

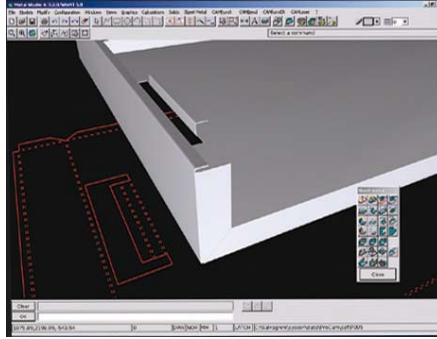


P4 abt®: range of automatic
Panel Benders. More flexible,
more versatile, more productive.

salvagnini

Leading the way in bending

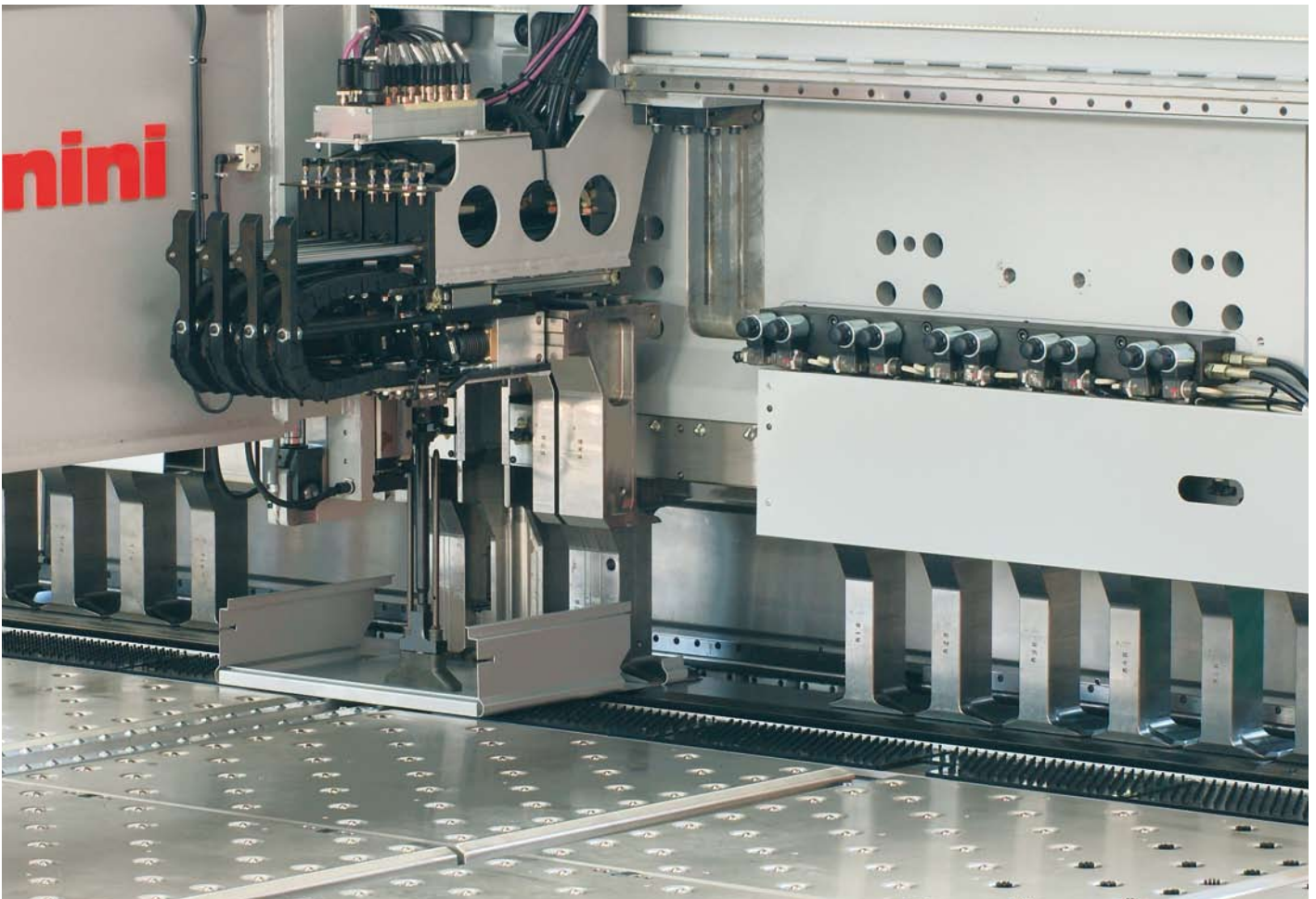
Panel forming is the process by which a specific subset in the universe of sheet metal objects, namely panels, are bent into the required shape. The term panel indicates a sheet metal object featuring a flat face with other faces attached in succession on one, some or all sides of the initial face, commonly referred to as the base face. The seams between the faces identify the bends to be made. The blank can be folded once or more, with any angle, along one or more of its sides. The Panel Bender is a numerically controlled machine tool for cold-forming flat sheets, designed to produce sheet metal panels from punched blanks by means of a complete, automatic, programmable and flexible work cycle. The first Salvagnini P4 Panel Bender was built in 1977 and exhibited at the EMO show in Hannover that year.

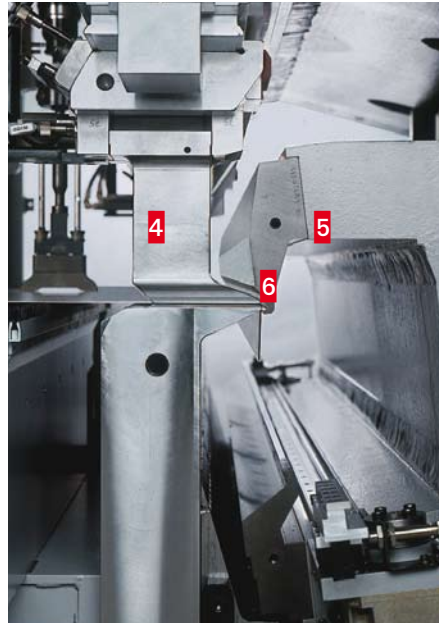
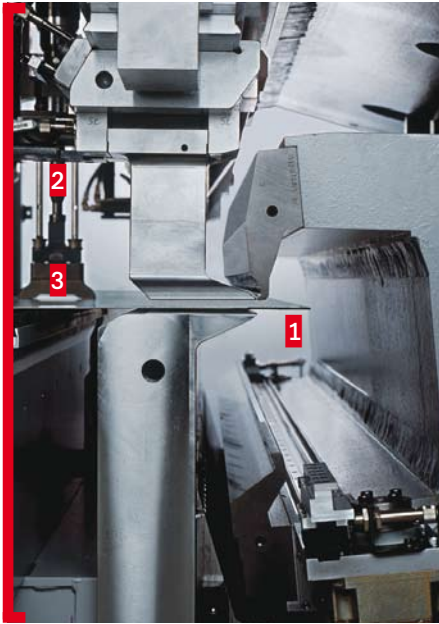


There had never been an automatic programmable machine for producing sheet metal panels until then and panels had been bent rigidly on purpose-built automatic lines or more flexibly on manual press-brakes. Unlike press-brakes, the Panel Bender handles panel production fully automatically, leaving the operator with just the job of loading the blank and removing the finished panel while the machine works on the next panel.

Zero set-up time

The Panel Bender works practically without any tool changes because its bending unit can be seen as a universal tool. The only set-up work required generally consists of composing the blankholder, which usually has to be adapted to the length of the longest side to be bent. This set-up can be performed manually or automatically.





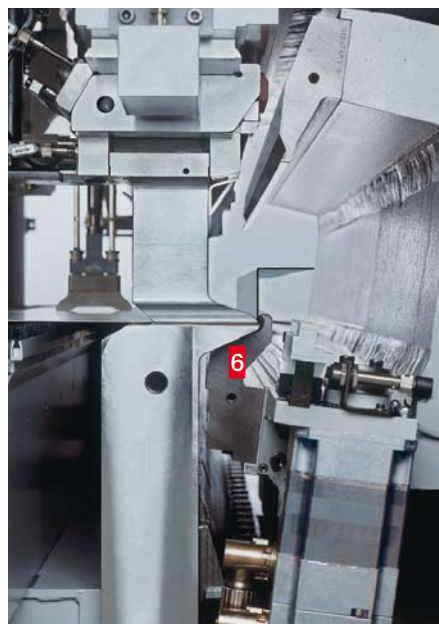
Bending unit and manipulator (operating procedure)

The blank **1** is moved on a horizontal plane by a manipulator **2** that moves across the plane quickly and accurately. A sheet rotator **3** fitted on the manipulator places the side to be bent in front of the press equally quickly and accurately. The blankholder **4** holds the blank firmly, or releases it as quickly as possible. The bending unit **5**, featuring interpolated movement and appropriate blades **6**, can thus make any number of bends, up or down, in rapid succession.

This bending method has the enormous advantage that part of the blank does not move during bending, which makes automating movements of the workpiece that much easier.

Centring on notches

The reference stops for the incoming sheet can be positioned both on the notches and on the edges of the sheet. The dimensions of the finished panel are always correct since any dimensional errors on the sheet are recovered in the first side bend.



Configuration and models

An extraordinarily high-production machine, the P4 is fitted with universal tools. Characterized by simple, intuitive programming and agile, precise sheet handling, the P4 can be set up in different ways to meet the user's production needs. Configurability depends on preferences in terms of

loading/unloading solutions and on the machine model.

The Salvagnini P4 Panel Bender range actually comprises 6 different models, split into two families - P4-**16 and P4-2525 - which together cover countless production requirements: the "more compact" version that bends up

to 1950 mm; the XXL model that produces parts up to 4 m long; the machine that makes bends up to 165 mm high; and the one that can bend panels up to 350 mm high and mild steel up to 3.2 mm thick. The already numerous fields of application are evolving all the time.



Setting up the automatic blankholder

The blankholder is modular, from the minimum to the maximum length, and can be composed in 5 mm steps. In operational terms, it is responsible for clamping the blank, for high-quality bending, for disengaging the sheet and for withdrawing from the bends made as quickly as possible. The central part is shaped to give the manipulator as much room as possible to advance.

The automatic instant composition version, referred to as ABA (Automatic Blankholder Adjustment), is fitted on P4-**16-type machines and is available in various sizes differing in terms of work range.

The P4-2525 model is instead fitted with a programmable, automatically set-up blankholder which, like the ABA, enables tools to be changed in masked time.

Setting up the manual blankholder (MLA)

The manual version, referred to as MLA (Manual Length Adjustment), enables quick, ergonomic tooling by inserting/removing a number of light, modular segments and moving the end segments along the appropriate supports.



Blades and tools: beyond the bend and the panel

Special production needs, or panels of a complex nature, make using special tools an industrial necessity.

Some limitations can be overcome with the T or P and CLA options or with special blades.

The T or P option is a mechanism that can insert and remove an auxiliary tool under the blankholder quickly and automatically. There are tools for radius and tubular bends and for other

requirements.

The CUT option can be used to produce a number of profiles or narrow panels, even all different from each other, starting from a single sheet.

This it does by making separation cuts after each sequence of bends that give the profile its shape. Using the CUT option, therefore, we can create and produce profiles that would otherwise be hard to produce on a Panel Bender

(given their dimensional difficulty).

In terms of operation, the CUT option uses a T/P tool in the shape of a plate and a cutting blade placed over the lower bending blade.

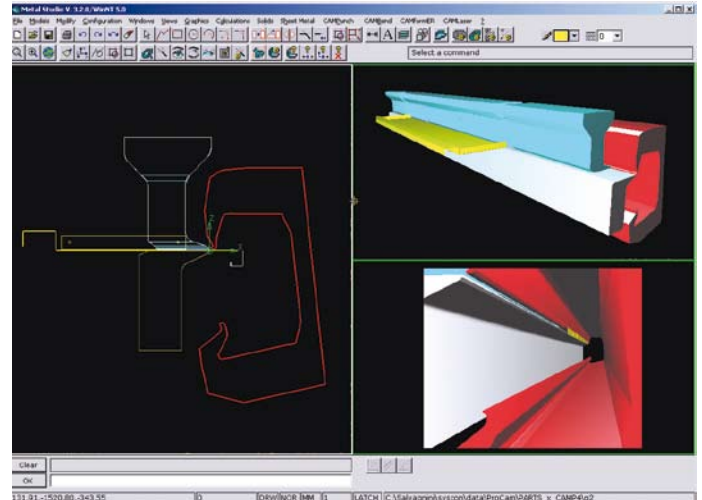
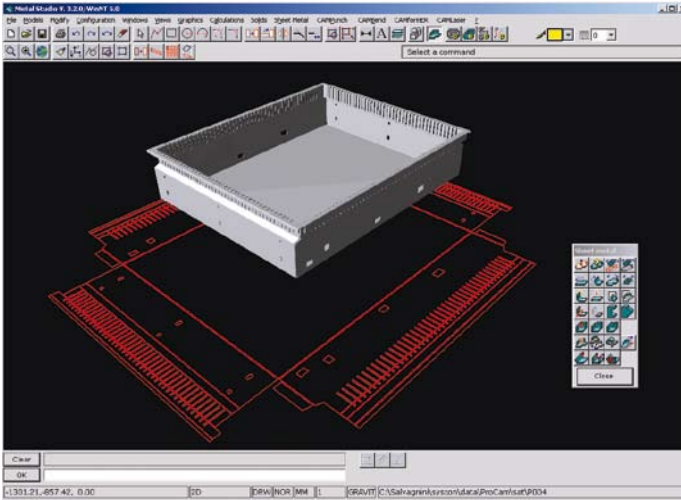


The CLA tools, modular in length, engage and disengage quickly and automatically between the sheet and the bending blades - they are used to make bends that are shorter than the side to be bent. The CLA blades can be positive (to bend sides downwards) or negative (to bend sides upwards), symmetrical or asymmetrical.

Lastly, to flatten bends that have been redefined, a special patented dual-purpose lower blade, LDN, is fitted on the P4.



The powerful programming From idea to finished



METALStudio

Powerful software platform devised to design sheet metal objects, using a solid modeller and user interface specially engineered for the purpose.

It enables 2D/3D drawings to be imported and exported from and to other CAD units. The 2D plan of the solid model can be used to automatically generate punching and laser-cutting programs.

Sheet metal fabrication technologies can be employed to optimal effect since the engineering of the part and its production techniques - such as punching, shearing, laser cutting and bending - can be developed in a single optimized, integrated software environment.

CAMBend

Generates the panel's bending program fully automatically, extracting the data from the solid model drawn or imported with METALStudio.

It uses tools, or tooling set-ups, based on three-dimensional (real) models of the system. It establishes the bending sequence and how each bend is to be made. It determines whether auxiliary tools will be needed.

It determines the composition of the blankholder, the gripping positions and any repositioning required.

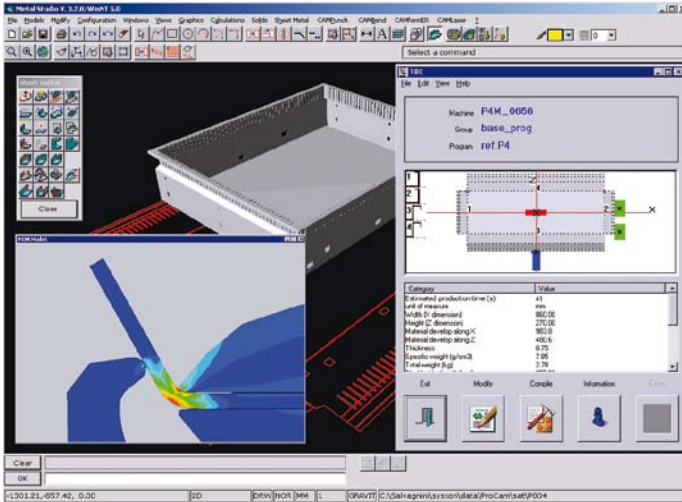
It locates and reports any interference between the panel and machine, and any geometrical ambiguities featured in the panel's drawing.

It can give a three-dimensional graphical representation of the bending cycle generated.

You can select viewpoints and choose between different viewing distances and graphical representation options.

suite.

product at the touch of a button



FORMabt/PDEX

Expert compilers for transforming the P4 program into machine language.

They include an adaptive mathematical model of the behaviour of the blank and the Panel Bender when subjected to bending stress. The mathematical model is the result of thorough and exhaustive experimental and theoretical academic research. The data furnished by the model, which is pre-calculated offline, is corrected in real-time whenever a cycle is carried out, with measurements provided by suitable detection equipment. Salvagnini compilers, with their bending formulas, thus make a decisive contribution to producing bent panels that match the drawing right from the very first part.

STACKER P4

Stacker P4 is an application designed to provide advanced management of loading, unloading and stacking on P4 Panel Benders, with automatic/robotic feeding and/or unloading.

The application is made up of two modules: StateShell and VisualStacker.

StateShell displays the situation in the unloading area as it really is. Using VisualStacker, you can set parameters relating to the feeding and unloading of the finished panel graphically and in an extremely straightforward manner.

The movements of the parts and the trajectories used by the robot are calculated automatically by the software, coming up with the best alternative for the unloading cycle, which can be chosen from numerous options.

The effectiveness of the settings can be checked graphically by cycle simulation.

Integration and modularity: simple, flexible solutions

As a result of its lengthy tradition of integrating sheet metal processing systems, with high-throughput part handling, Salvagnini manages to come up with solutions that are tailored to the customer's needs and geared towards achieving fully autonomous factory logistics.

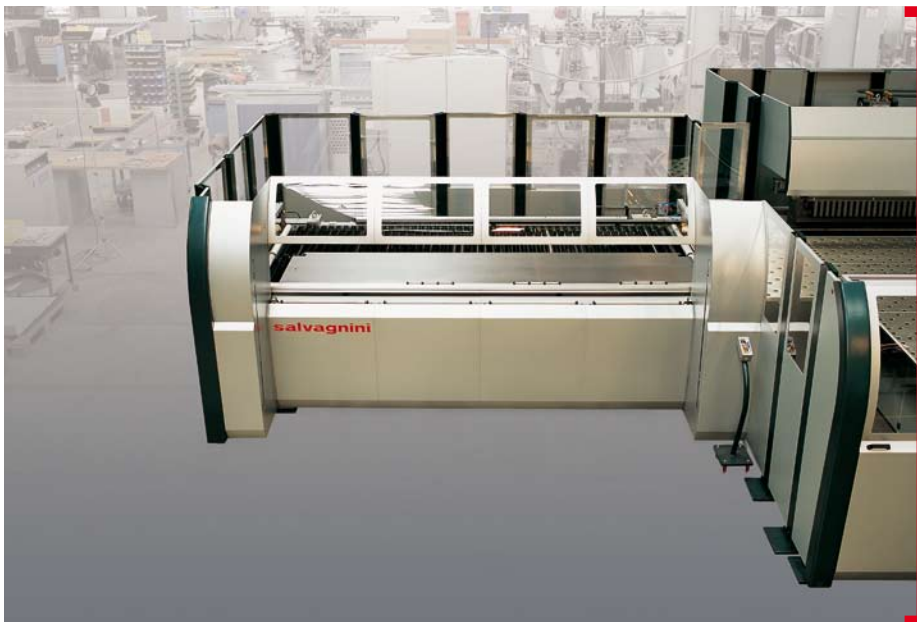
Feeding solutions

There are different types of connections to choose from. An important consideration when choosing between devices is whether you are interested in kit production or batch production. With kit production, which is becoming an increasingly popular option, each workpiece is different from the one before and the one after it, which is why you have to choose a feeding system that can feed from different packs quickly, without any waiting. Depending on the model, a P4 can be



fed manually (with HPT on the P4-**16 models) or automatically. With the automatic feeder incorporating a sheet pick-up device, sheets are taken from a pack of blanks and the Panel Bender is fed in masked time, i.e. during the machine work cycle. A single-sheet sensor detects whether a single sheet has been picked up - if this is not the case, attempts are made to separate the sheets. Sheets of any material and any size compatible with the P4 machine in question can be fed.

The feeder can also be used as a pass-through connection for sheets coming from an S4 punching and shearing machine in the same line. There are also solutions for automatic feeding from tray storage towers of the compact (MVP) or extended (MV) variety.



Kit production

The P4, which can be placed in line with a Salvagnini S4, can be used to produce assembly kits (kit production) instead of production batches, however small. To this end, the activity scheduler, the S4P4 line software package, interfaces with all the possible P4 feeding systems to fully automate production changeover between different batches or repetitive sequences of batches of one.

A new dimension in panels

The first panel

■ Energy savings

Energy consumption can be reduced to as little as 60% by slowing down the production rate for less urgent parts.

■ No set-up adjustment

The ABA (Automatic Blankholder Adjustment) blankholder is composed automatically and instantaneously. The bending blades are universal.

■ Heat compensation

Heat-sensitive parts of the machine have temperature sensors and compensation controls to ensure that the P4 machine's behaviour remains constant over time.

■ Fast radius bends

The bending unit's kinematic movement mechanism, with its special interpolated control, allows high-quality radius bends to be made in no time.

■ Low blade wear

The bending unit's kinematic movement mechanism, with its special interpolated control, allows bends to be made with a single point of contact between the bending blade and the blank. In addition to reduced blade wear, the resulting panels do not have bending marks on their surface.

■ Reverse cycle

This feature is used to perform the bending sequence in reverse: the long sides first, followed by the short sides, without operator intervention.

■ Auxiliary tools

Special radius, tubular and other bends can be made with specific tools and supporting machine options.



Panel bending. Panel is a good one

■ Controlled centring

The dimensional data and thickness of each incoming sheet are measured and compared with the program data.

■ Centring on notches

The reference stops for the incoming sheet can be positioned both on the notches and on the edges of the sheet. The dimensions of the finished panel are always correct since any dimensional errors on the sheet are recovered in the first side bend.

■ Unmanned operation

Versions with automatic loading and unloading can be used for lights-out manufacturing, and text messages regarding machine status are sent remotely to mobiles or landline phones. The production status of the system can be monitored from external computers by means of the Salvagnini remote control software (SARA).

■ Kit production

A system that encapsulates the series of technological solutions achieved to date. An unmanned P4, with no set-up adjustment, with heat compensation and centring control, possibly in line with a Salvagnini S4, makes for economically advantageous production, whether you're looking at producing assembly kits or large production batches

■ Numerical control

The Salvagnini SiX numerical controller is the synthesis of Salvagnini's experience with numerical controllers. It is a proprietary control system that, when integrated with the software part, gives complete control over every moving mechanical part.

■ Programming

Programming is automated if you opt to work with the solid 3D drawing of the finished panel. The METALStudio software suite has been developed specifically around the P4 with this goal in mind. Manual programming is straightforward and intuitive.



Unloading solutions

Panel Benders are machines that are well suited to being accessorized with manual, automatic or robotic unloading devices. Unlike the loading process, unloading bent parts is more complex industrially speaking because the space taken up by the bent panels is considerable and increases at quite a rate (several cubic metres/hour). This is why the most common unloading systems for Panel Benders are:

1] Manual

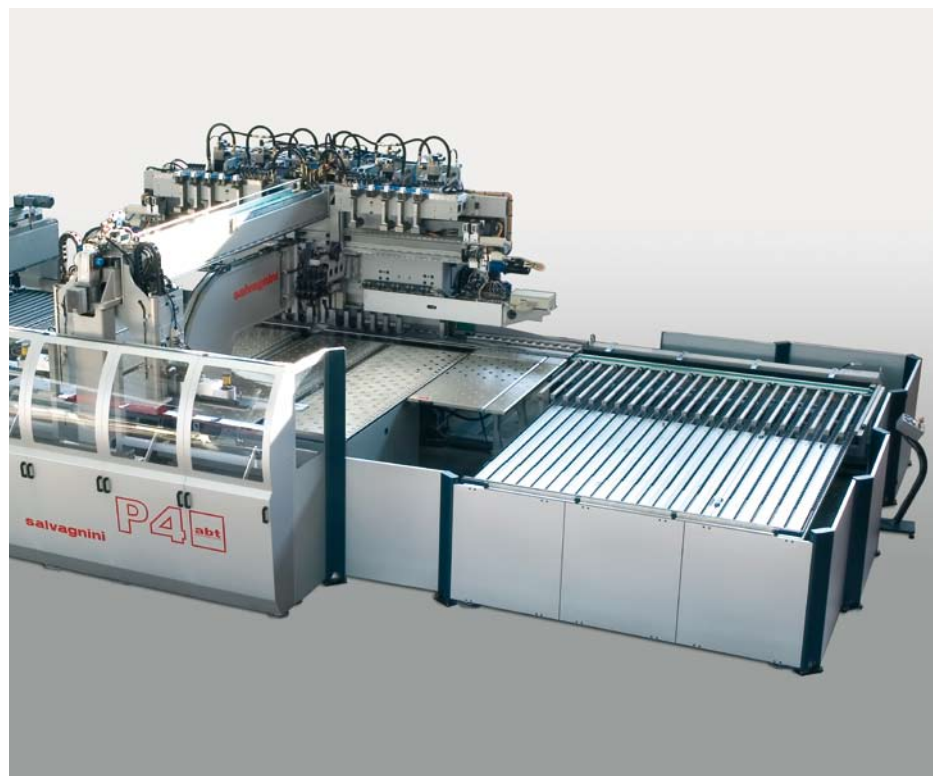
An operator takes the bent part and moves it wherever it has to go.

2] Automatic

A connection takes the part automatically to the next station, which may be a welding, assembly or painting station.

3] Robotic with palletizing

A robot unloads/palletizes the parts produced, which are then transferred manually or automatically to other production areas within the company.



Salvagnini software applications for production management

Salvagnini software applications (OPS, WMS) interface in real-time with ERP (Enterprise Resource Planning) management systems, CAD/CAM applications and the machines in the facility to ensure processes are fully automated and as efficient as can be.

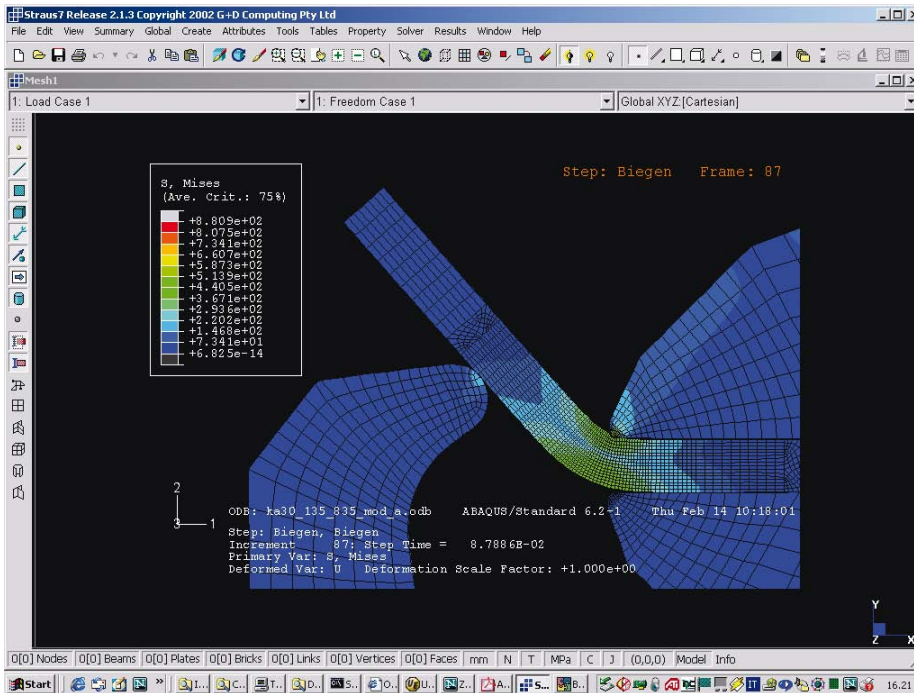
Advanced Bending Technology

One of the main difficulties encountered in bending is linked to the inconsistency of machine behaviour during the production of parts, which often differ in material quality or thickness even within

a single batch. Different results are often encountered (the bend angle varies) within the same batch of sheet metal. Moreover, notable variations in system behaviour can be seen as mechanical

conditions vary, affected by atmospheric agents (summer/winter/temperature). The fickle nature of this behaviour thus invalidates machine performance and, above all, calls for continuous product alterations and a considerable amount of rejected material.

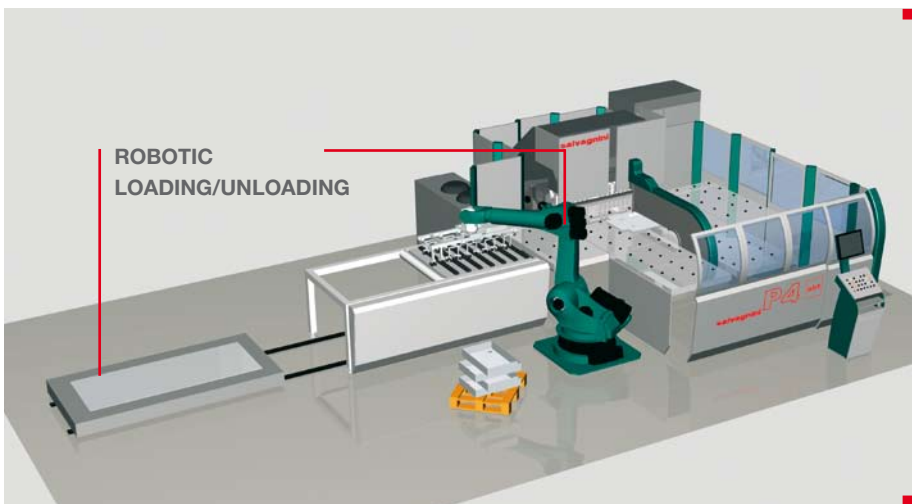
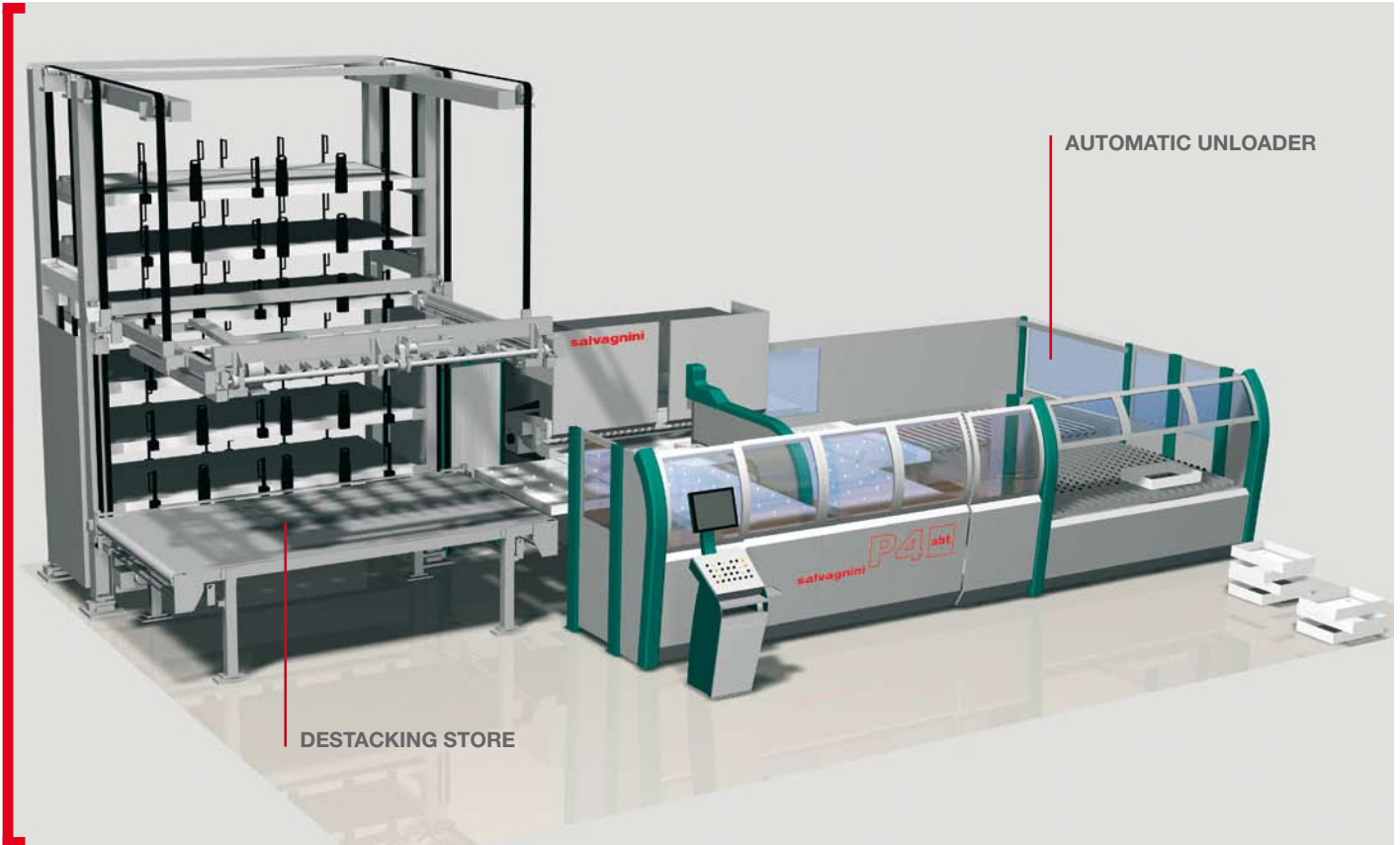
To get round the problem, Salvagnini has implemented abt (Advanced Bending Technology) in its Panel Benders. This proprietary technology is basically a set of components, formulas, algorithms and devices that are integrated inside the Panel Bender to make the machine reliable and boost performance, thus producing parts with accuracy that remains constant over time. Automatic compensation of thermal expansion and quality control of incoming material mean the P4 can automatically adapt to each production cycle, with the result that the first panel is a good one.



Sixth sense

Sixth sense, which is part of the group of innovations collectively called abt, is the latest and most revolutionary breakthrough in bending, by virtue of which the Panel Bender can detect the type of material being processed. The machine controller actually detects the type of material being fed and warns the operator if it does not match the type expected. If the operator confirms he wants to proceed anyway, the machine program is automatically regenerated/adapted to the properties of the material actually being fed, thus producing perfect, reproducible quality even in batch one production.

**6TH
S**
sixth sense



Simple and flexible automatic solutions

As a result of its consolidated tradition of integrating sheet metal processing machines, combined with its in-depth knowledge of mechanical, electrical, electronic and software engineering, Salvagnini manages to provide excellence in material handling and management for fully autonomous factory logistics.

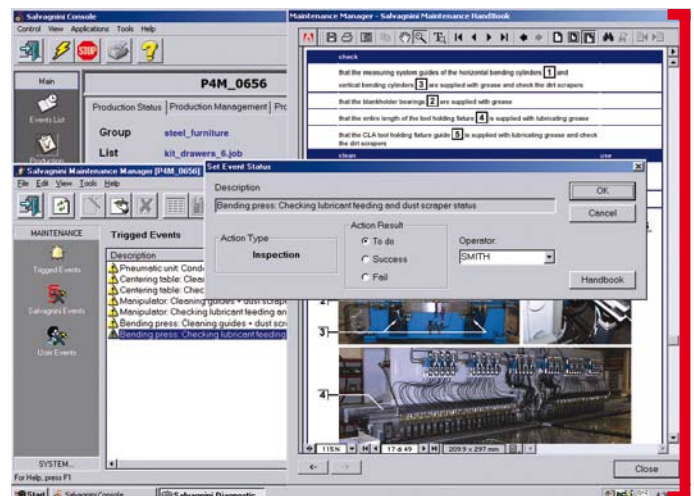
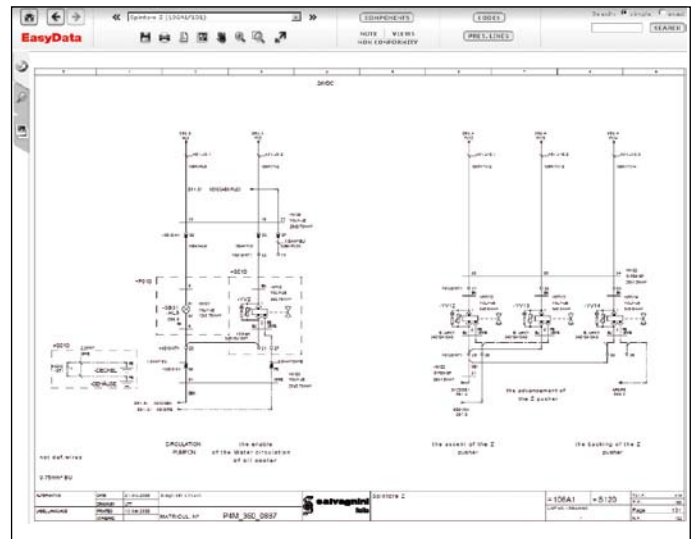
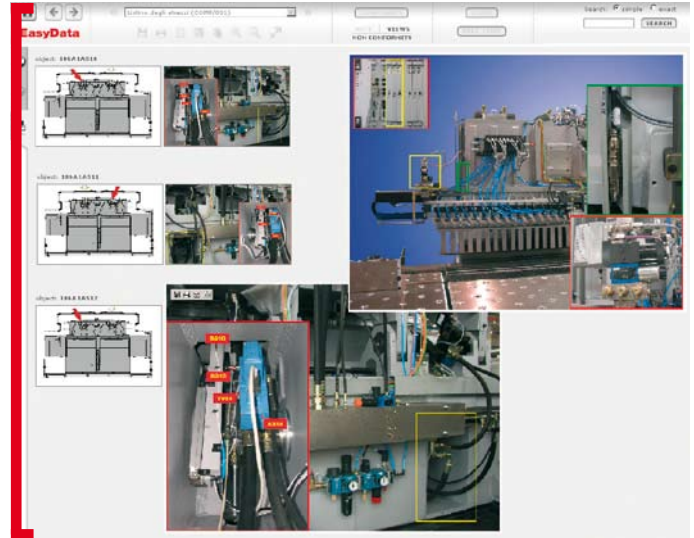
Diagnostics, Maintenance, Safety and Control

The dynamic analyzer of the production process provided in the control console and the interactive multimedia machine diagnostics (EasyData software package) are excellent supports created by Salvagnini for a production site that is easy to use and highly competitive. With the EasyData software, sensors, actuators, numerical axes and components are easily traced through the wiring and hydraulic diagrams and images available on the actual machine.

The MaintenanceManager software package is your tool for managing the scheduled maintenance of the Salvagnini P4 system in a modern, effective manner to achieve increasingly high levels of reliability. The Salvagnini SIX controller advises you of any maintenance and/or inspections required by the system, guides you through the relevant procedure, and then records the result of the action taken. Maintenance manual charts are displayed on the monitor. You can even add any personalized events you think ought to be checked.

Guards around the whole work area offer a high standard of passive safety. There are separate active safety circuits in the different work zones. Low noise levels are further reduced by the worktables being covered entirely by brushes.

The quality, precision and repeatability of the parts produced are a direct result of the synthesis of Salvagnini expertise and professionalism that the P4 Panel Bender epitomizes.





Machine	P4-1916	P4-2516	P4-2516/3	P4-2535
Technical specifications				
Maximum length of incoming sheet (mm)	2000	2795	2795	3495
Maximum width of incoming sheet (mm)	1524	1524	1524	1524
Max. diagonal that can be rotated (mm)	2150	2800	2800	3500
Maximum bend length (mm)	1950	2500	2500	2500
Maximum bend height (mm)	165	165	165	350
Minimum thickness (mm)	0.5	0.5	0.8	0.5
Max. thickness and bend angle steel, UTS 410 N/mm ² (mm)	2.5 (± 90°) 2.0 (± 135°)	2.5 (± 90°) 2.0 (± 135°)	3.0 (± 90°) 2.5 (± 130°)	2.5 (± 90°) 2.0 (± 135°)
Max. thickness and bend angle stainless steel, UTS 580 N/mm ² (mm)	2.0 (± 90°) 1.5 (± 125°)	2.0 (± 90°) 1.5 (± 125°)	2.0 (± 90°) 1.5 (± 125°)	2.0 (± 90°) 1.5 (± 125°)
Max. thickness and bend angle aluminium, UTS 265 N/mm ² (mm)	3.0 (± 90°) 2.0 (± 135°)	3.0 (± 90°) 2.0 (± 135°)	3.0 (± 120°) 2.0 (± 130°)	3.0 (± 90°) 2.0 (± 135°)

Machine	P4-3216	P4-3216/3	P4-3816	P4-2525
Technical specifications				
Maximum length of incoming sheet (mm)	3495	3495	3990	3000
Maximum width of incoming sheet (mm)	1524	1524	1524	1524
Max. diagonal that can be rotated (mm)	3500	3500	4000	3000
Maximum bend length (mm)	3200	3200	3850	2540
Maximum bend height (mm)	165	165	165	254
Minimum thickness (mm)	0.5	0.8	0.5	0.5
Max. thickness and bend angle steel, UTS 410 N/mm ² (mm)	2.5 (± 90°) 2.0 (± 135°)	3.0 (± 90°) 2.5 (± 130°)	2.0 (± 90°) 1.5 (± 135°)	3.2 (± 90°) 2.3 (± 135°)
Max. thickness and bend angle stainless steel, UTS 580 N/mm ² (mm)	2.0 (± 90°) 1.5 (± 125°)	2.0 (± 90°) 1.5 (± 125°)	1.5 (± 90°) 1.0 (± 125°)	2.0 (± 90°) 1.6 (± 135°)
Max. thickness and bend angle aluminium, UTS 265 N/mm ² (mm)	3.0 (± 90°) 2.0 (± 135°)	3.0 (± 120°) 2.5 (± 130°)	2.0 (± 90°) 1.5 (± 130°)	3.0 (± 90°) 2.0 (± 135°)

The indicative values are valid for a standard machine with no optional extras.

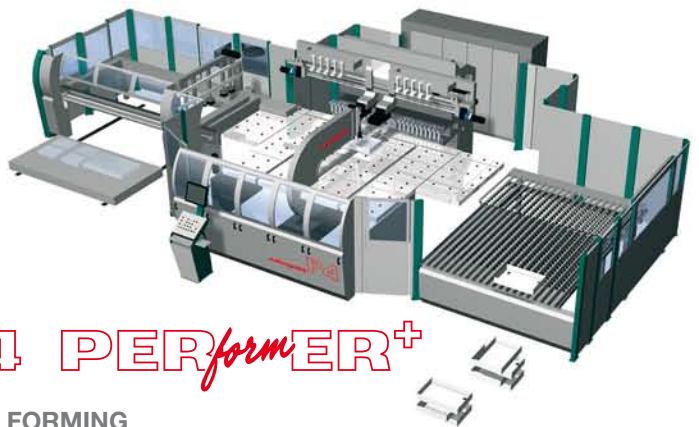
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AJS® Automated Job Shop



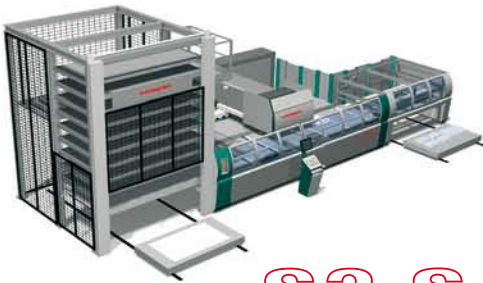
MV

INTEGRATED LOGISTICS



P4 PERformer⁺

PANEL FORMING



S2 S4

PUNCHING - SHEARING



L1.it L2

LASER CUTTING



ROBOformer[®]
G2

ROBOTIC BENDING