SAFETY REQUIREMENTS FOR POWER PRESSES TAKEN FROM OSHA

Any component of the safety system mounted on this press is available from one source:

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OSHA 29 CFR 1910.211, 1910.212, 1910.217, 1910.219, and 1910.147 are included in this catalog for use as a reference when determining safety requirements for bringing machines into compliance with the federal standards.

This information is a comprehensive guide to understanding Federal OSHA (Occupational Safety and Health Administration) and applying its requirements to mechanical power presses and other machines. It is copied verbatim from the Federal Register and contains all pertinent sections of the OSHA standards concerning power presses with which an employer (user) must comply. 29 CFR 1910.212 and 1910.219 can be applied to presses, press brakes and other machines discussed in this catalog as well as lathes, milling machines, etc. Safety standards for these types of machines are available from ANSI (American National Standards Institute). For a copy of the appropriate B11-series standard, see page 238 for the contact information. Be sure to review these standards before updating or installing any equipment on a machine. If you are unfamiliar with how to properly safeguard the point of operation or how to calculate the safety distance for two-hand control, etc., we offer a series of monthly machine safeguarding seminars to educate the employer/user on the safety requirements. Please see pages 2 through 6 for further details.

Following this section is OSHA standard 29 CFR 1910.147 which contains requirements for the control of hazardous energy (lockout/tagout). This standard covers the servicing and maintenance of machines and equipment where the unexpected energizing or start-up of the machines or equipment, or release of stored energy could cause injury to employees. See page 119 for information on air lockout valves, pages 221-226 for safety blocks, and page 235 for lockout tags to meet this requirement.

OSHA 29 CFR 1910.211—DEFINITIONS

AS USED IN 29 CFR 1910.217 AND 1910.219 UNLESS THE CONTENT CLEARLY REQUIRES OTHERWISE, THE FOLLOWING POWER PRESS AND MECHANICAL POWER-TRANSMISSION GUARDING TERMS SHALL HAVE THE FOLLOWING MEANING:

Adjustable barrier guard means a barrier requiring adjustment for each job or die setup.

Antirepeat means the part of the clutch/brake control system designed to limit the press to a single stroke if the tripping means is held operated. Antirepeat requires release of all tripping mechanisms before another stroke can be initiated. *Antirepeat* is also called single stroke reset or reset circuit.

Authorized person means one to whom the authority and responsibility to perform a specific assignment has been given by the employer.

Automatic feeding means feeding wherein the material or part being processed is placed within or removed from the point of operation by a method or means not requiring action by an operator on each stroke of the press.

Belts include all power transmission belts, such as flat belts, round belts, V-belts, etc., unless otherwise specified.

Belt shifter means a device for mechanically shifting belts from tight to loose pulleys or vice versa, or for shifting belts on cones of speed pulleys.

Belt pole (sometimes called a *belt shipper* or *shipper pole*) means a device used in shifting belts on and off fixed pulleys on line or countershaft where there are no loose pulleys.

Bolster plate means the plate attached to the top of the bed of the press having drilled holes or T-slots for attaching the lower die or die shoe.

Brake means the mechanism used on a mechanical power press to stop and/or hold the crankshaft, either directly or through a gear train, when the clutch is disengaged.

Brake Monitor means a sensor designed, constructed, and arranged to monitor the effectiveness of the press braking system.

Clutch means the coupling mechanism used on a mechanical power press to couple the flywheel to the crankshaft, either directly or through a gear train.

Concurrent means acting in conjunction, and is used to describe a situation wherein two or more controls exist in an operated condition at the same time.

Continuous means uninterrupted multiple strokes of the slide without intervening stops (or other clutch control action) at the end of individual strokes.

Control System means sensors, manual input and mode selection elements, interlocking and decision-making circuitry, and output elements to press operating mechanism.

Counterbalance means the mechanism that is used to balance or support the weight of the connecting rods, slide, and slide attachments.

Device means a press control or attachment that:

(i) Restrains the operator from inadvertently reaching into the point of operation; or

(ii) Prevents normal press operation if the operator's hands are inadvertently within the point of operation; or

(iii) Automatically withdraws the operator's hands, if the operator's hands are inadvertently within the point of operation as the dies close.

Die means the tooling used in a press for cutting or forming material. An upper and a lower die make a complete set.

Die builder means any person who builds dies for power presses.

Die enclosure guard means an enclosure attached to the die shoe or stripper, or both, in a fixed position.

Die set means a tool holder held in alignment by guide posts and bushings and consisting of a lower shoe, an upper shoe or punch holder, and guide posts and bushings.

Die setter means an individual who places or removes dies in or from mechanical power presses, and who, as a part of his duties, makes the necessary adjustments to cause the tooling to function properly and safely.

Die setting means the process of placing or removing dies in or from a mechanical power press, and the process of adjusting the dies, other tooling and safeguarding means to cause them to function properly and safely.

Die shoe means a plate or block upon which a die holder is mounted. A die shoe functions primarily as a base for the complete die assembly, and, when used, is bolted or clamped to the bolster plate or the face of slide.

Direct drive means the type driving arrangement wherein no clutch is used; coupling and decoupling of the driving torque is accomplished by energizing and deenergization of a motor. Even though not employing a clutch, direct drives match the operational characteristics of "part revolution clutches" because the driving power may be disengaged during the stroke of the press.

Exposed to contact means that the location of an object is such that a person is likely to come into contact with it and be injured.

Ejector means a mechanism for removing work or material from between the dies.

Face of slide means the bottom surface of the slide to which the punch or upper die is generally attached.

Feeding means the process of placing or removing material within or from the point of operation.

Fixed barrier guard means a die space barrier attached to the press frame.

Flywheels include flywheels, balance wheels, and flywheel pulleys mounted and revolving on crankshaft of engine or other shafting.

Foot control means the foot operated control mechanism designed to be used with a clutch or clutch/brake control system.

Foot pedal means the foot operated lever designed to operate the mechanical linkage that trips a full revolution clutch.

Full-revolution clutch means a type of clutch that, when tripped, cannot be disengaged until the crankshaft has completed a full revolution and the press slide a full stroke.

Gate or movable barrier device means a movable barrier arranged to enclose the point of operation before the press stroke can be started.

Guard means a barrier that prevents entry of the operator's hands or fingers into the point of operation.

Guide post means the pin attached to the upper or lower die shoe, operating within the bushing on the opposing die shoe, to maintain the alignment of the upper and lower dies.

OSHA 29 CFR 1910.211—DEFINITIONS (continued)

Hand feeding tool means any hand-held tool designed for placing or removing material or parts to be processed within or from the point of operation.

Holdout or restraint device means a mechanism, including attachments for operator's hands, that when anchored and adjusted prevent the operator's hands from entering the point of operation.

Inch means an intermittent motion imparted to the slide (on machines using part revolution clutches) by momentary operation of the "Inch" operating means. Operation of the "Inch" operating means engages the driving clutch so that a small portion of one stroke or indefinite stroking can occur, depending upon the length of time the "Inch" operating means is held operated. "Inch" is a function used by the die setter for setup of dies and tooling, but is not intended for use during production operations by the operator.

Interlocked press barrier guard means a barrier attached to the press frame and interlocked so that the press stroke cannot be started normally unless the guard itself, or its hinged or movable sections, enclose the point of operation.

Jog means an intermittent motion imparted to the slide by momentary operation of the drive motor, after the clutch is engaged with the flywheel at rest.

Knockout means a mechanism for releasing material from either die.

Liftout means the mechanism also known as knockout.

Maintenance runway means any permanent runway or platform used for oiling, maintenance, running adjustment, or repair work, but not for passageway.

Manual feeding means feeding wherein the material or part being processed is handled by the operator on each stroke of the press.

Nip-point belt and pulley guard means a device which encloses the pulley and is provided with rounded or rolled edge slots through which the belt passes.

Operator's station means the complete complement of controls used by or available to an operator on a given operation for stroking the press.

Part-revolution clutch means a type of clutch that can be disengaged at any point before the crankshaft has completed a full revolution and the press slide a full stroke.

Pinch point means any point other than the point of operation at which it is possible for a part of the body to be caught between the moving parts of a press or auxiliary equipment, or between moving and stationary parts of a press or auxiliary equipment or between the material and moving part or parts of the press or auxiliary equipment.

Point of operation means the area of the press where material is actually positioned and work is being performed during any process such as shearing, punching, forming, or assembling.

Presence-sensing device means a device designed, constructed and arranged to create a sensing field or area and to deactivate the clutch control of the press when an operator's hand or any other part of his body is within such field or area.

Press means a mechanically powered machine that shears, punches, forms or assembles metal or other material by means of cutting, shaping, or combination dies attached to slides. A press consists of a stationary bed or anvil, and a slide (or slides) having a controlled reciprocating motion toward and away from the bed surface, the slide being guided in a definite path by the frame of the press.

Prime movers include steam, gas, oil, and air engines, motors, steam and hydraulic turbines, and other equipment used as a source of power.

Pullout device means a mechanism attached to the operator's hands and connected to the upper die or slide of the press, that is designed, when properly adjusted, to withdraw the operator's hands as the dies close, if the operator's hands are inadvertently within the point of operation.

Repeat means an unintended or unexpected successive stroke of the press resulting from a malfunction.

Safety block means a prop that, when inserted between the upper and lower dies or between the bolster plate and the face of the slide, prevents the slide from falling of its own deadweight.

Safety system means the integrated total system, including the pertinent elements of the press, the controls, the safeguarding and any required supplemental safeguarding, and their interfaces with the operator, and the environment, designed, constructed and arranged to operate together as a unit, such that a single failure or single operating error will not cause injury to personnel due to point of operation hazards.

Semiautomatic feeding means feeding wherein the material or part being processed is placed within or removed from the point of operation by an auxiliary means controlled by the operator on each stroke of the press.

Sheaves mean grooved pulleys, and shall be so classified unless used as flywheels.

Single stroke means one complete stroke of the slide, usually initiated from a full open (or up) position, followed by closing (or down), and then a return to the full open position.

Single-stroke mechanism means an arrangement used on a full-revolution clutch to limit the travel of the slide to one complete stroke at each engagement of the clutch.

Slide means the main reciprocating press member. A slide is also called a ram, plunger, or platen.

Stop control means an operator control designed to immediately deactivate the clutch control and activate the brake to stop slide motion.

Stripper means a mechanism or die part for removing the parts or material from the punch.

Stroking selector means the part of the clutch/brake control that determines the type of stroking when the operating means is actuated. The stroking selector generally includes positions for Off (Clutch Control), Inch, Single Stroke, and Continuous (when Continuous is furnished).

Sweep device means a single or double arm (rod) attached to the upper die or slide of the press and designed to move the operator's hands to a safe position as the dies close, if the operator's hands are inadvertently within the point of operation.

Trip or (tripping) means activation of the clutch to "run" the press.

Turnover bar means a bar used in die setting to manually turn the crankshaft of the press.

Two-hand trip means a clutch actuating means requiring the concurrent use of both hands of the operator to trip the press.

Two-hand control device means a two-hand trip that further requires concurrent pressure from both hands of the operator during a substantial part of the die-closing portion of the stroke of the press.

Unitized tooling means a type of die in which the upper and lower members are incorporated into self-contained units arranged as to hold the die members in alignment.

OSHA 29 CFR 1910.217—MECHANICAL POWER PRESSES

EDITED FOR POWER PRESSES

As taken from Title 29 of the Code of Federal Regulations (CFR), Sections 1910.147, 1910.212, 1910.217, and 1910.219.

Many people find the OSHA standards confusing and difficult to read as published in the Code of Federal Regulations. As an aid to the metal stampers and fabricators, we have rearranged and labeled certain paragraphs and sections to help categorize the subject material. Each paragraph has been identified so that the reader can refer to the regulations and read the paragraph in context as the government wrote it. No words of the text have been changed; however, this information should never be used in place of the actual standards. We can assume no liability for acts taken as a result of reference to it. We offer this guide for use in analyzing problems and finding solutions for bringing full- and part-revolution mechanical power presses into compliance with the federal regulations.

WHEN MUST THINGS BE DONE?

(a)(4) Reconstruction and modification

It shall be the responsibility of any person reconstructing, or modifying a mechanical power press to do so in accordance with paragraph (b) of this section.

(a)(5) Excluded machines

Press brakes, hydraulic and pneumatic power presses, bulldozers, hot bending and hot metal presses, forging presses and hammers, riveting machines and similar types of fastener applicators are excluded from the requirements of this section.

CONSTRUCTION OF PRESS AND ITS CONTROLS —FULL REVOLUTION CLUTCHES

(b)(3) Machines using full revolution positive clutches

(i) Machines using full revolution clutches shall incorporate a single stroke mechanism.

(ii) If the single stroke mechanism is dependent upon spring action, the spring(s) shall be of the compression type, operating on a rod or guided within a hole or tube, and designed to prevent interleaving of the spring coils in event of breakage.

METHODS OF INITIATING PRESS CYCLE

(b)(4) Foot pedals (treadle)

(i) The pedal mechanism shall be protected to prevent unintended operation from falling or moving objects or by accidental stepping onto the pedal.

(ii) A pad with a nonslip contact area shall be firmly attached to the pedal.

(iii) The pedal return spring(s) shall be of the compression type, operating on a rod or guided within a hole or tube, and designed to prevent interleaving of spring coils in event of breakage.

(iv) If pedal counterweights are provided, the path of the travel of the weight shall be enclosed.

(b)(5) Hand operated levers

(i) Hand-lever-operated power presses shall be equipped with a spring latch on the operating lever to prevent premature or accidental tripping.

(ii) The operating levers on hand-tripped presses having more than one operating station shall be interlocked to prevent the tripping of the press except by the “concurrent” use of all levers.

(b)(6) Two-hand trip

See page 268, paragraph (c)(3)(viii).

(i) A two-hand trip shall have the individual operator’s hand controls protected against unintentional operation and have the individual operator’s hand controls arranged by design and construction and/or separation to require the use of both hands to trip the press and use a control arrangement requiring concurrent operation of the individual operator’s hand controls.

(ii) Two-hand trip systems on full revolution clutch machines shall incorporate an antirepeat feature.

(iii) If two-hand trip systems are used on multiple operator presses, each operator shall have a separate set of controls.

OSHA 29 CFR 1910.217—MECHANICAL POWER PRESSES (continued)

PART REVOLUTION CLUTCHES (AIR AND MECHANICAL-FRICTION CLUTCHES)

(b)(7) Machines using part revolution clutches

(i) The clutch shall release and the brake shall be applied when the external clutch engaging means is removed, deactivated or deenergized.

Stop control

(ii) A red color stop control shall be provided with the clutch/brake control system. Momentary operation of the stop control shall immediately deactivate the clutch and apply the brake. The stop control shall override any other control, and reactuation of the clutch shall require use of the operating (tripping) means which has been selected.

Press stroking selector

(iii) A means of selecting Off, Inch, Single Stroke, and Continuous (when the continuous function is furnished) shall be supplied with the clutch/brake control to select type of operation of the press. Fixing of selection shall be by means capable of supervision by the employer.

Inch operation

(iv) The "Inch" operating means shall be designed to prevent exposure of the worker's hands within the point of operation by:

(a) Requiring the concurrent use of both hands to actuate the clutch; or

(b) Being a single control protected against accidental actuation and so located that the worker cannot reach into the point of operation while operating the single control.

Single stroke - Two-hand control

See page 267, paragraph (c)(3)(vii)

(v) Two-hand controls for single stroke shall conform to the following requirements:

(a) Each hand control shall be protected against unintended operation and arranged by design, construction, and/or separation so that the concurrent use of both hands is required to trip the press.

(b) The control system shall be designed to permit an adjustment which will require concurrent pressure from both hands during the die closing portion of the stroke.

(c) The control system shall incorporate an antirepeat feature.

(d) The control systems shall be designed to require release of all operators' hand controls before an interrupted stroke can be resumed. This requirement pertains only to those single stroke, two-hand controls manufactured and installed on or after August 31, 1971. (Refer to (c)(5)(ii) on page 268.)

(vi) Reserved

Multiple operating stations

(vii) Controls for more than one operating station shall be designed to be activated and deactivated in complete sets of two operators' hand controls per operating station by means capable of being supervised by the employer. The clutch/brake control system shall be designed and constructed to prevent actuation of the clutch if all operating stations are bypassed.

Continuous

(viii) Those clutch/brake control systems which contain both single and continuous functions shall be designed so that completion of continuous circuits may be supervised by the employer. The initiation of continuous run shall require a prior action or decision by the operator in addition to the selection of Continuous on the stroking selector, before actuation of the operating means will result in continuous stroking.

Hand/foot selection

(ix) If foot control is provided, the selection method between hand and foot control shall be separate from the stroking selector and shall be designed so that the selection may be supervised by the employer.

Foot control

(x) Foot operated tripping controls, if used, shall be protected so as to prevent operation from falling or moving objects, or from unintended operation by accidental stepping onto the foot control.

Clutch/brake air valve failure

(xi) The control of air-clutch machines shall be designed to prevent a significant increase in the normal stopping time due to a failure within the operating valve mechanism, and to inhibit further operation if such failure does occur. This requirement shall apply only to those clutch/brake air valve controls manufactured and installed on or after August 31, 1971, but shall not apply to machines intended only for continuous, automatic feeding applications.

(Refer to (c)(5)(iii) on page 268.)

Press drive motor interlock

(xii) The clutch/brake control shall incorporate an automatic means to prevent initiation or continued activation of the Single Stroke or continuous functions unless the press drive motor is energized and in the forward direction.

Engaging method failure

(xiii) The clutch/brake control shall automatically deactivate in event of failure of the power or pressure supply for the clutch engaging means. Reactivation of the clutch shall require restoration of normal supply and the use of the tripping mechanism(s).

Air counterbalance supply

(xiv) The clutch/brake control shall automatically deactivate in event of failure of the counterbalance(s) air supply. Reactivation of the clutch shall require restoration of normal air supply and use of the tripping mechanism(s).

Turnover bar operation

(xv) Selection of bar operation shall be by means capable of being supervised by the employer. A separate pushbutton shall be employed to activate the clutch, and the clutch shall be activated only if the drive motor is deenergized.

SECTION 1910.217 MECHANICAL POWER PRESSES (continued)

METHODS OF SAFEGUARDING THE POINT OF OPERATION

(c)(1) General Requirements

(i) It shall be the responsibility of the employer to provide and insure the usage of "point-of-operation guards" or properly applied and adjusted point-of-operation devices on every operation performed on a mechanical power press. See Table O-10.

(ii) The requirement of paragraph (c)(1)(i) of this section shall not apply when the point-of-operation opening is one-fourth inch or less. See Table O-10.

(c)(2) Point of operation guards

(i) Every point of operation guard shall meet the following design, construction, application, and adjustment requirements:

(a) It shall prevent entry of hands or fingers into the point of operation by reaching through, over, under or around the guard;

(b) It shall conform to the maximum permissible openings of Table O-10;

(c) It shall, in itself, create no pinch point between the guard and moving machine parts;

(d) It shall utilize fasteners not readily removable by operator, so as to minimize the possibility of misuse or removal of essential parts;

(e) It shall facilitate its inspection, and

(f) It shall offer maximum visibility of the point of operation consistent with the other requirements.

(ii) A die enclosure guard shall be attached to the die shoe or stripper in a fixed position.

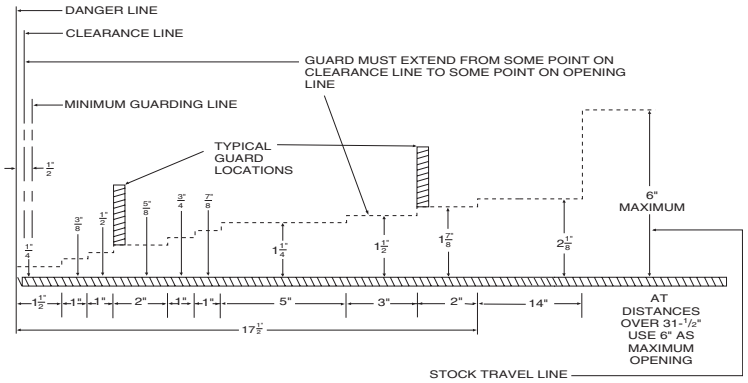
(iii) A fixed barrier guard shall be attached securely to the frame of the press or to the bolster plate.

(iv) An interlocked press barrier guard shall be attached to the press frame or bolster and shall be interlocked with the press clutch control so that the clutch cannot be activated unless the guard itself, or the hinged or movable sections of the guard are in position to conform to the requirements of Table O-10.

(v) The hinged or movable sections of an interlocked press barrier guard shall not be used for manual feeding. The guard shall prevent opening of the interlocked section and reaching into the point of operation prior to die closure or prior to the cessation of slide motion. See paragraph (c)(3)(ii) of this section regarding manual feeding through interlocked press barrier devices.

(vi) The adjustable barrier guard shall be securely attached to the press bed, bolster plate, or die shoe, and shall be adjusted and operated in conformity with Table O-10 and the requirements of this subparagraph. Adjustments shall be made only by authorized personnel whose qualifications include a knowledge of the provisions of Table O-10 and this subparagraph.

(vii) A point of operation enclosure which does not meet the requirements of this subparagraph and Table O-10 shall be used only in conjunction with point-of-operation devices.



Explanation of above diagram:

This diagram shows the accepted safe openings between the bottom edge of a guard and feed table at various distances from the danger line (point of operation).

The *clearance line* marks the distance required to prevent contact between guard and moving parts.

The *minimum guarding line* is the distance between the infeed side of the guard and the danger line which is one-half inch from the clearance line.

The various openings are such that for average size hands an operator's fingers won't reach the point of operation.

After installation of point-of-operation guards and before a machine is released for operation, a check should be made to verify that the guard will prevent the operator's hands from reaching the point of operation.

TABLE O-10

Distance of opening from point-of-operation hazard (inches)	Maximum width of opening (inches)
½ to 1½	¼
1½ to 2½	⅜
2½ to 3½	½
3½ to 5½	⅝
5½ to 6½	¾
6½ to 7½	⅞
7½ to 12½	1¼
12½ to 15½	1½
15½ to 17½	1⅞
17½ to 31½	2⅛

This table shows the distances that guards shall be positioned from the danger line in accordance with the required openings.

(Continued on next page.)

OSHA 29 CFR 1910.217—MECHANICAL POWER PRESSES (continued)

(c)(3) Point of operation devices

(i) Point of operation devices shall protect the operator by:

(a) Preventing and/or stopping normal stroking of the press if the operator's hands are inadvertently placed in the point of operation; or

(b) Preventing the operator from inadvertently reaching into the point of operation; or withdrawing his hands if they are inadvertently located in the point of operation as the dies close; or

(c) Preventing the operator from inadvertently reaching into the point of operation at all times; or

(d) [Reserved] (formerly sweep device)

(e) Requiring application of both of the operator's hands to machine operating controls and locating such controls at such a safety distance from the point of operation that the slide completes the downward travel or stops before the operator can reach into the point of operation with his hands; or

(f) Enclosing the point of operation before a press stroke can be initiated, and maintaining this closed condition until the motion of the slide has ceased; or

(g) Enclosing the point of operation before a press stroke can be initiated, so as to prevent an operator from reaching into the point of operation prior to die closure or prior to cessation of slide motion during the downward stroke.

Gate or movable barrier device

(ii) *A gate or movable barrier device* shall protect the operator as follows:

(*a*) A Type A gate or movable barrier device shall protect the operator in the manner specified in paragraph (c)(3)(i)(*f*) of this section, and

(*b*) A Type B gate or movable barrier device shall protect the operator in the manner specified in paragraph (c)(3)(i)(*g*) of this section.

Presence sensing

(iii) *A* presence sensing point of operation device shall protect the operator as provided in paragraph (c)(3)(i)(*a*) of this section, and shall be interlocked into the control circuit to prevent or stop slide motion if the operator's hand or other part of his body is within the sensing field of the device during the downstroke of the press slide.

(a) The devices may not be used on machines using full revolution clutches.

(b) The devices may not be used as a tripping means to initiate slide motion, except when used in total conformance with paragraph (h) of this section. (Paragraph (h) omitted.)

(c) The device shall be constructed so that a failure within the system does not prevent the normal stopping action from being applied to the press when required, but does prevent the initiation of a successive stroke until the failure is corrected. The failure shall be indicated by the system.

(d) Muting (bypassing of the protective function) of such device during the upstroke of the press slide is permitted for the purpose of parts ejection, circuit checking, and feeding.

(e) The safety distance (D_S) from the sensing field to the point of operation shall be greater than the distance determined by the following formula:

D_S = 63 inches/second x T_S; where:

D_S = minimum safety distance (inches);

63 inches/second = hand speed constant; and

T_S = stopping time of the press measured at approximately 90° position of the crankshaft rotation (seconds).

(f) Guards shall be used to protect all areas of entry to the point of operation not protected by the presence sensing device.

Pull-out (pullback)

(iv) *The* pull-out device shall protect the operator as specified in paragraph (c)(3)(i)*(b)* of this section and shall include attachments for each of the operator's hands.

(a) Attachments shall be connected to and operated only by the press slide or upper die.

(b) Attachments shall be adjusted to prevent the operator from reaching into the point of operation or to withdraw the operator's hands from the point of operation before the dies close.

(c) A separate pull-out device shall be provided for each operator if more than one operator is used on the press.

(d) Each pull-out device in use shall be visually inspected and checked for proper adjustment at the start of each operator shift, following a new die setup, and when operators are changed. Necessary maintenance or repair or both shall be performed and completed before the press is operated. Records of inspections and maintenance shall be kept in accordance with paragraph (e) of this section.

Sweep

(v) The sweep device may not be used for point-of-operation safeguarding after December 31, 1976.

Holdout or restraint

(vi) A holdout or a restraint device shall protect the operator as specified in paragraph (c)(3)(i)(c) of this section and shall include attachments for each of the operator's hands. Such attachments shall be securely anchored and adjusted in such a way that the operator is restrained from reaching into the point of operation. A separate set of restraints shall be provided for each operator if more than one operator is required on a press.

Two-hand control (part revolution only)

(vii) The two-hand control device shall protect the operator as specified in paragraph (c)(3)(i)*(e)* of this section.

(a) When used in press operations requiring more than one operator, separate two-hand controls shall be provided for each operator, and shall be designed to require concurrent application of all operators' controls to activate the slide. The removal of a hand from any control button shall cause the slide to stop.

(b) Each two-hand control shall meet the construction requirements of paragraph (b)(7)(v) of this section.

(c) The safety distance (D_S) between each two-hand control device and the point of operation shall be greater than the distance determined by the following formula:

D_S = 63 inches/second x T_S; where:

D_S = minimum safety distance (inches);

63 inches/second = hand speed constant; and

T_S = stopping time of the press measured at approximately 90° position of the crankshaft rotation (seconds).

(d) Two-hand controls shall be fixed in position so that only a supervisor or safety engineer is capable of relocating the controls.

(Continued on next page.)

OSHA 29 CFR 1910.217—MECHANICAL POWER PRESSES (continued)

Two-hand trip

(viii) *The two-hand trip device* shall protect the operator as specified in paragraph (c)(3)(i)*(e)* of this section.

(a) When used in press operations requiring more than one operator, separate two-hand trips shall be provided for each operator, and shall be designed to require concurrent application of all operator controls to activate the slide.

(b) Each two-hand trip shall meet the construction requirements of paragraph (b)(6) of this section.

(c) The safety distance (D_m) between the two-hand trip and the point of operation shall be greater than the distance determined by the following formula:

D_m = 63 inches/second x T_m; where:

D_m = minimum safety distance (inches);

63 inches/second = hand speed constant; and

T_m = the maximum time the press takes for the die closure after it has been tripped (seconds). For full revolution clutch presses with only one engaging point, T_m is equal to the time necessary for one and one-half revolutions of the crankshaft. For full revolution clutch presses with more than one engaging point, T_m shall be calculated as follows:

$$T_m = \left[1/2 + \frac{1}{\text{Number of engaging points per revolution}}\right] \times \text{time necessary to complete one revolution of the crankshaft (seconds)}$$

(d) Two-hand trips shall be fixed in position so that only a supervisor or safety engineer is capable of relocating the controls.

(c)(4) Hand Feeding Tools

Hand feeding tools are intended for placing and removing materials in and from the press. Hand feeding tools are not a point of operation guard or protection device and shall not be used in lieu of the "guards" or devices required in this section.

*(c)(5) Added requirements

Additional requirements for safeguarding. Where the operator feeds or removes parts by placing one or both hands in the point of operation, and a two-hand control, presence sensing device or Type B gate or movable barrier (on a part revolution clutch) is used for safeguarding:

(i) The employer shall use a control system and a brake monitor which comply with paragraphs (b)(13) and (14) of this section. This requirement shall be complied with by November 1, 1975;

(ii) The exception in paragraph (b)(7)(v)*(d)* of this section for two-hand controls manufactured and installed before August 31, 1971 is not applicable under this paragraph (c)(5);

(iii) The control of air clutch machines shall be designed to prevent a significant increase in the normal stopping time due to a failure within the operating valve mechanism, and to inhibit further operation if such failure does occur, where a part revolution clutch is employed. The exception in paragraph (b)(7)(xi) of this section for controls manufactured and installed before August 31, 1971, is not applicable under this paragraph (c)(5).

(b)(13) Control reliability*

When required by paragraph (c)(5) of this section, the control system shall be constructed so that a failure within the system does not prevent the normal stopping action from being applied to the press when required, but does prevent initiation of a successive stroke until the failure is corrected. The failure shall be detectable by a simple test, or indicated by the control system. This requirement does not apply to those elements of the control system which have no effect on the protection against point of operation injuries.

(b)(14) Brake monitoring*

When required by paragraph (c)(5) of this section, the brake monitor shall meet the following requirements:

(i) Be so constructed as to automatically prevent the activation of a successive stroke if the stopping time or braking distance deteriorates to a point where the safety distance being utilized does not meet the requirements set forth in paragraph (c)(3)(iii)*(e)* or (c)(3)(vii)*(c)* of this section. The brake monitor used with the Type B gate or movable barrier device shall be installed in a manner to detect slide top-stop overrun beyond the normal limit reasonably established by the employer;

(ii) Be installed on a press so that it indicates when the performance of the braking system has deteriorated to the extent described in paragraph (b)(14)(i) of this section; and

(iii) Be constructed and installed in a manner to monitor brake system performance on each stroke.

*Applies to part revolution only.

OSHA 29 CFR 1910.217—MECHANICAL POWER PRESSES (continued)

CONSTRUCTION OF PRESS AND ITS CONTROLS—FOR ALL PRESSES

(b)(1) Hazards to personnel associated with broken or falling machine components

Machine components shall be designed, secured or covered to minimize hazards caused by breakage or loosening and falling or release of mechanical energy (i.e. broken springs).

(b)(2) Brakes

Friction brakes provided for stopping or holding a slide movement shall be inherently self-engaging by requiring power or force from an external source to cause disengagement. Brake capacity shall be sufficient to stop the motion of the slide quickly and capable of holding the slide and its attachments at any point in its travel.

(b)(8) Electrical

Disconnect

(i) A main power disconnect switch capable of being locked only in the Off position shall be provided with every power press control system.

Starter

(ii) The motor start button shall be protected against accidental operation.

(iii) All mechanical power press controls shall incorporate a type of drive motor starter that will disconnect the drive motor from the power source in event of control voltage or power source failure, and require operation of the motor start button to restart the motor when voltage conditions are restored to normal.

Transformer

(iv) All a.c. control circuits and solenoid valve coils shall be powered by not more than a nominal 120-volt a.c. supply obtained from a transformer with an isolated secondary. Higher voltages that may be necessary for operation of machine or control mechanisms shall be isolated from any control mechanism handled by the operator, but motor starters with integral Start-Stop buttons may utilize line voltage control. All d.c. control circuits shall be powered by not more than a nominal 240-volt d.c. supply isolated from any higher voltage.

Ground

(v) All clutch/brake control electrical circuits shall be protected against the possibility of an accidental ground in the control circuit causing false operation of the press.

Control circuit

(vi) All clutch/brake control circuits shall incorporate features to minimize the possibility of an unintended stroke in the event of the failure of a control component to function properly, including relays, limit switches, and static output circuits.

(b)(9) Slide counterbalance systems

(i) Spring counterbalance systems, when used, shall incorporate means to retain system parts in event of breakage.

(ii) Spring counterbalances, when used, shall have the capability to hold the slide and its attachments at midstroke, without brake applied.

(iii) Air counterbalance cylinders shall incorporate means to retain the piston and rod in case of breakage or loosening.

(iv) Air counterbalance cylinders shall have adequate capability to hold the slide and its attachments at any point in stroke, without brake applied.

(v) Air counterbalance cylinders shall incorporate means to prevent failure of capability (sudden loss of pressure) in event of air supply failure.

(b)(10) Air controlling equipment

Air controlling equipment shall be protected against foreign material and water entering the pneumatic system of the press. A means of air lubrication shall be provided when needed.

(b)(11) Hydraulic equipment

The maximum anticipated working pressures in any hydraulic system on a mechanical power press shall not exceed the safe working pressure rating of any component used in the system.

(b)(12) Pressure vessels

All pressure vessels used in conjunction with power presses shall conform to the American Society of Mechanical Engineers Code for Pressure Vessels, 1968 Edition. (Also see 1910.169 Air Receivers.)

DESIGN, CONSTRUCTION, SETTING AND FEEDING OF DIES

(d)(1) General requirements

The employer shall: (i) use dies and operating methods designed to control or eliminate hazards to operating personnel, and (ii) furnish and enforce the use of hand tools for freeing and removing stuck work or scrap pieces from the die, so that no employee need reach into the point of operation for such purposes.

(d)(2) Reserved

(d)(3) Scrap handling

The employer shall provide means for handling scrap from roll feed or random length stock operations. Scrap cutters used in conjunction with scrap handling systems shall be safeguarded in accordance with paragraph (c) of this section and with 1910.219.

(Continued on next page.)

OSHA 29 CFR 1910.217—MECHANICAL POWER PRESSES (continued)

(d)(4) Guide post hazard

The hazard created by a guide post (when it is located in the immediate vicinity of the operator) when separated from its bushing by more than one-fourth inch shall be considered as a point of operation hazard and be protected in accordance with paragraph (c) of this section.

(d)(5) Unitized tooling

If unitized tooling is used, the opening between the top of the punch holder and the face of the slide, or striking pad, shall be safeguarded in accordance with the requirements of paragraph (c) of this section.

(d)(6) Tonnage, stroke, and weight designation

All dies shall be:

(i) Stamped with the tonnage and stroke requirements; or have these characteristics recorded if these records are readily available to the die setter;

(ii) Stamped to indicate upper die weight when necessary for air counterbalance pressure adjustment; and

(iii) Stamped to indicate complete die weight when handling equipment may become overloaded.

(d)(7) Die fastening

Provision shall be made in both the upper and lower shoes for securely mounting the die to the bolster and slide. Where clamp caps or setscrews are used in conjunction with punch stems, additional means of securing the upper shoe to the slide shall be used.

(d)(8) Die handling

Handling equipment attach points shall be provided on all dies requiring mechanical handling.

(d)(9) Diesetting

(i) The employer shall establish a die setting procedure that will insure compliance with paragraph (c) of this section.

(ii) The employer shall provide spring loaded turnover bars, for presses designed to accept such turnover bars.

(iii) The employer shall provide die stops or other means to prevent losing control of the die while setting or removing dies in presses which are inclined.

(iv) The employer shall provide and enforce the use of safety blocks for use whenever dies are being adjusted or repaired in the press.

(v) The employer shall provide brushes, swabs, lubricating rolls, and automatic or manual pressure guns so that operators and die setters shall not be required to reach into the point of operation or other hazard areas to lubricate material, punches or dies.

INSPECTION, MAINTENANCE, AND MODIFICATION OF PRESSES

(e)(1) Inspection and maintenance records

(i) It shall be the responsibility of the employer to establish and follow a program of periodic and regular inspections of his power presses to insure that all their parts, auxiliary equipment, and safeguards are in a safe operating condition and adjustment. The employer shall maintain a certification record of inspections which includes the date of inspection, the signature of the person who performed the inspection, and the serial number, or other identifier, of the power press that was inspected.

(ii) Each press shall be inspected and tested no less than weekly to determine the condition of the clutch/brake mechanism-antirepeat feature and single stroke mechanism. Necessary maintenance or repair or both shall be performed and completed before the press is operated. These requirements do not apply to those presses which comply with paragraphs (b)(13) and (14) of this section. The employer shall maintain a certification record of inspections, tests and maintenance work which includes the date of the inspection, test or maintenance; the signature of the person who performed the inspection, test, or maintenance; and the serial number or other identifier of the press that was inspected, tested or maintained.

(e)(2) Modification

It shall be the responsibility of any person modifying a power press to furnish instructions with the modification to establish new or changed guidelines for use and care of the power press so modified.

(e)(3) Training of maintenance personnel

It shall be the responsibility of the employer to insure the original and continuing competence of personnel caring for, inspecting, and maintaining power presses.

OPERATION OF POWER PRESSES

(f)(1) Reserved

(f)(2) Instruction to operators

The employer shall train and instruct the operator in the safe method of work before starting work on any operation covered by this section. The employer shall insure by adequate supervision that correct operating procedures are being followed.

(f)(3) Work area

The employer shall provide clearance between machines so that movement of one operator will not interfere with the work of another. Ample room for cleaning machines, handling material, work pieces, and scrap shall also be provided. All surrounding floors shall be kept in good condition and free from obstructions, grease, oil, and water.

(f)(4) Overloading

The employer shall operate his presses within the tonnage and attachment weight ratings specified by the manufacturer.

OSHA 29 CFR 1910.217—MECHANICAL POWER PRESSES (continued)

REPORTS OF INJURIES TO EMPLOYEES OPERATING MECHANICAL POWER PRESSES

(g)(1) The employer shall, within 30 days of the occurrence, report to either the Director of the Directorate of Safety Standards Programs, OSHA, U.S. Department of Labor, Washington, D.C. 20210, or the State agency administering plan approved by the Assistant Secretary of Labor for Occupational Safety and Health, all point of operation injuries to operators or other employees. The following information shall be included in the report:

(i) Employer's name, address and location of the workplace (establishment).

(ii) Employee's name, injury sustained, and the task being performed (operation, set-up, maintenance, or other).

(iii) Type of clutch used on the press (full revolution, part revolution or direct drive).

(iv) Type of safeguard(s) being used (two-hand control, two-hand trip, pullouts, sweeps or other). If the safeguard is not described in this section, give a complete description.

(v) Cause of the accident (repeat of press, safeguard failure, removing stuck part or scrap, no safeguard provided, no safeguard in use or other).

(vi) Type of feeding (manual with hands in dies or with hands out of dies, semi-automatic, automatic or other).

(vii) Means used to actuate press stroke (foot trip, foot control, hand trip, hand control or other).

(viii) Number of operators required for the operation and the number of operators provided with controls and safeguards.

Paragraph (h) on presence sensing device initiation (PSDI) has been intentionally omitted.

OSHA 29 CFR 1910.212—GENERAL REQUIREMENTS FOR ALL MACHINES

(a) *Machine guarding—(1) Types of guarding.* 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, ingoing nip points, rotating parts, flying chips and sparks. Examples of guarding methods are—barrier guards, two-hand tripping devices, electronic safety devices, etc.

(2) *General requirements for machine guards.* Guards shall be affixed to the machine where possible and secured elsewhere if for any reason attachment to the machine is not possible. The guard shall be such that it does not offer an accident hazard in itself.

(3) *Point of operation guarding.* (i) Point of operation is the area on a machine where work is actually performed upon the material being processed.

(ii) The point of operation of machines whose operation exposes an employee to injury shall be guarded. The guarding device shall be in conformity with any appropriate standards therefor; or, in the absence of applicable specific standards, shall be so designed and constructed as to prevent the operator from having any part of his body in the danger zone during the operating cycle.

(iii) Special hand tools for placing and removing material shall be such as to permit easy handling of material without the operator placing a hand in the danger zone. Such tools shall not be in lieu of other guarding required by this section, but can only be used to supplement protection provided.

(iv) The following are some of the machines which usually require point of operation guarding:

(a) Guillotine cutters

(b) Shears

(c) Alligator shears

(d) Power presses

(e) Milling machines

(f) Power saws

(g) Jointers

(h) Portable power tools

(i) Forming rolls and calenders

(4) *Barrels, containers and drums.* Revolving drums, barrels and containers shall be guarded by an enclosure which is interlocked with the drive mechanism, so that the barrel, drum or container cannot revolve unless the guard enclosure is in place.

(5) *Exposure of blades.* When the periphery of the blades of a fan is less than seven (7) feet above the floor or working level, the blades shall be guarded. The guard shall have openings no larger than one-half (½) inch.

(b) *Anchoring fixed machinery.* Machines designed for a fixed location shall be securely anchored to prevent walking or moving.

OSHA 29 CFR 1910.219—MECHANICAL POWER-TRANSMISSION APPARATUS

(a) *General requirements.* (1) This section covers all types and shapes of power-transmission belts, except the following when operating at two hundred and fifty (250) feet per minute or less: (i) Flat belts one (1) inch or less in width, (ii) flat belts two (2) inches or less in width which are free from metal lacings or fasteners, (iii) round belts one-half (½) inch or less in diameter; and (iv) single strand V-belts, the width of which is thirteen thirty-seconds (13/32) inch or less.

(2) Vertical and inclined belts (paragraphs (e) (3) and (4) of this section) if not more than two and one-half (2½) inches wide and running at a speed of less than one thousand (1,000) feet per minute, and if free from metal lacings or fastenings may be guarded with a nip-point belt and pulley guard.

(3) For the textile industry, because of the presence of excessive deposits of lint which constitutes a serious fire hazard, the sides and face sections only of nip-point belt and pulley guards are required, provided the guard shall extend at least six (6) inches beyond the rim of the pulley on the in-running and off-running sides of the belt and at least two (2) inches away from the rim and face of the pulley in all other directions.

(4) This section covers the principal features with which power-transmission safeguards shall comply.

(b) *Prime-mover guards*—(1) *Flywheels.* Flywheels located so that any part is seven (7) feet or less above floor or platform shall be guarded in accordance with the requirements of this subparagraph:

(i) With an enclosure of sheet, perforated, or expanded metal, or woven wire;

(ii) With guard rails placed not less than fifteen (15) inches nor more than twenty (20) inches from rim. When flywheel extends into pit or is within twelve (12) inches of floor, a standard toeboard shall also be provided;

(iii) When the upper rim of flywheel protrudes through a working floor, it shall be entirely enclosed or surrounded by a guardrail and toeboard.

(iv) For flywheels with smooth rims five (5) feet or less in diameter, where the preceding methods cannot be applied, the following may be used: A disk attached to the flywheel in such manner as to cover the spokes of the wheel on the exposed side and present a smooth surface and edge, at the same time providing means for periodic inspection. An open space, not exceeding four (4) inches in width, may be left between the outside edge of the disk and the rim of the wheel if desired, to facilitate turning the wheel over. Where a disk is used, the keys or other dangerous projections not covered by disk shall be cut off or covered. This subdivision does not apply to flywheels with solid web centers.

(v) Adjustable guard to be used for starting engine or for running adjustment may be provided at the flywheel of gas or oil engines. A slot opening for jack bar will be permitted.

(vi) Wherever flywheels are above working areas, guards shall be installed having sufficient strength to hold the weight of the flywheel in the event of a shaft or wheel mounting failure.

(2) *Cranks and connecting rods.* Cranks and connecting rods, when exposed to contact, shall be guarded in accordance with paragraphs (m) and (n) of this section, or by a guardrail as described in paragraph (o)(5) of this section.

(3) *Tail rods or extension piston rods.* Tail rods or extension piston rods shall be guarded in accordance with paragraphs (m) and (o) of this section, or by a guardrail on sides and end, with a clearance of not less than fifteen (15) nor more than twenty (20) inches when rod is fully extended.

(c) *Shafting*—(1) *Installation.* (i) Each continuous line of shafting shall be secured in position against excessive endwise movement.

(ii) Inclined and vertical shafts, particularly inclined idler shafts, shall be securely held in position against endwise thrust.

(2) *Guarding horizontal shafting.* (i) All exposed parts of horizontal shafting seven (7) feet or less from floor or working platform, excepting runways used exclusively for oiling, or running adjustments, shall be protected by a stationary casing enclosing shafting completely or by a trough enclosing sides and top or sides and bottom of shafting as location requires.

(ii) Shafting under bench machines shall be enclosed by a stationary casing, or by a trough at sides and top or sides and bottom, as location requires. The sides of the trough shall come within at least six (6) inches of the underside of table, or if shafting is located near floor within six (6) inches of floor. In every case the sides of trough shall extend at least two (2) inches beyond the shafting or protuberance.

(3) *Guarding vertical and inclined shafting.* Vertical and inclined shafting seven (7) feet or less from floor or working platform, excepting maintenance runways, shall be enclosed with a stationary casing in accordance with requirements of paragraphs (m) and (o) of this section.

(4) *Projecting shaft ends.* (i) Projecting shaft ends shall present a smooth edge and end and shall not project more than one-half the diameter of the shaft unless guarded by nonrotating caps or safety sleeves.

(ii) Unused keyways shall be filled up or covered.

(5) *Power-transmission apparatus located in basements.* All mechanical power-transmission apparatus located in basements, towers, and rooms used exclusively for power-transmission equipment shall be guarded in accordance with this section, except that the requirements for safeguarding belts, pulleys, and shafting need not be complied with when the following requirements are met:

(i) The basement, tower, or room occupied by transmission equipment is locked against unauthorized entrance.

(ii) The vertical clearance in passageways between the floor and power-transmission beams, ceiling, or any other objects, is not less than five feet six inches (5 ft. 6 in.).

(iii) The intensity of illumination conforms to the requirements of ANSI A11.1-1965 (R-1970).

(iv) [Reserved]

(v) The route followed by the oiler is protected in such manner as to prevent accident.

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OSHA 29 CFR 1910.219—MECHANICAL POWER-TRANSMISSION APPARATUS (continued)

(d) *Pulleys*—(1) *Guarding.* Pulleys, any parts of which are seven (7) feet or less from the floor or working platform, shall be guarded in accordance with the standards specified in paragraphs (m) and (o) of this section. Pulleys serving as balance wheels (e.g., punch presses) on which the point of contact between belt and pulley is more than six feet six inches (6 ft. 6 in.) from the floor or platform may be guarded with a disk covering the spokes.

(2) *Location of pulleys.* (i) Unless the distance to the nearest fixed pulley, clutch or hanger exceeds the width of the belt used, a guide shall be provided to prevent the belt from leaving the pulley on the side where insufficient clearance exists.

(ii) [Reserved]

(3) *Broken pulleys.* Pulleys with cracks or pieces broken out of rims shall not be used.

(4) *Pulley speeds.* Pulleys intended to operate at rim speed in excess of manufacturers normal recommendations shall be specially designed and carefully balanced for the speed at which they are to operate.

(e) *Belt, rope, and chain drives*—(1) *Horizontal belts and ropes.* (i) Where both runs of horizontal belts are seven (7) feet or less from the floor level, the guard shall extend to at least fifteen (15) inches above the belt or to a standard height (see Table O-12), except that where both runs of a horizontal belt are 42 inches or less from the floor, the belt shall be fully enclosed in accordance with paragraphs (m) and (o) of this section.

(ii) In power plants or power-development rooms, a guardrail may be used in lieu of the guard required by subdivision (i) of this subparagraph.

(2) *Overhead horizontal belts.* (i) Overhead horizontal belts, with lower parts seven (7) feet or less from the floor or platform, shall be guarded on sides and bottom in accordance with paragraph (o)(3) of this section.

(ii) Horizontal overhead belts more than seven (7) feet above floor or platform shall be guarded for their entire length under the following conditions:

(a) If located over passageways or work places and traveling 1,800 feet or more per minute.

(b) If center to center distance between pulleys is ten (10) feet or more.

(c) If belt is eight (8) inches or more in width.

(iii) Where the upper and lower runs of horizontal belts are so located that passage of persons between them would be possible, the passage shall be either:

(a) Completely barred by a guardrail or other barrier in accordance with paragraphs (m) and (o) of this section; or

(b) Where passage is regarded as necessary, there shall be a platform over the lower run guarded on either side by a railing completely filled in with wire mesh or other filler, or by a solid barrier. The upper run shall be so guarded as to prevent contact therewith either by the worker or by objects carried by him. In power plants only the lower run of the belt need be guarded.

(iv) Overhead chain and link belt drives are governed by the same rules as overhead horizontal belts and shall be guarded in the same manner as belts.

(3) *Vertical and inclined belts.* (i) Vertical and inclined belts shall be enclosed by a guard conforming to standards in paragraphs (m) and (o) of this section.

(ii) All guards for inclined belts shall be arranged in such a manner that a minimum clearance of seven (7) feet is maintained between belt and floor at any point outside of guard.

4) *Vertical belts.* Vertical belts running over a lower pulley more than seven (7) feet above floor or platform shall be guarded at the bottom in the same manner as horizontal overhead belts, if conditions are as stated in paragraphs (e)(2)(ii) *(a)* and *(c)* of this section.

(5) *Cone-pulley belts.* (i) The cone belt and pulley shall be equipped with a belt shifter so constructed as to adequately guard the nip point of the belt and pulley. If the frame of the belt shifter does not adequately guard the nip point of the belt and pulley, the nip point shall be further protected by means of a vertical guard placed in front of the pulley and extending at least to the top of the largest step of the cone.

(ii) If the belt is of the endless type or laced with rawhide laces, and a belt shifter is not desired, the belt will be considered guarded if the nip point of the belt and pulley is protected by a nip point guard located in front of the cone extending at least to the top of the largest step of the cone, and formed to show the contour of the cone in order to give the nip point of the belt and pulley the maximum protection.

(iii) If the cone is located less than 3 feet from the floor or working platform, the cone pulley and belt shall be guarded to a height of 3 feet regardless of whether the belt is endless or laced with rawhide.

(6) *Belt tighteners.* (i) Suspended counterbalanced tighteners and all parts thereof shall be of substantial construction and securely fastened; the bearings shall be securely capped. Means must be provided to prevent tightener from falling, in case the belt breaks.

(ii) Where suspended counterweights are used and not guarded by location, they shall be so encased as to prevent accident.

(f) *Gears, sprockets, and chains*—(1) *Gears.* Gears shall be guarded in accordance with one of the following methods:

(i) By a complete enclosure; or

(ii) By a standard guard as described in paragraph (o) of this section, at least seven (7) feet high extending six (6) inches above the mesh point of the gears; or

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OSHA 29 CFR 1910.219—MECHANICAL POWER-TRANSMISSION APPARATUS (continued)

(iii) By a band guard covering the face of gear and having flanges extended inward beyond the root of the teeth on the exposed side or sides. Where any portion of the train of gears guarded by a band guard is less than six (6) feet from the floor a disk guard or a complete enclosure to the height of six (6) feet shall be required.

(2) *Hand-operated gears.* Paragraph (f)(1) of this section does not apply to hand-operated gears used only to adjust machine parts and which do not continue to move after hand power is removed. However, the guarding of these gears is highly recommended.

(3) *Sprockets and chains.* All sprocket wheels and chains shall be enclosed unless they are more than seven (7) feet above the floor or platform. Where the drive extends over other machine or working areas, protection against falling shall be provided. This subparagraph does not apply to manually operated sprockets.

(4) *Openings for oiling.* When frequent oiling must be done, openings with hinged or sliding self-closing covers shall be provided. All points not readily accessible shall have oil feed tubes if lubricant is to be added while machinery is in motion.

(g) *Guarding friction drives.* The driving point of all friction drives when exposed to contact shall be guarded, all arm or spoke friction drives and all web friction drives with holes in the web shall be entirely enclosed, and all projecting belts on friction drives where exposed to contact shall be guarded.

(h) *Keys, setscrews, and other projections.* (1) All projecting keys, setscrews, and other projections in revolving parts shall be removed or made flush or guarded by metal cover. This subparagraph does not apply to keys or setscrews within gear or sprocket casings or other enclosures, nor to keys, setscrews, or oilcups in hubs of pulleys less than twenty (20) inches in diameter where they are within the plane of the rim of the pulley.

(2) It is recommended, however, that no projecting setscrews or oilcups be used in any revolving pulley or part of machinery.

(i) *Collars and couplings*—(1) *Collars.* All revolving collars, including split collars, shall be cylindrical, and screws or bolts used in collars shall not project beyond the largest periphery of the collar.

(2) *Couplings.* Shaft couplings shall be so constructed as to present no hazard from bolts, nuts, setscrews, or revolving surfaces. Bolts, nuts, and setscrews will, however, be permitted where they are covered with safety sleeves or where they are used parallel with the shafting and are countersunk or else do not extend beyond the flange of the coupling.

(j) *Bearings and facilities for oiling.* All drip cups and pans shall be securely fastened.

(k) *Guarding of clutches, cutoff couplings, and clutch pulleys*—(1) *Guards.* Clutches, cutoff couplings, or clutch pulleys having projecting parts, where such clutches are located seven (7) feet or less above the floor or working platform, shall be enclosed by a stationary guard constructed in accordance with this section. A "U" type guard is permissible.

(2) *Engine rooms.* In engine rooms a guardrail, preferably with toeboard, may be used instead of the guard required by paragraph (k)(1) of this section, provided such a room is occupied only by engine room attendants.

(l) *Belt shifters, clutches, shippers, poles, perches, and fasteners*—(1) *Belt shifters.* (i) Tight and loose pulleys on all new installations made on or after August 31, 1971, shall be equipped with a permanent belt shifter provided with mechanical means to prevent belt from creeping from loose to tight pulley. It is recommended that old installations be changed to conform to this rule.

(ii) Belt shifter and clutch handles shall be rounded and be located as far as possible from danger of accidental contact, but within easy reach of the operator. Where belt shifters are not directly located over a machine or bench, the handles shall be cut off six feet six inches (6 ft. 6 in.) above floor level.

(2) *Belt shippers and shipper poles.* The use of belt poles as substitutes for mechanical shifters is not recommended.

(3) *Belt perches.* Where loose pulleys or idlers are not practicable, belt perches in form of brackets, rollers, etc., shall be used to keep idle belts away from the shafts.

(4) *Belt fasteners.* Belts which of necessity must be shifted by hand and belts within seven (7) feet of the floor or working platform which are not guarded in accordance with this section shall not be fastened with metal in any case, nor with any other fastening which by construction or wear will constitute an accident hazard.

(m) *Standard guards—general requirements*—(1) *Materials.* (i) Standard conditions shall be secured by the use of the following materials: expanded metal, perforated or solid sheet metal, wire mesh on a frame of angle iron or iron pipe securely fastened to floor or to frame of machine.

(ii) All metal should be free from burrs and sharp edges.

(2) *Methods of manufacture.* (i) Expanded metal, sheet or perforated metal, and wire mesh shall be securely fastened to frame.

(n) [Reserved]

(o) *Approved materials*—(1) *Minimum requirements.* The materials and dimensions specified in this paragraph shall apply to all guards, except horizontal overhead belts, rope, cable or chain guards more than seven (7) feet above floor or platform.

(i) [Reserved]

(a) All guards shall be rigidly braced every three (3) feet or fractional part of their height to some fixed part of machinery or building structure. Where guard is exposed to contact with moving equipment additional strength may be necessary.

(2) *Wood guards.* (i) Wood guards may be used in the woodworking and chemical industries, in industries where the presence of fumes or where manufacturing conditions would cause the rapid deterioration of metal guards; also in construction work and in locations outdoors where extreme cold or extreme heat make metal guards and railings undesirable. In all other industries, wood guards shall not be used.

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(3) *Guards for horizontal overhead belts.* (i) Guards for horizontal overhead belts shall run the entire length of the belt and follow the line of the pulley to the ceiling or be carried to the nearest wall, thus enclosing the belt effectively. Where belts are so located as to make it impracticable to carry the guard to wall or ceiling, construction of guard shall be such as to enclose completely the top and bottom runs of belt and the face of pulleys.

(ii) [Reserved]

(iii) Suitable reinforcement shall be provided for the ceiling rafters or overhead floor beams, where such is necessary, to sustain safely the weight and stress likely to be imposed by the guard. The interior surface of all guards, by which is meant the surface of the guard with which a belt will come in contact, shall be smooth and free from all projections of any character, except where construction demands it; protruding shallow roundhead rivets may be used. Overhead belt guards shall be at least one-quarter wider than belt which they protect, except that this clearance need not in any case exceed six (6) inches on each side. Overhead rope drive and block and roller-chain-drive guards shall be not less than six (6) inches wider than the drive on each side. In overhead silent chain-drive guards where the chain is held from lateral displacement on the sprockets, the side clearances required on drives of twenty (20) inch centers or under shall be not less than one-fourth inch from the nearest moving chain part, and on drives of over twenty (20) inch centers a minimum of one-half inch from the nearest moving chain part.

(4) *Guards for horizontal overhead rope and chain drives.* Overhead-rope and chain-drive guard construction shall conform to the rules for overhead-belt guard.

(5) *Guardrails and toeboards.* (i) Guardrail shall be forty-two (42) inches in height, with midrail between top rail and floor.

(ii) Posts shall be not more than eight (8) feet apart; they are to be permanent and substantial, smooth, and free from protruding nails, bolts, and splinters. If made of pipe, the post shall be one and one-fourth (1¼) inches inside diameter or larger. If made of metal shapes or bars, their section shall be equal in strength to that of one and one-half (1½) by one and one-half (1½) by three-sixteenths (3⁄16) inch angle iron. If made of wood, the posts shall be two by four (2 x 4) inches or larger. The upper rail shall be two by four (2 x 4) inches or two one by four (1 x 4) strips, one at the top and one at the side of posts. The midrail may be one by four (1 x 4) inches or more. Where panels are fitted with expanded metal or wire mesh as noted in Table O-12 the middle rails may be omitted. Where guard is exposed to contact with moving equipment, additional strength may be necessary.

(iii) Toeboards shall be four (4) inches or more in height, of wood, metal or of metal grill not exceeding one (1) inch mesh.

(p) *Care of equipment*—(1) *General.* All power-transmission equipment shall be inspected at intervals not exceeding 60 days and be kept in good working condition at all times.

(2) *Shafting.* (i) Shafting shall be kept in alignment, free from rust and excess oil or grease.

(ii) Where explosives, explosive dusts, flammable vapors or flammable liquids exist, the hazard of static sparks from shafting shall be carefully considered.

(3) *Bearings.* Bearings shall be kept in alignment and properly adjusted.

(4) *Hangers.* Hangers shall be inspected to make certain that all supporting bolts and screws are tight and that supports of hanger boxes are adjusted properly.

(5) *Pulleys.* (i) Pulleys shall be kept in proper alignment to prevent belts from running off.

(6) *Care of belts.*

(i) [Reserved]

(ii) Inspection shall be made of belts, lacings, and fasteners and such equipment kept in good repair.

(7) *Lubrication.* The regular oilers shall wear tight-fitting clothing. Machinery shall be oiled when not in motion, wherever possible.

OSHA 29 CFR 1910.147— THE CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

(a) *Scope, application and purpose*—(1) *Scope.*

(i) This standard covers the servicing and maintenance of machines and equipment in which the unexpected energizing or start-up of the machines or equipment; or release of stored energy could cause injury to employees. This standard establishes minimum performance requirements for the control of such hazardous energy.

(ii) This standard does not cover the following:

(A) Construction, agriculture and maritime employment;

(B) Installations under the exclusive control of electric utilities for the purpose of power generation, transmission and distribution, including related equipment for communication or metering; and

(C) Exposure to electrical hazards from work on, near, or with conductors or equipment in electric utilization installations, which is covered by Subpart S of this part; and

(D) Oil and gas well drilling and servicing.

(2) *Application.* (i) This standard applies to the control of energy during servicing and/or maintenance of machines and equipment.

(ii) Normal production operations are not covered by this standard (see Subpart O of this part). Servicing and/or maintenance which takes place during normal production operations is covered by this standard only if:

(A) An employee is required to remove or bypass a guard or other safety device; or

(B) An employee is required to place any part of his or her body into an area on a machine or piece of equipment where work is actually performed upon the material being processed (point of operation) or where an associated danger zone exists during a machine operating cycle.

Note: Exception to paragraph (a)(2)(ii):

Minor tool changes and adjustments, and other minor servicing activities, which take place during normal production operations, are not covered by this standard if they are routine, repetitive, and integral to the use of the equipment for production, provided that the work is performed using alternative measures which provide effective protection (see subpart O of this Part).

(iii) This standard does not apply to the following:

(A) Work on cord and plug connected electric equipment for which exposure to the hazards of unexpected energizing or start-up of the equipment is controlled by the unplugging of the equipment from the energy source and by the plug being under the exclusive control of the employee performing the servicing or maintenance.

(B) Hot tap operations involving transmission and distribution systems for substances such as gas, steam, water or petroleum products when they are performed on pressurized pipelines, provided that the employer demonstrates that (*1*) continuity of service is essential; (*2*) shutdown of the system is impractical; and (*3*) documented procedures are followed, and special equipment is used which will provide proven effective protection for employees.

(3) *Purpose.* (i) This section requires employers to establish a program and utilize procedures for affixing appropriate lockout devices or tagout devices to energy isolating devices, and to otherwise disable machines or equipment to prevent unexpected energizing, start-up or release of stored energy in order to prevent injury to employees.

(ii) When other standards in this part require the use of lockout or tagout, they shall be used and supplemented by the procedural and training requirements of this section.

(b) Definitions applicable to this section.

Affected employee. An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout; or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

Authorized employee. A person who locks or implements a tagout system procedure on machines or equipment to perform the servicing or maintenance on that machine or equipment. An authorized employee and an affected employee may be the same person when the affected employee's duties also include performing maintenance or service on a machine or equipment which must be locked or a tagout system implemented.

"Capable of being locked out." An energy isolating device will be considered to be capable of being locked out either if it is designed with a hasp or other attachment or integral part to which, or through which, a lock can be affixed, or if it has a locking mechanism built into it. Other energy isolating devices will also be considered to be capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy isolating device or permanently alter its energy control capability.

Energized. Connected to an energy source or containing residual or stored energy.

Energy isolating device. A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: a manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors and, in addition, no pole can be operated independently; a slide gate; a slip blind; a line valve; a block; and any similar device used to block or isolate energy. The term does not include a push button, selector switch, and other control circuit type devices.

Energy source. Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other energy.

Hot tap. A procedure used in the repair, maintenance and services activities which involves welding on a piece of equipment (pipelines, vessels or tanks) under pressure, in order to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.

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OSHA 29 CFR 1910.147—LOCKOUT/TAGOUT (continued)

Lockout. The placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lockout device. A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energizing of a machine or equipment.

Normal production operations. The utilization of a machine or equipment to perform its intended production function.

Servicing and/or maintenance. Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energizing or start-up of the equipment or release of hazardous energy.

Setting up. Any work performed to prepare a machine or equipment to perform its normal production operation.

Tagout. The placement of a tagout device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

Tagout device. A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

(c)*General*—(1) *Energy control program.* The employer shall establish a program consisting of an energy control procedure and employee training to ensure that before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, start-up or release of stored energy could occur and cause injury, the machine or equipment shall be isolated, and rendered inoperative, in accordance with paragraph (c)(4) of this section.

(2) *Lockout/tagout* (i) If an energy isolating device is not capable of being locked out, the employer's energy control program under paragraph (c)(1) of this section shall utilize a tagout system.

(ii) If an energy isolating device is capable of being locked out, the employer's energy control program under paragraph (c)(1) of this section shall utilize lockout, unless the employer can demonstrate that the utilization of a tagout system will provide full employee protection as set forth in paragraph (c)(3) of this section.

(iii) After January 2, 1990, whenever major replacement, repair, renovation or modification of machines or equipment is performed, and whenever new machines or equipment are installed, energy isolating devices for such machines or equipment shall be designed to accept a lockout device.

(3) *Full employee protection.* (i) When a tagout device is used on an energy isolating device which is capable of being locked out, the tagout device shall be attached at the same location that the lockout device would have been attached, and the employer shall demonstrate that the tagout program will provide a level of safety equivalent to that obtained by using a lockout program.

(ii) In demonstrating that a level of safety is achieved in the tagout program which is equivalent to the level of safety obtained by using a lockout program, the employer shall demonstrate full compliance with all tagout-related provisions of this standard together with such additional elements as are necessary to provide the equivalent safety available from the use of a lockout device. Additional means to be considered as part of the demonstration of full employee protection shall include the implementation of additional safety measures such as the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle to reduce the likelihood of inadvertent energizing.

(4) *Energy control procedure.* (i) Procedures shall be developed, documented and utilized for the control of potentially hazardous energy when employees are engaged in the activities covered by this section.

Note: Exception: The employer need not document the required procedure for a particular machine or equipment, when all of the following elements exist: (1) The machine or equipment has no potential for stored or residual energy or reaccumulation of stored energy after shut down which could endanger employees; (2) the machine or equipment has a single energy source which can be readily identified and isolated; (3) the isolation and locking out of that energy source will completely de-energize and deactivate the machine or equipment; (4) the machine or equipment is isolated from that energy source and locked out during servicing or maintenance; (5) a single lockout device will achieve a locked-out condition; (6) the lockout device is under the exclusive control of the authorized employee performing the servicing or maintenance; (7) the servicing or maintenance does not create hazards for other employees; and (8) the employer, in utilizing this exception, has had no accidents involving the unexpected activation or reenergization of the machine or equipment during servicing or maintenance.

(ii) The procedures shall clearly and specifically outline the scope, purpose, authorization rules, and techniques to be utilized for the control of hazardous energy, and the means to enforce compliance including, but not limited to, the following:

(A) A specific statement of the intended use of the procedure;

(B) Specific procedural steps for shutting down, isolating, blocking and securing machines or equipment to control hazardous energy;

(C) Specific procedural steps for the placement, removal and transfer of lockout devices or tagout devices and the responsibility for them; and

(D) Specific requirements for testing a machine or equipment to determine and verify the effectiveness of lockout devices, tagout devices, and other energy control measures.

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OSHA 29 CFR 1910.147—LOCKOUT/TAGOUT (continued)

(5) *Protective materials and hardware.* (i) Locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware shall be provided by the employer for isolating, securing or blocking of machines or equipment from energy sources.

(ii) Lockout devices and tagout devices shall be singularly identified; shall be the only device(s) used for controlling energy; shall not be used for other purposes; and shall meet the following requirements:

(A) *Durable.* (*1*) Lockout and tagout devices shall be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected.

(2) Tagout devices shall be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.

(3) Tags shall not deteriorate when used in corrosive environments such as areas where acid and alkali chemicals are handled and stored.

(B) *Standardized.* Lockout and tagout devices shall be standardized within the facility in at least one of the following criteria: Color; shape; or size; and additionally, in the case of tagout devices, print and format shall be standardized.

(C) *Substantial*—(*1*) *Lockout devices.* Lockout devices shall be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or other metal cutting tools.

(2) *Tagout devices.* Tagout devices, including and their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal. Tagout device attachment means shall be of a non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds and having the general design and basic characteristics of being at least equivalent to a one-piece, all-environment-tolerant nylon cable tie.

(D) *Identifiable.* Lockout devices and tagout devices shall indicate the identity of the employee applying the device(s).

(iii) Tagout devices shall warn against hazardous conditions if the machine or equipment is energized and shall include a legend such as the following: *Do Not Start, Do Not Open, Do Not Close, Do Not Energize, Do Not Operate.*

(6) *Periodic inspection.* (i) The employer shall conduct a periodic inspection of the energy control procedure at least annually to ensure that the procedure and the requirements of this standard are being followed.

(A) The periodic inspection shall be performed by an authorized employee other than the one(s) utilizing the energy control procedure being inspected.

(B) The periodic inspection shall be designed to correct any deviations or inadequacies observed.

(C) Where lockout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected.

(D) Where tagout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized and affected employee, of that employee's responsibilities under the energy control procedure being inspected, and the elements set forth in paragraph (c)(7)(ii) of this section.

(ii) The employer shall certify that the periodic inspections have been performed. The certification shall identify the machine or equipment on which the energy control procedure was being utilized, the date of the inspection, the employees included in the inspection, and the person performing the inspection.

(7) *Training and communication.* (i) The employer shall provide training to ensure that the purpose and function of the energy control program are understood by employees and that the knowledge and skills required for the safe application, usage, and removal of energy controls are required by employees. The training shall include the following:

(A) Each authorized employee shall receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control.

(B) Each affected employee shall be instructed in the purpose and use of the energy control procedure.

(C) All other employees whose work operations are or may be in an area where energy control procedures may be utilized, shall be instructed about the procedure, and about the prohibition relating to attempts to restart or reenergize machines or equipment which are locked out or tagged out.

(ii) When tagout systems are used, employees shall also be trained in the following limitations of tags:

(A) Tags are essentially warning devices affixed to energy isolating devices, and do not provide the physical restraint on those devices that is provided by a lock.

(B) When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored or otherwise defeated.

(C) Tags must be legible and understandable by all authorized employees, affected employees, and all other employees whose work operations are or may be in the area, in order to be effective.

(D) Tags and their means of attachment must be made of materials which will withstand the environmental conditions encountered in the workplace.

(E) Tags may evoke a false sense of security, and their meaning needs to be understood as part of the overall energy control program.

(F) Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.

(iii) Employee retraining.

(A) Retraining shall be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in machines, equipment or processes that present a new hazard, or when there is a change in the energy control procedures.

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(B) Additional retraining shall also be conducted whenever a periodic inspection under paragraph (c)(6) of this section reveals, or whenever the employer has reason to believe, that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedures.

(C) The retraining shall reestablish employee proficiency and introduce new or revised control methods and procedures, as necessary.

(iv) The employer shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain each employee's name and dates of training.

(8) *Energy isolation.* Implementation of lockout or the tagout system shall be performed only by authorized employees.

(9) *Notification of employees.* Affected employees shall be notified by the employer or authorized employee of the application and removal of lockout devices or tagout devices. Notification shall be given before the controls are applied, and after they are removed from the machine or equipment.

(d) *Application of control.* The established procedure for the application of energy control (implementation of lockout or tagout system procedures) shall cover the following elements and actions and shall be done in the following sequence:

(1) *Preparation for shutdown.* Before an authorized or affected employee turns off a machine or equipment, the authorized employee shall have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.

(2) *Machine or equipment shutdown.* The machine or equipment shall be turned off or shut down using the procedures required by this standard. An orderly shutdown must be utilized to avoid any additional or increased hazard(s) to employees as a result of equipment deenergization.

(3) *Machine or equipment isolation.* All energy isolating devices that are needed to control the energy to the machine or equipment shall be physically located and operated in such a manner as to isolate the machine or equipment from the energy source(s).

(4) *Lockout or tagout device application.* (i) Lockout or tagout devices shall be affixed to each energy isolating device by authorized employees.

(ii) Lockout devices, where used, shall be affixed in a manner that will hold the energy isolating devices in a "safe" or "off" position.

(iii) Tagout devices, where used, shall be affixed in such a manner as will clearly indicate that the operation or movement of energy isolating devices from the "safe" or "off" position is prohibited.

(A) Where tagout devices are used with energy isolating devices designed with the capability of being locked, the tag attachment shall be fastened at the same point at which the lock would have been attached.

(B) Where a tag cannot be affixed directly to the energy isolating device, the tag shall be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.

(5) *Stored energy.* (i) Following the application of lockout or tagout devices to energy isolating devices, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained, and otherwise rendered safe.

(ii) If there is a possibility of reaccumulation of stored energy to a hazardous level, verification of isolation shall be continued until the servicing or maintenance is completed, or until the possibility of such accumulation no longer exists.

(6) *Verification of isolation.* Prior to starting work on machines or equipment that have been locked out or tagged out, the authorized employee shall verify that isolation and deenergization of the machines or equipment have been accomplished.

(e) *Release from lockout or tagout.* Before lockout or tagout devices are removed and energy is restored to the machine or equipment, procedures shall be followed and actions taken by the authorized employee(s) to ensure the following:

(1) *The machine or equipment.* The work area shall be inspected to ensure that nonessential items have been removed and to ensure that machine or equipment components are operationally intact.

(2) *Employees.* (i) The work area shall be checked to ensure that all employees have been safely positioned or removed.

(ii) Before lockout or tagout devices are removed and before machines or equipment are energized, affected employees shall be notified that the lockout or tagout devices have been removed.

(3) *Lockout or tagout devices removal.* Each lockout or tagout device shall be removed from each energy isolating device by the employee who applied the device. *Exception to paragraph (e)(3):* when the authorized employee who applied the lockout or tagout device is not available to remove it, that device may be removed under the direction of the employer, provided that specific procedures and training for such removal have been developed, documented and incorporated into the employer's energy control program. The employer shall demonstrate that the specific procedure provides equivalent safety to the removal of the device by the authorized employee who applied it. The specific procedure shall include at least the following elements:

(i) Verification by the employer that the authorized employee who applied the device is not at the facility;

(ii) Making all reasonable efforts to contact the authorized employee to inform him/her that his/her lockout or tagout device has been removed; and

(iii) Ensuring that the authorized employee has this knowledge before he/she resumes work at that facility.

(f) *Additional requirements* (1) *Testing or positioning of machines, equipment or components thereof.* In situations in which lockout or tagout devices must be temporarily removed from the energy isolating device and the machine or equipment energized to test or position the machine, equipment or component thereof, the following sequence of actions shall be followed.

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(i) Clear the machine or equipment of tools and materials in accordance with paragraph (e)(1) of this section;

(ii) Remove employees from the machine or equipment area in accordance with paragraph (e)(2) of this section;

(iii) Remove the lockout or tagout devices as specified in paragraph (e)(3) of this section;

(iv) Energize and proceed with testing or positioning;

(v) De-energize all systems and reapply energy control measures in accordance with paragraph (d) of this section to continue the servicing and/or maintenance.

(2) *Outside personnel (contractors, etc.).* (i) Whenever outside servicing personnel are to be engaged in activities covered by the scope and application of this standard, the on-site employer and the outside employer shall inform each other of their respective lockout or tagout procedures.

(ii) The on-site employer shall ensure that his/her personnel understand and comply with restrictions and prohibitions of the outside employer's energy control procedures.

(3) *Group lockout or tagout.* (i) When servicing and/or maintenance is performed by a crew, craft, department or other group, they shall utilize a procedure which affords the employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device.

(ii) Group lockout or tagout devices shall be used in accordance with the procedures required by paragraph (c)(4) of this section including, but not necessarily limited to, the following specific requirements:

(A) Primary responsibility is vested in an authorized employee for a set number of employees working under the protection of a group lockout or tagout device (such as an operations lock);

(B) Provision for the authorized employee to ascertain the exposure status of individual group members with regard to the lockout or tagout of the machine or equipment; and

(C) When more than one crew, craft, department, etc., is involved, assignment of overall job-associated lockout or tagout control responsibility to an authorized employee designated to coordinate affected work forces and ensure continuity of protection; and

(D) Each authorized employee shall affix a personal lockout or tagout device to the group lockout device, group lockbox, or comparable mechanism when he or she begins work, and shall remove those devices when he or she stops working on the machine or equipment being serviced or maintained.

(4) *Shift or personnel changes.* Specific procedures shall be utilized during shift or personnel changes to ensure the continuity of lockout or tagout protection, including provision for the orderly transfer of lockout or tagout devices between offgoing and oncoming employees, to minimize exposure to hazards from the unexpected energizing, start-up of the machine or equipment, or release of stored energy.

Note: The following Appendix to §1910.147 serves as a nonmandatory guideline to assist employers and employees in complying with the requirements of this section, as well as to provide other helpful information. Nothing in the Appendix adds to or detracts from any of the requirements of this section.

APPENDIX A—TYPICAL MINIMAL LOCKOUT OR TAGOUT SYSTEM PROCEDURES

General

Lockout is the preferred method of isolating machines or equipment from energy sources. To assist employers in developing a procedure which meets the requirements of the standard, however, the following simple procedure is provided for use in both lockout or tagout programs. This procedure may be used when there are limited number or types of machines or equipment or there is a single power source. For more complex systems, a more comprehensive procedure will need to be developed, documented, and utilized.

LOCKOUT (OR TAGOUT) PROCEDURE FOR (NAME OF COMPANY).

Purpose

This procedure establishes the minimum requirements for the lockout or tagout of energy isolating devices. It shall be used to ensure that the machine or equipment is isolated from all potentially hazardous energy, and locked out or tagged out before employees perform any servicing or maintenance activities where the unexpected energizing, start-up or release of stored energy could cause injury (Type(s) and Magnitude(s) of Energy and Hazards).

Responsibility

Appropriate employees shall be instructed in the safety significance of the lockout (or tagout) procedure (Name(s)/Job Title(s) of employees authorized to lockout or tagout). Each new or transferred affected employee and other employees whose work operations are or may be in the area shall be instructed in the purpose and use of the lockout or tagout procedure (Name(s)/Job Title(s) of affected employees and how to notify).

Preparation for Lockout or Tagout

Make a survey to locate and identify all isolating devices to be certain which switch(es), valve(s) or other energy isolating devices apply to the equipment to be locked or tagged out. More than one energy source (electrical, mechanical or others) may be involved. (Type(s) and Location(s) of energy isolating means.)

Sequence of Lockout or Tagout System Procedure

(1) Notify all affected employees that a lockout or tagout system is going to be utilized and the reason therefor. The authorized employee shall know the type and magnitude of energy that the machine or equipment utilizes and shall understand the hazards thereof.

(2) If the machine or equipment is operating, shut it down by the normal stopping procedure (depress stop button, open toggle switch, etc.).

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(3) Operate the switch, valve, or other energy isolating device(s) so that the equipment is isolated from its energy source(s). Stored energy (such as that in springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure, etc.) must be dissipated or restrained by methods such as repositioning, blocking, bleeding down, etc. (Type(s) of Stored Energy-methods to dissipate or restrain.)

(4) Lockout and/or tagout the energy isolating devices with assigned individual lock(s) and tag(s) (Method(s) Selected; i.e., locks tags, additional safety measures).

(5) After ensuring that no personnel are exposed, and as a check on having disconnected the energy sources, operate the push button or other normal operating controls to make certain the equipment will not operate (Type(s) of Equipment checked to ensure disconnections).

CAUTION: Return operating control(s) to "neutral" or "off" position after the test.

(6) The equipment is now locked out or tagged out.

Restoring Machines or Equipment to Normal Production Operations

(1) After the servicing and/or maintenance is complete and equipment is ready for normal production operations, check the area around the machines or equipment to ensure that no one is exposed.

(2) After all tools have been removed from the machine or equipment, guards have been reinstalled and employees are in the clear, remove all lockout or tagout devices. Operate the energy isolating devices to restore energy to the machine or equipment.

Procedure Involving More Than One Person

In the preceding steps, if more than one individual is required to lockout or tagout equipment, each shall place his/her own personal lockout device or tagout device on the energy isolating device(s). When an energy isolating device cannot accept multiple locks or tags, a multiple lockout or tagout device (hasp) may be used. If lockout is used, a single lock may be used to lockout the machine or equipment with the key being placed in a lockout box or cabinet which allows the use of multiple locks to secure it. Each employee will then use his/her own lock to secure the box or cabinet. As each person no longer needs to maintain his or her lockout protection, that person will remove his/her lock from the box or cabinet. (Name(s)/Job Title(s) of employees authorized for group lockout or tagout.)

Basic Rules for Using Lockout or Tagout System Procedure

All equipment shall be locked out or tagged out to protect against accidental or inadvertent operation when such operation could cause injury to personnel. Do not attempt to operate any switch, valve, or other energy isolating device where it is locked or tagged out.

Lockout (or Tagout) Procedure

Entry No.	(Description)
1	Name of Company
2	Type(s) and Magnitude(s) of energy and hazards
3	Name(s)/Job Title(s) of employees authorized to lockout or tagout
4	Name(s)/Job Title(s) of affected employees and how to notify
5	Type(s) and Location of energy isolating means
6	Type(s) of Stored Energy-methods to dissipate or restrain
7	Method(s) Selected i.e., locks, tags, additional safety measures, etc.
8	Type(s) of Equipment checked to ensure disconnections
9	Name(s)/Job Title(s) of employees authorized for group lockout or tagout

STD 1-7.3 LOCKOUT/TAGOUT

OSHA Instruction STD 1-7.3 (issued September 11, 1990)—Inspection Procedures and Interpretive Guidance is for 29 CFR 1910.147, The Control of Hazardous Energy (commonly referred to as OSHA's Lockout/Tagout Standard).

The purpose of STD 1-7.3 is to establish policies and provide clarification to ensure uniform enforcement of the Lockout/Tagout Standard. STD 1-7.3 also provides for the acceptance of "alternative procedures" in the servicing and maintenance of sophisticated and complex equipment such as that found in the petroleum and chemical industries.

The following is an outline of highlights from STD 1-7.3. This outline is intended to single out some of the new information which was not included in 29 CFR 1910.147. Reference must be made to the entire STD 1-7.3 to ensure complete compliance.

UNDER LETTER I. INTERPRETIVE GUIDANCE

1. *Scope (f)(1)* provides an explanation of cord and plug connected equipment by defining when the (unplugged) plug is under the exclusive control of the employee performing the servicing and/or maintenance. Listed are the following three options:

   1) plug is physically in the possession of the employee
   2) in arm's reach and in line of sight of the employee
   3) if the employee has affixed a lockout/tagout device on the plug

   Scope (f)(2) requires that the company lockout/tagout procedures specify the acceptable procedure for handling cord and plug connected equipment.

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2. *Procedures* (c) states that "similar machines and/or equipment (such as those using the same type and magnitude of energy and the same or similar types of controls) can be covered with a single written procedure."

3. *Lockout versus Tagout (a)* states that "OSHA has determined that lockout is a surer means of ensuring deenergization of equipment than tagout, and that it is the preferred method." (over tagout)

4. *Employees and Training (b)* states that "employees who exclusively perform functions related to normal production operations, and who perform servicing and/or maintenance under the protection of normal machine safeguarding, need only be trained as "affected" (rather than "authorized") employees even if tagout procedures are used." (See I.1.d. and I.1.e. of this instruction.)

5. *Periodic Inspection by the Employer (a)(3)* states that "energy control procedures used less frequently than once a year need be inspected only when used."

6. *Equipment Testing or Positioning (no changes from 1910.147)*

7. *Group Lockout/Tagout* states that "group lockout/tagout procedures shall be tailored to the specific industrial operation and may be unique in the manner that employee protection from the release of hazardous energy is achieved. Irrespective of the situation, the requirements of this generic standard specify that each employee performing maintenance or servicing activities shall be in control of hazardous energy during his/her period of exposure."

   (a) Group operations normally require that a lockout/tagout program be implemented which ensures that each authorized employee is protected from the unexpected release of hazardous energy by his/her personal lockout/tagout device(s). No employee may affix the personal lockout/tagout device of another employee. Various group lockout/tagout procedures discussed in Appendix C provide for each authorized employee's use of his/her personal lockout/tagout device(s).

   (b) One of the most difficult problems addressed by the standard involves the servicing and maintenance of complex equipment. Such equipment is frequently used in the petrochemical and chemical industries. Acceptable group lockout/tagout procedures for complex equipment are discussed further in Appendix C.

The following is the explanation for potentially hazardous stored energy or residual energy which might reaccumulate:

8. *Compliance with Group Lockout/Tagout (e)(2)* "Monitoring may be accomplished, for example, by observation or with the aid of a monitoring device which will sound an alarm if a hazardous energy level is being approached."

   (h) In regards to group lockout/tagout operations, "... a master tag is a personal tagout device if each employee personally signs on and signs off on it and if the tag clearly identifies each authorized employee who is being protected by it."

SUBPART J. CLASSIFICATION OF VIOLATIONS

1. A deficiency in the employer's energy control program and/or procedure that could contribute to a potential exposure capable of producing serious physical harm or death shall be cited as a serious violation.

2. The failure to train "authorized," "affected," and "other" employees as required for their respective classifications should normally be cited as a serious violation.

3. Paperwork deficiencies in lockout/tagout programs where effective lockout/tagout work procedures are in place shall be cited as other-than-serious.

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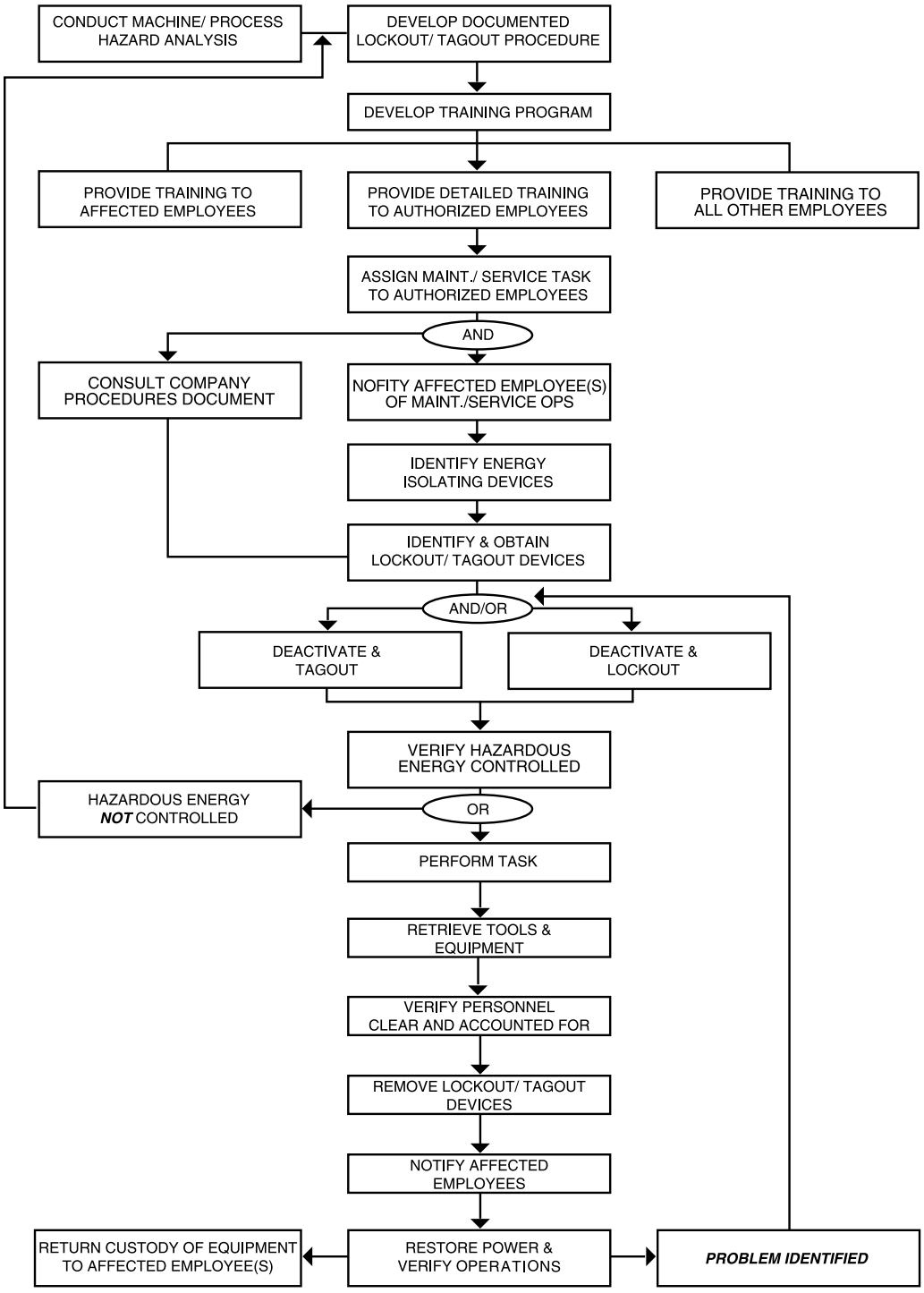
APPENDIX B

This flow diagram does not constitute the exclusive or definitive means of complying with the standard in any particular situation and is presented solely as an aid.

EXAMPLE—FUNCTIONAL FLOW DIAGRAM FOR IMPLEMENTATION OF LOCKOUT / TAGOUT REQUIREMENTS



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APPENDIX C

A. Normal Production Operations

1. Safeguarding of servicing/maintenance workers can be ensured by:

   a. Effective machine safeguarding in compliance with Subpart O [machine guarding requirements - see (A)(2)].

   b. Compliance with 29 CFR 1910.147 (Lockout/Tagout) in situations where the normal production operation safeguards are rendered ineffective or do not protect the servicing/maintenance worker.

2. Routine and repetitive activities are not covered by this standard if alternative measures provide effective protection from the hazards associated with unexpected energizing. Compliance with the machine guarding requirements of Subpart O is an example of such alternative measures.

3. Examples of routine maintenance/servicing which can often be done under the protection of "production-mode safeguarding" are: lubricating, draining sumps, servicing of filters, and inspection for leaks and/or mechanical malfunction.

   Examples that are not considered to be normal routine maintenance functions and would therefore trigger the need for lockout/tagout are: replacement of machine or process equipment components such as valves, gauges, linkages, support structure, etc.

4. It is explained that some of the safeguarding alternatives presented in ANSI B11.19 can be used to provide protection while clearing minor jams and performing other minor servicing functions. The two safeguarding alternatives mentioned are interlocked barrier guards and presence sensing devices.

B. Group Lockout/Tagout

Example procedures are given to illustrate the implementation of a group lockout/tagout procedure involving many energy isolating devices and/or many servicing/maintenance personnel. Several examples are given involving authorized employees who affix personal lockout/tagout devices in a group lockout/tagout setting.

1. *Definitions.*

   The following new definitions for group lockout/tagout are given:

   a. **Primary Authorized Employee** is the authorized employee who exercises overall responsibility for adherence to the company lockout/tagout procedure.

   b. **Principle Authorized Employee** is an authorized employee who oversees or leads a group of servicing/maintenance workers (e.g. plumbers, carpenters, electricians, metal workers, mechanics).

   c. **Job-Lock** is a device used to ensure the continuity of energy isolation during a multi-shift operation. It is placed upon a lock-box. A key to the job-lock is controlled by each assigned primary authorized employee from each shift.

   d. **Job-Tag** with **Tab** is a special tag for tagout of energy isolating devices during group lockout/tagout procedures. The tab of the tag is removed for insertion into the lock-box. The company procedure would require that the tagout job-tag cannot be removed until the tab is rejoined to it.

   e. **Master Lockbox** is the lockbox into which all keys and tabs from the lockout or tagout devices securing the machine or equipment are inserted and which would be secured by a "job-lock" during multi-shift operations.

   f. **Satellite Lockbox** is a secondary lockbox or lockboxes to which each authorized employee affixes his/her personal lock or tag.

   g. **Master Tag** is a document used as an administrative control and accountability device. This device is normally controlled by the operations department personnel and is a personal tagout device if each employee personally signs on and signs off on it, and if the tag clearly identifies each authorized employee who is being protected by it.

   h. **Work Permit** is a control document which authorizes specific tasks and procedures to be accomplished.

2. *Organization.*

   A sample "basic organizational structure" is outlined to explain the relationship between and responsibilities of the primary authorized employee, principal authorized employee, authorized employees, and equipment operators.

3. *Examples of Procedures for Group Lockout/Tagout.*

   Examples are presented for the various methods of lockout/tagout using lockbox procedures.

   a. Four procedures (Type A, Type B, Type C, Type D) address circumstances ranging from a small group of servicing/maintenance employees during a one-shift operation to a comprehensive operation involving many workers over a longer period. They are:

      (1) Type A. Each authorized employee places his/ her personal lock or tag upon each energy isolating device and removes it upon departure from that assignment. Each authorized employee verifies or observes the deenergization of the equipment.

      (2) Type B. Under a lockbox procedure, a lock or job-tag with tab is placed upon each energy isolation device after deenergization. The key(s) and removed tab(s) are then placed into a lockbox. Each authorized employee assigned to the job then affixes his/her personal lock or tag to the lockbox. As a member of a group, each assigned authorized employee verifies that all hazardous energy has been rendered safe. The lockout/tagout devices cannot be removed or the energy isolating device turned on until the appropriate key or tab is matched to its lock or tag.

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(3) Type C. After each energy isolating device is locked/tagged out and the keys/tabs placed into a master lockbox, each servicing/maintenance group "principal" authorized employee places his/her personal lock or tag upon the master lockbox. Then each principal authorized employee inserts his/her key into a satellite lockbox to which each authorized employee in that specific group affixes his/her personal lock or tag. As a member of a group, each assigned authorized employee verifies that all hazardous energy has been rendered safe. Only after the servicing/maintenance functions of the specific sub-group have been concluded and the personal locks or tags of the respective employees have been removed from the satellite lockbox can the principal authorized employee remove his/her lock from the master lockbox.

(4) Type D. During operations to be conducted over more than one shift (or even many days or weeks), a system such as described here might be used. Single locks/tags are affixed upon a lockbox by each authorized employee as described at Type B or Type C above. The master lockbox is first secured with a job-lock before subsequent locks by the principal authorized employees are put in place on the master lockbox. The job-lock may have multiple keys if they are in the sole possession of the various primary authorized employees (one on each shift). As a member of a group, each assigned authorized employee verifies that all hazardous energy has been rendered safe. In this manner, the security provisions of the energy control system are maintained across shift changes while permitting reenergization of the equipment at any appropriate time or shift.

b. Normal group lockout/tagout procedures require the affixing of individual lockout/tagout devices by each authorized employee to a group lockout device, as discussed in paragraph B.3.a. of this appendix. However, in the servicing and maintenance of sophisticated and complex equipment, such as process equipment in petroleum refining, petroleum production, and chemical production, there may be a need for adaptation and modification of normal group lockout/tagout procedures in order to ensure the safety of the employees performing the servicing and maintenance. To provide greater worker safety through implementation of a more feasible system, and to accommodate the special constraints of the standard's requirement for ensuring employees a level of protection equivalent to that provided by the use of a personal lockout or tagout device, an alternative procedure may be implemented if the company documentation justifies it. Lockout/tagout, blanking, blocking, etc., is often supplemented in these situations by the use of work permits and a system of continuous worker accountability. In evaluating whether the equipment being serviced or maintained is so complex as to necessitate a departure from the normal group lockout/tagout procedures (discussed in paragraph B.3.a.), to the use of an alternative procedure, the following factors (often occurring simultaneously) are some of those which must be evaluated: physical size and extent of the equipment being serviced/maintained; the relative inaccessibility of the energy isolating devices; the number of employees performing the servicing/maintenance; the number of energy isolating devices to be locked/tagged out; and the interdependence and interrelationship of the components in the system or between different systems.

(1) "Once the equipment is shut down and the hazardous energy has been controlled, maintenance/servicing personnel, together with operations personnel, must verify that the isolation of the equipment is effective . . ."

(2) (Fifteen) specific issues related to the control of hazardous energy in complex process equipment are described . . . in a typical situation which could be found at any facility."

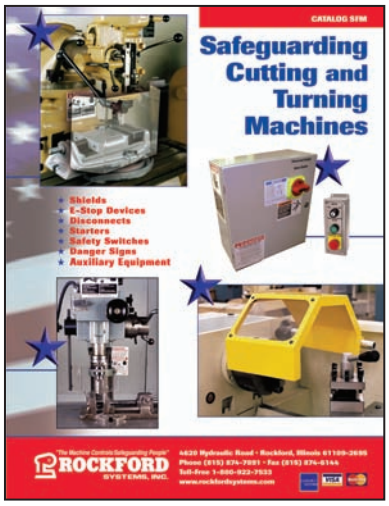
c. "It should be noted that the purpose of the lockout/tagout standard is to reduce the likelihood of worker injuries and fatalities during servicing/maintenance operations . . ."

OTHER SERVICES OFFERED BY ROCKFORD SYSTEMS

OSHA 29 CFR 1910.147—Lockout/Tagout Requirements

According to OSHA 29 CFR 1910.147, The control of hazardous energy (lockout/tagout), all employers must develop a complete hazardous control program by January 2, 1990. To assist employers in accomplishing this, Rockford Systems covers this subject in our machine safeguarding seminar as detailed on pages 2-6 of this catalog. Students are instructed on lockout/tagout procedures and taught the OSHA regulations for lockout/tagout.

This subject is taught through the use of classroom discussions, visual aids and handouts, including OSHA 29 CFR 1910.147, STD 1-7.3—Inspection Procedures and Interpretive Guidance for 29 CFR 1910.147—The Control of Hazardous Energy.



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