



STATE OF NEW JERSEY  
DEPARTMENT OF LABOR AND INDUSTRY

# Rules and Regulations

Governing Safe Operation of

# Power Presses and Foot and Hand Presses

DIVISION OF LABOR  
BUREAU OF ENGINEERING & SAFETY

TRENTON, NEW JERSEY

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STATE OF NEW JERSEY  
DEPARTMENT OF LABOR AND INDUSTRY

PERCY A. MILLER, JR., Commissioner

RULES AND REGULATIONS

GOVERNING SAFE OPERATION OF  
POWER PRESSES AND FOOT AND  
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BUREAU OF ENGINEERING & SAFETY

C. GEORGE KRUEGER, Deputy Director

Trenton, New Jersey

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## FOREWORD

(This foreword is not a part of these rules and regulations)

These rules and regulations supplant entirely those pertaining to Power Presses and Foot and Hand Presses issued in 1941. These rules and regulations are based on the American Standard Safety Code for Power Presses and Foot and Hand Presses, B11, that was originally initiated under the procedure of the American Standards Association in 1920, with the National Safety Council as sponsor. The first standard developed by a sectional committee was approved November 13, 1922. This standard has subsequently been revised on December 2, 1924, November 11, 1926, and October 22, 1937. The sectional committee resumed activity in 1946 and has revised the code in order to bring it up-to-date.

The guarding of power presses has been complicated by the wide variety of operations and operating conditions, due to the variations in size, speed, and type of press; size, thickness, and kind of pieces to be worked; construction of dies; required accuracy of the finished work; skill of operators; length of the run, etc. Because of these varying conditions, a wide variety of guards and feeding methods have been included in this standard.

The personnel of Sectional Committee, B11, which prepared the latest revision was as follows:

T. O. MEISNER, *Chairman*

H. B. DUFFUS, *Vice-Chairman*

<i>Organization Represented</i>	<i>Name of Representative and Business Affiliation</i>
American Society of Mechanical Engineers....	S. J. PAUKNER, E. W. Bliss Co.
Industrial Safety Equipment Association.....	C. B. CANNON, Surty Mfg. Co.
Massachusetts Dept. of Labor and Industries..	WM. H. WELLEN, Div. of Industrial Safety, Mass. Dept. of Labor and Industries.
National Association of Mutual Casualty Companies .....	W. A. VOLLMER, Employers Mutual Liability Insurance Co. of Wisconsin. L. A. FALKNER, Liberty Mutual Insurance Co. (Alt.) J. C. STENNETT, American Mutual Alliance (Alt.)

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National Bureau of Standards, U. S. Department of Commerce.....	STEWART J. OWEN, JR., Nat'l Bureau of Standards. J. A. DICKINSON, Nat'l Bureau of Standards (Alt.)
The National Conservation Bureau.....	DONALD VAUGHAN, Aetna Casualty and Surety Co. RICHARD CAPEN, Aetna Casualty and Surety Co. (Alt.)
National Electrical Manufacturers Assn.....	C. R. DEREAMER, General Electric Co.
National Machine Tool Builders' Assn.....	NEAL W. DORMAN, E. W. Bliss Co. T. O. MEISNER, American Can Co.
National Safety Council.....	C. A. DEMONGE, Kelsey Hayes Wheel Co. H. B. DUFFUS, Westinghouse Elec. Corp. R. H. FERGUSON, Republic Steel Corp. M. J. MCCARTHY, Fisher Body JOHN M. ROCHE, Nat'l Safety Council (Alt.)
New Jersey Department of Labor.....	C. GEORGE KRUEGER, New Jersey Department of Labor (Alternate—R. L. HIGGINS)
Pennsylvania Department of Labor & Industry.....	WILLIAM L. BOYLAN, Pennsylvania Department of Labor and Industry.
Underwriters' Laboratories.....	S. V. JAMES, Underwriters' Laboratories.
U.S. Department of Labor.....	JAMES EDGAR, International Association of Machinists.
U.S. Department of Labor, Child Labor and Youth Employment Branch.....	SHELDON W. HOMAN, Child Labor and Youth Employment Branch.
Wisconsin Industrial Commission.....	R. McA. KEOWN, Wisconsin Industrial Commission.

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## THE LAW

**R.S. 34:6-62. Machine guards.** The owner or person in charge of any factory, workshop, mill or place where the manufacture of goods is carried on where machinery is used, shall provide, in the discretion of the commissioner, friction clutches for stopping shafting, and belt shifters or other mechanical contrivances for the purpose of throwing on or off belts or pulleys. Whenever practicable, all machinery shall be provided with loose pulleys. All vats, pans, saws, planers, power presses, foot presses, cogs, gearing, belting, shafting, set screws, drums and machinery of every description shall be properly guarded. No person shall remove or make ineffective any safeguard around or attached to such machinery, vats or pans while the same are in use, unless for the purpose of immediately making repairs thereto, and all such safeguards so removed shall be promptly replaced. If the machinery, or any part thereof, or any vat, pan or vessel containing molten metal or hot liquid is in a dangerous condition or is not properly guarded, the use thereof may be prohibited by the commissioner, and a notice to that effect shall be attached thereto. Such notice shall not be removed until the machinery is made safe and the required safeguards are provided. In the meantime such unsafe or dangerous machinery, vats, pans, or vessels containing molten metal or liquid shall not be used. When, in the opinion of the commissioner, it is necessary, the halls or other portions of a building shall be provided with proper lighting facilities.

Any corporation, firm or person violating any of the provisions of this section shall, for each offense, be liable to a penalty of fifty dollars.

# RULES AND REGULATIONS

## GOVERNING SAFE OPERATION OF

### POWER PRESSES AND FOOT AND HAND PRESSES

#### Section 1

#### SCOPE AND PURPOSE

**1.1—Scope.** These requirements apply to all power presses, foot presses, and hand presses, by which are meant machines fitted with rams (plungers) and dies for the purpose of blanking, trimming, drawing, punching, or stamping material, also including plate shears and plate punches but not including bulldozers, hot-metal presses, hammers, bending presses or brakes, power screw or fitting presses, air presses, and hydraulic presses, which are either otherwise covered or require special treatment.

**1.2—Interpretations and Exceptions.** The purpose of this code is to provide reasonable safety for life, limb, and health. In cases of practical difficulty or unnecessary hardship, the Commissioner may grant exceptions from the literal requirements of this code or permit the use of other devices or methods, but only when it is clearly evident that equivalent protection is thereby secured.

#### Section 2

#### DEFINITIONS

**2.1—Shall, Should.** "Shall" is to be understood as mandatory and the word "should" as advisory.

**2.2—Approved.** Approved means approved by the Commissioner or his authorized representative.

**2.3—Point of Operation.** Point of operation of a machine means that part of the machine where stock is actually inserted or maintained during any process of forming, shaping, or other operation.

**2.4—Ram.** Ram means the reciprocating, moving part of the press which is sometimes called the plunger or slide.

**2.5—Knockout.** Knockout means a mechanical device for releasing material from either top or bottom die. A stripper is a type of a knockout.

**2.6—Ejector. Kickout.** An ejector or kickout is a device for completely removing work or material from between the dies.

**2.7—Manual Feeding.** Manual feeding is placing material under the ram by hand or by hand tools.

**2.8—Semiautomatic Feeding.** Semiautomatic feeding is placing material under the ram by some mechanical device, which device requires the attention of an operator at each stroke of the ram.

**2.9—Automatic Feeding.** Automatic feeding is placing the material under the ram by a mechanically actuated device that does not require the attention of an operator at each stroke of the ram.

**2.10—Fixed Barrier Guard.** A fixed barrier guard is an enclosure to prevent the hands of the operator from entering the area between the dies. It may be attached to the press or individual guards may be attached to the die.

**2.11—Gate Guard.** A gate guard is a movable barrier so arranged that it completes the enclosure of the point of operation before the operating clutch can become engaged.

**2.12—Pull-Out Guard.** A pull-out guard is a mechanism attached to the operator's hands or arms and connected to the ram, plunger, or outer slide of the press which withdraws the operator's hands from the danger zone as the ram, plunger, or outer slide descends.

**2.13—Two-Hand Tripping Device.** A two-hand tripping device requires the simultaneous use of both hands to trip the press.

**2.14—Sweep Guard.** A sweep guard is actuated by some movable part of the machine and so designed and constructed as to forcibly sweep the hands of the operator from the die zone as the ram or plunger descends.

**2.15—Electronic Safety Devices.** An electronic safety device is so designed and installed that when the operator's hand or any part of body is in the die zone, the press cannot be tripped and if the hand or any part of body is inserted while the ram is in a downward motion, it will immediately stop the ram.

**2.15.1—Photoelectric or Selenium Safety Device.** A photoelectric or selenium safety device is a source of light rays together with a receiver and other electronic equipment so designed and installed that when the operator's hand or any part of body is in the die zone the press cannot be tripped and if the hand or any part of the body is inserted while the ram is in a downward motion it will immediately stop the ram.

**2.15.2—Magnetic Safety Device.** A magnetic safety device is so designed and installed that when the operator's hand or any part of body is in the die zone, the press cannot be tripped and if the hand or any part of the body is inserted while the ram is in a downward motion it will immediately stop the ram.

**2.16—Single-Stroke Device.** A single-stroke device is an arrangement which limits the travel of the ram to one complete cycle or stroke at each tripping of the clutch.

**2.17—Foot Presses.** Foot presses, including kick presses, are machines of the plunger type, powered by foot and used for assembling, trimming, forming, drawing, punching, or stamping metals, plastics, or similar materials of moderate thickness, but excluding hot forging operations.

**2.18—Hand Presses.** Hand presses are machines of the plunger type powered by hand and similar in usage to a foot press.

**2.19—Foot Shears.** Foot shears are machines of the guillotine or alligator type powered by foot and used for shearing or cutting metals, plastics, and similar materials.

**2.20—Hand Shears.** Hand shears are machines of the guillotine or alligator design powered by hand and used for shearing or cutting metals, plastics, and similar materials.

### Section 3

#### REFERENCES TO OTHER RULES

These rules and regulations are supplemented by the following rules or the latest revisions thereof and shall modify the latter where discrepancies exist.

Safety Code for Mechanical Power-Transmission Apparatus.

Rules and Regulations governing Lighting in Places of Employment and Public Assembly.

### Section 4

#### REQUIREMENTS FOR PRESS INSTALLATIONS

**4.1—Press Foundation.** Every press shall be placed on a substantial foundation, floor, or other support, and shall be securely fastened or anchored in place.

**4.2—Working Space and Aisles.**

**4.2.1—Presses** shall be so located as to give enough clearance between machines so that the movement of one operator will not interfere with the work of another. Wherever possible presses should be so arranged that the operator's back is not toward an aisle used for trucking.

**4.2.2—Presses** shall be so located as to give ample room for cleaning machines and handling the work, including material and scrap.

**4.2.3—Surrounding floors and flooring** shall be kept in good condition, free from obstructions, grease, oils, and so forth.

**4.2.4—Aisles** used as a means of exit shall have a minimum clear width of 3 feet. Aisles for one-way traffic should not be less than the width of the widest vehicle or load plus 3 feet. For two-way traffic the minimum width of aisles should be not less than twice the width of the widest vehicles or loads plus 3 feet. Lines should be painted on the floor or some similar method should be used to mark aisleways.

**4.3—Lighting.** A minimum illumination of 20 foot-candles at the point of operation shall be provided for press work. Direct or reflected glare and shadows, including moving shadows, should be avoided.

**4.4—Means of Disconnecting Power.** Every power press shall be provided with means for disconnecting all power from the press or from the pulley on press. Acceptable methods are:

a. Individual motor drive. Drives shall be provided with switch or starter which will permit locking or latching in the off position. The switch shall be so located that it cannot be accidentally operated;

b. Tight and loose pulleys on countershaft with belt shifter which can be locked or latched in off position;

c. Belt perch or idler pulleys to facilitate throwing belts off and on the drive pulley;

d. Clutch on drive pulley, with clutch handle that can be locked or latched in off position.

**4.5—Belt, Pulley, Gear, and Shaft Guards.** Belts, pulleys, gears, and shafts shall be guarded in accordance with the Safety Code for Mechanical Power-Transmission Apparatus. Removable sections, preferably hinged, shall be provided in such guards where necessary, so that the press can be turned by hand. Power presses equipped with flywheels at the end of the shaft (where there is no out bearing beyond the flywheel) should have the flywheel guarded. This guard should be constructed with such a design and such strength that the guard will retain the flywheel in case of failure of the shaft.

**4.6—Switches and Other Electrical Apparatus.**

**4.6.1—Power switches and other electrical apparatus** shall be guarded. Push buttons for starting motors shall be so located or guarded that motor or motors cannot be accidentally started. Motor-starting push buttons may be line voltage up to 550 volts.

**4.6.2—Clutch-operating push buttons** shall not be operated on more than 110 volts from the secondary side of a transformer. Where possible the secondary side of the transformer should be grounded.

**4.6.3—A stop button** shall be readily accessible to each operator or starting station.

**4.6.4—All electrical equipment** shall be connected to the load side of the main disconnect switch of each machine.

**4.7—Feeding Mechanisms.** All gears and power-driven feed rolls on press-feeding mechanisms shall be guarded.

**4.8—Eye Protection Against Flying Particles.** A shield, goggles, or other means of protection shall be provided if the nature of the operation and the kind of material are such as to cause a hazard from flying particles.

## Section 5

### SAFEGUARDING POWER PRESSES AT POINT OF OPERATION

**5.1—Safeguarding Classification.** One or more means of safeguarding the press at the point of operation shall be provided and used on every power press, depending upon the method of feeding, and in accordance with Table 1.

TABLE 1  
SAFEGUARDING CLASSIFICATION

Method of Feeding Press	Safeguarding Required
A. Automatic feed Automatic roll feed Automatic push, pull, or dial feed	Fixed barrier guard (see 5.3), or gate guard (see 5.4)
B. Semiautomatic feed Chute feed (both gravity and follow feed) Slide or push feed Sliding dies Dial feed Revolving dies	Fixed barrier guard (see 5.3), or gate guard (see 5.4)
C. Manual feed	Fixed barrier guard (see 5.3), or gate guard (see 5.4), or two-hand tripping device (see 5.5); or sweep guard (see 5.8), or pull-out guard (see 5.6), or electronic device (see 5.7).

#### 5.2—General Requirements for Point of Operation Guarding.

**5.2.1—**Every such device shall be simple and reliable in construction, application, and adjustment. It shall be permanently attached to the press or the die. It shall not offer any accident hazard of itself. It shall be designed and constructed to minimize the possibility of removing or misusing essential parts and to facilitate inspection of them.

**5.2.2—**The device shall be so designed and constructed that it is impossible for the operator to place or permit his hand or fingers to remain within the danger zone created by the movement of the ram.

**5.2.3—**Care shall be used in the selection of the method of guarding for each particular job. Guards shall be installed, maintained, and adjusted to produce safe operation at each setting of the press.

**5.2.4—**Guards which are attached to the ram and which move downward so that the operator's hand or fingers might be caught between gate and lower die shall not be used.

#### 5.3—Fixed Barrier Guard.

**5.3.1—**A fixed barrier guard is an enclosure to prevent the hands or fingers of the operator from entering the area between the dies. It may be attached to the press or individual guards may be attached to the dies.

**5.3.2—**There shall be no exposed shear points between the guard and any moving part.

**5.3.3—**Openings in the guard or between the guard and working surface shall be not greater than those shown in Table 2.

TABLE 2  
PERMISSIBLE OPENINGS

Distance of Opening from Nip Point, Inches	Maximum Width of Opening, Inches
0 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 8½	1¼

**5.3.4—**For the portion of the guard between the operator and the die or working area, it is strongly recommended that 3/16 inch minimum vertical steel rods, vertically slotted material, or shatterproof, non-flammable, transparent material be used. Mesh, or perforated plate shall not be used between the operator and the die. (See Appendix, A4.1 and 4.1.1, re eye fatigue.)

**5.3.5—**Any hinged or movable section of a fixed barrier guard shall be connected to an interlocking device that will prevent tripping the press while the section is open.

#### 5.4—Gate Guards.

**5.4.1—**A gate guard is a movable barrier so arranged that it completes the enclosure of the point of operation before the operating clutch can become engaged.

**5.4.2—**Openings in the barrier of the gate guard shall be not greater than those specified for the openings in fixed barrier guards in 5.3. The mechanism of the guard shall be so designed that there will be no positive linkage or other close motion which may trap the hand of the operator.

**5.4.3—**It is the intent that gate guards include the provision of either fixed or movable side enclosures around the die.

**5.4.4—**Where the speed of the ram is so slow that the operator might beat the ram on the down stroke after the press has been tripped, the gate guard shall be so designed that the gate remains closed until the ram has completed the down stroke.

#### 5.5—Two-Hand Tripping Device.

**5.5.1—**A two-hand tripping device shall be so designed as to require the simultaneous use of both hands to trip the press. It shall be so designed, located, and arranged as to prevent tying,

wedging, or otherwise securing one handle or button and operating the press with the other hand only, except by use of a key in the possession of the foreman. The buttons or levers for two-hand tripping devices should be so located or protected by barriers that the operator cannot trip the press by means of his arm or some other device while his hand is within the danger zone of the point of operation.

5.5.2—On friction-clutch-operated presses the controls shall be so arranged that if any hand is removed from a control during the down stroke of the ram, it will be instantly stopped.

5.5.3—Where two or more persons are engaged in the operation of a single press, separate two-hand controls shall be provided for each person. Exception: An auxiliary foot control (air or electric) may be used in lieu of one set of two-hand controls, provided the foot control is located so that the nip point is out of the reach of the operator, but the foot controls shall in no case be less than a distance of 36 inches measured horizontally from the nip point.

#### 5.6—Pull-Out Guards.

5.6.1—Pull-out guards shall be so constructed as to be attached to the operator's hands or arms and connected to the ram, plunger, or outer slide of the press in such a way that the operator's hands or fingers will be withdrawn from the danger zone as the ram, plunger, or outer slide descends.

5.6.2—Where the open distance between the top of the work and the lower extremity of the punch is less than 2 inches the multiplying action of this guard shall be such that the hands will be withdrawn a safe distance from the nip point during the first quarter of the stroke.

#### 5.7—Electronic Safety Device.

5.7.1—An electronic safety device shall be so designed and installed that when the operator's hand or any part of the body is in the die zone, the press cannot be tripped and if the hand or any part of the body is inserted while the ram is in a downward motion, it will immediately stop the ram.

5.7.2—These guards shall be operated from a closed electric circuit so that interruption of the electric current will automatically prevent the press from tripping until the current has been restored.

5.7.3—Electronic safety devices shall not be used on positive clutch presses where the ram continues for a complete stroke after each tripping of the press.

#### 5.8—Sweep Guards.

5.8.1—Sweep guards may be provided with either single or double sweep arms. The sweep arm, or arms, shall be interconnected to the ram and shall be so designed and constructed as to forcibly sweep the hands of the operator from the die zone as the ram or plunger descends.

5.8.2—Sweep guards shall be so designed and operated that the operator cannot reach behind the sweep in the danger zone before the ram has completed its downward stroke. Each single sweep arm shall be provided with a flag or barrier attached to it so that the operator cannot reach behind the sweep.

5.8.3—The sweep or sweeps shall not offer any hazard of or in itself by creating a shear hazard between the sweep arm and press tie rods, die straps, or other parts of the press or guard.

5.9—One-Hand Tripping Device. Whenever a press is set up so as to require tripping the ram or plunger by one hand, additional guarding as specified in Section 5 shall be provided.

5.10—Special Hand Tools. Hand tools for placing and removing material shall be such as to permit easy handling of material without the operator placing his hand in the danger zone. Such tools shall not be accepted in lieu of other guarding as provided in this section.

### Section 6

#### FOOT AND HAND PRESSES

6.1—Point of Operation. Foot presses shall and hand presses should be guarded by one or more of the guards in 6.1.1 to 6.1.7, inclusive.

6.1.1—Fixed Barrier Guards. Fixed barrier guards shall conform to 5.3.

6.1.2—Limitation of Stroke. If a foot or kick press is guarded by limitation of the ram stroke, it shall mean that the adjustment must be set to limit the maximum travel of the ram  $\frac{3}{8}$  inch on the down stroke and  $\frac{3}{8}$  inch on the up stroke, and locked securely in position. There shall be no pinching or crushing hazards between other parts of the ram or die shoe.

6.1.3—Gate Guards. A gate shall be so designed as to close the opening at the front of the press before the foot lever can be actuated.

6.1.4—Two-Hand Operation. Two-hand operations shall conform to 5.5.

6.1.5—Sweep Guards. Sweep guards shall conform to 5.8.

6.1.6—Pull-Out Guards. Pull-out guards shall be so constructed as to be attached to the operator's hands or arms and connected to the ram of the press in such a way that the operator's hands will be withdrawn from the danger zone as the ram descends.

6.1.7—Ram-Locking Ring Guards. A ring shall be provided and so installed that it encircles the punch or top die. It shall be so connected that the ring descends ahead of the punch and is attached to a mechanism so that if the ring meets with an obstruction on its downward travel before reaching the bottom the ram will be locked.

6.2—**Location.** Foot presses should be so located that the operating lever will not extend into an aisle or passageway.

6.3—**Mounting.** Foot and hand presses shall be securely bolted to the floor or bench.

6.4—**Lever-Arm Extension.** All extensions placed on the lever arms of a hand press shall be securely attached.

6.5—**Clearance.** The job setup for hand presses shall allow the operator ample clearance for a free and uninterrupted swing of the press arm.

6.6—**Semiautomatic Feeding.** In addition to guarding as specified in this section semiautomatic feeding should be used wherever possible.

#### Section 7

### OTHER POWER-PRESS SAFETY DEVICES

7.1—**Treadle Guard.** On every foot-operated power press a substantial guard shall be placed over the treadle to prevent accidental tripping, or an equally effective special design of treadle shall be used. For treadles, other than long bars extending across the machine, the openings in such guards shall be not more than twice the width of the foot.

7.2—**Foot Treadle.** The use of tension springs or counterweights on treadle shaft or tension springs on treadle-shaft lever shall be prohibited.

7.3—**Latch on Hand-Operating Lever.** Hand-operated power presses, especially if of larger size, should be equipped with a spring latch on the operating lever to prevent accidental or premature tripping.

7.4—**Interlocking Device.** Each hand-operated power press, if tended by more than one person, should have an interlocking lever or similar device controlled by each person to prevent accident or premature tripping. (See 5.5.)

#### 7.5—Single-Stroke Attachment.

7.5.1—On positive-type clutch presses a single-stroke attachment should be provided, by which the treadle or operating lever is disconnected after each stroke. If single-stroke attachments are provided on some of the presses in a department, they should be provided on all of the positive-type clutch presses in the department so that there will be less likelihood of confusion and, therefore, of accident when operators are changed from one machine to another.

7.5.2—The single-stroke attachment shall not be dependent upon the action of any spring, except a compression spring operating in or on a closely fitting barrel or rod and so wound that the space between the coils is less than the diameter of the wire.

Note: A single-stroke attachment may be so arranged that it can be rendered inoperative in case continuous operation is desired.

#### Section 8

### MAKING AND SETTING DIES

8.1—**Design and Construction.** Newly constructed dies shall be designed and constructed so as to involve the least possible hazard to the press operator. They should be cut away so that unnecessary crushing hazards will not exist. They should be so arranged that the operator will assume a natural position and do his work in the safest possible manner. Dies should be so designed and constructed as to permit the use of enclosure guards as required in 5.3. Dies shall be so designed and constructed as to provide or permit safeguarding as required in Section 5.

8.2—**Die Guarding.** It is recommended that wherever possible each individual die should be guarded when the die is made. Die guards are usually in the form of fixed barrier guards.

8.3—**Die Setting.** The source of power shall be disconnected from the press while setting dies. On large presses which cannot be turned by hand, power should be used for inching the motor in order to properly align the dies. The die setter shall install, when he sets the dies for any operation, safe feeding arrangement and guards which have been provided.

#### Section 9

### INSPECTION AND MAINTENANCE

9.1—**Inspection.** Regular inspections of power presses shall be made to insure that all parts of the press are in safe operating condition. Adequate records of these inspections shall be made and kept on file. (See Appendix.)

9.2—**Maintenance.** All parts of power presses shall be so maintained as to be in safe operating condition.

#### Section 10

### OPERATION

10.1—**Employment of Minors.** No minor under 18 years of age shall operate, or assist in the operation of, a power press or a foot or hand press as covered by this code.\*

10.2—**Instruction of Operators.** Before starting to work on a press, and before starting to work on any materially different operation, the press operator shall be carefully instructed in the hazards of the machine and of the particular operation and in the safe method of work.

\* Numerous manufacturers have limited the operation of power presses to persons 21 years of age or over.

## APPENDIX

This Appendix is not a part of the Rules and Regulations for Power Presses and Food and Hand Presses. This Appendix includes a discussion of the said Rules and Regulations and recommendations for applying them.

### A1. GENERAL

**A1.1—Use of Appendix.** The operation of power presses, although generally considered hazardous, may be relatively safe if a few fundamental principles are followed. These principles include the designing of dies to facilitate safe operations, efficient feeding and ejection methods, effective point of operation guarding, proper press maintenance, proper operator training, and careful supervision. This appendix has been prepared to facilitate application of the material to actual power-press problems.

There are numerous guards and devices for protecting power-press operators at the point of operation. As a guide to the most efficient use of these protective devices and methods, there is included information relating to the application of each guard and its limitations.

### A2. FUNDAMENTAL PRINCIPLES

**A2.1—Die Design.** The feeding method must be considered by the die designer and the die maker, in planning and producing dies for each job. Preferred methods of automatic, or semi-automatic feeding are not something to be applied after the operation has been laid out and the dies constructed. Feeding devices, knockouts, and guards must in general be attached to the die; therefore, persons responsible for designing and constructing the die should have the element of safety constantly in mind.

The initial step in the provision of a safe and efficient operation is the planning of a method to produce a particular piece. Certain fundamental factors necessary to the safety of pressroom personnel must be considered in the design of the die. The method of guarding a particular operation is primarily dependent upon the method of feeding and ejecting the finished part or scrap. Therefore, the die designer must consider the safety factor in the operation of the die at the time of planning a given operation. Some of the items necessary to consider are as follows:

**A2.1.1—Feeds.** Feeding applications should be provided to eliminate the necessity of the operator reaching into the danger zone to place a part in the die. This can be done more often than is generally realized if sufficient thought is given to the design of the die. Where the production will warrant the expense,

the combining of operations into one progressive die minimizes the extent of point of operation exposure. The choice of the type of feed will depend on the design of the die, the shape of the part being processed, quantity of parts to be processed, and type of equipment available. Feeds include gravity, push, follow, magazine, automatic magazine, dial, roll, reciprocating feeds, hitch, and transfer, but are not limited to these types.

**A2.1.2—Finished-Part Ejection.** Ejection of the finished piece may influence the feeding method. Therefore, it must be considered carefully when selecting an automatic or semi-automatic feed. Various methods of ejection are used, including compressed air, punch, knockouts, spring strippers, gravity from an inclined press, etc. Operators should not be required to remove finished parts from the die manually. Press knockouts, or spring or rubber strippers should be used. Air blowoff systems can be timed with ram travel to provide an air blast that will blow finished parts out of the point of operation. Mechanical fingers or air-cylinder pushoffs are also used for this purpose.

**A2.1.3—Scrap Ejection.** Operators should not be required to remove scrap from the die manually because of the hazards involved. On some secondary operations, small pieces of scrap stock are produced (slugs, trimmings, etc.) which must be removed from the die to prevent damage. Air blowoff systems may be used to remove this scrap and, where necessary, chisel punches may be used to cut up material which might be difficult to remove as one piece. Long lengths of scrap protruding from the press or on the floor present a tripping hazard and removal problem. The use of a crankshaft-operated scrap cutter minimizes this problem as the scrap is cut into small pieces as it is produced. Scrap ejection air blowoffs can be provided to remove these small pieces of scrap to a scrap box. The mechanism must be guarded.

**A2.1.4—Stock gages** should be high enough to prevent the stock from slipping over the top of the gages.

Stop pins should be accurately located so that a minimum of scrap will be produced. Stop pins should be as high as is practical and beveled to facilitate easy feeding of the stock. Automatic stop pins activated by ram travel often prove practical.

**A2.1.5—Inclined Presses.** Whenever possible the die should be designed for use on an inclined press. This aids in the provision of a gravity ejection of scrap and finished parts.

**A2.1.6—Indexing Nests.** The operator should not be required to hold parts being processed (except strip stock) during the downstroke of the ram. Shaped or adjustable nesting plates should be provided.

Positive nesting devices are necessary to assure proper location of pieces in relation to the punch and die.

Sectional or shaped nesting plates should be beveled on the top surface so the part can be readily inserted and removed.

**A2.1.7—Die Fastenings.** Provision must be made in the design of the die for the use of standard die clamps and die sets. Make-shift arrangement of parallel bars increases the die-setting time factor and also often results in a setup that is apt to shift, causing die damage.

**A2.1.8—Positioning of Dies on Die Set.** If the piece is to be cut or formed on one end only, dies should be arranged on the die set so that the other end of the piece will project at the front or side and can be held safely.

**A2.1.9—Die-Handling Facilities.** It is advisable to tap heavy dies so eyebolts may be inserted for convenience in lifting. The screw eyes should be placed in the lower die or die shoe to prevent the punch and die from separating when die-handling equipment is used.

**A2.2—Maintenance.** A maintenance program designed to keep presses and equipment in good operating condition is of extreme importance.

Such items as clutch, clutch dog, brake, treadle, belt, air-ejection equipment, guards, are in need of periodic adjustment and repair.

Lubrication schedules must be maintained to avoid accidents caused by mechanical failures, as well as costly repairs, or part replacements.

Preventive maintenance provides a medium for replacing worn or fatigued parts before they fail, thus preventing unexpected breakdowns and needless personal injury.

**A2.3.—Purchasing New Equipment.** When purchasing new power-press equipment or when complete overhaul jobs are made on used equipment, every effort should be made to include the latest type of safeguards consistent with the work to be performed in the press. Most of the power-press manufacturers now have available certain safeguards or controls as auxiliary equipment that can be purchased at a slight increase in cost.

Failure to observe this recommendation can result in prohibiting the new or overhauled equipment from being used through the process of sealing to prevent use as provided by statute.

**A2.4—Supervision.** It is the responsibility of the supervisor to see that all press operations are conducted in accordance with established safe practices. Operators should be instructed and trained in the proper use of all safety devices provided for their protection. The supervisors should carefully follow the work of the setup man to be sure that a job is not turned over to the operator until all safeguards required for the operation have been provided and the operator instructed in their use.

These rules and regulations together with appendages will be found to be extremely helpful.

**A2.5—Die Setter's Responsibilities.** Die setters must be held responsible for setting up operations in accordance with approved safe practices. If, in the opinion of the die setter, the press is not operating correctly, or the guard is ineffective for the protection of the operator, he should report this matter to the proper party before releasing the press to the operator.

If the die setter is responsible for placing an adjustable barrier guard around the die, he should endeavor as far as possible to guard not only the front but both sides of the die, and the back if necessary, so the operator cannot reach around or under the ram if material sticks.

The die setter should always try out the press by running a few pieces with guards in place so as to check operation of guard before turning the press over to the operator.

The die setter should check on the progress of the operation periodically to check for faulty work, adjustment of guard, and general press operation.

### A3. METHODS OF FEED

**A3.1—Automatic Feeds.** Automatic methods of feeding presses are preferable from a safety point of view to either semi-automatic or manual feeding and can be adopted for a wide variety of work.

#### Applications.

- a. Operator does not have to reach into point of operation to feed the press.
- b. Feeding method usually makes it possible to enclose the die completely.
- c. Operator can load feed mechanism and start press, but does not have to be in the vicinity of the press at each stroke.

#### Limitations.

- a. Cost of installation is generally high and must be considered in accordance with production volume.
- b. They may not be practical on short run jobs.\*

**A3.1.1.—Automatic Roll Feeds.** These are often used on continuous operations blanking from strips. Small gears on feed rolls themselves should be guarded.

\* **Long and Short Runs.** It is often assumed that automatic or semiautomatic feeding is practicable only in large establishments or on continuous runs. This is not the case. Some companies have found it practical to use automatic or semiautomatic feeds on all press operations, for both long and short runs. There are doubtless still some cases where these inherently safe methods of feeding are impracticable and where a mechanically operated guard is the only form of protection that can be applied, but such cases have been found to be much less numerous than was formerly supposed.

**A3.2—Semiautomatic Feeds.** Semiautomatic methods of feeding presses are preferable to manual feeding and can usually be adapted for the jobs now being fed manually except for certain blanking operations.

**Applications.**

- a. Operator does not have to reach into point of operation to feed the press.
- b. Feeding method usually makes it possible to enclose the die completely.

**Limitations.**

- a. Not adaptable for certain blanking operations.
- b. Not adaptable for nesting operations of certain odd-shaped pieces.

**A3.2.1—Semiautomatic Push or Pull Feeds.** Such feeds approximate the action of hand feeding because control of the part is retained. Therefore, work can be accurately located on the die without placing hands in the danger zone. Forming operations, especially from rectangular stock, are adaptable to push feeds.

**A3.2.2.—Semiautomatic Plunger Feed.** Semiautomatic plunger feed is a magazine or chute in which blanks or partly formed pieces are placed and fed, one at a time, by a mechanical plunger or other device which pushes them into place under the ram.

**A3.2.3.—Chute Feed.** One of the most widely used semi-automatic methods of feeding consists of a horizontal or inclined chute into which each piece is placed by hand. Its value lies primarily in the fact that in regular operation the hand need never be placed in or inserted into the point of operation. A pick or other means for removing pieces of stock that may jam in the die should be provided (See A3.3.1. Hand Tools). Chute feeds may be used for many blanking and forming operations of small or moderate size.

**A3.2.4—Dial Feeds.** Dial feeding provides another semi-automatic method for feeding a press without requiring the operator to insert his hands into the point of operation. All pinch or shear points on the dial feed itself should be guarded.

(Caution: Guards should be designed and positioned so that pinch or shear point is not created between revolving dial and stationary barrier guard.)

**A3.2.5—Sliding Dies.** Sliding dies are those which slide forward at each feeding operation, and are returned to position under the punch for the downward ram stroke. The die may be slid forward and backward automatically or by hand, or by a foot treadle. Proper guards to enclose the danger zone are necessary, and interlocks are required to assure positive alignment of the punch and die and to prevent premature tripping of the press.

**A3.3—Manual Feeding.**

**A3.3.1—Hand Tools.** For hand feeding without placing the hand under the ram, a variety of special tools have been developed and used successfully on operations where automatic feeds, or enclosing guards, are impracticable. Such tools include pushers, pickers, pliers, tweezers, forks, magnets, and suction disks. They furnish protection provided they are always used by the operator.

Because of the human element involved, hand tools provide less protection than the various types of press guards described. They are not considered as a substitute for a guard and, when used, should be used in conjunction with a guard as required by these Rules and Regulations.

**A4—Point of Operation Guarding.** As specified in the rules and regulations, one or more means of safeguarding press operators at point of operation shall be provided and used on every press depending upon method of feeding. In the selection of a guard or protective device, the applications and limitations should be carefully considered.

**A4.1—Barrier Guards.** Barrier Guards are used to enclose the danger zone. Rod stock in a vertical position provides satisfactory barrier-guard construction. Avoid horizontal slots or spaces on barrier guard which not only create eye strain but provide limited visibility of the die zone.

Although a feeding device is used, it is still necessary to provide a guard so that the operator cannot reach over or around the feeding device into the danger zone. Too often, feeding devices are either not guarded or are inadequately guarded and, as a result, serious accidents occur when the operators attempt to relieve jams, remove scrap, or adjust parts. A stick or a pick should be provided to relieve a jam or remove scrap.

**A4.1.1—Die Guards.** Individual die guards which are a form of fixed barrier guards provide positive protection to the operator. They can be used on primary operations or on any type of press operation where the operator is not required to place his hands between the punch and die. These guards should be attached to the die shoe or stripper in a fixed position and should be designed so that the operator's hands cannot reach over, under, or around the guard into the point of operation. This type of guarding is superior to any other method because the die is enclosed and the guard is a permanent part of the die. In building this guard, the important factors are that the guard should permit easy feeding of the stock and should afford good visibility at all times. Various types of transparent materials are applicable for building guards and are fast becoming a popular method of providing an enclosure for a die, because of the advantage of visibility.

Prefabricated slotted material is often used in guard construction. In such cases, a metal frame is provided and the prefabricated metal is securely fastened to the metal frame. A

metal frame also can be built and rod stock welded or otherwise fastened to this metal frame. It is advisable to have the openings run in a vertical plane as it has been proved that this provides good visibility and lessens operator eye fatigue.

**A4.1.2—Adjustable Barrier Guards.** Where conditions exist under which an individual die-guarding program would take some time to complete or where short-run production is involved and the provision of individual die guards is considered economically impractical, it is suggested that consideration be given to providing an adjustable barrier guard on each press, which can be used on any blanking operation or where the operator is not required to feed under the punch.

With the use of this type guard, however, the die setter must be instructed as to the proper adjustment and given to understand that this adjustment is an important part of his job. The operators should not be allowed to make any changes in this adjustment at any time. Die setters must clearly understand that the proper adjustment is an important factor and complete coverage of the die is necessary.

Adjustable press barriers are available commercially or can be made by the average mechanic.

**A4.1.3—Interlocked Barrier Guards.** Barrier guards can be built or are available commercially designed with a pivot or slide gate to allow ready access to the die. The pivot or slide section is usually interlocked with the press control to prevent operation of the machine when the gate is open. The interlock is sometimes a gate-activated switch which controls the action of a solenoid catch on the clutch-trip lever or a straight mechanical lever interlock can be used.

This type of interlocked barrier guard is used successfully on automatic presses where occasional jams occur that necessitate exposure of the point of operation to relieve these jams.

**A4.2—Gate Guards.** The tripping mechanism of the press is so arranged that the operator actuates a gate which comes down in front of the die before the press can be tripped. If hands or anything else are in the way, the guard is stopped by the object and therefore the press cannot be tripped. However, if the gate reaches the point where protection is certain, the clutch can be engaged. The tripping may be accomplished by fastening the clutch-tripping mechanism to the gate so that the gate actually trips the press by mechanical or other means. The gate may return to the raised position by action of counterweights, or it may be lifted by mechanical or other means.

#### **Applications.**

- a. Operator has free access to die when gate is up.
- b. Press cannot be tripped unless guard is protecting the point of operation.

c. In some cases gate may be rearranged and used as a barrier guard.

#### **Limitations.**

- a. Guard provides no protection in case of mechanical failure or repeat action of press.
- b. Unless properly designed and applied, guard may be up before ram has completed down stroke.

**A4.3—Two-Hand Tripping Device.** There are several types of commercial two-hand control devices on the market that with proper supervision and maintenance can effectively protect the operator on nesting operations. Tweezers or other forms of hand tools are recommended for nesting material in the die on presses controlled by two-hand tripping device.

Presses, equipped with two-hand tripping devices, should also be equipped with single-stroke attachments. When electrically operated tripping devices are used, the circuit should contain the necessary relays to permit only one stroke of the press for each operation of the hand control. On pneumatic operated controls, the system should contain a measured chamber that will permit only one stroke of the press for each operation of the hand valve. On mechanically motivated controls, the mechanism should be such that both hand levers shall be released and depressed for each stroke of the press.

These intermediate controls are essential to prevent the operator from tying down one of the hand-control devices.

On short-run presses equipped with two-hand control, it is sometimes convenient to provide a selector switch that will provide the selection of hand or foot control. When this auxiliary equipment is provided, the selector switch should be equipped with a lock: it being the responsibility of the setup man to lock the selector in the proper position for each type of press control.

#### **Applications.**

- a. When properly designed and located, both hands must be removed from danger zone to trip press.
- b. Operator has free access to die.
- c. Minimum adjustments are required when dies are changed or during normal operation.

#### **Limitations.**

- a. No protection provided in case of mechanical failure or repeat stroke.
- b. If not properly designed or located, operator may be able to tie down lever or wedge control button or use elbow to trip press.

c. On positive clutch presses, hands are free the instant ram starts down. Therefore, two-hand trips are unsatisfactory unless controls are located so that ram completes down stroke before hands can reach the danger zone.

**A4.4—Pull-Out Guards.** This device employs cables extending from a ram connection to the rear of the operator, and over pulleys to his wrists, where they are clipped to wristlets held in place by a loop over the thumb. As ram descends, the operator's hands are pulled away from the danger zone.

#### **Applications.**

- a. When properly attached and adjusted guard removes hands from danger zone in all cases of ram descent.
- b. Use of guard does not introduce any additional motions in press operating cycle.
- c. Guard provides full protection if properly used, adjusted, and supervised.
- d. View of operating area is unobstructed.

#### **Limitations.**

- a. Guard is generally limited to nesting or secondary operations.
- b. Guard is limited to jobs where the operator can remain in the feeding position.
- c. Operator may resent being tied to machine unless educated in its uses.
- d. Operator may not hook cables to wrists unless closely supervised.
- e. Careful adjustment of guard is important and requires careful training of setup man.
- f. Guard must be readjusted or checked every time press setup or operator is changed.
- g. Visual inspection of critical moving parts is sometimes difficult to make.
- h. On short-stroke presses, sufficient pull back may not be obtained without proper multiplier.

**A4.5—Electronic Safety Devices.** Photoelectric relays and other electronic controls which operate because of the interruption of a light beam protecting the danger zone, have been applied with success to the protection of presses with friction clutches or brakes adequate for stopping the press at any point of the ram stroke. It is important to install such equipment in such a way that failure of the light or photoelectric relay will make the press inoperative.

#### **Applications.**

- a. No moving or mechanical guard mechanism is in front of operator to interfere with operation.
- b. View of operating area is unobstructed.

c. Guard is applicable to large presses where some other type of guard would be impracticable.

#### **Limitations.**

- a. Device is limited in application to presses that can be stopped during ram stroke.
- b. Device must be far enough from danger zones so it will stop ram before operator's hand can get under ram.
- c. A sufficient number of light beams must be used to cover the open area with a curtain of light.

**A4.6—Sweep Guards.** In theory, the guard will push the operator's hand out of the way, the sweep guard being activated by the motion of the ram.

#### **Applications.**

- a. The best use of these guards is on small presses and dies (not over 6 inches wide).
- b. The same protection is provided in case of clutch failure as for a regular stroke of the press.
- c. Guard is easily adjusted.

#### **Limitations.**

- a. If guard swings in arc and radius of arc is small compared to length of front of die, there is a space which is never guarded at end of stroke.
- b. When not properly designed or adjusted and sweep moves quickly, it may be possible to reach into a nip point after sweep passes; or if it moves slowly, the sweep may not clear danger zone in time.
- c. If die is large and the arm of the operator is struck by the sweep, there is a possibility the elbow will bend and the hand remain in the danger zone.
- d. It is easy to reach around guard into point of operation.
- e. If barriers are used to prevent reaching around sweep, barrier may prevent the sweep from clearing the hand in case of need.
- f. If a hand were in a deep indentation of the die, the sweep would not remove it.

### **A5. PRESS MECHANISM**

**A5.1—Maintaining Tension in Brake Band.** It is desirable to maintain constant tension in the brake band to reduce the likelihood of the press repeating or dropping back. This may be accomplished by introducing a strong spring at the brake band adjusting screw. Brakes should be properly adjusted and maintained.

**A5.2—Ratchet to Prevent Dropping Back.** Dropping back of the ram may be prevented by providing a ratchet wheel on the shaft with a dog or prawl so the shaft can revolve only in the forward direction.

**A5.3—Clutch Spring.** The clutch spring is so essential to safety of the operator that it is well to supplement it with an additional spring which will return the clutch pin in case of failure of the primary spring.

**A5.4—Single-Stroke Selectors.** Many manufacturers now equip their presses for selective single-stroke or continuous-stroke operation. Where this equipment is provided on the press, it should be the responsibility of the setup man to adjust the selector for each setup.

## A6. PRESS INSPECTIONS

**A6.1—Departmental Inspections.** Departmental inspections often reveal minor items which should be corrected to avoid major maintenance problems. These inspections should be made by experienced employees who will look for items that should be corrected in the interests of safety. To obtain best results, a mechanic familiar with press construction and operation should be a member of the inspection committee. Some plants establish inspection schedules and procedures whereby forms are used to assure a competent inspection and maintenance follow-up. The items found in need of correction are noted on the form and work orders issued to the proper department.

Table 1A. PUNCH-PRESS INSPECTION CHART

DATE OF INSPECTION—195		PRESS NO.....	
Inspection Items	Inspection Hints	Mo. of Jan. Remarks	Mo. of Feb. Remarks
LIGHTING	There should be sufficient lighting at point of operation to prevent fatigue, eye strain, and improve quality and production.		
SEATING	Seating should be of proper height and chairs or stools should be in good repair.		
LOCATION	Location of press should allow for easy removal of finished parts, room for strip stock and blanking operations, safe access to the press, operator away from interference of passers-by.		
HOUSE-KEEPING	Housekeeping should consider feed tables for machines, methods of keeping material off the floor, no bolster plates or dies or other material leaning against the press or on the press such as wrenches, bolts, strips, etc. A general orderly condition should exist.		

Inspection Items	Inspection Hints	Mo. of Jan. Remarks	Mo. of Feb. Remarks
AIR	Where air is used for ejection or operation a check for leaks, proper valve operation, and a check with reference to the general condition and question of whether the air is being used.		
BELTS	Check condition of belt looseness, signs of breakage, and question of guarding or replacement of worn belts.		
CLUTCH	Operate press a number of times to check clutch for repeat. If clutch is nonrepeat type, check. Note if clutch is "gummed up" with hardened grease or oil. Where clutch has springs, check springs. If clutch is worn, suggest repairs or replacement. Clutch pins may be purchased from press manufacturers.		
CLUTCH DOG	Make sure clutch dog returns to neutral position after each stroke of the press. Check return spring and safety spring and condition of bolts or screws. Note if clutch dog is "gummed up" with hardened grease or oil. Check clutch dog for wear and replace if necessary. Suggest purchase of clutch dog from press manufacturer where replacement is necessary.		
BRAKE	Check for wear of brake band and poor condition due to saturation of brake band with oil or grease. Check bolt fastening brake shoe to the press for condition and tightness. Check brake for proper adjustment.		
TREADLE	If treadle operated make sure all bolts, pins, and cotter pins are properly fastened. Check any possibilities of treadle sticking by rubbing against press or poor springs. Check height and distance away from press of the treadle. Make suggestions for adjustment where necessary. Check treadle guard which should allow sufficient foot room for operator and prevent tripping of the press caused by falling objects.		

Inspection Items	Inspection Hints	Mo. of Jan. Remarks	Mo. of Feb. Remarks
LUBRICA- TION	Check to see if proper grade of oil is being used. Oil is to be preferred over grease since it will not harden and "gum up" the clutch pin and clutch dog. This is particularly true when the press is in cold locations. Proper grade of oil is very important. Check how often machine is oiled.		
GUARDS	No matter what type of guard is used all parts should be checked very carefully. If any part of the guard is in need of repair or adjustment, notation should be made. If guard is provided and not in use, it should be entered under remarks. If guard is not practical for operations it should be noted and the proper type suggested.		