ALTERO
recycling machinery

Recycling solutions for a sustainable future

Pelletising lines for **recycling** of post-consumer and post-industrial **plastic waste**.

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CONTENTS

1. Altero in figures/

Aranow Machinery Group
60 employees

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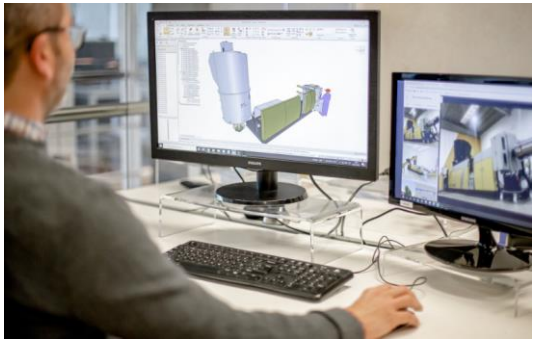
Design, manufacture and commercialisation of pelletising lines for plastics recycling

aranow
packaging machinery

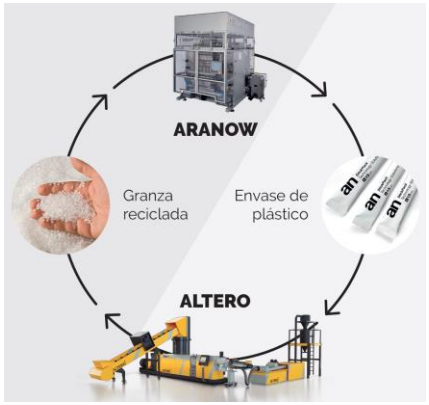
Design, manufacture and commercialisation of vertical machines for single dose packaging of products



More than 20 years of experience

2. Business strategy /

Circular Economy



- Solutions focused on **promoting the circular economy** in new materials and applications companies.
- Enhance **Altero - Aranow synergies** to offer comprehensive solutions to our customers

International Company

- **Orientation to all high-potential markets**
- In constant search of **synergies and collaboration** with international partners

R + D + I

- Investment in R&D&I projects to **develop new products and technologies** that respond to market needs.
- Constantly **evolving our products** to integrate state of the art technologies.

3. How we differ /

Productivity

- **Maximum machine uptime**
- Specific designs for **optimizing production**
- **Maximum performance** thanks to high quality components
- **Technical advice** to ensure optimal operation

Service

- Committed to offering **a top quality after-sales service** and with the excellent response time.
- Use of **new technologies** such as augmented reality **for remote troubleshooting.**

Flexibility

- Ability to develop **customized solutions.**
- **Maximum dialogue** with our customers to meet their specific needs
- Willing to **integrate new technologies** requested by our customers

Profitability

- **Very competitive prices**
- **Quality and durable** components
- Wear **parts repair**
- **Less Maintenance costs**

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4. Products

velox

Maximum efficiency and durability in the recycling of post-consumer plastic waste.

optima

Optimised for the recycling of production losses and post-industrial plastic waste.

duplo

Maximum degassing power to process highly printed materials.

aqua

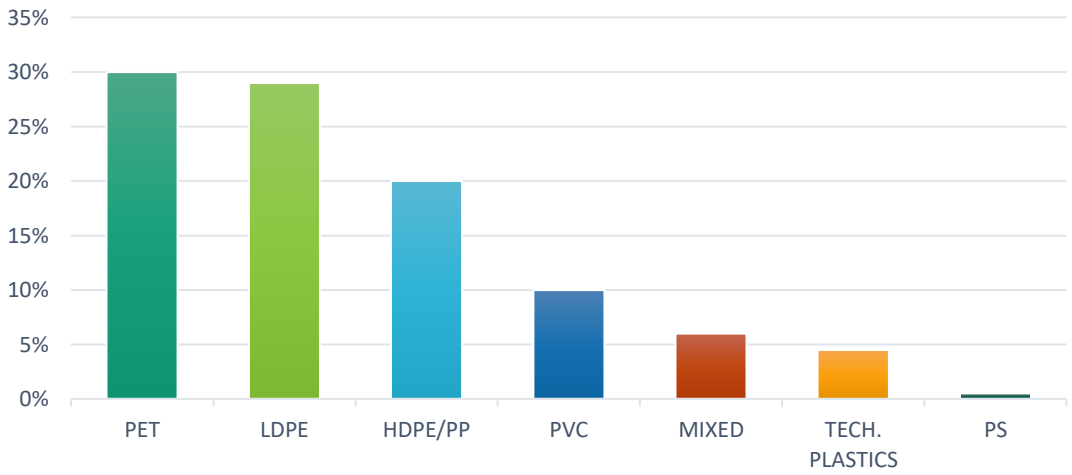
State of the art technology for the production of food and non food grade rPET.

5. Positioning by polymer

velox
duplo
aqua
optima

PET	LDPE	HDPE/PP	MIXED	PS
	●	●	●	●
	●	●	●	●
●				
	●	●		

Share of installed recycling capacity



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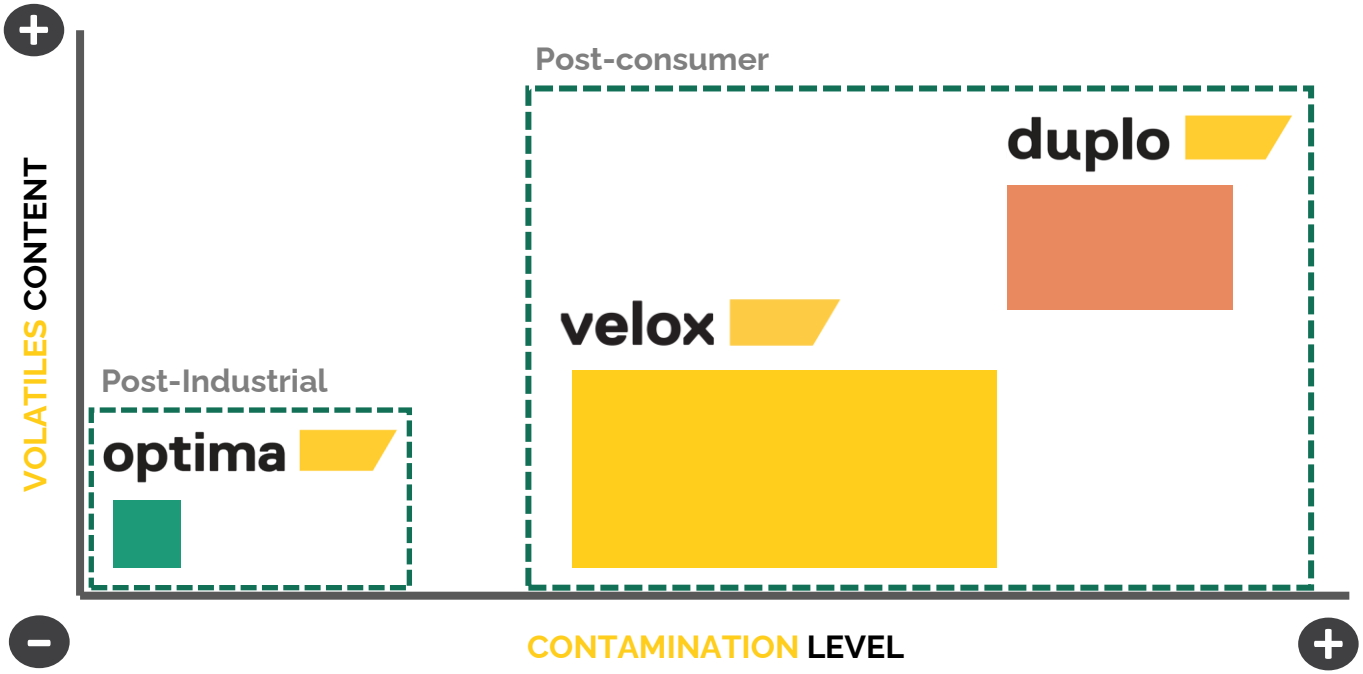
6. Positioning by application



aqua

PET RECYCLING APPLICATIONS

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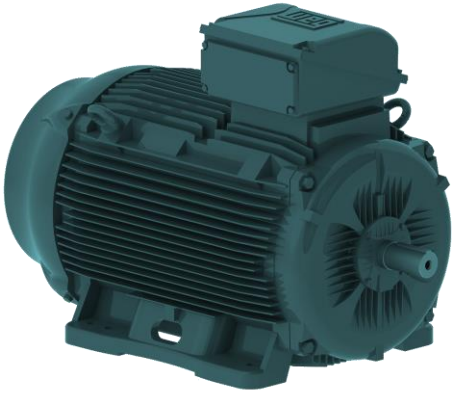
7. Altero Machines. Maximum durability/

- Barrel and Screw made of the **best bimetallic steel** by one of the best manufacturers in Europe
- **Knoedler FZ gearbox**. First brand in extrusion applications and used by the most prestigious manufacturers
- **Infrared heating elements** with 10 times longer service life than traditional ceramic devices.
- **Water ring vacuum pump** from one of the best manufacturers on the market.
- **ABB drives** excellent on high torque and load level applications.
- **GEFRAN solid state relays** of the highest quality and durability.
- **GEFRAN Impact pressure sensors** specially designed for recycling applications.
- **Internal nitriding of the filter** to increase wear resistance.
- **Blades** for the pelletiser made of **bimetallic steel** for greater durability
- **Robust chassis and fairing** to maintain integrity over time

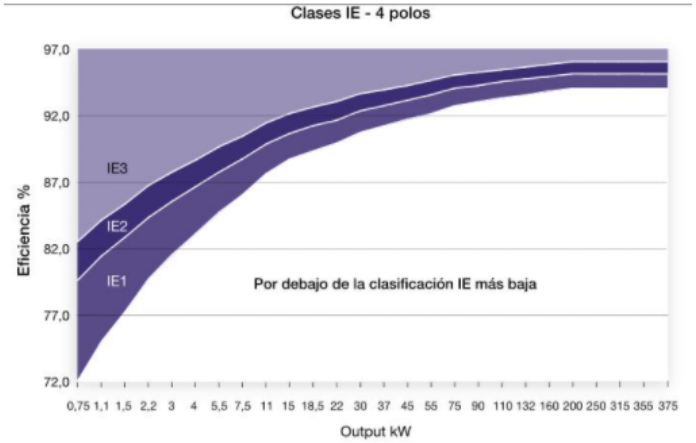
SIEMENS ETTLINGER ABB Telemecanique ROBUSCH
sesotec Lenze GEFRAN CARLO GAVAZZI weg

8. Altero machines. Energy efficiency /

By default, we install **WEG IE3 motors** with **premium energy efficiency**



- **IE1:** eficiencia estándar (equiparable to eff2)
- **IE2:** alta eficiencia (equiparable to eff1 or EPAct'92)
- **IE3:** eficiencia premium (equiparable to EPAct'05)



Optionlly Direct Drive motors with the highest energy efficiency. They do not need a gearbox (energy savings of 1-2%). Constant torque from 0 rpm.

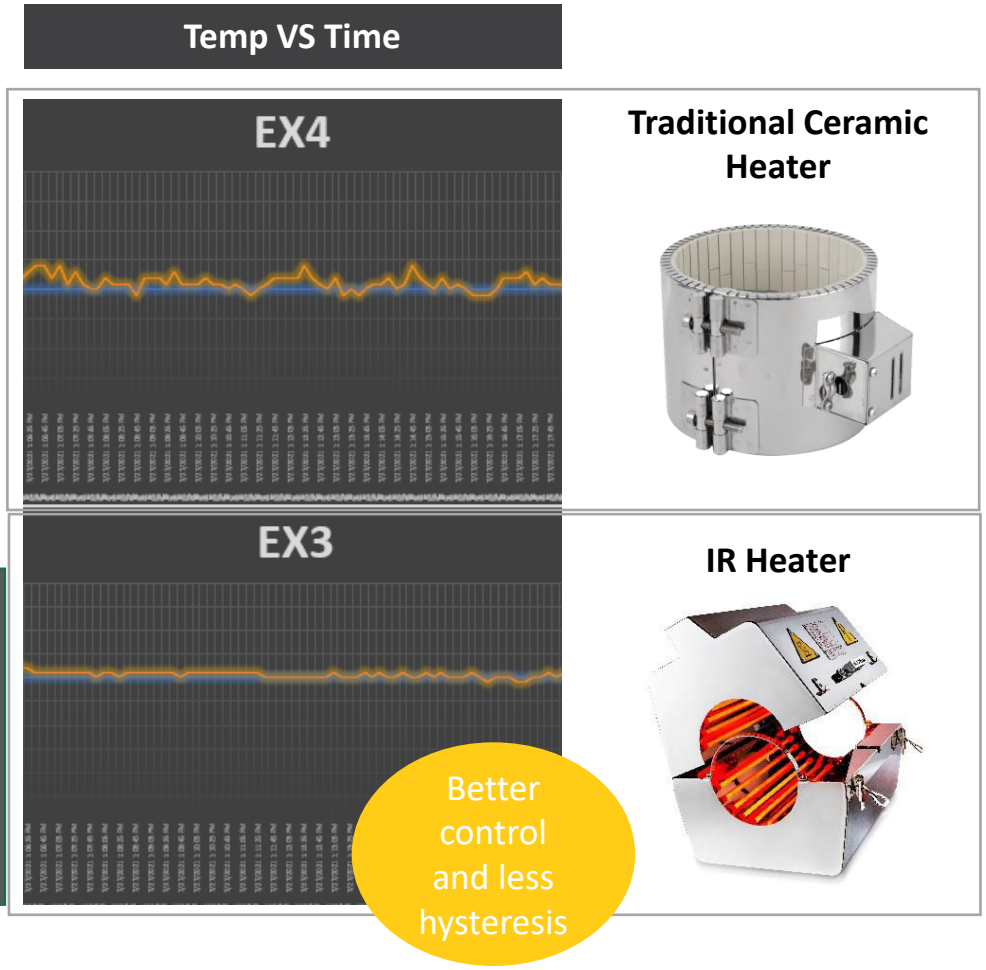
8. Altero machines. Energy efficiency (II)

Infrared heaters

- Energy savings of up to 40%
- More uniform heating
- Optimal temperature control
- Lifespan x 10
- Ultra-fast heating
- Minimal maintenance
- More secure

Benefits

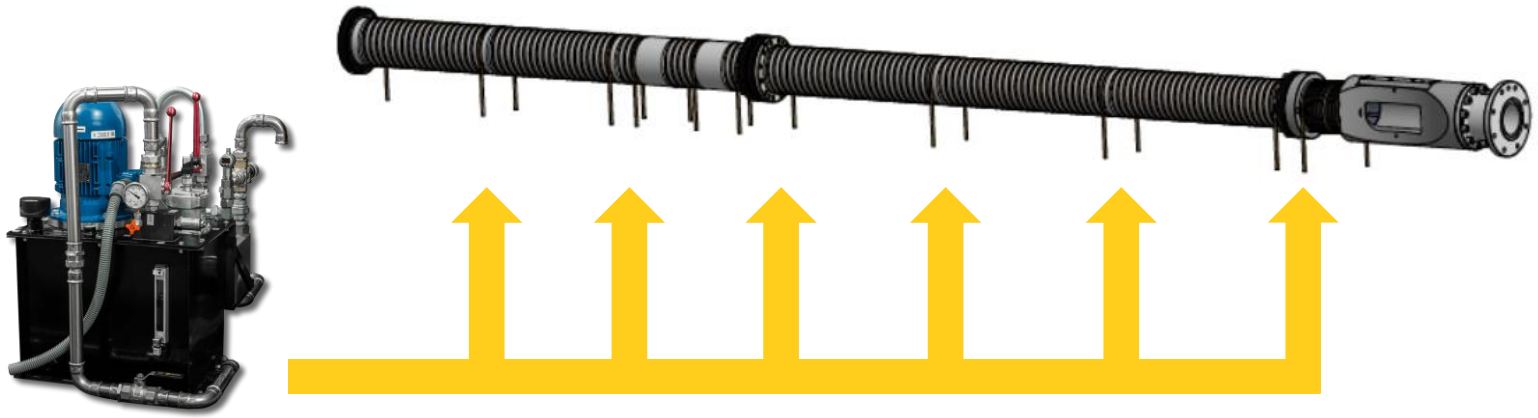
- Direct contact with the barrel is avoided ➔ **lower thermal inertia**
- Heating by electromagnetic waves instead of conduction ➔ **higher efficiency and speed**
- The cooling system is not in contact with the heater ➔ **higher efficiency**



8. Altero machines. Energy efficiency (III)/

Barrel Heating with thermal oil

- Maximum efficiency and stability
- Optimal temperature control
- Energy savings by minimising hysteresis
- No heat is transferred to the environment
- Reusable heat energy in other processes ➔ e.g. pre-drying of the material



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Post-consumer
Post-industrial
Ink
PET

9. VELOX: Maximum efficiency /

Optimised for processing /

- PE Film (HDPE, LDPE, LLDPE)
- PP Film (BOPP, CPP)
- PP non-woven
- BOPET Film
- PP Raffia
- PP Textile
- PP fibres
- Rigid PP waste

Typical applications /

- Mixed fraction pre-washed PE/PP
- Pre-washed agricultural film
- Flexible packaging
- Post-consumer LDPE film

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Velox. The essence /

Post-consumer
Post-industrial
Ink
PET

- Able to **process the most demanding materials in terms of contamination and moisture.**
- Components of the highest quality and durability to offer **maximum performance over time**
- **Reduce workloads and costs** related to maintenance
- Maximum **energy efficiency optimisation**
- Incorporate **control mechanisms** to help the operator
- **Very intuitive and user-friendly** control screen

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Velox. Components /

Post-consumer
Post-industrial
Ink
PET

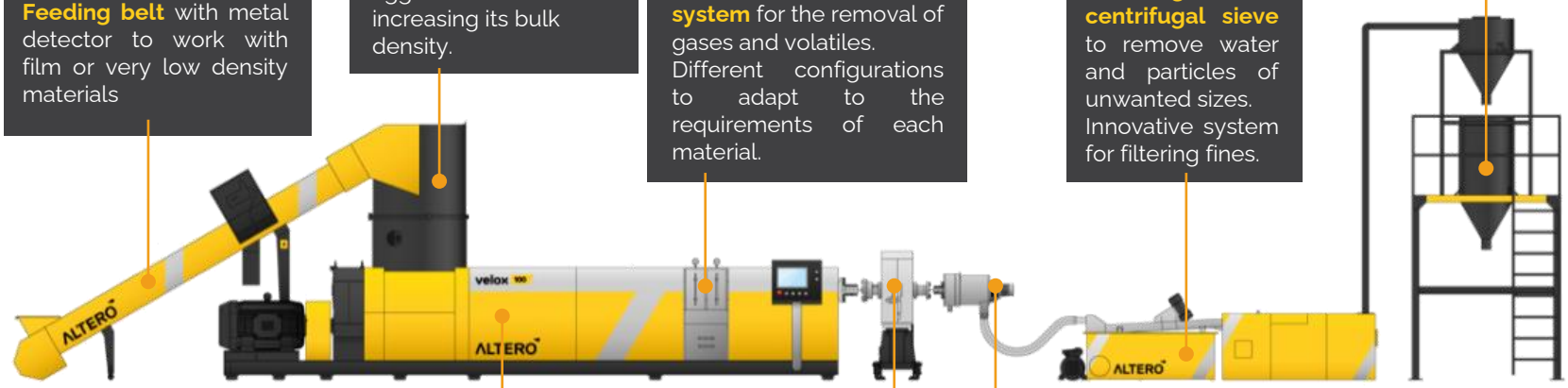
Feeding belt with metal detector to work with film or very low density materials

Compactor to precondition material and obtain the maximum performance in extrusion. The material is cut, heated, dried and agglomerated increasing its bulk density.

Double outlet **degassing system** for the removal of gases and volatiles. Different configurations to adapt to the requirements of each material.

Vibrating and centrifugal sieve to remove water and particles of unwanted sizes. Innovative system for filtering fines.

Silo with weighing system to control the production and bagging of the pellets



Single-screw extruder to ensure maximum homogenisation and plasticisation of the material. Includes the best reducer for extrusion applications and the highest efficiency motors.

High-performance filter for processing highly contaminated materials. Self-cleaning system to reduce the workload of the operators

Water ring pelletiser suitable for almost all materials with an MFI <70 and moderate filler content.

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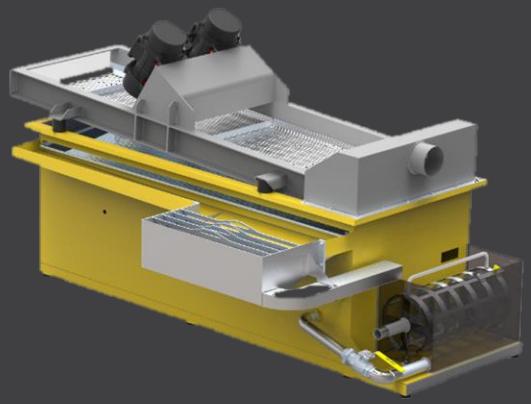
Velox. Details /

Post-consumer
Post-industrial
Ink
PET

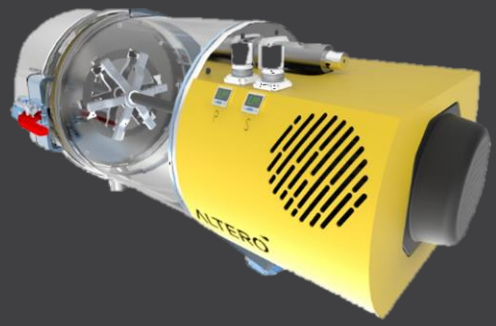
Compactor

Screen Changer with 2 pistons and backflush

Vibrating sieve with filtering of fines



Water Ring Pelletiser



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Velox. Maximum performance /

Post-consumer
Post-industrial
Ink
PET

Variable-speed feeding belt for **better regulation of the compactor load level** (4 speeds in automatic mode)

Large compactor

- **Increase the residence time** of the material and have a greater drying and compaction power
- **Higher thermal stability**
- **Various configurations** to increase energy transfer

Variable rotation speed

- **Temperature control**
- Working with **different types of materials** (film, rigid, pellets, etc.)
- **Optimize energy consumption** by reducing speed when the material does not need to be dried or agglomerated
- Possibility of **starting the compactor after an emergency stop** (heavy load and agglomerated material).

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Velox. Maximum Performance /

Post-consumer
Post-industrial
Ink
PET

- **Barrel and Screw design optimised** for maximum productivity with minimum energy
- **High-performance filters** with different filtering power and fineness depending on the application.

Filter options

Hydraulic Plate Filter

Piston Filter with automatic backflush

Continuous laser filter

Material contamination level

Velox. Maximum control /

Optimal Temperature Control

Compactor

Specific technologies for the heating and cooling of the material resulting in **optimal control of the temperature** just below the melting point.

Emergency mechanisms to **avoid material melting**.

Extruder

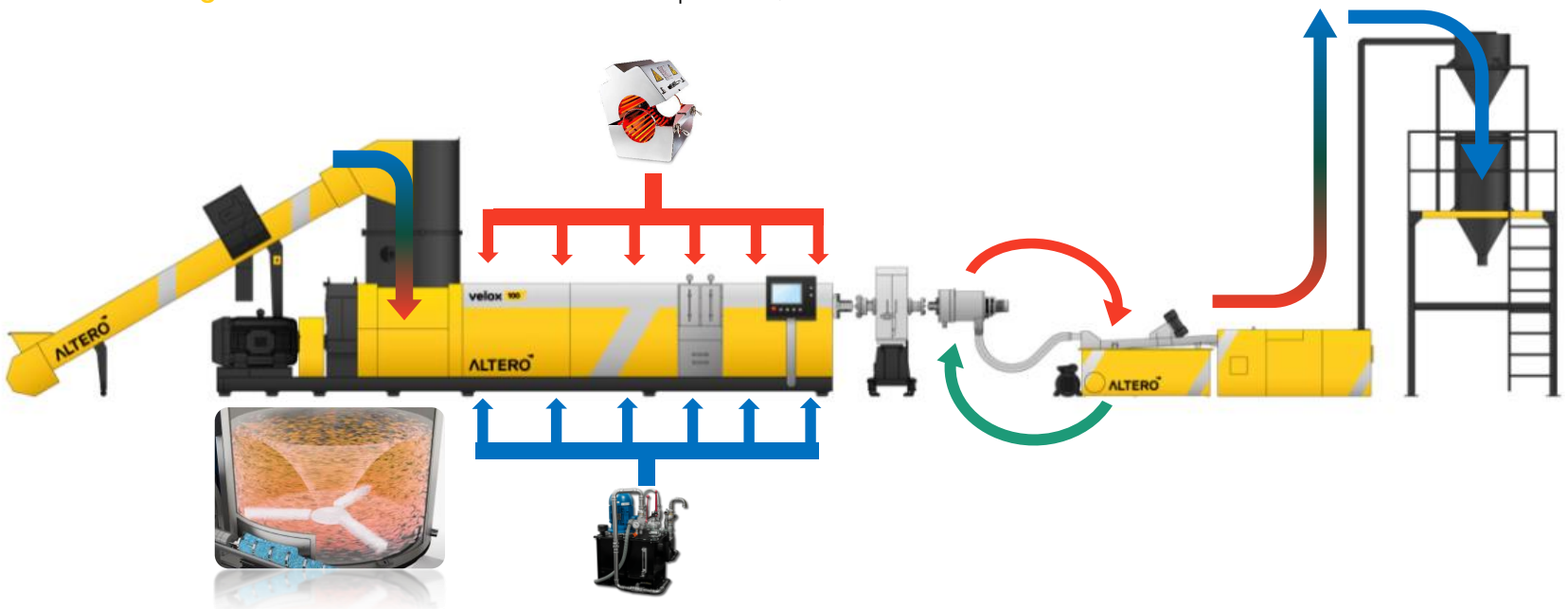
Optimal control of the operating temperature through IR heating and oil cooling.

Advanced monitoring of all parameters in the HMI (performance of each zone, resistor operation, melt temperature, etc.)

Pelletising and Storage

To obtain the best quality pellets with the minimum energy, **optimal control of the cutting temperature** is necessary.

The bagging temperature **should avoid sticking of the pellets**



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Velox. Maximum control /

Post-consumer
Post-industrial
Ink
PET

Performance Monitoring

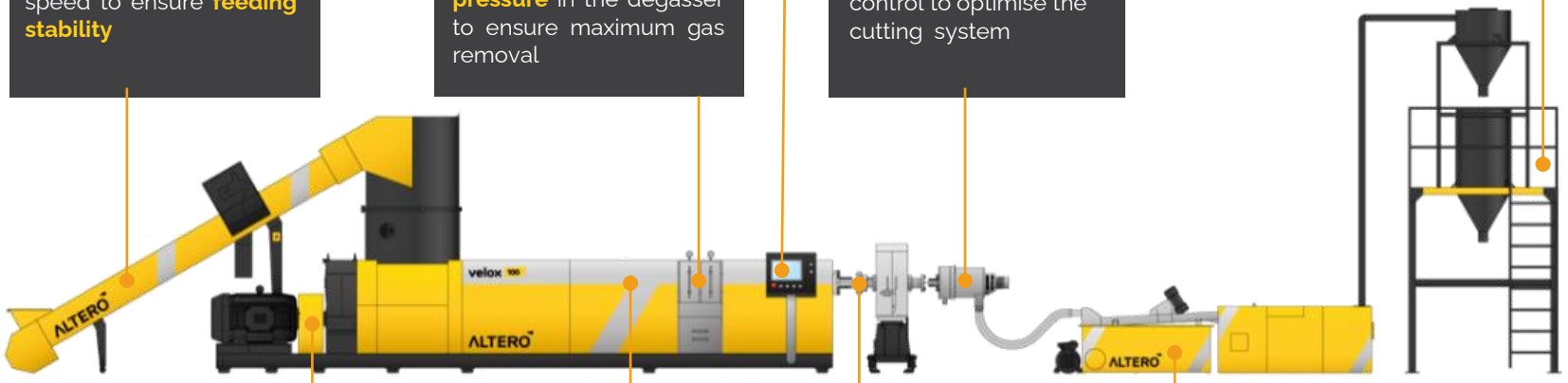
Real-time measurement **of instantaneous consumption (kWh), total energy consumed, consumption vs production ratio (kWh/kg)**

Measurement of **production in real time in kg/h**

Fine adjustment of belt speed to ensure **feeding stability**

Control of the **vacuum pressure** in the degasser to ensure maximum gas removal

Pelletiser performance control to optimise the cutting system



Monitoring the **load level of the compactor and extruder** to ensure maximum production

Temperature adjustment PID control to identify inefficiencies or malfunctions.

Charts for **head and pre-filter pressure**

Innovative system for filtering fines that guarantees water quality control..

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Post-consumer
Post-industrial
Ink
PET

10. OPTIMA: Invest just in what you need /

Optimised for processing /

- PE film (HDPE, LDPE, LLDPE)
- Reground material
- Shredded rigid material
- Ink-free material
- Low-moisture material
- Rigid PP waste

Typical applications

- Production losses
- Edge trimming.
- Granulated plastic losses from injection, blowing and extrusion machines.
- Start-up cakes or lumps.

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OPTIMA: The essence /

Post-consumer
Post-industrial
Ink
PET

- Optimised design for **recycling post-industrial plastic waste**
- **Compact solution at a very competitive price.**
- **Minimise the degradation of the material to the maximum** to preserve its mechanical properties.
- Components of the highest quality to offer **maximum performance over time**
- Maximum **energy efficiency optimisation**
- Incorporate **control mechanisms** to help the operator.
- **Very intuitive and user-friendly** control screen

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OPTIMA: Components /

Post-consumer
Post-industrial
Ink
PET

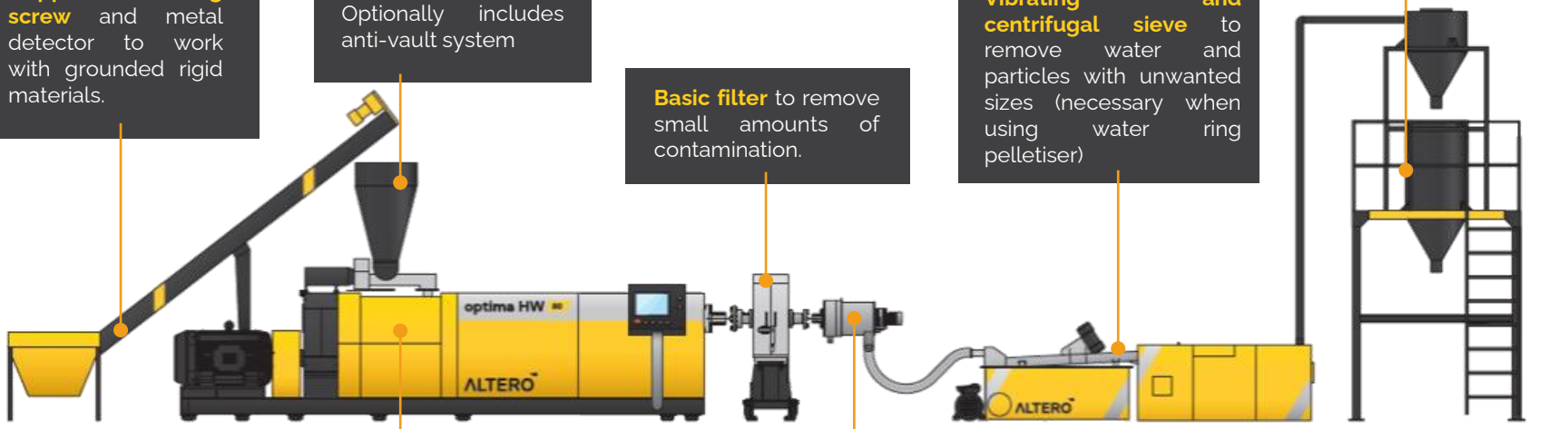
Hopper with feeding screw and metal detector to work with grounded rigid materials.

Vertical hopper to feed the extruder. Optionally includes anti-vault system

Basic filter to remove small amounts of contamination.

Vibrating and centrifugal sieve to remove water and particles with unwanted sizes (necessary when using water ring pelletiser)

Silo with weighing system to control the production and bagging of the pellets.



Very compact **single-screw extruder** to minimise material degradation.
Optionally it can integrate a vacuum degassing station.

Water ring pelletiser for applications where the appearance of the pellets is important.
Hot air pelletiser for self-consumption pellets where their appearance is irrelevant

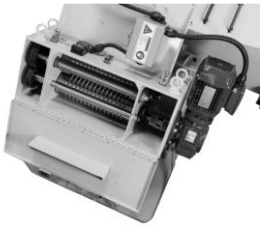
OPTIMA In-Line: In-Line Recycling/

Feeding with vertical Hopper to recycle shredded injection losses.
Roll feeder and compactor for recycling post-industrial film or roll trimmings.

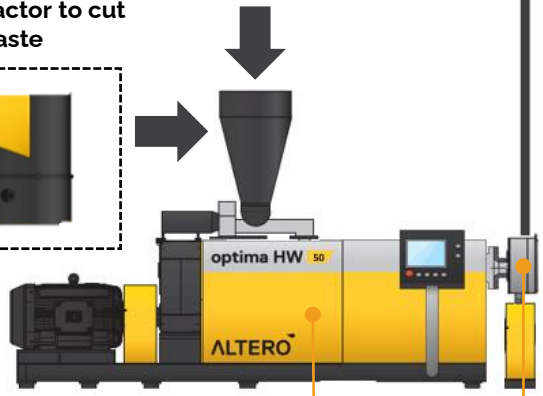
Grounded Injection losses

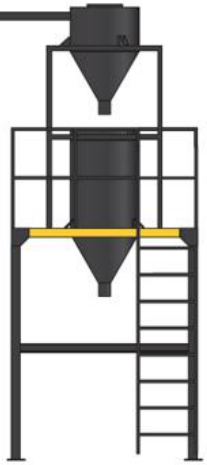
Option of **storage silo or direct transport to injection/blowing machine.**

Rool feeder for film



Compactor to cut film waste





Film production losses

Ultra compact extruder only to melt the material with minimal degradation.

Hot air pelletiser to reduce operating costs and simplify the process.

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11. DUPLO: Maximum degassing power /

Optimised for processing/

- PE film (HDPE, LDPE, LLDPE)
- PP film (BOPP, CPP)
- BOPET film
- High ink content material
- Heavily contaminated material
- High moisture content

Typical applications /

- Post-consumer film with high ink content
- High content of organic contaminants
- Compounding applications
- Additivation of large loads (wood, fibreglass, etc.)

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Duplo. The essence /

Post-consumer
Post-industrial
Ink
PET

- To have **a high degassing power to process materials with a high content of inks, humidity, organic contaminants and specific additives** that generate many volatiles.
- To be able **to eliminate the gases generated during the filtering process** of the molten material
- **Additivation of loads with large particle size** that can not be retained in the filter
- **Recycling and compounding** in a single process.

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Duplo. Components /

Post-consumer
Post-industrial
Ink
PET

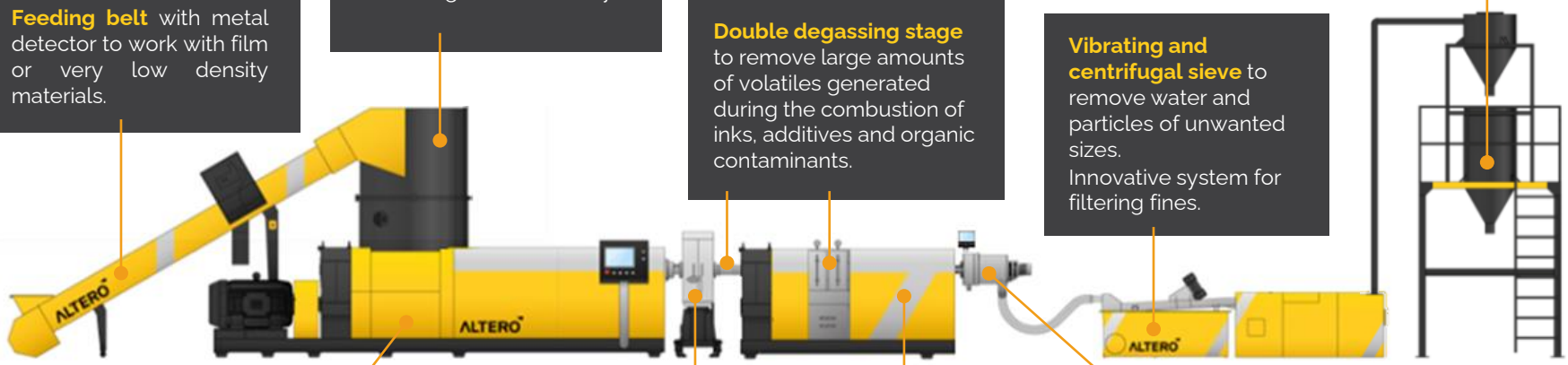
Feeding belt with metal detector to work with film or very low density materials.

Compactor to precondition the material and obtain the maximum performance in extrusion. The material is cut, heated, dried and agglomerated increasing its bulk density.

Double degassing stage to remove large amounts of volatiles generated during the combustion of inks, additives and organic contaminants.

Vibrating and centrifugal sieve to remove water and particles of unwanted sizes.
Innovative system for filtering fines.

Silo with weighing system to control the production and bagging of the pellets.



Single-screw primary extruder with very compact design to minimise material degradation.

High-performance filter for processing highly contaminated materials. The gases generated during filtering are subsequently removed..

Secondary single-screw extruder with specific screw design depending on the application. Possibility of compounding and additvation of fillers.

Water ring pelletiser suitable for almost all materiales with an MFI <70 and moderate content of fillers.

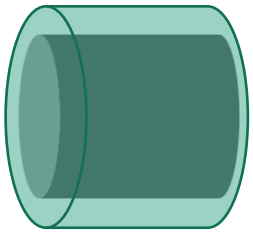
Duplo. Keys for optimal degassing /

duplo

Large exchange surface

To optimize the degassing power, it is essential to have as **large an exchange surface as possible**. This surface corresponds to the **area of the molten material in direct contact with the vacuum**.

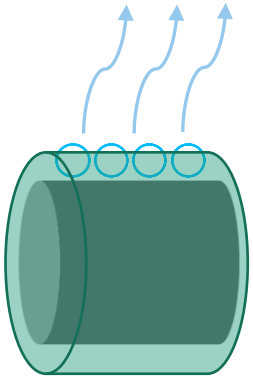
Duplo machines incorporate a **specific technology to exponentially increase the contact surface** compared to a traditional degassing system



High Vacuum

To remove the maximum amount of volatiles from the exchange surface, **it is necessary to use a high vacuum.**

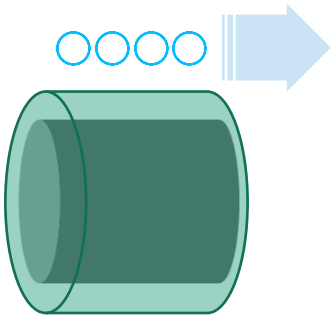
Duplo machines incorporate vacuum systems that reach **10 mbar absolute.**



Large Flow

All the volatiles absorbed by the degassing system must be **removed from inside the extruder and transported to the condenser and particle filter**. For this, it is essential to have an auto flow.

Fluid generated as a result of condensation must be removed from the system.



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12. AQUA: Quality and control in PET recycling /

Optimised for processing /

- PET bottle flakes
- Polyester fibres
- Termoforming losses
- PA 6, 6.6

Typical applications /

- Bottle recycling
- Food grade applications
- Waste in thermoforming processes
- PET headwaste
- Recycling of polyester fibers
- Shredded PET sheets

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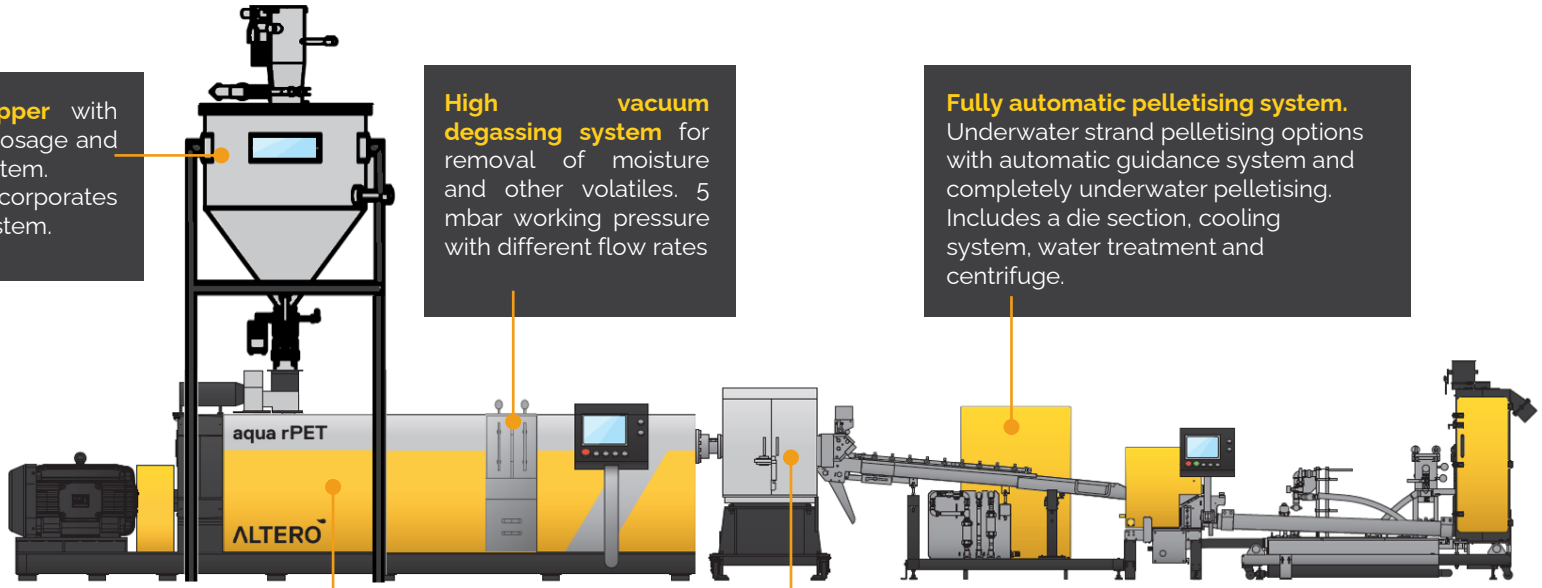
AQUA: Components /

Post-consumer
Post-industrial
Ink
PET

Feeding hopper with gravimetric dosage and anti-vault system. Optionally incorporates a vacuum system.

High vacuum degassing system for removal of moisture and other volatiles. 5 mbar working pressure with different flow rates

Fully automatic pelletising system. Underwater strand pelletising options with automatic guidance system and completely underwater pelletising. Includes a die section, cooling system, water treatment and centrifuge.



Hot air pre-drying option. To remove surface moisture and discharge the degassing system

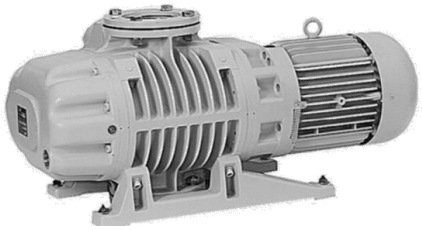
Single-screw extruder with specific screw for PET recycling. Optimised design to minimize IV drop and avoid the appearance of black spots.

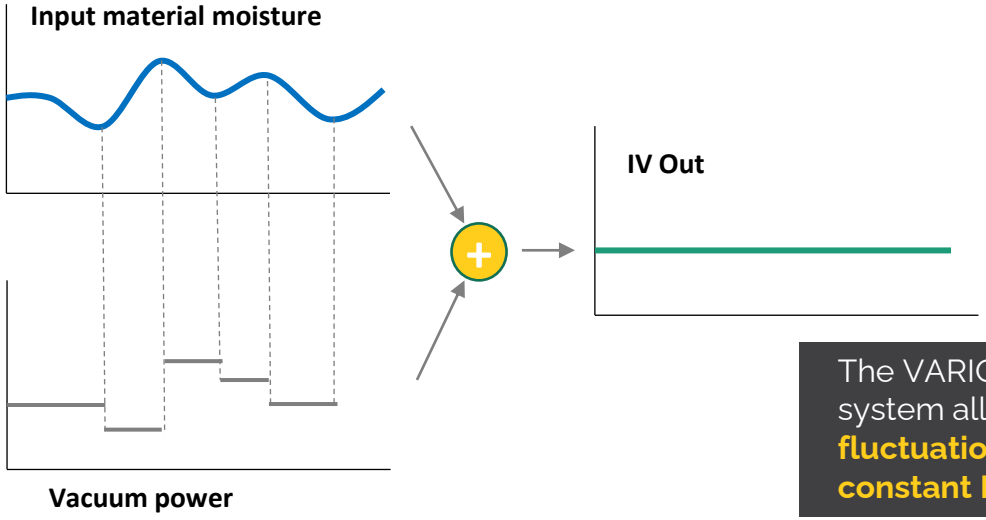
Specific filter with a large filtering surface to work with low and stable pressures. Filter fineness down to 30 microns.

AQUA: High vacuum degassing /

Altero Vario Dry vacuum system

- **Compact solution**: screw pump + roots pump + condenser + filters
- **Variable working pressure** to compensate for variations in humidity at the inlet
- **Maximum robustness, reliability and ease of maintenance**
- **Low energy consumption**
- **Connectivity options** for sending control parameters





The VARIODRY variable vacuum system allows to **compensate for fluctuations in humidity to have a constant IV** in the pellets produced.

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AQUA: Filtering technologies /

Post-consumer
Post-industrial
Ink
PET

Altero ACF-B Screen Changer

- Represents the most used filtering option due to its high cost-efficiency
- It incorporates a self-cleaning system to extend the lifespan of the meshes by up to 20 times. This reduces the workload of the operators.
- Filtration fineness from 50 microns
- Filtering surface of up to 1,900 cm^2 to reduce the working pressure and minimise the appearance of gels.
- Chrome interior coating to prevent the appearance of black spots.

Ettlinger ERF Filter

- Premium filter technology for applications with high levels of contamination
- The largest filtration surface (3,100 cm^2) to work at very low and constant pressures
- The only filter capable of removing silicone
- Minimal material waste - higher filtering efficiency
- Recommended option for applications that require constant pressure

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AQUA: Process control /

Post-consumer
Post-industrial
Ink
PET

Efficient information management and support in decision-making allow the operator to avoid inefficiencies in the process.

Control and automation systems allow for achieving maximum efficiency and stability in the process

Systems incorporated in Aqua rPET lines

- **Gravimetric Dosing System:** A dosing system guarantees a constant and controlled feeding of the extruder.
- **Main motor torque control:** Real-time monitoring of this data is an indicator of stability.
- **Melt Pressure Sensor Before and after the Filtering Unit:** It is highly relevant to work with a low pressure differential to prevent "soft" contaminants from passing through the filter (e.g. gels)
- **Melt Temperature Sensor:** Recording of temperature over time is an important quality control parameter. A high temperature can cause PET degradation.
- **Control and Adjustment of the vacuum pressure:** With a variable power vacuum system, a closed loop can be established to control and stabilise the IV of the final product.
- **Specific Energy Monitoring:** The specific energy value per kilogram produced allows us to control and optimise the energy efficiency of the process
- **Optionally:** Control of the colour of the pellets produced to detect and control "yellowing".

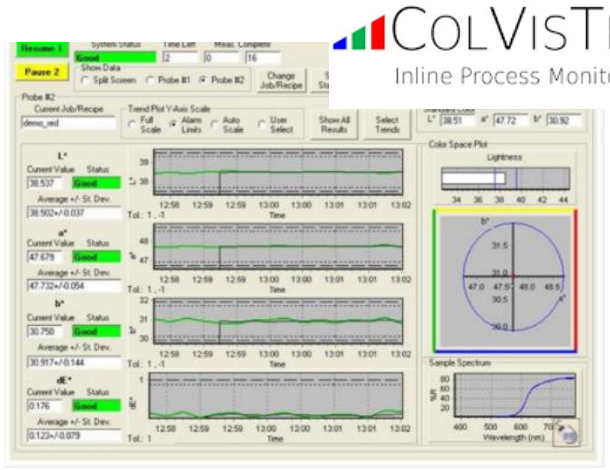
AQUA: Process control (optional) /

In-line Viscometer:

- IV measurement according to ASTM standard
- Out of specification product reduction
- Close-Loop with RPM/Vacuum to keep IV constant.
- Laboratory cost reduction.

Online UV-VIS spectrophotometry

- Colour measurement, yellowing
- Real-time analysis of the AA level.
- Real-time reading of the Degree of Polymerisation.
- Laboratory cost reduction.
- Reduction of product outside the laboratory.



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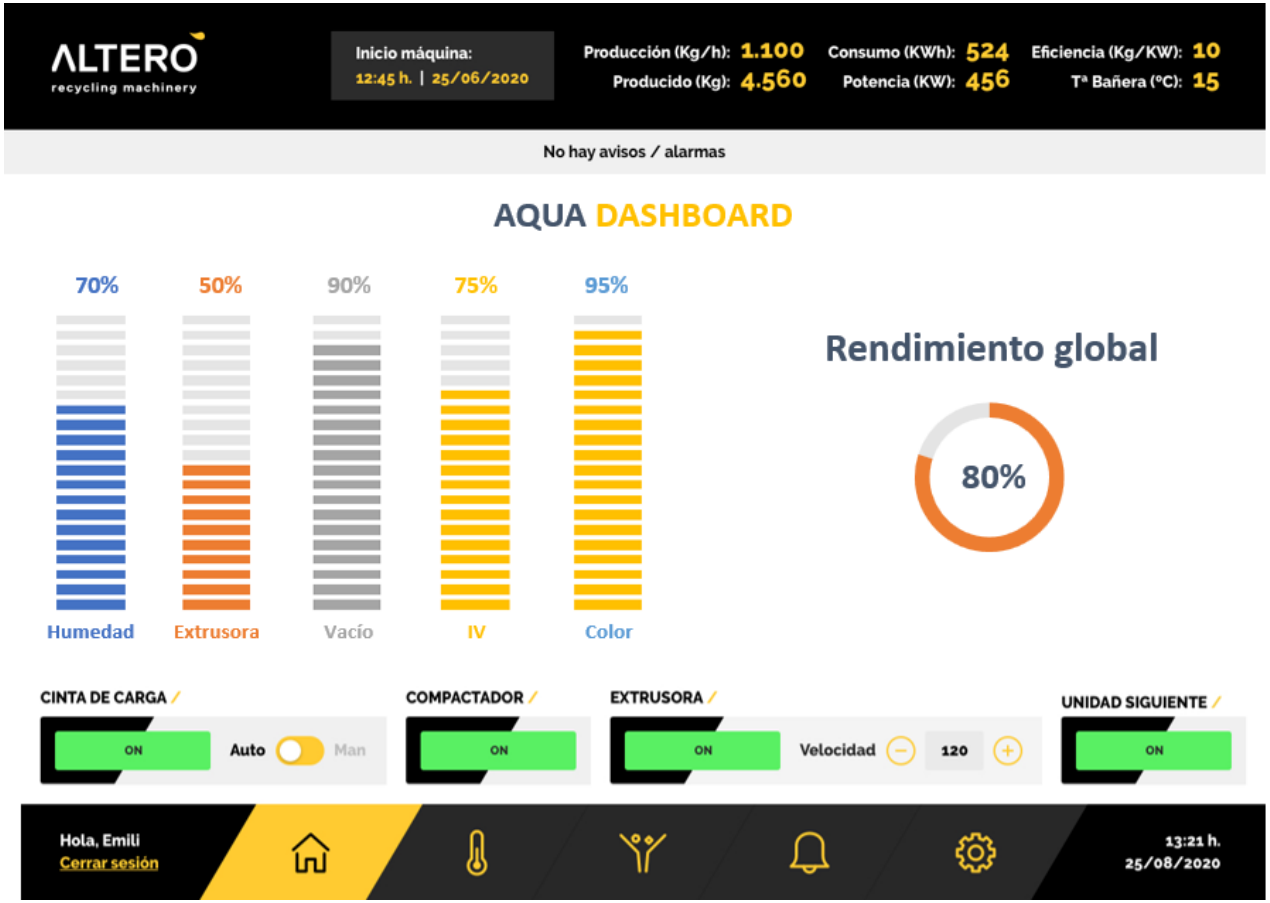
AQUA: Performance monitoring /

Post-consumer
Post-industrial
Ink
PET



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recycling machinery

AQUA: Pelletising System/

Post-consumer
Post-industrial
Ink
PET

IPS Under Water Strand Pelletiser

- Manufactured by IPS - Market leader with more than 20 years of experience
- 100% made in Germany
- Total reliability in the process
- Production of the highest quality pellets
- Extremely simple operation
- Soundproof and resistant system

Quick, easy and automatic start-up process

Descending ramp with constant water flow to cool down the strands and automatically guide them to the pelletiser in case of breakage

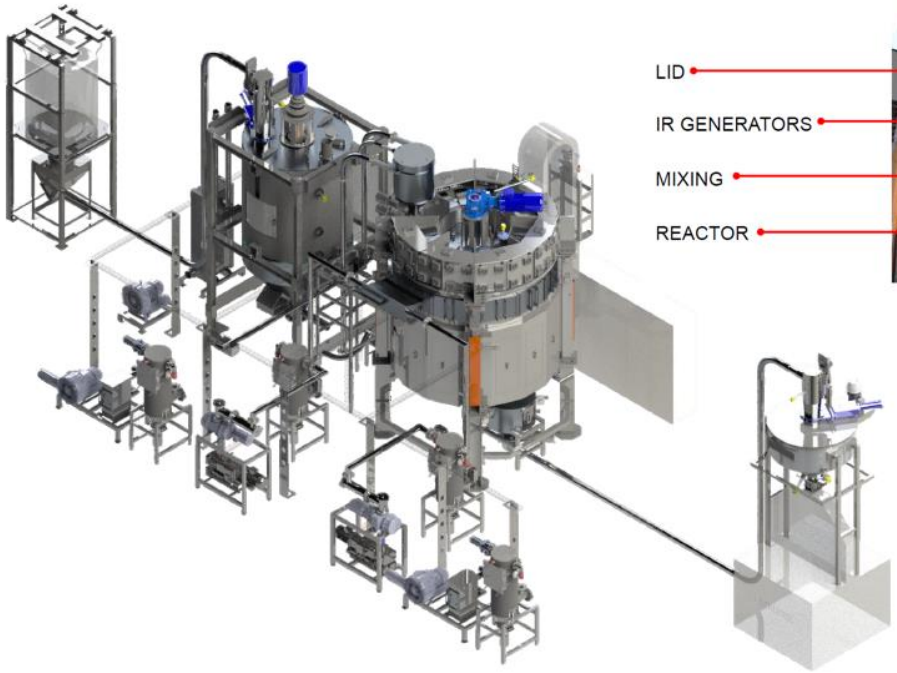
Underwater pelletiser for higher efficiency and lower generation of fines.

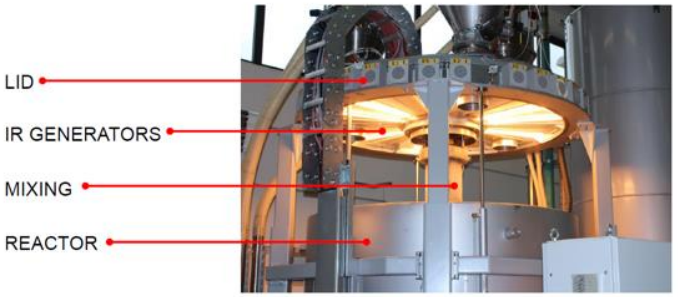
Water treatment and filtering system

Vertical centrifuge with very high drying power

AQUA: Food grade applications/

We collaborate with **SB plastics Machinery** to produce food grade PET pellets integrating its **Mobby system**.





sb plastics machinery

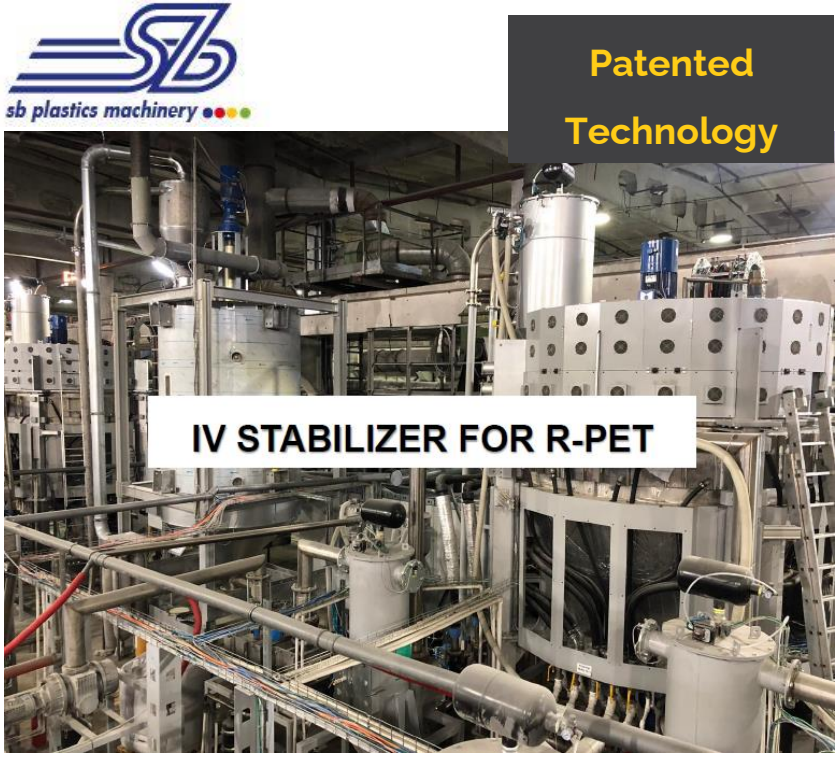
AQUA: Food grade applications /

MOBBY System: IV Stabiliser for rPET

- Vacuum and IR Polycondensation Reactor
- IR heating increases energy efficiency
- Working under vacuum, a high level of thermal insulation is achieved
- By modifying the wavelength, the IR acts on the water (drying) or on the PET (decontaminating and increasing IV)
- IV increase rate of up to 0.11 dl/g/h reaching values of 1.3 dl/g.
- FDA approved and ready for EFSA approval

FDA approved

With letters «PNC 1442 e 1443»



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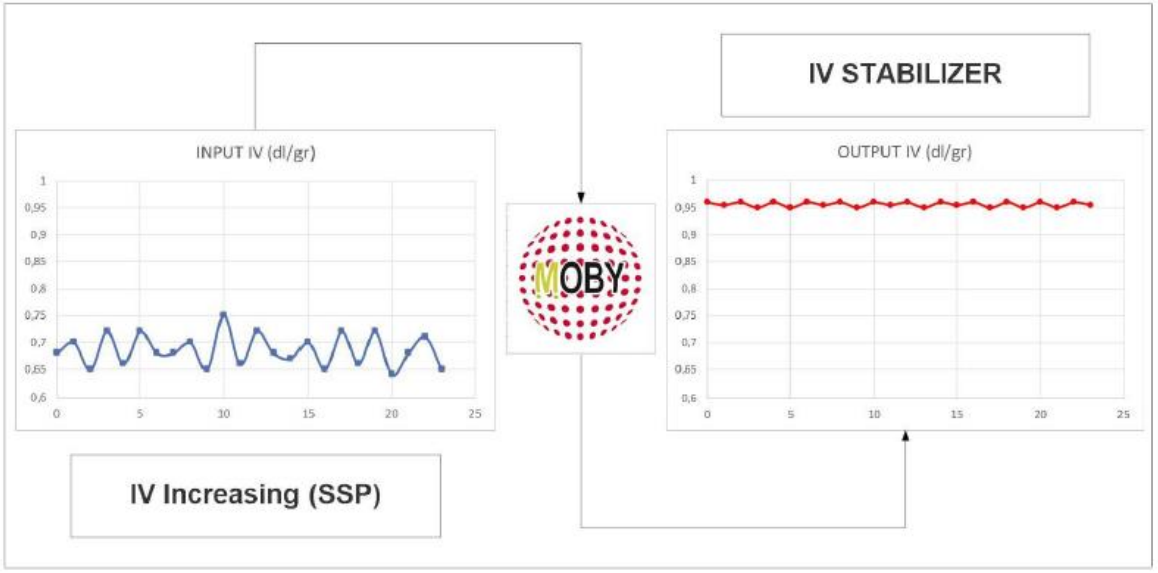
AQUA: Food grade applications /

Post-consumer
Post-industrial
Ink
PET

MOBBY System: The IV stabiliser for rPET

sb plastics machinery

Thanks to the **stabilisation of the IV in the pre-extrusion reactor**, a **final pellet with a homogeneous IV** is obtained.



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¡THANK YOU!