Productivity, Safety, and Ergonomic Considerations for Hand Fed Presses

Hand fed power press operations present employers with ergonomic and productivity concerns and choices. The means chosen to initiate a stroke and guard the point of operation heavily impact ergonomics and output. Hand fed press operations on part revolution clutch machines often involve high repetition/stroking rates, perhaps approaching 30 strokes per minute; accordingly, an operator could initiate several thousand strokes over the course of a shift. Hands fed single stroke rates are dependent on many things including clutch design, press tonnage/size, part size/weight/shape, safety distance, and operator strength/skill. Potential repetitive motion disorders that could develop from hand fed single stroke operation include: carpel tunnel syndrome, DeQuervain's disease, tendonitis, tendosynovitis, and Guyon tunnel syndrome. (Kroemer, Kroemer, & Kroemer-Elbert, 2001, p. 393).

Fatigue is another ergonomic concern. "Fatigue is not always simple physical tiredness. More often it is combined with mental and intellectual tiredness. This can be due to the extremely repetitive character of press operations" (Strasser, 1983, p. 200)

Employers often select a press stroking means on the basis of productivity concerns, or they simply choose to use what is currently available on a press. Actually, a variety of options exist. The press stroke initiation means may be single palm button, dual hand operated actuators (palm buttons), a foot switch, or presence sensing device initiation (psdi which has regulatory issues discussed later).

Types and Function of Stroke Initiation Controls

Two hand controls are the most commonly used press stroke initiation means. “Basically, these are two palm operated push buttons separated to prevent operation with one hand and elbow and ring guarded to prevent accidental operation.” (American National Standards Institute [ANSI], 1990, para. E4.2.4.2.3) The run buttons are often mounted in a run station and might be press or pedestal mounted and may be used in a standing or sitting position. The operator loads a part, and then operates the palm

buttons to start the stroke. With modern OSHA/ANSI compliant two-hand press controls, the operator can typically release the palm buttons at or near the bottom of the press stroke and the press will automatically continue to the top of the stroke. When properly designed as part of a control reliable clutch/brake control system and located according to an OSHA or ANSI prescribed safe distance, two-hand controls also function as a point of operation safeguarding device.

High tonnage machines may have larger bed sizes and take longer to stop, which increases the safety distance. Die design and it’s positioning on the press bolster, may force the operator to reach further. These reach factors may contribute to fatigue, lower back, and/or shoulder injury.

Two hand trips are similar to two hand controls but require only momentary actuation of the palm buttons. These require additional safeguarding such as a presence sensing device (light curtain).

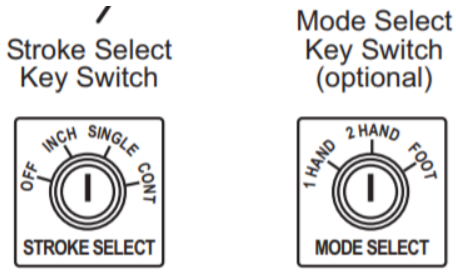
Both the two-hand control and two hand trips require anti-repeat capability, which means a new stroke cannot be initiated until the operator releases both palm buttons. (ANSI, 1990, para. E4.2.4.2.2)

Operating a press with a two-hand control can be physically demanding and workload is affected by the size and weight of the work piece, size of the press bed, and location of the palm buttons. Typically, palm buttons are spring set switch control inputs requiring force to operate and involve

repetitive motion and pronation of the wrist and hands. Low force mechanical buttons, light operated (modulated infra-red), and capacitive palm buttons are available and may have potential to reduce operator effort and the chance of overuse disorders. These types should be carefully evaluated to ensure that they are not likely to cause unintended press actuation due to shock/vibration, lubrication, interruption by clothing, ambient light, and/or electrical noise.

A one hand stroke initiation means, sometimes referred to as one hand trip, is less commonly used but has the advantage of freeing one of the operators' hands such that one hand can be used to load a part and the other to initiate a momentary contact with the one hand trip. Further, the operator may immediately release contact with the actuator. The one hand control may be separate from the standard run station and located close to the light curtain sensing field. This is thought to be less physically demanding and significantly more productive; however, it requires additional point of operation safeguarding (typically a presence sensing device – see illustration left) so a stroke cannot be initiated while one hand is still in the die. Typically, the operator can select which palm button is used for stroke initiation but cannot switch back and forth during normal operation. Like the two-hand trip, the one hand system requires the release of the palm button before a subsequent stroke can be initiated. Some control manufacturer's offer a "Light Curtain Break" mode, the press cycles only when you push the One-hand Control button within eight seconds after removing your hand(s) from the light curtain. If the button is pushed after this interval expires, the press does not cycle. Light Curtain Break mode prevents inadvertent operation of the press when an operator is loading or unloading parts One hand control has shown significant productivity increases compared to 2 hand controls. This method is not as extensively used as two hand controls, possibly due to unfamiliarity with the method and the additional cost of the presence sensing device. Regardless, it merits consideration given the ergonomic

and potential productivity benefits. *Note: the clutch/brake control should have supervisory stroke and mode selector switches.*



Foot switch/foot pedal stroke initiation is also commonly used and, like the one hand trip, requires a separate point of operation safeguard. Safeguarding devices commonly used with foot switch initiation include light curtains, pullouts, restraints, and type A or B sliding barrier devices. The light curtain is the most productive and ergonomically friendly choice. Foot switch stroke initiation is often chosen for productivity reasons rather than any ergonomic benefits. Use of a foot switch obviously leaves the operators hands free to load and unload the work piece. Despite the additional hand freedom, repetitive motion with the leg, ankle, and foot are required. Operators often complain that the front protective guard on the foot switch is clumsy and hard to use. Additionally, foot switches may sometimes require the operator to assume an awkward or strained position, which contributes to fatigue. “The foot switch must be protected such that it is not likely to be actuated by a falling object or having an operator accidentally step on it.” (United States Department of Labor OSHA 1910.217, 2004, para. 1910.217(b)(7)(x)).

Presence sensing device initiation (PSDI), sometimes referred to as self-tripping, is a stroke initiation means popularized by its common use in Europe. This stroke control method uses a specifically designed point of operation safeguarding device (light curtain), press control system, and control interface such that the guarding device also acts as a stroke initiation input means. The operator breaks the light curtain sensing field to load a part and then withdraws from the sensing field at which point the light curtain signals the press to cycle. This method has been thoroughly studied by Purdue University and OSHA and is thought to have significant ergonomic, safety, and productive benefits. However, an implementation constraint exists for mechanical power presses; namely, the OSHA

1910.217 standard has a requirement for safety system certification/validation (**1910.217(h)(11))**. To date, a qualified third-party certifier has not materialized. Accordingly, the method can't currently be used on mechanical power presses. ANSI B11.2 hydraulic press standards and B11.1 mechanical press standards both appear to allow use of PSDI. These standards place the documentation and certification burdern on the end user versus a third-party certifier.

Regardless, of the stroke initiation means and guarding method chosen it is important that the employer ensure that the clutch brake control system is OSHA/ANSI compliant, control reliable, equipped with a brake monitor, and a means to measure/monitor stop time/safety distance.

While the use of hand tools should be encouraged, where possible, employers must recognize that a hand tool is not a substitute for a point of operation safeguard or device.

It is clear that hand fed power press operations present ergonomic challenges to employers. The repetitive motions involved in stroke initiation are a major issue complicated by the lifting and reach demands associated with parts handling

Conclusion

Employers need to pay as much attention to the ergonomic issues as they do to the productivity issues when selecting hand fed press stroke initiation means. Employers have a responsibility to provide a safe workplace. Further they have an economic interest in reducing lost time, insurance costs, and workers compensation claims resulting from overuse disorders and repetitive motion injuries.

Workers vary in size, strength, and physical ability. Employer's need to take differences into consideration when assigning workers to hand fed power press tasks. Appropriate physical conditioning and training to properly and safely perform the task is vital.

Ideally, employers would consider engineering controls to eliminate the ergonomic risk factors associated with stroke initiation means on hand fed press operations. Hand and foot stroke initiation

methods demand high numbers of repetitive motions. One hand trips used in conjunction with presence sensing devices appear to offer some promise, while PSDI operation is clearly a major step toward reducing the motions required to stroke a press. Unfortunately, employers face regulatory constraints with regard to its implementation.

Employers might also consider administrative controls to reduce employee exposure by shortening work hours on hand fed press operations, rotating employees, and/or increasing break frequency. Wellness programs where exposed employees get regular examinations to screen for overuse disorders would also be useful preventive measures.

Production Resources can help you select the right safety and productivity devices for your power presses. One of our Application Engineers can provide on site assistance in OH, PA, TN, KY, AL, GA, MS, and FL.

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References

American National Standards Institute. (1990). *ANSI B11.19 Safeguarding when referenced by the other B11 machine tool safety standards.* (Safety Standard B11.19). New York, New York: American National Standards Institute.

DeVore, D. (2011). *Light curtains: Following the PSDI compliance trail* . Retrieved from http://www.fandmmag.com/print/Fabricating-and-Metalworking/Light-Curtains--Following-The-PSDI-Compliance-Trail-/1$82

Ergonomics. (2007). Retrieved from http://www.osha.gov/SLTC/ergonomics/index.html

Hutter, G. (2004). *Safeguarding machines with an ergonomic spin*. Retrieved from http://www.thefabricator.com/article/safety/safeguarding-machines-with-an-ergonomic-spin

Kroemer, K. H., Kroemer, H. B., & Kroemer-Elbert, K. E. (2001). *Ergonomics - How to Design For Ease and Efficiency* (Second ed.). Upper Saddle River, New Jersey: Prentice Hall.

Millar, D. (1987). *Current Intelligence Bulletin 49 - Injuries and Amputations Resulting from Work with Mechanical Power Presses* . Retrieved from http://www.cdc.gov/niosh/87107_49.html

PMA. (n.d.). *PMA Ergonomics checklist*. Retrieved from http://www.pma.org/osha/docs/ergo-checklist.pdf

Precision Metalforming Association. (2011). *About PMA*. Retrieved from http://www.pma.org/about/

Strasser, F. (1983). *Metal stamping plant productivity handbook.* New York, N.Y.: Industrial Press Inc..

The Association for Manufacturing Technology. (2009). *ANSI B11.1-2009*. McLean, Virginia: American National Standards Institute.

United States Department of Labor OSHA 1910.217. (2004). Retrieved from http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9841