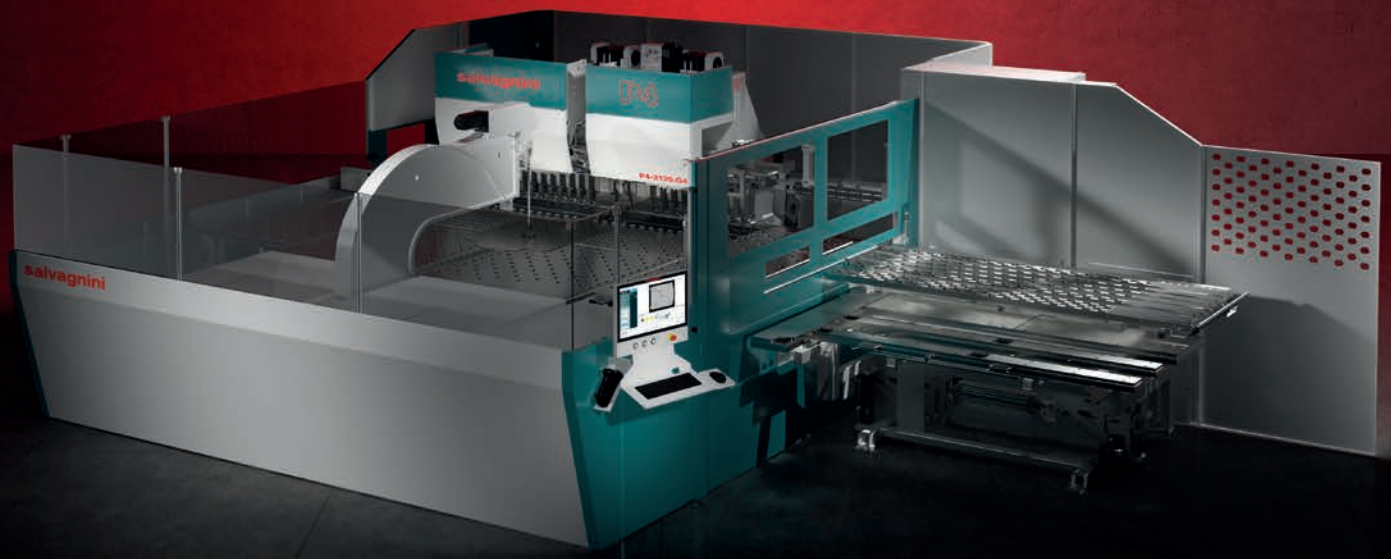
P4



Range of automatic panel benders

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CHANGE

What are the challenges faced by companies today?

Today companies have to cope with many challenges in order to remain competitive in a continuously developing market. These challenges include:

1. The need to automate information distribution, in order to create a **lean, error-proof production environment**, by integrating company ERP/MRP systems with process software for production management.
2. The growing need to **increase the autonomy and efficiency of production systems** by automating loading, unloading and sorting operations.
3. Finally, to prevent programming from becoming a bottleneck for production, the aim **of implementing simple and quick office software solutions,** able to make procedures leaner and improve overall efficiency.

Discovering Generation 4.

With the new Generation 4, Salvagnini presents innovative solutions for **improving simple use and repeatability of jobs, eliminating low added value activities, reducing lead times and optimizing production flows,** for lower product costs and increasingly high business competitiveness.
For the P4 family, Generation 4 introduces **safety guards with a modern design** and **new servo-electric actuators with hybrid technology;** more efficient, reliable and high-performing, these components help to **further increase productivity levels.**

What is Salvagnini's perspective on panel bending?

For Salvagnini, panel bending is an innovative and fully automated process of bending sheet metal, designed by Guido Salvagnini in 1977 with the invention of the first panel bender. Today the Salvagnini panel bender combines speed, flexibility and precision, and is the **ideal solution for batch-one and kit productions.**

How can we justify the investment?

In today's scenario, marked by short lead times and increasingly small batches, maintaining high quality and margins is a challenge that can be successfully met with **innovative technologies** that ensure **precision, flexibility and production efficiency.** Investing in a Salvagnini panel bender means significantly increasing these, while reducing times and running costs. The Salvagnini panel bender in fact combines **productivity,** with its automatic bending cycles and handling with an average of **17 bends per minute,** and **flexibility,** with its **universal bending tools** able to process a full range of thicknesses and materials that can be machined **without the need for setting up special tools,** for kit machining and single batches. The Salvagnini **P4** panel bender can work **independently,** in **line** or as part of an **automatic factory.** It can be **fed manually or automatically,** picking the sheets up from one or more sheet metal packs, in masked time. It can also be equipped with different **unloading devices: manual or robotized.** Its evolved sensors also guarantee **zero-waste production,** automatically adapting the process to the geometrical and mechanical variations of the sheet metal being machined and the external ambient conditions, ensuring top production quality and reliability.

Smart system, constant quality.

The **P4** natively combines **productivity,** with its automatic bending and handling cycles, and **flexibility,** with its universal bending tools.

PRECISION

How to obtain maximum precision?

The sheet metal is centered only once at the start of the process, along the notches and against controlled reference stops: this minimizes both the cycle time and any potential precision errors. The Bending Formula automatically optimizes the bending parameters to reduce waste, while the MAC3.0 system detects and compensates any variability in the material in real time to guarantee precise, high-quality bends.

ADAPTIVITY

How to make production independent of changes in material?

MAC3.0 is the set of integrated technologies – sensors, formulas and algorithms – that make the panel bender intelligent: it eliminates waste and reduces corrections, measuring in-cycle and automatically compensating any variability in the material being machined.

How to make production independent of external variations?

P4 integrates advanced sensors that precisely measure the actual thickness and effective size of the blank, also detecting any deformations caused by variations in temperature. The data are fed in real time into the Bending Formula, which calculates the correct force to apply to the sheet metal, guaranteeing the precision, repeatability and quality of the finished product.

P4 is the ideal bending solution for flexible line or cell production.

How to adapt the panel bender to different production needs?

In addition to the automatic blankholder, the P4 offers a range of options to guarantee maximum versatility and adaptability, to suit any production strategy or mix.

How to make the process reactive to changes in the production lists?

P4 can be equipped with the proprietary OPS software that enables communication between the panel bender and the factory ERP. Depending on needs, OPS manages the production of sequences composed of different parts. The universal bending tools, automatic set-up in-cycle and fully automated handling respond in real time to any variations in the production list.

PRODUCTIVITY

How to combine productivity and flexibility?
Conventional bending is characterized by an average OEE of 30%, with flexibility dependent on the tool change system - which is often costly and more time consuming than on a panel bender - or on the installation of more than one press brake. The P4 panel bender, on the other hand, natively combines productivity, with its automatic bending and handling cycles, and flexibility, with its universal bending tools. And with its advanced cycles, the P4 completes an average of 17 bends per minute.

How long does re-tooling take?
The P4 panel bender doesn't need re-tooling: the upper and lower blades, the counterblade and the blankholder are universal tools that are able to process the whole range of thicknesses and machinable materials.

What is the best configuration?
With its 15 models available, Salvagnini offers the widest range of panel benders on the market today. Each of these models can be configured and customized with many options, to respond to many different production needs. Following an in-depth feasibility study, Salvagnini accompanies each customer in the choice of the most suitable panel bender, according to variables including production strategies, field of application, level of automation required for loading and unloading the semi-finished parts, any options for achieving full versatility and, if necessary, types of auxiliary products such as cutting and punching.

SUSTAINABILITY

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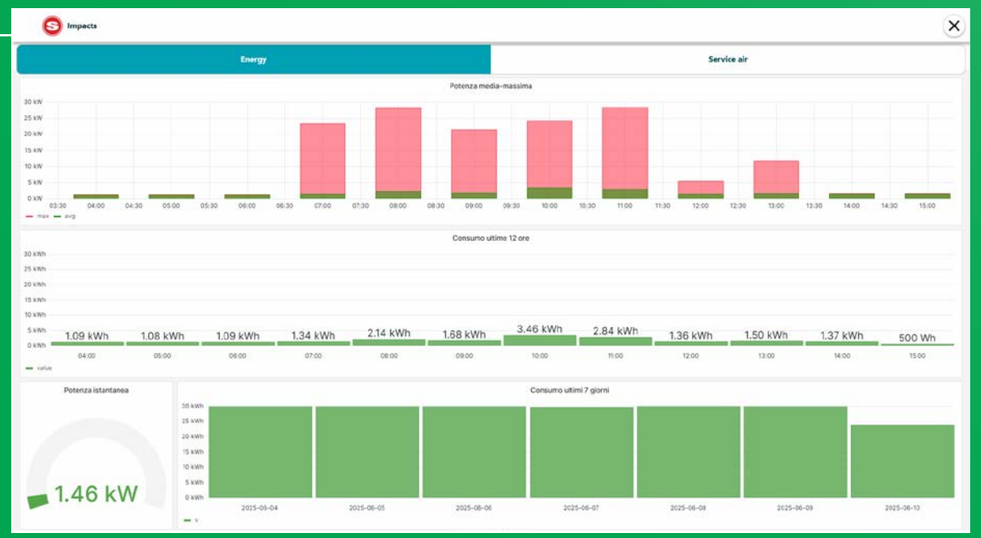
Is the P4 panel bender a sustainable solution?

Salvagnini has always worked to develop solutions with low environmental impacts, guaranteeing maximum operator safety and resource optimization.

Direct drives
The P4 panel bender adopts only electric actuators, thus removing the hydraulics. Bending cylinders are driven by brushless motors, which offers great advantages in terms of the reduced wear and deterioration of components that, unlike in other similar technologies, are no longer subjected to continuous extreme mechanical stress.

Intelligent energy use
The efficiency of the drives and intelligent cycles use the right amount of energy only when needed, without it being dissipated as heat.

Impacts: embrace a more sustainable future and measure the difference every day
Impacts measures the consumption of electricity and compressed air on the panel bender. It is the first step towards calculating volumes of CO_2 equivalent of each single manufactured component. Impacts is used to monitor and become aware of our own consumptions, to optimize and reduce them. It increases profitability, because reducing consumption means reducing running costs.



The panel bender of the future, available today.

Adaptive system
The integrated adaptive technologies (advanced sensors, Bending Formula, MAC3.0) make the system intelligent and able to **automatically adapt** to changes in the material and the external environment, **eliminating waste and corrections,** and extending the range of products that can be made.

Flexible automation
It uses **universal bending tools** which automatically adapt in-cycle to the panel geometry, without machine down times or manual re-tooling, allowing **batch-one or kit productions.**

Connectivity 4.0
The proprietary LINKS and OPS software programs establish communication between the system and the company departments involved in the production flow.

Production versatility
It offers **customized solutions,** including **auxiliary tools** and **additional devices** for special geometries or **different loading/ unloading solutions.**

Sustainable technology
The technical solutions adopted (Direct Drive and pneumatic and electric actuators) allow it to **respect both people and the environment** without reducing its productivity.

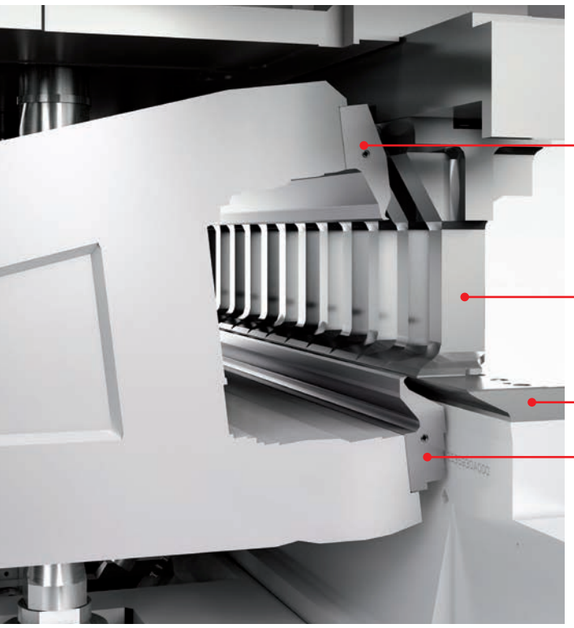
Salvagnini is panel bending, panel bending is Salvagnini.

4,000 installations in over 85 countries, the world's largest panel bender manufacturing plant and over 40 years of experience and competence speak for themselves: Salvagnini is an authority on "panel bending 4.0", a flexible process the likes of which has never been seen before, whose application boundaries are extended to sectors and environments that have always been considered poorly suited to this technology.

The loading/unloading devices available allow each P4 panel bender **to be configured** for working stand-alone or in-line or to be integrated into a flexible manufacturing cell or an automated factory.

Flexible automation.

Upper and lower blade, counterblade and blankholder are the **four universal tools** used to process the whole range of thicknesses and machinable materials, from 0.4 to 3.2 mm, during the cycle and without machine down times or manual re-tooling.



The upper and lower blades (A, D) are the two tools that feature interpolated controlled movement and are responsible for bending.

The automatic **blankholder (B)** works simultaneously with the blades and counterblade to bend and clamp the sheet accurately and effectively. It adapts the tool length according to the size of the part being produced during the cycle, without machine down times or manual re-tooling. The tool profile allows inward bends up to 65 mm.

The **counterblade (C)** helps to clamp the sheet during. the cycle.

Automatic manipulator: fast and accurate.

Quickly and fully automatically, this moves, handles, grips and rotates the sheet metal throughout the whole machining cycle. **It requires no manual interventions during the cycle.**

Operating mode: simple, quick and lean.

The bending on each side of the sheet is achieved thanks to the **controlled interpolated blade movements.**

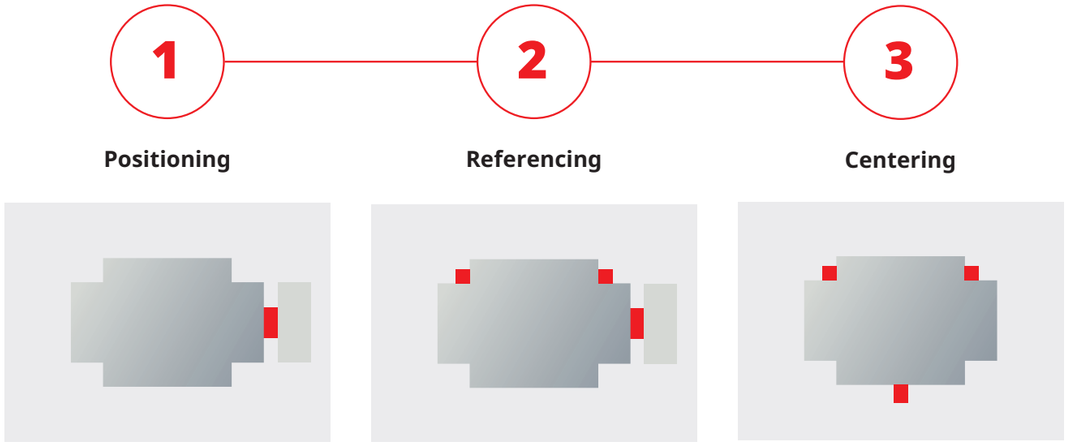
Downward bend
NEGATIVE

Upward bend
POSITIVE

Safe-edge bend
WITH BLADE

Adaptive system.

One single and controlled centering process
The sheet metal is centered, just once at the start of the process, against controlled mechanical stops: the cycle time is minimized and any precision errors are all absorbed by the first bend. The mechanical stops are a further guarantee of finished panels of the correct size, every time.



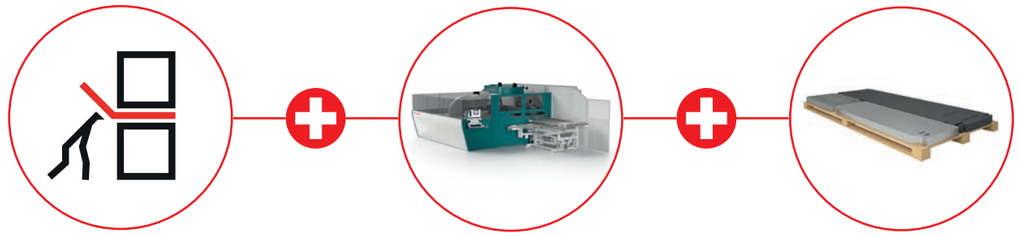
Proprietary bending formula

Developed over the years, the **Bending Formula** defines the force and manages the movements of the universal tools, analyzing different parameters in real time, including deflections, temperature and thickness, guaranteeing the precision, repeatability and quality of the finished product.

MAC3.0

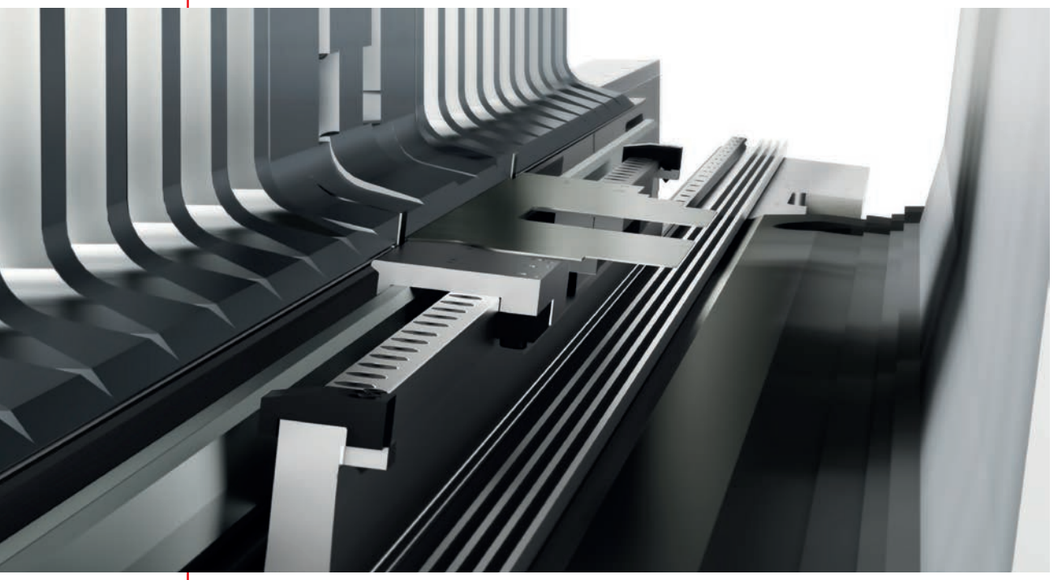
MAC3.0 detects any differences in the mechanical characteristics of the material compared to their nominal value during the cycle, adapting the movements of the bending unit and the manipulator to compensate them.
Compensation is automatic if the ratio between the bending force required for the material actually being processed and that required for the material expected (Kσ) is between 0.75 and 1.25. In this case, the panel bender guarantees a constant bending angle and the correct dimension of flanges and boxes.
If Kσ exceeds this range but not the maximum value (2), the operator can quickly extend the field of application of MAC3.0 by defining a new material.

For values beyond the maximum threshold (2), the bending process is interrupted automatically.
A digital indicator integrated in FACE monitors the situation in real time, informing the operator of the actual characteristics of the material being machined.



Custom solutions to widen versatility.

- **T/P tools:** auxiliary tools that can be engaged and disengaged beneath the blankholder, rapidly and automatically, to handle narrow panels or make tubular, hidden or radius bends or bends with intrusive embossings.
- **CUT tools:** specific T/P tool, consisting of a cutting blade that overlaps the lower bending blade and an evacuation device for automatic and sequential cutting of profiles with different lengths, materials and thicknesses, starting from a single sheet; it makes separation cuts after each free bending sequence.
- **CLA tools:** auxiliary blades, modular in length, available in both positive and negative versions, for making upward or downward tabs. They engage and disengage between the sheet metal and the blades, quickly and automatically, to make bends that are shorter than the whole sheet length. Auxiliary blades can be set up manually or automatically, with the CLA/SIM option, which composes sequences of different lengths in masked time.
- **AQC - Angle Quality Control:** automatic integrated system that measures and corrects the bending angle, even with tight bends, thus reducing the cycle time. Complementary to MAC3.0, it is ideal for sectors demanding high quality, such as the automotive or aerospace industries, or for lines with subsequent automated processes.



Made-to-measure modularity.

Loading devices

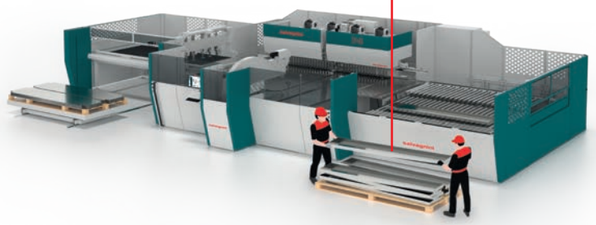
P4 can be fed **manually or automatically,** picking the sheets up from one or more sheet metal packs and feeding the machine in masked time. Even with production solutions that work in-line, the results are balanced and optimized for all the intermediate stations.

Unloading devices

P4 can also be equipped with different unloading devices, **manual or robotized.**

Manual unloading

the bent part is handled and picked up by an operator.



Robotized unloading with palletization

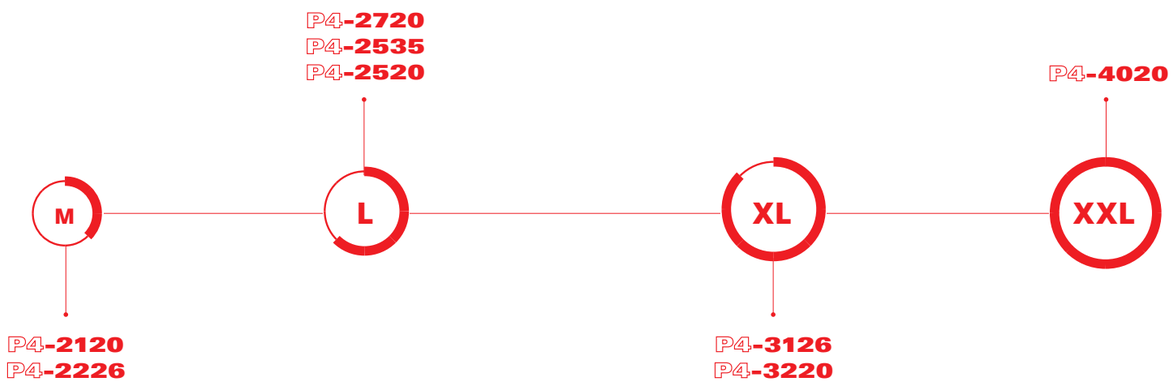
the parts produced are handled by a robot

Choose the model that best suits your needs

Salvagnini offers 8 different P4 models, which bend up to **4000 mm in length and 350 mm in height,** responding to all production needs and maximizing use of the panel bender.

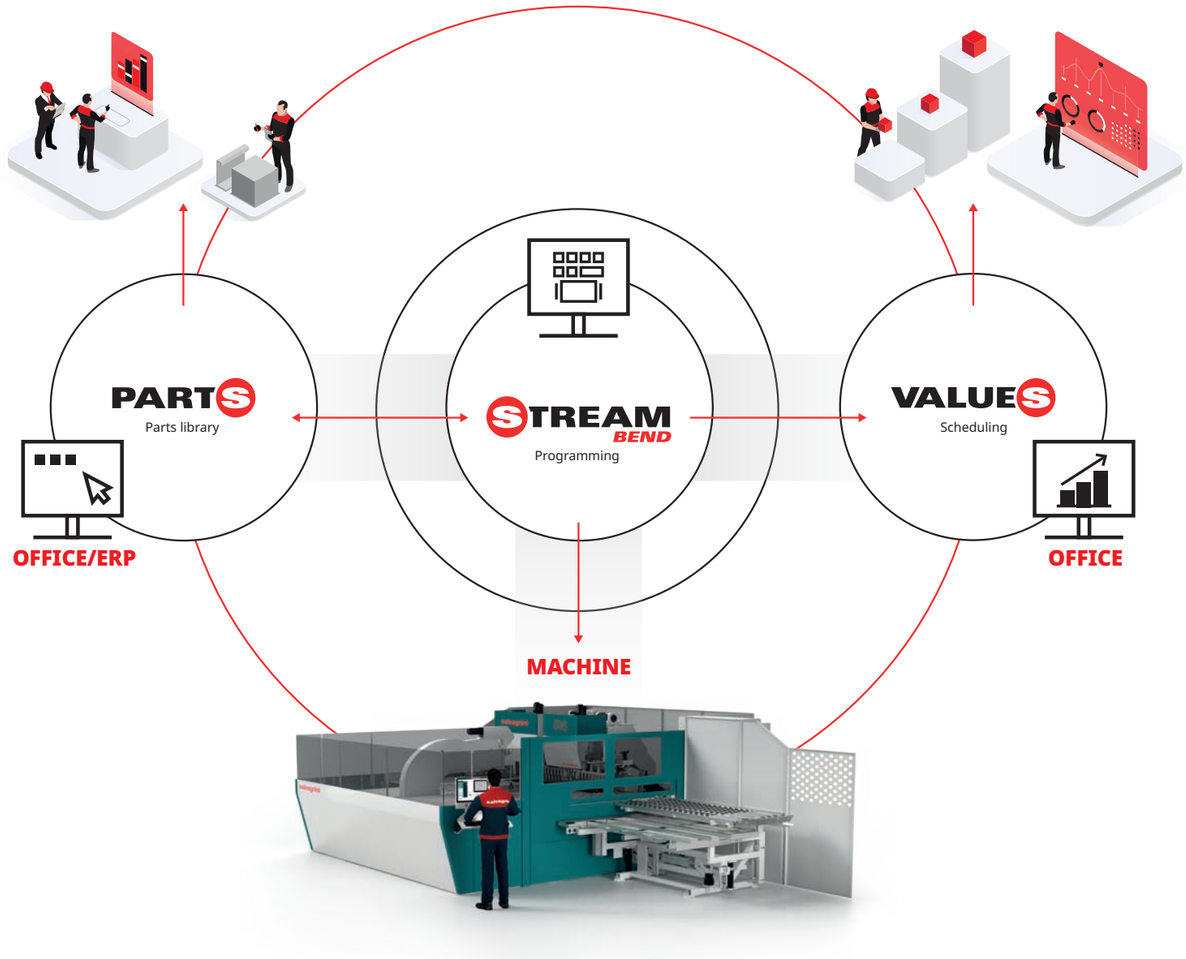
Technical specifications	P4-2120	P4-2226	P4-2520	P4-2535	P4-2720	P4-3126	P4-3220	P4-4020		
Maximum length of incoming sheet (mm)	2495	2815	3050	3495	3050	3495	3850	4000		
Maximum width of incoming sheet (mm)	1524	1524	1524	1524	1524	1524	1524	1524		
Maximum diagonal that can be rotated (mm)	2500	2820	3200	3500	3200	3500	4000	4280		
Maximum bending force (kN)	330	590	660	660	660	625	660	660		
Maximum sheet bending force (kN)	530	635	1060	1060	1060	825	1060	1060		
Maximum bending length (mm)	2180	2200	2500	2500	2750	3100	3200	400-3200	3200-3850	3850-4000
Maximum bending height (mm)	203	260	203	350	203	260	203	203	203	203
Minimum thickness (mm)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4		
Maximum thickness and bending angle steel, UTS 410 N/mm² (mm)	3.2 (±90°) 2.5 (±120°) 2.1 (±135°)	3.2 (±90°) 2.5 (±130°) 2.1 (±135°)	3.2 (±90°) 2.5 (±130°) 2.1 (±135°)	2.5 (±90°) 2.1 (±135°)	3.2 (±90°) 2.5 (±130°) 2.1 (±135°)	3.2 (±90°) 2.5 (±130°) 2.1 (±135°)	3.2 (±90°) 2.5 (±130°) 2.1 (±135°)	3.2 (±90°) 2.5 (±130°) 2.1 (±135°)	2.5 (±125°) 2.1 (±130°) 1.6 (±135°)	1.6 (±130°)
Maximum thickness and bending angle stainless steel, UTS 660 N/mm² (mm)	2.5 (±90°) 2.1 (±120°) 1.6 (±130°)	2.5 (±90°) 2.1 (±125°) 1.6 (±135°)	2.5 (±90°) 2.1 (±125°) 1.6 (±135°)	2.1 (±90°) 1.6 (±130°)	2.5 (±90°) 2.1 (±125°) 1.6 (±135°)	2.5 (±90°) 2.1 (±125°) 1.6 (±135°)	2.5 (±90°) 2.1 (±125°) 1.6 (±135°)	2.5 (±90°) 2.1 (±125°) 1.6 (±135°)	2.5 (±90°) 2.1 (±120°) 1.6 (±135°)	1.3 (±120°)
Maximum thickness and bending angle aluminium, UTS 265 N/mm² (mm)	4.0 (±120°) 3.5 (±130°)	4.0 (±120°) 3.5 (±130°) 3.0 (±135°)	4.0 (±120°) 3.5 (±130°) 3.0 (±135°)	3.2 (±120°) 2.5 (±130°)	4.0 (±120°) 3.5 (±130°) 3.0 (±135°)	4.0 (±120°) 3.5 (±130°) 3.0 (±135°)	4.0 (±120°) 3.5 (±130°) 3.0 (±135°)	4.0 (±120°) 3.5 (±130°) 3.0 (±135°)	4.0 (±120°) 3.5 (±130°) 3.0 (±135°)	2.5 (±125°)

The values refer to a standard machine. Salvagnini reserves the right to modify this data without warning.

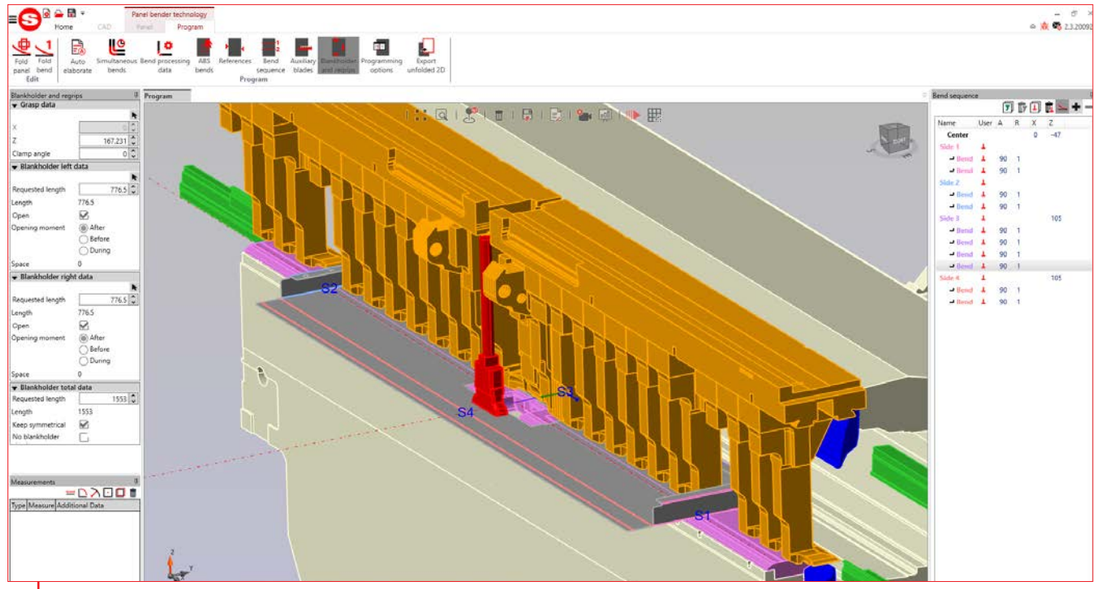


The software ecosystem.

STREAM is Salvagnini's answer to the modern industrial context, a programming suite that improves reactivity and reduces costs, operating errors and process inefficiencies.



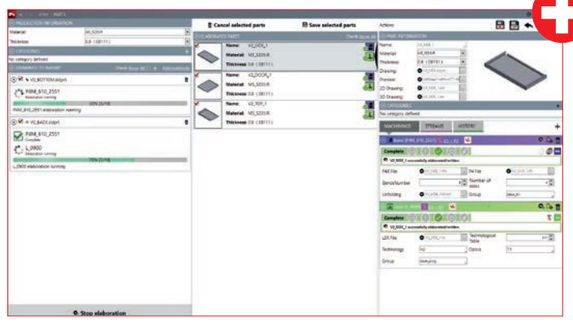
It is an integrated environment for **managing all activities in the office and on the factory floor;** it constitutes a **single point of access for all technologies,** from cutting to bending; it is capable of meeting all planning, programming, production, management, control and optimization needs throughout the production process. STREAM can also be used to **calculate costs,** including those for upstream and downstream processes where necessary.



STREAMBEND

STREAMBEND is the software for developing panel bending programs, including multiple parts:

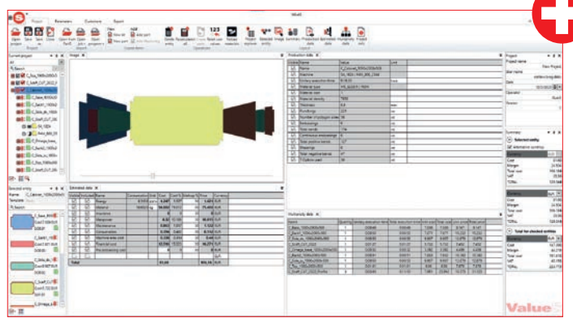
- **Automatic mode:** it develops programs independently, starting from a 3D model.
- **Interactive mode:** it is used for generation/editing/completion operations.
- **Simulator:** virtually assesses the results obtained on the machine.



PARTS

PARTS is the software used to manage the whole database of products and parts:

- it is the point of access of all programming activities;
- it is fully integrated with all STREAM software;
- it defines the production flows for each part to be machined;
- it classifies the elements according to common or customized categories.



VALUES

VALUES is the software which provides an accurate estimation of production costs.
It allows calculation not only on the basis of the individual technology, but also over the entire process, including upstream and downstream machining where necessary.

Coordinate your factory with OPS in real time.

The adoption of evolved digital technologies makes it possible to implement and manage complex, integrated, highly automated high-performance systems. It can help develop simple solutions that require no structural changes to the production layout, making the world of smart manufacturing much more accessible.

In the production equation, **OPS,** the **modular Salvagnini process software,** acts as a central coordinator, managing and distributing information among all the environments to make the process truly efficient.

OPS receives the production list from the factory ERP/MRP in **real time** and supports the programming activities.

OPS defines **rules and algorithms** for automating the process, **adding intelligence to the system:** it can set constraints for the part production sequence and the composition of the kits to produce, guaranteeing greater process efficiency.

OPS can make **independent decisions,** according to a production logic – or according to a mix of multiple production logics. It is used to exchange information between different technologies, such as the components of an FSJ cell (Flexible Smart Job shop).

- **It organizes production,** defining priorities, managing any order changes or cancellations and checks the availability of the semi-finished parts needed for production;
- **It automatically produces the production lists by** grouping parts according to order, job and production sequence;
- **It provides feedback to the factory ERP/MRP,** updating the state of production in real time, part by part.

The OPS Shop Floor Control module integrates solutions for labeling and traceability downstream of the bending process, supporting operators in the logistics management of parts.

The software permits displaying on an intuitive interface touch monitor, or printing on a label, the information about the part, such as the production code, job code, or next work station. A bar code can also be placed on the label to automatically call up the program for the next job.

OPS Shop Floor Control also provides feedback to the factory ERP/MRP, marking a picked part as completed and updating the production list. It is simple technology that helps to reduce sorting times of the parts produced, avoiding identification errors, reducing process costs and increasing production reactivity.

Transforming values into value.

A modular solution developed on 3 service levels, designed respectively for:

Act
managing day-to-day needs

Plan
offering preventive maintenance and planning services

Grow
maximizing system use and performance

Proximity, reliability and orientation to the future are the values that have always been found in the wide range of services available for responding to contemporary challenges.

LINKS

LINKS (ACT) is the IoT solution that improves the overall effectiveness of Salvagnini systems, using the latest business intelligence technologies. LINKS is used to monitor the machine performance and access the production data, logbooks, performance KPIs, telemetry and parameter monitoring, through the Condition Monitoring process.

SupportYou

SupportYou (ACT) is a subscription-based service that manages updates and provides support for using and programming STREAM and all the applications in the office station.

Close2You

Close2You Report (PLAN) uses LINKS data to offer an overview of the state of health of a system, suggesting the required maintenance interventions according to their criticality and proposing agreed interventions to minimize the risk of malfunctions.

Rethinks

Rethinks (GROW) is the ideal solution for anyone wishing to optimize their production process and improve quality and efficiency, reducing the number of work steps, material usage and costs.

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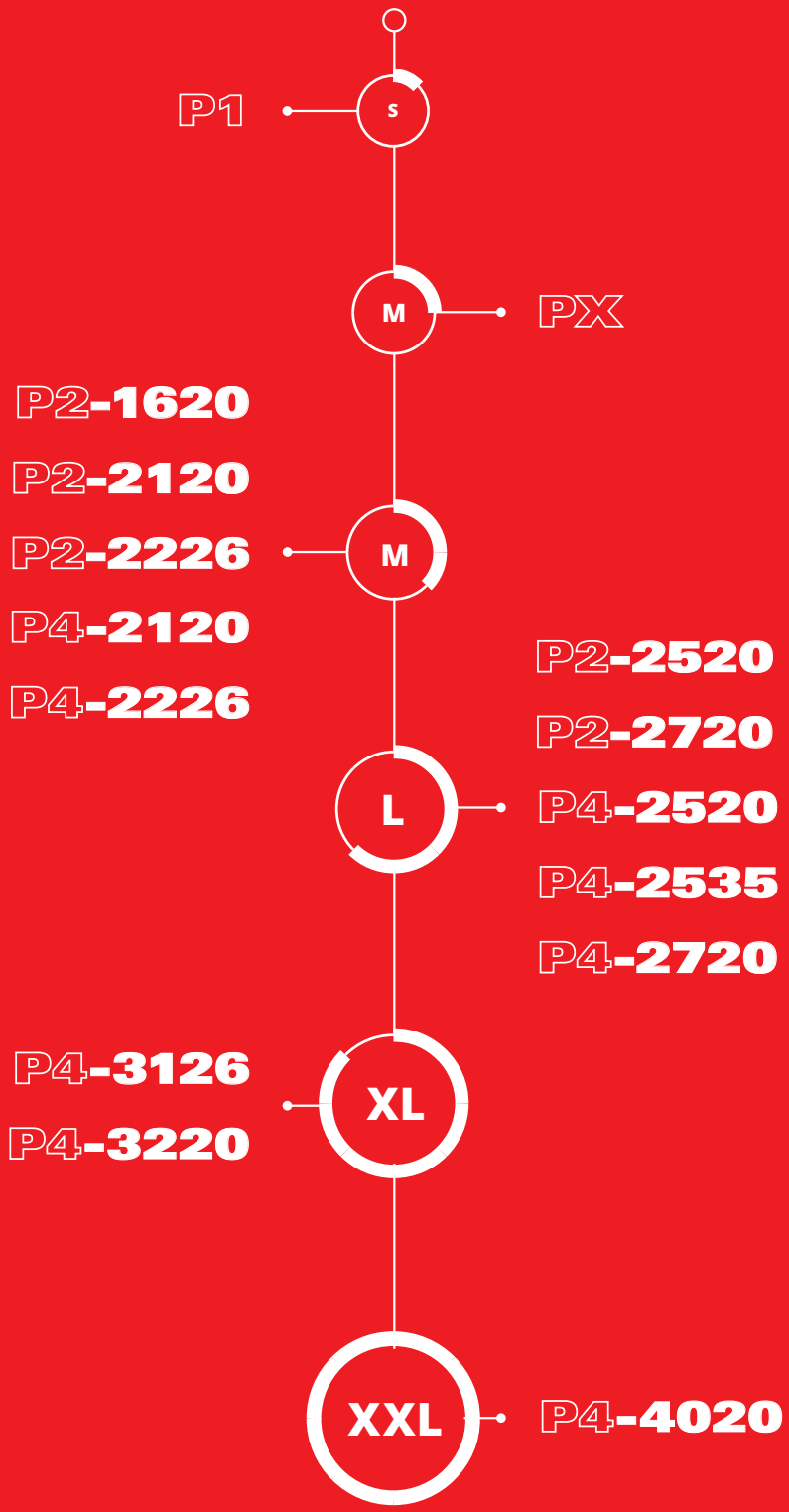

Salvagnini Italia S.p.A.

Via Guido Salvagnini, 51
36040 Sarego Vicenza
T 0444 72 51 11