

TECHNICAL REPORT ON PSDI

PSDI stands for presence-sensing device initiation. When PSDI is applied, a light curtain is used to initiate a machine cycle rather than palm buttons or a foot switch. The main advantages of PSDI are increased productivity, improved ergonomics, and reduced operator fatigue. The PSDI mode of operation can be applied to presses, press brakes, shears, riveters, spot welders, assembly machines, molding machines, and any other machines that are single-cycled or sequenced. PSDI is most often applied to machines where an operator manually feeds or feeds and retrieves workpieces.

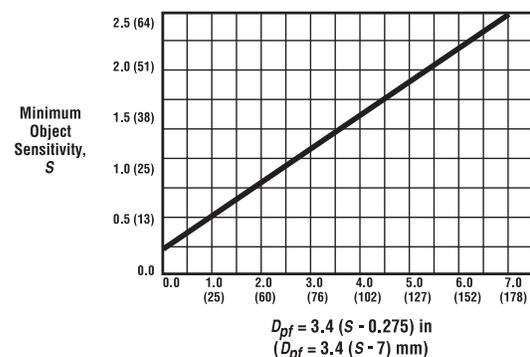
A light curtain presence-sensing device is usually applied vertically between the operator and the point-of-operation hazard. With PSDI, the machine gets its signal to initiate a cycle when an object enters and leaves the light curtain's plane of light (i.e., the hand and arm of an operator using a hand tool to feed a part). In most cases, not only is the light curtain an initiating means, it also serves as a safeguard during the hazardous portion of the cycle. During the nonhazardous portion of the cycle, the light curtain can be muted.

Machines must have good stopping capability to apply PSDI. Light curtains must be installed at a safety distance so the operator's hand cannot get to the hazardous area before the motion of the machine stops. To establish the safety distance, the stopping time during the hazardous portion of the cycle must be determined. Added factors such as reaction time and minimum object sensitivity (MOS) of the light curtain are part of the formula found in the ANSI standards. Also, if the machine has a stopping-performance monitor that allows overrun stopping time, this time must be added to the total stopping time in the formula. Once the total time is known, it is multiplied by 63 (63 inches per second being the hand speed constant) to determine the safety distance. As mentioned, the MOS must be taken into account when establishing the safety distance. The MOS of a light curtain is the smallest size of object that will always induce an output stop signal from the light curtain when inserted in the plane of light. For example, if a light curtain has a 1" MOS, any object that is an inch or larger will force the light curtain to provide a stop signal when inserted into the plane of light. In this example, the additional distance (D_{pf}) that must be factored into the safety distance formula is 2.5" (please see the chart below). When applying a light curtain to a machine for PSDI, the standards require the unit not to have more than a 1¼" MOS. The equation from Annex D of ANSI B11.19-2003, *Performance Criteria for Safeguarding*, for establishing this safety distance is $D_S = K(T_S + T_C + T_R + T_{spm}) + D_{pf}$.

Where:

- D_S = safety distance
- K = maximum speed that an individual can approach the hazard (63 inches/second is commonly used)
- T_S = stopping time of the machine measured at the final control element
- T_C = reaction time of the control system
- T_R = reaction time of the light curtain and its interface
- T_{spm} = additional time allowed for the stopping-performance monitor to compensate for variations in normal stopping time
- D_{pf} = amount of penetration allowed by the light curtain into its sensing field before someone is detected

Penetration Factor, D_{pf}



The value of D_{pf} can be found using the chart to the right, and it can then be used in the safety-distance equation above.

Machines arranged with PSDI must have a control system, components, etc., that are control reliable. This means that the electrical, pneumatic, and hydraulic systems that are relied upon to stop the machine must provide a stop signal. The latest ANSI B11-series standards are calling this “performance of the safety related functions.” Some other requirements of the standards include:

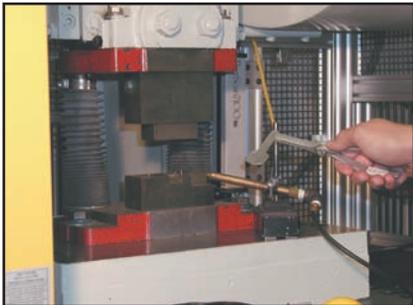
- The machine operator controls must be arranged for supervisory selection of the PSDI mode.
- The control must have a prior action before initiating a PSDI cycle.
- The control must have a timer to shut down the PSDI mode if the sequence of the workpiece-feeding operation doesn’t take place within a preset time established by the user.

Provisions must also be made so the system can differentiate between a break and rapid changes of the light curtain output. Rapid changes could be caused by changing profiles in the workpiece or by a hand tool passing in and out of the plane of light. These changes should not initiate any machine cycles.

Most PSDI control systems offered have single- and double-break tripping arrangements. Single break is used when the workpiece doesn’t need to be manually retrieved. The workpiece is usually blown, kicked, or dropped down from the point of operation (see Photos 1-3).

NOTE: Photos are for demonstration purposes only.

Photo 1—Single Break



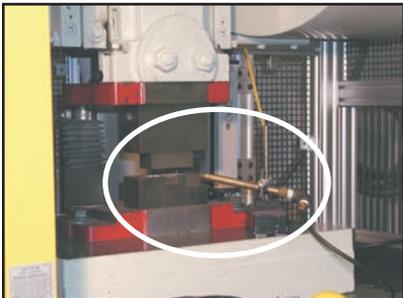
Workpiece entering the plane of light.

Photo 2—Single Break



Workpiece being placed in the die.

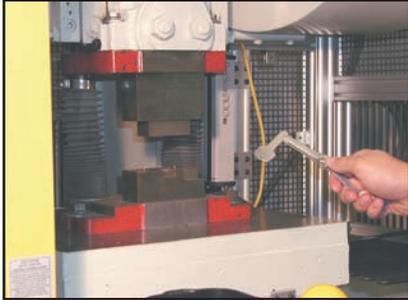
Photo 3—Single Break



**Operator’s hand is removed from the plane of light.
The cycle is complete and the workpiece will be blown off.**

If the workpiece needs to be manually retrieved, the double-break mode is used. The machine will cycle every other interruption of the light curtain and allow the operator to remove the workpiece through the plane of light without initiating a cycle (see Photos 4-8).

Photo 4—Double Break



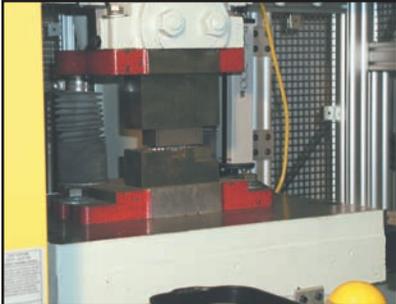
Workpiece entering the plane of light.

Photo 5—Double Break



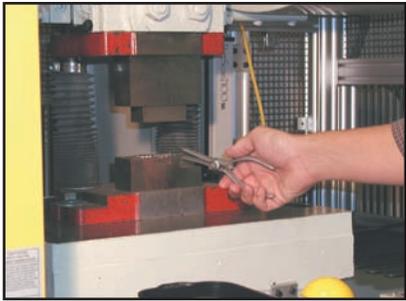
Workpiece being placed in the die.

Photo 6—Double Break



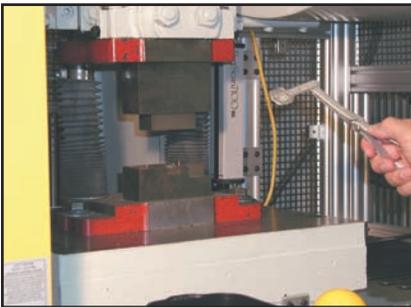
Operator's hand is removed from plane of light and the cycle is complete.

Photo 7—Double Break



Operator uses hand tool to manually retrieve the workpiece.

Photo 8—Double Break



The operator's hand and workpiece are removed from the plane of light.

NOTE: Photos are for demonstration purposes only.

If someone's body can pass entirely through the light curtain's vertical plane of light due to the configuration of the machine and/or by meeting the safety distance requirements, PSDI cannot be applied unless pass-through protection is provided. The areas of the point of operation not safeguarded by the PSDI light curtain must also be safeguarded. This safeguarding must be arranged so that someone cannot reach into the hazardous area. This can be accomplished with mirrors reflecting the plane of light around the point of operation, with additional light curtains, or with barrier guards.

When using PSDI, the operators, set-up, and maintenance personnel must be thoroughly trained in the operation and adjustment of the light curtain and the complete control system. The control system must be checked on a regular basis and records must be kept of these inspections.

Because there is no OSHA-recognized third-party validation organization in existence to meet 29 CFR 1910.217 requirements, PSDI cannot currently be applied to mechanical power presses. However, OSHA recently conducted a review of PSDI to determine whether there are changes that can be made to 29 CFR 1910.217 which will encourage its implementation and improve small business productivity, while continuing to protect workers.

The final report, "Regulatory Review of OSHA's Presence Sensing Device Initiation (PSDI) Standard, May 2004," estimates that 40,000 employees use mechanical power presses which could be converted to PSDI. It estimates that 88% of such presses are used by small businesses. It also estimates that adding PSDI to a press would increase productivity on average 24.3% and that, if added to all suitable presses, PSDI would save industry \$162 million per year.

Based on this review and public comments, OSHA has decided to update all of 29 CFR 1910.217 to ANSI B11.1-2001 or something similar. The ANSI B11.1-2001 standard for mechanical power presses permits PSDI without independent validation but includes other provisions to maintain PSDI safety. In addition, it improves safety and productivity of mechanical power presses in other ways. OSHA plans to add the update of the standard to the regulatory agenda in the near future.

The ANSI B11.2-1995 standard for hydraulic power presses provides guidelines for PSDI. Michigan is the only state in the United States (that we are aware of) that doesn't allow PSDI on hydraulic presses. However, there may be other states that don't allow PSDI on hydraulic presses or other machines. Be sure to check with your state's OSHA requirements before applying PSDI to your machines.

The ANSI B11.3-2002 standard for press brakes also has guidelines for PSDI. When using PSDI on press brakes, the machine can be arranged to single cycle or sequence. Sequencing allows the machine to be initiated with PSDI and then automatically stops the slide just above the workpiece. The remainder of the stroke can also be initiated by the light curtain, or by palm buttons or a foot switch.

Many machines can be arranged to use PSDI. This can help industry with productivity and ergonomics. If you are interested in applying PSDI to your machines, please contact Rockford Systems, Inc. For more details about PSDI and to see a hands-on demonstration, you may want to attend one of our monthly seminars on machine safeguarding. Please call 1-800-922-7533 or check our Web site for the seminar schedule.



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