The Smiform SR series of rotary stretch blow-molders ensures high performances in the stretch blow-molding of PET, PEN and PP bottles, mainly used in the “food & beverage” sector. High-tech components, low TCO and excellent quality-price ratio make of the SR series the ideal solution for the production of different-sized plastic containers, featuring from the simplest to the most sophisticated shape.

In more detail, the SR series includes:

- 7 SR / SR HP models, featuring 4 to 20 cavities, for the production of bottles of up to 3 liters capacity, at the maximum output speed of 1,800/2,000 bph/cavity*;
- 2 SR HC – High Capacity - models, featuring 4 to 6 cavities, specifically designed for the production of up to 10 litres high-capacity bottles, at the maximum output speed of 1,100/1,200 bph/cavity*.

* Depending on the machine model and container’s features.
The stated values are not binding, as they have to be confirmed by Smiform according to production conditions and preform/container technical specifications.

* Length x width x height. Without preforms hopper and unscrambler.
From the preform to the bottle

1. PREFORMS FEEDING

The preforms are transferred from the hopper to the unscrambler through a lifting belt; the unscrambler conveys them to an inclined guide, from where they reach the spacer star wheel at the heating module infeed, by gravitational fall.

The star wheel feeds a rotary mandrel chain, through which the preforms are “captured” and let into the heating module.

2. PREFORMS HEATING

Before entering the heating module, equipped with infrared lamps, each preform is checked twice: first preforms whose size and vertical position don’t comply with parameters set are automatically discharged; then, should a certain number of preforms exceed the allowed range, the machine stops.

The preforms, supported by the mandrels, start moving along the heating module, first with their neck upwards, and then downwards.

During the heating process, the preforms keep rotating, so as to ensure an excellent and symmetrical heat distribution.

The heating module is equipped with two different cooling systems: a liquid-fed cooling system, in order to cool the protection ring and prevent the preforms thread deformation during the heating process; an air-fed cooling system, in order to keep such a temperature inside the heating module as to protect the preforms outer walls from overheating.

At the module outlet, a sensor gauges the preform temperature to make sure it corresponds to setpoint; if not, the lamps power is increased or decreased accordingly.
Why to choose Smiform rotary technology

- Technology developed in order to reach high outputs and excellent performances;
- Independent machine axis, controlled by brushless motors;
- Accurate heating profile, differentiated for each preform;
- Single-cavity molds (they can contain one preform only);
- Control and check of each mold and, consequently, of each cavity, by means of “Intelicavity” technology:
  - Precise and constant monitoring of all phases of the stretch-blowing process, thanks to the specific parameters for each preform;
  - Quick changeover and mold replacement;
  - Reduction of the maintenance and operating costs;
  - Low energy consumption, as the constant rotation of the blowing-wheel generates inertial loads almost equal to zero;
  - Compressed air consumption very low, thanks to the air recovery system (optional) and to the low dead volume of each stretch-blowing station;
- Possibility to stop a stretch-blowing station, while keeping the machine running, in case of failure.

PREFORMS ROTARY STRETCH BLOW-MOLDING

A special rotary group of grippers picks up the preforms from the spacer star wheel positioned at the heating module outlet and delivers them to the stretch-blowing stations. The stretch-blowing process consists of two phases:
- Stretching and pre-blowing, which occur simultaneously through the descent of the stretching rod and the supply of low-pressure compressed air;
- Final blowing with high-pressure compressed air, giving the containers their final shape. A counter-pressure air system ensures the perfect locking of the moulds, whereas the mechanical locking of the mold-holders allows bearing the strengths generated by the stretch-blow moulding process with the maximum reliability. Also the stretch-blowing stations are equipped with a liquid-fed cooling system, which keeps the molds temperature constant.

BOTTLES OUTLET

During the blowing process, an accurate measurement system checks if the pressure inside each mold is constant; in fact, a pressure drop would alter the shape of the container which would then be rejected.

The finished bottles are picked from the stretch-blowing stations by another rotary group of grippers and put onto an air conveyor which finally transfers them to the filling machine.
Features and benefits

**Preforms unscrambler**
- equipped with system of recovery of the preforms in excess, carried back to the hopper.

**Spacer star wheels and grippers rotary groups**
- spacer star wheels, situated both at the infeed and at the outlet of the preforms heating module, easy to replace in case of changeover;
- positively actuated valve gear control of the grippers rotary groups, by means of a double cam.

**Preforms heating module**
- Vertically positioned infrared lamps, grouped in various sections:
  - SR / SR HP models: up to 10 infrared lamps for each section of the heating module;
  - SR HC models: up to 11 infrared lamps for each section of the heating module;
- Possibility to set and modify the parameters of each lamp through the POSYC operator panel:
• Preform heating lengthwise differentiated and radially homogeneous;
• Liquid-fed protection ring cooling system preventing the preforms thread deformation during the heating process;
• Air-fed cooling system, in order to keep the heating module temperature constant and low enough;
• Modular and compact design for all stretch blow-molder models.

**Stretch-blowing wheel**
- cam-controlled highly reliable technology;
- standardized stretch-blowing stations for all blow-molders models, with a very low dead volume;
- liquid-fed cooling system, in order to keep the molds temperature constant;
- air recovery system available upon request;
- molds treated on the surface and made from a special wear-resistant aluminium alloy;
- mold-holders made from a special aluminium alloy resistant to mechanical stress.

**Air recovery system (optional)**
- two exhaust valves for each stretch-blowing station:
  - the first valve introduces the air into the air recovery system tank,
  - the second one discharges the air that cannot be recycled:
- considerable reduction of the energy costs and 40% saving on compressed air consumption:
- recovery system: a part of the air in the blowing circuit (high pressure) is recovered and recycled for the pre-blowing circuit (low pressure) and for the machine service air;
  - the pressure of the pre-blowing circuit is controlled by an electronic adjusting device, whereas the service air circuit is controlled by manual reducers;
  - if the pre-blowing circuit or the service air circuit do not need the recycled air, it is possible to use it for the low-pressure circuit of other external systems;
- use of eco-compatible, environment-friendly technology.

**Electrical panel and machine wiring**
- Electrical panel integrated in the heating module, thus reducing the machine overall dimensions:
  - larger space to install any optional equipment or additional accessories;
- machine structure more compact and of easier access, thanks to the elimination of the connection cables (air or ground cables) to the electrical panel, if external to the machine:
  - use of pre-assembled and pre-tested cables;
  - automation and control on™ field bus.
Smiform stretch-blow moulders are available either as stand-alone machine or integrated in complete systems of stretch-blowing, filling and capping.

In fact, Smiform’s ECOBLOC® series brings together the operations of a rotary stretch-blow moulder, of a rotary electronic filler and of a rotary capper (a rotary labeller for the application of pre-glued labels can be supplied upon request).

ECOBLOC® systems are the ideal solution to blow, fill and cap (and to label if required) PET and PP rigid containers processed in bottling lines of still and carbonated water, soft drinks, milk and edible oil.

**ECOBLOC® machines range features:**

- **ECOBLOC® models**, ideal for the production, filling and capping of rigid containers up to 3 liters for still liquids;
- **ECOBLOC® LG models**, ideal for the production, filling and capping of rigid containers up to 3 liters for sparkling liquids;
- **ECOBLOC® “HC - High Capacity” models**, ideal for the production, filling and capping of rigid high capacity containers (up to 10 liters) for still liquids.

*The stated values are not binding, as they have to be confirmed by Smiform according to production conditions and preform/container technical specifications.*
The flow amount is gauged by pulses-counting: upon reaching the set amount of pulses for the current format, a signal is sent to the filling valve to be closed.

Full bottles are transferred to the capper (9) by means of a star-wheel equipped with grippers (8).

Caps are oriented in the correct position by a hopper-unscrambler (10) standing outside the machine at an easy-access height, and are transferred to a pick&place device positioning the cap under the capping head, which moves downwards and applies the cap on the bottle.

A carousel conveys capped bottles to an outlet conveyor with adjustable height, suitable for different bottle sizes.

The product to be bottled is fed from a small external tank (7) to the filling valves by means of a pump or by gravity in the case of foam products.

The filling process is electronic volumetric with magnetic flow-meters (VMAG models for conductive products) or electronic massic with mass meters based on the Coriolis' principle (VMAS models for non-conductive products).

A flowmeter positioned upstream of each filling valve gauges the amount of product flowing through.

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Energy-saving: “SACS” compact line

ECOBLOC® integrated system is at the core of the new compact bottling line named “SACS”, acronym standing for “Stella Alpina Cost Saving”, installed at Acqua Minerale Stella Alpina plant in Mojo de' Calvi (Bergamo).

The whole line was conceived, designed and manufactured by SMi (in partnership with Stella Alpina, SIAD and PE Labellers) – covering a surface of only 800 mq – to bottle up to 14,400 bottles / hour, more efficiently and with lower costs if compared to the existing line processing bottles of carbonated and still water.

SACS’ state-of-the-art equipment, availing of compact machines and new-concept technologies, allows for dramatic cutbacks on the cost of each bottle produced, ensuring low environmental impact and maximum product traceability, thanks to laser marking.

The new production line is down-sized if compared to traditional bottling plants, as all machines are grouped into two multi-tasking blocks: the ECOBLOC® – upstream – for blowing, filling, capping and labelling, and the PACK BLOC – downstream – for secondary packaging and palletising.

The project master plan pursues the following objectives (in full operation and compared to the existing bottling line):

- up to 30% cutback on primary packaging material (“ultra-light” PET bottles);
- up to 50% cutback on secondary packaging material (thermo-shrinkable film with thickness < 40 micron);
- up to 20% cutback on Total Cost of Ownership (integrated systems ECOBLOC® and “PACK BLOC”);
- up to 90% cutback on water consumption for plant cleaning (filling module “baseless” technology);
- up to 15% cutback on energy consumption.
- up to 50% cutback on co2 emission.

The bottles are conveyed directly from the blower to the filler neck-handling style by means of transfer star-wheels.

The star-wheel at the blowmoulder outlet (4) is equipped with grippers electronically-synchronised with the brackets of the star-wheel at the filler inlet (5).

A sensor detects the presence of the bottle at the filler inlet; the filling process starts only if a bottle is detected (6).

The product to be bottled is fed from a small external tank (7) to the filling valves by means of a pump or by gravity in the case of foam products.

The filling process is electronic volumetric with magnetic flow-meters (VMAG models for conductive products) or electronic massic with mass meters based on the Coriolis' principle (VMAS models for non-conductive products).

A flowmeter positioned upstream of each filling valve gauges the amount of product flowing through.
**Benefits**

- Modular compact frame, offering a wide array of customization options;
- Perfect separation between the “dry” environment of the stretch-blow moulding module and the “wet” environment of the filling module;
- The “Baseless” technology employed allows for a minimum number of transfer star-wheels and for easier access to the blower and to the filler for maintenance and cleaning operations;
- Direct bottle transfer by means of adjoining star-wheels (neck-handling style with pitch circle diameter);
- The integrated system – excluding both rinser and connecting conveyors – drives down energy and water consumption;
- Dramatic cutback of TCO;
- Use of eco-friendly technologies, for the safeguard of the environment;
- High cleanliness and hygiene standards;
- Excellent quality-price ratio.

**The filling module**

The “Baseless” technology employed on the filling module features the following benefits:

- Area underneath the bottles completely clear, so as to ease the operator’s access to the machine for maintenance and cleaning operations;
- Lower maintenance and intervention times;
- Contamination-free and high-hygiene environment;
- Motors and transmissions placed in the upper part of the machine, in a dry and easy-to-inspect area;
- Dummy bottle system, for CIP operations.

**Electronic volumetric filling**

ECOBLOC® VMAG/VMAS: FLAT LIQUIDS

- Magnetic flow-meters, for flat conductive products (> 50 uS/cm), such as STILL WATER and MILK;
- Massic flow-meters, for flat non-conductive products (< 50 uS/cm), such as STILL WATER and EDIBLE OIL;
- The flowmeter gauges the quantity of product (volume or mass).

- Fully electronic management of the filling cycle;
- High filling precision (+/- 0.2% of the set-point volume);
- Filling parameters selection from the operator panel, according to product, container, speed;
- Simple-design, ready-to-clean filling valves;
- Easy and quick format changeover, with no need to replace mechanical components.
mass) flowing through the pipe feeding the filling valve and turns it into pulses.

• Upon reaching a given number of pulses, the filling process stops.

Isobaric electronic volumetric filling
ECOBLOC® LG-VMAG: CARBONATED LIQUIDS

• Magnetic flowmeters, for carbonated conductive products (>50 uS/cm) such as SPARKLING WATER and CSDs
• The flowmeter gauges the quantity of product (volume or mass) flowing through the pipe feeding the filling valve and turns it into pulses.
• Upon reaching a given number of pulses, the filling process stops.

The capping module

• Arol rotary capper;
• high precision system, for the application of screw caps and pressure caps;
• external cap feeding hopper;
• shorter intervention time in case of cap jamming;
• cap hopper-unsnarbler with “waterfall” system (optional), delivers caps conveniently oriented to the feeding channel;
• no more centrifugal hopper with relevant cap jamming hazard;
• no more air thrust.

Upon request, ECOBLOC® compact systems can integrate a rotary labeler employing the innovative “Adhesleeve” technology from PE. Labelers, for the application of pre-glued adhesive labels.

The main benefits offered from such system are:
• no more hot melt glue and traditional label cutting;
• adhesive pre-applied during label printing;
• label and glue (water based) 100% recyclable;

The labelling module

• one cylinder only for label cutting and dispensing;
• no more critical passage between label cutting and feeding;
• the film is cut with as many blades as the divisions in drum;
• no cleaning operations required over a working shift;
• the absence of hot melt glue and fix/rotating blades improves the line efficiency;
• the “Adhesleeve” technology employs 20 micron transparent film (compared to 35 micron standard film), allowing for a 70% increase in the number of labels on a reel.
Thanks to their flexibility, Smiform rotary stretch-blow molders are the ideal solution to produce a wide array of containers with one machine model.

Large vertically-sliding doors provide easy access to the machine components and to the moving organs from two sides.

Low changeover times allow to re-start production immediately.

The parameters for each container are stored in the POSYC control panel, ready to be selected by the operator from the touch screen display.

The mechanical adjustments, the replacement of the molds and of any other component, if necessary, require few minutes and can be carried out by using the set of tools supplied with the machine.

Molds replacement

The changeover procedure consists of a few simple operations: opening of the mold-holder (1), removal of each half-mold (2) by loosening three screws, change of the mold bottom (3) by means of a mechanical hook (4) driven by a mechanical device (5), replacement of the stretching rod lock and selection of the new type of container from the POSYC control panel.
**OPTIONAL EQUIPMENT**

**PREFORMS AUTOMATIC LOADER**

Allowing for a considerable reduction of loading time: in a few seconds, in fact, it is possible to load up to 2 pallets of preforms (depending on the blow-molder model).

**THREE STERIL FILTERS FILTRATION UNIT**

The high-pressure air used in the stretch-blowing process of plastic containers (PET, PP, PLA, etc.) must comply with certain quality standards to allow for the pneumatic devices to work properly and to safeguard the equipment efficiency and integrity during its entire life cycle.

The filtration unit is composed of a metal “bar” to which three filter-cartridges containers are fixed, in order to provide three filtration stages:

1. coalescing pre-filtration: for the removal of solid particles, water and oil;
2. active carbon filtration: for the removal of odors and oil vapors;
3. final filtration for sterile air.

**SUCTION OF THE SPACER STAR WHEEL**

In any bottling line, the hygiene of the product and of the container is crucial. Thanks to the installation of a special spacer star-wheel, the preforms undergo an accurate cleaning process before entering the heating module.

Special nozzles remove any residual dust or microscopic particles from inside the preforms.

**MOLD STORAGE TROLLEY AND SET OF TOOLS FOR EXTRAORDINARY MAINTENANCE**

In order to make changeover and extraordinary maintenance operations easier and quicker, SMi can supply a set of tools and a mold storage trolley, with a capacity of up to 15 molds on SR / SR HP machine models and up to 4 molds on SR HC models.

**CHILLER**

In order to cool the heating module and the blowing-wheel, SMi offers different models of air coolers, suitable for indoor installations.

**AUTOMATIC DUMMY BOTTLES SYSTEM**

ECOBLOC® integrated systems feature – as an option – a device for the automatic insertion of dummy bottles during the machine sanitization and cleaning process (CIP).

The bottles are lifted, screwed to the filling valve and discharged at the end of the cleaning cycle; such system prevents any contact between the operator and the machine, staving off the relevant product contamination hazards.

The process automation allows as well to drive down CIP operation times.
Smiform relies on an advanced 3D CAD Department for the design and graphic processing of the bottles. After an accurate analysis of the customer’s requests, the container idea is developed and turns into a detailed project.

Up to now, Smiform engineers have designed over 1,000 different containers, featuring from the most simple to the most sophisticated shape.

**Design of the containers**

**Mold production**

The molds mounted on Smiform stretch blow-molders are made of a special aluminium alloy and are manufactured by Smimec, a company equipped with an FMS line consisting of 12 CNC machining centres: highly automated machines, running 7 days a week round the clock, even operator-less, according to pre-set production programmes (CAM).

The 12 machining centres can achieve an output of more than 15,000 molds per year; they are equipped with linear motors with a speed rate up to 80 meters per minute and mandrels achieving a speed rate of 30,000 rounds per minute.

As a result, top-level quality standards are constantly provided.

**Preform checks**

In a state-of-the-art laboratory, equipped with sophisticated technologies, the customer’s preforms are accurately tested before entering the stretch-blowing unit.

In particular, the preforms size is checked by a videocamera, while a special software for the comparison of dimensional parameters measures the preform walls thickness by means of infrared rays and checks the polymer homogeneity by means of polarized light equipment.

Smiform constantly invests in research and development activities, such as testing new materials and applications, especially multi-layer or hot-filling preforms.

**Container tests**

All the containers produced by stretch blow-molding are tested to check their mechanical-thermal features, that is:

- top load;
- drop impact resistance;
- resistance to deformations;
- thermal stability;
- homogeneous distribution of the resin;
- burst pressure;
- stress cracking.
In the Smiform SR blow-molders, the fully automatic processes, the electronically-controlled and the wiring by field bus are synonyms of reliability, considerable operational flexibility and high performance.

The hardware and software components are "open" and modular, in compliance with the most important international certifications and rely upon consolidated standards of the industrial field and of the packaging sector: OMAC guidelines (Open Modular Architecture Controls), sercos, PROFIBUS, IEC61131, OPC, Industrial PC.

In particular, by following the OMAC guidelines and the Omac Packaging Workgroup (OPW), SMI can guarantee easy integration with the other machines in line, user friendly technology and maintenance of the investment value.

The automation and control system of Smiform machines, called MotorNet System® includes the following hardware components: MaRTS (process controller), POSYC (man-machine interface), COSMOS (digital servodriver for brushless motors), dGATE and aGATE (remote IP65 I/O digital/analogic modules).

The MaRTS is a PAC (Programmable Automation Controller), based on an industrial PC, which can be programmed in IEC61131 languages.

The COSMOS servodrivers and the dGATE/aGATE I/O modules are connected to the PAC via sercos.

The POSYC is a HMI terminal, (touch screen IP65), based on an industrial PC with solid state drives.

Smiform stretch blow-molders are very easy to use; in fact, thanks to the MotorNet System® technology, it is possible:

- To set the heating profile for each preform and the parameters influencing the phases of the stretch-blowing process (from when the preform enters the heating module up to the container);
- To adjust the power of each lamp in each section of the heating module;
- To control the operation parameters of each stretch-blowing station and monitor the whole stretch-blowing process in real time;
- To store the parameters of each container blown;
- To check and set the machine production speed, according to the different types of containers;
- To change format quickly and easily;
- To solve or prevent any problems, thanks to the teleservice, the graphic alarms displayed on the POSYC and the signal of the maintenance interventions to be carried out;
- To have direct access to the manuals on the POSYC;
- To ensure high outputs, excellent quality and low noise levels;
- To monitor the performance and analyse the down-times (Pareto diagram);
- To interchange the POSYC with compatible Panel PC;
- To interchange the COSMOS with compatible sercos pack profile servodrivers.