LineAr

CONCEPT PRESENTATION

SCHIAVI MACCHINE INTERNATIONAL

THE LINEAR CONCEPT

During bending operations, the tool holder beams are subjected to flexion deformation under the action of the bending load. **Deformations** of the tool holder beams are the **main cause of imprecision** in the bending process. Manufacturers of press brakes implement **complicated active devices**, which are occasionally electronically controlled, to **minimize** the differences between the deformation of the two tool holder beams.

Schiavi Macchine International, with the **LineAr** concept, reduces to **negligible values** the deformation of the tool holder beams with **natural mechanical reactions** ensuring **straight** tool holder beams; there is no need for complicated crowning devices.

Figure 1: LineAr 1000 tons 8 meters

Schiavi Macchine International S.r.l
Via Boschetti 61 - 24050 Grassobbio (BG) ITALY - VAT number: 01656570338
Ph: +39 035 4242411 Fax: +39 035 424241
sales@schiavimacchine.it - service@schiavimacchine.it - tooling@schiavimacchine.it
www.schiavimacchine.it

A BENDING PRESS BRAKE WITH UNDEFORMABLE TOOL-HOLDER BEAMS (*)

The main advantages of the application are:

1. The tool holder beams (upper and lower), under a uniform load, remain straight. **No crowning or any other systems** to compensate the deformations of the tool holder beams are needed. The benefit on the quality of the bending work is immediate: **the bending line is straight**.
   a. There is no need of correcting the theoretical crowning compensation for each different material reaction.
   b. There is no need of calculating the required crowning compensation before each different bend.
   c. There is no curvature in the line of bend, which is a typical effect of traditional crowning systems.
2. The structural benefits can be summarized as follows:
   a. The machine is designed with **no welds**; the entire structure is **bolted together**.
   b. Small size press brakes: 3÷4 meters bending length and up to 400 tons. **The height of the lower tooling from the ground is reduced**.
   c. Medium size press brakes: 4÷6 meters bending length and up to 600 tons. The foundation for the lower table is not necessary. **Huge advantages for the installation and for the customer's plant layout**.
   d. Big size press brakes: 6÷12 meters bending length and up to 1200 tons. **The foundation for the lower table is smaller** than "traditional" ones. The size of the tables, their **weight and** then their **cost are greatly decreased**.

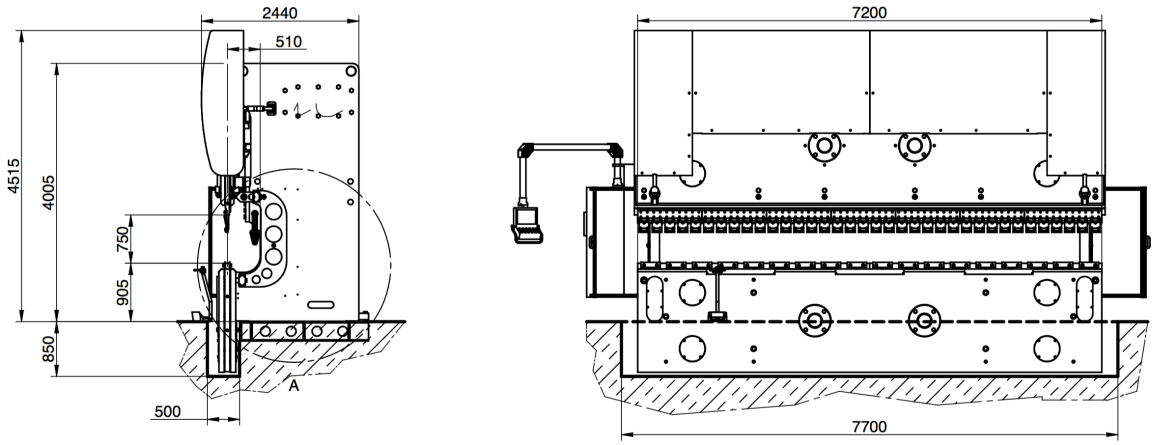
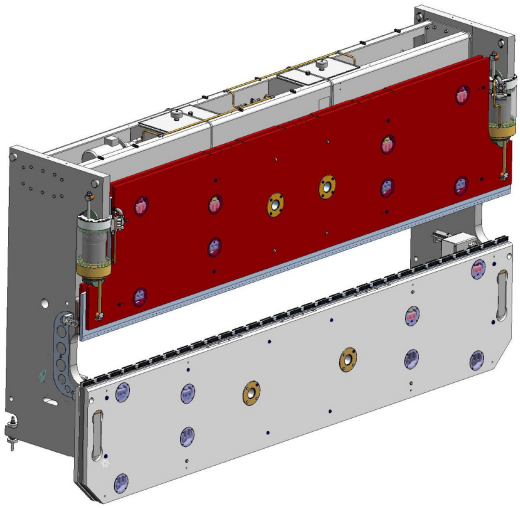


Figure 2: Layout of LineAr 630 tons 7 meters

(*) The concept is deeply illustrated in the text of the European patent No. 1410854 issued on Nov 16 2005USA patent No 7013698 issued on Mar 21 2006Japan patent No 4546709 on Jul 9 2009. Patent extensions: AUSTRIA, BELGIUM, SWITZERLAND, CZECH REPUBLIC, GERMANY, DANMARK, SPAIN, FINNLAND, FRANCE, GREAT BRITAIN, ITALY, NETHERLANDS, SWEDEN, SLOVAK REPUBLIC, TURKEY

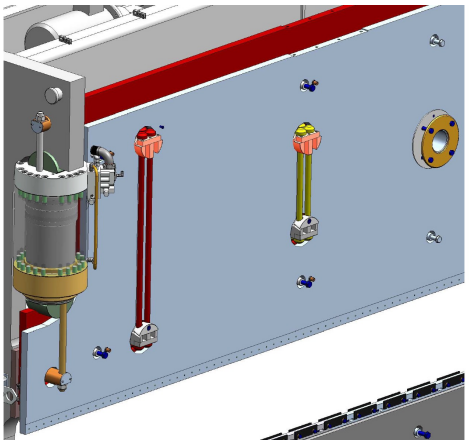
THE LINEAR REACTION – PART 1

The upper and lower beams are composed of **one central tool holding beam and two side beams**. The side beams are designed to receive the forces of the upper and lower tool holding beams.



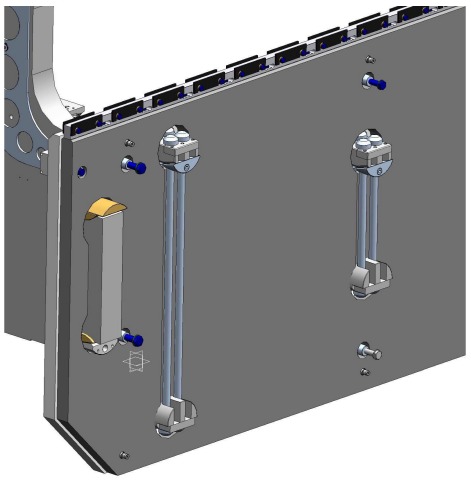
The upper tool holding beam is connected to the two lateral sides by **specially designed tie-rods, which are used to distribute the forces**, and the deformations, of the central beam to the two lateral sides. This procedure maintains **the central beam straight**, with minimum tolerance.

(One of the lateral side, shown in the first picture, has been removed to display the tie-rod system)



Similarly to the upper beam, the lower tool holding beam is connected to the two lateral sides by specially designed tie-rods. The **forces**, and the deflection, of the central tool holding beam **travel to the two sides** through the tie rods. **The lower beam remains straight**, with minimum tolerance, during the bending process

(One of the lateral side, shown in the first picture, has been removed to display the tie-rod system)



Schiavi Macchine International S.r.l
Via Boschetti 61 - 24050 Grassobbio (BG) ITALY - VAT number: 01656570338
Ph: +39 035 4242411 Fax: +39 035 424241
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www.schiavimacchine.it

THE LINEAR REACTION – PART 2

The video below shows the finite element analysis simulation of the deformations, under load, of the LineAr lower table systems. In the video, on of the two side beams was removed to highlight the movement of the central tool holding beam.

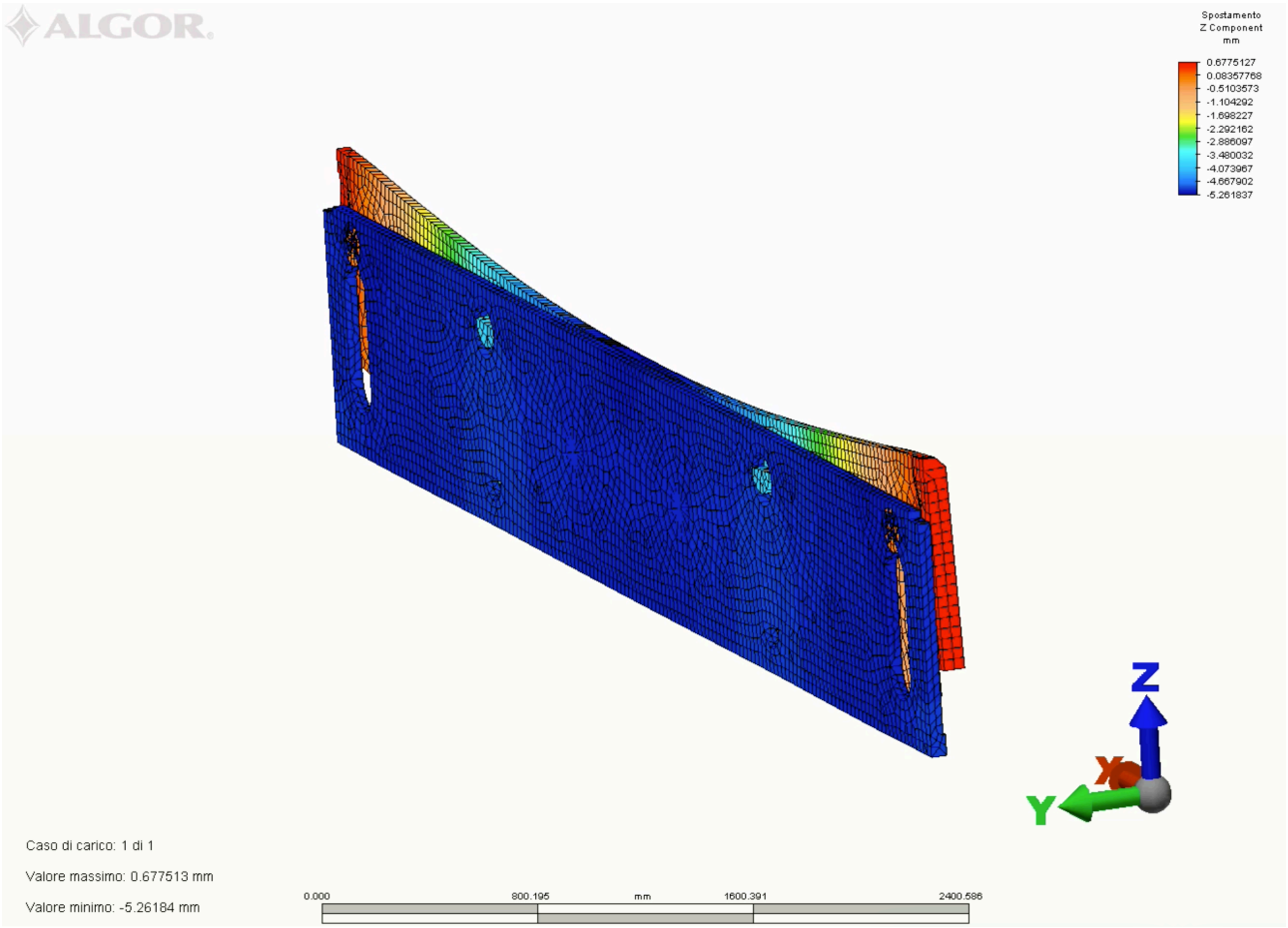


Figure 3: FEA simulation of the LineAr lower table system, composed of the tool holder beam and 1 of the 2 side beams.

The central beam distributes the bending forces to the external sides, and **remains perfectly straight**. The upper beam system is designed similarly to the lower system, and it allows the upper tool holding table to remain straight during the bending process.

Traditional crowning systems have one major fault: a component which is curved along the line of bend. The upper beam is curved by the force applied by the cylinders, and the lower beam is curved by external crowning systems. The bending result of such system might maintain a constant angle along the component. However, **the line of bend is curved, especially on large components**.

The LineAr system, with the upper and lower tool holding beams that remains straight during the bend, allow for components with:

- **Correct angle** along the component
- **Perfectly straight components** along the line of bend, even on very large press brakes.

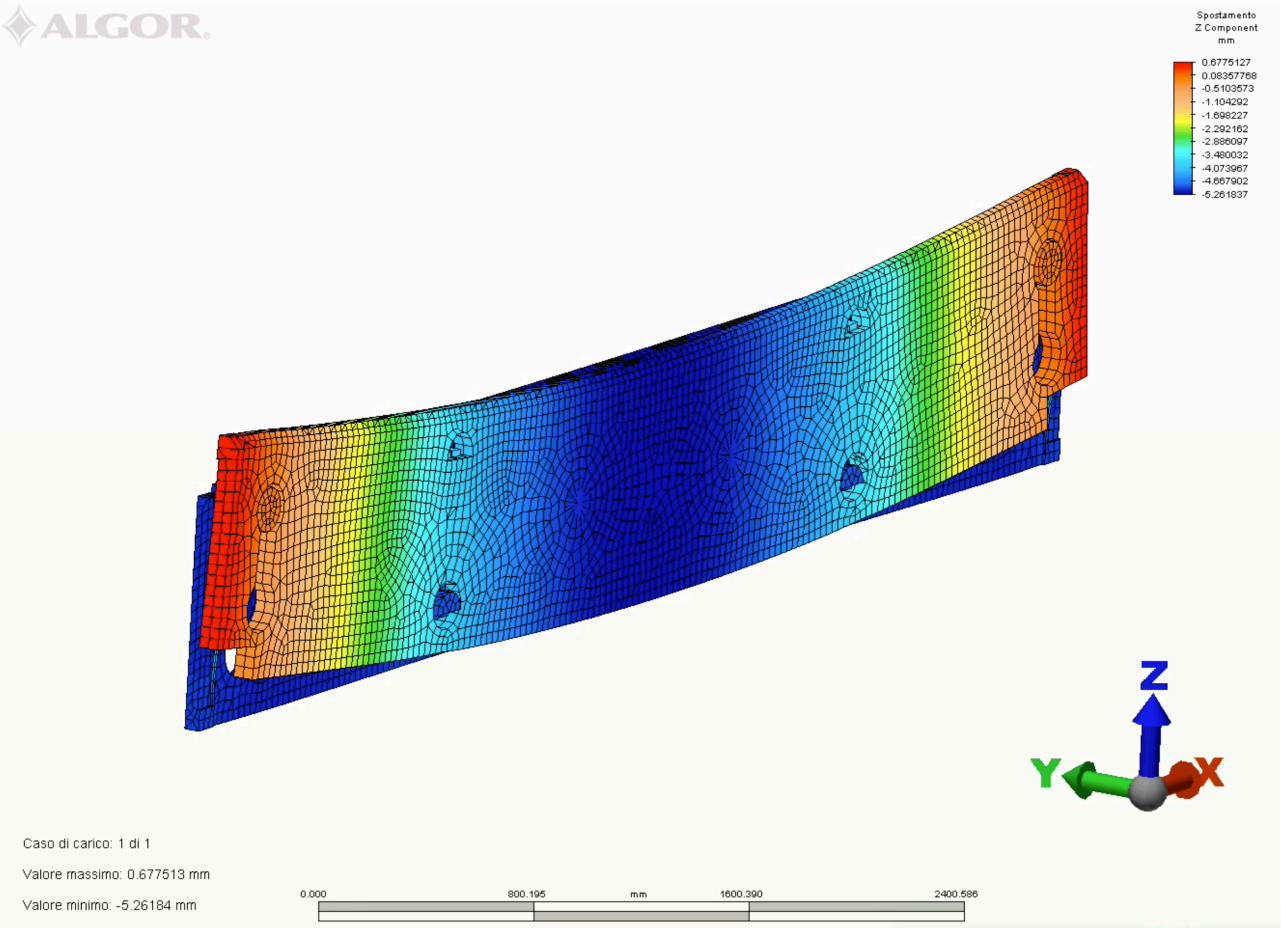


Figure 4: FEA simulation of the LineAr lower table system, composed of the tool holder beam and 1 of the 2 side beams.

LINEAR BENDING TESTS

MODEL 400-4 (4 meters, 400 ton)

TEST 1

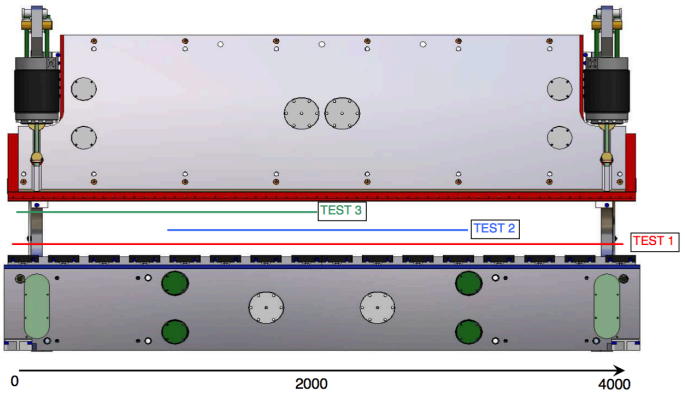
V width =	50	mm	Die V width
t =	6	mm	Sheet thickness
mat =	Fe 510		Sheet material
Bending length =	4'000	mm	CENTERED

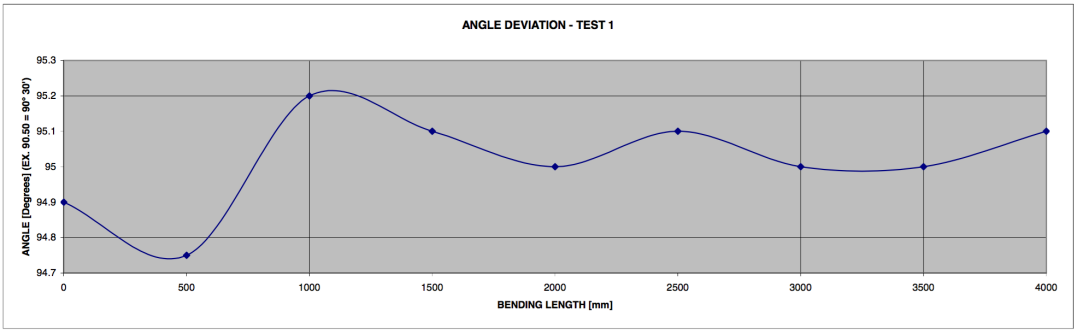
TEST 2

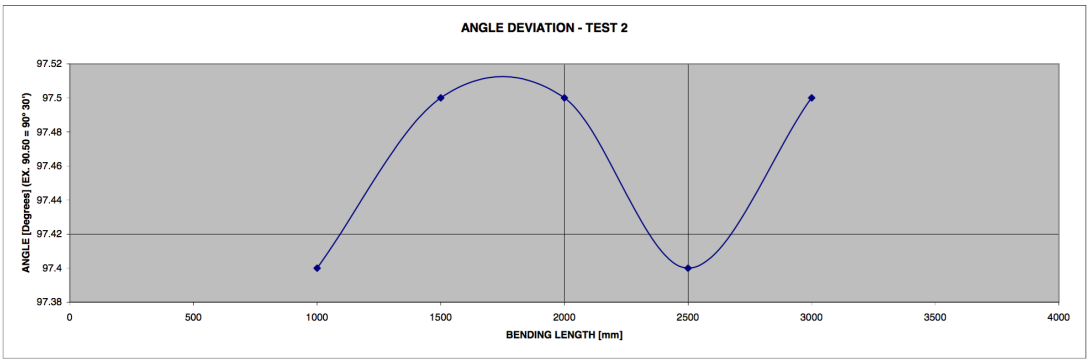
V width =	50	mm	Die V width
t =	6	mm	Sheet thickness
mat =	Fe 510		Sheet material
Bending length =	2'000	mm	CENTERED

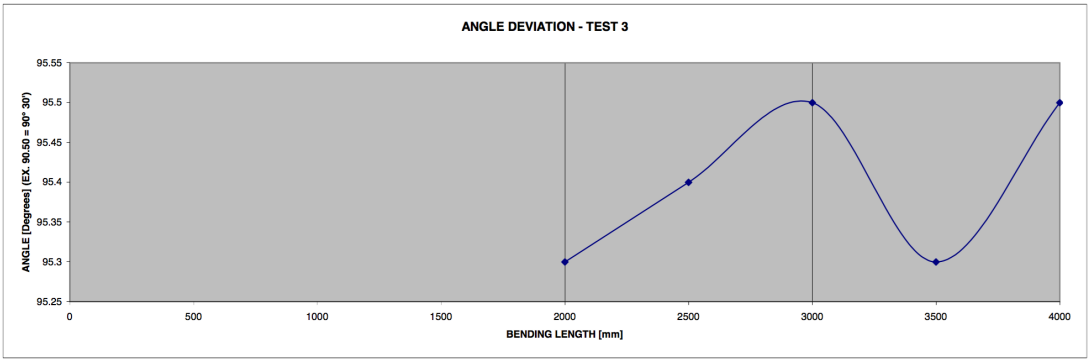
TEST 3

V width =	50	mm	Die V width
t =	6	mm	Sheet thickness
mat =	Fe 510		Sheet material
Bending length =	2'000	mm	SIDE









Schiavi Macchine International S.r.l
Via Boschetti 61 - 24050 Grassobbio (BG) ITALY - VAT number: 01656570338
Ph: +39 035 4242411 Fax: +39 035 424241
sales@schiavimacchine.it - service@schiavimacchine.it - tooling@schiavimacchine.it
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MODEL 1200-12 (12 meters, 1200 ton)

TEST 1

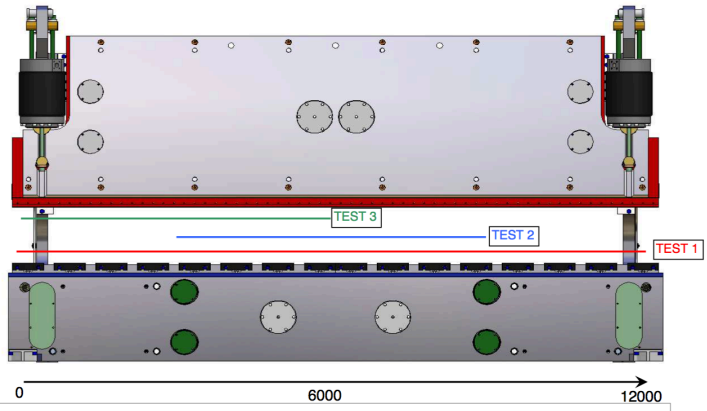
V width =	50	mm	Die V width
t =	6	mm	Sheet thickness
mat =	Fe 510		Sheet material
Bending length =	12'000	mm	CENTERED

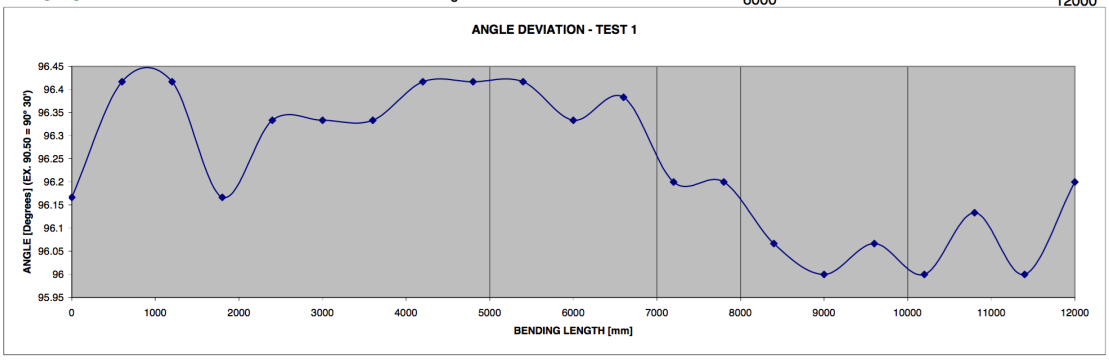
TEST 2

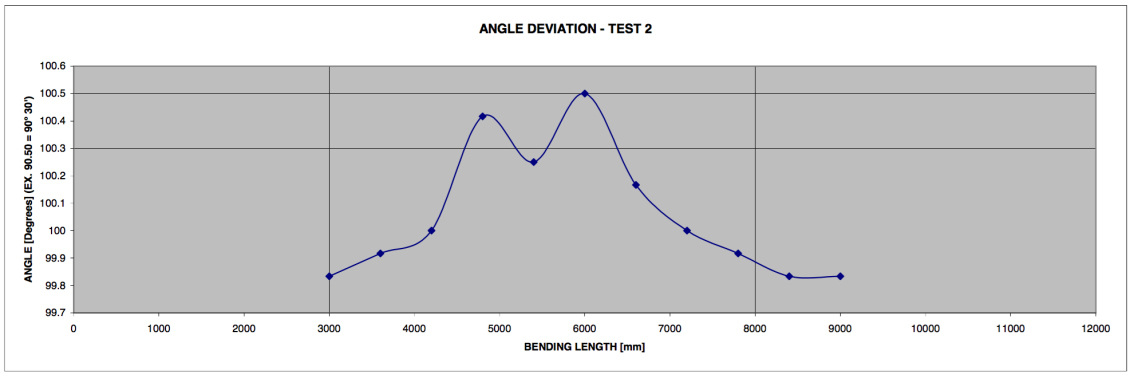
V width =	50	mm	Die V width
t =	6	mm	Sheet thickness
mat =	Fe 510		Sheet material
Bending length =	6'000	mm	CENTERED

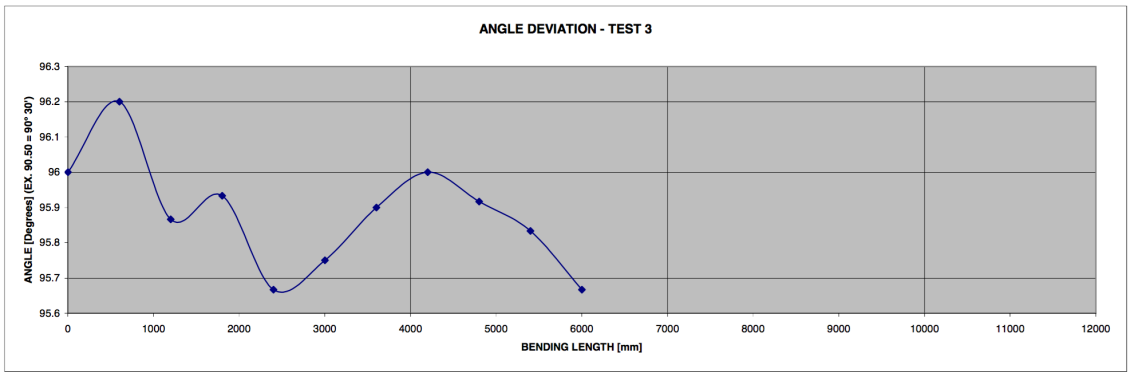
TEST 3

V width =	50	mm	Die V width
t =	6	mm	Sheet thickness
mat =	Fe 510		Sheet material
Bending length =	6'000	mm	SIDE









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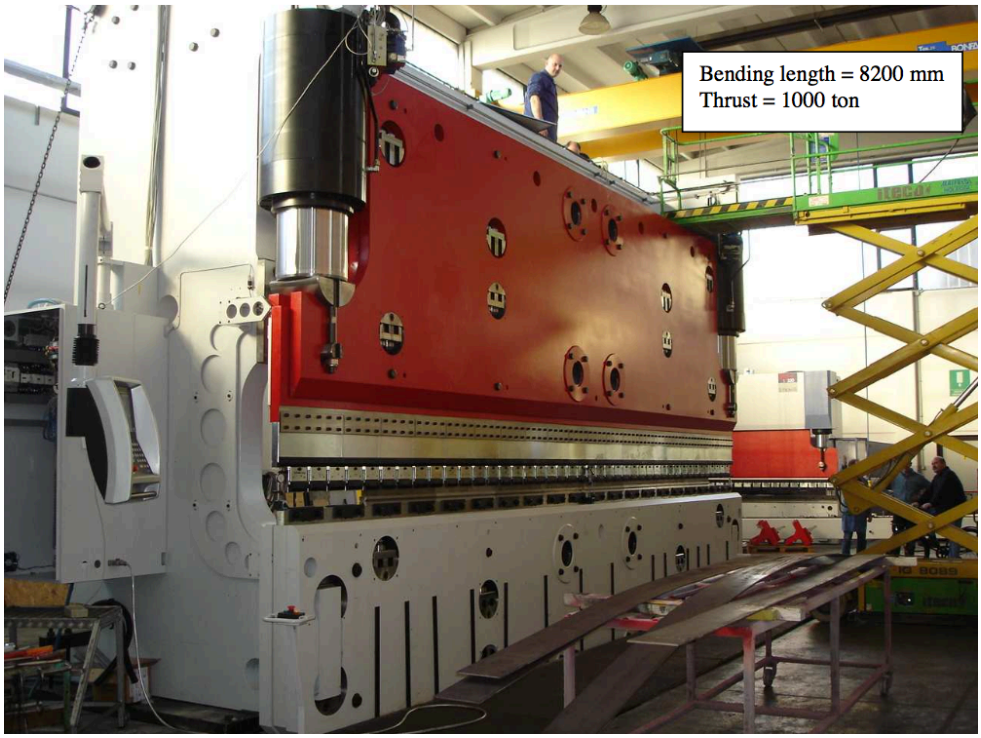
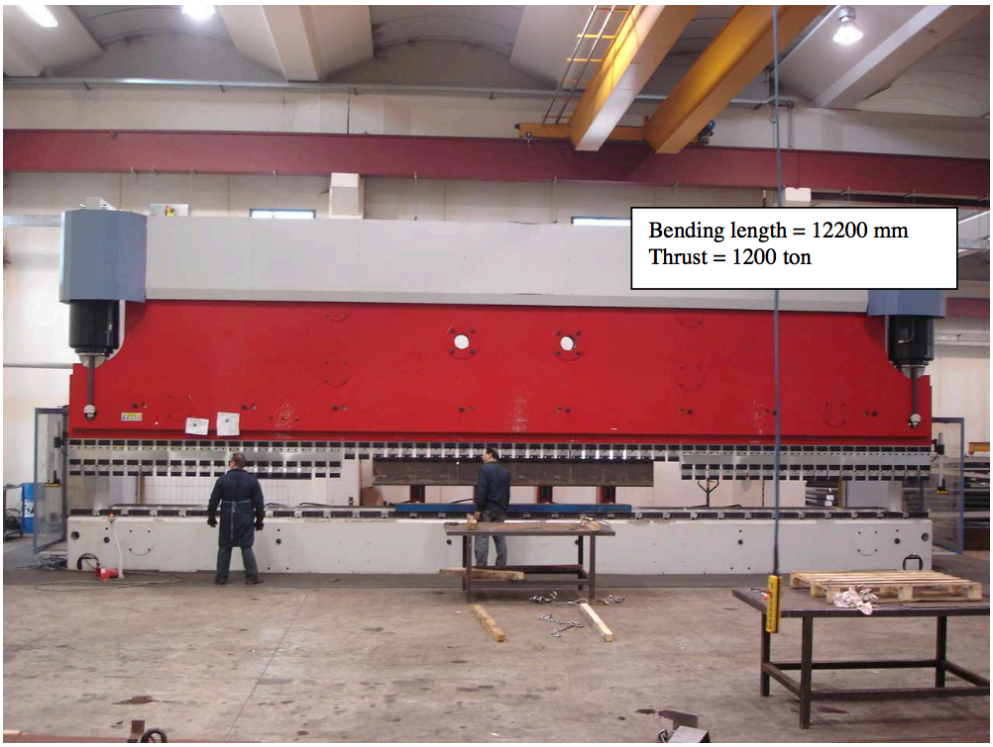
CURRENTLY INSTALLED LINEAR

Below, a list of same of the currently installed and producing LineAr.

Bending Length [mm]	Bending Force [ton]	Foundation Depth [mm]	Installation [year]
4200	400	-	2007
4200	630	-	2008
6200	250	-	2006
6200	320	-	2007
6200	400	-	2008
7200	630	850(*)	2008
8200	250	-	2008
8200	320	750(*)	2012
8200	630	1200(*)	2012
8200	1000	1050	2006
10200	1000	1550	2008
12200	1200	2000	2007

(*) foundation only for the lower table, not the entire machine base





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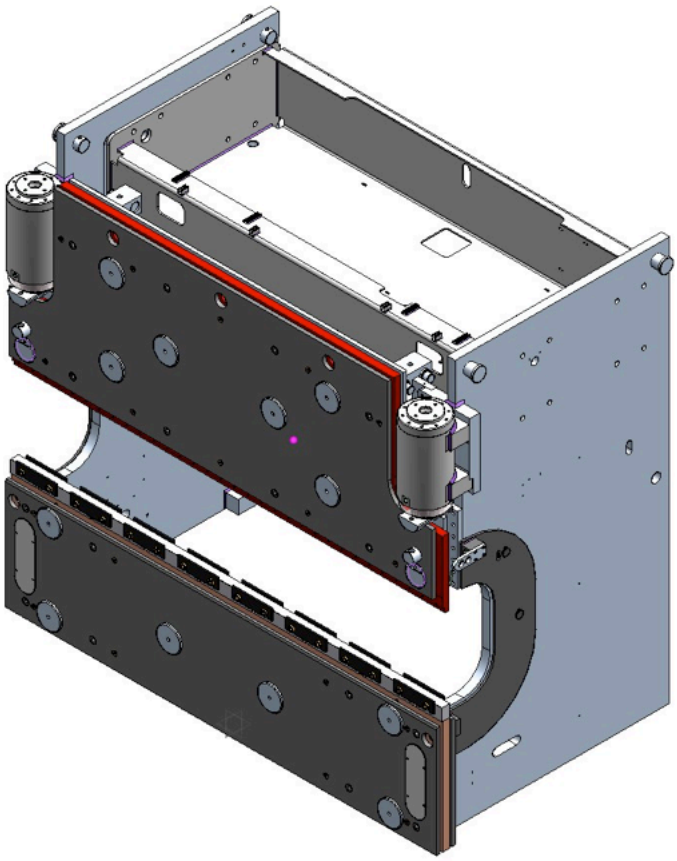
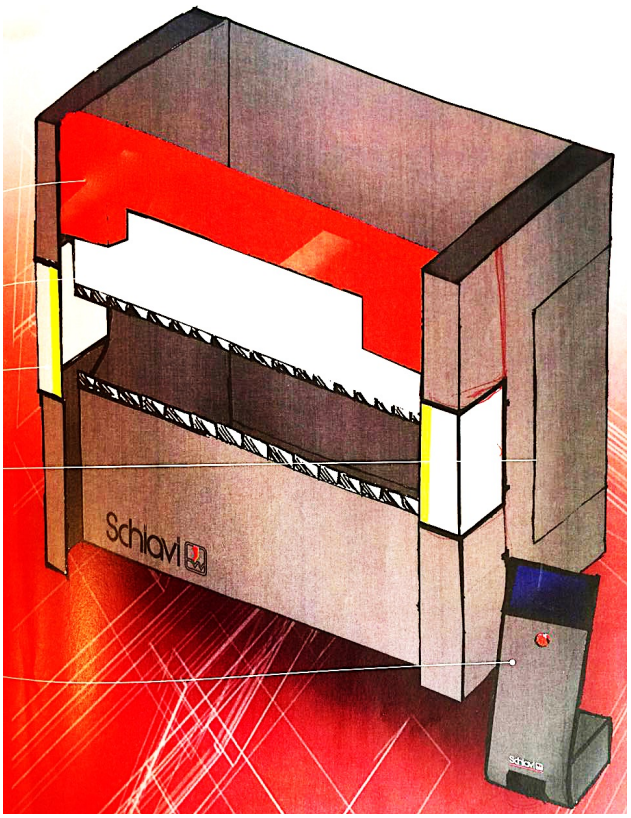
LINEAR 130.3: EVOLUTION OF THE SYSTEM

The LineAr concept **is evolving**, and at Blechexpo 03-06 November in Stuttgart, Schiavi Macchine International will unveil the LineAr 130.3: 130 tons of bending force for 3 meters of length.

The new LineAr 130.3 maintains the **undeformable upper and lower tool holding beams**, and moves forward with more efficient mechanical solutions, which allows the LineAr 130.3 to improve upon the current LineAr specifications:

- Tables with **smaller dimensions** and smaller thickness.
- **Increased daylight opening** to easily manufacture large and complicated components.
- **Working plane** for the operator **closer to the ground**.



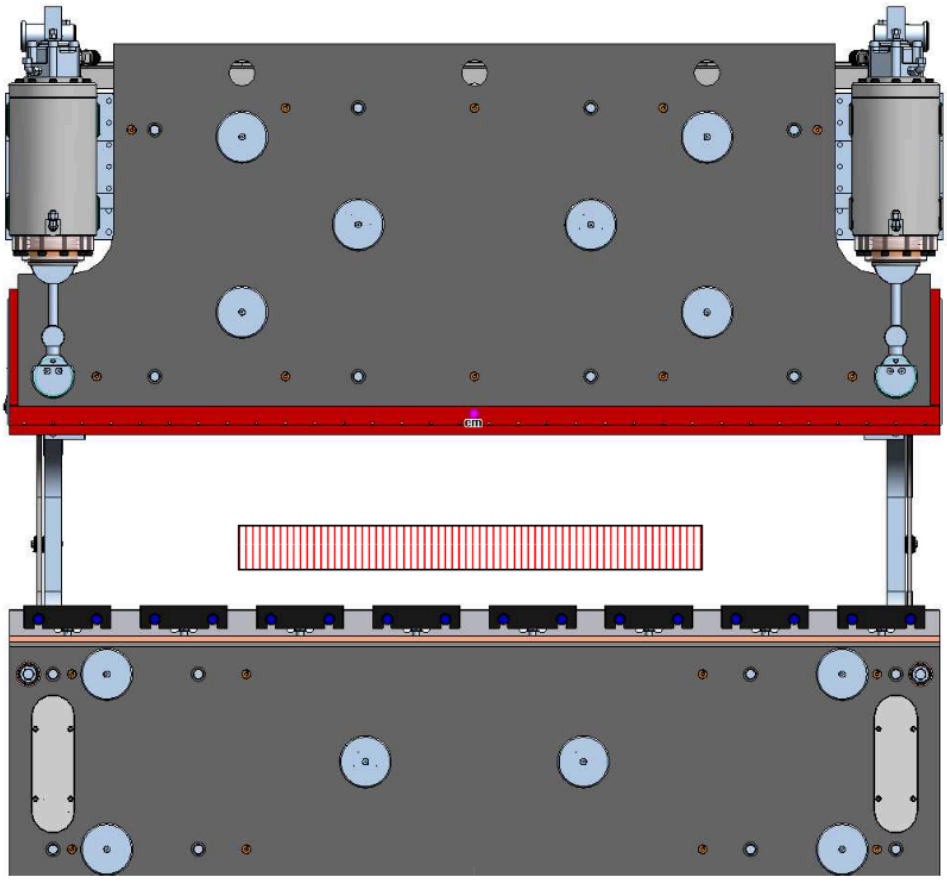


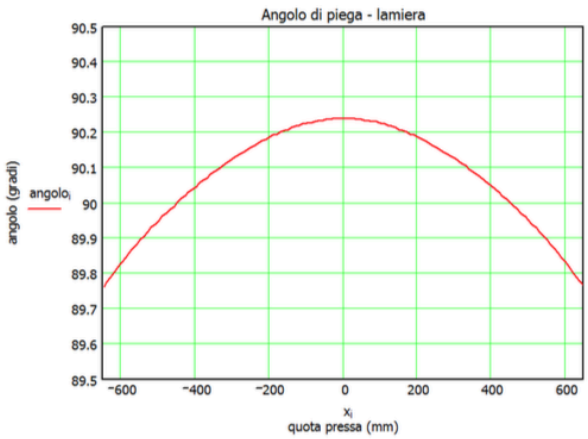
Below the preliminary bending test of the all new LineAr 130.3.

Schiavi Macchine International S.r.l
Via Boschetti 61 - 24050 Grassobbio (BG) ITALY - VAT number: 01656570338
Ph: +39 035 4242411 Fax: +39 035 424241
sales@schiavimacchine.it - service@schiavimacchine.it - tooling@schiavimacchine.it
www.schiavimacchine.it

Bending case 6

Mat. Thikness =	10 mm
V width =	63 mm
Applied force =	100 ton / m
Bending length =	1,3 m – centered
Total force =	130 ton





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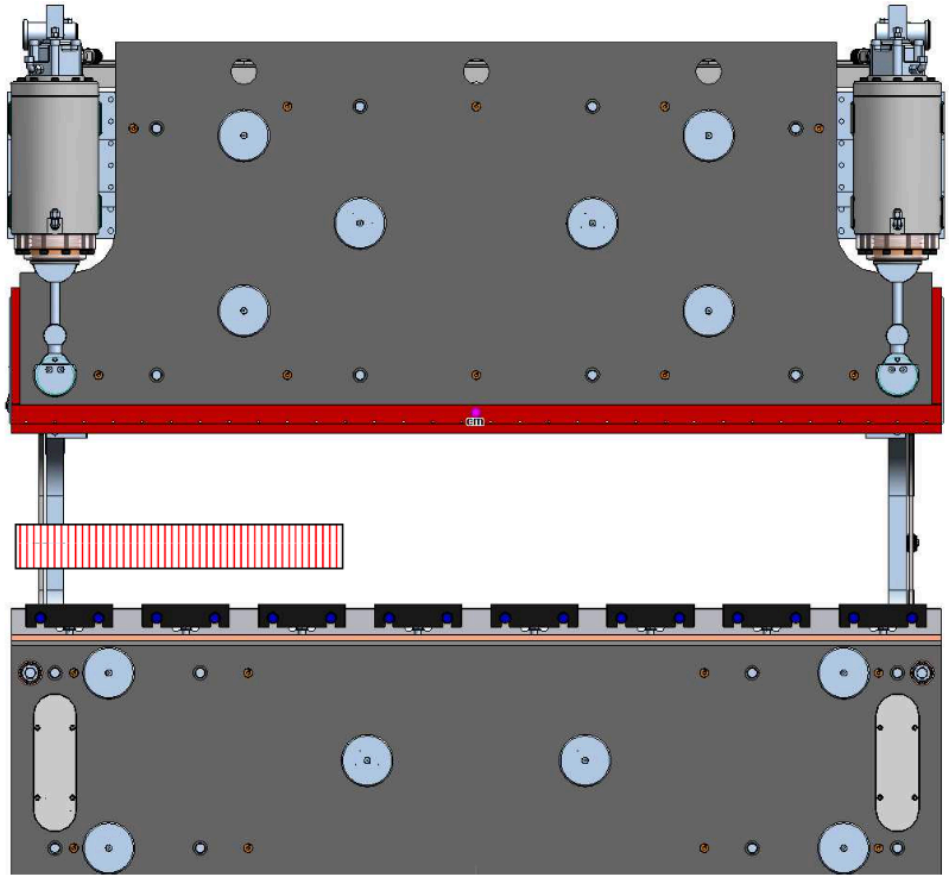
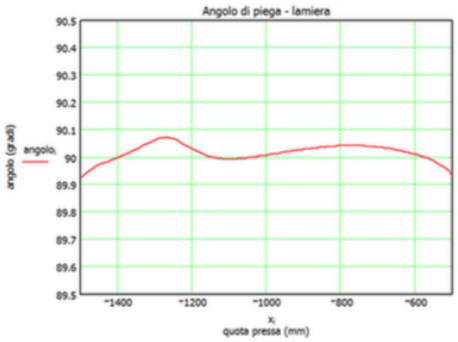
Ph: +39 035 4242411 Fax: +39 035 424241
sales@schiavimacchine.it - service@schiavimacchine.it - tooling@schiavimacchine.it
www.schiavimacchine.it

Bending case 4

Mat. Thikness =	1 mm
V width =	6 mm
Applied force =	11 ton / m
Bending length =	1,0 m – one side
Total force =	11 ton





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Ph: +39 035 4242411 Fax: +39 035 424241
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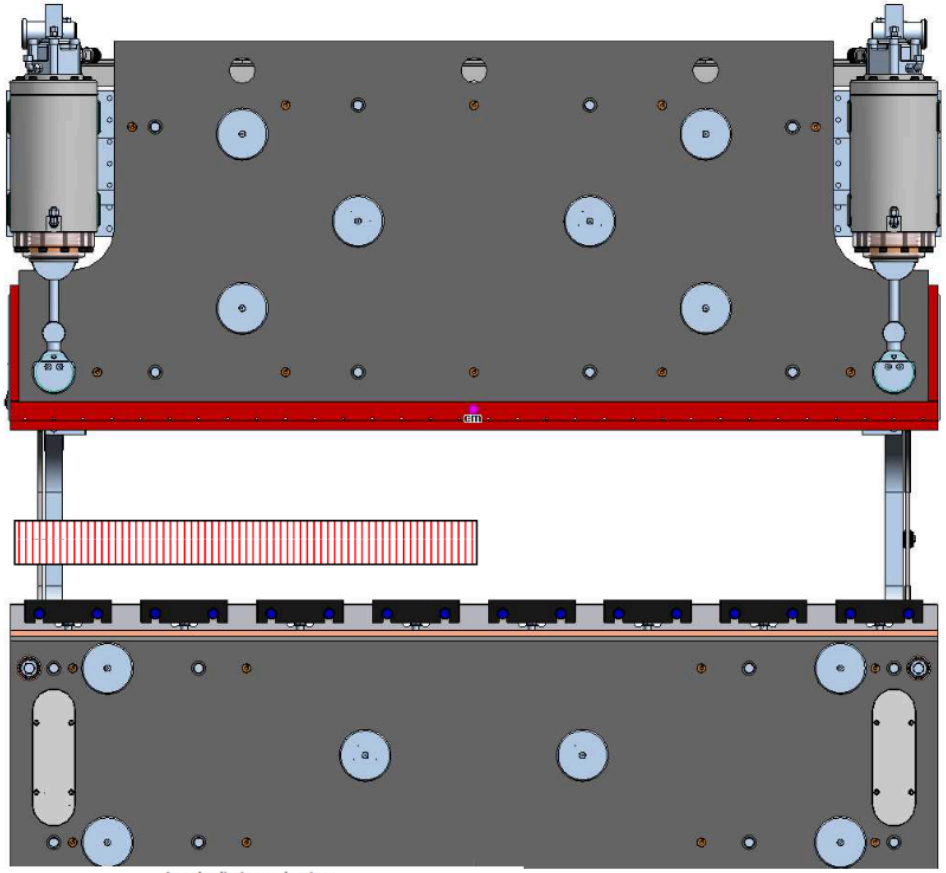
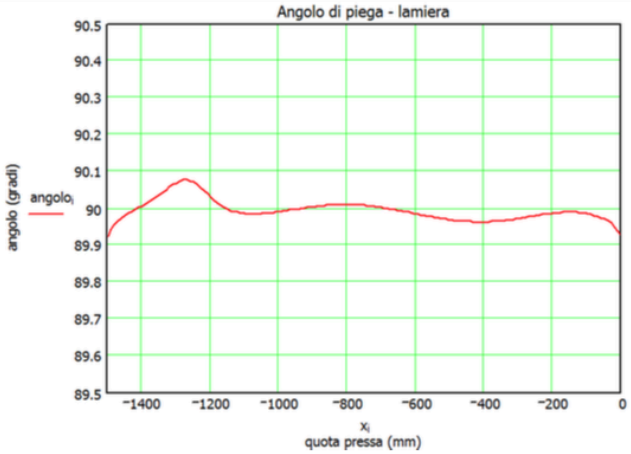
Bending case 3

Mat. Thikness =	1 mm
V width =	6 mm
Applied force =	11 ton / m
Bending length =	1,5 m – one side
Total force =	16.5 ton





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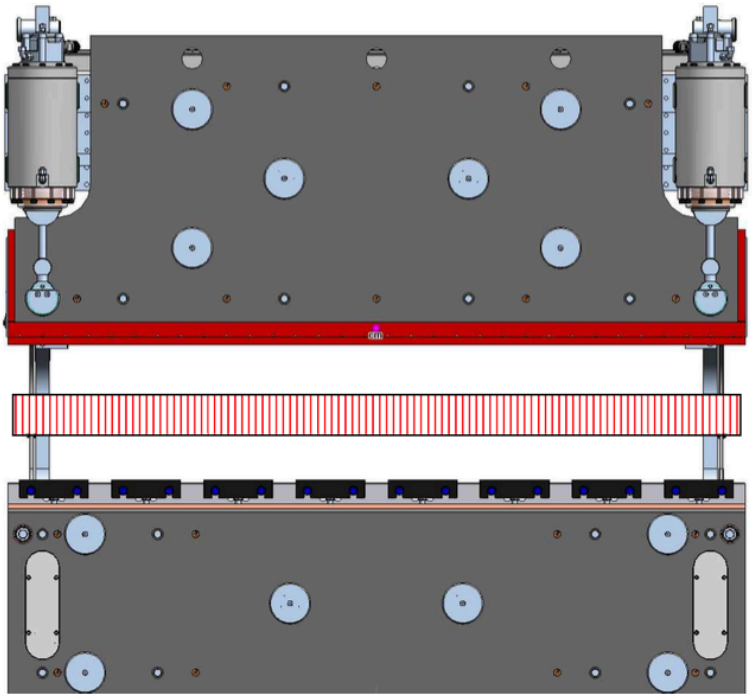
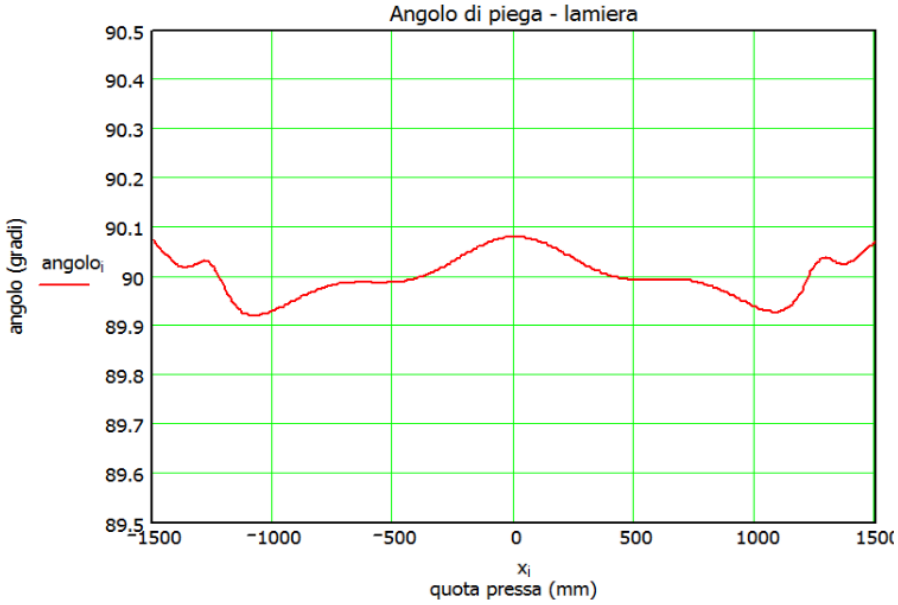
Ph: +39 035 4242411 Fax: +39 035 424241
sales@schiavimacchine.it - service@schiavimacchine.it - tooling@schiavimacchine.it
www.schiavimacchine.it

Bending case 2

Mat. Thikness =	1 mm
V width =	6 mm
Applied force =	11 ton / m
Bending length =	3 m
Total force =	33 ton





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Ph: +39 035 4242411 Fax: +39 035 424241
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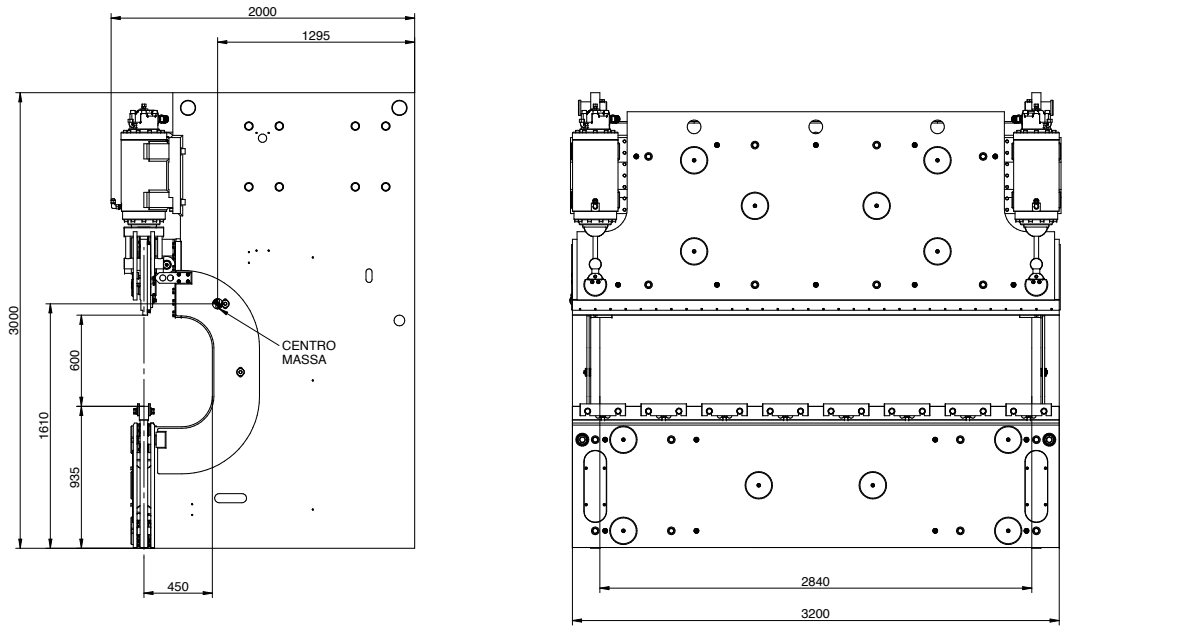
LINEAR 130.3: MACHINE SPECIFICATION & LAYOUT

Tonnage	130	Tons
Length of the table	3140	mm
Distance between uprights	2840	mm
Throat depth	420	mm
Length of stroke	320	mm
Open height	600	mm
Working level height	935	mm
Working level width	60	mm
No. intermediates	15	N°
Approach speed	250	mm/sec
Working speed	1-9	mm/sec
Return speed	250	mm/sec
Electrical three-phase motor –400 V- Hz 50	22	kW
Approx. weight of the machine	12.500	Kg
Overall dimensions: length	3.200	mm
Overall dimensions: width	2.000	mm
Overall dimensions: height with Upper Table up	3.000	mm



Descr.: LINEAR 130 - 3 LUCE 600 - CORSA 320			
Gruppo appartenenza.:			
Mat.: -	Massa.: 11616.02 kg		
Stato: -			
Tratt. Term.: -			
Tratt. Sup: -			
Lav.:	Scala = 1:20		
Dis.: Arduino	il 03/08/2015	cod.	1303AX.00.001_00

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Via Boschetti 61 - 24050 Grassobbio (BG) ITALY - VAT number: 01656570338
Ph: +39 035 4242411 Fax: +39 035 424241
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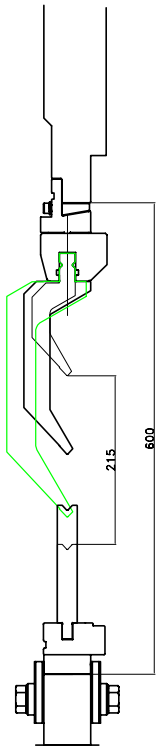
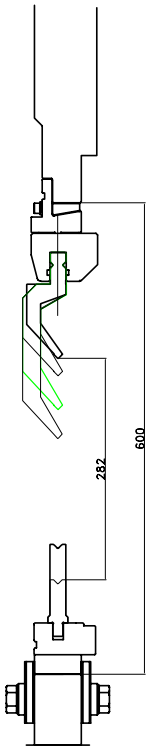
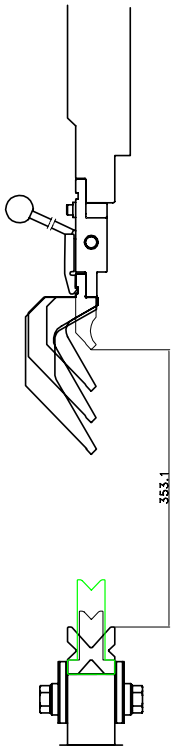
LINEAR 130.3: TOOLING OPTIONS



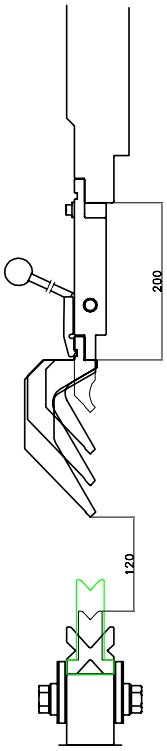
Trumpf Style Tooling



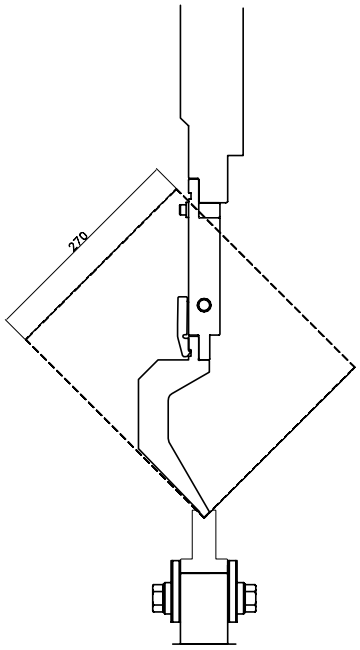
Wila Style Tooling



European Style Tooling
with standard clamping



European Style Tooling
with clamping H=200mm



Sample box dimension

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Via Boschetti 61 - 24050 Grassobbio (BG) ITALY - VAT number: 01656570338
Ph: +39 035 4242411 Fax: +39 035 424241
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LINEAR 130.3: INNOVATION, EFFICIENCY AND SERVICE

UNDEFORMABLE UPPER AND LOWER BEAM

The LineAr 130.3 utilizes the patented Schiavi Technology "**Crowning Free System**". This mechanical solution guarantees **constant angle** along the bend and **horizontal edge** along the line of bend.

TASK84

SINCE 1984 WE PRODUCE CNC CONTROL SYSTEMS.
SIMPLICITY AND USABILITY ARE THE KEYS TO OUR SUCCESS.

The CNC control system of the LineAr 130.3 is produced by **Task84**, a department of Schiavi Macchine International. Task84 is committed to the develop **simple and efficient CNC controls** using Schiavi **customers' feedback**.

efficiency

LOW ENERGY CONSUMPTION SYSTEMS.

The LineAr 130.3 is equipped with an inverter that permits to **speed up the bending cycle.** A **specially designed hydraulic system**, with **Start & Stop function**, allows LineAr 130.3 to **significantly improve efficiency** by using maximum bending force only when in contact with the material.

CUSTOMER SERVICE

PROFESSIONAL ASSISTANCE AT THE SERVICE OF THE CUSTOMER.

INNOVATION & RESEARCH

CONSTINUOUS DEVELOPMENT TO FORSEE MARKET DEMANDS

The LineAr 130.3 is backed by the **customer service** and the **continuous innovation** unique to **Schiavi**.

Schiavi Macchine International S.r.l
Via Boschetti 61 - 24050 Grassobbio (BG) ITALY - VAT number: 01656570338
Ph: +39 035 4242411 Fax: +39 035 424241
sales@schiavimacchine.it - service@schiavimacchine.it - tooling@schiavimacchine.it
www.schiavimacchine.it