

Innovative Flat Die PET Film extrusion lines



Costruzioni Meccaniche Luigi Bandera S.p.A. is a worldwide leader in the design and manufacture of complete extrusion lines for packaging and converting sector.

A history of technology, research and innovation

1947

Luigi Bandera officially established the company and started the history of extrusion in Italy

1960/70

Luigi Bandera experienced a remarkable industrial growth developing a wide and diversified range of extrusion products

1999

Luigi Bandera presented the first patent for a co-rotating twin-screw extruder to process recycled PET materials

2009

Co-rotating technology received FDA no objection letter, a milestone in the use of recycled plastics in food

2015

Bandera launched Lighter Packaging campaign with foam PET process

2017

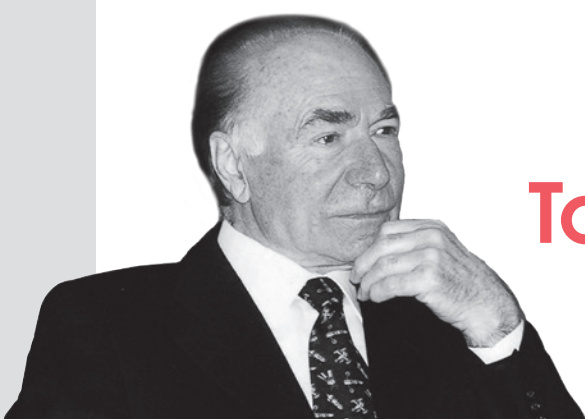
Bandera launched PURE[®] Technology and received FDA No Objection Letter

2019

The first Bandera customer received EFSA positive scientific opinion

Today

Bandera focuses on innovative Rigid Packaging ECO solutions from recycled and biodegradable materials, in compliance with the circular economy vision





Our mission, Extruding Future Plastics Now®

Establishing Bandera as the most important design and manufacturing centre for extrusion in Europe and a worldwide leader in packaging and converting solutions.

Providing production lines featuring state-of-the-art technology for innovative thermoplastic materials.

As a globally recognised brand, Bandera is a synonym for technological innovation in extrusion, supplies reliable and cost-efficient solutions and equipment, as well as engineering services, know-how and turn-key installations.

PACKAGING FORWARD>>>®

Eco packaging solutions from recycled and biodegradable materials

The House of Extrusion®

The **House of Extrusion®** is the most innovative European extrusion centre for packaging and converting outlining the sign of Bandera's vision. Jointly with customers, industry, academia and research centres, Bandera opens the doors to the creation of new solutions anticipating market demand.

THOE was recently upscaled with a dedicated facility for a new wet trials area including a 2-hall brand new building with 35 mt height.



since **1947**
experts in extrusion

35,000
extruders installed
running worldwide

54,000 t
of extruded polymers
per day

15,500
active clients all
over the world

55,000
m² production sites

100%
In-house design
and manufacturing



Advantages of Bandera as technological partner in Flat Die technology

Flat Die

Extrusion lines dedicated to the production of rigid windable films and high thickness sheets respectively for thermoformed packaging and converting sectors and for most various industrial applications.

Rigid Film

The Bandera PET, PLA, PP, PS Rigid Film lines are engineered for top performances focused on the thermoformed packaging and converting (FFS) sectors.

- Single screw extruders and/or **HVTSE® - Highly Vented Twin Screw Extruder** (dry-less process) with possibility of mineral fillers (pellets/powder) inclusion
- Single or multi-manifold flat extrusion die (auto or manual) with internal deckling systems
- Robust and highly engineered calender stack
- Lamination systems for the production of composite materials
- Wide range of winding systems with different grades of automation



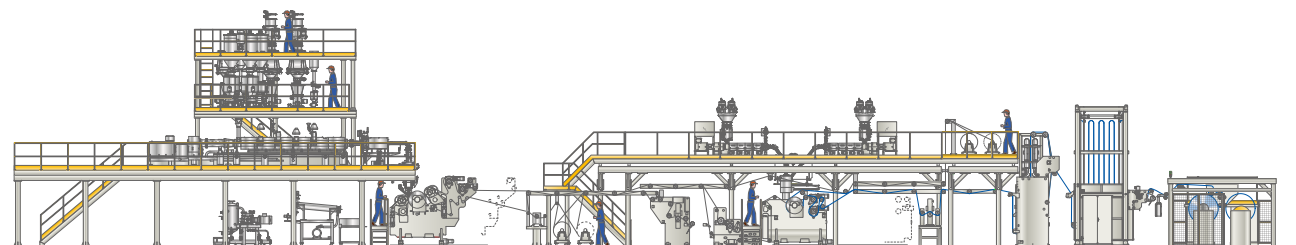


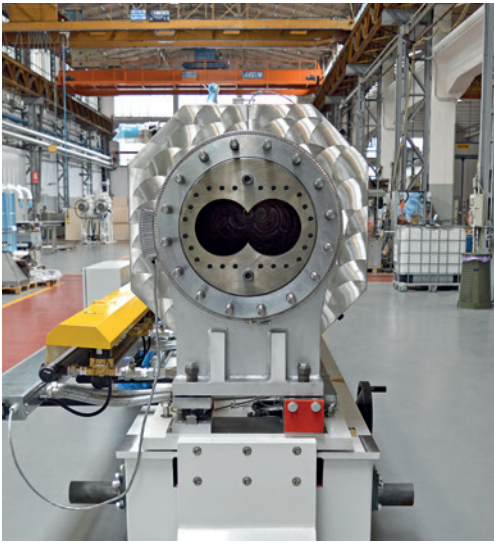
Condor Line® is the first European programme to develop new processes from recyclable and biodegradable materials; it is an asset of technologies and skills available to any company which wants to innovate in the packaging and converting market and in general to develop new ideas on a Flat Die hardware.

Condor Line® is much more than a PET, PLA, PP, PS substrate extrusion line; **it is a real industrial production island:** a specific Flat Die plant with raw material dosing units, 9 extruders, 2 automatic flat dies, melt filters and pumps, polishing calander, complete film lamination unit and extrusion coating section, foam process equipment plus semi automatic winders and complete PC control with synoptic HMI.

The main benefits of the **Condor Line®** are:

- Enhancing barrier effect to prolong the shelf-life of packaged products, with standard or innovative materials
- Challenging improved mechanical and physical properties by the combination of rigid layers with flexible layers; by lamination as well as direct extrusion coating
- Developing light weight recyclable packaging films by technologies for the physical and chemical foaming of internal layers
- Testing new formulation and raw material composition
- Improving extensive use of compostable or biodegradable materials in complex structures for new generation packaging
- Optimizing capability to mix mineral fillers into different polymers
- Attending intensive training courses as new investors or existing customers
- Producing samples and run a pre-production trials including pre-treatments





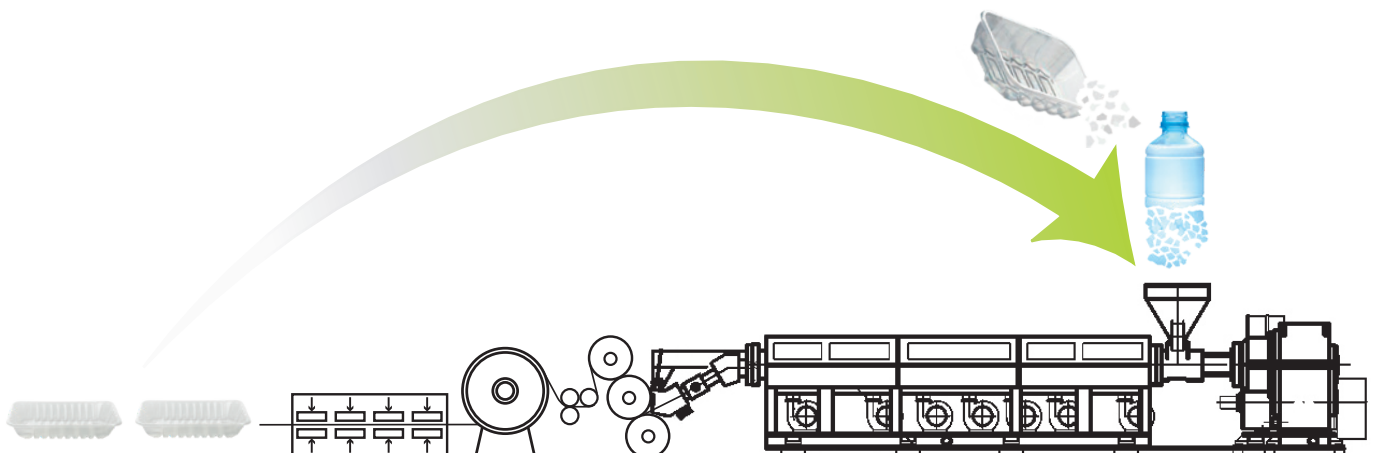
Twin screw technology, the ground-breaking concept for PET processing

At the end of the 90's Bandera R&D Dept. focused its attention on the co-rotating highly vented twin-screw extrusion **HVTSE® technology**, specially designed for the direct production of PET Rigid Film and Sheet.

Renowned among world-leading twin-screw extruder producers, in the year 2000 Bandera manufactured a dedicated PET processing machine: in consideration of the outstanding results in terms of flexibility, purification and cost-effectiveness, Bandera patented the technology (# EP 1 226 922 A1).

Bandera constantly supplies production lines and equipment to the major players operating in the food and non-food packaging industry.

Innovative ideas supported by indisputable experience deliver fruitful solutions





The re-use of post-consumer and materials industrial scraps

DIRECT PRODUCTION of food packaging rigid films using:

- up to 100% PET post-consumer hot washed bottle flakes
- up to 100% PET skeleton thermoforming regrind
- up to 100% PET-PE post-industrial waste

All having up to 1,5% residual humidity content!
All possible with no need of pre-drying treatments!

ENERGY SAVING GOAL

(up to 35% compared to conventional technologies).

Thanks to the nature of the twin screw geometry and the absence of the drying power, Bandera technology results to an impressive energy saving factor: experimentally proven.

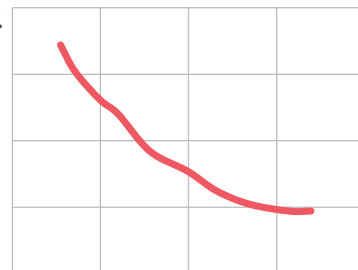
MELT PROCESS CRITERIA

The extrusion screws profile (52 L/D long) allows a very extended venting zone and highly cared shear rate (low rpm achievable) resulting to

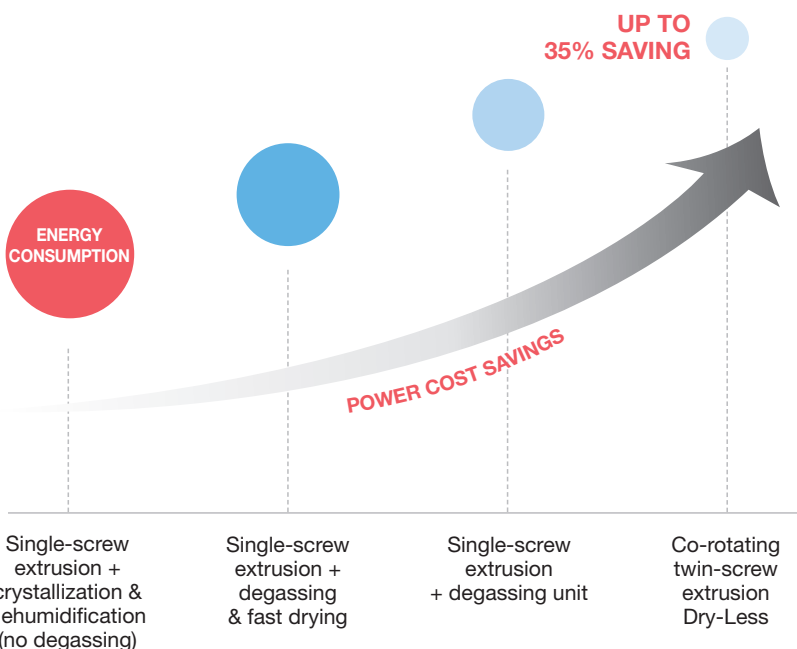
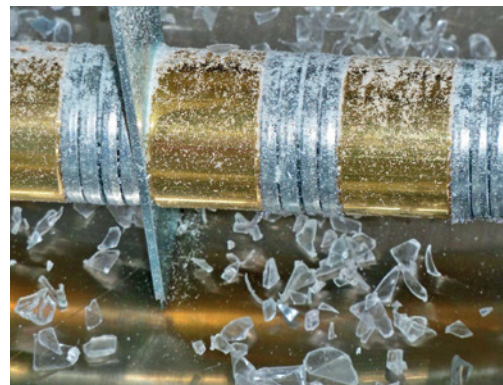
- Top level decontamination (NOL issued by FDA on 2009)
- Lowest IV drop
- Lowest polymer stress
- Fast switch-over operation (colours and resins)
- NO thermic and NO hydrolytic degradation

0.90 dl/g

I.V.



Screw rpm 500





Robust process, easy-to-operate equipment

From the raw material feeding system to the winder all equipment are synchronized. Operators can handle the process through extremely simple actions. Dosing system is accurate, reliable and problem-free.

Versatility towards other polymers

PP, PLA, PS and Bio-Polymers can be processed with full flexibility thanks to the mild screws geometry (lowest MFI drop achievable).



Top OEEE levels reachable

Thanks to the accurate design and manufacturing (**in house**), the critical aspects of the process are minimized and easily monitorable.

The final accomplishment is safe and productive.





PET Food Grade Rigid Film, EFSA and FDA approved

PURE® is an innovative solution for the production of super clean material (suitable for direct food contact) starting from conventionally recycled post-consumer PET flakes, by using a highly effective pre-treatment (the so-called **PURE**®) in combination with the outstanding **Highly Vented Twin Screw Extruders (HVTSE**® achieved the No Objection Letter #119 issued by FDA on 2009).

The new combined **PURE**® & **HVTSE**® Technology is ideal to fulfill all requirements of the PET rigid film sector.

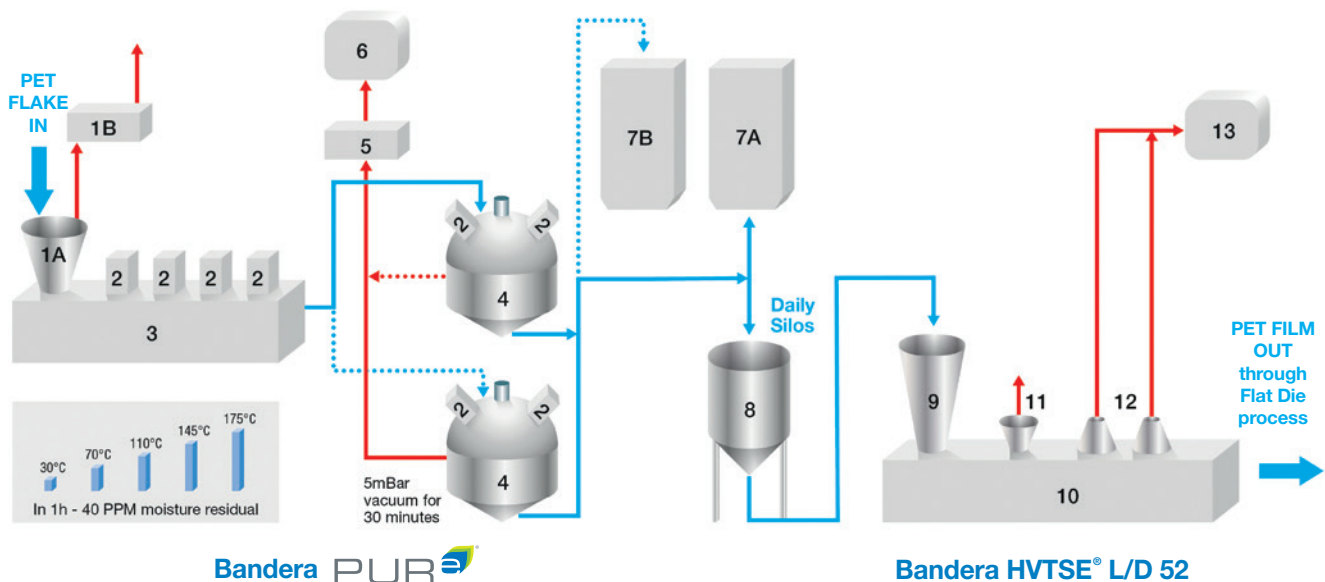
The **PURE**® treatment system can guarantee:

- Easy-to-run operation
- Deep PET flakes decontamination
- Better initial IV level before extrusion
- Limited power consumption



BANDERA **PURE**® System + Highly Vented Twin Screw Extruder

Operation principle



LEGEND:

- | | | |
|---------------------------------|---|--|
| 1A Feeding hopper | 5 Pump protection filters | 9 Extruder dosing system |
| 1B Exhaust air treatment | 6 PURE® vacuum pump | 10 Bandera co-rotating twin-screw |
| 2 Microwave devices | 7A Extrusion buffer for complying material | 11 Extruder venting to the atmosphere |
| 3 Heating chamber | 7B Off-spec material buffer | 12 Extruder vacuum venting stacks |
| 4 Reactors | 8 Daily silos with mixer | 13 Extruder vacuum pumps |

Cooling and polishing calender roll-stack and winding system

Further to the extrusion equipment, the calibration and downstream machines represent a huge benefit for ensuring performances, safety, steadiness and reliability to the whole production line.

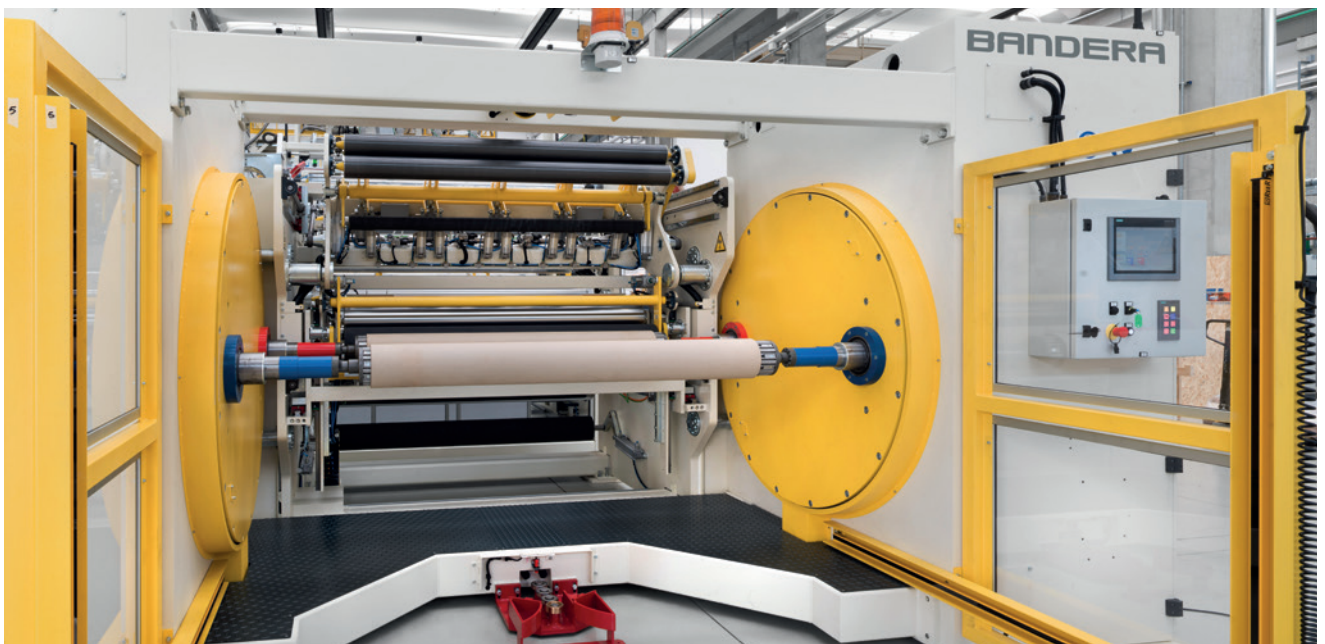


A Bandera calender roll stack provides:

- Widest thickness range and highest accuracy for all processable polymers
- Horizontal, sloped or vertical configuration to fulfil the most various exigencies
- Superior cooling efficiency of the rolls with spiral or peripheral water circuit
- Special roll design to improve mechanical features
- Cross-axis system for thin film production (even motorized for non-stop operation)
- Ability to install air-blade, vacuum box and electrical pin devices for thin flexible products
- Rolls cleaning systems

A Bandera winding system offers:

- Manual, semi-automatic or fully automatic operability applied to the various winding principles
- Turret-revolver, cantilever and trolley version always ensure accurate results
- Single and/or multi-reel production, jumbo heavy-reel option available
- Specially designed handling of the final product with customized storing solutions

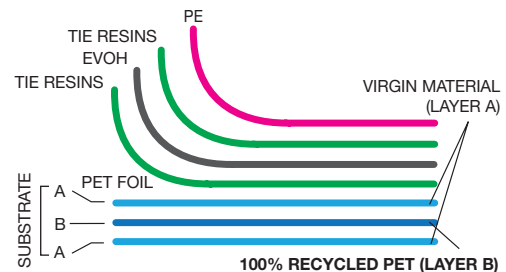




Composite rigid film production

To fulfil the Form-Fill-Seal market and some particular thermoforming exigencies, it is frequently required the production of PET-PE composite film (often including barrier resins as EVOH).

Thanks to its experience and expertise, Bandera can propose different solutions to satisfy the most various customer's expectations.



Film lamination system

Based on the application of a multi-layer PE blown or cast film (barrier or non-barrier) on top of the PET extruded substrate.

The **Calender-wise** solution is the most used in the market thanks to its cost effectiveness, limited space requirement and easiness to use. The scenario can also foresee the installation of a corona treatment for increasing the PET-PE bond strength.

The **Off-Calender** accomplishment is more sophisticated, more performing and steady.

The two semi-finished products are joined together into a proper lamination station purposely designed to optimize PET-PE adhesion and to ensure constant performances whichever is the final product thickness.



In-line extrusion coating Technology

The In-Line coating system ensures full flexibility in terms of raw material choice and management, which delivers production costs reduction, compared to standard multi-layer film technology (blown or cast).

Standard PET foil - typically with A-B-A structure - is coated with barrier layers (EVOH and tie resin) and/or PE layers by small single screw extruders mounted on a dedicated support frame. Coating operation is performed by an automatic flat extrusion die and a specially designed chill roll equipment.

The adhesion between PET and PE barrier layers is extremely effective - in all probability the best on the market.

Bandera technology can be applied to PP and PS foil and retrofitted to existing extrusion lines.

Customised and innovative structures are available on request.





LIGHTER
PACKAGING®
Bandera



Turning plastic materials into eco-friendly lower-weight products

- Packaging weight reduction by keeping adequate skills
- Specific density achievable
- Customised multilayer structures
- Re-processable industrial scraps
- Overall remarkable advantages than PS foam & PET rigid
- Top aesthetical properties
- Low production costs as well as raw materials volume



VELPET[®]

The crucial innovation challenge of Bandera: **recycled materials usage for creating lighter products** featuring characteristics as good as standard rigid films.

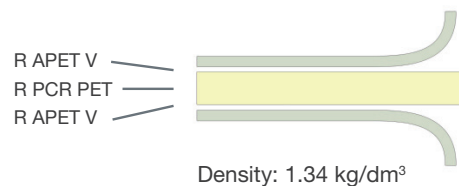
Bandera VELPET technology foresees a physical foam process by using inert gas injected into the twin screw co-rotating extruder: simpler solution for better results compared to chemical foaming process (currently available in the market) where expensive additives must be used and no possibility of re-processing industrial scraps is allowed.

Although the Bandera Lighter Packaging Campaign is an innovative market step, the result is proven by several equipment supplied and running all around the world. All Bandera foam projects are customized following specific requirements in terms of thickness, density, width, output and raw materials. Weight reduction rate depends on the final applications.

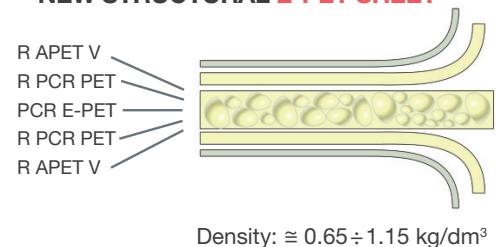
A Bandera standard rigid film extrusion line can be easily converted (or retro-fitted) to the foam production possibility by adding specific complementary equipment.



STANDARD COMPACT PET SHEET



NEW STRUCTURAL E-PET SHEET



**Processable polymers:
PET, PETG, CPET, PLA, PP, PS
and Bio-resins**

- Thickness range: 0.12 - 2.00 mm
- Film width: up to 2300 mm
- Gross output: up to 3200 kg/h





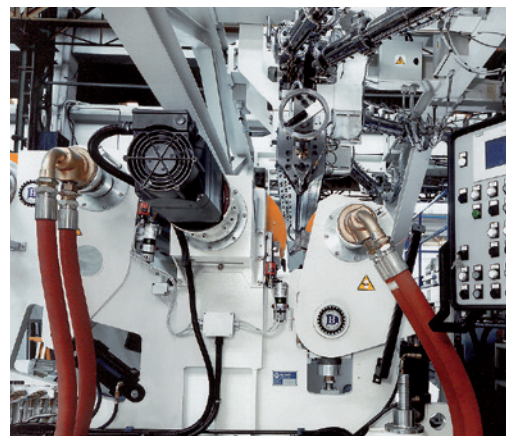
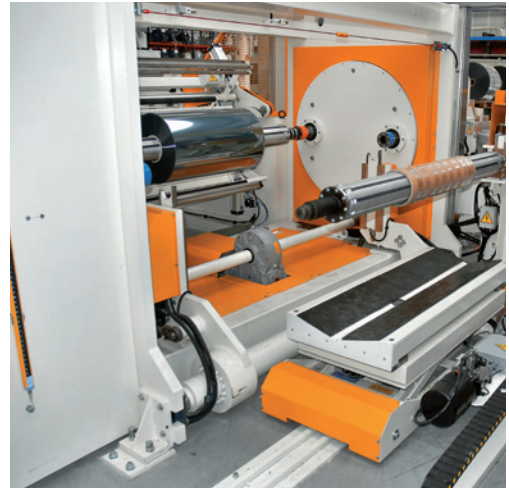
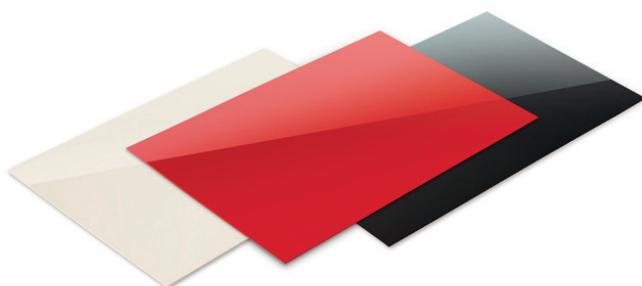
ALPHA PET®

AlphaPET® is an innovative extrusion line that - thanks to the inclusion of cutting-edge technologies-satisfies the most exigent production targets in a wide range of application. Highly cared equipment and complete automation fulfil the requirements of the deepest demanding users.

The whole accomplishment of the plant is usually equipped with multiple twin screw and/or single screw extruders, automatic filtering systems, single or multi-manifold flat die, sophisticated calender roll stack, lamination or coating systems, customized winding systems or stacking units.

The **AlphaPET®** line is suitable for the most demanding fields:

- Food and non-Food packaging markets (thermoforming and Form-Fill-Seal)
- Blistering and medical/pharma area
- Industrial purposes (flooring, roofing, credit cards, aesthetical panels, furniture etc.)
- Very thin and top technical films
- Foam sheets for various applications





SMARTDUTY®

Cost effective solution with no compromise on both the machine versatility (PET, PLA, PP, PS) and the final product quality.

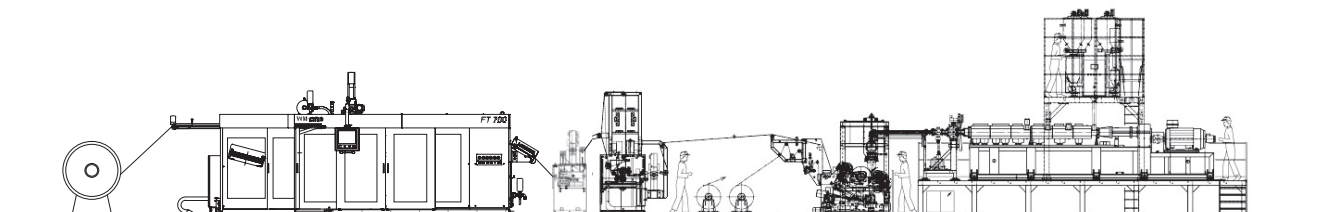
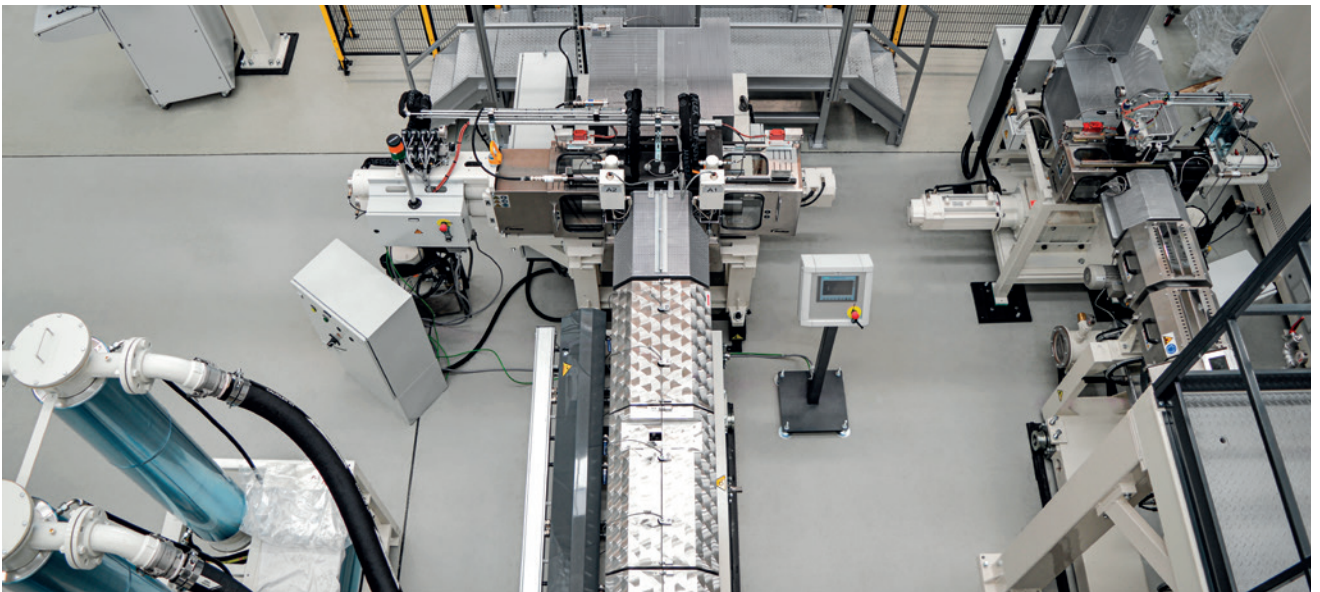
The technical solutions applied to all equipment (from raw material feeding device to the winding system) allow an extremely appreciable quality / price ratio.

Being one of the Bandera best seller equipment, the key factor of the **SmartDuty®** line is the repeatability of the projects all over the world.

Medium rate output (700 kg/h and 1000 kg/h size) to satisfy the thermoforming and Form-Fill-Seal markets, predominantly destined to the food packaging sector.

Recycled or virgin PET (APET-CPET-GPET-EPET),
PP, PS, PLA or further resins

Film width	Up to 1300 mm net
Film thickness	180 ÷ 1400 µm
Output capacity	700 ÷ 1000 kg/h





IoE Internet of Extrusion® Condition Monitoring

Efficiency and reliability at hand.

IoE Internet of Extrusion® Condition Monitoring is the quickest and most intuitive web based Human Machine Interface.

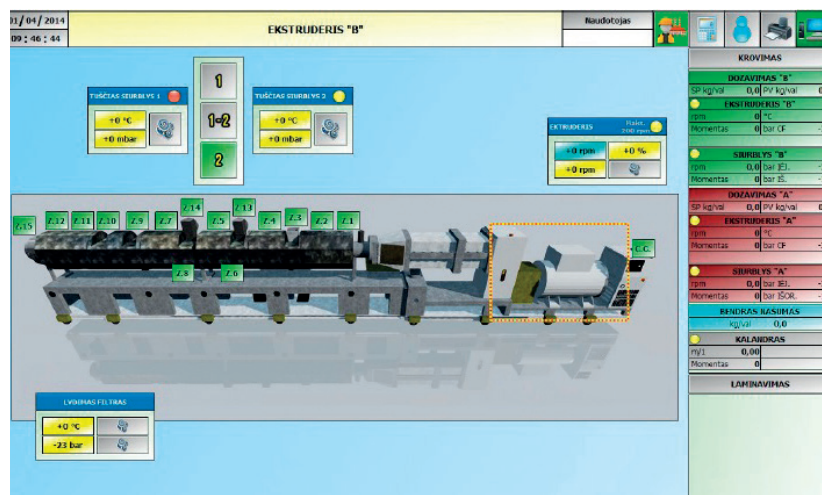
HMI provides detailed information in real time on the status of the line to ensure that it is consistent and reliable.

The data can be stored in the cloud or in the local storage memory.

The operator can remotely access to the information instantly and securely.

The main features of Bandera HMI are:

- **Production efficiency** and full control of machine operation
- **Best traceability** of raw materials
- Control, management and **certification of production lots**
- **Top connectivity** and integration with MRP systems
- **Native Web Based Technology** design in HTML 5
- Industrial Panel **PC Multi-touch**
- **Diagnostic** for predictive drives maintenance
- Personalized **remote monitoring APP**



OEEE - Overall Extrusion Equipment Effectiveness

The **OEEE - Overall Extrusion Equipment Effectiveness**[®] index has originally been applied to Lean Production System. The Bandera OEEE has now been adapted to extrusion for film production working on 3 key concepts:

- The availability index gives the line **EFFECTIVE OPERATING TIME**, i.e. machine running time
- The efficiency index which is the parameter for line output performance (effective product + scraps, in kg)
- The quality index given by the quotient of the scrap quantity (in kg) multiplied by the total production quantity (in kg).

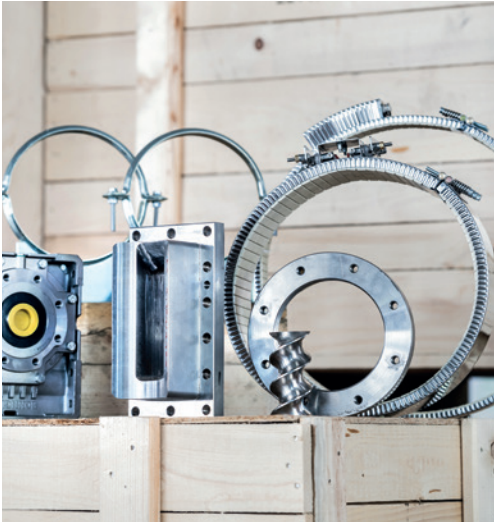
Such indexes are aimed at enhancing maintenance efficiency to minimize downtimes due to line operating failures.

Bandera plays a leading role in helping the customer to reach the highest levels of efficiency in long terms runs following the best procedures of **OEEE - Overall Extrusion Equipment Effectiveness**[®].

A responsive and efficient Customer Service

Bandera long term expertise, know-how, customised solutions are supported by a responsive and efficient customer service characterized by:

- 5 After-sales service centres for a worldwide assistance
- **Over 24-months warranty** upon request
- **High skill on-site technicians** specialised in installation and start-up
- **Customised specific training** for new applications
- **Scheduled technical servicing** for extraordinary maintenance
- **Cost effective spare parts** packages
- **Revamping** of complete extrusion lines
- **Cognitive Extrusion**[®] with **IoE Internet of Extrusion**[®] for continuous intelligent maintenance






Close to
our customers



Top loyalty

More than 250 complete PET lines installed worldwide, since 2000, with full customer satisfaction

-  Headquarters in Italy
-  PET lines sold in the world 2000-2019
-  Service centres
 - UK
 - China
 - Indonesia
 - USA



Rigid Film and
Sheet lines



Blown
Film lines



Pelletizing

Top packaging
and **converting** solutions

BANDERA
EXTRUSION INTELLIGENCE®

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