

expected operational and environmental stresses, at least including those outlined in Appendix A. Such stresses shall not so affect the control system as to cause unsafe operation.

(h) Safety System.

(1) *Mechanical power presses* used in the PSDI mode shall be operated under the control of a safety system which, in addition to meeting the applicable requirements of Sections 4193(o) and 4193(m) and other applicable provisions of this section, shall function such that a single failure or single operating error shall not cause injury to personnel from point of operation hazards.

(2) *The safety system* shall be designed, constructed, and arranged as an integral total system including all elements of the press; the controls; the safeguarding, any required supplemental safeguarding, and their interfaces with the operator; and that part of the environment which has effect on the protection against point of operation hazards.

(i) Safeguarding the Point of Operation.

(1) *The point of operation* of presses operated in the PSDI mode shall be safeguarded in accordance with the requirements of Section 4206, except that the safety distance requirement of Section 4208.1(i)(6) shall be used for PSDI operation.

(2) *PSDI shall be implemented* only by use of light curtain (photo-electric) presence sensing devices which meet the requirements of paragraph 4208(c)(3), unless the requirements of the following paragraph have been met.

(3) *Alternatives to photo-electric light curtains* may be used for PSDI when the employer can demonstrate, through tests and analysis by the employer or the manufacturer, that the alternative is as safe as the photo-electric light curtain, that the alternative meets the conditions of this section, and that the alternative has the same long term reliability as light curtains and can be integrated into the entire safety system as provided for in this section. Prior to use, both the employer and manufacturer must certify that these requirements and all the other applicable requirements of this section are met, and these certifications must be validated by a Division-recognized third-party validation organization to meet these additional requirements and all the other applicable requirements of Sections 4192 through 4211 and Appendix A of this section. Three months prior to the operation of any alternative system, the employer must notify the Division of the name of the system to be installed, the manufacturer, and the Division-recognized third-party validation organization. Upon request, the employer must make available to the Division all tests and analyses for Division review.

(4) *Individual sensing fields* of presence sensing devices used to initiate strokes in the PSDI mode shall cover only one side of the press.

(5) *Light curtains* used for PSDI operation shall have minimum object sensitivity not to exceed one and one-fourth inches. Where light curtain object sensitivity is user-adjustable, either discretely or continuously, design features shall limit the minimum object sensitivity adjustment not exceed one and one-fourth inches. Blanking of the sensing field is not permitted.

(6) *The safety distance (D_s)* from the sensing field of the presence sensing device to the point of operation shall be greater than or equal to the distance determined by the formula:

$$D_s = H_s (T_s + T_p + T_r + 2T_m) + D_p$$

Where:

D_s = Minimum safety distance.

H_s = Hand speed constant of 63 inches per second.

T_s = Longest press stopping time, in seconds, computed by taking averages of multiple measurements at each of three positions (45 degrees, 60 degrees, and 90 degrees) of crankshaft angular position; the longest of the three averages is the stopping time to use. (T_s is defined as the sum of the kinetic energy dissipation time plus the pneumatic/magnetic/hydraulic reaction time of the clutch/brake operating mechanism(s).)

T_p = Longest presence sensing device response time, in seconds.

T_r = Longest response time, in seconds, of all interposing control elements between the presence sensing device and the clutch/brake operating mechanism(s).

T_m = Increase in the press stopping time at the top of the stroke, in seconds, allowed by the brake monitor for brake wear. The time increase allowed shall be limited to no more than 10 percent of the longest press stopping time measured at

the top of the stroke, or 10 milliseconds, whichever is longer.

D_p = Penetration depth factor, required to provide for possible penetration through the presence sensing field by fingers or hand before detection occurs. The penetration depth factor shall be determined from Figure G-9 using the minimum object sensitivity size.

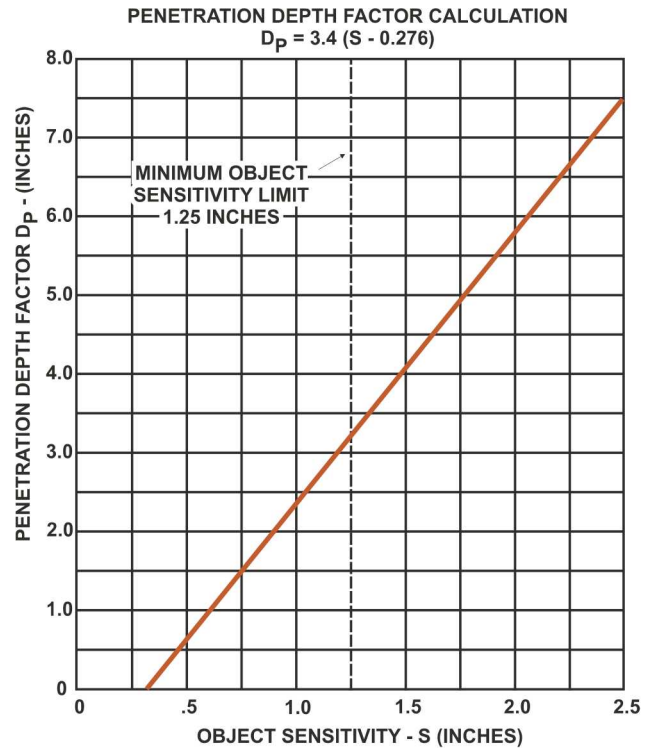


Figure G-9
Penetration Depth Factor Calculation

(7) *The presence sensing device location* shall either be set at each tool change and set-up to provide at least the minimum safety distance, or fixed in location to provide a safety distance greater than or equal to the minimum safety distance for all tooling set-ups which are to be used on that press.

(8) *Where presence sensing device location is adjustable*, adjustment shall require the use of a special tool available only to authorized persons.

(9) *Supplemental safeguarding* shall be used to protect all areas of access to the point of operation which are unprotected by the PSDI presence sensing device. Such supplemental safeguarding shall consist of either additional light curtain (photo-electric) presence sensing devices or other types of guards which meet the requirements of Sections 4207 and 4208.1.

(A) *Presence sensing devices* used as supplemental safeguarding shall not initiate a press stroke, and shall conform to the requirements of Section 4208(c) and other applicable provisions of this section, except that the safety distance shall comply with Section 4208.1(i)(6).

(B) *Guards used as supplemental safeguarding* shall conform to the design, construction and application requirements of Section 4207, and shall be interlocked with the press control to prevent press PSDI operation if the guard fails, is removed, or is out of position.

(10) *Barriers shall be fixed* to the press frame or bolster to prevent personnel from passing completely through the sensing field, where safety distance or press configuration is such that personnel could pass through the PSDI presence sensing field and assume a position where the point of operation could be accessed without detection by the PSDI presence sensing device. As an alternative, supplemental presence sensing devices used only in the safeguard mode may be provided. If used, these devices shall be located so as to detect all operator locations and positions not detected by the PSDI sensing field, and shall prevent stroking or stop a stroke in process when any supplemental sensing field(s) are interrupted.