DEMYSTIFYING DIE SAFETY BLOCKS

Die safety blocks are called by many names: safety blocks, ram blocks, die blocks or prop blocks. Regardless of the term, die safety blocks all have the same purpose: provide protection to anyone working in the die area from a free-falling upper die/slide. This all-too-common accident happens in the event of a brake or counterbalance failure, broken pitman or adjusting screw, or a sudden loss of hydraulic pressure on presses. While die safety blocks are on the surface simple devices, there are many factors to consider in choosing what type of to use, as well as how many to use or where to put them. As a result many organizations struggle with this topic.

OSHA REGULATIONS

Die safety blocks are required by OSHA CFR 29, Subpart O, 1910.217 (d)(9)(iv) Mechanical Power Presses which states, “The employer shall provide and enforce the use of safety blocks for use whenever dies are being adjusted or repaired in the press.” OSHA does not require the use of safety blocks during die setting; however, companies may include them during die setting procedures as a best safety practice. Proper use of die safety blocks also satisfies OSHA’s lockout/tagout requirements for controlling mechanical energy.

Anytime an employee needs to put their hands in the die area of a press or is required to work on the die, they must follow OSHA regulations without exception. At no time should the employee make any adjustments or service within the die space area without taking proper protection measures that meet OSHA and ANSI requirements. Regardless of how time-consuming, the company is responsible—and liable—for these procedures in a press shop.

With the press motor off and the flywheel at rest (for mechanical presses), safety blocks are placed between the die punch and holder with the machine stroke up. The number of safety blocks is determined by the size of the press bed and the weight the blocks must support. On larger presses, the total slide weight must then be distributed among the quantity of safety blocks required. In some applications, as many as four safety blocks may be required.

The ram is usually adjustable; therefore, wedges or the adjustable screw device is offered to provide a proper fit. If the die takes up most of the space on the die set, it may be difficult to find a place to insert the block. To avoid accidentally stroking the press or leaving the safety block in the die after use, an electrical power cut-off interlock system should be used. According to ANSI B11.19-2003, safety blocks “shall be interlocked with the machine to prevent actuation of hazardous motion of the machine.” The electrical interlock system for die safety blocks must be interfaced into the control system so that when the plug is pulled, the power to the main drive motor and control is disconnected. If the machine has a mechanical energy source, such as a flywheel, it must come to rest before the die block can be inserted.

GOT DIE SAFETY BLOCKS?

DIE SAFETY BLOCK CALCULATIONS

Three factors need to be determined to guide your selection of safety blocks: static load, block length and block size.

1. Determine Static Load

The actual static load that the die safety block(s) will support is determined by adding the actual weights of the press slide and slide components (ram-adjustment assembly, connection rod[s] or pitman arm[s], and the upper die).

If this weight cannot be determined, an approximate static load can be calculated using the formula below. Allow 2000 pounds of static load for each cubic foot displaced in the press bed area (front to back x right to left) multiplied by the shut height (die space) of the press. Note: When using this formula, the calculated approximated static load has a safety factor of two (2).

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Static Load Formula:

- (Press Bed Area (sq in) x Shut Height (in))/(Cubic Inches/Cubic Feet (1728 cu in/cu ft constant))

- Cubic feet displaced x 2000 lb/cubic foot = Total Static Load

Example:

- Press Bed Area = 48 in x 96 in
- Shut Height = 24 in
- (48 x 96 x 24)/1728 or 110,592/1728 = 64 cu ft
- 64 cubic feet displaced x 2000 lb/cu ft = 128,000 Total Cubic Static Load

2. Determine Block Length

With the machine at the top of its stroke; stroke up—adjustment up (S.U.A.U.), measure the space between the upper and lower die set plates (not the distance between the bolster and slide). This gives the maximum safety block length.
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To determine the stroke up—adjustment down (S.U.A.D. measurement, subtract the ram adjustment from the S.U.A.U. figure. This provides the minimum length of the die safety block.

**Total Length of Die Safety Block Required ____________”**

**EXCEPTIONS:**

1. If wedges will be used, subtract 11/2” maximum. This is an allowance for variation in the stopping point of the crankshaft or adjustment of the ram.

**Total Length of Die Safety Block Required ____________”**

1. When an adjustable screw is added to an octagonal safety block, the minimum length of the aluminum portion of the safety block is as follows:

When an adjustable screw device is added to an octagonal safety block and the screw is all the way inside of the safety block, it will add 2” to the overall length of small and medium safety blocks and 21/2” to the overall length of large safety blocks. Therefore, subtract 2” for small or medium blocks and 21/2” for large blocks to determine the length of the aluminum portion of the die block.

Example:

- If the minimum overall length of the small or medium safety block required is 101/2” with any size adjustable screw device, the aluminum portion of the safety block would be 81/2” (101/2” – 2” = 81/2”).

Example:

- If the minimum overall length of the large safety block required is 16” with any size adjustable screw device, the aluminum portion of the safety block would be 131/2” (16” – 21/2” = 131/2”).

**Total Length of the Aluminum Portion of the Die Safety Block ____________”**

3. Determine Block Size

The size of the die safety block (small, medium, large) is determined by one or both of the following factors:

1. The size of the block itself and the area available in the die.
2. The static load capacity of the block (small, medium, large) versus the total static load being supported.

**ROCKFORD SYSTEMS CAN HELP**

Rockford Systems offers a variety of die safety blocks, electrical interlock systems, accessories and operator safety resources. Our line of high-strength, aluminum wedge die safety blocks that are lightweight and come in several shapes (x-shape, u-shape, octagon shape) and sizes (small, medium, large) to meet every press application. The unique shape and mechanical properties of the 6063-T5 aluminum have been calculated according to stringent structural aluminum design analysis standards to provide high strength. Blocks are sold in standard 9’ lengths or can be cut to any size.

Rockford Systems also offers adjustable die safety blocks. These adjustable die safety blocks feature a tough malleable-iron bell-bottom base. The blocks also have a convenient handle for lifting and precision-cut acme threads for easy adjustment and extra rigidity. The adjusting screw can be easily adjusted up or down by hand. Turning holes are also provided in the screw neck to facilitate the use of a turning bar, if required.

All Rockford Systems static load charts, (see example below) are found on www.rockfordsystems.com on die block product pages.

Unlike most competitors, Rockford Systems offers electrically interlocked systems. The interlock system is available in a yellow plug with one contact (KTS518) or an orange plug with two contacts (KTS533). The electrical interlock system for die safety blocks includes the plug, a 24-inch long chain, a receptacle, and an electrical mounting box.

Additional die block accessories available from Rockford Systems include lifting handles, holders and bases. Our octagon shape safety block comes with an optional heavy-duty steel, adjustable screw device to prevent any space between the block and die when various dies are used or when the slide is adjusted.

**DANGER SIGN FOR DIE SAFETY BLOCKS**

Don’t forget to post the appropriate danger signs near all machinery in the plant. The purpose of danger signs is to warn personnel of the danger of bodily injury or death. The suggested procedure for mounting this sign is as follows:

1. Sign must be clearly visible to the operator and other personnel
2. Sign must be at or near eye level
3. Sign must be PERMANENTLY fastened with bolts or rivets

Please call 1-800-922-7533 or visit www.rockfordsystems.com for more information.
GOT GUARD OPENING SCALES? GET SAFEGUARDING!

HOW TO USE A GUARD OPENING SCALE

Point-of-operation barrier guards are essential safeguarding equipment for hazardous industrial processes and machinery such as presses, pumps, motors and drills. When properly installed the barriers prevent a person from placing any part of their body into the point of operation by reaching through, over, under or around the guards to access a hazard. However, because barrier guards are typically constructed out of materials such as wire mesh, expanded metal, rods, or hairpins, most have openings that present the potential for injuries if a person reached through them. As a result, whether the guard is fixed, adjustable, movable, or interlocked, any openings must be measured for compliance with Table O-10 of OSHA 29 CFR 1910.217 (Mechanical Power Presses), current ANSI/CSA standards, or International standard ISO 13857 to determine the safe distance from the hazard.

The critical role of measuring barrier openings falls on a simple but often misunderstood tool: the Guard Opening Scale. Also known as “gotcha sticks,” Guard Opening Scales mimic the human hand and forearm. Over the past 70 years they’ve proven to be the most accurate means of ensuring any opening in a barrier guard will not allow a hazardous zone to be accessed.

HISTORY OF THE GUARD OPENING SCALE

The history of the Guard Opening Scale dates back to 1948. It was then that Liberty Mutual Insurance, joined with the Writing Committee for the ANSI B11.1 Safety Standard on Mechanical Power Presses, engineered a stair-step shaped measurement tool to determine guard-opening size vs. guard distance to the nearest Point of Operation hazard. A rash of injuries to mechanical power press operators who reached through barriers and suffered lacerations, amputations and crushed limbs prompted Liberty Mutual’s actions. Although Guard Opening Scales were first designed for point of operation guards on mechanical power presses, they are now often used on other machines as well.

Originally, the recommended dimensions used for the scale were based upon “average-size hands,” which at the time were a woman’s size 6 glove. ANSI incorporated these dimensions from Liberty Mutual into its 1971 revision of the ANSI B11.1 safety standard for mechanical power presses. In 1995, however, a study entitled “A Review of Machine-Guarding Recommendations” was conducted by Donald Vaillancourt and Stover Snook of Liberty Mutual Research to establish whether the 1948 drawings were consistent with current hand size data, in particular as the data relates to women and minorities who have become more prevalent in manufacturing. Vaillancourt and Snook suggested several important modifications including moving the glove size from a woman’s size 6 to a size 4. Drawings from the study have been adopted in several current ANSI B11-series safety standards for machine tools as well as in the ANSI/zz R15.06 safety standard for industrial robots and robot systems. OSHA in Table O-10 of OSHA 29 CFR 1910.217 did not, on the other hand, officially adopt the drawings.

OSHA VS. ANSI GUARD OPENING SCALES

OSHA Compliance Officers are usually limited to using OSHA’s own scale, which is referenced by CFR 1910.217, Table 0-10. The ANSI scale is more likely to be used by Insurance Loss Control Engineers in manufacturing plants where smaller hand sizes tend to dominate the employee population. Let’s look at the differences in the two designs:

Note that the OSHA scale locks on the 3rd stair-step on the entrance side, and that the tip of the scale does not reach the die, meaning the test is “failed” for that opening size at that distance away. Also note that the ANSI scale locks on the last stair-step on the entrance side, and that the tip of the scale goes past the die, meaning that the test is “passed” for that opening size at that distance away. That problem can be fixed in one of two ways; move the guard a little further away from the die, or make the adjustable guard opening a little smaller, or some combination of those two.

USING A GUARD OPENING SCALE

A Guard Opening Scale is a two-dimensional representative of an average sized finger, hand and arm. Of course, the human body is not two-dimensional but three-dimensional, thus making its correct use critically important. Follow these simple instructions for proper measurements.

First, place the scaled side perpendicular to the smallest dimension in a hole in the barrier guard material and attempt to insert it towards the hazard. If properly designed, the barrier guard will stop the tip from accessing the hazard area. When multiple openings of various sizes exist in a barrier guard, each must be tested with the tool. The maximum guard opening that OSHA allows is a 6-inch opening at 31.5 inches away. For most people that’s armpit to fingertip. Also, the openings should always be measured empty, not with any material in place. This is based on the logic that personnel may put a hand through the guard opening without material taking up a portion of the space. Remember that Safety Inspectors won’t cut a plant operator any slack because the guard happens to be adjustable. Adjustable guard openings must be measured the same as fixed guard openings.

Please call 1-800-922-7533 or visit rockfordsystems.com for more information.
Another type of protection commonly used on lathes is a chip/coolant shield. These are often useful when the operator’s personal protective equipment (PPE) does not adequately control the waste product coming off of the cutting tool. If chips strike the operator in the upper body or accumulate on the floor creating a slip-trip hazard, a chip/coolant shield is often suggested to supplement the operator’s PPE. OSHA’s 1910.219 addresses the need to cover rotating components to prevent the operator’s hair and clothing from getting entangled, dragging them into the machine. These rotating components include the lead screw, feed rod, traverse rod, and camshaft, in the lower front portion of the lathe.

In April 2011, a lathe’s horizontal rotating components took the life of a 22-year old female student at Yale University’s Sterling Chemistry Laboratory. While working very late at night by herself, her hair became entangled in that part of the machine, resulting in asphyxiation. (Google; Yale Lathe Fatality)

Telescopic metal sleeves are available to cover a lathe’s horizontal rotating components, although many manufacturing companies elect not to use them. According to feedback from OSHA Compliance Officers and Insurance Loss Control Inspectors, one of the most common lathe accidents results from the misuse of the standard chuck wrench furnished by the lathe manufacturer.

When the lathe is not being used, a typical (unsafe) storage place for the chuck-wrench is in the chuck. At some point in time, the operator turns the lathe on without checking to see where the chuck wrench is located, which sends it flying. This has caused serious accidents, including the loss of eyes. Spring-loaded, self-ejecting chuck wrenches are a solution to this problem because they won’t stay in the chuck by themselves. They are available in a number of sizes.

Many older lathes also need updates to bring them up to code with electrical standards like NFPA 79. The two most common updates are for: 1) magnetic motor-starters to provide dropout protection, (a.k.a. anti-restart), and 2) main power disconnects that lock only in the OFF position. As with any machine, provision for Lockout/Tagout is always important.

Danger and Warning signs, depicting specific hazards on lathes are also available.

To see these and other lathe safeguarding products, please call 1-800-922-7533 or visit our website.
RING TESTING

OSHA says that you must “ring test” grinding wheels before mounting them to prevent the inadvertent mounting of a cracked grinding wheel.

Ring testing involves suspending the grinding wheel by its center hole, then tapping the side of the wheel with a non-metallic object. This should produce a bell tone if the wheel is intact. A thud, or a cracked-plate sound indicates a cracked wheel. NEVER mount a cracked wheel.

For larger grinders, grinding wheels are laid flat on a vibration-table, with sand evenly spread over the wheel. If the wheel is cracked, the sand moves away from the crack.

To prevent cracking a wheel during the mounting procedure, employees must be very carefully trained in those procedures. This starts with making sure the wheel is properly matched to that particular grinder, using proper blotters and spacers, and knowing exactly how much pressure to exert with a torque-wrench, just to mention a few things.

This OSHA-compliant “Wheel-Cover” allows no more than 90 degrees (total) of the wheel left exposed. (65 degrees from horizontal plane to the top of wheel-cover). Never exceed these wheel-cover maximum opening dimensions.

Larger wheel-cover openings create a wider pattern of flying debris should the wheel explode. A well-recognized safety precaution on bench/pedestal grinders is to stand well off to the side of the wheel for the first full minute before using the machine. Accidents have shown that grinding wheels are most likely to shatter/explode during that first minute.

There is an OSHA Instruction Standard #STD 1-12.8 October 30, 1978 addressing the conditional and temporary removal of the “Work Rest” for use only with larger piece parts based on the condition that “Side Guards” are provided.

SAFEGUARDING STANDARDS FOR BENCH AND PEDESTAL GRINDERS

Grinders are one of the most frequently cited machines during OSHA machine-safety inspections. This is frequently due to improperly adjusted work rests and tongue guards on bench/pedestal grinders, as well as a lack of ring testing for the grinding wheels.

OSHA 29 CFR SubPart O 1910.215 is a “machine specific” (vertical) regulation with a number of requirements, which if left unchecked, are often cited by OSHA as violations. ANSI B11.9-2010 (Grinders) and ANSI B7.1 2000 (Abrasive Wheels) also apply.

WORK RESTS AND TONGUE GUARDS

OSHA specifies that work rests must be kept adjusted to within 1/8-inch of the wheel, to prevent the workpiece from being jammed between the wheel and the rest, resulting in potential wheel breakage. Because grinders run at such a high RPM, wheels actually explode when they break, causing very serious injury, like blindness and even death.

In addition, the distance between the grinding wheel and the adjustable tongue guard (also known as a “spark arrester”) must never exceed 1/4-inch. Because the wheel wears down during use, both these dimensions must be regularly checked/adjusted.

“Grinder safety gauges” can be used during the installation, maintenance, and inspection of bench/pedestal grinders to make sure the work rests and tongue guards comply with OSHA’s 1910.215 regulation and ANSI standards. Wait until the wheel has completely stopped and the Grinder is properly “Locked Out” before using a “grinder safety gauge”. Grinder coast-down time takes several minutes, which tempts employees to use the “grinder safety gauge” while the wheel is still rotating. This practice is very dangerous because it can cause wheel breakage.

Where grinders are concerned, personal protective equipment (PPE) usually means a full face-shield, not just safety glasses. You cannot be too careful with a machine that operates at several thousand RPM.

Remember, you must DOCUMENT any and all safety requirements set forth by OSHA, as that is their best evidence that safety procedures are really being followed.

GOT GRINDERS?
GET SAFEGUARDING!

BENCH GRINDER SAFETY GAUGE

The bench grinder safety gauge is laser-cut, Grade 5052 aluminum with H32 hardness. The safety yellow, durable powder-coated gauge has silk-screened text and graphics. The bench grinder safety gauge measures 2 3/4-inches wide by 2 1/4-inches high by .1000-inches thick and has a 1/4-inch hole for attachment to the bench grinder.

STANDARD MOUNT GRINDER SHIELDS

These standard mount grinder shields are available in various sizes for protection from the swarf of bench or pedestal grinders. The frames are constructed of reinforced fiber nylon or heavy cast aluminum. Each shield is furnished with a threaded support rod. The transparent portion of the standard mount grinder shields is made of high-impact resistant polycarbonate to minimize scratching and provide durability.

DOUBLE-WHEEL AND SINGLE-WHEEL BENCH GRINDER SHIELDS

Double-wheel bench grinder shields provide protection for both wheels of the grinder with one continuous shield. The durable shield is made of clear, 3/16-inch-thick polycarbonate and measures 18-inch x 6-inch. A special shield bracket adds stability to the top of the shield. The single-wheel bench grinder shield is made of clear, 3/16-inch-thick polycarbonate and measures 6-inch x 6-inch. This sturdy, impact-resistant shield is designed for use when a single wheel needs safeguarding. These shields have a direct-mount base that attaches directly to the grinder table or pedestal.

ELECTRICALLY-INTERLOCKED GRINDER AND TOOL GRINDER SHIELDS

These electrically-interlocked grinder and tool grinder shields are ideal for single- and double-wheel grinders. When the heavy-duty shield is swung out of position, the positive contacts on the microswitch open, sending a stop signal to the machine control. The safety microswitch electrical wires are furnished with a protective sheath and connect to the safety circuit of the machine that switches off the control to the movement of the grinding wheel. All safety micro switches are mounted in an enclosed housing with an enclosure rating of IP 67. The multi-adjustable, hexagonal steel arm structure allows easy mounting on the most diverse grinders. A versatile clamp allows horizontal and vertical adjustment of the shield. All electrically-interlocked grinder and tool grinder shields consist of a high impact-resistant, transparent polycarbonate shield with an aluminum profile support and provide operator protection from flying chips and coolant.

SINGLE-PHASE DISCONNECT SWITCH AND MAGNETIC MOTOR STARTER

This single-phase unit is designed for motors that have built-in over-loads. Typical applications for these combinations include smaller crimping machines, grinders, drill presses, and all types of saws. The 115-V, 15-A disconnect switch and non-reversing magnetic motor starter are housed in a NEMA-12 enclosure. Enclosure size is 8” x 6” x 3-1/2”. It includes a self-latching red emergency-stop palm button and a green motor control start push button. It can be used on machines with 115-V and is rated up to 1/2 HP maximum. The disconnect switch has a rotary operating handle which is lockable in the off position only. This meets OSHA and ANSI standards.

DANGER SIGN FOR CUTTING AND TURNING MACHINES

Don’t forget to post the appropriate danger signs near all machinery in the plant. The purpose of danger signs is to warn personnel of the danger of bodily injury or death. The suggested procedure for mounting this sign is as follows:

1. Sign must be clearly visible to the operator and other personnel
2. Sign must be at or near eye level
3. Sign must be PERMANENTLY fastened with bolts or rivets

Please call 1-800-922-7533 or visit www.rockfordsystems.com for more information.
SAFEGUARDING MECHANICAL POWER PRESSES

Mechanical power presses (a.k.a. punch presses, stamping presses, flywheel presses), have existed in the United States since 1857. They were originally designed as either full-revolution or part-revolution, both of which still exist, although the latter currently represents an estimated 90 percent of the roughly 300,000 mechanical power presses being used in the U.S. today.

This blog will address part-revolution presses only. These are often referred to as “air clutch” presses, made by dozens of manufacturers. The idea of safety for these machines has existed since 1922, when the first ANSI B11.1 Safety Standard was developed. The latest version, ANSI B11.1-2009 is the 10th update of that standard. This is generally considered to contain the “Best Safety Practices” for press users.

In the early 1970’s, OSHA promulgated a “machine specific regulation” for mechanical power presses, their CFR SubPart 0, 1910.217. Very few changes have been made to that regulation since then. Keep in mind that OSHA’s 1910.217 Regulation was taken from ANSI B11.1 using a version that was freshly updated for OSHA in 1971. ANSI has updated their B11.1 four times since that time. Every update adds new, more stringent requirements than the previous version.

Although many companies have long since met the basic OSHA requirements for their presses, a significant number of those shops have yet to make updates to meet the latest ANSI B11.1 Standard. When OSHA regulations came 46 years ago, press control systems were primarily relay-logic systems, designed to meet OSHA’s initial requirement for “Control Reliability” and “Brake Monitoring.”

Press control systems manufactured in the mid 1980’s and beyond have been mostly solid-state, designed to meet the ANSI Standard concept for the “Performance of Safety Related Functions.” One of the advantages to solid-state controls are the features built-into them. Two of these are a: built-in “Stopping Performance Monitor” and built-in “Stop Time Measurement,” which prevents users from having to use a portable device to determine “Safety Distance” when applying Light Curtain and Two-hand Control devices.

Mechanical Power Presses require some combination of guards and/or devices to reduce or eliminate exposure to hazards at the “point of operation” where the dies close. Safeguarding alternatives include: Point-of-Operation Guards, Awareness Barriers, Light Curtains, and Two-Hand Controls.

1) Point-of-Operation Guards
Point-Of-Operation Guards are typically used for continuous operations where coil-stock feeds into the press as it operates in an uninterrupted mode of operation.

By OSHA’s definition, a guard must prevent people from reaching over, under, through, or around it. (OUTA is an acronym easy to remember; This guard keeps you “OUTA” here.) Guards must meet one of two measurement scales (the OSHA guard opening scale or the ANSI/CSA guard opening scale), to ensure that a small hand can’t reach far enough through any opening to get hurt.

To discourage misuse, hinged or sliding guard sections are often electrically interlocked, so that they remain in position (closed) during press operations. Without interlocks, movable sections can easily be left open, whether intentional or not, leaving Operators and others in the area unprotected.

Guard Interlocks are attached to hinged or moving guard sections, since access to the point-of-operation is most often made through those openings. Interlock attachment is best accomplished with tamper-resistant fasteners to discourage cheating the switch.

Many older guards use simple lever-arm or push-button switches. Not only are these switches easy to cheat with tape or wire, they are also spring-operated, leaving them subject to failure if the spring breaks. Newer switches are free of springs, and use actuators with a unique geometry, making them much more difficult to defeat.

2) Awareness Barriers (for low-level hazards only)
Another common method of safeguarding on coil-fed presses is an “Awareness Barrier” (A/B). They should completely surround auxiliary equipment like coil-payoffs, feeds, straighteners, etc.

Awareness Barriers are considered superior to just a yellow line on the floor, because to get beyond the A/B requires an intentional act and some physical contact with them. This means the person is well aware that they are entering a hazard area, contrary to their safety training. Auxiliary equipment may also require that ingoing rolls are covered to prevent entanglement with long hair or loose clothing.

Awareness barriers should also have several Danger or Warning signs attached to them specifying what the hazards are in going beyond the A/Bs. Examples of sign verbiage might include: moving coil stock, ingoing pinch points, sharp edges, tripping hazard, etc.
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3) Light Curtains
Light Curtains have been around since the mid-1950’s. They consist of a vertically mounted transmitter and receiver with closely spaced beams of infra-red light, creating a flat sensing-field. When fingers, hands, or arms that reach through that sensing-field, the press cycle is prevented or stopped to avoid operator injury.

One of the reasons that presses make a good application for light curtains is that they can be stopped mid-cycle very quickly. Light curtains can be used for either single or continuous applications. The only thing that light curtains don’t provide is “impact protection” should something break in the point of operation and be ejected in the operator’s direction. Where that’s an issue, poly carbonate shields or guards may be appropriate.

Like any safeguarding device, light curtains should be “function-tested” before every operating shift to ensure that they are continuing to provide protection. Make/model specific “function-test procedures” are usually available on each light curtain manufacturer’s website.

4) Two-Hand Controls
Two-Hand Controls are considered a safer means of cycling a press than a foot-switch because both hands must be in a safe position to use them. When cycling a press with a foot switch, hands can be anywhere. When operating a press in the single-cycle mode of operation, it’s possible to use a two-hand control as a safeguarding device as well. This requires that they meet a list of rules in both OSHA and ANSI.

Ten of the basic requirements for a two-hand control being used as a safeguarding device (in the single-cycle mode of operation) include:

1) Protection from unintended operation
2) Located to require the use of both hands (no elbow & finger tips)
3) Concurrently operated (actuation within half-second of each other)
4) Holding-time during the downstroke (hazardous portion of cycle)
5) Anti-repeat (push and release both actuators for each single cycle)
6) Interrupted stroke protection (for all operating stations)
7) Separate set of two-hand controls for each operator
8) Mounted at a calculated “Safety Distance” from nearest hazard
9) Control system to meet “Performance of Safety Related Functions”
10) Stopping Performance Monitor is also required

When running high-production operations, don’t forget to consider ergonomics when choosing and installing two-hand controls. Several manufacturers of low-force and no-force actuators are on the market.

Also required by OSHA on Mechanical Power Presses is an electrically interlocked “Safety Block” whenever dies are being adjusting or repaired while they are in the press. The interlock is required because safety blocks are very seldom designed to hold the full working-force of the press (please refer to our Die Safety Blocks blog for additional information).

Mechanical Power Presses require two types of OSHA inspections:

1) Periodic and regular (typically quarterly) inspections of the press parts, auxiliary equipment, and safeguards... (don’t forget to document)
2) Weekly inspections of; clutch/brake mechanism, anti-repeat feature...along with other items (don’t forget to document)

OSHA requires training (in 1910.217) for anyone who cares for, inspects, maintains, or operates mechanical power presses.

ANSI B11.1-2009, requires training for “all (people) associated with press production systems, including operators, die setters, maintenance personnel, supervisors, which must also include (OSHA) 1910.147 Lockout/Tagout.”

Please call 1-800-922-7533 or visit rockfordsystems.com for more information.
PRESS BRAKE SAFEGUARDING BASICS

Press Brakes are currently a hot topic in the “Machine Safeguarding” arena. OSHA regulations consider press brakes to be a 1910.212 machine, saying to the employer; “one or more methods of machine guarding shall be provided to protect the operator and other employees in the machine area from hazards such as those created by point of operation, in-going nip points, rotating parts, flying chips, and sparks”...1910.212 requirements are good place to start, but they leave out the details of exactly how to go about safeguarding any particular machine. Therefore, a reference to an ANSI Standard like B11.3 on press brakes is often used to identify specific safeguarding alternatives. ANSI B11.3 may however need some help from ANSI B11.19 on safeguarding methods, to provide a complete picture of how to go about protecting people.

Older press brakes, like those manufactured in the mid-1980’s and before, were mechanical (flywheel-type) machines, some of which are still in use today. Because the stopping times on mechanical press brakes are long, equally long light curtain safety-distances result, making that safeguarding device impractical in many cases.

Press brakes manufactured after the mid-1980’s are much more likely to be hydraulic. Hydraulic press brakes allow for a wider variety of safeguarding options than mechanical press brakes do, and offer faster stopping-times, resulting in closer safety-distances where light curtains or two-hand controls are used.

A common method of safeguarding press brakes is with a vertically mounted infra-red light curtain. Hydraulic press brakes allow for short stopping times so that a light curtain can be mounted relatively close to the dies.

Two-hand controls on press brakes are often used in the sequence-mode of operation where the actuators bring the machine down and stop before the dies close, allowing just enough die-space to feed the part. The part is placed in the remaining die-opening, then a foot-switch is used to make the bend and return the machine to its full-open position.

Safety distance is required for both light curtains, and two-hand controls. That distance must be calculated with a stop-time measurement (STM) device on a quarterly basis. STM readings must be documented to show safety inspectors.

ANSI B11.3 which was updated in 2012, offers two completely new categories of protection for hydraulic press brakes: Active Optical Protective Devices (lasers) and Safe Speed Safeguarding. Active Optical Protective Devices (AOPDs) detect hands and fingers in a danger area. The biggest attraction for AOPDs are for jobs where the operator must hand hold small parts up close to the dies. A unique feature of AOPDs is that they are designed to be mounted with zero safety distance, unlike light curtains that must be mounted at a calculated safety-distance, as outlined in ANSI B11.3. Safe Speed Safeguarding is based on a ram speed of 10mm per second or less, providing that speed is carefully monitored. Again, these two new methods of protection can only be applied to hydraulic press brakes (and potentially Servo-Drive Press Brakes).

The Lazersafe Sentinel Plus is the most advanced guarding solution available designed specifically for hydraulic press brakes. The Lazersafe ties directly into the machine’s existing hydraulic and electric control circuits, providing a Category 4 solution. The Lazersafe is CE rated and allows machine operators to hold workpieces within 20mm of the point of operation. Encoder feedback ensures that the speed and position of the tooling is continuously monitored, and a 4.3” HMI provides machine operators immediate feedback of all vital functions. The Lazersafe Sentinel Plus is compatible with a wide variety...
of machines and tooling types, material thickness and easily allows for box shapes to be formed.

The backs of press brakes cannot be left wide open. Two hazards exist often exist here. The first is reaching the dies from the back. The second is the possibility of a multi-axis back gauge moving and creating pinch points. As to exactly what is required on the back of equipment often depends on local OSHA interpretation. The very least, an awareness barrier, like a railing, chain, or cable with a “Danger” or “Warning” sign, complete with Pictograms, not just verbiage.

For local OSHA interpretations that won’t accept awareness barriers, a full perimeter guard may be the answer for the back of a press brake. That guard can either be bolted into position, or if it’s movable, an electrical interlock switch can be installed to make sure it stays closed.

As with any industrial machine, Lockout/Tagout on Press Brakes must strive for “Zero Energy State” to and within each piece of equipment using both locks and tags.

Also mentioned in the ANSI standard is die safety blocks; please see our related blog post on “Demystifying Die Safety Blocks”.

Please call 1-800-922-7533 or visit rockfordsystems.com for more information.
PLAYING IT SAFE WITH ROBOTICS

Robotics is a growing field as more and more companies are incorporating industrial automation into their production processes. In just the first nine months of 2016, 23,985 robots were ordered from North American companies, many of which require machine guarding equipment to maximize productivity and safety. Robots are used for replacing humans who were performing unsafe, hazardous, highly repetitive, and unpleasant tasks. They are utilized to accomplish many different types of application functions such as material handling, assembly, arc welding, resistance welding, machine tool load/unload functions, painting/spraying, etc.

POTENTIAL HAZARDS

Studies indicate that many robot injuries occurring in robotic automation typically occur during non-routine operating conditions, such as programming, maintenance, repair, testing, setup, or adjustment when the worker may temporarily be within the robot’s working envelope.

As stated by OSHA, mechanical hazards might include workers colliding with equipment, being crushed, or trapped by equipment, or being injured by failing equipment components. For example, a worker could collide with the robot’s arm or peripheral equipment as a result of unpredictable movements, component malfunctions, or random program changes. The worker could be injured by being trapped between the robot’s arm and other peripheral equipment or being crushed by peripheral equipment as a result of being impacted by the robot into this equipment.

Mechanical hazards also can result from the mechanical failure of components associated with the robot or its power source, drive components, tooling or end-effector, and/or peripheral equipment. The failure of gripper mechanisms with resultant release of parts, or the failure of end-effector power tools such as grinding wheels, buffing wheels, deburring tools, power screwdrivers, and nut runners are a few of the possibilities.

Human errors can result in hazards both to personnel and equipment. Errors in programming, interfacing peripheral equipment, connecting input/output sensors, can all result in unpredictable movement or action by the robot which can result in personnel injury or equipment breakage.

Human errors in judgment frequently result from incorrectly activating the teach pendant or control panel. The greatest human judgment error results from becoming so familiar with the robot’s redundant motions that personnel are too trusting in assuming the nature of these motions and place themselves in hazardous positions while programming or performing maintenance within the robot’s work envelope.

SAFEGUARDING AUTOMATION CELLS

Robots in the workplace are generally associated with the machine tools or process equipment. Robots are machines, and as such, must be safeguarded in ways similar to those presented for any hazardous remotely controlled machine, falling under the general duty clause or OSHA 1910.212(a)(1) or 1910.212(a)(3)ii. Refer to https://www.osha.gov/SLTC/robotics/standards.html and OSHA’s compliance directive on robotics STD 01-12-002 at https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=170 for more information.

Various techniques are available to prevent employee exposure to the hazards which can be imposed by robots. The most common technique is through the installation of perimeter guarding with interlocked gates. A critical parameter relates to the manner in which the interlocks function. Of major concern is whether the computer program, control circuit, or the primary power circuit, is interrupted when an interlock is activated. The various industry standards should be investigated for guidance; however, it is generally accepted that the primary motor power to the robot should be interrupted by the interlock.

Although ANSI standards are guidelines, many U.S. industry experts agree that ANSI standards provide the best guidelines for safeguarding machinery that doesn’t have a vertical OSHA requirement. ANSI/RIA R15.06-2012 is the most recent U.S. Standard on Industrial Robots, which requires that perimeter guards contain the robot automation. These guards are required to have a 12-inch sweep and a 60-inch height (ANSI/RIA R15.06-1999). However, CSA 2003 cite best practices at a 6-inch (.15m) sweep and a 72-inch (1.8m) height.

When a robot is to be used in a workplace, the employer should accomplish a comprehensive operational safety/health hazard analysis and then devise and implement an effective safeguarding system which is fully responsive to the situation. In general, the scale of the automation cell will drive the scale of the safeguarding. (Various effective safeguarding techniques are described in ANSI B11.19-2010.)
ROCKFORD SYSTEMS CAN HELP

During Rockford Systems Onsite Risk Assessments and Onsite Machine Surveys, we find one of the most common problems with robotics is the failure to accurately calculate safety distances, typically used in regard to the installation of safety mats. Robots make rapid and wide-reaching moves. The goal is to stop a robot before it can hurt someone.

Any robot that moves more than 10 inches per second must be safeguarded adequately. Safe distance is determined by the following Robotics Industry Associations (RIA) formula with the following parameters:

\[
DS = 63 \text{ inches per second (IPS)} \times (TS + TC + TR) + DPF
\]

DPF= 1.2 m (48 in.)

Where:

- DS= minimum safe distance
- TS= stopping time of device
- TC= worst stopping time of control system
- TR= response time of safeguarding device including interface
- DPF= maximum travel distance toward a hazard once someone has entered the field

So the total horizontal space to be protected is 48 in. plus 63 IPS, multiplied by the total time delay between detection of a person in the protected area and the actual time it takes for the robot to stop.

It’s imperative that the automation cell and all aspects of machine use be identified and considered when selecting and implementing a robotics safeguarding. Ultimately, the best type of protective measure will be the device or system that provides maximum protection, with minimal impact on normal machine operation.

Please call 1-800-922-7533 or visit www.rockfordsystems.com for more information.