P4Xe: the automatic hybrid adaptive panel bender. The perfect balance between consumption, productivity, flexibility and automation.
P4Xe: the automatic hybrid adaptive panel bender. The perfect balance.

The values of the P4Xe: lean process and flexible automation.

With process improvement as its guiding principle, the P4Xe automatic panel bender is an excellent tool for creating a production facility that is automatic, flexible and lean.

Rapid return on your investment thanks to technological firsts and intelligent innovations.

The P4Xe panel bender provides a fast and effective return on investment thanks to its reduced scrap (ABT technology), to the high quality of the bent parts (proprietary control and software), to the reliability of the product and process (digital communications protocols) and to its productive flexibility combined with a high level of automation.

Reduced environmental impact.

Over the years the P4Xe panel bender has been subject to substantial and significant changes to improve both its performance and its environmental impact. All the recent design criteria have targeted solutions that maximize energy efficiency and reduce environmental impact: the mean electrical consumption in cycle has been reduced to 75% (it does not exceed 11 kW in model P4Xe-2116 for example) and the use of electrical actuators has been maximized in the handling, gripping, centering and pick-up devices, i.e. in all those operations that do not require any special power.
Automation, Flexibility and Reliability: the pluses of the manipulator.

Controlled handling.

The blank is moved, gripped and rotated by the manipulator [1], clamp [2] and rotator [3], respectively. Sheet handling throughout the entire processing cycle is both fast and totally automatic.

In the P4Xe the manipulator, clamp and rotator have been redesigned completely in order to maximize the machine’s versatility: clamp descent on the P4Xe is controlled digitally, reducing cycle times and increasing productivity. The innovative structure and new digital drives that control latest-generation electric motors mean that sheet gripping and rotation remain precise and accurate throughout the entire life cycle of the Panel Bender. The continuous rotator assures an angular resolution of 0.01° for more flexible production - even with polygonal panels.
Intelligent gripping and centering.

The worktable unit is composed of a feeder pincer \[1\], reference system \[2\] and work surfaces \[3\]. Its role is to transport the blank onto the worktable, stop it, center it and support it so the manipulator can get a perfect grip on it.

The feeder pincer picks up the blank, and sensors automatically verify the material to determine if it is of the correct thickness and type, before bending can begin. Once verified, the carriage positions the sheet against mechanical stops.

Controlled references are positioned on the notches and a series of pneumatic pushers presses the sheet against them. In this way, the dimensions of the base of the finished panel will always be correct, as any dimensional errors on the blank are recovered in the first bend.

The advantage of the Salvagnini centering system.

The sheet centering principle on Salvagnini’s Panel Benders represents a considerable advantage over similar technologies because the blank is centered only once, at the beginning of the machining cycle.

On the P4Xe, feeding and the centering cycle take place in masked time, thanks to the flying pincer carriage which, once it has positioned the blank, returns to its rest position while the centering cycle takes place.
Mode of operation: maximum accuracy and no time wasting.

- Pick-up
- Positioning
- Centering
- Bending
A single tool and zero set-up time for maximum productivity.

The press: the heart of the machine.

The press is the functional heart of the Salvagnini P4Xe Panel Bender. It is composed of:

- a solid structure on which the blankholder tool is installed.
- the bending unit (bladeholder) a C-shaped structure that holds the upper and lower blades as well as any optional tools (CLA, CUT);
- the counterblade, which is joined to the press and works with the blankholder to firmly grip the blank while the blades are bending it.
The blankholder: a single solution for all production requirements.

In Salvagnini’s Panel Benders, the blankholder changes its configuration according to the dimensions of the panel being bent. There is no need to change tools when production specifications change. The blankholder tool generally consists of a central segment which allows it to expand or contract (when creating a new set-up or disengaging the blankholder), and a given number of segments placed along the longitudinal axis, to achieve the specified part length. The blankholder can be composed – either manually or automatically – in 5 mm/0.19” steps, from the minimum to the maximum length. Its function is to clamp the blank so as to provide high-quality bending and to disengage it so that bending is as rapid as possible. The central section is shaped to give the manipulator as much space as possible to advance.

Manual blankholder set-up (MLA).

The manual version, referred to as MLA (Manual Length Adjustment), allows fast and ergonomic set-up by inserting/removing a number of light, modular segments and moving the end segments along the supports.

Automatic blankholder set-up.

The automatic, instant composition version is known as ABA (Automatic Blankholder Adjustment) and is fitted on all P4Xe-***16 model machines. A programmable blankholder for automatic set-up, the U1, is installed on the P4X-2725 model where, like the ABA, it performs tool changes in masked time. With ABA, blankholder tool composition takes place in masked time and in-cycle set-up adjustment requires zero time.
Mode of operation: fast, easy and lean.

The blank 1 is moved on a horizontal plane by the manipulator 2. A rotator fitted on the manipulator quickly and accurately places the side to be bent in front of the press. The blankholder 3 holds the blank firmly in position. The bending unit 4 and its blades can thus make any number of bends, up 5 or down 6, in rapid succession.

Down bend, negative

Up bend, positive

Safe edge (flattened with blade)
Blades and tools: beyond the bend and the panel.

Maximum versatility.

The particularly refined cycle and the optimized universal bending tool of the P4Xe have made it possible to further increase the range of panels that can be produced with a single bending tool.

Tools for special applications.

Sometimes for special production needs, such as some tubular bends, or panels with complex bending profiles, it is industrially necessary to use special tools such as the T or P and CLA options. The T (P4X-2725) or P (P4Xe**16) option is a mechanism that can insert and remove an auxiliary tool under the blankholder quickly and automatically. The CLA tools are modular in length, engaging and disengaging quickly and automatically between the blank and the bending blades. They are used to make bends that are shorter than the side being bent. The CLA blades can be positive (for making upward bends) or negative (for making downward ones).

The Salvagnini CUT option: extremely accurate profiles.

The CUT option is used to obtain a number of different profiles or narrow panels from a single sheet. This is accomplished by making separation cuts after each of the sequences of bends that give the profile its shape. In this way, the CUT option is used to create profiles that, because of their dimensions, would otherwise be difficult to produce on a bending machine. The CUT option functions by using a cutting reference created by a T/P tool [1] in the shape of a plate, and a cutting blade [2] placed over the lower bending blade.

Detail of CLA blade

Example of CLA bend

CUT option

Part produced using the CUT option
The great advantages of the hybrid panel bender: no waste for real lean production with respect for the environment.

Centering on notches.
The reference stops for incoming sheets are positioned on the notches. The dimensions of the finished panel will always be correct, since any dimensional errors on the sheet are recovered in the first bend on the side.

Automatic crowning.
On request, the panel bender can be equipped with an automatic crowning system which guarantees extremely high bend quality even in limited applications.

Adaptive technology.
The P4Xe automatically compensates for all the deflections which occur during the cycle, thanks to the recent and sophisticated improvements in the bladeholder.

Reduced environmental impact.
Over the years the P4Xe panel bender has been subject to substantial and significant changes to improve both its performance and its environmental impact. For example, the mean electrical consumption for the P4Xe-2116 does not exceed 11 kW.

Rapid return on the investment.
The P4Xe always guarantees an effective return on your investment thanks to its low processing waste (ABT technology), to the high quality of the bent parts (proprietary control and software), to the reliability of the product and process (digital communications protocols) and to its productive flexibility combined with a high level of automation.

Kit production
The P4 Panel Bender, either in a stand-alone version or in-line with an S4 punch/shear, makes kit assembly production possible, thanks to Salvagnini’s universal bending tools, zero set-up time and unmanned operation.
No set-up adjustment.  

The ABA blankholder is composed automatically and instantaneously. The bending blades are universal, because it is the blankholder that automatically adjusts its size to move and grip the panel and make the different bends.

Unmanned operation.  

The system can work totally autonomously, minimizing operator handling, times and costs.

Heat compensation.  

Heat-sensitive parts of the machine are equipped with temperature sensors and compensation controls to ensure that the performance of the P4Xe remains constant.

Minimum tool wear.  

The simulations and the FEM analyses of the latest generation have made it possible to carry out in-depth studies of the dilations, stresses and deformations of the structure and therefore optimize the tools and their operation.

The state of the art in bending.  

The first Salvagnini P4 Panel Bender was built in 1977. Until then, panels had been bent on dedicated automatic lines or on manual press-brakes. With the advent of the Salvagnini Panel Bender, panel production, for the first time, became totally automatic.

Rolling mode.  

In the P4Xe, bending is managed by an algorithm that combines the interpolated movement of the blade with it rolling on the sheet.
Unlimited logistical efficiency.

Salvagnini offers extremely flexible systems that are suitable for all production requirements and capable of significantly reducing production and running costs, while satisfying the latest fabrication trends and the most competitive production strategies. Thanks to the wide range of sheet handling devices, the P4Xe Panel Benders can run unmanned and are easily integrated into FMS or AJS systems. The different feeding and unloading connections optimize production flow and eliminate non-productive operations and their associated processing costs, while at the same time assuring excellent product quality and a fast, secure return on investment.

**BASIC Configuration:**
Semi-automatic loading and unloading.

- Lean production
- Kit production

**LEAN Configuration:**
Automatic loading from a table and automatic unloading onto an accumulator.

- Lean production
- Kit production
- Flexible automation

1. HPT Loader/Unloader
2. P4X Panel bender
3. PCD Automatic destacker
4. SAP Unloader/Accumulator
### AUTO Configuration:
Feeding from a store-tower and automatic unloading onto an accumulator.

<table>
<thead>
<tr>
<th>Lean production</th>
<th>Kit production</th>
<th>Flexible automation</th>
<th>Just-in-time production</th>
</tr>
</thead>
</table>

1. MVP Automatic store-tower
2. P4X Panel bender
3. SAP Unloader/Accumulator

### FLEX Configuration:
Automatic feeding from a table and robotic unloading onto an accumulator.

<table>
<thead>
<tr>
<th>Lean production</th>
<th>Kit production</th>
<th>Flexible Automation</th>
<th>Just-in-time production</th>
<th>Unmanned operation</th>
</tr>
</thead>
</table>

1. PCD Automatic destacker
2. RIP Turnover device
3. P4X Panel Bender
4. SAP Unloader/Accumulator
5. SAR Unloading robot
Feeding solutions.

Panel Benders can be fed manually (with HPT) or automatically. The PCD automatic feeder picks sheets up from a pack of blanks and feeds them to the Panel Bender in masked time (i.e. during the machine’s work cycle). The PCD can also be used as a pass-through connection for sheets coming from an S4 punch-shear in the same line. There are also solutions for automatic feeding from compact (MVP) or extended (MV) pack store-towers. The proprietary Pack Modus software assures totally balanced production and manages all the intermediate stations in the optimum manner, allowing the production line to run continuously.

Unloading solutions.

Panel Benders are well suited to being accessorized with manual, automatic or robotic unloading devices.

The most common unloading systems for Panel Benders are:

- Manual: an operator picks the bent part up and moves it as required;
- Automatic: a connection automatically transports the part to the next station for welding, assembly or painting;
- Robotic with palletizing: a robot unloads/palletizes the parts produced.
The Salvagnini P4 family.

Configuration and models.

An extraordinarily high-throughput machine, the Panel Bender is characterized by simple, intuitive programming and agile, precise sheet handling. It can be set up in a variety of ways for different production needs. The various configurations will depend on the user’s preferences in terms of loading/unloading solutions and on the model of machine.

The Salvagnini range of Panel Benders incorporates 5 different models, split into two families, P4Xe and P4X-2725, which together cover countless production requirements: the more compact version that bends up to 2180 mm (85.83”) long; the XXL model that produces panels up to 4 m (157”) long; a machine that makes bends up to 165 mm (6.5”) high; and another capable of making bends up to 254 mm (10”) high on mild steel up to 3.2 mm (11 gage) thick.
The P4Xe and ABT™ technology: an adaptive machine for unparalleled quality, reduced consumption and high productivity.

One of the main difficulties encountered during bending is caused by inconsistent machine behavior when producing parts of different material, quality or thickness. Different batches of material often yield different results (bends more or less closed) and show variations in machine behavior because of changing atmospheric conditions (temperature). Inconsistent behavior affects part quality and requires the product to be continually modified, leading to considerable material waste.

To assure consistent accuracy and to improve machine productivity, Salvagnini has implemented proprietary technology known as ABT™ (Advanced Bending Technology) in its Panel Benders. This is a set of components, formulas, algorithms and devices which are integrated into the Panel Bender in order to provide high performance and reliability. The ABT™ technology has been applied and implemented throughout all machine components - hydraulic, pneumatic, mechanical and electronic. The result is a hybrid adaptive panel bender which makes it possible to achieve unparalleled quality, with low consumption, high throughput and a minimum layout.

The most recent simulation technologies and the FEM analyses on dilation, force and structural distortion have led to component innovations, and to their mode of operation being redesigned, reinforced and modified so as to assure an extremely high degree of product repeatability, quality and reliability.
P4Xe software.

JOB.CONSOLE

JOB.CONSOLE is the set of software packages integrated into the SIX controller to graphically manage and supervise the system.

JOB.CONSOLE provides the operator with all the information he needs to run production, thanks to the following modules:

**Salvagnini Console**
Main system command module that allows user-friendly management by:
- filing and editing production programs directly via the graphical interface;
- making parts of the system perform semiautomatic movements, guided by a self-explanatory graphical interface.

**Maintenance Manager**
Database that analyzes the movements and cycles of the components of the system, allowing simple and structured management of maintenance activities.

**JOBP4Xe**
Software that dynamically programs the day’s production: the operator can create a series of programs called “job” (or list) on the screen. JOBP4Xe allows a series of jobs to be prepared, edited or suspended, without stopping the current production.

**EasyData**
Integrated diagnostic software for interactively browsing the documentation. EasyData provides information about each of the components managed by the Salvagnini controller, using photos, part codes and automatic filters.

The system’s electrical and/or hydraulic diagrams are available in the main command console. The operator can:
- search for specific text or codes in the diagrams;
- add personalized notes or photos to the image archive;
- print one or more diagrams from the documentation or export them in PDF or JPG format.
Salvagnini designs and manufactures state-of-the-art machines that provide workplace safety and environmental respect. Machines that process metal and are made of metal, an eco-friendly material by definition: recyclable, resistant and easy to work. Machines produced within a company that is committed to minimizing energy consumption, handling and disposing of waste correctly and providing complete workplace safety (for which it has been awarded OHSAS 18001 accreditation).

**Salvagnini and the environment.**

Over the years The P4Xe Panel Bender has undergone continuous improvement over the years, not only increasing its efficiency and performance but also reducing its energy consumption by more than 50%. The reduction in energy consumption has been achieved by introducing high-performance components and reducing thermal dispersion on the machine, and through the intensive utilization of electric axes in operations that do not require any special power, such as handling, tightening, centering and gripping. Thanks to the use of high-efficiency components of the latest generation and to the refined software cycles The following important results have been obtained:

- the machine automatically compensates for any deflections during the cycle;
- the automatic setup blankholder and the manipulator are driven by electric actuators.

Considerable attention has also been paid to machine maintenance: this is now even more cost-effective, thanks to the use of original design solutions and commercially available components; the optimization of the parts in the bending unit; and the introduction of the new bending mode.

**Ecologically responsible.**

With maximum respect for the environment in mind, Salvagnini has chosen to use only metal covers for its machines and the main system command console. Salvagnini has also made an important investment to connect the production facility of the P4Xe to an ecologic power plant that provides both thermal and electric energy.
### Technical specifications

<table>
<thead>
<tr>
<th>Machine</th>
<th>P4Xe-2116</th>
<th>P4Xe-2116</th>
<th>P4Xe-2116/3</th>
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<tr>
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