DOSH DIRECTIVE
Department of Labor and Industries
Division of Occupational Safety and Health
Keeping WA workers safe.

6.10 Inspection of Slide-Locks used on Mechanical and Hydraulic Power Presses

Date: March 1, 2008

I. Purpose

This directive establishes inspection procedures and enforcement policies related to slide-locks being used to control hazardous energy on mechanical and hydraulic machinery.

II. Scope and Application

A. This directive applies to all DOSH operations statewide. It replaces all previous instructions on this issue, whether formal or informal.

B. This directive applies only to slide-locks that are used to control hazardous energy on mechanical and hydraulic power-presses in general industry. When slide-locks are used on machines that are not hydraulic and mechanical power-presses, or when non-interlocked manual type slide-locks are used, staff should refer to the specifications from the Original Equipment Manufacturer (OEM), applicable industry standards or any other available references. Staff shall ensure slide locks of this nature have been designed, installed, maintained and used in accordance with recognized engineering practices for that particular piece of equipment and the OEM specifications.

C. Compliance with this directive shall in no case replace other requirements contained in other relevant WISHA standards, such as WAC 296-806-45510, Point of Operation Guarding.

III. References

- Chapter 296-803 WAC: Lockout/Tagout (Control of Hazardous Energy)
- Chapter 296-806 WAC: Machine Safety
- CPL 02-01-043: Slide Locks – Enforcement policy, inspection procedures and performance guidance criteria.
- American National Standards Institute; *Safety Requirements for Mechanical Power-presses*, ANSI B11.1 - 2001.
- American National Standards Institute; *Hydraulic Power-presses - Safety Requirements for Construction, Care and Use*, ANSI B11.2 - 1995 (R 2005).
- American National Standards Institute; *Performance Criteria for Safeguarding*, ANSI B11.19 – 2003.
- American National Standards Institute; *Control of Hazardous Energy – Lockout/Tagout and Alternative Methods*, ANSI Z244.1-2003.

IV. Background

When it is necessary for workers to place their hands or other body parts into the hazardous machine areas for servicing and maintenance purposes, practices and procedures are necessary to disable the machinery and control the hazardous energy source(s). In particular, the standard for mechanical power-presses, (WAC 296-806-45532), requires employers to provide and enforce the use of safety blocks whenever dies are being adjusted or repaired in the press. When maintenance work is being performed on the machine, the lockout/tagout standard (Chapter 296-803 WAC) requires, in part, machine shutdown and isolation of hazardous energy and the application of Energy Isolating Devices (EID). Safety blocks are used as an EID for power press energy.

Another type of EID used for power-press energy isolation is the slide-lock. A *slide-lock device* is a positive mechanical engaging device – i.e., a lock or block – that is capable of preventing the slide from closing of its own deadweight.

OSHA has evaluated the use of *slide-locks* as energy isolating devices on mechanical power-presses or other general machinery. On September 14, 2007 OSHA issued a new interpretation directive (CPL 02-01-043 Slide Locks) which established new policy concerning the use of slide-locks.

V. Enforcement Policies:

A. Employer and Equipment Manufacturer Responsibility.
The employer (owner/operator) is responsible for the proper installation, inspection, testing, maintenance and use of machine slide-lock systems. Where employers delegate their responsibility to the original equipment manufacturers (OEMs) or contracted engineering firms, the employer still has an obligation to monitor and ensure that the outside personnel's actions are adequate to meet the WISHA requirements and recognized good engineering practices. OEMs, architects, engineering firms and other entities should produce a slide-lock system in accordance with recognized good engineering practice so that the isolating device effectively and reliably controls the hazardous energy associated with the machine. Failure to do so may create hazardous conditions through inadequate slide-lock design, construction or installation. However, CSHOs generally shall not cite these entities for slide-lock system design, construction, and installation issues, except if the entities had employees on site and exposed to a hazard. It is the ultimate responsibility of the employer using slide-lock devices to exercise reasonable diligence to discover hazardous conditions and to take steps to protect its employees.

Some employers may retain slide-lock design specifications from the original manufacturer's instructions, training records/certifications and other documentation regarding slide-lock installation, testing (both initial and periodic), inspection, use and maintenance. Where available, these documents shall be used by the compliance officer in accordance with this directive to determine if the slide-lock program is equally as effective as safety blocks.

B. Lock Out/Tag Out (LOTO) Minor Servicing Exception: The LOTO standard is not intended to cover certain minor servicing activities which are necessary to carry out the production process, provided that all of the criteria detailed in the exemption are met. When evaluating slide-lock usage, CSHOs must first determine whether the employer's work activity meets the minor servicing exception described in WAC 296-803-100. Minor tool changes and adjustments, and other minor servicing operations which take place during normal production operations, are **not** covered by Chapter 296-803 WAC **if** they are routine, repetitive, and integral to the use of machines or equipment for production, and **if** work is performed using alternative protective measures that provide *effective employee protection*. LOTO is not required when each of these elements exists and employees may perform servicing and maintenance activities with the machine or equipment energized.

However, the exclusion from LOTO **does not** mean that the employer can avoid providing employee protection even though employees carry out these minor servicing tasks with the machine or equipment energized. Rather, in order to apply the **limited exception**, an employer must provide effective alternative protection instead of lockout/tagout. In terms of minor press activities, such as minor cleaning, minor adjustment or minor repair of dies in the press, effective alternative protection will be considered to be provided if employers meet the electrical performance criteria contained in Appendix A and if the properly applied control circuits are used in conjunction with other necessary control measures, such as shutting off the press drive motor; deactivating the clutch/brake mechanism or trip control system; dissipating residual energy by waiting for the flywheel to stop; actuating the electro-mechanical slide-lock device that consists of a control-reliable electrical system **or** removing the interlocked safety blocks from the press, and inserting the safety blocks in the working area of the press to prevent hazardous slide motion.

NOTE: Pursuant to Chapter 296-803 WAC, electrical interlocks and other control circuits may not be exclusively used to control hazardous energy during servicing and maintenance operations **which are covered by the LOTO standard**. By definition, control circuits are not energy isolating devices.

C. Staff shall inspect slide-locks: If an employer is using slide locks in lieu of safety blocks, staff will inspect the slide-locks in accordance with the procedures outlined in this directive to determine if they:

1. Are properly installed, inspected, tested, maintained and used.

2. Meet the requirements of Appendix A: *Performance Criteria for Slide Locks.*

VI. <u>Inspection Procedures</u>

A. Evaluate Slide-Lock Documentation

This directive does not require additional documentation other than that already required by other standards -- e.g., energy control (lockout/tagout) procedure documentation, as required by Chapter 296-803 WAC. The following screening questions provide a general framework to assist CSHOs in evaluating documentation associated with the design and usage of a slide-lock:

1. Who designed, constructed and installed the slide-locks: the employer, an OEM, or an engineering contractor? Does the installer possess adequate expertise to properly design, construct and install the slide-lock system? Were the slide-locks designed and constructed in accordance with recognized good practice and installed as per the manufacturer's instructions?

2. Did the employer perform a formal hazard analysis (risk assessment) for foreseeable hazards – e.g., the determination of the slide-lock's rated load (maximum use) capacity? If so, does the analysis apply general recognized good engineering practice, such as the criteria contained in the Appendix?
3. Does the slide-lock use a safety factor of at least 2.0 – i.e., based on the maximum anticipated load definition contained in Appendix A? If the employer designed and installed the slide-locks, how was the safety factor determined and does it consider reasonably foreseeable dynamic forces? What information did the employer provide to the designer and installer of the slide-locks? Is the safety factor legibly marked on the slide-lock?
4. Has anyone modified the slide-locks from the original installation? An employer who has or has had a slide-lock device modified from its original design and installation must be capable of assuring that the modifications provide a safe level of performance.
5. Does the employer have a mechanical integrity program for the slide-locks? Are the slide-locks inspected and tested in accordance with Appendix A? Does the employer perform preventive maintenance? How are defective or damaged slide-locks identified and removed from service? Who performs the maintenance and repair of the slide-locks? Who performs testing of slide-locks?
6. Has the employer developed, documented, and implemented an energy control procedure that includes specific procedural steps for shutting down, isolating (e.g., applying the slide-lock isolating device(s); opening the press electric disconnect), and securing machines to control hazardous energy during servicing and maintenance activities? Does the energy control procedure outline the steps to release lockout/tagout as well as the sequence of action to be taken to test or reposition a press component so that the employee(s) is protected from the press point-of-operation hazards?

B. Evaluate Slide-lock Operation

The following considerations may be used to evaluate slide-lock use:

1. Are point-of-operation guards or safety devices used to complement lockout/tagout to protect employees during machine testing, machine component repositioning or other activities such as setting up the press?

   NOTE: WISHA's mechanical power-presses standard, WAC 296-806-45532, requires employers to develop a procedure that ensures that an employee is safeguarded from the point-of-operation hazards during die-setting activities. Thus, a mechanical power-press die-set procedure would need to clearly and specifically outline both the point-of-operation safeguarding methods (e.g., use of a two-hand control device to position the slide) and the hazardous energy control (lockout/tagout) steps necessary to control employee exposure to hazardous areas of the machinery – i.e., pursuant to the requirements contained in WAC 296-803-500 and WAC 296-806-45532, respectively.

2. On mechanical power-presses, does the employer properly de-energize the hazardous energy before engaging the slide-lock – i.e., shut off the press drive motor and its control system; deactivate the clutch/brake control or trip control system; wait for the flywheel to stop?

3. Is the slide-lock interlocked with the machine control to prevent actuation of slide motion during work activities – i.e., for minor servicing tasks that meet the minor servicing exception contained in the lockout/tagout standard? Are all electrical control components that actuate and monitor the slide-lock position designed and installed using a control-reliable system? See the Electrical Performance section of Appendix A.

4. Are there at least two independent visual means of verifying slide-lock engagement (i.e., isolation of the mechanical energy created by the slide)? Some slide-locks can be verified as engaged by visible means from the slide-lock operation point (e.g., the slide-lock can clearly be seen as engaged) while others may use a control-reliable indicator light. In both cases, a second visual verification must be provided.

5. Do employees visually verify that the slide-locks are in place before accessing the hazardous area? Does the energy control procedure require the verification of isolation and de-energization (e.g., pushing a press *start* button and visually checking that the disconnect switch handle is in the *off* or open position) of other energy sources, such as electric disconnects?

6. On hydraulic power-presses, are electric disconnects used to isolate the electrical energy source or, in case of the minor servicing exemption, are properly applied electrical interlocks used as *effective protection* to prevent hazardous motion? See the Electrical Performance section of Appendix A for more detail on the coordination of slide-lock use and the lockout/tagout standard.

7. Does each employee performing the servicing and/or maintenance exercise personal control over the slide-lock and other energy isolating devices through the application of personal lockout/tagout devices?

8. Does the slide-lock create any additional hazards, due to broken or damaged machined components, pinch point, projectile or ergonomic hazards?

C. Evaluate Training Program

A training program must ensure that employees who use slide-locks (i.e., as an energy isolating device) are instructed in the safe working procedures and are qualified to safely perform the functions to which they are assigned.

Employees who implement the energy control procedures (e.g., when an employee is to use a slide-lock for energy isolation purposes) or perform the servicing/maintenance activities, are, by definition, *authorized employees*. Pursuant to WAC 296-803-60005, these employees must have the knowledge (e.g., methods and means necessary for energy isolation) and skills necessary for the safe application, usage, and removal of the energy controls -- e.g., how to engage and disengage slide-locks; how to verify that slide-locks are engaged.

At a minimum, the hazardous energy (lockout/tagout) control training program must address the following:

1. Purpose and function of the energy control program;

2. Elements of the energy control procedure relevant to employee duties; and

3. Pertinent requirements and the restrictions of the program applicable to each employee as required by the LOTO standard.

D. Evaluate Mechanical Integrity Program. To ensure that all slide-lock components, auxiliary equipment, and safeguarding are in safe operating condition and adjustment, employers must have a mechanical integrity program based on recommendations from the manufacturer, good engineering practice, and operational experience. Appendix A should be consulted for inspection, testing, and maintenance criteria.

E. Interview Employees

Interviews shall be conducted as part of this evaluation to verify that employee training was provided for slide-locks and to determine the effectiveness of the lockout/tagout training program. Employees whose job duties require them to inspect, test or maintain slide-locks must demonstrate the following:

1. Knowledge of the employer's performance criteria for the slide-lock. Appendix A to this directive may be used to evaluate an employer's performance criteria for slide-locks;

2. Knowledge of the employer's mechanical integrity program for the slide-locks. This includes the types of testing and inspection required, the frequency of testing and inspection, and the types and frequency of maintenance required. Further guidance can be found in the Inspection, Testing, and Maintenance section of Appendix A; and

3. Experience, education and knowledge that qualifies the employee to inspect, test and maintain slide-lock systems. Supervisory employees should have additional qualifications that would allow them to determine that the testing, inspection, and maintenance are performed in accordance with good engineering practice.

VI. Citation Policy

A. CSHOs generally should not cite an employer for slide-lock design and construction deficiencies if they exercised reasonable diligence to have the slide-lock system designed, constructed, and installed in accordance with recognized good engineering practice, such as the performance guideline criteria contained in Appendix A. CSHOs may, however, cite employers when an employer has not exercised reasonable diligence and/or his or her slide-lock system presents a serious safety hazard.

B. Employers who provide and enforce the use of slide-locks that meet the performance guidance criteria contained in this directive will be considered to be in compliance with the safety block provision in WAC 296-806-45532 and will be considered as meeting the *Energy isolating device* definition contained in Chapter 296-803 WAC lockout/tagout standard.

C. If the slide-lock usage being used in lieu of safety blocks does not meet the performance criteria for slide-locks contained in appendix A, the employer will be issued a citation for not complying with WAC 296-806-45532. Any other violations of the LOTO standards or other related standards will be issued separately. Any violation that results in or may result in death or serious physical harm to employees may be classified as a serious violation.

Approved**:**

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Department of Labor and Industries
Division of Occupational Safety and Health

Appendix A
Performance Criteria for Slide-Locks

I. Purpose

The intent of the criteria is to define the responsibility (supplier and user) for design, construction, installation, testing, maintenance and use of slide-locks in hydraulic, mechanical and other power-press operations when such use is required. This guideline supplements and is not intended to replace existing WISHA requirements (e.g. WAC 296-803 and WAC 296-806). Rather, it creates criteria under which slides locks can be used to provide a level of employee protection that is equal to or greater than that provided by safety blocks.
Note: A slide-lock is an energy-isolating device intended to address gravity hazards, and it is not usually intended or designed to withstand a powered stroke of the slide.

II. Scope

Any power-press where slide-locks are used with or in lieu of safety blocks.

III. Definitions

Control Reliability. The capability of the machine control system, the safeguarding, other control components and related interfacing to achieve a safe state in the event of a failure within their safety related functions. This performance-oriented requirement includes system component/part redundancy (two processors, two controllers, two concurrently operating relay circuits, etc,) and performance monitoring/fault detection features that assure that redundancy is maintained. Control reliability ensures that the failure of a control system or device will not result in the loss of the safety-related functions.

Maximum Anticipated Load. The maximum anticipated load is normally the static weight of the slides, upper dies, tooling, and all attachments that apply downward force due to gravity plus reasonably foreseeable dynamic forces such as settling inertia.

Slide-lock. A mechanical engaging device applied to a power-press, which shall be designed such that it will support the maximum anticipated load. The slide-lock system also incorporates an electrical interlocking circuit that prevents the actuation of hazardous slide motion, when engaged.

Test, Initial. Testing performed prior to initial use to validate the control circuitry and the capability of the slide-lock system to reliably and effectively hold the maximum anticipated load. Testing shall be performed after any of the following circumstances:

- Installation
- Modification to the slide-lock system
- Significant incident such as exposure to dynamic forces

Test, Periodic. Testing performed as specified by the slide-lock manufacturer as part of the mechanical integrity program.

IV. Design and Construction Criteria

A. Mechanical Performance

The slide-lock device must be secured to the main structure of the press. When a press has two or more mechanical connections between the slide and crown, a gear train slide-lock option can be used.

The Safety Factor of the Slide-lock System shall be a minimum of 2.0 based on the maximum anticipated load. The 2.0 safety factor presumes the slide-lock system will be designed, constructed, installed, tested, maintained and used in accordance with all of the performance criteria in this directive. The slide-lock device shall be designed and installed as not to create an additional hazard (e.g. pinch point guarding or ergonomics considerations).

The supplier of the Slide-lock System on a power-press shall calculate the safety factor for the system. The supplier of the slide-lock shall rate the energy-isolating device at its rated load (maximum use) capacity. The installer shall post this information on the press, and the user shall assure that the information remains on the press in a legible format.

B. Electrical Performance

When the slide-lock system is engaged, it shall be interlocked with the machine control to prevent actuation of slide motion.

The system shall be designed to enable users to personally secure the system in the engaged state (typical means of achieving this would be a lockable device).

All electrical control of components actuating and monitoring the slide-lock position shall be designed and installed using a control-reliable system. Control-reliable systems achieve a safe state in the event of a failure within their safety-related function.

Prior to slide-lock engagement on mechanical power-presses, the clutch shall be disengaged. The main motor shall be de-energized (to prevent dynamic loading) if machine actuation and/or dynamic loading present an employee hazard.

Note: Electrical interlocks and other control circuits may not be used exclusively to control hazardous energy during servicing and maintenance operations covered by WISHA's Lockout/tagout (Control of hazardous energy) standard, Chapter 296-803 WAC.

However, electrical interlocks and other control circuits, which meet the *American National Standards for Machine Tools, Performance Criteria for Safeguarding* (ANSI B11.19-2003) control reliability provisions, may be used in conjunction with slide-locks and in lieu of other energy isolation devices to provide effective alternative employee protection for servicing and maintenance activities that meet each of the elements in the exemption for minor servicing and maintenance during normal production operations in the lockout/tagout standard (WAC 296-803-100).

Prior to slide-lock engagement on hydraulic power-presses, electrical interlocks shall prevent hazardous motion.

Dynamic loading shall be prevented through the use of multiple parallel independent circuits or components with a combination of cross checking, self-checking, and redundancy. Energy isolation devices meeting the provisions of Chapter 296-803 WAC also must be used to prevent hazardous motion after slide-lock engagement, if machine actuation and/or dynamic loading after slide-lock engagement would present an employee hazard.

C. Visual indication Criteria

When the slide-lock engagement can be visually seen from the slide-lock operation point, an additional visual verification of the slide-lock engagement shall be provided by mechanical or electrical control-reliable means (e.g. indicator light). When the slide-lock engagement can not be visually seen from a slide-lock operation point, two independent indications verifying slide-lock engagement shall be provided by mechanical and/or electrical control-reliable means (e.g. indicator light).

D. General Design Modifications

The user shall not modify the slide-lock system without prior consultation with the Slide-lock Manufacturer, or if no longer available, an entity capable of assuring that any modification provides a level of performance equal to or greater than the original design.

V. Installation, Inspection, Testing, Maintenance, and Use

A. Installation

1. The slide-lock supplier shall provide instructions for the proper installation.
2. The slide-lock device shall be installed per the supplier's instructions.
3. Initial startup safety review. The user shall verify that the slide-lock system was installed per the design and installation instructions.

4. All installation and verification shall be performed by an individual(s) that has the training and/or experience necessary to perform these functions in a manner that assures the safe operation of the slide-lock system.

B. Inspection, testing, and maintenance

The user must conduct initial testing and inspection of the slide-lock to verify and document the system meets all of the performance criteria as specified in this guideline.

The slide-lock manufacturer shall establish and document criteria and procedures for a mechanical integrity program (e.g. preventive maintenance, predictive maintenance), including the type and frequency of inspections and periodic testing. Some examples include:

- Visual inspections of mechanical system and components such as gears, pins, bushings, fasteners, bolts, and gauges;
- Nondestructive examination requirements for safety critical components (e.g., pins);
- Operational inspection and testing (e.g., verification of fault messages; component functional tests); and
- Electrical diagnostic checks – review manufacturer's recommendations.

The user shall establish, document, and implement a mechanical integrity program based upon the recommendations of the slide-lock manufacturer, good engineering practice, and prior operating experience.

All inspection, testing, and maintenance shall be performed or supervised by an individual(s) that has the training and/or experience necessary to assure the inspection, testing, and maintenance is performed in a manner that assures safe operation of the slide-lock system.