



100%
eXtrusion
SHEET LINES

PET / R-PET SHEET

LINES FOR PET SHEET EXTRUSION

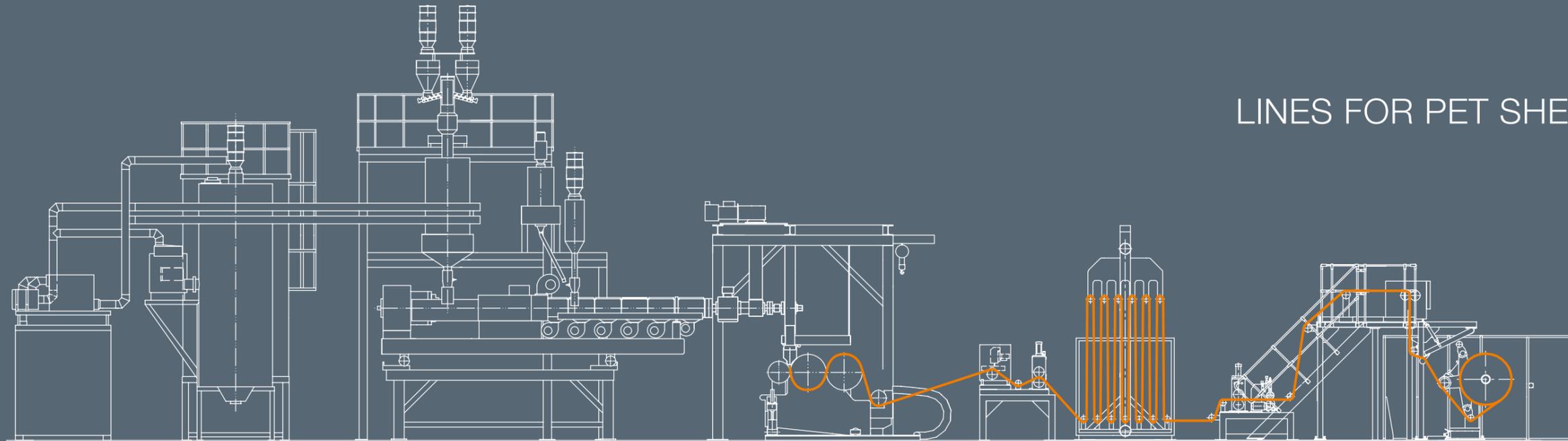


SML has been producing high-performance sheet lines for PET and R-PET for more than four decades, constantly expanding the limits of what is technically feasible.

With thickness ranges from 150µm to 2mm and with widths up to 2,100mm as field-tested standards, **SML's highly tailor-made PET and R-PET lines meet the most specific requirements for products – above all in terms of thermoformability, transparency and stiffness.**

SML provides a huge array of customisable options for efficient manufacturing with a maximum of flexibility – including three different extrusion concepts, highly advanced roll stack technologies, various winding systems as well as several options for co-extrusion and lamination.

Machinery made by SML is engineered to perform for several decades – keeping a **reasonable balance between well proven technologies and technical innovation.** Whatever the requirement, SML's PET and R-PET sheet line's high degree of efficiency means moderate capital expenditure, along high outputs, reduced energy consumption, ease of operation and first-class service.

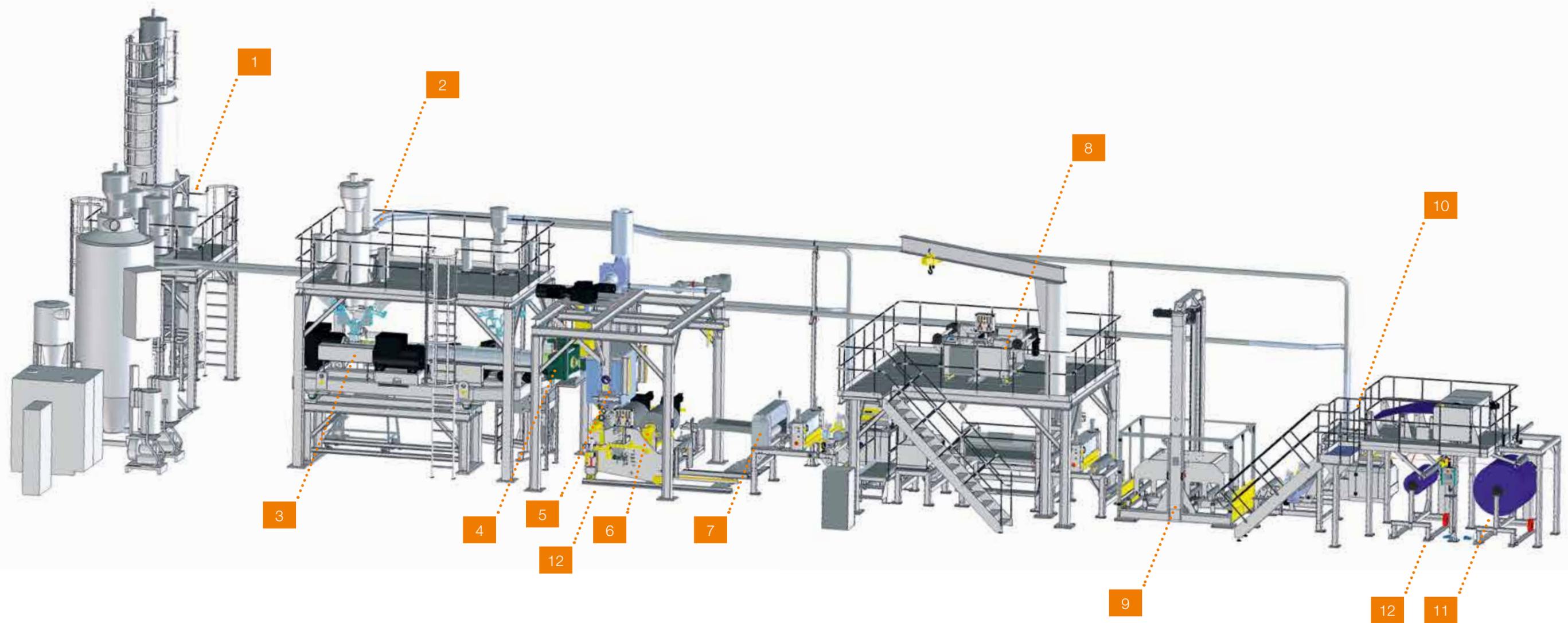


LINES FOR PET SHEET EXTRUSION

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STANDARD EXTRUDER ▲

Extrusion concept 1: Single-screw extrusion with pre-drying

With this extrusion concept, minimised IV (intrinsic viscosity) reduction allows the production of top quality sheet. SML's single-screw extruders are robust, very comfortable and they fit perfectly in in SML's coherent and technically mature line set-up. In this extrusion concept, two separate single-screw extruders, combined with drying equipment, represent a typical co-extrusion unit for the production of standard 3-layer structures (A/B/A). Single-screw extrusion with pre-drying is especially suitable for a high percentage of virgin or repelletised material.

DRY AIR DRYING

According to this extrusion concept, the raw materials are pre-dried through conventional dry air systems or in combination with infrared (IR) dryers. In the dry air process, the individual components are usually dried separately, which provides a maximum of flexibility with regard to mixture changes. When drying A-PET regrind, the amorphous flakes have to be pre-crystallised or agglomerated in a separate unit. Conventional SML air drying systems are suitable for processing PET-G.

IR-DRYING

In combination with IR-drying, which reduces drying times by more than half, the main components such as flakes and different types of regrind materials are pre-mixed. After that, they are pre-dried in an IR-dryer before being further dehumidified in a conventional dry air dryer. Another advantage is gained from the ability of the IR-dryer to crystallise the regrind material in the same process.

To add additives to the main material, small blenders are mounted just above the inlet of the extruder.

Your Advantages

- ✓ Robust, technically mature and easy-to-operate
- ✓ Minimised reduction of intrinsic viscosity
- ✓ Maximum flexibility towards product changes

SML SINGLE-SCREW EXTRUDER OUTPUT:

Ø L/D	45/28	60/28	75/33	90/33	105/33	120/33	135/33	150/33	180/33
A-PET [kg/h]	100	200	350	450	600	800	1000	1350	1750



VACUREMA EXTRUDER ▲

Extrusion concept 2: Recycling Extruder (VACUREMA® System)

No discoloration, no integrated pre-drying of the input material and a low energy consumption: the compact VACUREMA® system is ideal for processing PET bottle flakes and regrind. The process complies with the regulations of European and US authorities (EFSA/FDA). It is especially suitable for the decontamination of post-consumer bottle flakes and therefore suitable for producing single (mono) layer PET sheet for direct food contact purposes.

PATENTED PRE-TREATMENT IN HIGH VACUUM

In its key components, the system consists of a vacuum reactor, which is linked directly to a single-screw extruder. The patented pre-treatment at elevated temperature and in a high vacuum before the extrusion process, removes moisture and migration materials from the feedstock very effectively. From the reactor, the hot material is fed under high vacuum into the single-screw extruder which does not require of a degassing port.

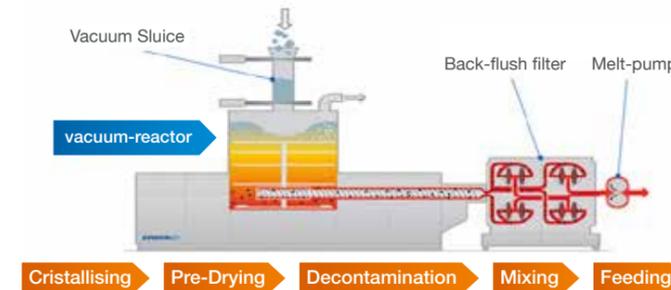
SEPARATE DOSING UNIT FOR PRE-MIXING

For processing mixtures containing different materials, such as bottle flakes, regrind and virgin granules, the components are first premixed in a separate dosing unit and then fed into the reactor. Additives are injected directly into the extruder by a side feeder behind the material inlet zone.

Your Advantages

- ✓ EFSA/FDA approved process
- ✓ Patented vacuum reactor for pre-treatment
- ✓ Field-approved recycling technology

VACUUM REACTOR + SINGLE-SCREW EXTRUDER - RECYSHHEET



VACUREMA BASIC	output for an IV change of 0 to 4% (kg/h)	maximum output
1108 T	250	400
1109 T	300	500
1310 T	400	600
1512 T	600	900
1714 T	850	1000
1716 T	1100	1450
2018 T	1350	2000
2021 T	1800	2600
2321 T	2000	2900



CONICAL TWIN-SCREW EXTRUDER ▲

Extrusion concept 3: Conical twin-screw extruder

Conical twin-screw extruders contain highly advanced technology for a maximum of flexibility. They are able to process a wide range of different materials such as virgin and regrind PET granules, PP and PS.

PET PRODUCTION WITH OR WITHOUT PRE-DRYING

Depending on the moisture level in the raw material and the required sheet quality, PET can be processed without pre-drying, which has a positive effect on total energy consumption. When material is additionally pre-dried before processing, the IV loss is lower and the values for AA-content and yellowing are supreme, which, compared to the process without pre-drying, results in superior sheet quality from the same material.

100 % FOOD GRADE-SHEET FROM BOTTLE FLAKES

By combining conventional pre-drying of washed bottle flakes with the high vacuum on the conical twin screw extruder, this system complies

with the regulations of European and US authorities (EFSA & FDA). So washed **PCR bottle flakes can be directly converted to "excellent quality – 100% Food Grade-sheet"**

OPTIMISED FEEDING THROUGH CONICAL DESIGN

Owing to their ability to control the precise filling rate of the extruder, gravimetric loss-in-weight dosing units are generally employed with twin-screw extruders. Due to its conical shape, the conical twin-screw extruder provides advantages relating to the feeding section, because it is larger than the screw diameter at the outlet. Hence the pressure build-up is significantly higher than that of a parallel twin-screw extruder. This effect opens the way to operations using a backflush filter without the need for an additional melt pump in front of it.

CONICAL TWIN-SCREW EXTRUDER OUTPUT:

Max. output for PET (IR 0.65 - 0.8)	undried (*) kg/h	hot and dried (**) kg/h
MAS 24	30	35 - 40
MAS 45	220 - 250	250 - 350
MAS 55-L	500 - 550	550 - 600
MAS 75	800 - 900	900 - 1,000
MAS 90	1,300 - 1,400	1,500 - 1,600
MAS 93	- 1,600	1,800 - 2,000
MAS 93-S	- 1,800	2,000 - 2,200

(*) max. ~8000ppm, (**) >140°C, max. ~50ppm

Your Advantages

- ✓ Multifunctional extrusion system
- ✓ Excellent venting ability
- ✓ EFSA/FDA approved process





DOUBLE-PISTON FILTER ▲

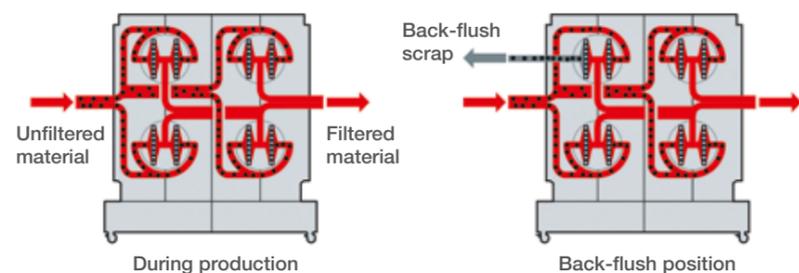
Filtration system

SML provides different types of filters, in line with the specific extruder design and the expected level of impurities in the raw material:

- Single-piston, hydraulically actuated discontinuous filters
- Double-piston (2 or 4 cavities), hydraulically actuated continuous filters
- Backflush filters with up to 12 cavities
- Laser filters

In order to guarantee a stable pressure and good melt homogenisation in front of the die, all SML PET lines are equipped with melt pumps and static mixers.

SCHEMATIC DRAWING 8-CAVITIES BACK-FLUSH FILTER



Tool unit with continuous double-piston filter and melt pump



DIE SPLITTING SYSTEM ▲

Feedblock and flat die

As a leading supplier of high-quality PET sheet lines, SML relies exclusively on renowned partners for its feedblocks and flat dies. PET sheet lines from SML are basically configured for the production of a 3-layer A/B/A sheet structure with thin outside layers – providing various options:

- Processing virgin material only in the two outside layers, while using recycled material in the middle layer. This avoids contact between the packaged goods and recycled material – complying with the food contact regulations of most countries.
- Applying anti-block additives only in the thin outside layers, helping to keep production costs low.
- Producing with various different additives like Masterbatch or foaming agent, just in the centre layer.
- Manufacturing GAG sheet (PETG/APET/PETG).

READY FOR SPECIAL APPLICATIONS

Feedblocks integrated in SML's PET sheet lines are available for processing up to nine layers as a standard. They are ready for special applications, i.e. for PET sheet with functional layers such as barrier and/or peel or seal layers. SML provides manual and automatic flat dies with special features such as lip heaters or compound angles, for closer adjustments between the die and the roll stack. Dies are usually deckled with external or internal deckles or a combination of external/internal deckles. The SML die splitting system guarantees the quick and safe opening of the flat die for cleaning purposes.

Your Advantages

- ✓ Configurable for the manufacturing of various sheet structures
- ✓ Die splitting system for fast and easy cleaning
- ✓ Approved technologies from renowned partners



Tool unit with melt pump, static mixer, feedblock and flat die



HORIZONTAL ROLL STACK ▲



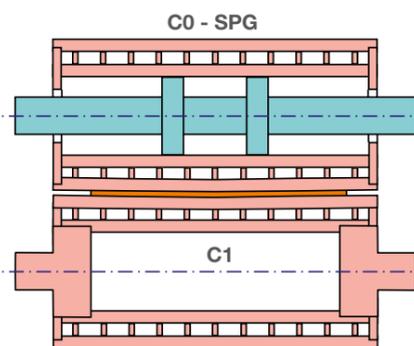
INCLINED ROLL STACK ▲

Roll stack

It is also the outstanding roll stack technology that gives PET and R-PET sheet lines a clear edge. SML's roll stacks are operator-friendly and very easy to adjust, process stability is reached swiftly. **All of the roll stacks for PET sheet are equipped with the specially designed SPG (Smart-Parallel-Gap) C0 polishing roll for superior thickness tolerances.**

SUPERIOR HEAT TRANSFER

The C1 main cooling roll and the C2 secondary cooling roll have very thin outer shells. Due to an optimal heat transfer, they enable a highly specific output. All rolls at the roll stack are hardened to 60+/-2 HRC, chromium plated and polished to a high-gloss mirror finish. Each roll is equipped with a separate water temperature control system and an individual, highly accurate drive system. The maximum mechanical speed depends on the basic line configuration and factors such as extrusion capacity, width and thickness range. SML sheet lines for PET are available for mechanical line speeds of 50, 70 and 100 m/min. Depending on the sheet thickness and output, additional post cooling rolls can be mounted on the roll stack after the C2 roll.



HORIZONTAL ROLL STACKS FOR THERMOFORMABLE PET

For the typical thermoformable PET sheet thickness range, SML recommends a horizontal roll stack, which offers significant advantages such as:

- Superior sheet surface quality thanks to the optimised positioning of the melt bank
- Vertical melt exit – the melt is not pulled over the edge of the die lip
- No sagging of the melt before roll contact, as can happen with vertical roll stacks
- Minimised internal stress in the sheet as the melt is not cooled by roll contact before it enters the gap



Flat die in operation position

SLANTED ROLL ARRANGEMENT FOR THICK SHEET

For very thick sheet, SML supplies roll stacks with a slanted roll arrangement – which is the optimal design for these products. In combination with an elaborated temperature control, the slanted roll arrangement developed by SML guarantees the smooth production of PET sheet up to 2mm.

MANUAL VS. MOTORISED GAP ADJUSTMENT

In its standard designs, SML offers gap adjustment using manually adjustable spindles with scales and readings. As an option, motorised gap adjustment is available with AC servo-motors driving the spindles. Adjustment parameters are displayed on a touch screen in the control panel on the roll stack and stored in the SMILE control system. A very useful optional feature is the nip load measurement

system, which shows the actual pressure (N/cm) in the polishing nip, online. SML's motorised gap adjustment system supports operating personnel in strictly following production specifications – making changes in production very fast and easy to implement at the operational level.

Your Advantages

- ✓ Patented Smart Parallel Gap – SPG C0 polishing rolls
- ✓ Outstanding thickness profile
- ✓ Smooth processing of PET sheet up to 2mm

STANDARD SML ROLL STACK CONFIGURATIONS:

Diameter mm Roll combination	Roll width in [mm]							
	1050	1200	1400	1650	1800	2000	2200	2400
CO SPG / C1 / C2	300/400/400		330/400/400					
CO SPG / C1 / C2	370/490/490	370/490/490	370/490/490	370/490/490				
CO SPG / C1 / C2	370/600/600	370/600/600	370/600/600	430/600/600	430/600/600	430/600/600	490/600/600	490/600/600
CO SPG / C1 / C2	370/700/700	370/700/700	370/700/700	430/700/700	430/700/700			
CO SPG / C1 / C2					430/715/715	430/715/715	490/715/715	490/715/715



INLINE THICKNESS MEASURING UNIT WITH INDUCTIVE / CAPACITIVE SENSOR ▲

Gauging system

In answer to the various regulations in customer countries and to specific requirements in production, SML supplies different automatic gauging systems:

- Inductive / capacitive sensors
- Air caliper systems
- Radioactive Beta-ray sensors (Krypton 85 or Sr 90)
- X-ray sensors
- Laser shadow

All these systems are available for dies with manual adjustment or automatic profile control. They are equipped with a control unit to regulate the speed of the main cooling roll C1 – in order to maintain the value of the thickness setting in the machine direction.



Inline thickness measuring unit with Beta-ray sensor

Edge trim cutting/removal

Edge trims are cut off using static blades or motor-driven circular knives. A precise cut is required for an excellent winding quality. The edge trim is usually pulled into an inline grinder. The regrind is then either filled into big-bags for interim storage or refed directly to the main extruder via a conveying screw mounted above the extruder inlet opening.



Edge trim cutting



ROLL STACK ▲

Production of foamed PET Sheet

SML is an accepted technology leader in lines for foamed PET sheet. Foamed PET sheet produced with machinery from SML has around 40 % less weight than usual PET sheet – a key property, that is unparalleled in the market so far.

ECONOMIC PRODUCTION OF HOT-FILL APPLICATIONS

This foamed PET sheet can be used especially for hot-fill applications such as cups. The production of 3-layer A/B/A sheet, where the middle layer is foamed, can be either done chemically, or physically with the injection of nitrogen or simple carbon dioxide which is widely available. No special additives are required to enhance the heat stability of the sheet, which is thus suitable for the economic production of low-weight cups with excellent insulation properties.

FIELD-TESTED, OPERATOR-FRIENDLY TECHNOLOGY

SML applies different foaming methods, depending on the type of extruder. Post-consumer PET bottle flakes can be used as a raw material for the central, foamed layer together with virgin and regrind PET. Regardless of the foaming method applied – SML only delivers comprehensive, field-tested and extremely operator-friendly foaming solutions with unparalleled sheet qualities.



Cross section 3-layer sheet with foamed middle layer

Your Advantages

- ✓ 40 % less weight than conventional PET sheet
- ✓ Perfectly useable for hot-fill applications
- ✓ Exceptional heat-insulation, rigidity and surface feel



Foamed sheet roll

HIGHEST QUALITY PRODUCTS





Winding Systems

SML's customers can select from a wide range of different semi- and fully-automatic sheet winding systems for PET.

All of the winders for PET sheets are designed and manufactured in-house by SML. They have a proven track-record for longevity and outstanding properties in terms of technical precision, reliability and operability:

SEMI AUTOMATIC SHEET WINDERS

Semi automatic sheet winders are known for their excellent production reliability at an attractive cost level. They are used in combination with an accumulator, that works from a bottom to top position, while a torque-driven servo-motor generates storage movement and precise web tension. The accumulator picks up the sheet during the manual change of the roll in the winder, making roll changes by the operators very easy and safe.

Your Advantages

- ✓ Film capacity: standard 38m and 50m, others possible upon request
- ✓ Access doors on operation side for easy sheet feeding into the accumulator in the bottom position
- ✓ Compact solutions for limited floor space



Winder W400 A-frame

minimises the downtimes

The winder W400 A-frame is a highly economical solution with A-frame winding trolleys for single web operation.

This jumbo roll winder can produce rolls with diameters of up to 2,000mm, which minimises the downtimes caused by roll changes in in-house thermoforming applications.

The winder W400 A-Frame is equipped with A-frame winding trolleys with 3 or 6 inch pneumatic winding shafts. It works according to the twin-trolley principle: while one trolley is in active operation, the other is on stand-by for a roll change.

Your Advantages

- ✓ For jumbo rolls up to 2,000mm diameter
- ✓ Time saving twin-trolley principle
- ✓ Minimised downtimes at roll changes



Winder W500 A-frame

The winder W500 A-frame is a comfortable and economic solution for large roll diameters.

It is a single or multi web winder equipped with an electric drive and with two A-frame winding trolleys for each web.

The operation of the winder is simple and straightforward - after the roll change procedure, an operator removes the A-frame trolley with the finished roll from the winder. The roll itself has to be lifted from the trolley by means of a crane or a forklift.

Your Advantages

- ✓ Suitable for large roll diameters
- ✓ Single or multi web winder
- ✓ Electrically-driven winding trolley optional

comfortable and
economic



Winder W600 cantilever

The winder W600 cantilever ensures a maximum of operator convenience, especially in the case of small diameter rolls and frequent roll changes.

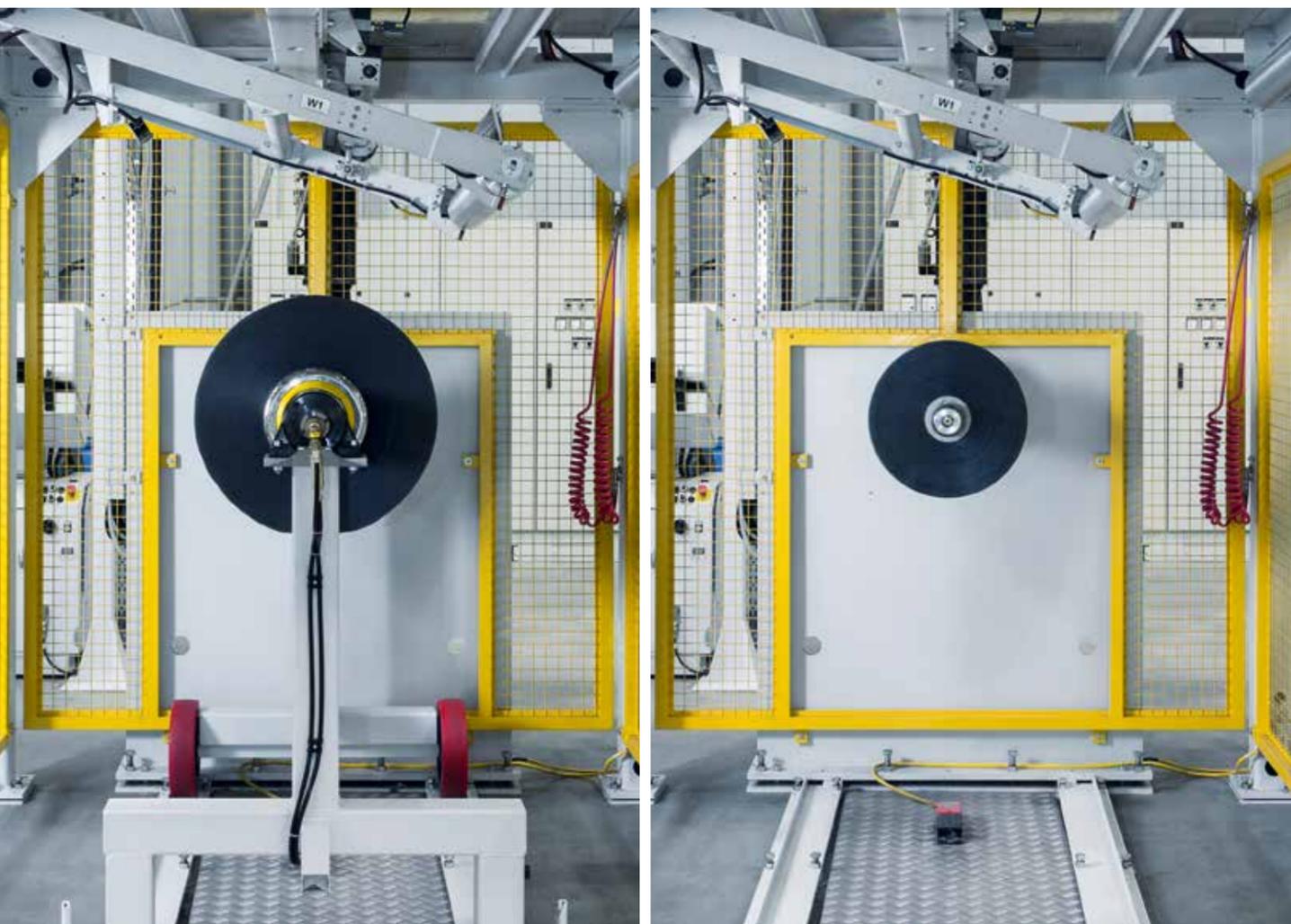
It is a single or multi web winder which has two winding stations with winding shafts for each web, supported on just one side.

After the roll change procedure, a manually operated lifting trolley is used to remove the finished roll from the cantilever shaft, which remains in the winder.

Your Advantages

- ✓ Suitable for smaller roll diameters and frequent roll changes
- ✓ Single or multi web winder
- ✓ Winding shafts for each web, supported on just one side

maximum operator
convenience



Winder W550 combined A-frame / cantilever



can be easily modified

Combining the advantages of the A-frame winder W500 and the cantilever winder W600.

The W550 stands for increased flexibility and production reliability in making roll diameters from small to big. The A-frame winding trolley is typically used for production processes requiring jumbo rolls, while the cantilever winding shaft is best suited to making frequent roll changes when producing small rolls.

The winder W550 can be easily modified from an A-frame winder into a cantilever winder. The A-frame trolley only has to be moved out and the cantilever shaft is quickly fixed to the drive disc.

Your Advantages

- ✓ Highly flexible system – efficiently usable for all roll diameters
- ✓ Operator-friendly modification from A-frame to cantilever winder



Winder W900 turret



available with friction winding

The semi-automatic turret winder W900 is easy to operate and requires less floor and handling space than A-frame winders.

Because of its short, internal film guideways, the turret winder is especially suited for medium roll diameters and the production of thin sheet.

As an option, the winder W900 turret is available with friction winding shafts, which makes it possible to wind two or more webs.

Your Advantages

- ✓ Specially suited for medium roll diameters and the production of thin sheet
- ✓ Space saving
- ✓ Available with friction winding shafts as an option



Winder W2000 TF fully automatic

As opposed to semi-automatic winders, SML's fully automatic sheet winder W2000 TF enables roll changes at full line speed, with the result that no accumulator is required.

The short web path in the winder, and the automatic attachment of the film to the new winding core, represent advantageous features, especially with regard to thin films. Generally, the W2000 TF is designed for winding PET sheet in a wide thickness range.

powerful guillotine
cutting unit



HORIZONTAL SHAFT MOVEMENT

In the winder entrance, this winder has a web tension-measuring roll, which separates winding tension from upstream web. Owing to the horizontal shaft movement principle, the roll remains in an optimum winding position until the very last moment before crosscutting, thus guaranteeing a perfect winding quality up to the last layer on the roll.

ELABORATED CUTTING UNIT

The W2000 TF is equipped with a powerful guillotine cutting unit. After cutting, the leading edge of the film enters a guide system and is pressed onto the newly prepared winding core. The winder is also designed for precise gap winding. The upper side of the sheet is wound on the inside.

FRICION WINDING FOR INLINE SPLIT ROLLS

The winder W2000 TF can be fitted with optional friction winding shafts for the production of inline slit rolls. In this case, two adjustable banana rolls are positioned behind the slitting unit in order to separate the webs with a small clearance in between. In the friction-winding mode, the pneumatic pressure in the winding shaft controls the winding tension in line with the start tension and the selected taper curve.

FULLY INTEGRATED ROLL AND SHAFT HANDLING

At the end of the winding process, the finished roll and the winding shaft are transported onto a moveable lifting table by an overhead robot, which then pulls the rolls off the clamped shaft. The complete roll and shaft handling process is fully integrated in the winder's automatic mode.

Your Advantages

- ✓ Automatic roll changes at full speed
- ✓ Horizontal shaft movement for an equally high product quality up to the last layer on the roll
- ✓ Powerful guillotine cutting unit
- ✓ Fully automatic control of winding quality



Winding	W400	W500	W600	W550	W900	W2000 TF
Max. net film width	950mm / 1,100mm	950mm / 1,100mm 1,300mm / 1,550mm 1,700mm / 1,900mm	650mm / 950mm 1,100mm / 1,300mm 1,550mm	950mm / 1,100mm 1,300mm / 1,550mm	650mm / 950mm 1,100mm / 1,300mm 1,550mm / 1,700mm	1,450mm / 1,650mm 1,850mm / 2,050mm
Number of webs	1	up to 3	up to 3	up to 3	up to 3	up to 3
Core ID (inch)	3, 6	3, 6, 8	3, 6, 8	3, 6, 8	3, 6, 8	3, 6
Thickness range	150-1,200µm	150-2,000µm	150-2,000µm	150-2,000µm	150-1,200µm	150-1,000µm
Max. mech. speed	70 m/min	70 m/min	70 m/min	70 m/min	70 m/min	100 m/min
Accumulator	yes	yes	yes	yes	yes	no
Max. roll diameter up to*	1,200mm	1,200mm 2,000mm	1,000mm 1,400mm	1,200mm	1,200mm	1,100mm

(* Depending on shaft diameter, roll width and number of webs)



E-CONTAINER ▲

SMILE® control system

SMILE is SML's generic machine control and operation concept. It stands for all-encompassing automation, providing machine control systems with the highest usability in combination with outstanding capacities for profound process management and monitoring.

The end-to-end integration of third-party systems, overall line effectiveness, operator-friendliness as well as tailor-made and flexible software solutions are the key elements of SMILE.

SMILE is developed as a whole in-house and is integrated one hundred percent in SML's extrusion lines. It is the highly precise, centralised control and synchronisation of all components in an extrusion system, which is blazing the way to new manufacturing concepts as well as delivering product properties, line efficiency and output volumes.

INTUITIVE MACHINE CONTROL CONCEPT

SMILE is an integral part of SML's coherent and user-friendly over-all line concept; machine control and operation is highly intuitive and self-explanatory:

- A central control station system for the highest operating comfort and the visualisation of all processes
- Reduced training efforts and error rates at operator level, less personnel required
- Remote control, remote update and remote service for minimised maintenance-costs, multi-client / multi-user capability

OPTIMISED PRODUCTION EFFICIENCY

One key purpose of SMILE is the increase in the Overall Equipment Effectiveness (OEE) through optimised production processes.

- Optimised use of raw materials, preventing waste
- Faster start-up of production
- Minimised times for product change-overs – customisable assistant for product changes



Control panel



SYSTEMATISED QUALITY CONTROL

In close interaction with SML's data collection and analysis system bitWise, SMILE is an efficient tool to keep output quality stable and to optimise output properties.

- Formula recipe system to copy production parameters
- Documentation and detailed reporting of production processes
- Automatised alarm functions via e-mail or text message for quick debugging

INTERCONNECTIVITY AND THIRD-PARTY INTEGRATION

SMILE has open interfaces that allow the web-based data exchange with third-party machines and systems.

- Open to interconnecting with systems like Enterprise Resource Planning (ERP), Quality Assurance (QA) or SML's data analysis tool bitWise
- Based on open standards like HTML5 and UPC-UA
- Complete end-to-end process control beyond SML extrusion lines

INTEGRATED ALL-IN-ONE CONCEPT

It is SMILE's all-in-one concept that helps to create completely new types of extrusion solutions, making one single operator-friendly step out of the most complex production processes. The control of temperatures, speeds and pressures on SML extrusion lines is highly centralised. All of the line modules and motors are perfectly interconnected and synchronised with each other.

CENTRAL CONTROL STATION SYSTEM

SMILE's central control station system allows the management of all of the production processes from the wide touch screen attached to the line. As SMILE is web-based, all of the production and maintenance processes can be entirely remote controlled, i.e. from a PC or even a smartphone. The system is fully multi-client and multi-user capable, different types of users can log-in simultaneously.

OPEN FOR CUSTOMISATION

Developed in close consistency with the hardware components of SML's extrusion lines, SMILE is highly customisable. It is SML's flexibility that offers a wide range of opportunities if customer-specific solutions are required.

SOFTWARE 100 % DEVELOPED IN-HOUSE

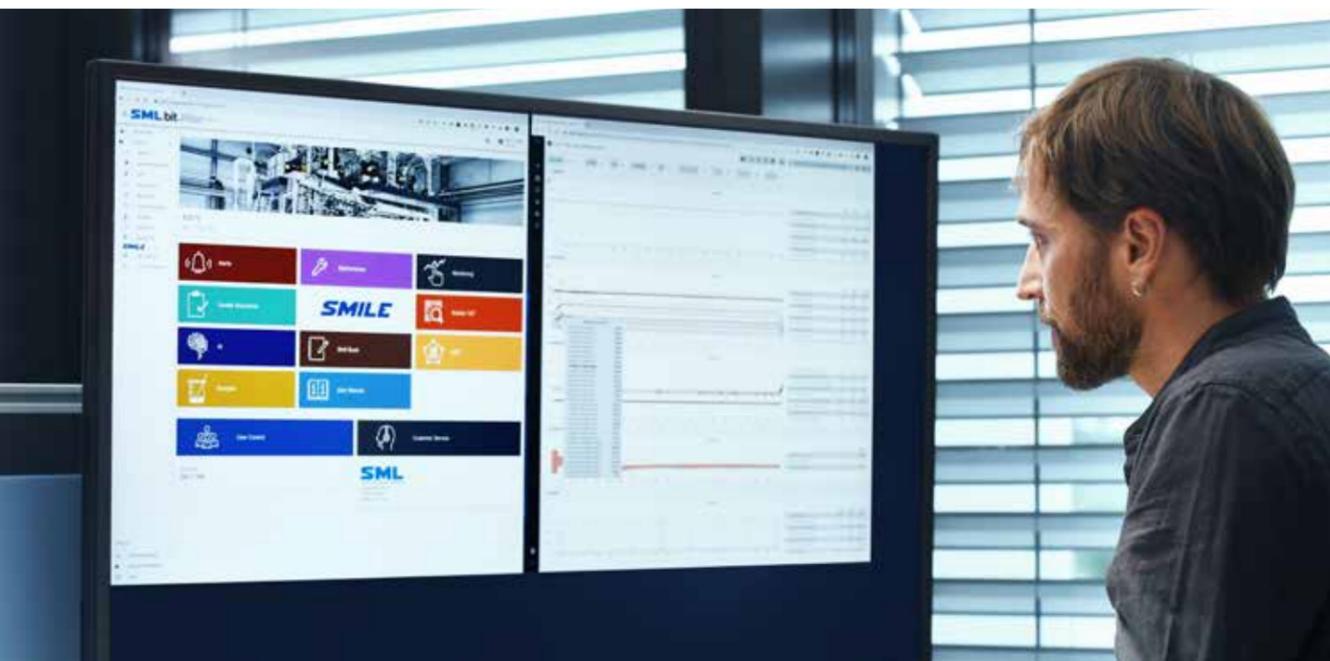
Above all, it is SML's long-standing in-house competence in the field of automation and machine control that provides loads of innovative functions tailored to specific customer requirements. In-house developed, state-of-the-art and dynamic controller systems always allow running the machines at their very best performance-level – considering both economic and environmental aspects. All of SMILE's software solutions are developed by SML technicians. Last but not least, it is SML's concentrated know-how in any aspect of automation, that helps to create the extrusion solutions of tomorrow.

SMILE SOFTWARE FEATURES

- ▶ Central control station system for all production processes
- ▶ Full interconnectivity – global UPC-UA, programmed on HTML5, open interface to other machines and systems
- ▶ Remote access for operators and service teams – worldwide via the internet, from any PC, laptop or most smartphones
- ▶ Multi-client / multi user capability – simultaneous access for different type of users, simple assignment of permissions
- ▶ Highest comfortability – visualisation of all production processes on a wide screen
- ▶ Worldwide possibility of remote update for customisation and technical support

SMILE HARDWARE FEATURES

- ▶ The hardware components of SMILE are supplied by B&R Industrial Automation GmbH, a member of the ABB group, a global leader in automation.



bitWise data analytics

bitWise is SML's digital transformation solution for extrusion lines. It breathes life into the buzzword **"Industry 4.0"**. bitWise provides for a wide range of entirely new opportunities for data driven decisions with a clear focus on the optimisation of production processes and the final product. Completely developed in-house, it incorporates SML's decades of experience in automation with the latest technologies in data analytics and visualisation.

IN-DEPTH PROCESS INSIGHTS

SML extrusion lines are equipped with hundreds of data-generating sensors. Following the principle of **"stop guessing – start knowing"**, bitWise collects, records and visualises this data up to 10 times per second. This gives manufacturers a 360 degree in-depth view of all of the details involved in a production process, both in the present and in the past.

OPTIMISING QUALITY

bitWise is a powerful tool to optimise any aspect of the production process with a direct effect on product quality.

- In-depth monitoring of all quality-related process parameters, allowing quick corrective action
- Comprehensive tracking and documenting of product quality
- Making quality reproducible

3871
qhObwH

Position:	B4_1
Width:	500
Weight:	17.6
Diameter:	234
Endtime:	10.9.2019, 15:55
Length:	2665
Length difference:	0
Rolls:	4
Order Nr.:	bitWise
Quality:	excess length
Recipe:	12mic_K-Show
Shaft:	4
Shift:	KW37
Starttime:	10.9.2019, 15:51
Station:	B
Tags:	show, lab
Thickness:	12.6
Trial:	K-SHOW_12mic
Trigger:	meter

SHOW METRICS

GENERATE A REPORT

MAXIMISING OUTPUT

Data recorded, aggregated and visualised by bitWise helps to raise overall line utilisation and deliver a faster return on investment (ROI).

- Discovering hidden or unused output capacities
- Preventing downtimes by detecting potential problems at an early stage
- Minimising maintenance times through optimised scheduling and structured access to documentation and service support

MINIMISING PRODUCTION COSTS

bitWise is the central tool to measure and visualise all production-related costs. It forms a strong and reliable basis for the continuous cost-optimisation of production processes.

- Detailed monitoring and reporting of energy and raw material consumption
- In-depth optimising, tracking and reporting of Overall Equipment Effectiveness (OEE)
- Full end-to-end cost transparency through third-party integration

ON-PREMISE SOLUTION

bitWise is a 100 % on-premise solution. Your data stays in your company, on dedicated and secured hardware, no cloud services required.

CUSTOMISATION AND RETRO-FIT

As with most technologies developed by SML, bitWise is highly customisable. bitWise can be retro-fitted to many existing SML extrusion lines optimising production processes, cutting costs, raising the OEE and ROI of existing investments.

OPEN FOR VERTICAL INTEGRATION

Extrusion lines are a key part in a wider production chain. For end-to-end optimisation, bitWise supports data exchange and vertical integration with third-party systems, e.g. Manufacturing Execution Systems (MES), Enterprise Resource Planning (ERP) or Quality Assurance (QA).



PET SHEET LINE WITH THERMO-LAMINATION ▲

Production of PET/PE or PET/barrier structures

When sealability or barrier functions are required, the PET sheet needs to be supplemented with different polymer layers or films. SML offers a vast range of customised solutions for the production of PET/PE or PET/barrier structures.

Such functional outer layers can be added in different ways – but whatever the method used, it can be integrated inline into a PET sheet line made by SML.



1. CO-EXTRUSION

This process provides outstanding optical properties and excellent adhesion between the individual layers. However, owing to the very different material melt viscosities of the PET on the one hand and the PE or barrier material I on the other, the process is difficult to handle and adjust during product changes. Co-extrusion is therefore recommended for large production lots and a low number of product variations.

2. ADHESIVE LAMINATION

This is a very efficient process to achieve the highest possible bonding strength and maximum flexibility. The PET film is extruded independently from the lamination process, which allows the recovery of 100 % clean edge trims.

The lamination film enters the lamination station from an unwinder and can be changed very easily, in order to obtain a final product with completely different properties. The lamination process is not started before the PET sheet quality has been stabilised, and for this reason the scrap rate is very low.

3. THERMO-LAMINATION

This process is easy to handle and offers very efficient production. Here also the PET sheet is produced independently from the lamination process. The surface of the PET sheet and the lamination film are heated up by infrared heaters prior to the lamination point in a pressing roll duo. Basically, the strength of the bonding with the PET film depends on the properties of the lamination film and is generally lower than that provided by adhesive lamination or co-extrusion.

4. LAMINATION AT THE ROLLSTACK

This is an option to do lamination with low additional investment costs in machinery. Applying this method, the lamination process is done directly at the roll stack by utilising the existing heat of the extruded PET.

This way of lamination is mainly for occasional, small production runs, as there are certain limitations and disadvantages in this process, compared to others.

5. EXTRUSION COATING

The separately produced PET film is guided through an extrusion coating station with one or more extruders. This production method is cost-efficient and the product quality, bonding strength and transparency are excellent. Additionally, this method covers a large diversity of products.



LAMINATION AT THE ROLLSTACK ▲

PET/PE PRODUCTION - COMPARISON

	Co-extrusion	Adhesive lamination	IR-Thermo-lamination	Lamination on the roll stack	Extrusion coating
Adhesion	+	++	-	-	+
Flexibility	-	++	+	-	+
Investment	+	-	+	++	--
Personnel	++	-	+	+	--
Output	-	+	+	--	++
Edge trim loss	--	++	++	--	+

NOTES:

SML

EXTRUSION LINES – ENGINEERED TO PERFORM ▶

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