

# **Investigation Of Safety Instrument For Power Press Machine Operating Workers**

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## **ABSTRACT**

Deficiencies in safety cause negative consequences for companies, national economy and individuals and therefore safer and healthier products and work environments are required. Improvements in safety of existing workplaces increase job satisfaction, decrease absenteeism and accidents in companies and may also have positive effects on the quality of the products of companies. The responsibility for ensuring that manufacturing equipment complies with regulatory and safety requirements frequently falls to the manufacturing engineer. A significant challenge to exploring machine guarding is for the workers who are working in machines in the machinery. Studies have found that engineers, many of whom have responsibility for machine safety, are either uneducated or poorly educated on the subject of machine guarding and safety standards. Machine operators in particular face high risks, often stemming from the absence or improper use of machine safeguarding or the failure to implement lockout procedures. The machine related injuries have a potential for uprooting if the research can provide better knowledge for machine workers, designers etc. Because machines are frequent and persist source for occupational injury.

Keywords;

Safety instrument, risk assessment,  
hydraulic press, DSP Laser

This paper clearly explains about the workers safety instrument and uses of safety instrument so that the accidents that occur at industries can be minimized.

## **1. INTRODUCTION**

Machinery and equipment have been evolved to meet a need whether for producing, changing or moving materials and components. Initially they were essentially functional with scant regard for the health and safety of those using them. But attitudes have changed and all work equipment must now be designed and built so that it does not put the user at risk of damage to health or injury. Most people think of a machine guard when industrial safety is mentioned, and for good reason. More efforts and resources have been expended to guard machines than for any other industrial safety and health endeavour. To modify or guard a single machine is generally not a major project when compared with installing a ventilation system or a noise-abatement system. However, although each machine guarding modification is usually small, the aggregate becomes a major undertaking involving plant maintenance, operations, purchasing, scheduling, and, of course, the safety and health manager. The safety and health manager should take a leadership role in the implementation of machine guards—enumerating problem areas, setting priorities, selecting safeguarding alternatives, and ensuring compliance with standards.

### **1.1 INTRODUCTION TO POWER PRESS**

A power press machine is a machine which is used for cutting, shaping, blending and pressing any metal sheet into required shape. This is a multi-purpose machine used to shape the metal sheet to be used for getting the desired shape of the parts to be used in electric and electronic appliances, automobile industry etc. Earlier, the task of giving shape to the metal sheet was done manually with great effort and force. The power press machine has revolutionized this process by adding force and accuracy in the operation of pressing.

### **1.1 INTRODUCTION TO PNEUMATIC PRESS**

A pneumatic press is a type of machine tool that uses compressed air to generate force for pressing, shaping, or forming materials. These presses are commonly used in industries such as automotive manufacturing, electronics, plastics, and assembly operations. The pneumatic press machine operates using compressed air as its power source. Compressed air is stored in a tank or generated by an air compressor and supplied to the press through a series of hoses and valves. To operate the pneumatic press machine, the operator places the workpiece between the dies and initiates the press cycle. Compressed air is supplied to the pneumatic cylinder, causing the piston to move and exert force on the workpiece.

### **1.2 HYDRAULIC PRESS MACHINE**

A hydraulic press machine is a type of machine tool that uses hydraulic pressure to exert force on a workpiece. These machines are widely used in various industries for tasks such as forming, molding, punching, forging, and stamping. A hydraulic press machine is a type of machine tool that uses hydraulic pressure to exert force on a workpiece. These machines are widely used in various industries for tasks such as forming, molding, punching, forging, and stamping. The hydraulic press features one or more hydraulic cylinders, each containing a



**Fig 1 Hydraulic Press**

#### **1.2.1 BED**

piston connected to a ram or plunger. When hydraulic fluid is pumped into the cylinder, it pushes against the piston, causing the ram move.

Bed is a plate on which the die is supposed to hold. It is used for mounting the die on support frame at desired position. The holes produced on the sides is the support plate to be clamped on support frame.

### **1.2.2 DIE**

Die is an integral part of any manufacturing process which enables the desired shape that one require. Here for the experimental purpose a compound die have been used which produces a washer from the strip of sheet metal. A blanking die produces a flat piece of material by cutting the desired shape in single operation. The finished part is referred to as a blank. Generally a blanking die may only cut an outer contour of part, often used for parts with no internal features.

### **1.2.3 PUNCH**

Punch is the male component of die. In compound die we used two punch one cuts inner diameter of washer and another cuts outer diameter of same. Punch which cuts outer diameter, is placed at bottom side of female die. Second punch that cuts outer diameter of washer is attached with piston rod of hydraulic cylinder. Position of same punch is above side of die.

### **1.2.4 CRANK SHAFT**

Crankshaft is a large component with a complex geometry in the Power Press, which converts the rotary motion of motor into the reciprocating motion of the Ram with a connecting rod link mechanism.

### **1.2.5 FRAME**

Frame constitute main body of the press located at one edge of its base. It houses support for ram, driving mechanism and control mechanisms. All presses except the straight side type have "C" shaped frame to take up the vertical thrust of the ram.

### **1.2.6 CLUTCH**

The clutch is used for connecting and disconnecting and the driving shaft with the flywheel when it is necessary to start or stop the movement of the ram.

## **1.3 REQUIREMENTS IN CONSTRUCTION OF MACHINE TOOLS**

Machine tools are expected to fulfil the highest demands put upon them to implement technological advances in production. Apart from the purely functional capabilities that must be fulfilled, the ease of operation of the machine must be provided for its economic operation (attention to controls and layout). The adherence to a variety of legal requirements is a further constraint.

## **1.4 DIGITAL SIGNAL PROCESS USING FOR HYDRAULIC PRESS MACHINE**

Signal processing is simply the manipulation of the properties of a specific signal to obtain a signal with more desirable properties. Properties such as amplitude, phase, or frequency spectrum may be altered to meet a specific requirement. In the early days electronic engineers achieved signal processing using discrete hardware components such as resistors, capacitors, inductors, transistors, diodes, and other semiconductor devices. In such a case a signal variable that was continuous with time was used as an input to a hardware device that produced a new version of the signal variable where some of the properties have been altered. In digital signal processing the processes that were achieved using hardware . the safety device

DSP laser contributes to protect the operator in press brake machine.



**Fig 2 DSP Laser**

complex pulse shapes and optimize pulse compression techniques.

## **2.1 FUNDAMENTAL OF LASER SYSTEM**

Signal processing: DSP helps in conditioning the signals received from the laser system. This involves filtering out noise, amplifying weak signals, and adjusting signal levels for optimal processing.

Beam scanning and steering: DSP algorithms can control the movement of laser beams for applications like laser scanning microscopy, lidar, and laser material processing. These algorithms calculate the precise control signals needed to steer the laser beam accurately.

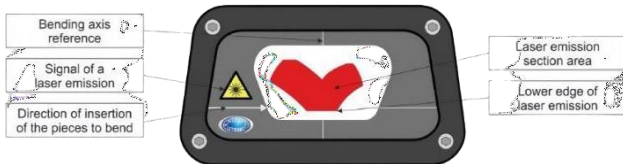
Feed back control system: Many laser systems require precise control over parameters such as power, wavelength, and beam quality. DSP is used to implement feedback control loops to continuously monitor these parameters and adjust laser settings accordingly.

Signal processing in laser spectroscopy: Laser spectroscopy techniques, such as Raman spectroscopy and laser-induced breakdown spectroscopy (LIBS), rely on DSP for processing spectral data. This includes background subtraction, peak identification, and spectral analysis.

Pulse shaping and compression: Ultrafast laser systems often require precise shaping and compression of laser pulses for applications like femtosecond laser machining, nonlinear microscopy, and ultrafast spectroscopy. DSP algorithms design

## 2.2 FRONT SIDE OF THE TRANSMITTER

In a laser system transmitter, digital signal processing (DSP) plays a crucial role in various aspects of signal generation, modulation, and control.

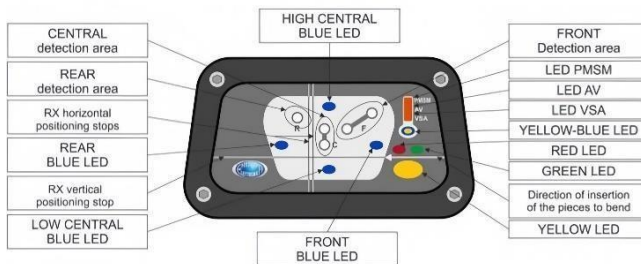


**Fig 3 Front side of the Transmitter**

The state of laser emission present points out that the power supply is connected to the transmitter. The state of LASER EMISSION absent points out that the power supply device is not energized.

## 2.3 FRONT SIDE OF THE RECEIVER

In a laser system receiver, digital signal processing (DSP) is crucial for various tasks related to receiving, detecting, and processing signals transmitted by the laser system.



**Fig 4 Front side of the Receiver**

DSP is involved in acquiring the optical signal received by photodetectors and converting it into digital form through analog-to-digital conversion (ADC). This allows subsequent digital processing of the received signal. DSP algorithms are used to detect the received signal and distinguish it from background noise. Various detection techniques such as thresholding, matched filtering, or correlation may be employed depending on the modulation scheme and noise characteristics.

## 2.4 IDENTIFICATION PLATES OF DSP

Identification plates, often found on electronic equipment including DSP (Digital Signal Processing) devices, typically provide important information about the device such as its model number, serial number, manufacturing date, specifications, and regulatory compliance information. These identification plates serve as important reference points for users, technicians, and manufacturers, ensuring accurate identification and proper handling of DSP equipment.

## 2.5 REAR IDENTIFICATION PLATES OF TX

- Name, address and contact references of the Manufacturer of the device.
- Number of the Patent which protects the device: 0001342651.
- Safety category in compliance with the standard EN 61496-1:2014:TYPE 4.
- Logotype “Costruito in Italia”.
- CE marking.
- Logotype of the Notified Body which has executed the certification.
- Indication of the presence of the laser beam.
- Class of the laser equipment according to EN 60825: class 1M.
- Warning not to directly observe the laser beam with optical instruments.

## 2.6 REAR IDENTIFICATION PLATES OF RX

- Name, address and contact references of the Manufacturer of the device.
- Patent number: 000134265.
- Safety category in compliance with the standard EN 61496-1:2014 : TYPE 4.
- Logotype “Costruito in Italia”.
- CE marking.
- Logotype of the Notified Body which has executed the certification.
- Detection capacity:  $\geq 14\text{mm}$ .

## **2.7 DSP TECHNIQUES FOR LASER CONTROL**

Digital signal processing (DSP) techniques play a significant role in controlling various aspects of laser systems, ensuring precise operation and optimization. Feedback control: Feedback control loops are essential for maintaining desired laser parameters such as output power, wavelength, and beam quality. DSP algorithms analyze feedback signals from sensors and adjust control parameters to keep the laser output within specified limits.

**PID Control:** Proportional-Integral-Derivative (PID) control is a common technique used for feedback control in laser systems. DSP algorithms calculate control signals based on the error between desired and measured values of laser parameters, incorporating proportional, integral, and derivative terms to achieve stable and responsive control.

**Adaptive Control:** Adaptive control techniques adjust control parameters in real-time based on changing environmental conditions or variations in laser performance. DSP algorithms continuously monitor system parameters and adapt control strategies to optimize laser operation under varying conditions.

**Pulse duration and shape:** Digital control techniques, such as pulse shaping algorithms, can manipulate the temporal profile of laser pulses. This allows for precise control over parameters such as pulse duration, rise time, and shape, which is important in applications like laser material processing and spectroscopy.

**Frequency control:** Digital control can adjust the frequency of a laser source, particularly in applications where frequency stability is critical.

## **2.8 SPECIFICATION OF DSP**

- Laser light source visible 650 nm.
- Beam divergence: < 0,2 mrad.
- Voltage of current 24vdc.
- Frequency of laser 50HZ/60HZ.
- Maximum operating distance in 15mm.
- Operating temperature: from 0°C a 50°C.
- Maximum standard length of the connection Cable of TX and RX to the electrical board 20mm.

## **3 RESULT AND DISCUSSION**

DSP retrofit safety laser systems are designed for both hydraulic and electric press brakes. The laser receiver and transmitter are mounted onto the brackets that are also included in the system. This precisely covers the entire bending area and protects the operator. If an obstruction is detected the system immediately stops the downward upper tool motion, preventing injuries.

The Implementing a DSP (Digital Signal Processing) laser system in a press machine can enhance safety for workers by providing real-time monitoring and control.

1. The power press machine is a higher risk of lacerations and amputations if not operated with caution, This causes many injuries to the hands and fingers of the workers.
2. Its more than for 50% of injuries in machine operators. Due to this, the amount of products that can be produced has also decreased.

3. This DSP laser system Totally reduces risk to machine operators. Therefore, the volume of products will increase by 70%.

#### 4 CONCLUSION

- DSP laser protection device comprehensively protects the personal safety of the operators and avoid danger due to the rapid movements of the slider on the bending machine.
- The beam protects the press brake operator from the danger of being crushed between upper and lower tool.
- It represents the evolution in press brake safety with respect to the inefficient light curtains or obsolete single-beam protections.

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