INTRODUCTION TO PRESS BRAKES

A Vital Piece of Shop Equipment

SOUTHERN FABRICATING
MACHINERY SALES

Introduction to Press Brakes

Press Brakes are utilized in the forming lengths of sheet metal components. A press brake is a vital necessity to most shops with shape cutting capabilities and is one of the most sought after and misunderstood machines available for sheet metal working. Press Brakes are rated generally by their pressing capacity, or tonnage, and their overall bending length or machine width such as 175X10 (175 Tons of pressing force by 10’ of overall length). The press brake may be fitted with a wide variety of standard and custom tooling that are used to press the material into the desired form. There are two major types of press brakes available on the used market as are described below.

Mechanical

A motor spins a large flywheel at high speed the operator then engages a clutch which can be activated via pneumatic, hydraulic or mechanical engagement. Once the clutch is engaged the moving flywheel is mated to a crankshaft in which the machines ram is attached. The crankshaft then spins cycling the ram up and down. The advantage to this type of press brake is that the machine is electronically simpler and, due to the crankshaft action tonnages are generally 2-3X the rated capacity of the press brake at the bottom of the machines stroke.

A mechanical press brake is a good solution for punching applications as the shock of punching material is distributed much easier due to the machines design. The major disadvantages to mechanical press brakes is that the ram must complete a full cycle, or stroke, and typically cannot be reversed during operation. This poses some safety concerns and operational limitations as well as provides for the possibility that the press brake can be "locked" into an over stroke situation where the ram has traveled too far into the die and the machine has flexed to its maximum and literally locked all movement.

Hydraulic

Hydraulic pressure is applied through one or more cylinders to force the ram of the machine down (on some models of Amada and Adira the hydraulics will force the bed up instead). Due to the hydraulic control of the machine the ram accuracy is more precisely controlled and adjusted for individual bend depths. Hydraulic machines can have one, two or four hydraulic cylinders for operation

Controls

A press brake, like any machine tool can benefit greatly from computerization of the axis of motion. In the early years of mechanical press brakes there was only one axis of motion, the ram. Today there are press brakes available on the market with 12 or more programmable axis for precision metal forming. A CNC controller can be misunderstood in press brake applications. Typically CNC is associated with high production numbers. In actuality the CNC control on a press brake can be an enormous time saver for simple applications of 2-3 bends or more on part lots of 1-2 pieces.

The controllers today give the operator a graphical representation of the formed part in a simple to use format. By entering the material type, thickness, length and describing the bends and flange lengths the controller can set the positions and speeds of all the axis of the machine. This greatly reduces setup time, scrap rate and operator experience required for bending. The majority of controllable axis are found in the "backgage" which employs typically two or more "fingers" which act as material stops and supports which allow for accurate gaging of flanges. Below is a listing and the description of the most common axis a press brake can control.

Y: Single Axis Ram Motion Up/Down, Typically a single cylinder hydraulic and all mechanical machines.

Y1 / Y2: The Ram's Cylinders are Programmable on either side of the machine allowing for tilt or compensating for worn tooling in addition to the standard Up/Down Motion.

X: This is the backgage or material stop which can be programmed to support the material directly perpendicular to the ram of the machine. The XAxis moves this gage towards or away from the ram of the machine adjusting for shallower or deeper flange lengths.

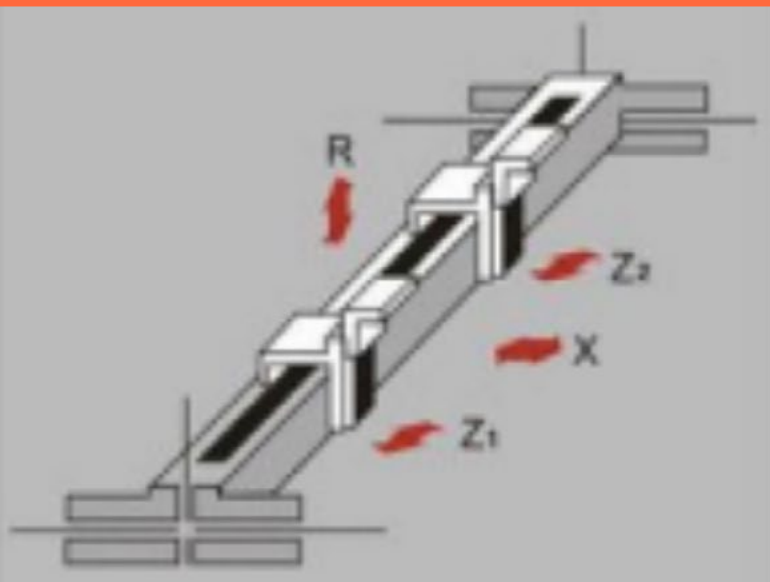
X1 / X2: Individually programmable backgage "fingers" or stops with the same motion as described above. This would allow for complex part gaging and tapered flanges.

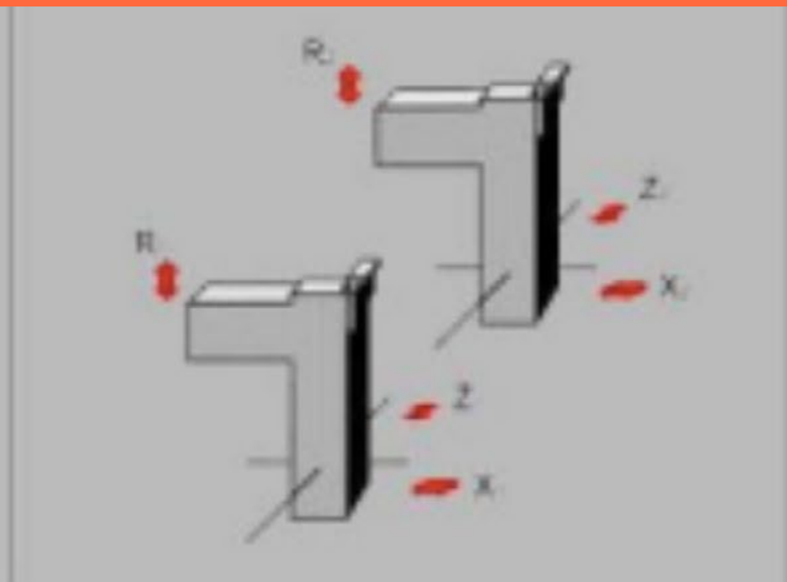
R: This is the axis that allows the backgage to move up and down allowing for a part to be gaged that has a down formed flange.

R1 / R2: The up and down movement of the backgage fingers in cases where they are independent if each other. This optional axis allows for gaging of extremely complex parts.

Z: Positioning of the stops or "fingers" of the backgage in the left to right axis of motion. This would best be utilized for stage bending (multiple press brake set-ups located or "staged" down the length of the press brake).

Z1 / Z2: Individually positioned gage "fingers" from left to right. This optional axis of motion is best used when bending large pans or rectangular pieces that have a disproportionate width to length. By the independent movement of the gage fingers the width and length can both be gaged more accurately by opening/closing the distance the gage fingers are from each other.





Other Possible Controllable Press Brake Axis

CNC Crowning

Control or "pre-bending" of the bed of the machine to correct for worn tooling or flexing of the press brake frame under bending conditions.

Sheet Lifters

Lifting supports for large sheets of material that act in unison with the down stroke of the press brake allowing for single operator operation of a press brake when bending large sheets of material.

Robotic Interfaces

Robotic loading, operation and unloading of the Press Brake. Types of Bending: There are two categories of bending sheet metals. Below is detailed the two types along with the advantages and disadvantages of each. Bottom Bending: Bottom bending is the simple operation of the tool, or punch mounted in the Ram of the press brake forcing the workpiece down into the bottom of the die mounted on the bed of the press brake. The tool is typically forced slight closer to the die than the material thickness of the workpiece being formed. This over bending action "coins" the material and uniformly "seats" the bend.

Types of Bending

Bottom Bending

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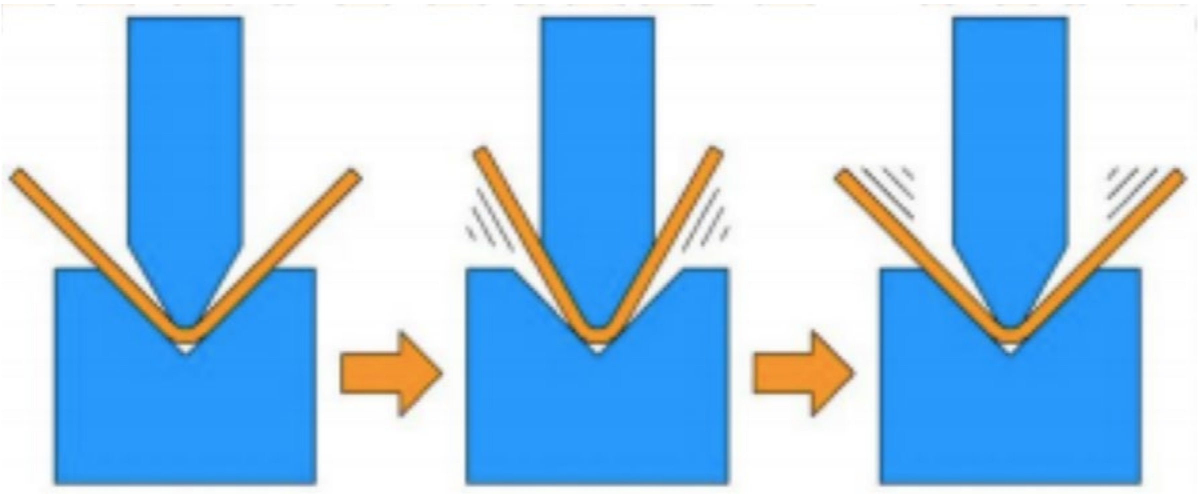
The advantage to this type of bending is that the accuracy of the bend angle lies solely in the tooling used (punch and die) and the press brake itself has little bearing on it.

The disadvantage to this type of bending is that the forces required to “coin” the material or 3-4X that of air-bending. Another disadvantage is that tooling must be purchased top match the angle and thickness of every bend desired.

When press brakes were first developed the control of the ram’s depth was very difficult and it was simply easier to purchase accurate tooling and “force” the angle desired. Today fewer than 10% of the fabrication facilities utilize this method of bending.



Air Bending

Air bending is simply pressing the material down into a die (of typically 85 degrees angle) only far enough to achieve the desired angle plus any spring-back that the material might have once the punch is retracted. The material is never pressed to the bottom of the die and thus leaves a small gap of air between the material an die bottom thus the name “Air Bending.” Overall this is the preferred method for bending in a press brake.

The advantage to this type of forming method is that the die need only be changed as material thickness changes so that any angle from flat to 90 degrees can be achieved with the same punch and die tooling combination (Typically the die opening or width is 8X that of the material thickness). Also this type of bending requires far less tonnage to achieve.

The disadvantage to this type of bending is that angle accuracy is greatly affected by the material thickness and the ram depth will have to be adjusted as material thicknesses change from mill run to mill run of sheet stock.

Air-Bending

Bottoming

Selecting a Press Brake

Tonnage

The first important factor is to determine the maximum thickness and hardness of the hardest material that will be bent. If you bend 0.125" Aluminum but also bend up to 10 Gage Stainless Steel than use the tonnages required for stainless steel when selecting your press brake. Contact us to assist you in selecting the proper tonnage of press brake required for your application.

Pit or No Pit

As press brakes increase in tonnage, or stretch out in width, they may require a "pit" (more accurately described as a slot in the floor). The reason this relief in the floor is required is due the mechanical properties of bending that cause both the bed and ram to deflect under high tonnage. While adding mass to the ram simply makes the machine taller and does not affect its operability, adding mass to the bed would raise the working height of the machine beyond a comfortable level. Therefore the easiest and best way to counter these forces is to add more mass to the bed and put that mass below the floor.

Although there are other mechanical opposing deflection devices such as hydraulics, crowning devices etc. the best method for keeping the machine and parts straight is to not let it bend in the first place and thus a pit is actually preferred over flush floor mount machines in higher tonnages or wider widths.

Machine Length

The maximum part length that you wish to bend may require a press brake that is slightly bigger. This is due to the side frames of the machine that support both the bed and ram of the machine. Typically a 10' capacity press brake has only 8' clearance between the side frames. Although all manufacturers have a relief in the side frames this is typically only 4", 6", or 8" deep. If your application calls for a 10' long piece to be formed with a 12" Flange you may be best suited looking for a 12' overall bed length in your press brake.

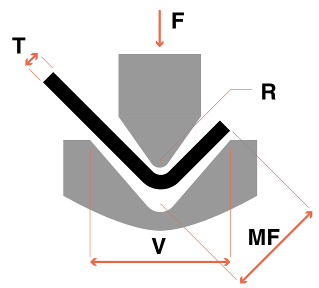
Force to air-bend mild steel

T	V	1/4	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10
	MF	3/16	9/32	11/32	7/16	9/16	11/16	7/8	1 1/8	1 3/8	1 3/4	2 3/16	2 13/16	3 1/2	4 1/2	5 1/2	6 7/8
GA	IN R	1/32	1/16	5/64	7/64	9/64	5/32	13/64	1/4	5/16	13/32	33/64	5/8	3/4	1 1/32	1 5/16	1 5/8
20	.036	3.1	1.75	1.2													
18	.048	5.4	3.1	2.1	1.55	1.3		F Values									
16	.060	9.6	5.5	3.8	2.8	2.2	1.45										
14	.075		9.3	6.4	4.7	3.8	2.5	1.85									
12	.105		20.5	14.0	10.4	8.1	5.6	4.1	3.2	2.2							
11	.120			18.5	13.9	10.9	7.4	5.6	4.3	2.9	2.15						
10	.135			25.2	17.2	14.5	9.9	7.3	5.7	3.8	2.85	2.23					
3/16	.188				34.8	27.6	19.1	13.9	11.0	7.5	5.6	4.3					
1/4	.250					58.0	39.5	29.0	22.8	15.5	11.4	8.9	6.1	4.5			
5/16	.313						69.5	51.0	40.0	27.0	20.0	15.6	10.5	7.8	6.1		
3/8	.375							75.0	61.0	40.0	29.5	23.4	15.8	11.7	9.2	6.2	4.6
7/16	.438							115.0	85.0	61.0	45.5	35.2	24.0	17.8	13.9	9.4	6.9
1/2	.500									85.0	62.0	44.3	33.0	24.5	19.1	13.0	9.8
5/8	.625											86.0	58.0	43.0	34.0	23.2	17.5
3/4	.750												91.0	67.0	53.0	36.4	26.7
7/8	.875												136.0	101.0	79.0	54.0	40.0
1	1.00													146.0	115.0	68.0	58.0

For steel of different tensile strength, F value differes in proportion to strength ratio.

Inside radius for mild steel is about 5/32 of female die opening

Shaded F values are for V = 8t, common for average 90ª bending. For T ≥ 1/2" use V = 10t



F: US ton/linear ft. T: Workpiece thickness R: Inside radius of form V: Vee-die opening MF: Minimum flange

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