

USER GUIDE

CNC BELT-PULLEY PRESS BRAKE



Shaping the Future

VALUES

Respect: We respect people, we respect nature, we respect the past and the future.

Result: We set clear, specific goals, and we deliver them. For this purpose, we equip our people with the best tools and equipment they need.

Responsiveness: We are aware that doing business is a human to human activity. We listen to empathetically and reply quickly and appropriately.



MVD

MISSION

We design, produce and deliver safe, high-quality and high-efficient machine tools for our customers' success.

VISION

Become the world's most reliable leading brand by continuous growth, and to provide sustainability as the 1st choice of the customers with the product and service quality.

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List of Abbreviations

<p>CNC Belt Pulley</p> <p>Press Brake</p>	<p>It is a machine designed to transmit power to the moving tool by means of electric servo motor (mainly for long linear bending between narrow shaping tools).</p>
<p>Top table</p>	<p>It is the main part of the press brake which holds the upper tool and moves up and down.</p>
<p>Lower table</p>	<p>It is a fixed table which carries the lower tool.</p>
<p>Back gauge</p>	<p>It is the motor-driven stop on which the sheet to be bent is rested to provide the bending width. The position and movement are controlled by the NC digital position controller depending on the bending program. This unit also has manual adjustment buttons.</p>
<p>Bottom Tool</p>	<p>It is the bottom part of the tools connected to the table which gives the requested shape to the product.</p>
<p>Servo</p> <p>Motor</p>	<p>It is the part existent in column and that transmits the rotational force to the presscrake by belt pulley</p>
<p>Top Dead Center (TDC)</p>	<p>It is the top position at which the fast closing of the top beam starts and at the same time the return movement ends. It can be calculated by CNC unit or written directly to the screen. UDP (Upper Dead Point)</p>
<p>Bottom Dead Center (BDC)</p>	<p>It is the lowest point at which the top plate completes the bending process in a bending hub. It can be calculated by CNC unit or written directly to the screen. BDP (Bottom Dead Point)</p>

Introduction

These user guide contains supportive and corrective information for operating and maintenance personnel in connection with the operation and maintenance of the machine. It is divided into 6 parts:

- i. General information
- ii. Installation
- iii. Operating
- IV. Maintenance and Repair
- V. The Security Precautions
- VI. Possible Trouble Types
- VII. Training Guide

Unless authorized by the manufacturer in writing, any operation or adjustment not in accordance with these operating instructions shall be at the customer's risk and the manufacturer shall be entitled to terminate the warranty period.

If you require further technical information, our service department will be happy to provide you help. For further information, and demand for spare parts and service, please contact us at the information below.

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Please write down the following information and keep it for future reference:

Model Number:

Serial Number:

Date of purchase:

Standards applied:
EN 12622:2001, CEI/IEC 60204-1997+A1:1999

Customer:

Note: The Serial Number is located on the label on the side of the machine.
Keep this User Guide together with the machine's invoice to prove that you have purchased the product to use under warranty maintenance.

Warranty Certificate (1/2)

This protocol must be returned to MVD Inan, signed within 1 week of taking the machine into operation. This document is the beginning of the warranty period.

Type of machine:

Serial number:

Warranty period: 12 months following the delivery of the machine

Standards applied: EN 12622:2001, CEI/IEC 60204-1997+A1:1999

Customer:

Signatories declare that they have received the user guide and CE declaration with the machine. Signatories should also ensure that the personnel operating the machine read and understand the issues related to the use and safety of the machine and that the procedures in this manual are strictly adhered to.

Notes:

On behalf of the receiving company

On behalf of the manufacturer

Date:

Date:

Customer:

Agency/MVD Inan representative

Name:

Name:

Signature:

Signature:

Warranty Certificate (2/2)

1. All kinds of troubles arising from wrong materials used in the manufacture of machinery and faulty work-manship will be fixed by without charge.
2. All kinds of breakage and failure that may occur during the transportation, loading and unloading of the machines are not covered by the warranty.
3. The warranty period starts following the date of delivery and lasts 12 months. Electronic components are not covered by the warranty.
4. The service process starts within 24 hours (except transportation period) from the written notification of the failure under the warranty.
5. Any breakage, failure and loss due to natural conditions and natural disasters in the place where the machine is installed by the customer is not covered by the warranty.
6. Breakdowns and failures that may occur as a result of improper handling and misuse of the user during the operation of the machines are not covered by the warranty.
7. All mechanical and electrical equipment in the facility which is manufactured and assembled by MVD INAN Inc. are covered by the warranty of our company.
8. In the electrical installation which is required for the operation of the machine and which is provided by the customer company, the failures and breakages caused by the electrical installation error are covered by the warranty.
9. Any problem caused by the mains supply is not under warranty coverage.
10. In case of interventions performed by technical service in cases beyond the scope of warranty; transportation, accommodation, labor and parts replacement expenses are invoiced to the company / institution requesting the service.
11. MVD INAN Inc. undertakes and guarantees to provide spare parts for 10 years and/or service for 5 years.

Operation and acceptance report

Before the machine is started, the checks listed below must be carried out by the customer or qualified ser-vice personnel.

Machine:		Model:		Serial Number:	
				Yes	No
1	Is there any user manual?				
2	Are safety doors or/and light barriers set?				
4	Are electrical connections, correct voltage and electrical fuse checked?				
5	Has the test run been performed?				
6	Is machine photographed before putting into use?				
7	Is the delivery complete?				
8	Are all required functions on the machine as desired?				
9	Does the machine technically provide all requirements?				
10	Has the operator received the required training?				
11	Has the operator been notified of the periodic interval for all necessary maintenance work?				

1. General information

1.1 Operating conditions to consider

Do not turn on the machine until you have read the instruction guide completely!

1. As described in the Installation Section, the machine must be installed on a concrete floor.

Electrical working values for CNC Press Brake are as follows:

3. The input voltage should be 380-400 Volts and the frequency should be 50 Hz. The main power cable must be at least 4x10 mm², R, S, T phases and GND(PE) with grounding connections must be ready. (This may be different depending on the location) Cable sizes may change machine by machine, please check electric drawings for the certain information.
4. In crowning option applied models, motor rotation is limited in one direction by „Phase relay“(FR). If the motor does not start, change the two main connections of the R, S, T phases until the phase relay (FR) led become on then try to start main motor again.
5. No welding or grinding should be done on or around the press brake. **Caution:** Electronic devices can be damaged.
6. The press brake can only be operated by suitably qualified users who have read and understood the information in the user guide.
7. In case of any problem, please inform the agent first. **If needed, ask MVD INAN Inc. Service Center** (service@mvdinan.com).
8. Make sure that the covers of the body and electrical control panels are closed during operation of the press brake.
9. The electrical panel must be kept closed unless the main switch is closed or locked. **Caution:** Injury or death risk.
10. The user is responsible for providing 500 lux local lighting in the tools area.
11. At the working stroke of the top table, the light curtain becomes deactivated and the operator is responsible.
Caution: Injury or death risk.
12. During maintenance and adjustments, the main power switch must be kept closed and locked. **Caution:** Injury or death risk.
13. Maintenance and adjustments must be made according to the user and maintenance guides.
14. The clothing of the workers must comply with the required standards.
15. Unnecessary tools and workpieces must be removed from the work area.

1.2 Safety and warning information.



Figure 1 Safety warning signs

1. Do not carry out any repair or maintenance under the electrical voltage.
2. Do not step on electrical cables and devices.
3. Do not disassemble the coverings of electric motors and moving parts. Do not replace them with any non-standard material.
4. Do not approach the sheet more than the safety distance during bending. During bending, take care of your hands, body and head.
5. Keep your hands away from the top tool once the top table starts to descend.
6. Do not approach the rear of the machine while the back gauge is running and do not perform any work.
7. Start bending the sheet metal at equal distance from both sides(centered) of the machine.
8. Make sure that the sheet metal rests on the back of the machine. Otherwise, bending will not be as desired.
9. For short sheet metal parts, use your thumb when bending with your hand.
10. When bending large sheets, the bending speed should be kept low. Please keep the sheet away from you when bending it.
11. Do not take keys or any material by reaching with your hands between the top and bottom Tools of the machine. If you have any tools or parts you need to take, take them around the machine.
12. Decide how to hold the sheet when bending, paying attention to the shape of the sheet after the process. Especially on short sheets, make sure that your fingers do not come to the top.
13. Do not be under the load during loading.

1.3 Scope of delivery

- 1x Press brake machine
- 1x Top Tool
- 1x Bottom Tool
- 1x Pedal-set
- 1x Leg plate set (Optional)

1.4 Purpose of use

CNC Press Brake is a sheet metal forming machine which bends the metal sheet to the desired form. By the press brake machines, sheet metal is pressed between two tools and takes shape. The top tool compresses the sheet with force and provides bending at different angles.

1.5 Environmental protection

Machine packaging must be disposed of in accordance with environmental regulations.

1.6 User safety information

The user must wear protective clothing when using the press brake. The clothing must not be oversized. Long haired users must tie their hair.

	Protection against	Features
Protective gloves	<ul style="list-style-type: none"> ▪ cracks ▪ cuts ▪ abrasions ▪ irritation ▪ heat 	<ul style="list-style-type: none"> ▪ cut resistant ▪ tear resistant ▪ made of durable and thick material ▪ sterile ▪ easy to disinfect ▪ tear resistant ▪ anti-slide
Safety shoes	<ul style="list-style-type: none"> ▪ Thermal, electrical, mechanical ve chemical hazards 	<ul style="list-style-type: none"> ▪ front nose made of metal or plastic ▪ puncture-resistnat base ▪ waterproof(conditional) ▪ cold insulated ▪ anti-slide
Safety glasses	<ul style="list-style-type: none"> ▪ UV radiation ▪ chemicals ▪ dust ▪ spall ▪ chips 	<ul style="list-style-type: none"> ▪ antistatic ▪ optically corrective ▪ unbreakable ▪ wide view

1.7 Responsibility

MVD INAN Inc. CNC iBend type belt pulley press brakes are designed and produced for bending plates and sheet materials. The operating guides of the machine, CNC unit and the back gauge unit should be the basis for using the machine. MVD Machine Industrials is not responsible for any damages and consequences arising from im-proper use of the machine.

1.8 Warnings

1. Only the qualified personnel may operate the machine.
2. Before operating the machine; the area must be cleared of all obstacles that may cause falling, tripping, or slipping and striking.
3. The operator must have a thorough understanding of the user guide and, if necessary, refer to it.
4. The operator must ensure that no persons are on, behind or inside the machine during operation.
5. Safety in front of the tools is ensured by the light curtain or laser. When the two-hand controller is used, the dangerously fast descending movement of the table continues until it reaches the sheet holding point. During this period, the light curtain or laser provides equal protection for everyone around. If there is any interference with the light curtain or laser, the table stops immediately.
6. On the sheet holding point, the foot pedal initiates a slow closing (i.e. pressing) speed. Safety at this speed is entirely the responsibility of the operator. Light curtain or laser does not work at this speed.
7. Operators must pay attention to the control panel or footswitch cables.
8. The electrical cabinet must be kept closed during operation. No one is allowed to open this booth, except for fully qualified maintenance personnel.
9. Exposing the machine to direct fire, welding or grinding on the processing piece on the machine is forbidden.
10. Operators should be dressed according to the requirements of the relevant law (durable and non-sagging clothing, industrial protective footwear, industrial gloves, etc).
11. For safety during maintenance and repair, the main switch should be set to the "0" position and locked with a padlock. The electrical system must not be interfered with to disable any safety equipment. The responsibility belongs to the customer.
12. If emergency stop is needed, the foot pedal stand has an emergency stop button.

Note: Use the " **table up** " button in case of any jamming between the bottom and top table. Use the manual control buttons of the digital (NC) resting unit to rescue when someone is trapped by the back gauge

1.9 What to do in case of malfunction?

Problem	REASON, SOLUTION
RESET LIGHT CAN NOT BE SWITCHED OFF	CHECK BACK SIDE RESET LIGHTS AND SWITCH THEM OFF FIRST, CHECK EMERGENCY STOP BUTTONS, AND SIDE GATE SENSORS.
MACHINE DOESN'T MODE DOWN	ALL RESET LIGHTS MUST BE SWITCHED OFF PHASE RELAY (FR) AND MAIN ELECTRIC INPUTS (R, S, T) MUST BE CHECKED AND SHOULD BE EXCHANGED IF NEEDED.
MACHINE DOESN'T BEND	MACHINE MUST BE IN AUTOMATIC OR SEMIAUTOMATIC MODE MODE KEY MUST BE ON MODE 2 FRONT LASER DEVICES MUST BE ALIGNED.
BENDING ANGLES ARE NOT REQUESTED ANGLES	CHECK THE CONDITION OF TOOLS AND CHANGE THE BROKEN TOOL IF NEEDED. SET CORRECTION FOR Y AXES AND CHANGE THE CROWNING VALUE IF NEEDED.

2. Installation

2.1 Lifting and transporting

The customer must unpack and check for any damage or loss after receiving the machine, which is safely load-ed and transported. Any objections that are not made at this time and the ones that are subsequently made cannot be accepted by the manufacturer.

When lifting the machine, steel ropes must be used and the machine must be lifted from the marked lifting extensions on both columns (See Figure 2 and Figure 3). It is the customer's responsibility to lift, transport and place in accordance with the safety rules. If the transportation will be shipped or take a long time, the machine tools and metal surfaces are covered with an anti-rust coating. After the machine is unpacked, it should be cleaned well and the rust preventive coating on the tables, tools and metal surfaces should be removed with proper chemicals. It is recommended to apply a thin layer of machine oil to these surfaces. For further details, see Chapter 3 of the operation guide.



Figure 2 Example of lifting and transporting

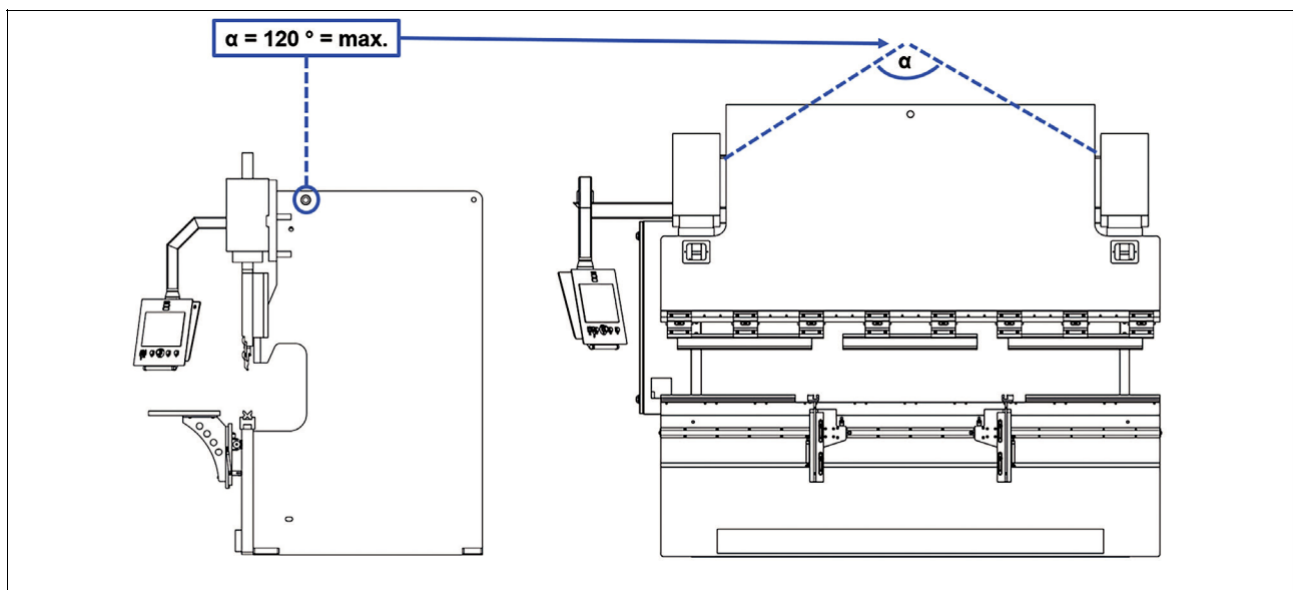


Figure 3 Lifting and transporting

2.2 Unpacking the product

Removing the packaging on the product after it has been placed in the desired location is recommended to prevent scratches and other possible damages. After placing the machine on the metal foot plates, the packaging can be removed. The packaging must be disposed of according to the environmental protection standards.



Figure 4 Packaged product - front side



Figure 5 Packaged product - back side

2.3 Locating

The place where the machine is to be installed (=base) must be concrete, flat and levelled thoroughly. The machine must be provided with the necessary space around it to safely hold and bend the pieces as well as to allow for check and maintenance work. To replace large tools, there must be a crane and also a space equal to the machine length on one side. During the bending process, the force applied is absorbed by the machine body, so the concrete foundation on which the machine will be installed must be able to support the machine and hold it steady in case of an earthquake.

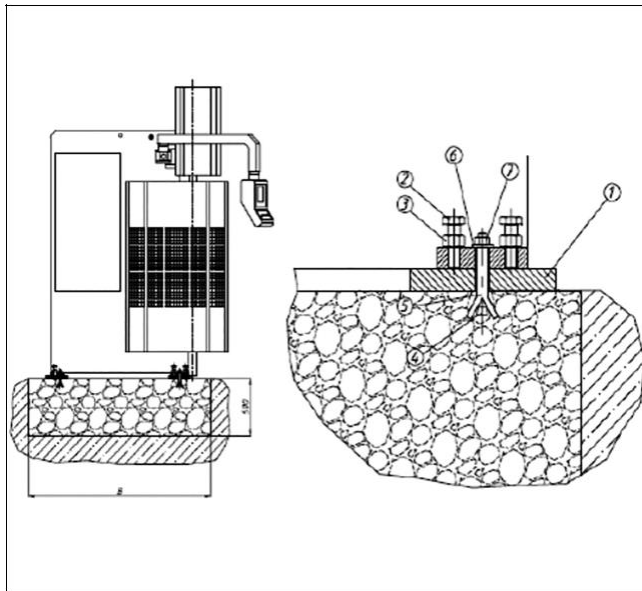


Figure 6 Locating the machine

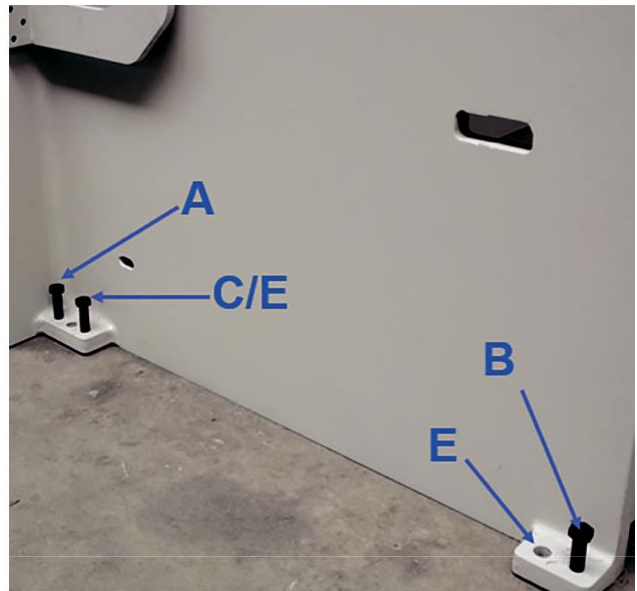


Figure 7 Machine Leg Holes

Note: It is an obligation for the customer to secure the machine to the ground with bolts or anchor bolts fixed by chemical dowels, and to make a grounding connection from the ground (PE) clamp in the control cabinet to the factory ground.

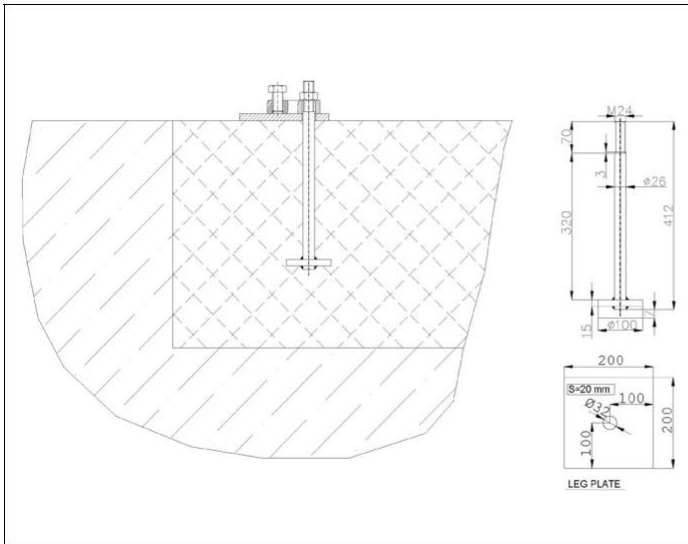


Figure 8 Leg Plates and Anchor Bolts

2.4 Leveling

When placing the machine on the prepared base, the bottom of each corner of the machine should be supported with iron plates of 20 mm thickness and the machine should be leveled both crossingly and longitudinally. The permissible tolerances are as follows:

Latitudinal leveling: approx. 0.1-0.2 mm / m. (machine depth)

Longitudinal leveling: approx. 0.2-0.3 mm / m. (machine length)

As seen in figure 8, the adjusting screws and nuts are provided at each corner of the machine. Anchor bolts, chemical dowels and foot plates are not parts of the machine, and MVD INAN A.Ş. is not responsible to provide them with the machine. These plates can be supplied by the customer for an extra fee. The thickness of the foot plates varies according to the tonnage.

Machine Weight \leq 7 tons = 15mm plate thickness

Machine Weight $>$ 7 tons = 20mm plate thickness

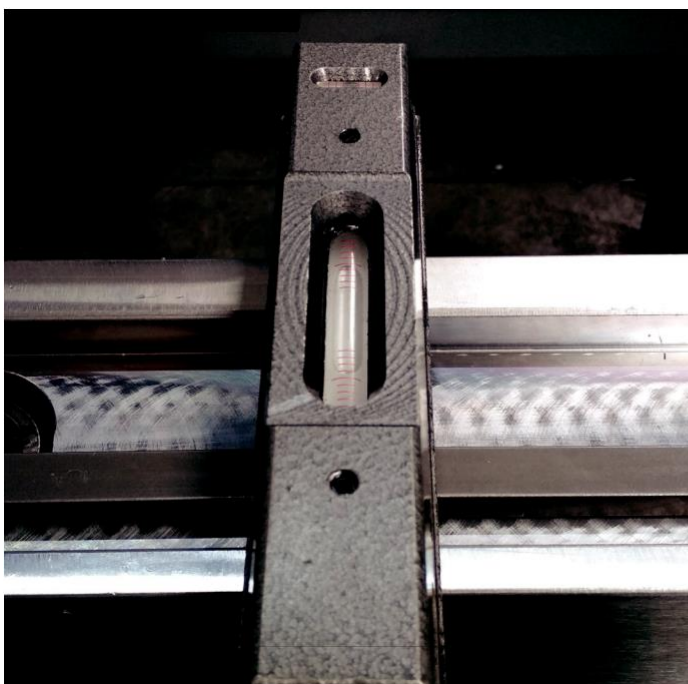


Figure 9 Leveling in transverse and lengthwise directions

2.5 Connecting to power

The power connections of the machine are delivered ready for use. Only the power cables must be connected to the main power switch in the electrical cabinet. Power connections must be made by suitably qualified personnel and in accordance with applicable standards. The cross-sectional area of the connecting cable must correspond to the required total power indicated on the machine nameplate. The outer protector on the panel entry should be stripped and the shield inside should be connected to the metal fitting. The phase cables must be connected to the main power switch and the grounding cable must be connected to the ground terminal. The motor only rotates in one direction. When all the electrical circuits are connected and the reset light is off, if the phase relay is not lit, change places of two phases randomly and check the phase relay again (Continue this process until the phase relay 's light is on).

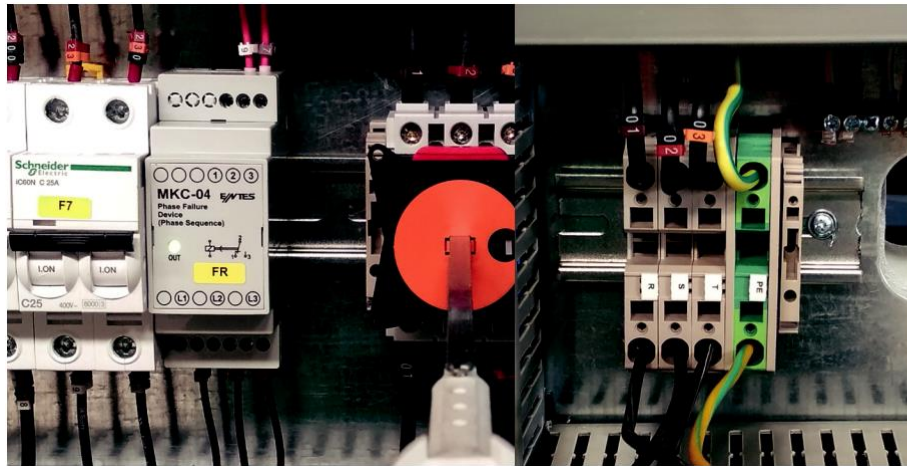


Figure 11 Main Power Connection and the Phase Relay (FR)

Attention:

1. Check if the mains voltage has correct voltage value before connecting the de-vice.
 2. Power cable and plug comply with 400V AC 3 phase, neutral and grounding input power structure.
 3. Serious damage to the machine may occur if the mains voltage constantly falls below the safe operating voltage. In this case it is recommended to use a voltage regulator.
-

2.6 Putting the machine into use

Turn on the main power switches of the workplace and the machine. The power light on the cover of the machine's electrical cabinet will turn on (if not, check the main power supply). Firstly, the reset lamps, if any, of the rear light curtain, must be switched off by pressing the reset button on the control panel. To switch off the rear reset lamp, simultaneously press on two different buttons on the cover of the control cabinet and on the side of the cover (Some models have one button). If the rear reset lamps do not turn off, the object that prevents the rear light curtains from seeing each other should be removed. The reset lamp on the front or on the pedal console must then be turned off.

If the reset lamp does not turn off, check whether the door switches, the emergency stop buttons and the rear reset lamps. If there is still a problem, other safety-related equipment such as monitor valves, light curtains and connections, and relays must be checked and, if necessary, MVD INAN A.Ş. service department should be informed.

If the light is off when reset button is pressed, the machine is ready to start. Press the "table up" button to raise the table. Then the table is moved down by pressing the pedal or by pressing the two-hand buttons simultaneously on two-hand machines. After the reset lamps go out, press the "Start" button and the motor will start. At this point, the CNC control unit controls the stopping time of the machine (for machines with Overrun Test). If there is a problem, the machine does not start. If the stop is complete, the machine is raised again with the "table up" button. Now it is ready to start.

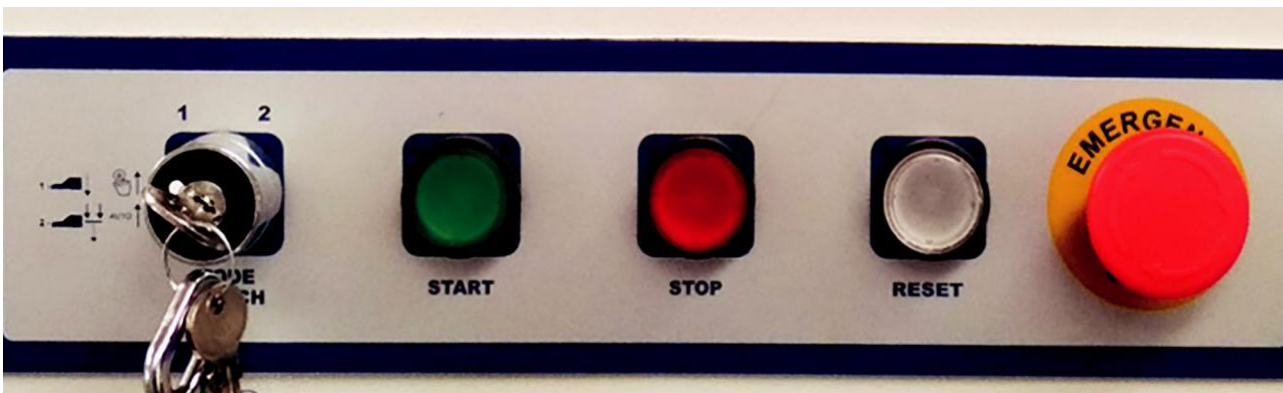


Figure 12 Pedal Command Console

Attention:

The relays (S1, S2, S3) of the controlled valves shall be in the closed position with the top table at the top-dead-center. If not, this means that there is a problem with the valves or the control system of the valves and in this case the top plate will not move, reset light will be on.

2.7 Temperature of the installation place

The temperature of the place where the machine will be used should be between 5 °C and 35 °C. If the area is warmer, we recommend using oil cooler and if it is colder, you can use oil heater

3 Operation Guide

3.1 Machine Information

3.1.1 General Features

Press brakes, as standard, are between 2 and 4 meters and 60 to 1000 tons.

Our press brakes are among the best in the industry with continuous technological research and development in the field of modern bending. In this sense, the co-operation of the -electric and mechanic duo shows how advanced the current technique is.

1. Top table moving bending system,
2. Robust body structure where side columns, table and tank are welded,
3. Two operation stages:

Down movement with torque control and up movement.

4. Bottom control and fast descending of upper table,
5. Bending movement with adjustable force control.
6. Return to top dead center (TDC) after reaching the limit position and completing the bending,
7. Belt Pulley servo system with very high descending and returning speed,
8. CNC controlled adjustment of top and bottom dead centers (TDC and BDC), identification of back gauge position, bending angle, sheet thickness, bending length, bending width, top Tool and bottom Tool measures in CNC unit. Automatic calculation and application of servo motor such as position and force by CNC unit.
9. The force required for the rollers is calculated by the CNC unit and controlled by servo motor.
10. Servo system to control torque and force.
11. Precise bending process with control of the top table movement by electronic scale, servo valves and CNC control unit. In this system, the electronic ruler is placed on the side slides of the top table so that it is not affected by the flexing on the side walls and they have their base on the bottom table. This provides 0.01 mm precision in bending positioning.
12. Laser or light curtain safety systems that minimize the risk of injury during use.
13. Precise back gauge system to adjust the bending width.
14. Front supports with right and left movement and fixing possibility, which supports the sheet to be bent from the front.
15. Promecam system holding the top tool which is compatibly hardened with the crane structure of the machine.
16. "Position switch" that selects different operating and safety positions.
17. Emergency stop, beam up and safety reset buttons.
18. The servo system has a torque control to limit the required working force while bending. The required force is calculated by the CNC unit. The machine performs bending at this force. If the calculated force is not sufficient, the bending movement does not continue. In this case it may be necessary to manually enter the pressing force. This feature both enables operation and is important for the safety of tools.

3.1.1.1 Machine body

Press brake is a bending machine of which all basic parts are made of various steel pieces. It consists of a stable body, drawings of which are made by CAD program and it is created with FEM analysis and various calculations. The main parts of the press brake consists of top table, back gauge, bottom body and side walls. There are two cylinders that connected with top beam to perform the bending. These cylinders enable the top table to move with the servo system. Up and down commands are given by the control panel and pedal. With the simple commanding feature of the Control Panel, the use of CNC has become easier. (For detailed information, look at the controller manual) In addition, the safety of both the machine and the user has been maximized with the latest safety standards.



Figure 14 Machine main parts

3.1.1.2 Front support

MVD INAN Inc. uses front supports to enable the bending and folding of the sheet. Two front supports are available in the presses as standard. On the front support, there is also an booster ruler to ensure the desired bending of the sheet. The front supports can be shifted to the right and left and stabilized from anywhere by quick clamping.

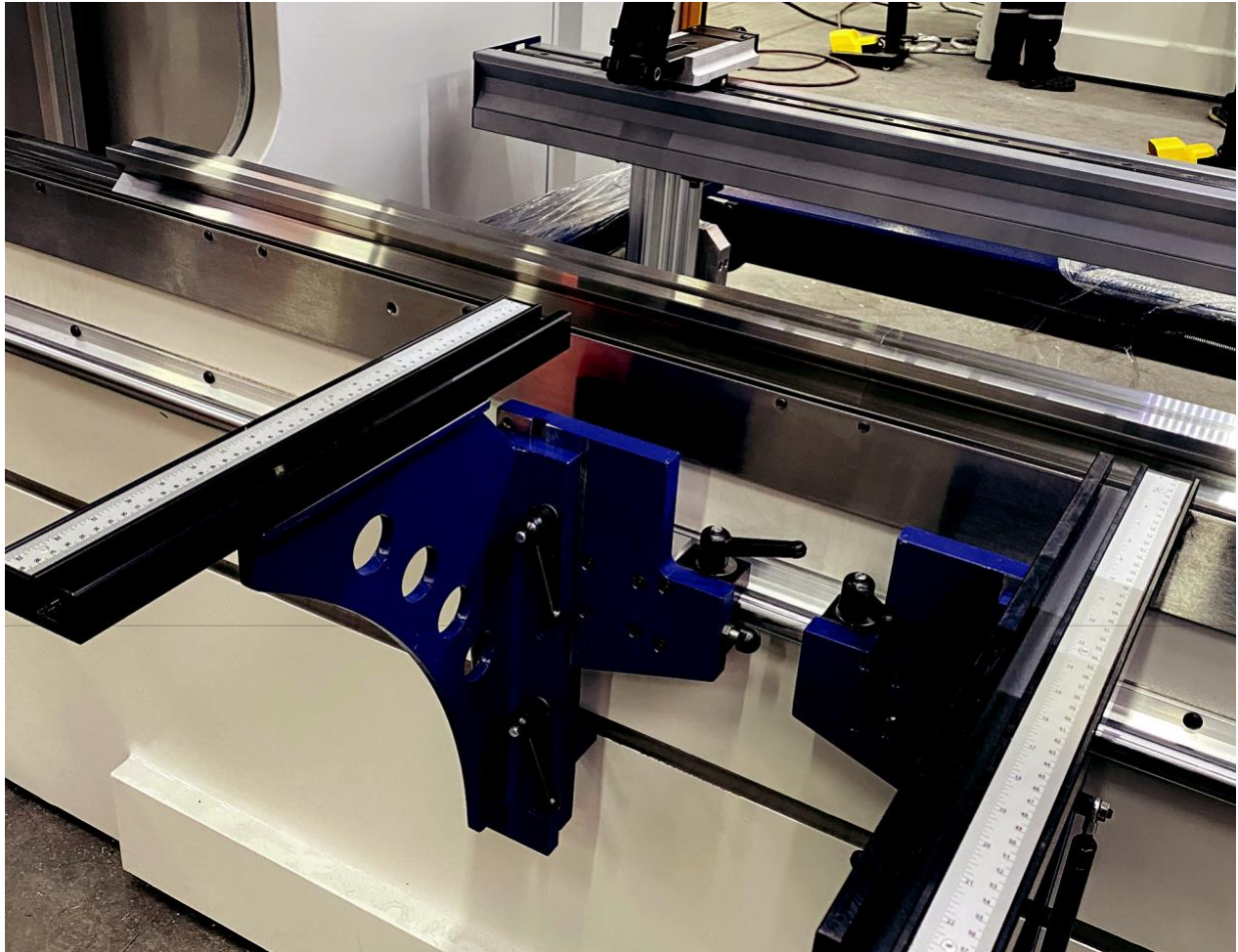


Figure 16 Front Supports

3.1.1.3 Top Table

The top table is connected to the machine body by ballscrew. The difference of the top table from the other body parts is that it can move due to servo motor. This precise balancing enables electronic signals to be transferred to servo driver by the principle designed by MVD motorers and allows the top table to move. with this system, both sides of the machine (Y1 and Y2 axes) are provided to work correspondingly. The Y1 and Y2 axes are precisely adjusted before the machine is operated. Position difference between two axes can be maximum 10%.

3.1.1.4 Back gauge

The back gauge ensures that the sheet does not slip during the bending phase and is responsible for the desired degree of bending. It also plays an important role in the second and third bending phase. Back gauge provides distance (X-Axis, forward-backward), height (R-Axis, up-down) and side movement (Z-Axis, right-left). The command setting is entered from the CNC Control panel (This command can be given by the controller with a „drawing“ also, as an option of graphical screen controllers). Depending on the order, the stop axes can be increased from 1 to 6. In addition, the back gauge has the ability to send to the exact position with high speed and CNC control. Due to this feature, large sheets and complex bent parts can be produced without any problem. At the same time, the production time is shortened and time is saved as large sheets do not require continuous back gauge adjustment.

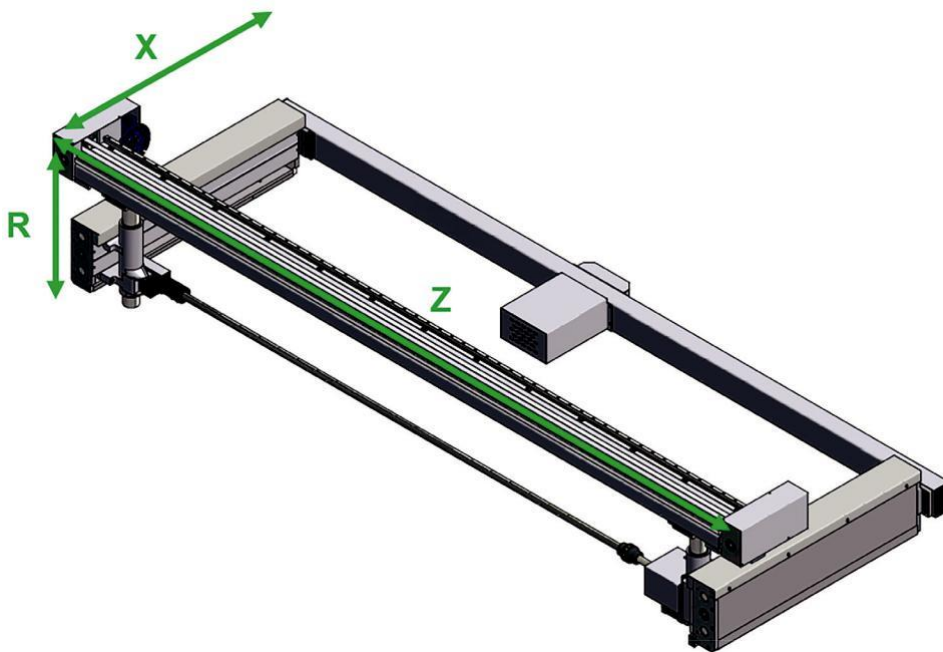


Figure 18 Back gauge

Back gauge is produced with the framework of “plug & play” mounting system concept and is a design that guarantees both highest quality and reliability. In this way, the bending can always be carried out to the desired extent. It is equipped with limit switches to prevent accidental impact or unwanted maneuvering errors.

Each back gauge axis movements are limited by control unit (Maximum and minimum values are set) and by limit switches (Maximum and minimum limit switches). Maximum limit switches are reference switches at the same time. When the machine is started up, all axes are indexed by sending them to their maximum limit switches and controller understands again their reference positions. (In manual mode by pressing controller start button after re-set lights are switched off and the pump is run)

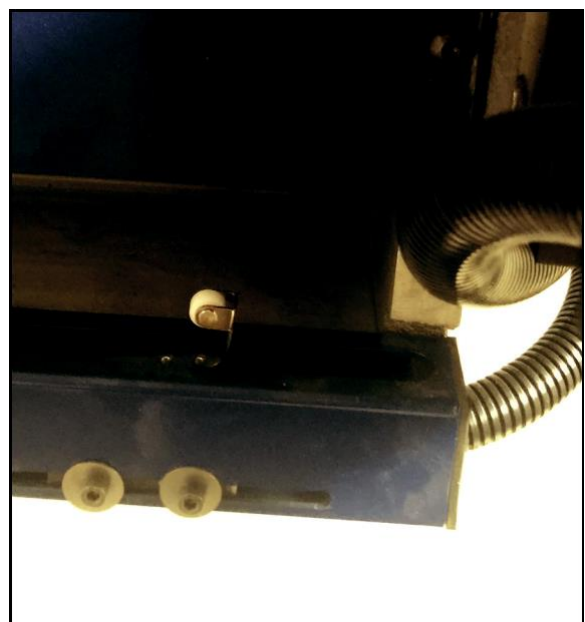


Figure 19 Limit Switch

3.1.1.5 Back Gauge Finger

The back gauge holds the sheet metal with fingers. The sheet rests on these fingers. The resting flervers are various and are available up to four steps. As in Figure 24, step H1 is 10 mm high. The resting levers can be moved manually or automatically. Z1 and Z2 are the axes of these resting levers. As a standard, the press brakes have two levers. This number can be increased up to six, depending on the customer's request.

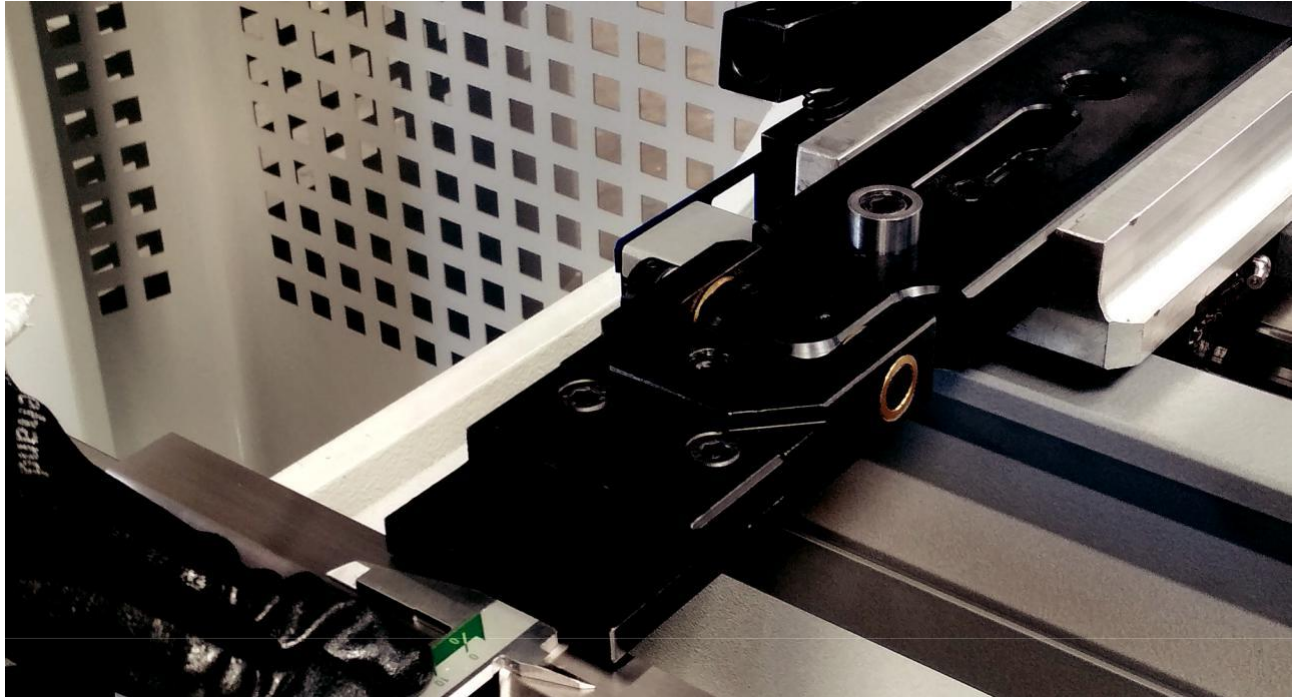


Figure 20 Backgauge finger (Example)



Figure 21 Back gauge finger and steps

3.1.1.6 Top Tool (Punch)

The upper Tool is connected to the promecams and directly contacts with the sheet to be bent. The Tool used as standard has 0.8 mm Radius (R), 66,60 mm (H) height and, its resistance is maximum: 100 T/m.

3.1.1.7 Bottom Tool (Die)

The upper beam can have manual or pneumatic supports. Bottom tool is placed on it. The standard bottom tool consists of four different “V” bending channels 16mm, 22mm, 35mm, 50mm, with 80T / m maximum resistance.

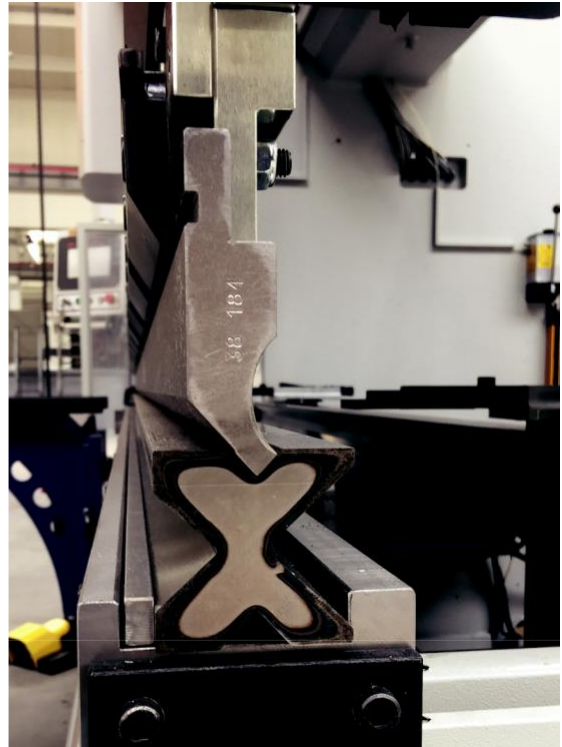


Figure 24 Tools

3.1.1.8 Control Unit

It is the main unit used in press brakes. The Control Unit brings all the units of the machine together, provides functionality and saves machine information. The improved LCD display allows you to optimize the working process. The equipment and sheet are displayed in two dimensions (2D) on the screen. The command buttons at the bottom of the screen provide automatic control of the machine. It also reduces waiting times in mass production. There are start and stop buttons of the main motor, a reset button, a normal and fast descent button of the worktop and an emergency stop button on the panel. On the right, bottom or back of the LCD screen, there is a USB memory port for loading and saving the machine's parameters. For more information on the Control Panel, refer to the enclosed control unit guide.

In addition, the complete bending program can be created specifically on the screen and the bending program created according to the preference can be saved for future use. Moreover, the bending program can be transferred to the computer via USB flash drive. In short, it differs from other production softwares in that it is an “open” system for transferring or receiving data. Also, the machine can be integrated in a multiple production cycle and connected to a network.

In this way, MVD INAN Inc. press brakes can be easily customized to the new specific order. The most important difference of the control panel is that the user can program it in a simple way.



Figure 25 Control Panel Examples (Delem and Esa)

3.1.1.9 Slides

The slide setting consists of 5 setscrew on the back of the worktop and L-Block connected. Larger machines also have an upper slide. In principle, after the table is descended, the Y1 and Y2 sides of all bolts are tightened so that the top table can be fully pulled into the L-Block. In this way, the top table is pulled into the body of the machine and the table is stabilized precisely and better during movement. Stable ascent and descent is also supported by the bearings on the back of the table.

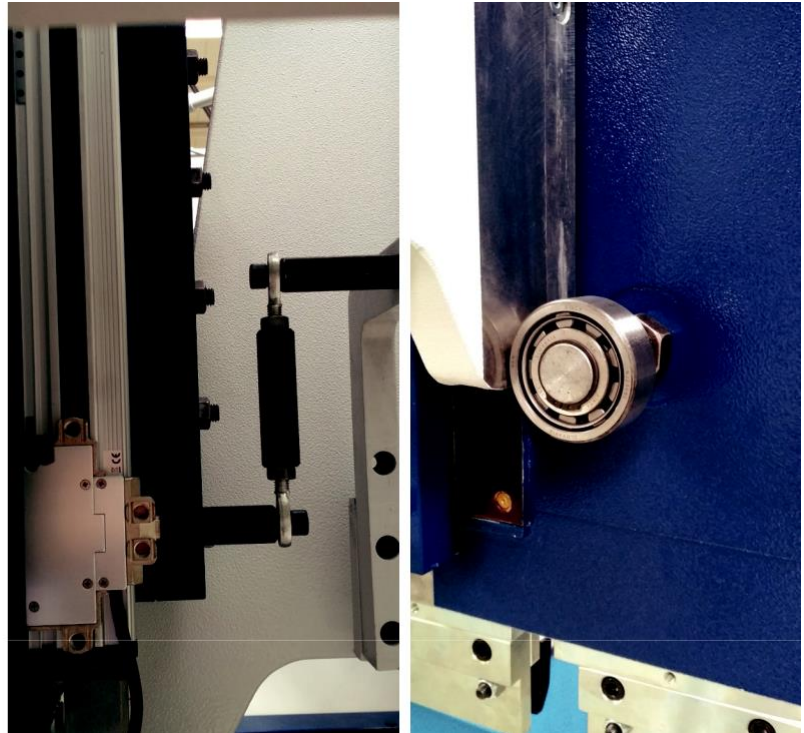
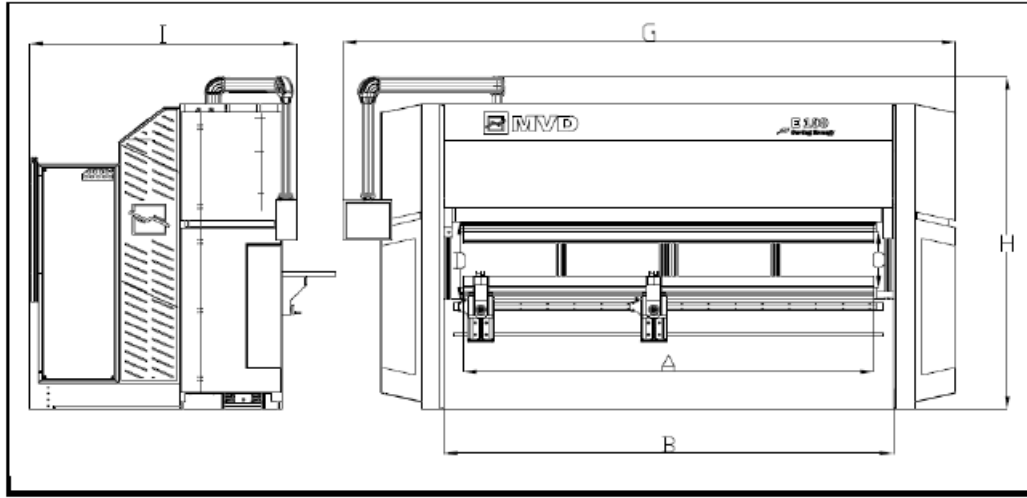


Figure 26 Slideway group and bearing

3.1.2 Technical features

Press brake is a machine which is designed and manufactured according to order. It can perform bending process with a single press and has versatile features. Although it has standard features, it can be personalized with small mechanical changes at the request of the user. The order is made according to the customer's personal requirements and optional features are added on request. Then, an order-specific task table is prepared with both standard features and optional features, and the features are planned to be integrated. As shown in Figure 13, the standard measures of the machine are as follows



**E100.3100 TECHNICAL SPECIFICATIONS
(E100.3100 KAYIŞLI SERVO TEKNİK ÖZELLİKLER)**

Bending Power (Presleme kuvveti)		100	ton.
Bending Lenght. (Bükme boyu)	A	3100	mm
Distance Between colums (Kolonlar Arası mesafe)	B	3345	mm
Stroke (Strok)	C	330	mm
Throat depth (Boğaz derinliği)		XX	mm
Table Height (Tabla yüksekliği)		995	mm
Depth of pit. (Yeraltı tabla yüksekliği)		XX	mm
Overall Length (Toplam uzunluk)	G	4650	mm
Overall Height. (Toplam yükseklik)	H	2750	mm
Height over the ground (Yerüstü yükseklik)		XX	mm
Overall depth.(Toplam genişlik)	I	2300	mm
Daylight.(İki tabla arası)	D	450	mm
Free Apporoach Speed (Serbest iniş hızı)		75	mm/sn
Working Speed (Presleme hızı)		10	mm/sn
Return Speed (Geri dönüş hızı)		75	mm/sn
Motor Power (Motor Gücü)		3.5 x2	Kw.
Weight. (Yaklaşık Ağırlık)		7000	kg

Figure 27 Standard measures of the press brake

3.1.3 Points to consider before the operation

- The customer is responsible for connections that are not made well by qualified personnel.
- The customer must be sure that there is at least 500 Lux local lighting or lights around the tools.

3.1.4 A sample of the label

The label on the MVD press brakes (as in Fig. 14) is located on the wall of the machine. The label contains the most important general information about the machine. In case of any Technical problem, it is always necessary to specify the serial number of the machine for communication.

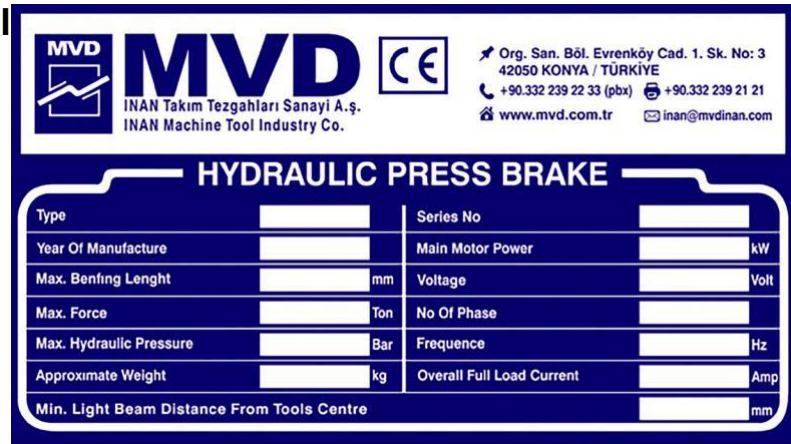


Figure 28 A sample of Press Brake Label

Figure 29 It is a chart explaining which Tool and how many millimeters thick sheet metal the machine can bend. In the chart, the sheet type is considered as medium hardness ($\sigma_t = 42 \text{ kg} / \text{mm}^2$) and calculated according to this sheet type. For different sheet metal types, C coefficient is found from the small chart on the side and new force values are obtained by multiplying the existing force value with this coefficient.

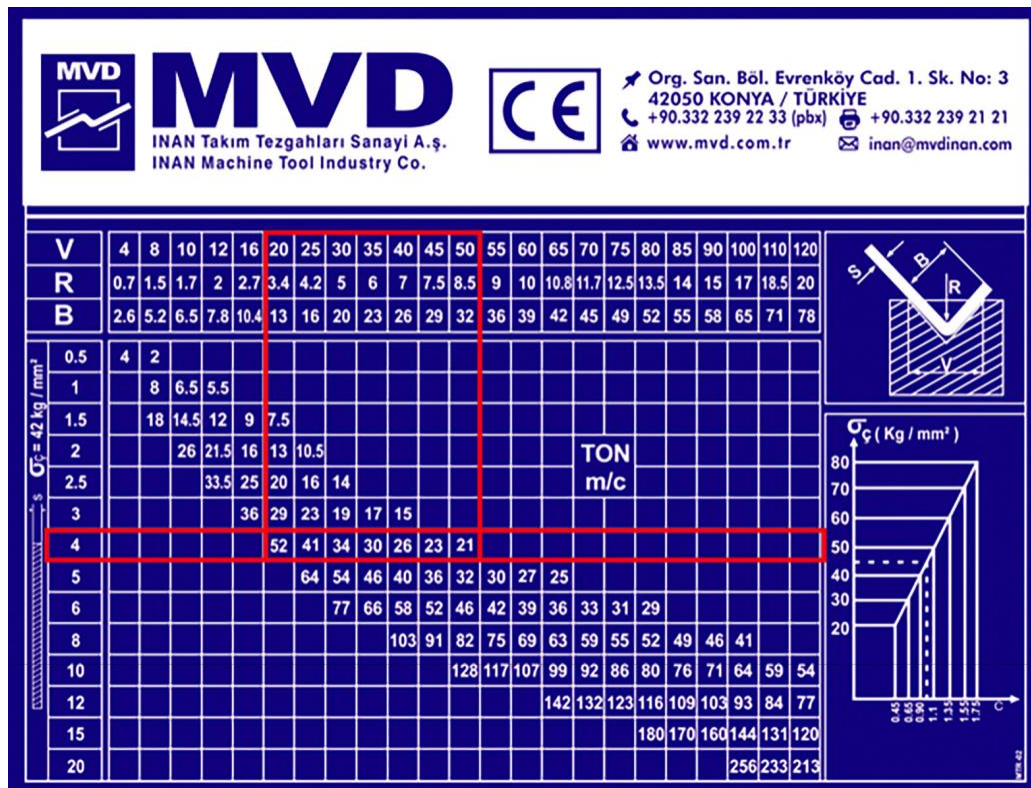


Figure 29 Sheet metal and tonnage calculation Identification Chart

Example: For medium-strength sheet ($\sigma_t = 42 \text{ kg} / \text{mm}^2$), the bottom Tool width of a sheet for 4 mm thick-ness can be V 20, 25, 30, 35, 40, 45 or 50 mm. When a V bottom Tool width of 30 mm is selected, the machine should have a minimum force of 34 Ton per bending length of meter.

3.2 Security Equipments

Before operating the machine, the operating manual must be read, understood and carried out properly. One or more of the following equipment varies by machine model and region of sale.

3.2.1 Laser front security

Before operating the machine, the operating manual must be read, understood and carried out properly. One or more of the following equipment varies by machine model and region of sale.



Figure 31 Current laser front security

Laser safety is placed on the beam in front of the machine to protect the operator when performing the bending process. If anything enters the laser light before reaching the mute point (bottom dead point), the machine stops. Laser front guards

vary depending on the user's demand. Some of these lasers are managed by Plc, whereas not necessary for some of the others.

- Fiemler Akas-II front security; This front security system, which receives commands from FPSC Plc, is the most comprehensive front security laser that is used.
- DSP; This finger protection conservation with Nuova electronic MCS plc is a recommended product.
- MSD; It is a front security system that can be operated without being connected to any command system.

Laser safety system;

It is integrated into press brakes to prevent dangers during bending. The front security is mounted on the upper platform and moves with the upper platform. The laser is just adjusted to the lower point of the upper Tool and follows the upper Tool with continuous laser beam. In the meantime, the two lasers on the Y1 and Y2 sides are in communication with the continuous beam. During rapid fall, in case of going off the laser beams, the platform descent movement is interrupted. By the help of the front security, it protects the hands, fingers and body from any contusion and cutting.

3.2.2 Light curtain

The front light curtain is an AOPD (active opto electronic protective device), that is, an optical curtain in front of the tools. It can be active if the green indicator light is on. If there is an obstacle between the sending and receiving units or if it is not at the same level, the red light will be on. During rapid fall, if any obstacle enters between the sender and the receiver units, the platform will stop for safety. In this case, the platform can be moved again with the foot pedal or the “table up” button that operates the platform at a slow bend speed.

When any object enters the rear light curtain, operation will stop and the reset lamps will light. For re-operation, the rear reset buttons on the panel must be turned off first, making sure that there are no obstacles or obstructions at the rear of the machine. Then, the reset lamp must be turned off from the controller or the pedal.

The distance of the light curtain from the center of the tools was calculated according to the standards and the stopping time of the machine. It is strictly prohibited to move the light curtains closer than the value indicated on the machine. The CNC unit tests the stop time at the first downward movement after the machine starts.

Caution: Position 1 of the position selector switch provides operation at a slow closing speed. Other safety systems, except light curtains or lasers, are still in operation. In slow speed operations, the front safety belongs to the operator.



Figure 32 Laser light curtain used for the rear security

3.2.3 Security switches and protection

The safety switches are connected to the safety guards. These magnetic door switches are activated when the doors of the safety guards are opened and enable the machine to return to the reset state, thus the interference to the hazardous area is prevented. In addition, in some models, the rear guard door can be used instead of the light curtain, and is equipped with a mechanical switch to prevent unintentional opening and closing.

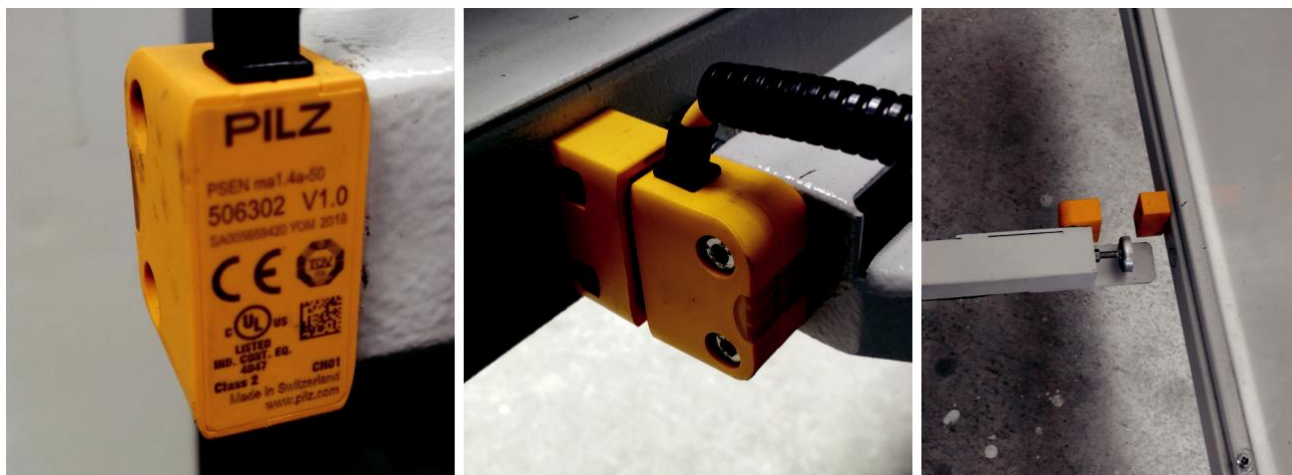


Figure 33 Security switches

3.2.4 Two-hand controller(Special ordered models only)

To start the operator free fall movement, it must be pressed to both mushroom buttons of the two-hand controller at the same time (within 0.5 seconds) using two different hands. When it is reached the platform sheet metal holding point is reached, the operator can hold the process piece by hand during bend with the foot pedal.

Two-hand control devices are controlled by a separate two-hand control relay. If two buttons are not pressed within 0.5 seconds, it does not allow movement and stops the movement when any one is released. It should also be noted that in systems with a light curtain, a two-hand control device is not required. The foot pedal can be used to perform both rapid fall and bending.

3.2.5 Foot pedal

Bending operation is achieved by pressing the foot pedal. When the plate sheet reaches the holding point, the foot pedal continues the slow descent of the plate and initiates the application of force to the process piece. The pedal has 3 positions. In the first position, the pedal is in free position and there are no movements. The second position is the state when the pedal is pressed lightly and it provides moving down the upper beam. The third position is applying more force to the pedal and in this position the downward movement of the upper beam stops and it immediately rises up.



Figure 34 Foot pedal



3.2.6 Emergency stop button

It is used in case of emergency stop. It allows stopping all controls and movements immediately. To resume operation, the head is rotated and it becomes ready to press again then “reset” and “start buttons are pressed respectively.



Figure 35 Emergency stop button

3.2.7 Reset button

This button is for turning off the reset light. The reset light controls the safety system. In case of a safety system error or intervention in the safety system, it locks the operating system until the error is cleared and the reset button is pressed. This error may be due to emergency stop buttons, light curtain, switches.



Figure 36 Reset button

3.2.8 Servo motor force limit

Servo motor has variable torque to limit the required working force during bending. The required force is calculated by the CNC unit. The machine performs bending at this set force. If the calculated force is not sufficient, the bending movement does not continue. In this case, it may be necessary to increase the force value from the control unit. This feature provides both ease of operation and is useful for the safety of the tools. In addition, it provides less aging the machine equipment.

3.2.9 Table up button

When this button is pressed, the table moves up. Before the table is turned back before it reaches the lower dead point, it is used to lift the table up. This can also be used to save someone when he is stuck between uten-cils. As long as this button is pressed, the table moves up and stops when it reaches UDP (upper dead point).

3.3 Operating the machine

3.3.1 General operating principle of the machine

CNC Press Brake is a sheet metal forming machine that brings the metal sheet to the desired form by bending. The press brake bending counters press the metal sheet between two Tools and let it take its shape. The lower part is called the lower Tool, and the upper part is called the upper Tool. With the movement of the upper Tool and the application of force, bending is achieved by compressing the sheet between the upper and lower Tool. Standard top Tools are usually „V“ shaped. Standard bottom Tools are usually „V“ or „U“ shaped. Information such as material type, material thickness, bending length, force to be applied are entered into the device from the CNC control panel. After entering these information, animation is obtained (In some models) and the product is obtained after the bending process is seen.

With the animation, the product error that will occur in the production will be prevented and thus the error will be corrected before the bending and necessary changes will be made and production will be provided. Another feature of CNC controlled press brakes is the active movement of the back gauge. With forward, backward, up and down movement, the desired form can be given to the metal sheet with precise production. CNC

Press Brakes have too many features such as programming, Figure 38 Bottom and top Tool storing programs, recalling if desired, changing the operating speeds, upper and lower Tool identification and storage, programme transferring to the counter with network connection from the computer or USB flash memory.



3.3.2 First operation

The main switch of the workshop and the machine is switched on so that the power lamp in the machine's electrical cabinet will light. Then the motor start button is pressed. Now the reset lights must be off to go on. At first, back side reset lights will be off, for this, back side reset (Photocell reset) button (On the electric cabinet) must be pressed by looking at the rear area of the machine to avoid any danger (In some types, there are two back side reset button, they must be pressed at the same time together). Then press the safety reset button on the foot pedal stand. If the safety reset light does not go out, there is a problem with the installed safety system and therefore the machine will not start. In this case, it is checked whether the safety switch in the side gate is locked. Then the safety reset button is pressed again. If there is still a problem, you should consider other safety-related equipment, such as controlled valves, connections and relays, or contact MVD

INAN AS Service.



Figure 39 Photocell Reset Buttons

3.3.3 Reference to the upper table and back gauge

The control panel works when the motor starts and the reset light turns off. Position 1 is selected from the selector switch in the electrical cabinet and the manual operation button is pressed from the control panel. Then after pressing the „Start“ button, the back gauge first moves to the reference points and then to the position written on the screen.



Figure 40 Main electric switch



Figure 41 Mode key

After that, first, by pressing the “Up” button, the upper table is moved to the top position and sent to the reference. By this way, electronic scales were passed through the reference point and position information was given to CNC control unit. After this, machines equipped with overrun test equipment test the fast fall time with the first series descent of the table and give approval to the system. Now the machine is ready to bend to ± 0.01 mm parallelism at the lower dead point.



Figure 42 2nd step: Table up button

3.3.4 State 1: Setting state

Set the position selector switch on the control panel to “1” position for installation and adjustment before starting serial operation. In this position, the foot switch (or two-hand controller) operates the machine only at a slow closing speed. Fast closing speed or automatic return is not possible. As long as the pedal (or two-hand) is pressed, the beam will come down and stop when not pressed. In order to move the beam up, the “Up” button must be held down.

Caution: Before position 1 starts serial operation, it is for setting up and adjusting. The light curtain does not work, so the safety of the people around is entirely under the responsibility of the operator.

State 2: Operating state

The foot switch must be pressed until the upper beam goes down to the lower dead point and lifts up after it has finished bending (on machines with two hand controllers, both buttons must be pressed simultaneously). If the force calculated by the CNC unit is not sufficient for bending, the beam does not move as the desired position cannot be reached. In this case, a higher force value must be entered in the control unit and the value of the material, tool, etc. must be checked. The accuracy of the information should be checked.

Caution: The schematic illustrations on the front of the sheet only warn the operator of the most common injuries during bending. Users should always be prepared for the dangers that may occur during their work!

3.3.5 Tool placement

When the machines arrive, the anti-rust coating on the upper and lower bending Tools should be cleaned and a small amount of machine oil should be applied instead.

Dirt on the table must be cleaned before the bending tools are placed on the machine. Lower tools weighing less than 25 kg should be placed by hand, and the heavier lower tools should be supported by lifting by means of rope and winch in the middle and carried out by pushing after half of it is put onto the table. At the same time, it should be paid attention that the front part does not go out and fall out of the table.

The lower plate is lowered in the 1st position to set the upper tool. When the distance between the table and the lowest point of the opposite "V" is 3 mm - 5 mm from the distance required for the insertion of the upper Tool, the motor is stopped and the Tool is installed from the side. Since there is very little distance between the upper and lower Tools, no one will be able to put his hands under the tool. Upper Tools weighing less than 25 kg should be placed by hand as in the lower tool, and the heavy ones should be lifted with rope and winch as in the lower tool and pushed into the canal of the upper table (Figure 30, detail D). Since the upper tool has a safety lip, the tool will not fall after the tool has fully penetrated into the channel and unless the clamping bolts are loosened too much. Upper tools, half of which enter into the canal, are pushed by hand and slid inside the canal and all are placed this way. They must be pushed upwards while fastening and fixing in place with clamping bolts, push them upwards with a wooden wedge and make sure that they stand up to the lower part of the table.

The clamping brackets on the right and left heads of the table are used to bring the upper and lower tools (see Figure 30). To do this, the top table is moved down in the 1st position. The V-canal in the lower tool is moved by means of the lower tool clamping to the center the end of the upper tool. In addition to rough adjustment by eye, the gap between the Tools must be precisely equal-ized from the front and rear with the help of the feeler gauge.

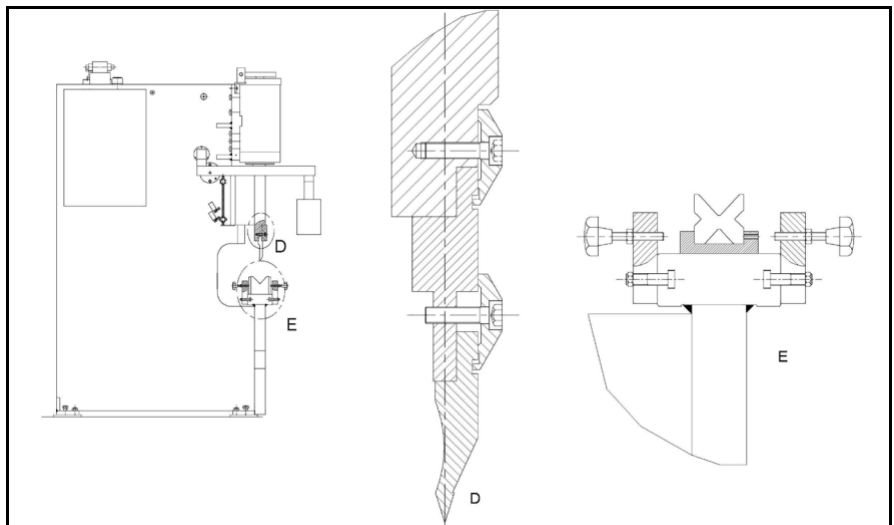


Figure 43 Placing the Tools

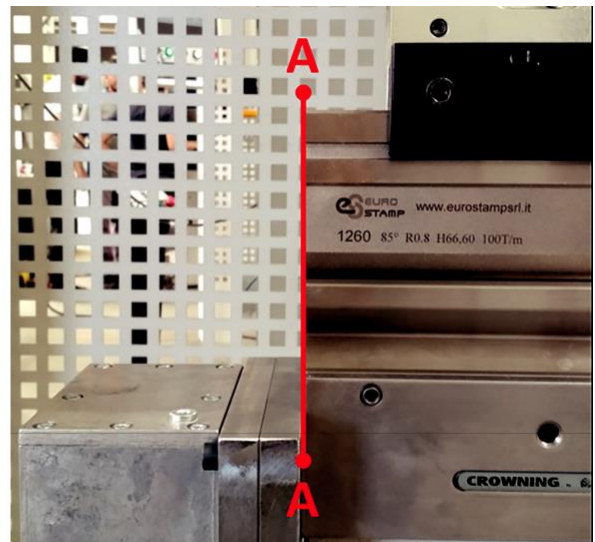
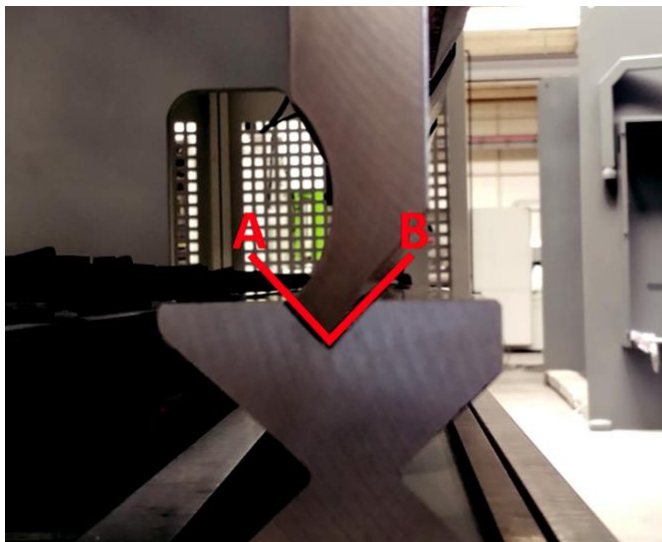


Figure 44 Bottom and top Tool placement

When the lower tool is fastened in its place, the bolts of the front and rear clamp supports must be aligned. Otherwise, the linearity of the lower tool is distorted and the upper and lower tools do not center each other in the middle.

Attention: Please don't use red colored bolts. Green colored bolts can be used if needed. (For quick clamp models, if these green bolts have to be tightened, quick clamping lever should be in closed position to hold the punch.)

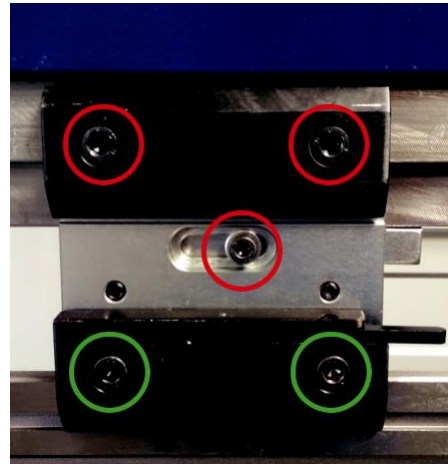


Figure 45 Promecam

3.3.6 TDP, PCS and SCP adjustment

For all these points, the values calculated by the CNC unit can be used as well as it can be manually entered into the screen of the CNC unit. In addition, the force required for bending is calculated by the CNC unit. It is under the responsibility of the operator to enter the values correctly that the CNC unit uses in the calculations.



Figure 46 Delem Controller as Example

For Delem controllers; Bending Length, Angle, Thickness, Material, Punch, Die, X-axis and, R-axis fields should be filled as minimum for a bend. Other values will be calculated automatically. For detailed information, please check controllers user manual.

For Esa controllers; Width, Thickness, ResistMaterial, Die, Punch, Angle, X1 and, R1 fields should be filled as minimum for a bend. Other values will be calculated automatically. For detailed information, please check controllers user manual.

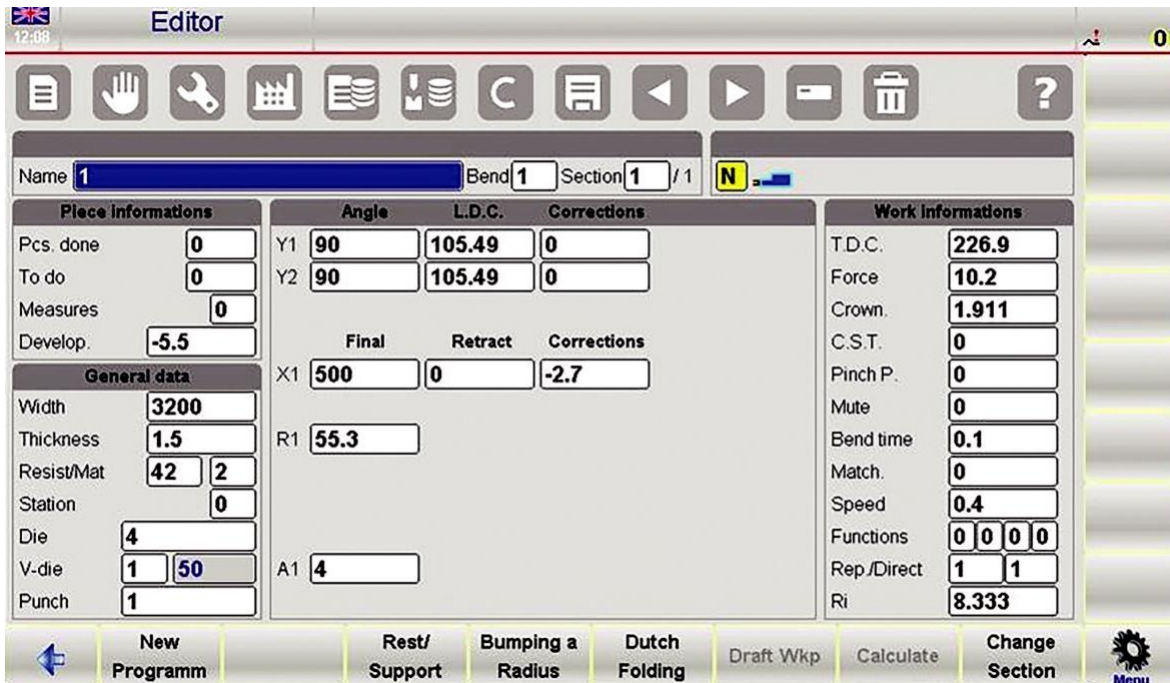


Figure 47 Esa Controller as Example

Upper dead point, Opening	<p>Upper dead point: The upper dead point is the opening distance of the top plate after bending, it is the opening between the two tools. In new programs prepared with graphics, this distance is calculated automatically and if necessary, it can be changed manually.</p>
Force	<p>After the width, thickness, type and other data of the sheet are given, the force required to perform the bending is automatically calculated. Sometimes the calculated force may not be enough to bend the sheet. The sheet may sometimes be harder than it should be. In this case, the machine can be forced or tries to bend very slowly. To solve this problem, the force is manually increased and the bend is retried.</p>
Crowning	<p>If the angle of the middle part is more open than the two ends after the sheet is bent, the crowning should be applied. In machines with motorized crowning, the control unit automatically calculates and applies the crowning value. If the value of the sheet is not suitable, over or under calculated as a result of inadequate sheet metal quality, it may need to be corrected manually.</p>
BGT, Gauge delay	<p>Back Gauge Time: It is the back gauge waiting time between two bends in the programme. Values (in terms of) [s = second]</p>
PCS, CC	<p>Point of contact to the sheet: Point of contact to the sheet of the upper tool. Gauge uses the retraction function in this point.</p>
SCP, Mute Point	<p>Speed change point: The point at which the upper beam moves fast and starts to move slowly is calculated by the control unit based on the sheet thickness. In case of need, the user can also change it by hand in order to work more easily.</p>
Bend time, Waiting time	<p>Bend time: This feature is used to allow the upper Tool to continue to apply force to the sheet for a period of time as the bending is completed. It is recommended to wait for a few seconds for the bending of high tension or thick sheets.</p>

3.3.7 Back gauge setting

To adjust the bend width, the back gauge must be adjusted by the controller. The X-axis position shown on the screen corresponds to the distance between the back gauge finger tips and the bottom Tool V-canal center to be used. The R axis is set to "0" (zero) at the upper level of the lower Tools.

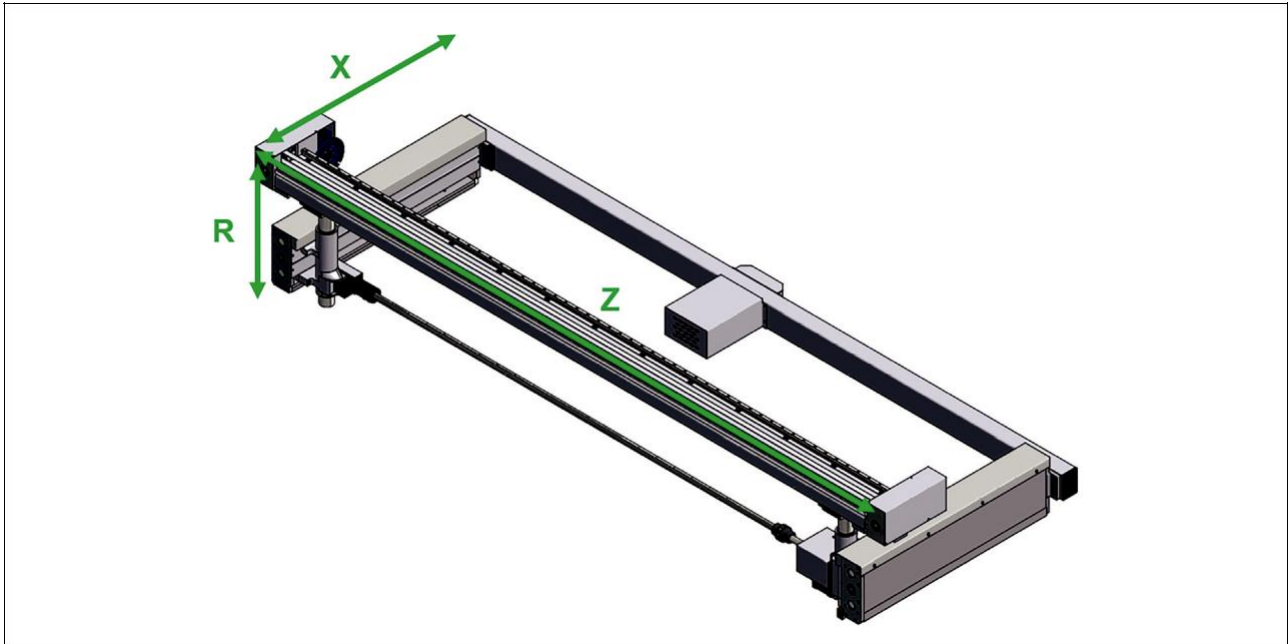


Figure 48 Back gauge

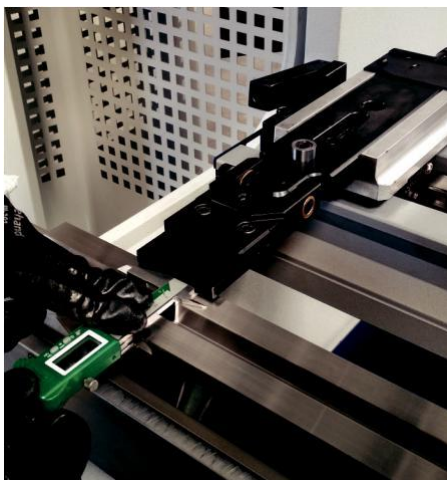


Figure 49 Back gauge finger settings

The back-gauge fingers are capable of fine adjustment and are balanced before shipment. At the same time, each finger can be moved and tightened by hand (with the motor on Z-axis machines) along the gauge.

Caution: It is dangerous to adjust the back gauge fingers between the tools. Adjustment must be made from the rear side of the machine or adjustment bars should be used.

For any control or adjustment, if the user impairs the light curtain or opens the door of the middle-locked protector, the security system intervenes to prevent the movement of the back gauge and the top table. A limiting extension was also provided which prevents unintentional opening and closing of the door.

3.3.8 Turning off the machine, turning off completely

If the machine is to be stopped for several hours or more, the top beam must be in the down position (the upper and lower tools may be between 5 mm - 10 mm), then the motor stop button is pressed, the control lock switch is turned off and the key is removed. Controller must be closed from screen. The main power switch is turned off by turning it to the “0” position. (The main power switch is locked with a padlock for safety when the machine is not running and in maintenance.)



Figure 50 Steps to turn off the machine

4 The security precautions to be considered during maintenance and cleaning

General maintenance rules must also be followed for maintenance and cleaning of the machine. The maintenance can be carried out by fully qualified maintenance personnel or by a service technician of MVD INAN A.Ş. The machine is designed for safe maintenance and lubrication.

Caution: During maintenance and repair work, the main power switch must be set to “0” and locked with a padlock for safety reasons.

4.1 Lubrication

The guide and screw shafts connected to the back gauge should be lubricated by hand using a special grease such as SKF LGMT2 every week. The skidders of the top platform must be lubricated at least once a day (In case of continuous usage or heavy duty, it is recommended to lubricate more than once a day.)

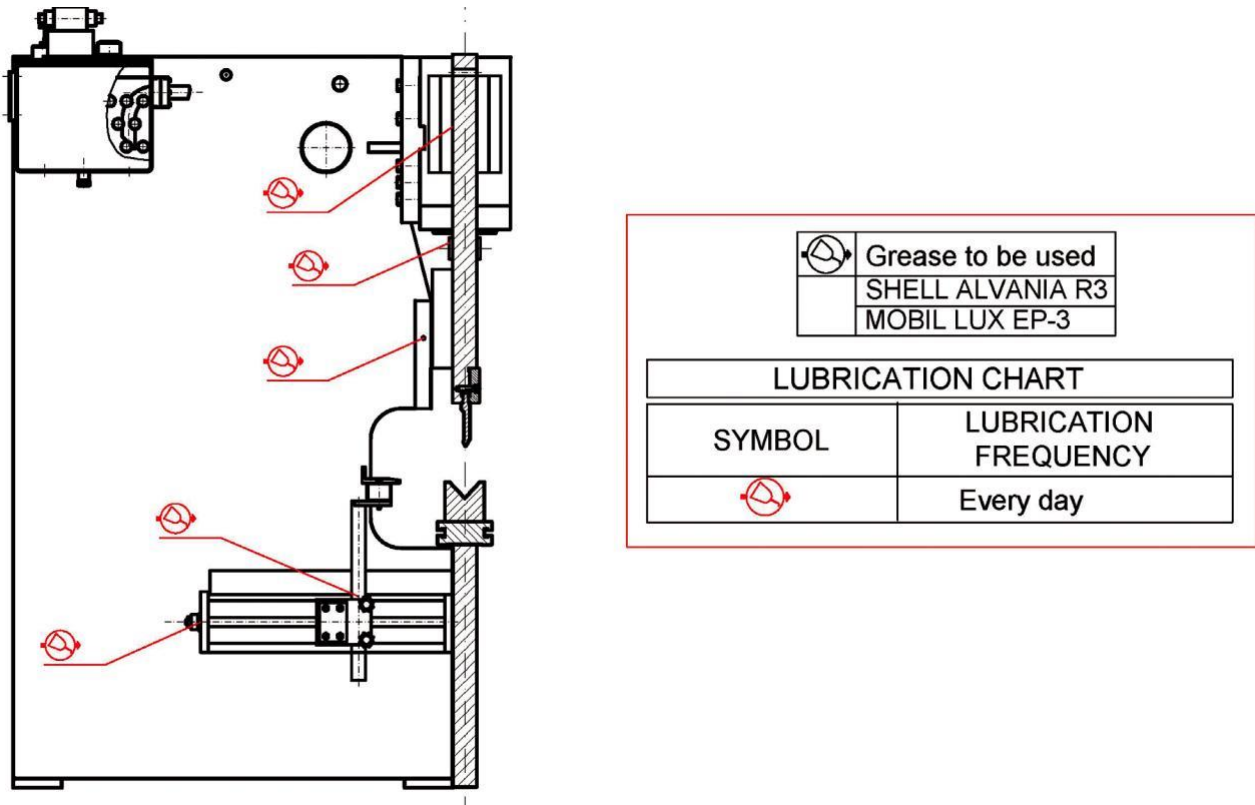


Figure 51 Lubrication Chart

4.2 The maintenance of the mechanic system

Once every two weeks, the tightness that fixes the screw connecting the upper table to the cylinders and the condition of the disc springs should be checked. The fixing screw was fixed to the cylinder with a lock nut from the top. In the lower part, the two lock nuts were tightened together and necessary measures were taken against dissolution.

In addition, the tightness of all bolts and screws must be checked once a month.

4.3 Planned maintenance table

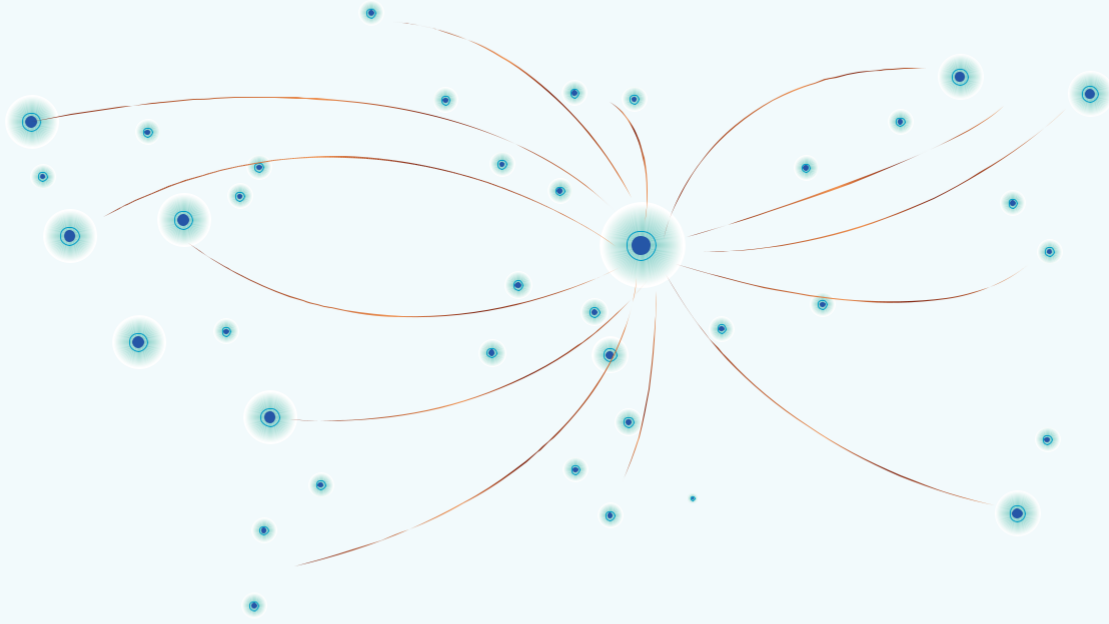
The maintenance to be carried out	Interval
Upper beam's slides	Daily
Visual system check	Once a week
Checking of cylinder bolt that is bound to upper table	Once a week
The sequence of all bolts and screws	Every other week
Pneumatics system check	Once a month

Table 54 Maintenance table

PROBLEM	CAUSE	SOLUTION
<ul style="list-style-type: none"> • MAIN MOTOR DOES NOT WORK. 	<ul style="list-style-type: none"> • Reset lights might not have gone off. • The phase cables might not have been connected properly. 	<ul style="list-style-type: none"> • Check the reset circuit and turn off the reset lights. • Try connecting the cables in different order until the phase relay lights up.
<ul style="list-style-type: none"> • THE TABLE DOES NOT GO DOWN WHEN PEDAL IS PRESSED. 	<ul style="list-style-type: none"> • The „Start“ button of the control unit might not have been pressed. • One of the axes might not have reached the desired position. • Crowning might not have reached the desired value. 	<ul style="list-style-type: none"> • Press the „Start“ button of the control unit and try again. • Find out which axis position does not find the position from the controller display and try to move that axis. If necessary, clean the lubricated parts of the relevant axis with petrol and re-lubricate them. • If the crowning motor protection labeled „MK2 has been broken off in the electric cabinet, the black button must be pressed.
<ul style="list-style-type: none"> • RESET LAMP DOES NOT GO OFF. 	<ul style="list-style-type: none"> • The backlight curtains may have not been reset. • Side door switches or emergency stops may not allow resetting. 	<ul style="list-style-type: none"> • First check the rear part, turn off the reset lights of the rear light curtain (two reset buttons on some models on the dashboard at the same time) and try again. • Check that the side doors are closed and the emergency stops are unlocked.
<ul style="list-style-type: none"> • PRESS BENDING CANNOT COMPLETE BY ITSELF, THE TABLE IS WAITING ON THE SHEET. 	<ul style="list-style-type: none"> • The force specified by the control unit is not sufficient. (Probably the sheet is harder than usual) 	<ul style="list-style-type: none"> • Increase the force by 10% and try again. Continue this process until the bending is completed and the table can lift itself. (Control units do not exceed the resistance value of the Tools in order to protect the Tools, however, pay attention.) Make sure all bending values are correct (length, material, Tools, etc.)

<ul style="list-style-type: none"> • THE MACHINE ONLY WORKS SLOW MODE. FAST FALL POSITION DOES NOT WORK. 	<ul style="list-style-type: none"> • Front laser safety device does not allow going down fast. • The selector key is not in the 2nd position. 	<ul style="list-style-type: none"> • Ensure that the two units of the laser safety device are facing each other. • Turn the key 2nd position.. <p>(Some control units may not allow going down fast in „Manual“ mode. Try the „Semi-automatic“ or „Auto“ modes)</p>
<ul style="list-style-type: none"> • BACK GAUGE DOES NOT TAKE REFERENCE AND MOVE TO REQUESTED POSITION. 	<ul style="list-style-type: none"> • There may be a problem with the back-gauge limit switch (at the very back). • There may be a problem with the frontal limit switch (near the Tool area). 	<ul style="list-style-type: none"> • The rear limit switch that performs the stop reference operation may be depressed or broken. • If the stop is referenced but does not come to the front, the front limit switch must be checked, may have been depressed or broken





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