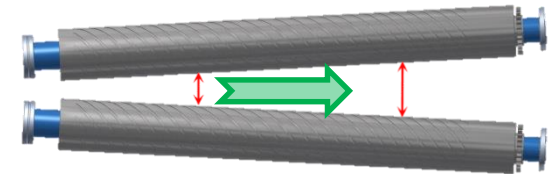
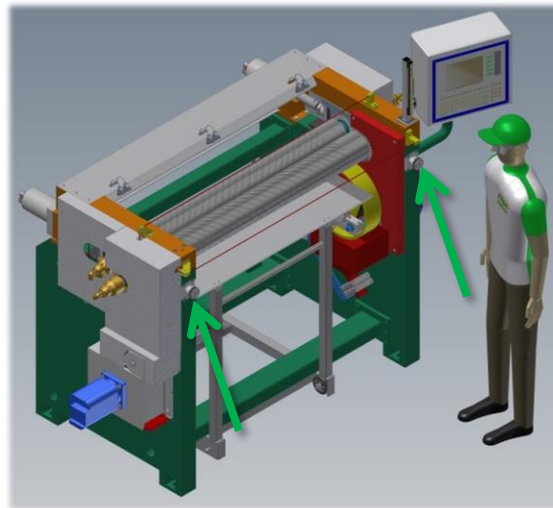
The surface of the stainless steel rollers is hardened by plasma nitriding to enhance mechanical stability against abrasion and corrosion.



Parallel Orientation  
Gap: 500 to 5000  $\mu\text{m}$   
Constant Shear



Decreasing Gap  
Minimum Distance 500  $\mu\text{m}$   
Increasing Shear



Increasing Gap  
Maximum Distance 5000  $\mu\text{m}$   
Decreasing Shear

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## The Atextruder for continuous processing: Areas of Application by Product

The new kneading and mixing process, enabled by the Atextruder allows the user to develop and manufacture new combinations of materials with increased quality and very often increased productivity, especially with raw materials, which are difficult to handle and drive conventional extrusion to its limits.

The Atextruder can be employed to handle solids and paste like products of medium to high viscosity. Typical areas of application are:

### Products:

- Pencil leads
- Laser printer and copier toners
- Pigment concentrates
- Masterbatches
- Rubbers
- Ceramic compounds
- Metal powders and compounds for powder metallurgy
- Energetic materials of various kinds (Nitro cellulose, powders, propellants)
- Peroxides
- Polymeric materials, resins



We are quite convinced that this list of possible applications is by no means exhaustive. Tell us yours.



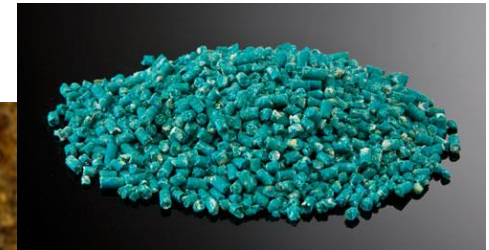
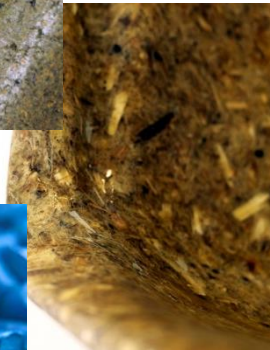
## The Atextruder for continuous processing: Areas of Application by Process Steps

The new kneading and mixing process, enabled by the Atextruder allows the user to develop and manufacture new combinations of materials with increased quality and very often increased productivity, especially with raw materials, which are difficult to handle and drive conventional extrusion to its limits.

The Atextruder can be employed to perform several process steps in one. The steps are not separated but happen in parallel on the machine.

### Process steps:

- Fibre reinforced materials
- Compacting of powders
- Grinding and dispersion of solids
- Melting
- Evaporation of volatiles
- Granulation







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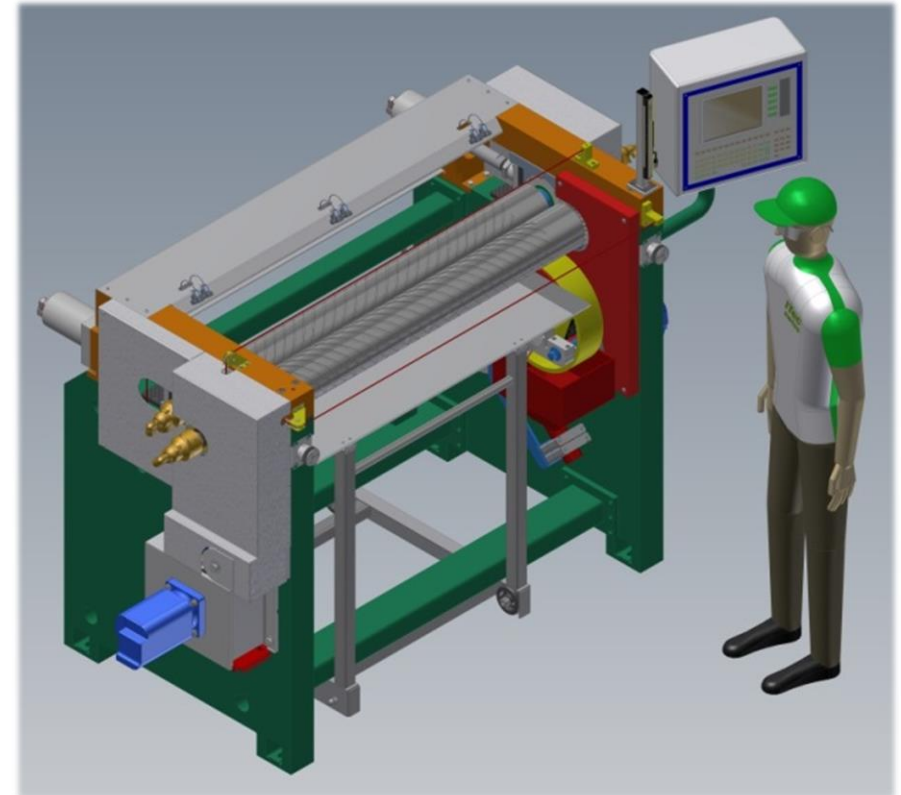
The impressive shear forces, friction and temperature control result in an excellent homogenisation of the product and fine dispersion of solids. A state of the art PLC system combined with process visualisation and parameter recording allow for reproducible product quality.

## Available Atextruder models

There are three sizes of Atextruders available. They cover laboratory development, pilot plant stage and commercial processing:

Type ATE 150	approximate capacity: 3 to 30 L/h
Type ATE 250	approximate capacity: 15 to 150 L/h
Type ATE 350	approximate capacity: 75 to 500 L/h

Installed drive performance is between 11 to 40 kW. For superior control of the drives, Ingtec Technik AG employs hydraulic systems.



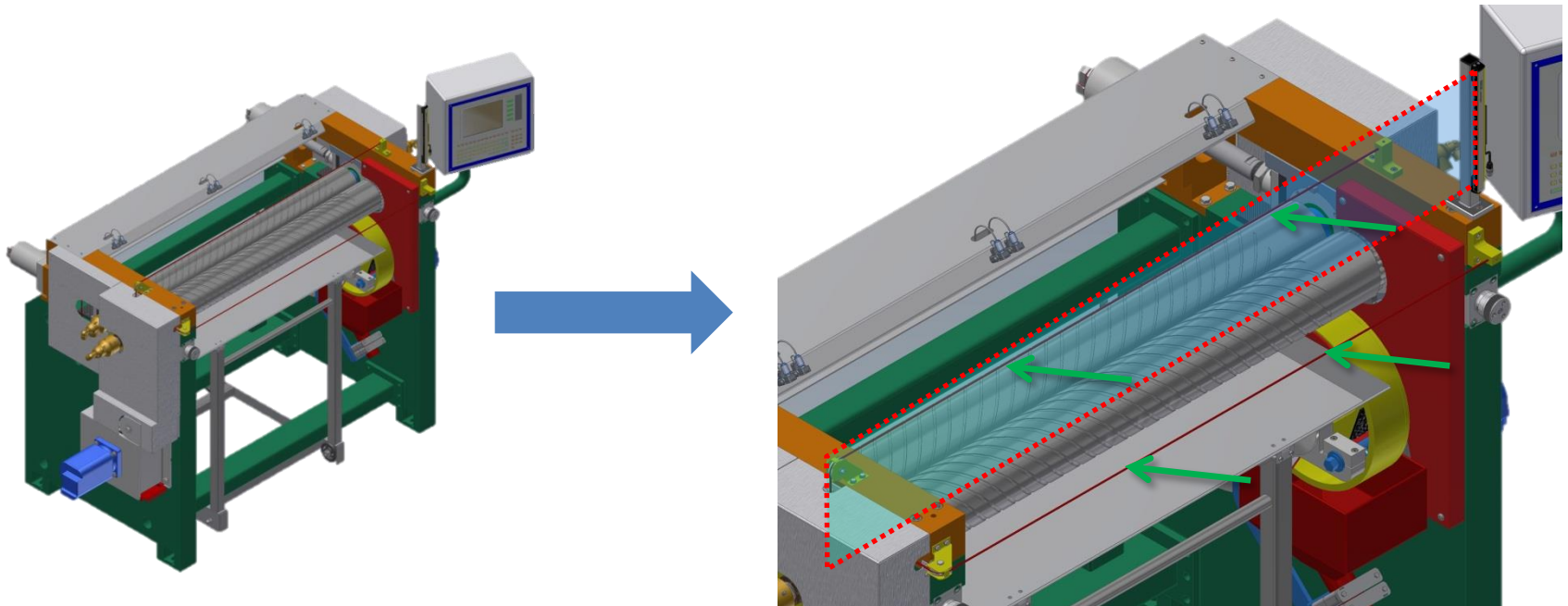
	ATEXTRUDER ATE 150 with granulating device	
Length of the rollers:	1345 mm	Length/Diameter (L/D): 9
Diameter of the rollers:	150 mm	Installed Power: 11 kW
		Capacity: 3 to 30 L/h



## The Atextruder for continuous processing: Safety Concept

Safety first is our motto at Ingtec Technik AG. Especially when dealing with an open machine like the Atextruder. To avoid any harm to operating staff and as a second thought to the machine itself, we have implemented several safety features.

When accidentally approaching the running Atextruder, a **photoelectric safety barrier** (red dots) will immediately stop the rollers. Additional **safety cords** will switch off the machine as well and form a visible barrier (green arrows). Of course, we can also provide a complete containment for the Atextruder, adding safety and industrial hygiene.

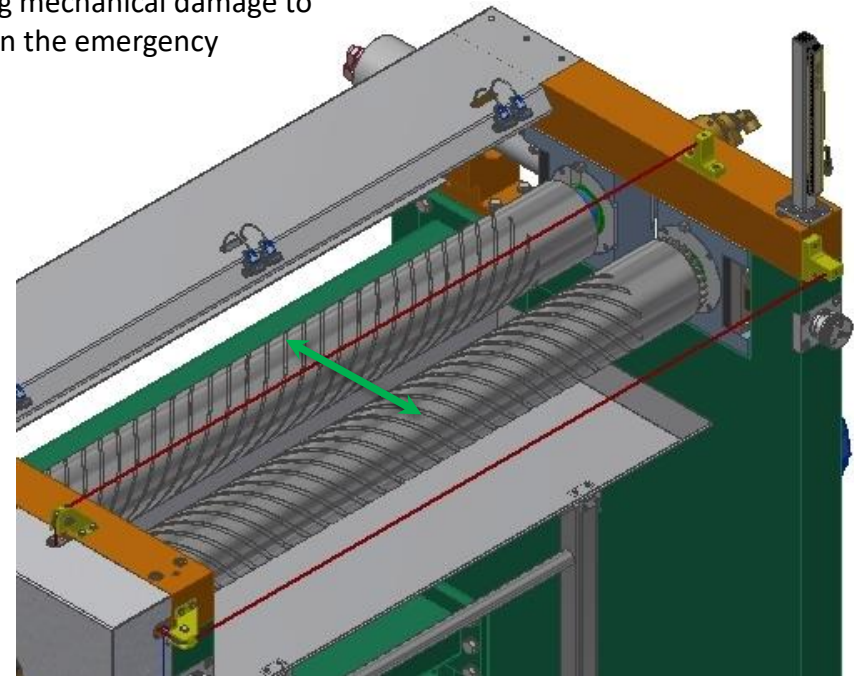
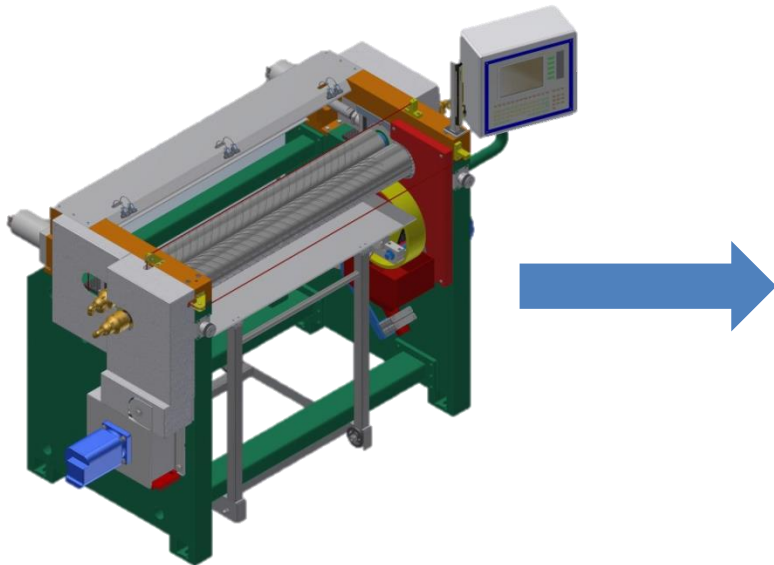




## The Atextruder for continuous processing: Safety Concept

Safety first is our motto at Ingtec Technik AG. Especially when dealing with an open machine like the Atextruder. To avoid any harm to operating staff and as a second thought to the machine itself, we have implemented several safety features.

In case hard objects like tools or large lumps of starting materials get accidentally in the nip of the rollers, the lateral forces, applied on the bearings of the rollers will trigger a hydraulic quick release mechanism. This will at the same time immediately drive the **rollers** into a **safety position, 100 mm apart** and stop the rotating thus avoiding mechanical damage to the rollers or the drives. This mechanism will also be activated when the emergency stop is hit by the operator and for cleaning purposes.





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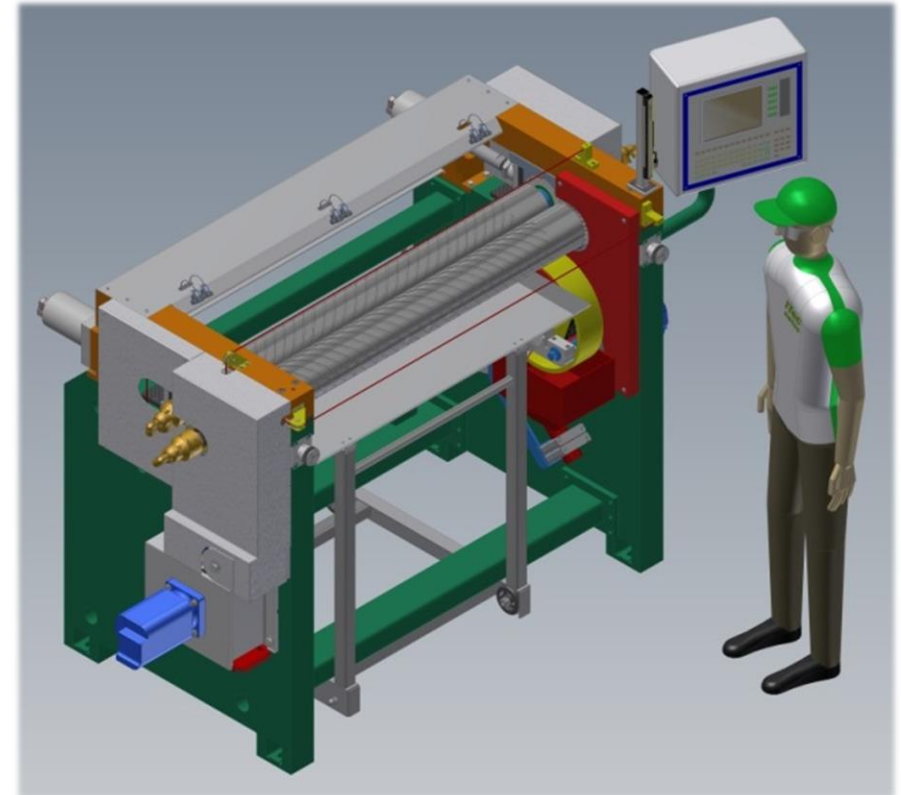


Please do not hesitate to ask any questions, regarding the ATEXTRUDER, its operating principle or its applications.

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ATEXTRUDER ATE 150