Press Brake Productivity

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The productivity of a Press Brake is determined by the cycle time to complete a stroke which determines the number of bends per hour or productivity rate of the machine. Short cycle times require maximum fast speed operation thereby minimizing slow speed operation. Cycle time is dependent upon some key factors:

• **Descent speed of the ram** – generally the ram approaches at 4 in/sec although in some high speed systems this reaches 8 in/sec;

• **Back-up speed of ram** – under hydraulic pressure the ram returns to the beginning of the stroke height at around 2 in/sec and up to 4 in/sec on some very fast machines;

• **Back-up height** – the height above the tool at which a stroke cycle commences, this is determined by the need to have sufficient working opening for the material including any flange involved;

• **Mute Point setting** – the position where the suspension of the safety function is initiated by safety related parts of the control system during otherwise safe conditions in the operation of the machine and where slow bending speed is required;

• **Controller functionality** – given job parameters it will control the operation of the press brake determining the opening height, depth of travel into the tool (bending angle) and the change of speed point from fast to slow operation;

• **Safety Guarding system employed** – while primarily used to provide operator safety a guarding system that is productivity based will have little to no impact on the productivity of the machine, without impacting on its safety role, allowing the machine to operate at fast speed while allowing the operator good safe working access to the machine.

Safety Guarding

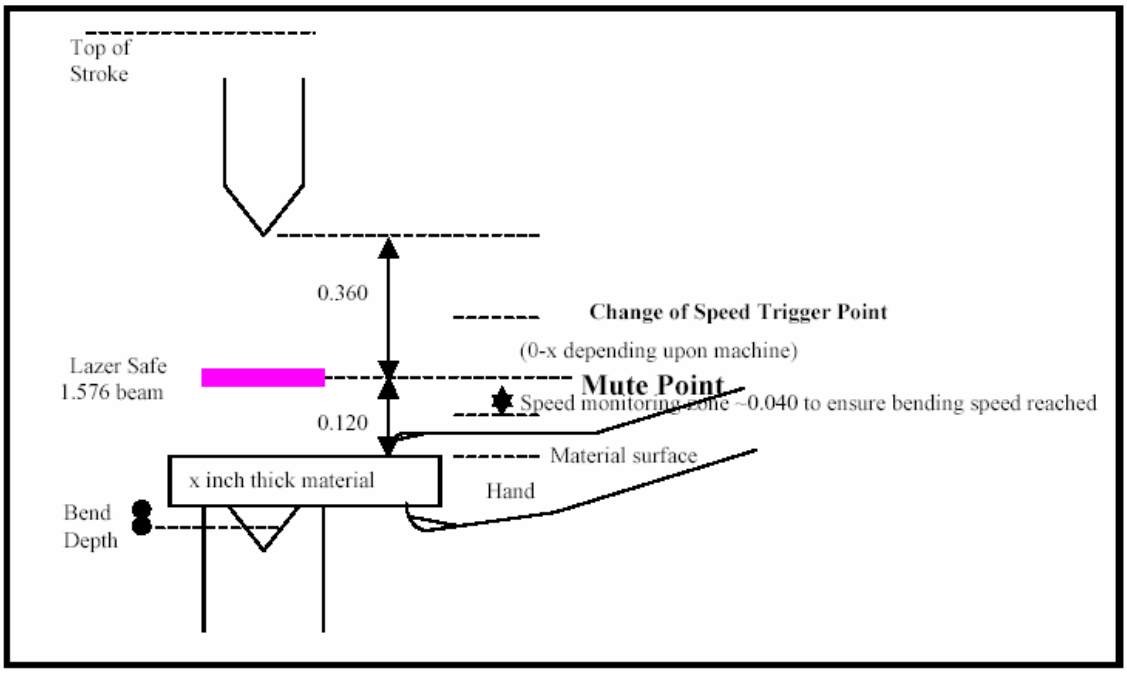
The LazerSafe is designed to provide minimum impact on productivity while at the same time providing maximum operator safety protection. Some particular measures over and above stopping the press brake when an obstruction is detected are:

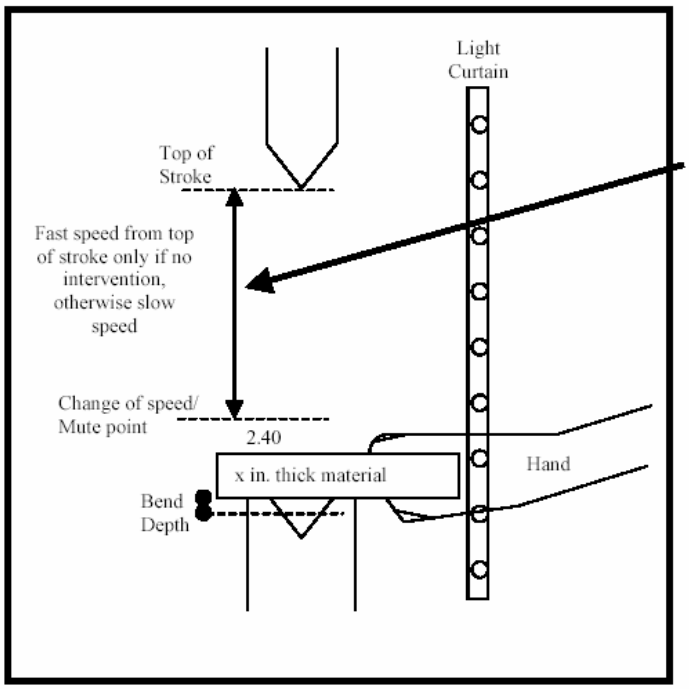
• **Stopping distance monitoring** – on every stroke the stopping distance is monitored to ensure that the press brake can stop as required. If this were not monitored then it could be possible for the press brake to overrun and impact on operator safety even though the safety system had initiated a stop.

• **Speed Monitoring** – on every stroke to ensure that the change of speed occurs as required. Again should the change occur too late or not at all operator safety would be impacted.

• **Rear beam protection** – safety standard EN 12622 requires that approaches to the rear of the tool be protected. The rear section of the LazerSafe beam provides this protection and, therefore, segmented tools or tools that do not reach the extremity of the bed of the machine can safely be used. In these circumstances the operators can, through the gaps between or around the tools, reach the rear of the tools.

The LazerSafe Guarding System is designed to maximize the fast speed operation of a press brake by allowing an operator close access and the ability to adjust the material with safety maintained until the mute point is reached. At that stage, to satisfy standards requirements, the LazerSafe system monitors that the bending speed has been reached, if not the machine will be stopped.





A light curtain system will, in circumstances requiring close in operator intervention, cause the machine to operate in slow speed for the full cycle and not provide safety protection during the stroke.

Operational Performance

Consider the situation where the Press Brake is employed bending a flat piece of 0.800 thick material to make a flange of 2.000 in. at one end requiring an opening height of 3.000 in. at the top of stroke.

Lazer Safe Productivity

Cycle assumptions Stroke length 3.000 in Change of Speed 0.500 in above Bend depth 0.200 in Material Thickness 0.040 in	4.000in/sec PB with Lazer Safe LZS-003 seconds	8.000 in/sec PB with Lazer Safe LZS-003HS seconds
Top of stroke to change of speed point	0.625	0.355
Deceleration zone		0.020
Change of speed to bending complete	1.750	0.550
Dwell Time	0.100	0.100
Back-up to top of stroke	1.480	0.740
Complete Cycle Time	3.955	1.765
Cycles per hour	**910**	**2040**
Performance Comparison	**100%**	**224%**

For the light curtain there are two situations. One where the operator can work close in while the press is on the upstroke and then step back, the other where the operator is working close in at all times and where all of the stroke is at bending speed.

Light Curtain Productivity

	Operator moving outside LC before down stroke starts		Operator working small material always inside the LC
	Simple work piece, very good Operator	Less simple work piece, average Operator	
Cycle assumptions	**4.000in/sec PB with Light Curtain**	**4.000 in/sec PB with Light Curtain**	**4.000 in/sec PB with Light Curtain**
Stroke length 3.000 in Change of Speed Point 0.240 in Bend depth 0.200 in Material Thickness 0.040 in			
Top of stroke to change of speed point	0.64	0.64	
Place Material move out	1.25	1.50	
Change of speed to bending complete	1.10	1.10	7.40
Dwell Time	0.10	0.10	0.10
Back-up to top of stroke – 75 mm	1.48	1.48	1.48
Complete Cycle Time	4.57	4.82	8.98
Cycles per hour	**788**	**747**	**401**
Performance Comparison to Lazer Safe	**87%**	**82%**	**44%**

Productivity can be adversely impacted when a change of speed point is set too high:

Traveling Beam Productivity

Productivity is adversely impacted by the height of the change of speed point.

Cycle component	4.000in/sec PB Standard Lazer Safe System	4.000 in/sec PB	4.000 in/sec PB	4.000 in/sec PB
Change of Speed (CoS) height	0.480in	0.600in	0.680in	0.880in
Top of stroke to CoS point	0.625	0.60	0.58	0.53
CoS point to bending complete	1.750	2.05	2.25	2.75
Dwell Point	0.100	0.10	0.10	0.10
Back-up to top of stroke	1.480	1.48	1.48	1.48
Complete Cycle Time	3.955	4.23	4.41	4.86
Cycles per hour	**910**	**851**	**816**	**741**
Performance Comparison	**100%**	**93%**	**90%**	**81%**

The LazerSafe system is designed to minimize the height at which a change of speed is required taking into account machine stopping distance and mute point needs.

Cost benefit consideration

Converting the productivity percentage to a monetary cost:

Establishing an Hourly Production Cost

Press Brake Cost	$50,000
Finance Rate	8%
Term - months	60
Residual	$15,000
Monthly finance cost	$960
Monthly Operator cost	$2500
Total monthly cost of Machine & Operator	$3460
Average work days per month	22
Hours scheduled for work	8
Productivity rate	80%
Hourly cost of machine & operator (no overheads)	**$24.60**

System Comparison

System	Time for one cycle (sec)	Strokes per hour	% of LZS-003	Cost per Bend (cents)
LZS-003	3.955	910	100	2.70
Trav Beam 0.600 in	4.23	851	93	2.89
Trav Beam 0.680 in	4.41	816	90	3.01
Light Curt SW-VGO	4.57	788	87	3.12
Light Curt W-AO	4.82	747	82	3.29
Trav Beam 0.880 in	4.86	741	81	3.32
Light Curt 75% W-AO 25% SS	5.86	614	67	4.00
Light Curt W-AO SS	8.98	401	44	6.14

Note: The productivity of a Press Brake is dependent upon the efficiency of the guarding system. A productivity loss of 5% can be considered as paying $2,500 too much for a $50,000 machine and guarding system or alternatively $2,500 too little on a better guarding system. These values increase as the value of the Press Brake increases.

Note: An unfortunate consequence of machines fitted with low productivity safety devices is that they are prone to being switched off in order to achieve competitive performance and cost figures.